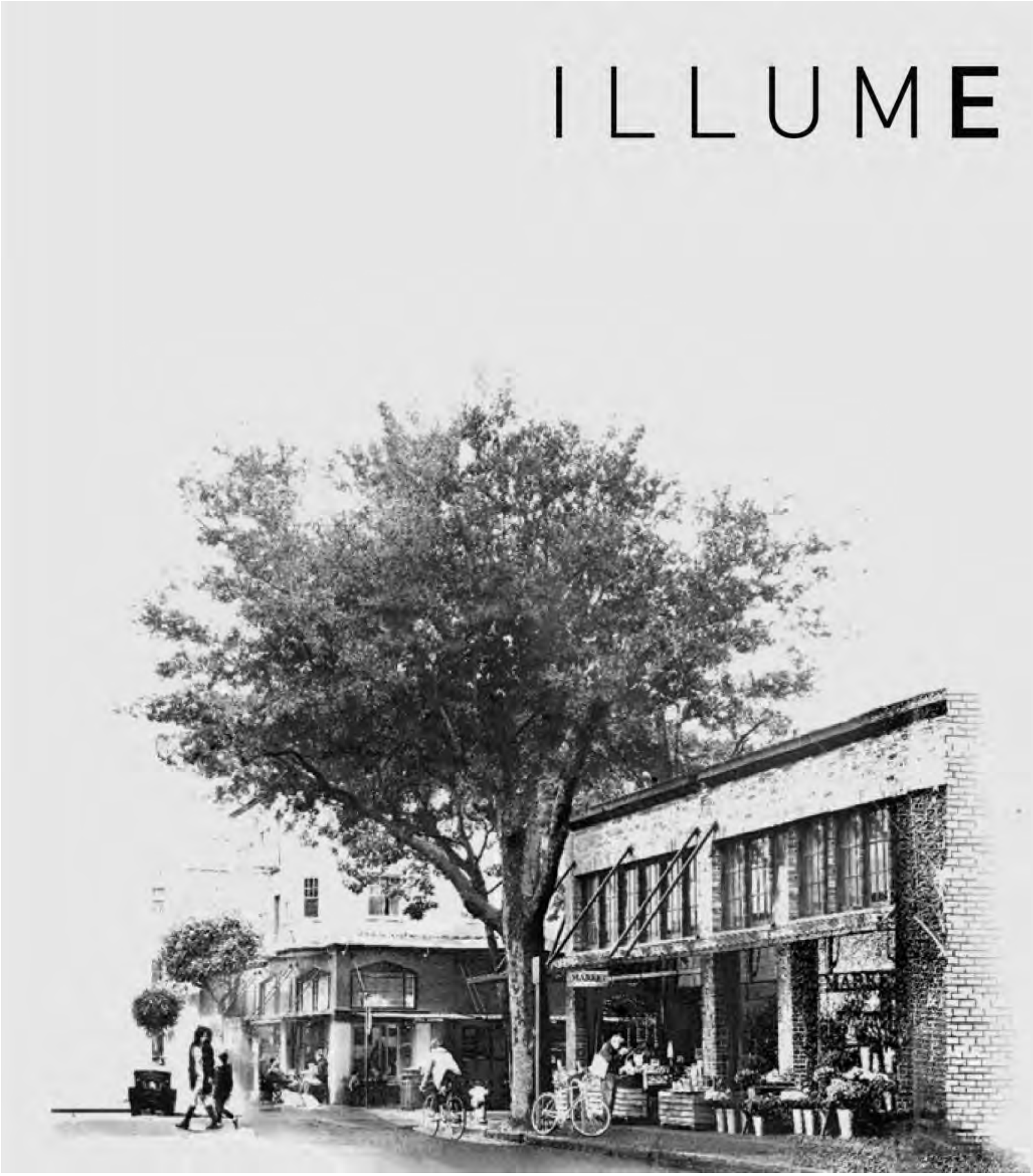


**PROJECT:**

2022 DSM Portfolio Evaluation Report

June 26, 2023

**PROJECT SPONSOR:**

NIPSCO

**PREPARED BY:**

ILLUME Advising, LLC

With subcontractors:

The Cadmus Group, LLC

NV5

# ACKNOWLEDGMENTS

ILLUME Advising, LLC is a forward-thinking consulting company at the rare intersection of insight and execution. Founded in 2013 by industry thought-leaders Anne Dougherty and Sara Conzemius, the company has quickly grown to include a deep bench of quantitative and qualitative research experts. ILLUME uses cutting edge research strategies to help build a resilient energy future to enrich lives, improve global health, and ensure a more secure and sustainable future.

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# LIST OF ACRONYMS AND ABBREVIATIONS

| ACRONYM/ABBREVIATION | DEFINITION |
|---|---|
| ACFM | Actual cubic feet per minute of compressed air |
| ARCA | Appliance Recycling Centers of America |
| C&I | Commercial and Industrial |
| CAC | Central air conditioner |
| CBCP | Center beam candle power |
| CDD | Cooling degree days |
| CF | Coincidence factor |
| CFM | Cubic feet per minute |
| CHA report | Comprehensive home assessment report |
| COP | Coefficient of performance |
| DHW | Domestic hot water |
| DOE | U.S. Department of Energy |
| DP&L | Dayton Power and Light |
| DSM | Demand-side management |
| EFLH | Effective full-load hours |
| EISA | Energy Independence and Security Act |
| EM&V | Evaluation, measurement, and verification |
| HDD | Heating degree day |
| HEA program | Home Energy Assessment program |
| HEW | Home energy worksheet |
| HOU | Hours of use |
| IQW program | Income Qualified Weatherization program |
| ISR | In-service rates |
| M&V | Measurement and verification |
| MFDI program | Multifamily Direct Install program |
| NPV | Net present value |
| NTG | Net-to-gross |
| PCT | Participant cost test |
| PPS | Probability proportional to size |
| QA/QC | Quality assurance and quality control |
| RIM | Ratepayer impact measure test |
| ROI | Return on investment |
| SBDI program | Small Business Direct Install program |
| TMY3 | Typical meteorological year |
| TRC | Total resource cost test |
| TRM | Technical Reference Manual |
| UCT | Utility cost test |
| UMP | Uniform Methods Project |
| VFD | Variable frequency drive |
| WHF | Waste heat factor |

# EXECUTIVE SUMMARY

NIPSCO's demand-side management (DSM) portfolio contains eleven residential programs and seven[1] commercial and industrial (C&I) programs that serve its customer base. This executive summary includes key findings from the evaluation team's[2] evaluation, measurement, and verification (EM&V) of these programs, including impact results (*ex post* gross and net savings impacts) and process findings (program operations, performance, and opportunities for improvement). Overall, the portfolio achieved 104,440,632 kWh *ex post* gross electric energy savings, 15,602 kW *ex post* gross peak demand reduction, and 5,057,217 therms *ex post* gross natural gas energy savings. Considering *ex post* gross savings, the residential portfolio exceeded its peak demand reduction and natural gas energy goals for 2022, but did not meet its electric energy goal. The C&I portfolio did not meet its electric energy, peak demand reduction, and natural gas energy goals.

## PORTFOLIO PERFORMANCE AND INSIGHTS

Thousands of residential and C&I customers participated in NIPSCO's DSM programs in 2022. NIPSCO's portfolio included similar programs as offered in 2021. The Residential Employee Education program was no longer offered in 2022, and NIPSCO launched two new C&I programs, the Schools SEM and Smart Energy Engagement programs. The Smart Energy Engagement program has since been removed from the portfolio.

To evaluate program impacts and performance, the evaluation team interviewed program staff and surveyed and interviewed customers/participants. The evaluation team also conducted tracking data analysis, engineering analysis, desk reviews, and/or virtual on-sites and interviews for each program.

The next two pages summarize savings impacts, spending, and key accomplishments for the residential and C&I portfolios. As the summaries show, NIPSCO's residential programs performed well against its peak demand reduction and natural gas energy goals and resulted in high realization rates across all fuels. NIPSCO's C&I programs fell short of their electric and natural gas goals; realization rates for the C&I portfolio were relatively close to 100% across all fuels.

[1] The Smart Energy Engagement program did not have any participation or savings in 2022 and has since been removed from the C&I Portfolio. We include it in this count and in overall budget tables as there were program expenditures in 2022.
[2] The evaluation team includes ILLUME Advising (lead firm), Cadmus, and NV5.

# RESIDENTIAL SECTOR

- The Residential portfolio had a fairly successful year in 2022, exceeding its savings goals for demand reduction and natural gas.
- Overall, electric portfolio performance was driven by the Behavioral and Lighting programs. Gas program performance was driven by the Behavioral and EE Rebates programs.
- Realization rates varied across programs; net-to-gross factors remained relatively consistent across time.

| | Electric Savings (KWH) | Peak Demand Reduction (KW) | Natural Gas Savings (Therms) |
|---|---|---|---|
| Goal | 46,253,953 | 4,694 | 2,703,335 |
| Ex Ante | 39,923,712 | 3,488 | 3,675,772 |
| Audited | 39,923,576 | 3,486 | 3,677,545 |
| Verified | 39,441,034 | 3,407 | 3,637,024 |
| Ex Post Gross | 42,424,536 | 6,562 | 3,697,221 |
| Ex Post Net | 33,784,896 | 5,093 | 3,121,641 |

| | Electric | Peak Demand | Natural Gas |
|---|---|---|---|
| Ex Post Gross Achieved to Gross Goal | 92% | 140% | 137% |
| Realization Rate | 106% | 188% | 101% |

## Budget

### Electric and Peak Demand

| | |
|---|---|
| Budget | 9,123,977 |
| Expenditures | 6,382,793 |

Spent 70%

### Natural Gas

| | |
|---|---|
| Budget | 5,190,980 |
| Expenditures | 4,430,528 |

Spent 85%

# COMMERCIAL & INDUSTRIAL SECTOR

- 2022 continued to be a challenging year for the C&I portfolio, falling short of its savings goals across all fuel types.
- The evaluation team found realization rates close to 100% across most programs, indicating alignment between the implementation and evaluation teams in estimating savings.
- Net-to-gross for the Online Marketplace program saw an increase in 2022.

| | Electric Savings (KWH) | Peak Demand Reduction (KW) | Natural Gas Savings (Therms) |
|---|---|---|---|
| Goal | 92,147,000 | 16,616 | 1,540,906 |
| Ex Ante | 63,207,425 | 9,154 | 1,451,514 |
| Audited | 63,217,069 | 9,161 | 1,449,382 |
| Verified | 62,816,749 | 9,011 | 1,453,588 |
| Ex Post Gross | 62,016,096 | 9,040 | 1,359,996 |
| Ex Post Net | 49,944,770 | 7,186 | 940,926 |

## Ex Post Gross Achieved to Gross Goal

| Electric | Peak Demand | Natural Gas |
|---|---|---|
| 67% | 54% | 88% |

## Realization Rate

| Electric | Peak Demand | Natural Gas |
|---|---|---|
| 98% | 99% | 94% |

## Budget

### Electric and Peak Demand

| | |
|---|---|
| Budget | 13,210,945 |
| Expenditures | 8,549,717 |

*Spent* 65%

### Natural Gas

| | |
|---|---|
| Budget | 2,051,297 |
| Expenditures | 1,950,927 |

*Spent* 95%

# SAVINGS ACHIEVEMENTS

The following section details the program and portfolio-level savings achievements relative to planning goals, the savings achievements at each step of the impact evaluation, the contribution of each program to portfolio savings, and a summary of recommendations for each program.

## PORTFOLIO RESULTS

Table 1 and Table 2 show 2022 gross planning goals for electric and natural gas savings, and each program's performance in achieving those goals. These tables show goal achievement in terms of *ex post* gross savings.

When compared to 2022 goals, program performance varied widely across individual programs. The residential Multi Family Direct Install program had the lowest goal achievement across all fuel types, largely due to COVID-19 restrictions, difficulties in reaching the correct contacts at property management companies, field team staff turnover, and property management teams not having enough bandwidth to engage with the program. The C&I programs continued to achieve lower-than-expected savings.

TABLE 1. 2022 PORTFOLIO ELECTRIC GOAL ACHIEVEMENT

| PROGRAM | ELECTRICITY | | | DEMAND | | |
|---|---|---|---|---|---|---|
| | GROSS ELECTRIC SAVINGS GOAL (KWH) | *EX POST* GROSS ELECTRIC SAVINGS (KWH) | SHARE OF ELECTRIC GOAL ACHIEVED (%) | GROSS PEAK DEMAND REDUCTION GOAL (KW) | *EX POST* GROSS PEAK DEMAND REDUCTION (KW) | SHARE OF PEAK DEMAND GOAL ACHIEVED (%) |
| Residential Programs | | | | | | |
| EE Rebates | 1,624,168 | 871,103 | 54% | 1,379 | 763 | 55% |
| Lighting | 12,000,000 | 11,810,939 | 98% | 1,459 | 1,608 | 110% |
| Home Energy Analysis | 612,072 | 751,047 | 123% | 196 | 470 | 239% |
| Appliance Recycling | 2,330,676 | 1,151,522 | 49% | 587 | 162 | 28% |
| School Education | 1,986,455 | 1,943,592 | 98% | 141 | 181 | 128% |
| Multi Family Direct Install | 2,342,017 | 49,039 | 2% | 297 | 12 | 4% |
| Behavioral | 23,120,000 | 24,236,775 | 105% | 0 | 2,849 | n/a |
| New Construction | 22,671 | 12,399 | 55% | 53 | 6 | 12% |
| Home Life EE Calculator | 133,834 | 266,915 | 199% | 11 | 30 | 264% |
| IQW | 1,523,492 | 566,297 | 37% | 416 | 258 | 62% |
| Online Marketplace | 558,569 | 764,907 | 137% | 154 | 222 | 144% |
| **Total Residential** | **46,253,953** | **42,424,536** | **92%** | **4,694** | **6,562** | **140%** |
| Commercial & Industrial Programs | | | | | | |
| Prescriptive | 42,462,503 | 25,724,089 | 61% | 9,981 | 4,919 | 49% |
| Custom | 37,591,431 | 18,735,182 | 50% | 4,779 | 1,288 | 27% |
| New Construction | 4,607,350 | 13,444,792 | 292% | 494 | 2,097 | 425% |
| Small Business Direct Install | 2,772,602 | 1,435,472 | 52% | 423 | 153 | 36% |
| Online Marketplace | 4,252,379 | 2,615,039 | 61% | 881 | 569 | 65% |

| PROGRAM | ELECTRICITY | | | DEMAND | | |
|---|---|---|---|---|---|---|
| | GROSS ELECTRIC SAVINGS GOAL (KWH) | *EX POST* GROSS ELECTRIC SAVINGS (KWH) | SHARE OF ELECTRIC GOAL ACHIEVED (%) | GROSS PEAK DEMAND REDUCTION GOAL (KW) | *EX POST* GROSS PEAK DEMAND REDUCTION (KW) | SHARE OF PEAK DEMAND GOAL ACHIEVED (%) |
| Schools SEM | 460,735 | 61,523 | 13% | 59 | 15 | 25% |
| **Total Commercial & Industrial** | **92,147,000** | **62,016,096** | **67%** | **16,616** | **9,040** | **54%** |
| Total 2022 Portfolio | 138,400,953 | 104,440,632 | 75% | 21,310 | 15,602 | 73% |

TABLE 2. 2022 PORTFOLIO NATURAL GAS GOAL ACHIEVEMENT

| PROGRAM | GROSS NATURAL GAS SAVINGS GOAL (THERMS) | *EX POST* NATURAL GAS SAVINGS (THERMS) | SHARE OF NATURAL GAS GOAL ACHIEVED (%) |
|---|---|---|---|
| Residential Programs | | | |
| EE Rebates | 569,472 | 959,507 | 168% |
| Lighting | n/a | n/a | n/a |
| Home Energy Analysis | 57,980 | 201,908 | 348% |
| Appliance Recycling | n/a | n/a | n/a |
| School Education | 190,520 | 96,791 | 51% |
| Multi Family Direct Install | 108,740 | 2,884 | 3% |
| Behavioral | 1,119,213 | 1,989,986 | 178% |
| New Construction | 311,063 | 210,100 | 68% |
| Home Life EE Calculator | 12,251 | 23,521 | 192% |
| IQW | 323,412 | 209,675 | 65% |
| Online Marketplace | 11,085 | 2,849 | 26% |
| **Total Residential** | **2,703,735** | **3,697,221** | **137%** |
| Commercial & Industrial Programs | | | |
| Prescriptive | 330,809 | 31,519 | 10% |
| Custom | 620,723 | 487,176 | 78% |
| New Construction | 246,410 | 788,832 | 320% |
| Small Business Direct Install | 244,487 | 43,796 | 18% |
| Online Marketplace | 90,773 | 8,674 | 10% |
| Schools SEM | 7,705 | 0 | 0% |
| **Total Commercial & Industrial** | **1,540,906** | **1,359,996** | **88%** |
| Total 2022 Portfolio | 4,244,641 | 5,057,217 | 119% |

Table 3 through Table 5 show the electric energy, peak demand reduction, and natural gas energy savings achieved by each program in the 2022 NIPSCO portfolio. The tables include realization rates, which are the percentage of savings claimed by NIPSCO (*ex ante*) that the evaluation team verified. Ideally, realization rates are as close to 100% as possible, indicating that the planned savings closely align with actual savings. At the portfolio-level, this is generally the case; the team verified 101% of electric energy, 123% of demand, and 99% of therms savings. Program-level realization rates varied for reasons described in the individual chapters.

TABLE 3. 2022 PORTFOLIO ELECTRIC ENERGY SAVINGS

| PROGRAM | REPORTED ELECTRIC SAVINGS (KWH) | | | EVALUATED ELECTRIC SAVINGS (KWH) | | | |
|---|---|---|---|---|---|---|---|
| | *EX ANTE* | AUDITED | VERIFIED | *EX POST* GROSS | REALIZATION RATE (%) | NTG RATIO (%) | *EX POST* NET |
| Residential Programs | | | | | | | |
| EE Rebates | 923,577 | 923,467 | 923,467 | 871,103 | 94% | 62% | 543,219 |
| Lighting | 8,704,677 | 8,704,677 | 8,063,141 | 11,810,939 | 136% | 37% | 4,323,112 |
| Home Energy Analysis | 730,910 | 730,910 | 721,803 | 751,047 | 103% | 71% | 534,181 |
| Appliance Recycling | 1,181,095 | 1,181,095 | 1,181,095 | 1,151,522 | 97% | 57% | 651,705 |
| School Education | 1,986,793 | 1,986,760 | 2,264,630 | 1,943,592 | 98% | 97% | 1,877,561 |
| Multi Family Direct Install | 60,784 | 60,784 | 52,070 | 49,039 | 81% | 95% | 46,711 |
| Behavioral | 24,568,838 | 24,568,838 | 24,568,838 | 24,236,775 | 99% | 100% | 24,236,775 |
| New Construction | 4,216 | 4,216 | 4,216 | 12,399 | 294% | 21% | 2,604 |
| Home Life EE Calculator | 266,197 | 266,193 | 275,443 | 266,915 | 100% | 97% | 260,075 |
| IQW | 554,699 | 554,699 | 540,632 | 566,297 | 102% | 100% | 566,297 |
| Online Marketplace | 941,927 | 941,936 | 845,699 | 764,907 | 81% | 97% | 742,657 |
| **Total Residential** | **39,923,712** | **39,923,576** | **39,441,034** | **42,424,536** | **106%** | **n/a** | **33,784,896** |
| Commercial & Industrial Programs | | | | | | | |
| Prescriptive | 26,137,346 | 26,137,382 | 26,093,617 | 25,724,089 | 98% | 85% | 21,865,476 |
| Custom | 19,386,561 | 19,386,559 | 19,073,608 | 18,735,182 | 97% | 90% | 16,861,664 |
| New Construction | 13,029,948 | 13,029,949 | 13,482,557 | 13,444,792 | 103% | 54% | 7,260,188 |
| Small Business Direct Install | 1,470,495 | 1,470,494 | 1,458,784 | 1,435,472 | 98% | 94% | 1,349,343 |
| Online Marketplace | 3,121,262 | 3,130,872 | 2,646,369 | 2,615,039 | 84% | 98% | 2,552,729 |
| Schools SEM | 61,813 | 61,813 | 61,813 | 61,523 | 100% | 90% | 55,370 |
| **Total Commercial & Industrial** | **63,207,425** | **63,217,069** | **62,816,749** | **62,016,096** | **98%** | **n/a** | **49,944,770** |
| Total 2022 Portfolio | 103,131,137 | 103,140,644 | 102,257,782 | 104,440,632 | 101% | n/a | 83,729,666 |

TABLE 4. 2022 PORTFOLIO PEAK DEMAND REDUCTION

| PROGRAM | REPORTED PEAK DEMAND REDUCTION (KW) | | | EVALUATED PEAK DEMAND REDUCTION (KW) | | | |
|---|---|---|---|---|---|---|---|
| | *EX ANTE* | AUDITED | VERIFIED | *EX POST* GROSS | REALIZATION RATE (%) | NTG RATIO (%) | *EX POST* NET |
| Residential Programs | | | | | | | |
| EE Rebates | 932 | 932 | 932 | 763 | 82% | 65% | 497 |
| Lighting | 1,200 | 1,200 | 1,108 | 1,608 | 134% | 37% | 588 |
| Home Energy Analysis | 463 | 463 | 462 | 470 | 102% | 82% | 387 |
| Appliance Recycling | 196 | 196 | 196 | 162 | 83% | 56% | 91 |
| School Education | 141 | 138 | 178 | 181 | 128% | 91% | 165 |
| Multi Family Direct Install | 7 | 7 | 6 | 12 | 182% | 93% | 12 |
| Behavioral | - | - | - | 2,849 | n/a | 100% | 2,849 |
| New Construction | 10 | 10 | 10 | 6 | 63% | 21% | 1 |
| Home Life EE Calculator | 23 | 23 | 27 | 30 | 133% | 94% | 28 |
| IQW | 267 | 267 | 265 | 258 | 97% | 100% | 258 |
| Online Marketplace | 250 | 250 | 223 | 222 | 89% | 98% | 217 |
| **Total Residential** | **3,488** | **3,486** | **3,407** | **6,562** | **188%** | **n/a** | **5,093** |
| Commercial & Industrial Programs | | | | | | | |
| Prescriptive | 4,971 | 4,962 | 4,969 | 4,919 | 99% | 85% | 4,181 |
| Custom | 1,298 | 1,298 | 1,257 | 1,288 | 99% | 90% | 1,160 |
| New Construction | 2,042 | 2,050 | 2,050 | 2,097 | 103% | 54% | 1,133 |
| Small Business Direct Install | 153 | 153 | 152 | 153 | 100% | 94% | 143 |
| Online Marketplace | 674 | 682 | 568 | 569 | 84% | 98% | 557 |
| Schools SEM | 15 | 15 | 15 | 15 | 97% | 90% | 13 |
| **Total Commercial & Industrial** | **9,154** | **9,161** | **9,011** | **9,040** | **99%** | **n/a** | **7,186** |
| Total 2022 Portfolio | 12,642 | 12,647 | 12,419 | 15,602 | 123% | n/a | 12,280 |

TABLE 5. 2022 PORTFOLIO NATURAL GAS SAVINGS

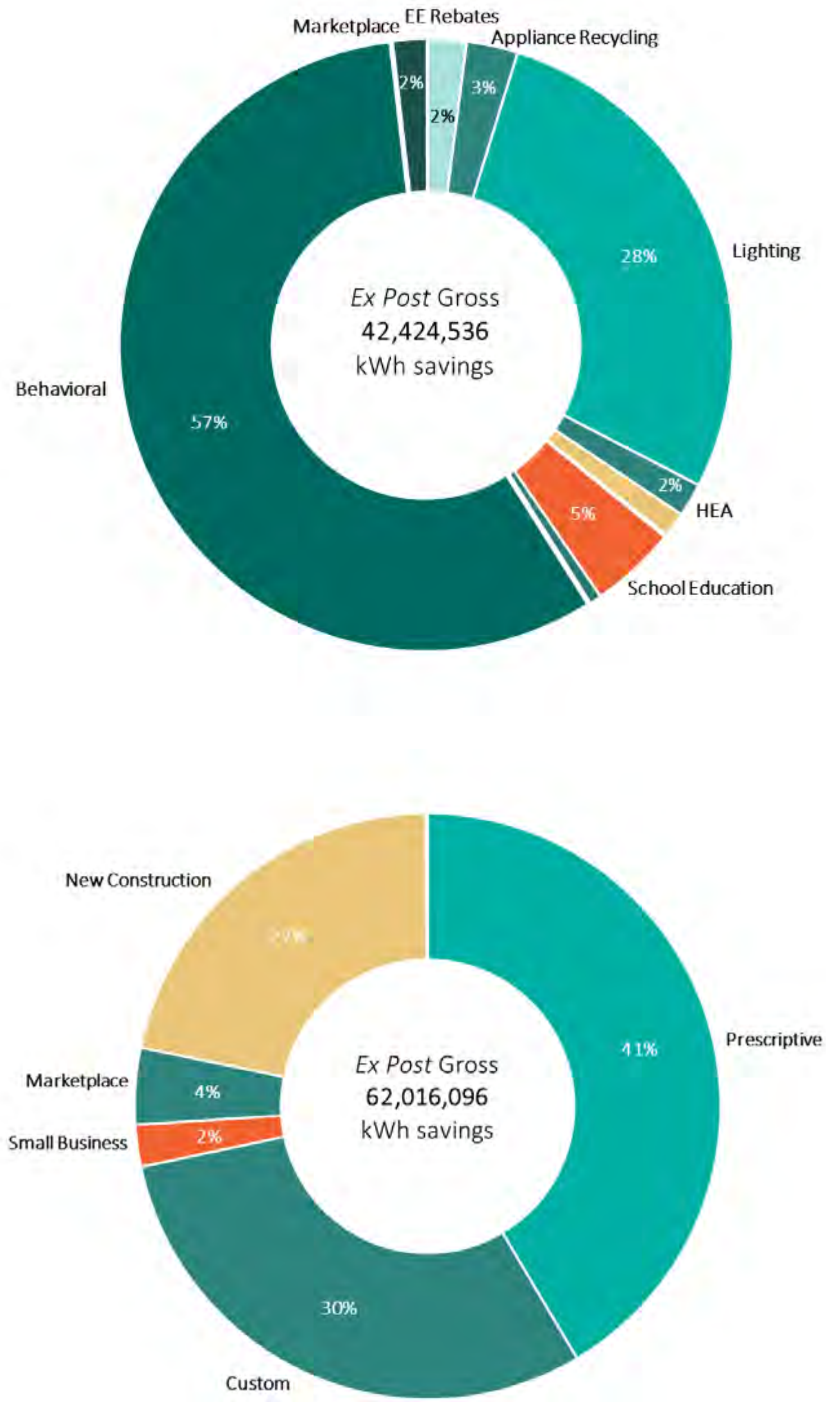
| PROGRAM | REPORTED NATURAL GAS SAVINGS (THERMS) | | | EVALUATED NATURAL GAS SAVINGS (THERMS) | | | |
|---|---|---|---|---|---|---|---|
| | *EX ANTE* | AUDITED | VERIFIED | *EX POST* GROSS | REALIZATION RATE (%) | NTG RATIO (%) | *EX POST* NET |
| Residential Programs | | | | | | | |
| EE Rebates | 749,533 | 749,511 | 749,511 | 959,507 | 128% | 60% | 576,871 |
| Lighting | n/a | n/a | n/a | n/a | n/a | n/a | n/a |
| Home Energy Analysis | 164,402 | 164,402 | 162,248 | 201,908 | 123% | 86% | 173,457 |
| Appliance Recycling | n/a | n/a | n/a | n/a | n/a | n/a | n/a |
| School Education | 191,278 | 191,265 | 166,154 | 96,791 | 51% | 102% | 98,616 |
| Multi Family Direct Install | 4,186 | 4,186 | 3,926 | 2,884 | 69% | 101% | 2,921 |
| Behavioral | 2,111,356 | 2,111,356 | 2,111,356 | 1,989,986 | 94% | 100% | 1,989,986 |
| New Construction | 204,090 | 204,090 | 204,090 | 210,100 | 103% | 21% | 44,121 |
| Home Life EE Calculator | 35,715 | 37,523 | 33,270 | 23,521 | 66% | 99% | 23,377 |
| IQW | 204,127 | 204,127 | 197,705 | 209,675 | 103% | 100% | 209,675 |
| Online Marketplace | 11,085 | 11,085 | 8,764 | 2,849 | 26% | 92% | 2,617 |
| **Total Residential** | **3,675,772** | **3,677,545** | **3,637,024** | **3,697,221** | **101%** | **n/a** | **3,121,641** |
| Commercial & Industrial Programs | | | | | | | |
| Prescriptive | 30,723 | 30,723 | 30,723 | 31,519 | 103% | 85% | 26,791 |
| Custom | 493,593 | 493,831 | 491,443 | 487,176 | 99% | 90% | 438,458 |
| New Construction | 877,174 | 874,730 | 879,692 | 788,832 | 90% | 54% | 425,969 |
| Small Business Direct Install | 43,796 | 43,796 | 43,796 | 43,796 | 100% | 94% | 41,168 |
| Online Marketplace | 6,228 | 6,303 | 7,935 | 8,674 | 139% | 98% | 8,539 |
| Schools SEM | - | - | - | - | - | - | - |
| **Total Commercial & Industrial** | **1,451,514** | **1,449,382** | **1,453,588** | **1,359,996** | **94%** | **n/a** | **940,926** |
| Total 2022 Portfolio | 5,127,286 | 5,126,927 | 5,090,612 | 5,057,217 | 99% | n/a | 4,062,567 |

## PROGRAM CONTRIBUTION TO PORTFOLIO SAVINGS

Figure 1 and Figure 2 illustrate each program's contribution to total *ex post* gross portfolio energy and demand savings. The Behavioral program contributed the largest share of electric energy savings to the Residential portfolio, with 57% of total electric energy (kilowatt-hour) savings. The Lighting program accounted for the next largest share (28%). The Behavioral program also accounted for the largest share of peak demand reduction (kilowatts) for the Residential portfolio, contributing 43% of total peak demand reduction, followed by the Lighting program at 25%.

In the C&I sector, the Prescriptive program contributed the largest share of electric energy savings, with 41% of the total C&I portfolio electric energy (kilowatt-hour) savings, with the Custom program contributing 30% and the New Construction program contributing 22%. The Prescriptive and New Construction programs contributed the largest shares of peak demand reduction (kilowatts) to the C&I portfolio, accounting for 54% and 23% of peak demand reduction, respectively.

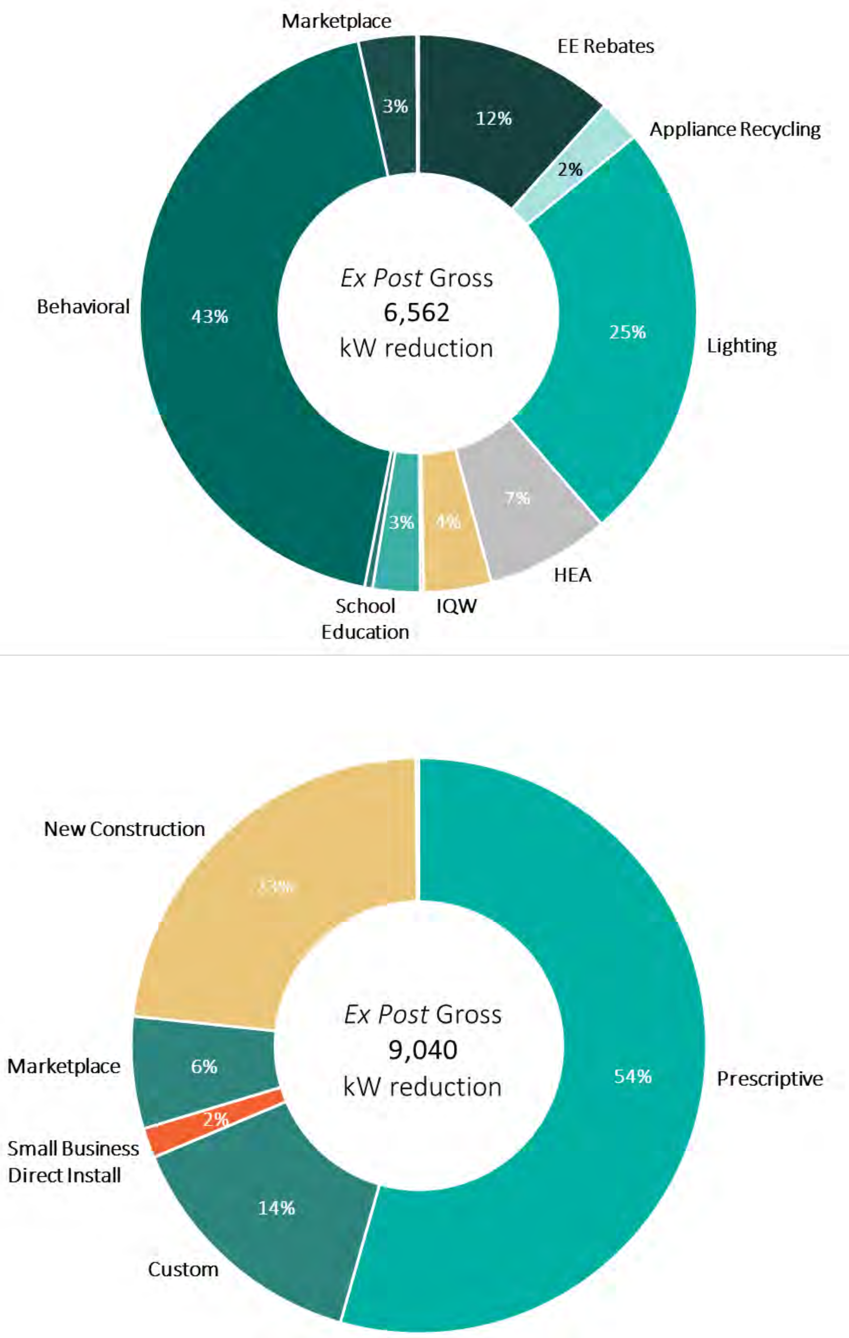
FIGURE 1. PROGRAM CONTRIBUTIONS TO PORTFOLIO ELECTRIC SAVINGS (KWH) BY *EX POST* GROSS [a,b]




[a] Four residential programs are not labeled due to savings of 1% or less of the total portfolio in 2022. This includes MFDI, Homelife, IQW, and New Construction.

[b] One C&I program, Schools SEM, is not labeled due to savings of less than 1% of the total portfolio in 2022.

FIGURE 2. PROGRAM CONTRIBUTION TO PORTFOLIO PEAK DEMAND REDUCTION (KW) BY *EX POST* GROSS [a,b]

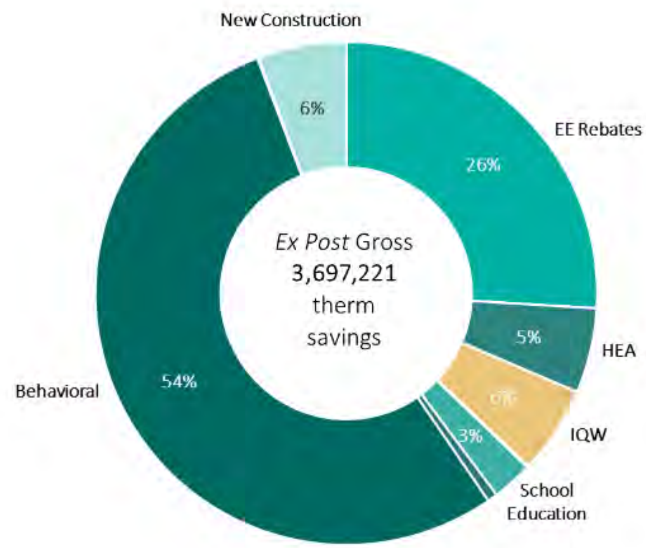


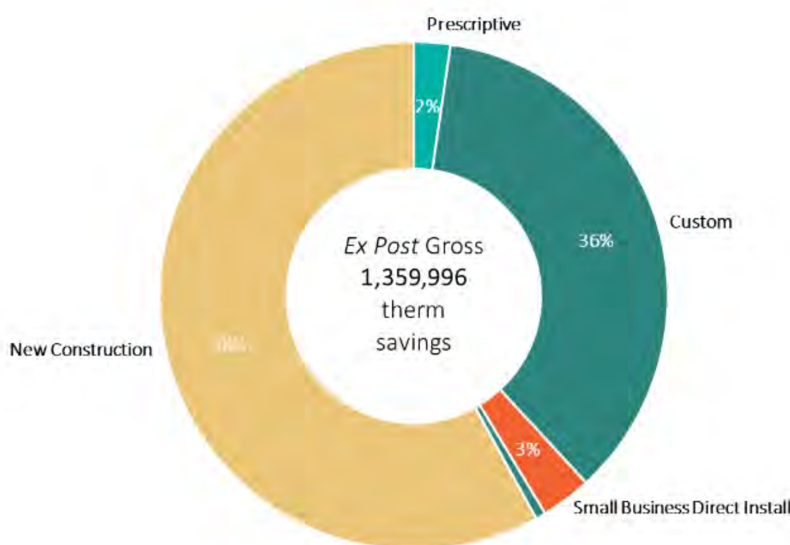

[a] Three residential programs are not labeled due to savings of less than 1% of the total portfolio in 2022. This includes MFDI, Homelife, and New Construction.

[b] One C&I program, Schools SEM, is not labeled due to savings of less than 1% of the total portfolio in 2022.

Figure 3 illustrates each program's contribution to total *ex post* gross natural gas portfolio energy savings. The Behavioral program accounted for the largest share of Residential natural gas energy (therm) savings, with 54% of the Residential portfolio savings. The EE Rebates program was the second largest contributor to the Residential program's natural gas savings total (26%). The New Construction program contributed 58% of the natural gas energy savings for the C&I sector, the most of any of the C&I programs, followed by Custom at 36%.

FIGURE 3. PROGRAM CONTRIBUTION TO PORTFOLIO NATURAL GAS SAVINGS (THERMS) BY *EX POST* GROSS [a,b]




[a] Three residential programs are not labeled due to savings of less than 1% of the total portfolio in 2022. This includes MFDI, Homelife, and the Online Marketplace.

[b] Two C&I programs, the Online Marketplace, and Schools SEM, are not labeled due to savings of less than 1% of the total portfolio in 2022.

## BUDGET

As shown in Table 6 and Table 7, NIPSCO spent 67% of its electric budget and 88% of its natural gas budget for the 2022 portfolio.

TABLE 6. 2022 ELECTRIC PORTFOLIO BUDGET AND SPENDING

| PROGRAM | BUDGET ($) | ACTUAL SPEND ($) | BUDGET SPENT (%) | SHARE OF ELECTRIC GOAL ACHIEVED (%) | SHARE OF PEAK DEMAND GOAL ACHIEVED (%) |
|---|---|---|---|---|---|
| Residential Programs | | | | | |
| HVAC Rebates | 658,915.13 | 380,794.49 | 58% | 54% | 55% |
| Lighting | 3,001,319.47 | 1,678,471.36 | 56% | 98% | 110% |
| Home Energy Analysis | 449,990.10 | 574,187.88 | 128% | 123% | 239% |
| Appliance Recycling | 370,234.47 | 191,510.59 | 52% | 49% | 28% |
| School Education | 755,050.61 | 731,346.84 | 97% | 98% | 128% |
| Multi Family Direct Install | 799,487.50 | 60,489.91 | 8% | 2% | 4% |
| Behavioral | 1,727,710.11 | 1,673,197.91 | 97% | 105% | n/a |
| New Construction | 8,898.52 | 1,753.67 | 20% | 55% | 12% |
| Home Life EE Calculator | 58,579.75 | 112,528.37 | 192% | 199% | 264% |
| IQW | 1,133,565.22 | 556,651.47 | 49% | 37% | 62% |
| Online Marketplace | 160,225.62 | 421,860.71 | 263% | 137% | 144% |
| **Total Residential** | **9,123,976.50** | **6,382,793.21** | **70%** | **92%** | **140%** |
| Commercial & Industrial Programs | | | | | |
| Prescriptive | 6,041,373.11 | 3,617,204.36 | 60% | 61% | 49% |
| Custom | 5,571,339.47 | 2,852,098.57 | 51% | 50% | 27% |
| New Construction | 647,415.15 | 1,569,463.89 | 242% | 292% | 425% |
| Small Business Direct Install | 366,763.10 | 262,614.11 | 72% | 52% | 36% |
| Online Marketplace | 518,705.14 | 238,408.40 | 46% | 61% | 65% |
| Smart Energy Engagement | 607.20 | 309.99 | 51% | - | - |
| Schools SEM | 64,741.52 | 9,618.15 | 15% | 13% | 25% |
| **Total Commercial & Industrial** | **13,210,944.69** | **8,549,717.47** | **65%** | **67%** | **54%** |
| Total 2022 Portfolio | 22,334,921.19 | 14,932,510.68 | 67% | 75% | 73% |

Source: 2022 DSM Scorecard.
Note: Totals may not properly sum due to rounding

TABLE 7. 2022 NATURAL GAS PORTFOLIO BUDGET AND SPENDING

| PROGRAM | BUDGET ($) | ACTUAL SPEND ($) | BUDGET SPENT (%) | SHARE OF NATURAL GAS GOAL ACHIEVED (%) |
|---|---|---|---|---|
| Residential Programs | | | | |
| HVAC Rebates | 1,357,262.44 | 1,593,698.65 | 117% | 168% |
| Lighting | n/a | n/a | n/a | n/a |
| Home Energy Analysis | 152,417.07 | 392,583.19 | 258% | 348% |
| Appliance Recycling | n/a | n/a | n/a | n/a |
| School Education | 332,201.07 | 322,114.47 | 97% | 51% |
| Multi Family Direct Install | 212,636.12 | 18,309.16 | 9% | 3% |
| Behavioral | 432,152.25 | 416,727.09 | 96% | 178% |
| New Construction | 688,381.53 | 439,210.37 | 64% | 68% |
| Home Life EE Calculator | 26,329.58 | 84,049.40 | 319% | 192% |
| IQW | 1,978,842.05 | 1,153,461.44 | 58% | 65% |
| Online Marketplace | 10,757.94 | 10,373.95 | 96% | 26% |
| **Total Residential** | **5,190,980.06** | **4,430,527.73** | **85%** | **137%** |
| Commercial & Industrial Programs | | | | |
| Prescriptive | 378,091.19 | 50,283.04 | 13% | 10% |
| Custom | 871,936.93 | 675,315.01 | 77% | 78% |
| New Construction | 346,135.28 | 1,148,303.34 | 332% | 320% |
| Small Business Direct Install | 345,735.42 | 64,891.27 | 19% | 18% |
| Online Marketplace | 98,346.63 | 11,595.84 | 12% | 10% |
| Smart Energy Engagement | 228.70 | 118.98 | 52% | - |
| Schools SEM | 10,822.65 | 419.72 | 4% | 0% |
| **Total Commercial & Industrial** | **2,051,296.80** | **1,950,927.20** | **95%** | **88%** |
| Total 2022 Portfolio | 7,242,276.86 | 6,381,454.93 | 88% | 119% |

Source: 2022 DSM Scorecard.
Note: Totals may not properly sum due to rounding

# SUMMARY OF RECOMMENDATIONS

Based on the 2022 evaluation findings, the evaluation team proposes several recommendations intended to improve program uptake, processes, and performance within NIPSCO's DSM portfolio. This section includes a summary of these recommendations. Please refer to the individual program chapters for more details on recommendations and detailed findings that support these recommendations.

## ENERGY EFFICIENCY REBATES PROGRAM

- Explore rebate levels of neighboring utilities, compare them against NIPSCO rebates, and consider increasing rebate levels where cost-effective and feasible.
- Advertise the program more actively to both residential customers and contractors.
- Continue to cross-promote the program through current participants of other NIPSCO programs.
- Continue to encourage contractors to cross-promote other NIPSCO offerings with customers, including the smaller measures offered through EE Rebates. Consider creating marketing material that contractors could leave behind with customers.
- Continue to advertise the online portal to customers – and particularly to contractors – to ensure participants are aware of this option.
- Consider a referral program that rewards participants for engaging others in the program. For example, customers who refer a friend and family member could be entered into a drawing for a gift card. Alternatively, NIPSCO could award customers a cash rebate for every referral they make.
- Advertise the benefits of participating in the TRC Trade Ally Program to contractors. Consider leveraging this to inform contractors about tools they could use to their benefit, such as the online application or materials to cross-promote other NIPSCO programs to customers.
- Consider prioritizing program delivery strategies (i.e., targeted outreach) that will bring more electric energy savings through the EE Rebates program.
- If NIPSCO and TRC are concerned about this year-to-year inconsistency, the implementation team could consider using semi-custom calculations for large HVAC measures, more like the evaluation methods, which would allow the program to more closely estimate savings based on the specific breakdown of measures installed in that year.
- Encourage program staff to collect non-required fields. And, when possible, include fields for the following within the tracking database, rather than in the program documentation:
    - HVAC characteristics such as SEER, EER, HSPF, and cooling/heating capacities are included in the tracking data for air conditioners, AC tune ups, air source heat pumps, and ductless heat pumps.
    - When including the cooling capacity, provide it in units of Btuh instead of tons, for more accuracy.
    - Water heater uniform energy factor (UEF) in the tracking data.
    - With the ENERGY STAR measures, include the unique ENERGY STAR number for all measures and the clean air delivery rate (CADR), liters of water per kWh consumed, energy factor, and combined energy factor (CEF) for air purifiers, dehumidifiers, pool pumps, and clothes dryers, respectively.

- For future evaluation years, if this information is not able to be tracked consistently in Captures, the evaluation team should consider budgeting for a more in-depth impact evaluation approach for impacted measures, such as sampled desk reviews.
- Work with the evaluation and implementation teams to determine the frequency and importance of exploring estimating savings for dual installations of furnaces and heat pumps.
- Consider collecting data on the heat pump that is installed. This could be done in multiple ways, given logistical needs. First, the corresponding heat pump information could be collected and included in the tracking data. A section may need to be added to the rebate application for furnaces (or heat pumps, if more logical). Second, a flag could be added to the tracking data, and rebate application, which says whether there was a dual installation.
- Consider creating a unique measure type for heat pumps and furnaces that are installed in conjunction with one another. Calculate a new deemed savings value and incentive level for these measures.
- Work with the evaluation and implementation teams to determine the frequency and importance of exploring estimating savings for early replacement scenarios.
- Consider collecting data on whether the replaced unit qualifies as early replacement and include detailed tracking of the existing equipment specifications.

## RESIDENTIAL LIGHTING PROGRAM

- For the 2023 program year, continue to follow ex post baseline calculations implemented in 2022 for LEDs incentivized from January 2023 through the end of June 2023, in anticipation of full enforcement of retail sales rules beginning in July 2023. Discontinue buy downs of all EISA-impacted lamp types beginning in July 2023.

## HOME ENERGY ASSESSMENT PROGRAM

- Update savings approaches to the Illinois TRM to anticipate the upcoming Indiana TRM update. Where applicable, use Indiana location specific input assumptions from Indiana TRM (v2.2) until an updated Indiana TRM is provided.
- Set clear expectations about what the program does in program marketing materials, on the website, and when scheduling.
- Consider offering additional support to customers with air sealing to help customers concerned about losing heat (e.g., thermal camera analysis or blower door test offerings).
- Continue to emphasize that auditors share details on other rebate programs with participants. This could include providing additional collateral material on complementary programs or specific information on what to look for when purchasing efficient home appliances.
- Make sure auditors are explaining the available measures to customers and explaining why they aren't eligible to receive certain measures. Continue to ensure energy advisors are trained to offer and install all applicable measures to each customer.
- Consider reviewing or increasing the educational aspect of the direct install measures to help contractors explain to customers how these measures will save energy and money on their bill. Some customers noted they were skeptical that the installed measures would save them money on their energy bills.

- Continue to consider having the assessment team track reasons for not installing measures by adding checkboxes on the assessment form such as "customer already has efficient equipment", "customer faucets not compatible with aerators", "customer refused measure", etc. With this additional data, NIPSCO and the evaluation team can better determine how to improve the acceptance rate, if needed.
- Continue to focus efforts on the in-person visit but offer virtual options on a case-by-case basis due to health and safety issues.
- Consider adding new measures or adjusting current measures to increase participation and savings.
- Consider whether low-flow handheld showerheads are a cost-effective measure that could be added to the program, to make them available to more customers.
- Consider whether the program could cost-effectively incorporate enhanced audit practices, such as thermal camera analyses or blower door tests, to encourage more customers to take on home weatherization projects.
- Consider if there are opportunities to optimize the incentive to pursue attic insulation to help more customers be able to afford it (e.g., promoting federal tax credits and other incentives).

## INCOME-QUALIFIED WEATHERIZATION PROGRAM

- Increase targeted marketing efforts to drive participation in the program. This could include geographic targeting and working with community-based organizations to promote the program. Targeted marketing efforts and outreach should be specific to IQW-eligible customers, instead of general home assessment marketing that relies on triaging customers between HEA and IQW.
- Consider adding more measures that are applicable to manufactured homes, to provide more savings to those customers (10% of respondents in 2022).
- Ensure that energy advisors provide detailed guidance to customers for follow-on measures such as air sealing/insulation.
- Continue to ensure that assessment reports include information on how to properly use programmable thermostats and encourage energy advisors to explain usage so that customers do not remove or decline that measure.
- Consider changing the age ranges annually in the tracking data to align with the program eligibility requirements (10 years old) and EUL in the TRM or tracking actual age of replaced appliances if possible. The IL TRM allows for a significant boost in savings for refrigerators older than 1990 vintage. Therefore, strata for PY2023 would be 2006-2013, 1990-2006 and <1990.
- If NIPSCO is considering expanding income qualified refrigerator replacements, a survey of TRMs outside of IL and IN for low-income baseline approaches would be advised.
- Ensure that program materials sufficiently explain what weatherization services are offered so that customers are not disappointed when they receive measures.
- Continue to train advisors to explain rules around health and safety issues that might lead to fewer measures being installed.
- Continue to train advisors to provide detailed guidance on follow-on measures such as air sealing and insulation.

- Continue to include information in the assessment reports that connect customers with other funding resources for energy efficiency and health and safety upgrades (including federal funding sources), when applicable.
- Continue to offer in-person assessments for IQW but continue to offer a virtual assessment on a case-by-case basis to accommodate health and safety concerns.
- Make sure advisors are explaining the available measures to customers and explaining why they aren't eligible or able to receive certain measures. Continue to ensure energy advisors are trained to offer and install all applicable measures to each customer.
- Continue to consider having the assessment team track reasons for not installing measures by adding checkboxes on the assessment form such as "customer already has efficient equipment," "customer faucets not compatible with aerators," "customer refused measure," etc. With this additional data, NIPSCO and the evaluation team can better determine how to improve the acceptance rate, if needed.
- Continue to provide clear information about the next steps for each follow-up measure (when installation does not occur during the assessment). The program already includes pamphlets with qualification and contact information but could also encourage advisors to emphasize the estimated timeline for how long the delivery will take for each measure.
- Consider adding new measures or adjusting current measures to increase participation and savings.
- Consider whether low-flow handheld showerheads are a cost-effective measure that could be added to the program, to make them available to more customers.

## MULTIFAMILY DIRECT INSTALL PROGRAM

- When planning for future program designs, consider a strategic marketing and outreach plan that uses one-to-one outreach strategies and other community stakeholders or groups to reach eligible property managers.
- In terms of program design and delivery, consider ways to increase the value proposition for participants. Several peer utility programs have transitioned to one-stop-shop participation models, which streamline the process and emphasize both in-unit and common area improvements as part of the same participation experience.
- Additionally, helping buildings unlock deeper savings through partnerships with specialized trade allies might provide additional incentives for property managers to participate, thus enhancing the value proposition.
- Update savings approaches to the Illinois TRM to anticipate the upcoming Indiana TRM update. Where applicable, use Indiana location specific input assumptions from Indiana TRM (v2.2) until an updated Indiana TRM is provided. For new programable thermostat measures, utilize the Indiana TRM algorithms and assume savings factors calculated in the most recent NIPSCO HVAC billing analysis. Additionally, apply the provided multifamily adjustment factors to account for reduced heating and cooling loads in multifamily units.
- The program might consider expanding on the evaluation's mapping exercise to home in on key neighborhoods to target for MFDI program marketing.

- The program could consider focusing marketing and outreach efforts on geographic areas with a greater concentration of multifamily units and renters. Enlisting the help of community-based organizations, local elected officials, or city planning agencies might help the program connect to property management firms.
- Using case studies or program materials that emphasize the benefits to property owners (e.g., happier tenants, fewer maintenance issues, bill savings) might help attract property managers to the program.
- One-to-one marketing channels could focus on developing trusted relationships with property owners and on finding project champions within property management organizations.

## APPLIANCE RECYCLING PROGRAM

- NIPSCO and TRC should update the program *ex ante* savings estimates to reflect the most recent evaluated results.
- If TRC is not already doing so, TRC should collect, document, and clearly label in the program tracking data the pints of water per day capacity of the dehumidifier units recycled to provide inputs for the evaluated savings calculations.
- Re-evaluate this program in the next program cycle to re-assess customer experiences and update evaluation metrics (such as part-use factor, ISR, and NTG).

## BEHAVIORAL PROGRAM

- Consider ways to boost engagement with the portal if this is a priority for NIPSCO. Boosting engagement with the portal may be a way to provide more targeted cross-channeling to other programs.
- Consider two options for Wave 2 savings in 2023: a) group Wave 2 with another wave during evaluation or b) consider filling Wave 2 with new randomly assigned treatment and control group customers. Increasing the sample size will increase the statistical power and hedge the risk of random variation in the modeling results (the risk that the program would see negative savings when there are positive savings or positive savings when there are negative savings).
- If new waves need more treatment customers, consider looking at how to re-use control customers across waves to minimize the number of total control customers across the program.
- If Wave 10 continues to see negative savings, consider doing a more in-depth look at the baseline used, which was during 2020, and could have been impacted by unusual usage during the height of COVID-19 restrictions.

## RESIDENTIAL NEW CONSTRUCTION PROGRAM

- Consider increasing the electric rebate value to incentivize more builders to move to 15+ SEER (or higher) equipment, offsetting the upfront cost of higher efficiency, where cost-effective and feasible.
- Consider adding an ENERGY STAR bonus tier. Utilities programs in Michigan and Pennsylvania that rebated ENERGY STAR certified new homes, had average claimed electric savings 24-335% higher than NIPSCO ex post savings.
- Consider the possibility of offering prescriptive rebates for high efficiency HVAC equipment and appliances that can be stacked with builder gas and/or electric HERS tier rebates. There is room for improvement in

efficiency, especially on the gas side. In 2022, sampled electric projects had an average 15.3 SEER, while gas projects had an average 13.8 SEER. The average furnace AFUE was 96.4% for electric projects and 94.9% for gas projects. Additionally, rebates could be offered for energy recovery ventilation (ERV) and above-code envelope measures, including roof/wall insulation and windows to reduce heating and cooling losses. Table 19 in the Appendix provides various home efficiency characteristics for the 2022 participating homes.

- In addition to the recommendations outlined in Conclusion 1, which would all potentially increase electric savings, look to expand the program into new markets, such as home renovations and remodels. High demand and cost for new housing will cause homeowners to stay in their homes longer and thus pursue renovation or additional projects. Home addition projects offer opportunities for energy savings by installing efficient building shell measures like insulation and windows, as well as targeting upgrades to HVAC, water heating, and appliances.
- The evaluation team recommends the following:
    - Equation to calculate EER from a given SEER[3]: $EER = -0.0228 \times (SEER) + 1.1522 \times (SEER)^2$
    - Updating EERs:
        - 11.35 $EER_{baseline}$ from 2023 federal minimum efficiency standard 13.4 SEER
        - 12.29 $EER_{ee}$ from weighted average of 2022 electric prototypes of 15.3 SEER
    - Resulting in 0.207 kW savings to be considered for 2023 deemed savings.
- Add to the tracking data an indicator for housing type (e.g., single-family, multifamily, duplex, etc.) so that the participation across the housing segments is clear. This can help inform program engagement activities.
- Explore the needs of builders in other housing segments that are currently eligible under the program. This work could also explore engagement needs for manufactured home builders in advance of the program's plan to incorporate that housing segment in the next program cycle.
- Review the incentive levels and consider opportunities to stack incentives to encourage builders to install certain high efficiency equipment (e.g., a 15 SEER air conditioner, heat pumps, etc.).
- Consider what opportunities there might be to funnel builders towards other offerings that might be relevant (e.g., incentives for EV chargers, solar, etc.).

## SCHOOL EDUCATION PROGRAM

- Continue providing high in-service rate items in kits and include additional information about gaskets, such as potential energy savings and infiltration reduction benefits, in the program materials.
- Like other programs offering lighting, follow plans to phase out non-exempt lighting measures from kit programs due to the upcoming EISA backstop.
- Consider updating the ISRs for new measures, such as the 5W candelabras, advanced power strips, and gaskets, based on the 2021 School Education program and the 2022 Homelife Calculator survey findings. Include space heating fuel saturation in the *ex ante* savings calculations for gaskets.

[3] Source: State of Pennsylvania Technical Reference Manual, Vol. 2: Residential Measures; Rev Date: Feb. 2021; Section 2.2 Table 2-10.

- Consider ways to increase education around the light switch and power gasket measures to promote higher in-service rates, specifically providing clear directions to install gaskets on exterior walls.

## HOMELIFE ENERGY EFFICIENCY CALCULATOR PROGRAM

- Given that most respondents appear to be very or somewhat satisfied with the kit contents overall, continue to offer gasket measures. Include information about potential energy savings and infiltration reduction benefits resulting from gasket installation, as well as instructions for installation, in program collateral to raise awareness and increase in-service rates.
- Continue to offer high-satisfaction measures. Investigate whether there are opportunities to elevate satisfaction and in-service rates across all measures. Respondents who did not install water savings measures stated they already had a device installed, it did not fit, or they did not know how to install the device. There may be opportunities to clarify installation instructions or include QR or website links in program collateral that connect participants to installation videos.
- Like other programs offering lighting, follow plans to phase out non-exempt lighting measures from kit programs due to the upcoming EISA backstop.
- Continue to use NIPSCO communication lists and NIPSCO-driven emails to maximize customer reach and engagement. Curate content to capture customer interest and motivators, indicating energy and money saving opportunities in messaging.
- Television, retailer, and vendor communications and rebate inserts are the lowest recalled forms of reaching participants. Continue to leverage low-cost pathways to reach customers, such as emails, newsletters, and social media posts, as they appear to be effective.
- Consider following-up with participants after sending out personalized recommendations to remind participants about the existence of recommendations and encourage them to act.
- Investigate ways to provide detailed instructions for installing measures, such as including step-by-step photos in the kits, or providing website links or QR codes in the program collateral that connect participants to online instructions and videos.
- Overall, participants are satisfied with the HomeLife Calculator program, NIPSCO, and the energy efficiency measures. Continue to build upon this satisfaction to increase awareness of and participation in other NIPSCO offerings through various communication channels, including outreach follow-up and program collateral in kits.
- Update the ISRs for new measures based on 2022 survey results, which capture measure information from NIPSCO customers participating in the HomeLife Calculator program.
- Consistently track customer fuel type and kit type, and confirm the agreement between Measure Description, Energy Type, and Material Description fields in the tracking data to limit risk for errors in savings calculations.

## RESIDENTIAL ONLINE MARKETPLACE

- For the 2023 program year, continue to follow ex post baseline calculations implemented in 2022 for kit LEDs incentivized from January 2023 through the end of June 2023. Consider applying lower ISRs, consistent with survey results.

- For the 2023 program year, continue to follow ex post baseline calculations implemented in 2022 for LEDs incentivized from January 2023 through the end of June 2023. Discontinue buy downs of all EISA-impacted lamp types in mid-2023.
- Inputs and deemed savings values from the 2020 billing analysis should be applied to all Wi-Fi thermostats.
- Continue to monitor thermostat in-service rate to ensure thermostats are being installed and customers are satisfied with their thermostat purchase and operation.
- Consider prioritizing a re-evaluation of the thermostat billing analysis within the EE Rebates program in the next two years, to update savings inputs.
- NIPSCO should exercise caution in widespread distribution of smart plugs unless documented savings can be substantiated. Savings could be substantiated if the measure is added to a TRM or another defensible source.
- Create a separate field in the tracking data that documents whether customers receive electric, gas or combo service from NIPSCO, so savings can be accurately assigned. This will allow the evaluation team to more accurately provide QA/QC and assign accurate savings to customers. This should be done consistently across all NIPSCO program tracking datasets.
- Water heating fuel and home heating fuel are both required inputs during the OLM check-out process. Since this information is collected for every customer, include it for every measure in the tracking data.
- Include a separate column in the tracking data to report therm penalties and consistently apply these for all lighting measures installed in natural gas heated homes.
- Conduct periodic quality checks of the data reporting throughout the program year and make corrections when areas for improvement are identified.
- Continue to promote the Marketplace through email, as it is the strongest channel for Marketplace participation. Emphasize how Marketplace prices may be cheaper than other retailers, as this was a commonly cited motivator for participants to purchase Marketplace products. Convenience and knowing products were energy efficient were two other benefits commonly highlighted by respondents.
- Consider sending re-engagement emails to respondents who have already purchased marketplace products, reminding them of limited time offers.
- Include instructional materials on these measures in the kits. The Marketplace website currently has instructional “resources” at the bottom of the product page (e.g., the Tier 1 TrickleStar 7-outlet Tier 1 Advanced Power Strip page has links to instructional videos and installation PDFs). We recommend that these instructions (in the case of PDF documents) should be included in the kit for customer reference. Alternatively, NIPSCO could include a QR code in the kit, linking respondents to the relevant PDFs and videos on the website.

## COMMERCIAL AND INDUSTRIAL PROGRAMS

- For Prescriptive, Custom, and SBDI programs, closely monitor participation trends throughout 2023 to determine if the decreased participation trend will persist and identify whether program strategies, such as bonus incentives to contractors, could help boost participation throughout the year.
- Conduct evaluation research with nonparticipating businesses to understand major barriers and needs across business segments (planned for summer 2023).

- To be consistent across the portfolio, NIPSCO should calculate WHFs for all C&I programs going forward in the project tracking data, so these factors can be included in cost-effectiveness and future planning, even if they are not counted in reported savings. To do this, NIPSCO should take the following steps:
  - Utilize the inputs in the applicable section of the application tool to determine how each area is heated or cooled. There is a "space conditioning type" variable in the "Project Information" tab of the application, but some areas may be conditioned differently (i.e., warehouses with an attached office area).
  - Add functionality to the application to look up the electricity, demand, and natural gas WHFs based on the project site location and the method of heating and cooling.
  - Modify kWh, kW, and therm calculation methodologies in the application Excel tool to include these WHFs. Note that some lighting projects accounted for kWh and kW WHFs, but not uniformly across all sampled projects, where lighting was installed within conditioned space.
  - Track fuel type by customer to accurately capture applicable WHFs for electric-only versus dual fuel customers.
- Explore options to reduce the administrative burden of Custom program applications and simplify the processes in general.
- Research options for adding incentives or other support for EV charging, advanced rooftop controls, and refrigeration options.
- Continually look for opportunities to add eligible measures to the SBDI offering and to make some of the more common Custom measures prescriptive so that customers can receive higher incentives.
- Continue to provide incentives for customers and contractors to upgrade existing inefficient EISA-exempt lamps and fixtures. Consider ways to "leapfrog" adoption and encourage related measures, such as lighting controls, with these projects where possible.
- TRC should track incremental cost data, and any other cost or incentive data, clearly and accurately within Captures for all measures, including prescriptive measures, in the C&I datasets. This will limit introduced errors and allow the evaluation team to more accurately QA/QC these data during the cost-effectiveness analysis process.
- If possible, TRC should track these data consistently on the residential side as well. Although all residential measures are prescriptive in nature and incremental costs are tracked in the measure assumptions documentation, tracking incremental costs directly in Captures would again limit the introduction of error and allow the evaluation team to more easily QA/QC these values by measure and program.

## COMMERCIAL AND INDUSTRIAL ONLINE MARKETPLACE

- Continue and expand upon established outreach methods and strategies that seem to be increasing awareness and are a good match to customer preferences.
- Use evaluation findings on the most influential messages to inform future outreach. Respondents mentioned influential kit items (e.g., LEDs and power strip), customer motivations and attitudes toward efficiency (e.g., reducing utility bills and energy use, getting free equipment), and economic challenges faced by businesses (e.g., inflation and high up-front costs) the most.
- Continue using emails, bill inserts or other printed material, and the company website to inform customers of incentive offerings because they are effective and popular.

- Continue to expand upon marketing efforts that promote the program as an easy way for customers to act to improve efficiency with free equipment from energy saving kits that can lower energy bills and fight the effects of inflation.
- Continue to monitor available self-install products that can motivate customers to order kits and products, particularly products that have a high impact on energy and water savings, given the upcoming EISA backstop.
- Continue to include advanced power strips in kit contents.

# 1. PROGRAM OFFERINGS

NIPSCO's DSM portfolio consists of 17 programs distributed across the Residential and C&I sectors. NIPSCO administers these programs with the support of a third-party implementer, TRC Company (formerly Lockheed Martin Energy). The 2022 program year marked the last year of a three-year program cycle. A brief description of each program's offering follows:

- The **Energy Efficiency Rebates program** provides incentives to natural gas and electric residential customers to purchase energy-efficient heating and cooling products. The program includes energy-efficient measures such as smart thermostats, furnaces, air conditioners, boilers, heat pumps dehumidifiers, electric clothes dryers, and air purifiers.
- The **Residential Lighting program** provides upstream discounts on LED lamps and LED lighting fixtures. NIPSCO works with retailers and manufacturers to offer reduced prices at the point of sale.
- The **Home Energy Assessment program** provides no-cost, in-home energy assessments to residential customers. During an assessment, an energy advisor analyzes the efficiency of the heating and cooling systems and insulation levels in the home and installs energy-saving lighting and water conservation measures, as well as duct sealing to qualifying homes during the assessment. The assessment concludes with the advisor providing a report of findings and energy-saving recommendations. The primary focus of the program is to educate customers about energy efficiency in their homes.
- The **Appliance Recycling program** provides removal and recycling services to electric customers who reduce energy consumption through recycling unneeded refrigerators, freezers, room air conditioners, and dehumidifiers. There is a limit of two large appliances (refrigerators and freezers) and two small appliances (room air conditioner or dehumidifier) per household, per year.
- The **School Education program** works with fifth-grade teachers to educate students about energy efficiency and how they can make an impact at school and home. Participating teachers receive classroom curriculum and take-home efficiency kits to distribute to their students.
- The **Multifamily Direct Install (MFDI) program** provides property owners and managers of multifamily housing a no-cost property walk-through for residential units and common spaces and energy efficiency measures in-unit at no-cost as well. The walk-through results in a report with recommendations for energy-efficient upgrades. During a follow up visit, a program approved contractor will install some or all the suggested energy-efficient measures in the residential units.
- The **Behavioral program** sends paper and/or electronic home energy reports to selected customers that educates them on their energy consumption patterns. Participants receive a targeted, individualized report that is intended to motivate them to engage in energy-saving behaviors. The report shows the participant's monthly energy use and compares this use to similarly sized homes nearby, and it also provides semi-customized energy-saving tips. Participants may opt-out through an online portal.
- The **Income-Qualified Weatherization (IQW) program** provides no-cost, in-home energy assessments to income-qualified residential customers. Program participants receive a home assessment, where an energy advisor first analyzes the efficiency of heating and cooling systems and insulation levels in the home. Depending on opportunities in the home, the advisor then installs energy-saving lighting and water-conservation measures, as well as duct sealing and air sealing to qualifying homes during the assessment.

Electric customers with qualifying refrigerators ten years old or older are also eligible to receive a new, ENERGY STAR®-rated refrigerator, and those with attic insulation levels below R-11 may qualify for attic insulation. Both items are installed after the initial assessment. The advisor also provides a report of findings and energy-saving recommendations.

- The **Residential New Construction program** provides incentives to residential home builders to build higher efficiency homes. The program offers several tiers of incentives utilizing HERS ratings, to encourage energy efficiency in residential home construction.

- The **Homelife Energy Efficiency Calculator program** offers residential customers a free online 'do-it-yourself' audit to help customers learn about their home's energy use and provide recommendations on how to save energy. Eligible participants also receive a free energy savings kit with various measures including specialty LEDs, water saving devices, advanced power strips, and light switch and power outlet gaskets.
- The **Residential Online Marketplace** provides an online retail platform for customers to buy energy saving equipment, such as lightbulbs, thermostats, advanced power strips, smart plugs, air purifiers and water-saving devices. Through the Online Marketplace, NIPSCO also offered energy-saving kits marketed as Home Office Kits, each containing a customized mix of measures such as lighting and water saving devices.
- The **C&I Prescriptive program** provides rebates for the installation of energy efficiency equipment and system improvements. The program offers rebates for lighting, pumps and drives, heating, cooling, and refrigeration equipment.
- The **C&I Custom program** provides incentives for measures not included in the Prescriptive program that are unique to the commercial participant's application or process. The program requires individual engineering analyses to determine savings. This program offers customers incentives based on the calculated savings for energy savings opportunities outside the traditional rebate program.
- The **C&I New Construction program** offers incentives to encourage building owners, designers, and architects to exceed standard building practice. Projects may also qualify for either prescriptive or custom incentives.
- The **Small Business Direct Install (SBDI) program** provides small business participants incentives for refrigeration, lighting, HVAC, and other natural gas–saving measures typically used in small business operations. These incentives are higher than offered through the C&I Prescriptive program to overcome first-cost barriers traditional experienced by small business customers.
- The **Schools SEM program** new for 2022, is designed to engage school districts in a process of continuous and evolving improvements at their facilities. School districts form teams that are coached to maximize the performance within their facilities. They are also encouraged to utilize a performance tracking tool, such as ENERGY STAR® Portfolio Manager®, to benchmark and track progress toward their energy conservation goals.
- The **C&I Online Marketplace** provides free energy-saving kits to businesses, with measures included in the kits customized to meet different sector's needs (such as office, retail, and restaurant sectors). These kits contain lighting and water saving measures as well as other measures, such as advanced power strips. The program also offers Lighting Add-On packs, for which the customer pays shipping, plus tax.

# 2. EVALUATION OBJECTIVES AND METHODOLOGY

The evaluation team employs consistent methods across-programs and from prior evaluation years whenever possible. The evaluation process can be broken into three key areas of research, which are summarized below:

**Impact Evaluation**. The evaluation team verifies measure installation, calculates evaluated (or gross) savings, and measures freeridership and spillover to produce net savings impacts. This research includes conducting engineering desk reviews of project savings calculations, completing site visits to observe project conditions and measure savings performance, and surveying participants to understand program influence.

**Process Evaluation**. The evaluation team investigates program processes, participation barriers, and the program experiences of customers and trade allies. This research uses telephone and online surveys with program actors (trade allies, participants, and other supporting actors), and interviews with implementation staff to better understand program performance. This research gives stakeholders insight into the aspects of success or potential improvement for each program and provides context for impact findings.

**Cost-Effectiveness**. The evaluation team conducts a cost-effectiveness analysis (a form of economic analysis) to compare the relative costs and benefits from NIPSCO's investment in each program. In the energy efficiency industry, cost-effectiveness metrics serve as an indicator of the economic attractiveness of any energy efficiency investment or practice, as compared to the costs of energy produced and delivered in the absence of such investments.

## RESEARCH QUESTIONS

The evaluation team developed key research questions for each program, designed to address program-specific evaluation needs. Impact activities for most programs included an assessment of these research areas:

- Data quality review
- In-service rates or ISRs
- Measure verification
- Freeridership
- Spillover
- Program cost-effectiveness

Process activities for most programs included an assessment of these research areas:

- Program design, delivery, and administration
- Communication and coordination between NIPSCO and its implementers
- Marketing strategies
- Program processes (including application processes)
- Drivers of participation and barriers to participation
- Quality control processes
- Future program plans

## IMPACT EVALUATION APPROACH

To determine portfolio impacts, the evaluation team completed the following activities for all programs:

- Compared tracking data, program documents, and scorecard data for alignment and accuracy
- Reviewed savings values, calculations, assumptions, and sources
- Collected ISR data for program measures, where applicable
- Calculated *ex post* gross savings values for programs and the portfolio
- Estimated freeridership and spillover behavior from participant surveys, site visits, and secondary sources
- Calculated *ex post* net savings values for programs and the portfolio

The team employed statistical and engineering-based analysis techniques to achieve these results, adjusting program-reported gross savings (*ex ante*) using the information gathered through database and document reviews, engineering reviews of tracking data and project work papers, Illinois TRM (v10), Indiana TRM (v2.2) deemed savings calculation reviews, and on-site verification and metering.

The evaluation team's presentation of analysis results follows a progression, with each savings type corresponding to a specific step in the evaluation process.

The evaluation team defined these key savings terms as follows for the impact evaluation:

- Reported *ex ante* savings: Annual gross savings for the evaluation period, as reported by NIPSCO in the 2022 DSM Scorecard.
- Audited savings: Annual gross savings after alignment or reconciliation with the program tracking data.
- Verified savings: Annual gross savings after alignment with the program tracking data (i.e., Audited savings), and adjustments related to ISRs.
- Evaluated *ex post* savings: Annual gross savings with all previous adjustments (i.e., Verified savings), and adjusted to include the best available inputs and methodology available at the time of the evaluation.
- Realization rate (percentage): the percentage of savings the program realized, calculated using the following equation:

$$Realization\ Rate = \frac{Ex\ Post\ \text{Gross Savings}}{Ex\ Ante\ \text{Gross Savings}}$$

- Evaluated net savings: Evaluated *ex post* savings, adjusted for attribution (i.e., freeridership and spillover).

## PROCESS EVALUATION APPROACH

For the process evaluation, the evaluation team conducted interviews with program and implementation staff to document how each program worked, identify and understand the important influences on the program's operations, and gain insight into factors influencing the program's performance. For some programs, the evaluation team also conducted surveys and interviews with program participants and participating trade allies to understand their perspectives and experiences with a given program.

# RESEARCH ACTIVITIES

The evaluation team conducted the following research activities by program. Table 8 details the activities that informed the impact evaluations, and Table 9 details the activities that informed the process evaluations.

TABLE 8. 2021 IMPACT EVALUATION ACTIVITIES

| PROGRAM | DATABASE REVIEW | ENGINEERING ANALYSIS | VERIFICATION/ SITE VISITS | NTG ESTIMATION/UPDATES | GATHER IMPACT INPUTS VIA PARTICIPANT SURVEYS | OTHER |
|---|---|---|---|---|---|---|
| HVAC Rebates | ✓ | ✓ | | ✓ | ✓ | |
| Lighting | ✓ | ✓ | | | | |
| HEA | ✓ | ✓ | | ✓ | ✓ | |
| Appliance Recycling | ✓ | ✓ | | | | |
| School Education | ✓ | ✓ | | | | |
| MFDI | ✓ | ✓ | | ✓ (literature review) | | |
| Behavioral | ✓ | ✓ | | N/A | | |
| New Construction | ✓ | ✓ | | ✓ | ✓ | |
| Homelife Calculator | ✓ | ✓ | | ✓ | ✓ | |
| IQW | ✓ | ✓ | | N/A | ✓ | |
| Residential Online Marketplace | ✓ | ✓ | | ✓ | ✓ | |
| Prescriptive | ✓ | ✓ | ✓ | | | |
| Custom | ✓ | ✓ | ✓ | | | |
| C&I New Construction | ✓ | ✓ | ✓ | | | |
| SBDI | ✓ | ✓ | ✓ | | | |
| C&I Online Marketplace | ✓ | ✓ | ✓ | ✓ | ✓ | |
| Schools SEM | ✓ | | | | | |

TABLE 9. 2021 PROCESS EVALUATION ACTIVITIES

| PROGRAM | PROGRAM STAFF INTERVIEWS/DISCUSSIONS | MATERIALS REVIEW | PARTICIPANT SURVEYS/INTERVIEWS |
|---|---|---|---|
| RESIDENTIAL | | | |
| HVAC Rebates | ✓ | ✓ | ✓ |
| Lighting | ✓ | ✓ | |
| HEA | ✓ | ✓ | ✓ |
| Appliance Recycling | ✓ | ✓ | |
| School Education | ✓ | ✓ | |
| MFDI | ✓ | ✓ | |
| Behavioral | ✓ | ✓ | |
| New Construction | ✓ | ✓ | ✓ |
| Homelife Calculator | ✓ | ✓ | ✓ |
| IQW | ✓ | ✓ | ✓ |
| Residential Online Marketplace | ✓ | ✓ | ✓ |
| C&I | | | |
| Prescriptive | ✓ | ✓ | |
| Custom | ✓ | ✓ | |
| New Construction | ✓ | ✓ | |
| SBDI | ✓ | ✓ | |
| C&I Online Marketplace | ✓ | ✓ | ✓ |
| Schools SEM | ✓ | | |

## DATABASE AND DOCUMENT REVIEW

The evaluation team reviewed NIPSCO's program tracking databases, scorecards, and other documentation to assess the quality of information and to identify potential anomalous entries, outliers, duplicates, and missing values. This included reviewing all data fields recommended in the Illinois TRM (v10), along with those necessary to calculate deemed savings. The evaluation team conducted a database and document review for all programs, including these specific activities:

- Verified that all customer and vendor information needed to conduct primary research was available and complete
- Confirmed that all measure-specific data included the necessary details in the proper formats to enable impact evaluation
- Confirmed that all program costs and other tracking information required to calculate impacts and assess resource allocation were available and complete
- Assessed new marketing, outreach materials, and other related activities

For measures not included in the Illinois TRM (v10), the evaluation team reviewed project documentation (e.g., audit reports and savings calculation work papers) from a sample of energy efficiency project sites. The evaluation team closely reviewed the calculation procedures and savings estimate documentation. The evaluation team also verified the appropriateness of NIPSCO's analyses for calculating savings as well as the assumptions used for participating facilities' structural attributes and operational characteristics.

## VERIFICATION AND METERING SITE VISITS

For the C&I programs, the evaluation team focused virtual site visit activities on verifying and measuring program measures installed in C&I buildings. The evaluation team did not perform any onsite activities, including metering, in the 2022 evaluation. Verification was conducted via phone interviews and virtual site visits with select customers.

The total number of measures reviewed via virtual site visits is outlined in Table 10 below. The team reviewed program tracking data in Spring 2022, a second time in fall 2022, and a third time in early 2023, to identify high-saving projects and draw these projects into a sample for recruitment. Virtual verifications were completed between Spring 2022 and February 2023.

TABLE 10. 2022 ON-SITE IMPACT EVALUATION SAMPLES

| PROGRAM | TOTAL NUMBER OF SAMPLED MEASURES | NUMBER OF VIRTUAL SITE VISIT MEASURES | PERCENT *EX ANTE* ELECTRIC SAVINGS SAMPLED | PERCENT *EX ANTE* GAS SAVINGS SAMPLED |
|---|---|---|---|---|
| C&I Prescriptive | 33 | 5 | 11% | 16% |
| C&I Custom | 35 | 13 | 28% | 53% |
| C&I New Construction | 23 | 6 | 30% | 39% |
| C&I SBDI | 27 | 3 | 37% | 100% |
| **C&I Total Programs** | **118** | **27** | **21%** | **45%** |

NIPSCO provided contact information for project decision-makers and implementation contractors, and the evaluation team contacted customers at selected sites to schedule interviews and virtual visits in advance. The evaluation team conducted these primary tasks during the M&V virtual visits:

- Verified that all measures were installed correctly and functioning properly and confirmed the operational characteristics of the installed equipment such as temperature, setpoints, and annual operating hours.
- Collected physical data such as cooling capacity or horsepower and analyzed the energy savings realized from the installed improvements and measures.

## PROGRAM STAFF INTERVIEWS AND DISCUSSIONS

The evaluation team set up overarching meetings with NIPSCO implementation staff to understand how the programs were designed and delivered, what worked well in 2022, and what could be improved. The interviews covered wide-ranging topics such as program design and administration, communication and data tracking processes, marketing strategies, trade ally and participant interactions, and challenges and successes.

## PARTICIPANT SURVEYS

The team conducted quantitative research to address the program's impact and process needs, depending on the status and design of the program. To support the impact and process evaluations, the evaluation team conducted surveys for select programs. The evaluation team designed these surveys to collect data about market awareness of NIPSCO's energy-saving programs, product installation rates, customer behavior and equipment use, participant satisfaction with program components, and barriers to participation. Where applicable, the surveys informed process and impact research questions, such as freeridership and spillover.

### SAMPLING

The evaluation team used a sampling approach to develop sample frames for participant and nonparticipant surveys, and to determine the number of site visits needed for field work. Table 11 shows the population and sample sizes, as well as the number of completes for surveys.

TABLE 11. SURVEY POPULATION AND SAMPLE SIZES

| PROGRAM | RESPONDENT GROUP | SURVEYS OR INTERVIEWS | POPULATION (COUNT OF UNIQUE ELIGIBLE CUSTOMERS) | TARGET COMPLETES | ACHIEVED COMPLETES |
|---|---|---|---|---|---|
| RESIDENTIAL | | | | | |
| EE Rebates | Participants | Surveys | 4,223 | Census | 332 |
| EE Rebates | Contractors | Interviews | 120 | Census | 6 |
| HEA | Participants | Surveys | 1,348 | Census | 152 |
| IQW | Participants | Surveys | 828 | Census | 100 |
| HEA/IQW/MFDI | Energy Advisors | Interviews | 6 | Census | 6 |
| HomeLife Calculator | Participants | Surveys | 2,543 | 120 | 142 |
| Residential Online Marketplace | Participants | Surveys | 3,765 | 260 | 285 |
| Residential New Construction | Builders | Interviews | 75 | 6 | 3 full, 6 partial |
| Residential New Construction | Raters | Interviews | 3 | Census | 2 |
| C&I | | | | | |
| Prescriptive/Custom/SBDI | Contractors | Interviews | 217 | 15-30 | 19 |
| C&I Online Marketplace | Participants | Surveys | 862 | Census | 89 |

## NTG METHODS

An NTG ratio is made of two components: freeridership and spillover. Freeridership is the percentage of savings that would have occurred in the absence of the program because participants would have behaved the same (purchasing the same measures) without the influence of the program. Spillover occurs when customers purchase energy-efficient measures or adopt energy-efficient building practices without participating in a utility-sponsored program. The evaluation team used the following equation to calculate NTG for each program:

$$Program\ NTG\ Ratio = 100\% - Freeridership + \ Spillover$$

In 2022, programs that included NTG analysis primarily used the self-report approach. The approach accounted for customers' intention absent the program and influence of program offerings on customers' decisions. Several programs that did not include customer surveys, but would require a self-report approach, used prior years' NTG results.

### SELF-REPORT METHOD

To determine a freeridership score, the evaluation team relied on self-report participant surveys, in which the evaluation team asked participants a series of questions about what their actions would have been in the absence of the program. The specific net-to-gross batteries were tailored to each individual program design. The evaluation team used each unique set of responses to calculate a freeridership score for that individual. The evaluation team then aggregated the scores and determined a total freeridership score by fuel type. To facilitate comparisons over program years, the evaluation team used NTG question batteries consistent with those used in prior evaluations.

Spillover is measured by asking participants who purchased a particular measure if, because of the program, they decided to install another energy-efficient measure or undertake some other activity to improve energy efficiency. The evaluation team assessed spillover through self-report surveys, in which interviewers read a list of energy-efficient products to respondents and asked if they had installed any of the products in their home or business since participating in the program. If respondents said they had made energy-efficient improvements or purchased products, interviewers asked how influential the program was on their purchasing decisions.

The evaluation team estimated spillover savings for measures where participants said the program was very influential in their decision. The team used specific information about participants, determined through the evaluation, and used the Illinois TRM (v10) and EM&V *ex post* savings analyses as a baseline reference. The sum of the estimated spillover savings, divided by savings achieved through the program for each relevant measure, yielded spillover savings as a percentage of total savings, which the evaluation team then extrapolated to the population of program participants.

### INTENTION/INFLUENCE METHOD FOR SELF-REPORTS

For the *intention/influence* method, the evaluation team assessed freeridership in two steps. Although the questions were like those used in the self-report method, the *intention/influence* questions explored the participant's intention and the program's *influence* in more detail. The evaluation team first scored these two parts of the survey separately, then combined them with equal weight to determine one freeridership score for each survey respondent. A similar but slightly modified version of this approach was used for kit programs, which have a somewhat different program design compared to other programs such as the HVAC or C&I programs. Spillover under this method focused on the program's *influence* on a participant's decision to invest in additional energy-efficient measures.

The evaluation team derived the participants' *intention* freeridership score by translating their responses into a matrix value and applying a consistent, rules-based calculation to obtain the final freeridership score.

The evaluation team used the following process for determining the intention freeridership score:

- Customers were categorized as 0% freeriders if they were not aware of a program (i.e., efficient) measure and had no plans to install that measure prior to hearing about the program. Customers also were categorized as 0% freeriders if they knew about the program but had no plans to install an efficient, program-promoted measure.

- Customers were categorized as 100% freeriders if they would have installed the measure in the program's absence or if they had already installed the measure before learning about the program.
- Customers received a partial freeridership score if they planned to install the measure and the program altered their decision. This effect may have included the installation's timing, the number of measures installed, or the efficiency levels of measures installed. For customers who were highly likely to install a measure, and for whom the program had less effect on their decisions, the evaluation team assigned a higher intention freeridership score.

The evaluation team assessed the influence of freeridership by asking participants how important various program elements were in their purchase decision-making process. The maximum rating of any program factor determined a participant's influence freeridership score (0% to 100% score range using a 1 to 4 scale).

The evaluation team calculated the arithmetic mean of the intention and influence freeridership components to estimate total freeridership for programs.

$$\text{Total Freeridership} = \frac{\mathit{Intention}\text{ FR Score } + \mathit{Influence}\text{ FR Score}}{2}$$

The influence and intention scores contribute equally to the total freeridership score. The higher the total freeridership score, the greater the deduction of savings from the gross savings estimates.

Using the calculated freeridership and spillover values, the evaluation team applied the overall NTG ratio to the *ex post* gross savings to identify the *ex post* net savings.

### DEEMED SAVINGS METHOD

The evaluation team applied a deemed NTG ratio in two types of situations. First, the evaluation team applied an NTG of 100% for programs targeting low-income customers. Low-income programs tend to focus on direct installation of measures and are based on the hypothesis that the customer would not have installed the energy-efficient product without the assistance of the program. For the Income Qualified Weatherization program, the evaluation team applied an NTG of 100%.

Additionally, for several programs, where there was not enough participation or robust enough data to calculate new NTG values from primary research, the evaluation relied on either 1) past evaluation estimates for that same program or 2) NTG values from other NIPSCO programs with similar program designs to estimate NTG for the 2022 evaluation year.

# 3. ENERGY EFFICIENCY REBATES PROGRAM

## PROGRAM DESIGN AND DELIVERY

NIPSCO offers the Energy Efficiency (EE) Rebates Program to encourage customers to install energy efficient equipment to reduce energy consumption. The program is available to all residential gas and electric customers with an active NIPSCO account. The 2022 program includes the following measure categories:

- Air conditioners
- Air conditioner tune-ups
- Air purifiers
- Air-source heat pumps
- Air-source heat pump tune-ups
- Boilers
- Dehumidifiers
- Ductless mini-split heat pumps
- Electric clothes dryers
- Furnaces
- Heat pump water heaters
- Pool pumps
- Wi-Fi thermostat

Program rebates range from $25.00 to $350.00, covering a variety of HVAC equipment and appliances, such as Wi-Fi thermostats, boilers, and furnaces. Rebate levels vary by equipment efficiency level and measure type.

As in previous years, 2022 participants can either install measures through a contractor of their choice or install measures themselves. A licensed HVAC contractor must complete air conditioner and air-source heat pump tune-ups. Customers and contractors can fill out the application either through an online form or on paper and then mail or fax it to NIPSCO.

While NIPSCO does not have a contractor network and does not promote any individual contractors, TRC has its own network of contractors. Customers can use the link on the NIPSCO website to find a contractor; it will link them to the TRC contractor portal. Contractors have the option to provide an instant discount on equipment or services to their customers and submit the rebate application on their behalf. If contractors do not pursue the instant discount option, participants must fill out and submit the rebate forms. Customers or contractors must submit rebate applications within 60 days of installation. Program staff randomly inspect 10% of all installations each year as a means of quality control.

According to the program documentation and Georgia Power staff, NIPSCO advertised the program through direct contractor outreach, bill and check inserts, mail, email, marketing collateral, community outreach events, public relations, social media, cross-selling, and its website.

### CHANGES FROM 2021 DESIGN

In 2022, NIPSCO added three new measures:

- ENERGY STAR heat pump water heaters,
- Air-source heat pump tune-ups, and
- Pool pumps, both ENERGY STAR in-ground pumps and CEE Tier 1 certified above ground pumps.

The in-ground pool pumps must be ENERGY STAR rated and the above ground pool pumps must be CEE Tier 1 certified. Both must use variable speed motors.

NIPSCO also removed several measures and changed the efficiency levels for several measures resulting in the changes outlined in Table 12.

TABLE 12. EE REBATES 2021 AND 2022 ENERGY EFFICIENCY MEASURES

| 2021 MEASURE | 2022 MEASURE |
|---|---|
| Boiler tune-up | *No longer eligible* |
| Natural gas storage water heater 0.70+ UEF | *No longer eligible* |
| Natural gas condensing water heater 0.70+ UEF | *No longer eligible* |
| Natural gas tankless water heater (whole house) 0.94+ UEF | *No longer eligible* |
| Natural gas boiler 90%+ AFUE | *No longer eligible* |
| Air-source heat pump 14+ SEER | Air-source heat pump 15+ SEER<br>Air-source heat pump 16 SEER<br>Air-source heat pump 17 SEER |

Finally, the rebate amounts for a few measures were updated resulting in the changes outlined in Table 13.

TABLE 13. EE REBATES 2021 AND 2022 REBATE AMOUNTS

| 2021 MEASURE | 2021 REBATE | 2022 MEASURE | 2022 REBATE |
|---|---|---|---|
| Air conditioner tune-up | $60 | Air conditioner tune-up | $25 |
| Air conditioner 15+ SEER | $250 | Air conditioner 15 SEER<br>Air conditioner 16 SEER<br>Air conditioner 17 SEER | $200<br>$250<br>$300 |
| Air-source heat pump 14+ SEER | $175 | Air-source heat pump 15+ SEER<br>Air-source heat pump 16 SEER<br>Air-source heat pump 17 SEER | $150<br>$200<br>$300 |

# PROGRAM PERFORMANCE

The EE Rebates program fell short of its electric energy savings and peak demand reduction goals. It well exceeded its natural gas energy savings goal. Table 14 summarizes savings for the full year of program performance, including program savings goals.

TABLE 14. 2022 EE REBATES PROGRAM SAVINGS SUMMARY

| METRIC | GROSS SAVINGS GOAL | *EX ANTE* | AUDITED | VERIFIED | *EX POST* GROSS | *EX POST* NET | *EX POST* GROSS GOAL ACHIEVEMENT |
|---|---|---|---|---|---|---|---|
| Electric Energy Savings (kWh/yr.) | 1,624,167.77 | 923,576.70 | 923,467.44 | 923,467.44 | 871,102.86 | 543,218.82 | 54% |
| Peak Demand Reduction (kW) | 1,379.336 | 931.970 | 931.846 | 931.846 | 763.292 | 496.508 | 55% |
| Natural Gas Energy Savings (therms/yr.) | 569,471.90 | 749,532.69 | 749,510.69 | 749,510.69 | 959,506.63 | 576,870.76 | 168% |

Table 15 outlines the *ex post* gross and NTG adjustment factors.

TABLE 15. 2022 EE REBATES PROGRAM ADJUSTMENT FACTORS

| METRIC | REALIZATION RATE (%)[a] | FREERIDERSHIP | SPILLOVER | NTG (%)[b] |
|---|---|---|---|---|
| Electric Energy Savings (kWh/yr.) | 94% | 39% | 1% | 62% |
| Peak Demand Reduction (kW) | 82% | 36% | 1% | 65% |
| Natural Gas Energy Savings (therms/yr.) | 128% | 41% | 1% | 60% |

[a] Realization Rate is defined as *ex post* Gross savings divided by *ex ante* savings.
[b] NTG is defined as *ex post* net savings divided by *ex post* gross savings.

The program spent 58% of the electric budget and 117% of the gas budget. Table 16 lists the 2022 program budget and expenditures by fuel type.

TABLE 16. 2022 EE REBATES PROGRAM EXPENDITURES

| FUEL | PROGRAM BUDGET | PROGRAM EXPENDITURES | BUDGET SPENT (%) |
|---|---|---|---|
| Electric | $658,915.13 | $380,794.49 | 58% |
| Natural Gas | $1,357,262.44 | $1,593,698.65 | 117% |

## EVALUATION METHODOLOGY

To inform the 2022 NIPSCO impact and process evaluation, the evaluation team completed the following research activities:

- **Program staff interviews and discussions,** to understand the program process, delivery, and design.
- **Program documentation and materials review,** to provide context on program implementation.
- **Tracking data analysis,** to audit and verify the accuracy of program participation data.
- **Engineering analysis,** to review program savings assumptions and algorithms for reasonableness and accuracy.
- **Participant surveys (n=332),** to understand the participant experience in the program and to gather information to calculate freeridership and spillover rates.
- **Contractor interviews (n=6),** to better understand the contractor perspective and gain insight into customer experience from those who often interact with them.

## IMPACT EVALUATION

The evaluation team completed the impact evaluation to answer the following research questions:

- What assumptions were used to develop savings estimates? Are there any updates that should be made?
- What are *ex post* program savings? Do these suggest any needed updates to program design, delivery, or savings assumptions?

For all measure types, the evaluation team compared its engineering calculations to NIPSCO's *ex ante* savings, basing its savings methodologies and inputs for each measure on several sources: standard engineering practices, the 2015 Indiana TRM (v2.2), the Illinois TRM (v10.0) and NIPSCO's program tracking database.[4] It should be noted that prior to this evaluation year, the evaluation team used the Indiana TRM as our primary source and supplemented with other sources as needed. However, the Indiana TRM is out-of-date, and currently in the process of being updated to align more closely with the Illinois TRM. After discussions with NIPSCO, our team felt it would be best practice to use the Illinois TRM as our primary source while the Indiana TRM is in process of being updated, as the Illinois TRM is updated annually and should align closely with the new version of the Indiana TRM.

## AUDITED AND VERIFIED SAVINGS

### AUDITED SAVINGS

In 2022, the program rebated 8,711 measures through the Energy Efficiency Rebates program. The evaluation team audited measure quantities by looking for duplicate records, ensuring measures followed program guidelines, and making sure the proper deemed savings values were applied.

When conducting the tracking data audit, the evaluation team found that one customer received a rebate for three Wi-Fi thermostats within the program year. The evaluation team removed one of the three Wi-Fi thermostats as part of the audit because the program design only allows for two Wi-Fi thermostats to receive a rebate.

The evaluation team also found that one new construction builder applied for rebates for 30 projects through the program. The program design only allows for 20 projects from a new construction builder. However, the evaluation team retained these records in the data.

While conducting model number verification during the engineering reviews, the evaluation team found that two model numbers reported as furnaces in the tracking data, were instead boilers. The evaluation team retained reported deemed savings for these two measures but moved the quantities from furnaces to boilers during the audited savings stage and evaluated them as boiler measures.

Finally, the evaluation team found that some measures were carried over from the end of PY 2021 and that some measures claimed savings values from 2021. These measures include air conditioners, air conditioner tune-ups, air purifiers, air-source heat pumps, boilers, dehumidifiers, furnaces, natural gas condensing water heaters and natural gas tankless water heaters, and Wi-Fi thermostats. We denote these measures as a separate line item with "[Measure Name] – Legacy 2021 Measure" in the tables throughout this report.

Table 17 summarizes the tracking data quantity and audited quantity that corrects for the adjustments mentioned above.

TABLE 17. 2022 EE REBATES PROGRAM AUDITED QUANTITIES

| MEASURE | TRACKING DATA QUANTITY | AUDITED QUANTITY |
|---|---|---|
| Air conditioner | 903 | 903 |
| Air conditioner – Legacy 2021 Measure | 90 | 90 |
| Air conditioner tune-ups | 64 | 64 |
| Air conditioner tune-ups – Legacy 2021 Measure | 1 | 1 |
| Air purifiers | 53 | 53 |

[4] Cadmus. *Indiana Technical Reference Manual Version 2.2*. July 28, 2015.

| MEASURE | TRACKING DATA QUANTITY | AUDITED QUANTITY |
|---|---|---|
| Air purifiers – Legacy 2021 Measure | 2 | 2 |
| Air-source heat pumps | 10 | 10 |
| Air-source heat pumps – Legacy 2021 Measure | 2 | 2 |
| Air-source heat pump tune-ups | 0 | 0 |
| Boilers | 60 | 61 |
| Boilers – Legacy 2021 Measure | 12 | 13 |
| Dehumidifiers | 63 | 63 |
| Dehumidifiers – Legacy 2021 Measure | 4 | 4 |
| Ductless mini-split heat pumps | 52 | 52 |
| Electric clothes dryers | 16 | 16 |
| Furnaces | 4,587 | 4586 |
| Furnaces – Legacy 2021 Measure | 617 | 616 |
| Heat pump water heaters | 10 | 10 |
| Natural Gas Condensing Water Heater – Legacy 2021 Measure | 2 | 2 |
| Natural Gas Tankless Water Heater – Legacy 2021 Measure | 5 | 5 |
| Pool pumps | 16 | 16 |
| Wi-Fi thermostats | 1,873 | 1,872 |
| Wi-Fi thermostats – Legacy 2021 Measure | 269 | 269 |
| | 8,711 | 8,710 |

Air conditioners made up 73% of program audited electric energy savings and 80% of program audited demand savings. Furnaces made up 88% of program audited gas savings. Table 18 summarizes audited savings for the measure categories.

TABLE 18. 2022 EE REBATES PROGRAM SAVINGS SHARES BY MEASURE TYPE

| MEASURE CATEGORY | AUDITED ELECTRIC ENERGY SAVINGS | | AUDITED PEAK DEMAND REDUCTION | | AUDITED NATURAL GAS ENERGY SAVINGS | |
|---|---|---|---|---|---|---|
| | KWH/YR. | SHARE | KW | SHARE | THERMS/YR. | SHARE |
| Air conditioner | 609,185.25 | 66% | 675.243 | 72% | 0.00 | 0% |
| Air conditioner – Legacy 2021 Measure | 61,518.60 | 7% | 69.930 | 8% | 0.00 | 0% |
| Air conditioner tune-ups | 2,769.92 | 0% | 7.808 | 1% | 0.00 | 0% |
| Air conditioner tune-ups – Legacy 2021 Measure | 51.11 | 0% | 0.116 | 0% | 0.00 | 0% |
| Air purifiers | 21,970.00 | 2% | 2.504 | 0% | 0.00 | 0% |
| Air purifiers – Legacy 2021 Measure | 2,046.00 | 0% | 0.233 | 0% | 0.00 | 0% |
| Air-source heat pumps | 12,183.44 | 1% | 7.554 | 1% | 0.00 | 0% |
| Air-source heat pumps – Legacy 2021 Measure | 2,092.12 | 0% | 0.730 | 0% | 0.00 | 0% |
| Air-source heat pump tune-ups | 0.00 | 0% | 0.000 | 0% | 0.00 | 0% |
| Boilers | 0.00 | 0% | 0.000 | 0% | 13,159.84 | 2% |
| Boilers – Legacy 2021 Savings | 0.00 | 0% | 0.000 | 0% | 3,824.25 | 1% |

| MEASURE CATEGORY | AUDITED ELECTRIC ENERGY SAVINGS | | AUDITED PEAK DEMAND REDUCTION | | AUDITED NATURAL GAS ENERGY SAVINGS | |
|---|---|---|---|---|---|---|
| | KWH/YR. | SHARE | KW | SHARE | THERMS/YR. | SHARE |
| Dehumidifiers | 7,258.00 | 1% | 1.667 | 0% | 0.00 | 0% |
| Dehumidifiers – Legacy 2021 Savings | 381.77 | 0% | 0.087 | 0% | 0.00 | 0% |
| Ductless mini-split heat pumps | 36,499.84 | 4% | 5.200 | 1% | 0.00 | 0% |
| Electric clothes dryers | 2,567.04 | 0% | 0.352 | 0% | 0.00 | 0% |
| Furnaces | 0.00 | 0% | 0.000 | 0% | 547,751.84 | 73% |
| Furnaces – Legacy 2021 Savings | 0.00 | 0% | 0.000 | 0% | 115,370.64 | 15% |
| Heat pump water heaters | 19,008.50 | 2% | 0.900 | 0% | 0.00 | 0% |
| Natural Gas Condensing Water Heater – Legacy 2021 Measure | 0.00 | 0% | 0.000 | 0% | 30.12 | 0% |
| Natural Gas Tankless Water Heater – Legacy 2021 Measure | 0.00 | 0% | 0.000 | 0% | 298.80 | 0% |
| Pool pumps | 5,586.88 | 1% | 4.934 | 1% | 0.00 | 0% |
| Wi-Fi thermostats | 112,446.67 | 12% | 125.06 | 13% | 40,678.00 | 5% |
| Wi-Fi thermostat – Legacy 2021 Measure | 27,902.30 | 3% | 29.528 | 3% | 28,397.20 | 4% |
| Total | 923,467.44 | 100% [a] | 931.846 | 100% [a] | 749,510.69 | 100% [a] |

[a] Totals may not add to 100% due to rounding.

## VERIFIED SAVINGS

Table 19 lists the in-service rates (ISRs) for all program-installed measures. As is typical for programs rebating larger HVAC measures, where measures are typically not uninstalled, the in-service rate for this program is 100% across all measures. The program added several new, smaller measures in the last several years, and for these measures the evaluation team has assumed a 100% ISR. Given the size and function of clothes dryers and ductless heat pumps, the evaluation team assumes that they will follow the same ISR pattern as other large appliances, like a furnace or boiler. For the new measures that are somewhat smaller and somewhat more easily uninstalled (air purifiers, pool pumps, and dehumidifiers), the evaluation team is assuming a 100% in-service rate, as we expect these ISRs to be high as well, but we recommend that this is confirmed in future evaluations if participant counts allow. Thermostat in-service rates are also set at 100%, as any uninstallations are accounted for within the 2020 *ex post* billing analysis savings estimates.

TABLE 19. 2022 EE REBATES PROGRAM IN-SERVICE RATES RATIOS BY MEASURE

| MEASURE | ISR |
|---|---|
| Air conditioner | 100% |
| Air conditioner – Legacy 2021 Measure | 100% |
| Air conditioner tune-ups | 100% |
| Air conditioner tune-up – Legacy 2021 Measure | 100% |
| Air purifiers | 100% |
| Air purifiers – Legacy 2021 Measure | 100% |
| Air-source heat pumps | 100% |
| Air-source heat pumps – Legacy 2021 Measure | 100% |

| MEASURE | ISR |
|---|---|
| Air-source heat pump tune-ups | 100% |
| Boilers | 100% |
| Boilers – Legacy 2021 Measure | 100% |
| Dehumidifiers | 100% |
| Dehumidifiers – Legacy 2021 Measure | 100% |
| Ductless mini-split heat pumps | 100% |
| Electric clothes dryers | 100% |
| Furnaces | 100% |
| Furnaces – Legacy 2021 Measure | 100% |
| Heat pump water heaters | 100% |
| Natural Gas Condensing Water Heater – Legacy 2021 Measure | 100% |
| Natural Gas Tankless Water Heater – Legacy 2021 Measure | 100% |
| Pool pumps | 100% |
| Wi-Fi thermostats | 100% |
| Wi-Fi thermostats – Legacy 2021 Measure | 100% |

Table 20 summarizes the audited quantity, applied in-service rates, and resulting verified quantity per measure. To calculate the verified measure quantity, the evaluation team multiplied the audited measure quantity by the installation rate. In this evaluation, with all measures achieving a 100% ISR, the verified savings and measure counts do not differ from the audited savings and measure counts.

TABLE 20. 2022 EE REBATES PROGRAM AUDITED & VERIFIED QUANTITIES

| MEASURE | AUDITED QUANTITY | ISR | VERIFIED QUANTITY |
|---|---|---|---|
| Air conditioner | 903 | 100% | 903 |
| Air conditioner – Legacy 2021 Measure | 90 | 100% | 90 |
| Air conditioner tune-ups | 64 | 100% | 64 |
| Air conditioner tune-ups – Legacy 2021 Measure | 1 | 100% | 1 |
| Air purifiers | 53 | 100% | 53 |
| Air purifiers – Legacy 2021 Measure | 2 | 100% | 2 |
| Air-source heat pumps | 10 | 100% | 10 |
| Air-source heat pumps – Legacy 2021 Measure | 2 | 100% | 2 |
| Air-source heat pump tune-ups | 0 | 100% | 0 |
| Boilers | 61 | 100% | 61 |
| Boilers – Legacy 2021 Measure | 13 | 100% | 13 |
| Dehumidifiers | 63 | 100% | 63 |
| Dehumidifiers – Legacy 2021 Measure | 4 | 100% | 4 |
| Ductless mini-split heat pumps | 52 | 100% | 52 |
| Electric clothes dryers | 16 | 100% | 16 |
| Furnaces | 4,586 | 100% | 4,586 |
| Furnaces – Legacy 2021 Measure | 616 | 100% | 616 |
| Heat pump water heaters | 10 | 100% | 10 |

| MEASURE | AUDITED QUANTITY | ISR | VERIFIED QUANTITY |
|---|---|---|---|
| Natural Gas Condensing Water Heater – Legacy 2021 Measure | 2 | 100% | 2 |
| Natural Gas Tankless Water Heater – Legacy 2021 Measure | 5 | 100% | 5 |
| Pool pumps | 16 | 100% | 16 |
| Wi-Fi thermostats | 1,872 | 100% | 1,872 |
| Wi-Fi thermostats – Legacy 2021 Measure | 269 | 100% | 269 |
| | 8,710 | N/A | 8,710 |

## *EX POST* GROSS SAVINGS

The evaluation team referred to the Illinois TRM (v10) to calculate *ex post* electric and natural gas energy savings and demand reduction for all measures, except Smart Wi-Fi Thermostats. For Smart Wi-Fi thermostats, the evaluation team continued to use the results of a 2020 billing analysis that provided updated gas and electric savings and savings inputs used in the IN TRM (v2.2) calculation. The evaluation team also employed measure characteristics provided in the database for variables such as capacities, efficiencies, HVAC equipment type and model, and project location.

To reflect the rate of early replacement measures versus time-of-sale and replace-on-burnout measures, the evaluation team used responses from the 2022 participant survey to calculate early replacement rates and blended savings according to the Illinois TRM (v10). Separate early replacement rates were calculated for furnaces and air conditioners while a blended early replacement rate was calculated for other measures where participation counts were low. The measures included in the blended early replacement rate counts are heat pumps, boilers, electric clothes dryers, and heat pump water heaters. Table 21 summarizes early replacement rates calculated for the 2022 evaluation.

TABLE 21. 2022 EE REBATES PROGRAM EARLY REPLACEMENT RATES BY MEASURE

| MEASURE CATEGORY | % EARLY REPLACEMENT |
|---|---|
| Natural Gas Furnace (n=80) | 14% |
| Air Conditioner (n=89) | 18% |
| Blended[a] (n=38) | 21% |

[a]A blended early replacement rate was used to capture early replacements for heat pumps, boilers, and water heaters

There were also other inputs where the evaluation team either applied the results of a 2020 billing analysis, the Indiana TRM (v2.2) or used a deemed savings value from the 2021 evaluation; these cases and the approach used are listed below:

- For furnaces, heat pumps, and boilers, the evaluation team used the results of a 2020 billing analysis which updated EFLH by nearest city. The evaluation team continued to apply these values to installations in the 2022 evaluation.
- For the Legacy 2021 Measures, which include some variations of air conditioners, air source heat pumps, air purifiers, and natural gas water heaters, the evaluation team used a deemed savings value specific to each measure that is equal to the *ex post* gross savings per measure from the 2021 evaluation.

- For demand reduction measures that exist in the Indiana TRM (v2.2), the evaluation team opted for Indiana specific coincidence factors rather than Illinois specific coincidence factors provided in the Illinois TRM (v10).
- Finally, for air conditioners, heat pumps, water heaters, and tune-ups, the evaluation team assigned cooling hours and ground water temperatures by matching each installation's city to the closest city from the Indiana TRM (v2.2).

## ENGINEERING REVIEWS

The evaluation team reviewed each of the measures, updated the assumptions if changes had been made, and recalculated savings based on the specific measure characteristics.

As in past evaluations, the evaluation team found that using actual measure characteristics could change the savings substantially. Also, due to differences between the approaches outlined in the Illinois TRM (v10) and Indiana TRM (v2.2), the latter of which includes the addition of early replacement savings for select measures, differences between *ex post* and *ex ante* savings are greater than in years prior. The implementer uses a deemed savings value for each measure; the evaluation team uses measure characteristics, like unit size or location, to create custom calculations for each installed measure. Detailed findings by measure type can be found in the Appendix.

Note that this table only includes data for 2022 measures. For all Legacy 2021 Measures, the evaluation team used a deemed savings value from the 2021 program evaluation results. The Legacy 2021 Measures' sources, assumptions, and notable differences are the same as in the previous evaluation and can be found in the 2021 EE Rebates Evaluation Report.

## *EX POST* GROSS SAVINGS

Table 22 shows the *ex ante* deemed savings and *ex post* gross per-measure savings for 2022 Energy Efficiency Rebates program measures.

TABLE 22. 2022 EE REBATES PROGRAM *EX ANTE* & *EX POST* GROSS PER-MEASURE SAVINGS VALUES

| MEASURE [a] | MEASURE TYPE | *EX ANTE* DEEMED SAVINGS | | | *EX POST* GROSS PER-MEASURE SAVINGS | | |
|---|---|---|---|---|---|---|---|
| | | KWH | KW | THERMS | KWH | KW | THERMS |
| Air conditioner | Air Conditioner | 674.62 | 0.748 | 0.00 | 272.04 | 0.579 | 0.00 |
| Air conditioner - Legacy 2021 Measure | Air Conditioner | 683.54 | 0.777 | 0.00 | 681.32 | 0.802 | 0.00 |
| Air conditioner tune-ups | Tune Up | 43.28 | 0.122 | 0.00 | 44.79 | 0.045 | 0.00 |
| Air conditioner tune-ups - Legacy 2021 Measure | Tune Up | 51.11 | 0.116 | 0.00 | 44.39 | 0.101 | 0.00 |
| Air purifiers | Air Purifier | 414.53 | 0.047 | 0.00 | 377.11 | 0.043 | 0.00 |
| Air purifier - Legacy 2021 Measure | Air Purifier | 1,023.00 | 0.117 | 0.00 | 328.00 | 0.037 | 0.00 |
| Air-source heat pumps | Heat Pump | 1,218.34 | 0.755 | 0.00 | 1,270.87 | 0.542 | 0.00 |
| Air-source heat pumps - Legacy 2021 Measure | Heat Pump | 1,046.06 | 0.365 | 0.00 | 757.47 | 0.696 | 0.00 |
| Boilers [b] | Boiler | 0.00 | 0.000 | 215.74 | 0.00 | 0.000 | 255.04 |

| MEASURE [a] | MEASURE TYPE | *EX ANTE* DEEMED SAVINGS | | | *EX POST* GROSS PER-MEASURE SAVINGS | | |
|---|---|---|---|---|---|---|---|
| | | KWH | KW | THERMS | KWH | KW | THERMS |
| Boilers - Legacy 2021 Measure | Boiler | 0.00 | 0.000 | 294.17 | 0.00 | 0.000 | 208.15 |
| Dehumidifiers | Dehumidifier | 115.21 | 0.026 | 0.00 | 165.50 | 0.038 | 0.00 |
| Dehumidifiers - Legacy 2021 Measure | Dehumidifier | 95.44 | 0.022 | 0.00 | 124.14 | 0.027 | 0.00 |
| Ductless mini-split heat pumps | Heat Pump | 701.92 | 0.100 | 0.00 | 1,020.83 | 0.294 | 0.00 |
| Electric clothes dryers | Clothes Dryer | 160.44 | 0.022 | 0.00 | 146.58 | 0.020 | 0.00 |
| Furnaces | Furnace | 0.00 | 0.000 | 119.44 | 67.88 | 0.000 | 172.27 |
| Furnaces - Legacy 2021 Measure | Furnace | 0.00 | 0.000 | 187.29 | 0.00 | 0.000 | 129.89 |
| Heat pump water heaters | Water Heater | 1,900.85 | 0.090 | 0.00 | 2,736.26 | 0.374 | 0.00 |
| Natural Gas Condensing Water Heater - Legacy 2021 Measure | Water Heater | 0.00 | 0.000 | 15.06 | 0.00 | 0.000 | 23.88 |
| Natural Gas Tankless Water Heater - Legacy 2021 Measure | Water Heater | 0.00 | 0.000 | 59.76 | 0.00 | 0.000 | 33.30 |
| Pool pumps | Pool Pump | 349.18 | 0.308 | 0.00 | 290.78 | 0.265 | 0.00 |
| Wi-Fi thermostats | Thermostat | 60.07 | 0.067 | 21.73 | 54.50 | 0.061 | 33.62 |
| Wi-Fi thermostats - Legacy 2021 Measure | Thermostat | 103.73 | 0.110 | 105.57 | 54.60 | 0.061 | 29.92 |

[a] Where there are measures that have more than one measure label (e.g., air conditioners, which include 5+ SEER, 16+ SEER, and 17+ SEER ACs), an average savings value was applied.

[b] While conducting model number verification during the engineering reviews, the evaluation team found that two reported furnaces were boilers. These units were verified by the model number lookups. The evaluation team retained reported deemed savings for these two measures but moved the quantities from furnaces to boilers during the audited savings stage and evaluated them as boiler measures.

## WASTE HEAT FACTOR – THERM PENALTIES

The evaluation team is not including therm penalties when calculating evaluated savings for the 2022 Energy Efficiency Rebates program. However, cost-effectiveness results for both the gas and electric programs will include these penalties. The evaluation team believes this approach is appropriate, as it accounts for the penalty on the electric side (where it is generated) and allows the evaluation team to show gas program performance and measure performance more clearly. The *ex ante* therm penalties estimated in the tracking data are -164.60 therms. In total, the *ex post* therm penalty for cost-effectiveness analysis is -8.95 therms (Table 23).

TABLE 23. 2022 EE REBATES PROGRAM WASTE HEAT FACTOR THERM PENALTY

| MEASURE | WASTE HEAT FACTOR THERM PENALTY |
|---|---|
| ENERGY STAR Heat Pump Water Heater ≥ 2.0 UEF | (8.95) |
| Total | (8.95) |

It should be noted that electric waste heat factors, including cooling credits and electric heating penalties, are currently reported within the kWh and kw savings for the overall program.

## REALIZATION RATES

The following section details the measure and fuel level differences and realization rates for the 2022 Energy Efficiency Rebates program. Table 24 highlights notable differences between *ex ante* and *ex post* gross estimates.

As the Table 24 illustrates, there were notable differences in the furnace *ex ante* and *ex post* gross savings values. This is because the Illinois TRM assigns kWh cooling savings associated with the ECM installed alongside existing ACs to furnaces, while in past evaluations and for *ex ante,* these savings were applied to ACs.

TABLE 24. 2022 EE REBATES NOTABLE DIFFERENCES BETWEEN *EX ANTE* & *EX POST* GROSS

| MEASURE | *EX ANTE* SOURCES AND ASSUMPTIONS | *EX POST* GROSS SOURCES AND ASSUMPTIONS | PRIMARY REASONS FOR DIFFERENCES |
|---|---|---|---|
| Air Conditioner | *Ex ante* savings were calculated using the Indiana TRM (v2.2) and EE Rebates 2020 EM&V results for assumed capacity. Heating and circulation motor savings were included for all sites. | IL TRM (v10) and program tracking data. Assumed EER = 90% x SEER for stock EER; stock SEER, resultant stock EER, and CF are assumed from the Indiana TRM (v2.2). Assumed an average EER conversion factor for each SEER measure group tier based on AHRI data. Early replacement rate from the 2022 EE Rebates participant survey. | Small differences due to using actual instead of assumed SEER, EER, and capacity; Also, differences between assumed EERee (0.9 x SEERee) and approximate actual EERee (varies from 0.82-0.74 x SEER) with conversions based on AHRI data and additional early replacement savings all contributed to *ex post* deviating from *ex ante*. However, the largest driver is due to differences in approach between the IN TRM (v2.2) and IL TRM (v10), specifically in the exclusion of additional circulation and heating fan energy savings that come from the installation of an ECM with new AC's. Updated standards have resulted in new SEER values already accounting for the added efficiency of the ECM. The IL TRM (v10) instead provides cooling and circulation electric energy savings for furnaces. |
| Air Conditioner Tune Up | *Ex ante* savings were calculated according to the Indiana TRM (v2.2) and using average capacity, SEER, and EER 2020 AC tune up data. Assumed South Bend for EFLH. | Illinois TRM (v10) and program tracking data. Assumed CF and EFLH from the Indiana TRM (v2.2). Used actual SEER and cooling capacity when available, average AC tracking data values when not. Varied Indiana TRM (v2.2) EFLH by closest city. Assumed IL TRM (v10) maintenance energy savings (MFe) and demand reduction (MFd) factors. | Differences in assumed maintenance demand reduction factor between the IN TRM (v2.2) of 0.05 and IL TRM (v10) 0.02 resulted in significantly less demand reduction. Higher average cooling capacity drove slightly higher energy savings in 2022. Also used the closest city instead of broadly applying South Bend for EFLH. |
| Air Purifier | *Ex ante* savings are calculated using the IL TRM (v10). Specifically, aligned deemed savings according to CADR range tracked in the measure name. | Illinois TRM (v10.0) and program tracking data. Used actual ENERGY STAR QPL reported CADR. | Differences due to the use of actual CADR and calculated savings cause *ex post* gross to deviate from *ex ante*. |
| Air Source Heat Pump | *Ex ante* savings were calculated using the Illinois TRM (v8.0) with baseline inputs and South Bend EFLH assumed from the Indiana TRM (v2.2). Assumed average capacity and efficient HSPF from 2018 EM&V ASHP | Illinois TRM (v10) and program tracking data. Assumed CF and cooling EFLH from the Indiana TRM (v2.2). 2020 billing analysis for heating EFLH and based on tracking data, used closest city EFLH. Used actual capacities and efficiencies | Additional early replacement savings, differences in assumed algorithms, and the evaluation teams use of actual capacities and efficiencies is the largest driver for greater than reported savings. Also, small differences due to *ex post* using the |

| MEASURE | *EX ANTE* SOURCES AND ASSUMPTIONS | *EX POST* GROSS SOURCES AND ASSUMPTIONS | PRIMARY REASONS FOR DIFFERENCES |
|---|---|---|---|
| | data. Assumed SEER aligned with measure name SEER. | confirmed during AHRI look ups. Early replacement rate from the 2022 EE Rebates participant survey. Included derating factors and SEER and HSPF adjustment factors. | closest city instead of broadly applying South Bend for EFLH. |
| Boiler | *Ex ante* savings were calculated using the Indiana TRM (v2.2). Assumed average capacity from 2020 EM&V boiler data, TRM assumed base AFUE, 2020 EM&V billing analysis South Bend EFLH, and a 2020 average AFUE of 95%. | Illinois TRM (v10) and program tracking data. Used actual capacity and AFUE. Used closest city EFLH from 2020 billing analysis. Early replacement rate from the 2022 EE Rebates participant survey. | Small differences due to using actual instead of assumed AFUE and capacity. Differences in approach between the IN TRM (v2.2) and IL TRM (v10). Additional early replacement savings, slightly higher average capacity, and using the closest city instead of broadly applying South Bend for EFLH drove slightly higher Therm savings than reported. |
| Dehumidifier | *Ex ante* savings are calculated using the IL TRM (v10). Specifically, pulled ENERGY STAR deemed savings based on measure capacity. | Illinois TRM (v10.0) and program tracking data. Used actual ENERGY STAR QPL reported average capacities and L/kWh. | Differences due to the use of actual capacities and L/kWh values cause *ex post* gross to deviate from *ex ante*. |
| Ductless Heat Pump | *Ex ante* savings were calculated using the Illinois TRM (v8.0) with baseline inputs and South Bend EFLH assumed from the Indiana TRM (v2.2). Manual assumptions for efficiencies based on minimum AHRI certification requirements and 2-ton cooling and heating capacities. | Illinois TRM (v10), program tracking data, and assumed same heat pump base efficiency assumptions as ASHP measure. Used actual efficient capacities and efficiencies. Early replacement rate from the 2022 EE Rebates participant survey. Assumed CF and EFLH cooling from the Indiana TRM (v2.2). Assumed 2020 billing analysis EFLH heating. Assumed closest city EFLH based on tracking data. | *Ex post* and *ex ante* differ due to the use of actual capacities and efficiencies, updated EFLH from the 2020 billing analysis and using the closest city instead of broadly applying South Bend, and *ex post*'s inclusion of additional early replacement savings. |
| Clothes Dryer | *Ex ante* savings are calculated using the IL TRM (v8.0). | Illinois TRM (v10.0) and program tracking data. Used actual ENERGY STAR QPL reported CEF efficient. | Small differences due to the use of actual efficient CEF. |
| Furnace | *Ex ante* savings were calculated using Indiana TRM (v2.2) and EE Rebates 2020 EM&V results for assumed AFUE and the 2020 billing analysis South Bend EFLHH. Assumed furnace capacity of 70,000 Btuh. | IL TRM (v10), 2020 billing analysis results for EFLHH, and information in program tracking data. Actual AFUE and capacity values were used to calculate *ex post* savings. Early replacement rate from the 2022 EE Rebates participant survey. | Illinois TRM assigns kWh cooling savings associated with the ECM installed alongside existing ACs to furnaces, while in past evaluations and for *ex ante* these savings were applied to ACs. Additional early replacement saving, plus small differences due to using actual instead of assumed AFUE (96% average) and capacity (74,186 Btuh average). |
| Heat Pump Water Heater | *Ex ante* savings were calculated using the Illinois TRM (v8.0) with people per home and Tin (South Bend) assumed from the Indiana TRM (v2.2). Pulled UEF efficient from lowest available UEF for 50-78 gallon heat pump water heaters on the ENERGY STAR website. | Illinois TRM (10) and program tracking data. Used actual UEF efficient and calculated baseline UEF values. Assumed people per home, Gallons per day per household, and Tin from the Indiana TRM (v2.2). Assumed closest city Tin based on tracking data. Used REC's 2020 East | Differences due to *ex post* using actual UEF efficient and calculated baseline UEF values and using the closest city instead of broadly applying South Bend for EFLH. Differences in assumed "unknown" values between Illinois TRM (v8) and Illinois TRM (v10). Small differences due to the use of 2020 census data |

| MEASURE | *EX ANTE* SOURCES AND ASSUMPTIONS | *EX POST* GROSS SOURCES AND ASSUMPTIONS | PRIMARY REASONS FOR DIFFERENCES |
|---|---|---|---|
| | | North Central census data for natural gas heating saturations. | for Indiana and Ohio to determine fossil fuel space heating saturations compared with the Illinois specific unknown space heat type provided in the Illinois TRM (v8). |
| Pool Pump | *Ex ante* savings were calculated using the Illinois TRM (v10). | Illinois TRM (v10), program tracking data used to determine in-ground or above ground configuration and whether a ENERGY STAR or CEE Tier 1 certified pump by ES QPL model number look ups. If model could not be found, assumed reported characterization. | Differences due to model number look ups resulting in different pool pump classification than reported. For the classifications that were the same between *ex ante* and *ex post*, savings were the same. |
| Smart Wi-Fi Thermostat | *Ex ante* savings were calculated using Indiana TRM (v2.2) and a combination of 2019 and 2020 EM&V values for capacities and efficiencies. Cooling and heating EFLH were assumed to be South Bend and were assumed from the Indiana TRM (v2.2) and 2020 billing analysis results, respectively. Savings factors follow results of the 2020 billing analysis with post COVID-19 assumptions. | Indiana TRM (v2.2) algorithm assuming billing-analysis derived savings fractions with COVID-19 assumptions still in place, 2022 program average heating and cooling capacities, and a CF or 0.44 (AC/HP cooling CF of 0.88 ÷ 2). Cooling and heating EFLH were assumed from the Indiana TRM (v2.2) and 2020 billing analysis results, respectively. Assumed closest city EFLH based on tracking data. | Small differences due to differences between 2020/2019 and 2022 average capacities and using the closest city instead of broadly applying South Bend for EFLH. *Ex ante* assumed the same capacity for natural gas and ACs (34,054 Btuh) while *ex post* assumed different capacities for each equipment (Average Furnace capacity of 74,186 Btuh and AC capacity of 34,044 Btuh) which resulted in therm savings greater than reported. *Ex ante* also assumed a 34,054 Btuh capacity for electric furnaces while *ex post* assumed the same capacity as natural gas furnaces, resulting in electric energy savings greater than reported. |

Table 25 shows the measure level realization rate for kWh, kW, and Therms.

TABLE 25. 2022 EE REBATES PROGRAM MEASURE LEVEL REALIZATION RATES

| MEASURE | KWH RR | KW RR | THERMS RR |
|---|---|---|---|
| Air Conditioner | 40% | 77% | - |
| Air Conditioner Tune-Ups | 103% | 37% | - |
| Air Purifiers | 91% | 91% | - |
| Air-Source Heat Pumps | 104% | 72% | - |
| Air-Source Heat Pump Tune-Ups | - | - | - |
| Boilers | - | - | 118% |
| Dehumidifiers | 144% | 142% | - |
| Ductless Mini-Split Heat Pumps | 145% | 294% | - |
| Electric Clothes Dryers | 91% | 89% | - |
| Furnaces | - | - | 144% |
| Heat Pump Water Heaters | 144% | 415% | - |
| Pool Pumps | 83% | 86% | - |

| MEASURE | KWH RR | KW RR | THERMS RR |
|---|---|---|---|
| Wi-Fi Thermostats | 91% | 91% | 155% |

The next three tables (Table 26, Table 27, and Table 28) show the program's *ex ante* reported savings, verified savings, and *ex post* gross savings.

TABLE 26. 2022 EE REBATES PROGRAM *EX ANTE* & *EX POST* GROSS ELECTRIC ENERGY SAVINGS

| MEASURE | *EX ANTE* [a] ELECTRIC ENERGY SAVINGS (kWh/yr.) | AUDITED GROSS ELECTRIC ENERGY SAVINGS (kWh/yr.) | VERIFIED GROSS ELECTRIC ENERGY SAVINGS (kWh/yr.) | *EX POST* GROSS ELECTRIC ENERGY SAVINGS (kWh/yr.) |
|---|---|---|---|---|
| Air conditioner | 609,185.25 | 609,185.25 | 609,185.25 | 245,650.04 |
| Air conditioner - Legacy 2021 Measure | 61,518.60 | 61,518.60 | 61,518.60 | 61,318.80 |
| Air conditioner tune-ups | 2,769.92 | 2,769.92 | 2,769.92 | 2,866.64 |
| Air conditioner tune-ups - Legacy 2021 Measure | 51.11 | 51.11 | 51.11 | 44.39 |
| Air purifiers | 21,970.00 | 21,970.00 | 21,970.00 | 19,986.93 |
| Air purifier - Legacy 2021 Measure | 2,046.00 | 2,046.00 | 2,046.00 | 656.00 |
| Air-source heat pumps | 12,183.44 | 12,183.44 | 12,183.44 | 12,708.67 |
| Air-source heat pumps - Legacy 2021 Measure | 2,092.12 | 2,092.12 | 2,092.12 | 1,514.94 |
| Air-source heat pump tune-ups | 0.00 | 0.00 | 0.00 | 0.00 |
| Boilers | 0.00 | 0.00 | 0.00 | 0.00 |
| Boilers - Legacy 2021 Measure | 0.00 | 0.00 | 0.00 | 0.00 |
| Dehumidifiers | 7,258.00 | 7,258.00 | 7,258.00 | 10,426.62 |
| Dehumidifiers - Legacy 2021 Measure | 381.77 | 381.77 | 381.77 | 496.57 |
| Ductless mini-split heat pumps | 36,499.84 | 36,499.84 | 36,499.84 | 53,083.36 |
| Electric clothes dryers | 2,567.04 | 2,567.04 | 2,567.04 | 2,345.26 |
| Furnaces | 0.00 | 0.00 | 0.00 | 311,278.44 |
| Furnaces - Legacy 2021 Measure | 0.00 | 0.00 | 0.00 | 0.00 |
| Heat pump water heaters | 19,008.50 | 19,008.50 | 19,008.50 | 27,362.59 |
| Natural Gas Condensing Water Heater - Legacy 2021 Measure | 0.00 | 0.00 | 0.00 | 0.00 |
| Natural Gas Tankless Water Heater - Legacy 2021 Measure | 0.00 | 0.00 | 0.00 | 0.00 |
| Pool pumps | 5,586.88 | 5,586.88 | 5,586.88 | 4,652.51 |
| Wi-Fi thermostats | 112,446.67 | 112,446.67 | 112,446.67 | 102,024.74 |
| Wi-Fi thermostats - Legacy 2021 Measure | 27,902.30 | 27,902.30 | 27,902.30 | 14,686.35 |
| Total Savings | 923,467.44 | 923,467.44 | 923,467.44 | 871,102.86 |
| Total Program Realization Rate | | | | 94% |

Note: Totals may not sum properly due to rounding.

[a] Values presented at a measure-level represent Audited values, since the scorecard provides only savings totals.

TABLE 27. 2022 EE REBATES PROGRAM *EX ANTE* & *EX POST* GROSS PEAK DEMAND REDUCTION

| MEASURE | *EX ANTE*[A] PEAK DEMAND REDUCTION (kW/yr.) | AUDITED GROSS PEAK DEMAND REDUCTION (kW/yr.) | VERIFIED GROSS PEAK DEMAND REDUCTION (kW/yr.) | *EX POST* GROSS PEAK DEMAND REDUCTION (kW/yr.) |
|---|---|---|---|---|
| Air conditioner | 675.243 | 675.243 | 675.243 | 522.932 |
| Air conditioner - Legacy 2021 Measure | 69.930 | 69.930 | 69.930 | 72.180 |
| Air conditioner tune-ups | 7.808 | 7.808 | 7.808 | 2.903 |
| Air conditioner tune-ups - Legacy 2021 Measure | 0.116 | 0.116 | 0.116 | 0.101 |
| Air purifiers | 2.504 | 2.504 | 2.504 | 2.283 |
| Air purifier - Legacy 2021 Measure | 0.233 | 0.233 | 0.233 | 0.074 |
| Air-source heat pumps | 7.554 | 7.554 | 7.554 | 5.424 |
| Air-source heat pumps - Legacy 2021 Measure | 0.730 | 0.730 | 0.730 | 1.392 |
| Air-source heat pump tune-ups | 0.000 | 0.000 | 0.000 | 0.000 |
| Boilers | 0.000 | 0.000 | 0.000 | 0.000 |
| Boilers - Legacy 2021 Measure | 0.000 | 0.000 | 0.000 | 0.000 |
| Dehumidifiers | 1.667 | 1.667 | 1.667 | 2.370 |
| Dehumidifiers - Legacy 2021 Measure | 0.087 | 0.087 | 0.087 | 0.107 |
| Ductless mini-split heat pumps | 5.200 | 5.200 | 5.200 | 15.263 |
| Electric clothes dryers | 0.352 | 0.352 | 0.352 | 0.315 |
| Furnaces | 0.000 | 0.000 | 0.000 | 0.000 |
| Furnaces - Legacy 2021 Measure | 0.000 | 0.000 | 0.000 | 0.000 |
| Heat pump water heaters | 0.900 | 0.900 | 0.900 | 3.738 |
| Natural Gas Condensing Water Heater - Legacy 2021 Measure | 0.000 | 0.000 | 0.000 | 0.000 |
| Natural Gas Tankless Water Heater - Legacy 2021 Measure | 0.000 | 0.000 | 0.000 | 0.000 |
| Pool pumps | 4.934 | 4.934 | 4.934 | 4.233 |
| Wi-Fi thermostats | 125.060 | 125.060 | 125.060 | 113.587 |
| Wi-Fi thermostats - Legacy 2021 Measure | 29.528 | 29.528 | 29.528 | 16.390 |
| Total Savings | 931.846 | 931.846 | 931.846 | 763.292 |
| Total Program Realization Rate | | | | 82% |

Note: Totals may not sum properly due to rounding.

[a] Values presented at a measure-level represent Audited values, since the scorecard provides only savings totals.

TABLE 28. 2022 EE REBATES PROGRAM *EX ANTE* & *EX POST* GROSS NATURAL GAS SAVINGS

| MEASURE | *EX ANTE*[A] NATURAL GAS ENERGY SAVINGS (therms/yr.) | AUDITED GROSS NATURAL GAS ENERGY (therms/yr.) | VERIFIED GROSS NATURAL GAS ENERGY SAVINGS (therms/yr.) | *EX POST* GROSS NATURAL GAS ENERGY SAVINGS (therms/yr.) |
|---|---|---|---|---|
| Air conditioner | 0.00 | 0.00 | 0.00 | 0.00 |
| Air conditioner - Legacy 2021 Measure | 0.00 | 0.00 | 0.00 | 0.00 |
| Air conditioner tune-ups | 0.00 | 0.00 | 0.00 | 0.00 |
| Air conditioner tune-ups - Legacy 2021 Measure | 0.00 | 0.00 | 0.00 | 0.00 |

| MEASURE | *EX ANTE*[A] NATURAL GAS ENERGY SAVINGS (therms/yr.) | AUDITED GROSS NATURAL GAS ENERGY (therms/yr.) | VERIFIED GROSS NATURAL GAS ENERGY SAVINGS (therms/yr.) | *EX POST* GROSS NATURAL GAS ENERGY SAVINGS (therms/yr.) |
|---|---|---|---|---|
| Air purifiers | 0.00 | 0.00 | 0.00 | 0.00 |
| Air purifier - Legacy 2021 Measure | 0.00 | 0.00 | 0.00 | 0.00 |
| Air-source heat pumps | 0.00 | 0.00 | 0.00 | 0.00 |
| Air-source heat pumps - Legacy 2021 Measure | 0.00 | 0.00 | 0.00 | 0.00 |
| Air-source heat pump tune-ups | 0.00 | 0.00 | 0.00 | 0.00 |
| Boilers | 13,159.84 | 13,159.84 | 13,159.84 | 15,557.45 |
| Boilers - Legacy 2021 Measure | 3,824.25 | 3,824.25 | 3,824.25 | 2,705.95 |
| Dehumidifiers | 0.00 | 0.00 | 0.00 | 0.00 |
| Dehumidifiers - Legacy 2021 Measure | 0.00 | 0.00 | 0.00 | 0.00 |
| Ductless mini-split heat pumps | 0.00 | 0.00 | 0.00 | 0.00 |
| Electric clothes dryers | 0.00 | 0.00 | 0.00 | 0.00 |
| Furnaces | 547,751.84 | 547,751.84 | 547,751.84 | 790,024.17 |
| Furnaces - Legacy 2021 Measure | 115,370.64 | 115,370.64 | 115,370.64 | 80,012.24 |
| Heat pump water heaters | 0.00 | 0.00 | 0.00 | 0.00 |
| Natural Gas Condensing Water Heater - Legacy 2021 Measure | 30.12 | 30.12 | 30.12 | 47.76 |
| Natural Gas Tankless Water Heater - Legacy 2021 Measure | 298.80 | 298.80 | 298.80 | 166.50 |
| Pool pumps | 0.00 | 0.00 | 0.00 | 0.00 |
| Wi-Fi thermostats | 40,678.00 | 40,678.00 | 40,678.00 | 62,942.88 |
| Wi-Fi thermostats - Legacy 2021 Measure | 28,397.20 | 28,397.20 | 28,397.20 | 8,049.68 |
| Total Savings | 749,510.69 | 749,510.69 | 749,510.69 | 959,506.63 |
| Total Program Realization Rate | | | | 128% |

Note: Totals may not sum properly due to rounding.

[a] Values presented at a measure-level represent Audited values, since the scorecard provides only savings totals.

## *EX POST* NET SAVINGS

The team estimated freeridership and spillover for measures using survey data collected from 2022 participants. The evaluation team calculated freeridership and participant spillover using survey data collected from the 2022 C&I Online Marketplace participant survey, which was fielded in early 2023. Due to the relative impact of the C&I Marketplace products in the population, the survey focused exclusively on questions related to the primary kit offerings (Retail, Restaurant, Restaurant Rev 1, and Office) which made up 95% of the *ex ante* kWh savings, rather than on the add on lighting packs (4%) or the individual products (1%). Table 29 shows the NTG ratios by measure, which are relatively high across measures, indicating most customers would not have purchased this equipment on their own if they had not received the kits for free.

Table 29 shows the NTG ratios by measure for surveyed measures only.

TABLE 29. 2022 EE REBATES PROGRAM EVALUATION NTG RESULTS BY MEASURE CATEGORY

| MEASURE CATEGORY | RESPONSES (n) | FREERIDERSHIP [a] | PARTICIPANT SPILLOVER | NTG |
|---|---|---|---|---|
| Air Conditioner | 89 | 37% | 1% | 64% |
| Furnace | 81 | 42% | 1% | 59% |
| HVAC Tune-Ups | 18 | 54% | 1% | 47% |
| Other Equipment [b] | 63 | 43% | 1% | 58% |
| Wi-Fi Thermostats | 81 | 25% | 1% | 76% |

a This score is an average weighted by survey sample *ex post* gross program MMBtu savings.
b This measure category the following measures: air purifiers, air-source heat pumps, boilers, dehumidifiers, ductless mini-split heat pumps, electric clothes dryers, heat pump water heaters, and pool pumps.

### INTENTION FREERIDERSHIP

The evaluation team estimated *intention* freeridership scores for all participants, based on their responses to the *intention*-focused freeridership questions. Table 30 shows the 2022 EE Rebates program's *intention* freeridership scores for equipment measures, smart thermostats, and air conditioner tune-ups.

TABLE 30. 2022 EE REBATES PROGRAM *INTENTION* FREERIDERSHIP RESULTS BY MEASURE CATEGORY

| MEASURE CATEGORY | INTENTION FREERIDERSHIP SCORE (%)[A] |
|---|---|
| Equipment Measures | 65% |
| Smart Thermostats | 72% |
| HVAC Tune-Ups | 83% |
| Other Equipment | 74% |
| Wi-Fi Thermostats | 39% |

[a] The intention freeridership score was weighted by survey sample *ex post* gross program MMBtu savings

To determine equipment intention freeridership, the evaluation team asked participants questions about whether they would have installed equipment at the same efficiency level, at the same time, and in the same amount in the EE Rebates program's absence. To determine HVAC equipment tune-up intention freeridership, the evaluation team asked participants about whether prior to participating in the NIPSCO program if they had a maintenance contract with a HVAC contractor that provided tune-ups, whether the contract covered the work necessary to receive the tune-up rebate from NIPSCO, and if the NIPSCO program had not provided the tune-up rebate, when they would have had a tune-up service completed.

### INFLUENCE FREERIDERSHIP

The evaluation team assessed *influence* freeridership by asking participants how important the following program elements were in their purchasing decision-making process:

- Information about the program from a contractor
- Rebate for the measure
- Information about energy efficiency that NIPSCO provided
- Previous participation in a NIPSCO energy efficiency program.

The evaluation team determined each respondent's *influence* freeridership score for a measure using the maximum rating provided for any program element, as shown in Table 31.

TABLE 31. 2022 EE REBATES PROGRAM INFLUENCE FREERIDERSHIP SCORING

| MAXIMUM RATING | INFLUENCE FREERIDERSHIP SCORE (%) |
|---|---|
| 1 - Not at all important | 100% |
| 2 - Not too important | 75% |
| 3 - Somewhat important | 25% |
| 4 - Very important | 0% |
| Don't know | 50% |
| Not applicable | 50% |

Table 32 shows *influence* freeridership score for each surveyed measure.

TABLE 32. 2022 EE REBATES PROGRAM INFLUENCE FREERIDERSHIP SCORES BY MEASURE CATEGORY

| MEASURE CATEGORY | INFLUENCE FREERIDERSHIP SCORE (%)[a] |
|---|---|
| Equipment Measures | 8% |
| Smart Thermostats | 12% |
| HVAC Tune-Ups | 25% |
| Other Equipment | 12% |
| Wi-Fi Thermostats | 10% |

[a] The intention freeridership score was weighted by survey sample *ex post* gross program MMBtu savings

### FINAL FREERIDERSHIP

The evaluation team calculated the mean of the *intention* and the *influence* of freeridership components to estimate final freeridership for each surveyed measure. A higher freeridership score translates to more savings that are deducted from the gross savings estimates. Table 33 lists the intention, influence, and final freeridership scores for the 2022 EE Rebates program.

TABLE 33. 2022 EE REBATES PROGRAM FREERIDERSHIP SCORE

| MEASURE | INTENTION SCORE | INFLUENCE SCORE | FREERIDERSHIP SCORE |
|---|---|---|---|
| Equipment Measures | 65% | 8% | 37% |
| Smart Thermostats | 72% | 12% | 42% |
| HVAC Tune-Ups | 83% | 25% | 54% |
| Other Equipment | 74% | 12% | 43% |
| Wi-Fi Thermostats | 39% | 10% | 25% |

## PARTICIPANT SPILLOVER

The evaluation team estimated participant spillover measure savings using specific information about participants, determined through the evaluation, using 2022 NIPSCO evaluation results, and the Illinois TRM v.10 as a baseline reference.[5] The evaluation team estimated the percentage of program participant spillover by dividing the sum of additional spillover savings (as reported by survey respondents) by the total gross savings achieved by all survey

[5] Nonparticipant spillover evaluation activities were not conducted for the 2022 program year.

respondents. The participant spillover estimate for the 2022 EE Rebates program, rounded to the nearest whole percent, can be seen in Table 34.

TABLE 34. 2022 EE REBATES PROGRAM PARTICIPANT SPILLOVER RESULTS

| MEASURE CATEGORY | SPILLOVER SAVINGS (MMBtu) | PARTICIPANT PROGRAM SAVINGS (MMBtu) | PARTICIPANT SPILLOVER |
|---|---|---|---|
| Total Program | 21.7 | 3,872.6 | 1% |

Table 35 presents the resulting net electric savings, demand reduction, and natural gas savings.

TABLE 35. 2022 EE REBATES PROGRAM *EX POST* NET SAVINGS

| MEASURE | *EX POST* GROSS SAVINGS/REDUCTION | | | NTG | *EX POST* NET SAVINGS/REDUCTION | | |
|---|---|---|---|---|---|---|---|
| | KWH | KW | THERMS | | KWH | KW | THERMS |
| Air conditioner | 245,650.04 | 522.932 | 0.00 | 64% | 157,216.03 | 334.676 | 0.00 |
| Air Conditioner - Legacy 2021 Measure | 61,318.80 | 72.180 | 0.00 | 58% [a] | 35,564.90 | 41.864 | 0.00 |
| Air conditioner tune-ups | 2,866.64 | 2.903 | 0.00 | 47% | 1,347.32 | 1.364 | 0.00 |
| Air conditioner tune-ups - Legacy 2021 Measure | 44.39 | 0.101 | 0.00 | 56% [a] | 24.86 | 0.057 | 0.00 |
| Air purifiers | 19,986.93 | 2.283 | 0.00 | 58% | 11,592.42 | 1.324 | 0.00 |
| Air purifier - Legacy 2021 Measure | 656.00 | 0.074 | 0.00 | 60% | 393.60 | 0.044 | 0.00 |
| Air-source heat pumps | 12,708.67 | 5.424 | 0.00 | 58% | 7,371.03 | 3.146 | 0.00 |
| Air-source heat pumps - Legacy 2021 Measure | 1,514.94 | 1.392 | 0.00 | 58% [a] | 878.67 | 0.807 | 0.00 |
| Air-source heat pump tune-ups | 0.00 | 0.000 | 0.00 | 47% | 0.00 | 0.000 | 0.00 |
| Boilers | 0.00 | 0.000 | 15,557.45 | 58% | 0.00 | 0.000 | 9,023.32 |
| Boilers - Legacy 2021 Measure | 0.00 | 0.000 | 2,705.95 | 58% [a] | 0.00 | 0.000 | 1,569.45 |
| Dehumidifiers | 10,426.62 | 2.370 | 0.00 | 58% | 6,047.44 | 1.374 | 0.00 |
| Dehumidifiers - Legacy 2021 Measure | 496.57 | 0.107 | 0.00 | 60% [a] | 297.94 | 0.064 | 0.00 |
| Ductless mini-split heat pumps | 53,083.36 | 15.263 | 0.00 | 58% | 30,788.35 | 8.853 | 0.00 |
| Electric clothes dryers | 2,345.26 | 0.315 | 0.00 | 58% | 1,360.25 | 0.183 | 0.00 |
| Furnaces | 311,278.44 | 0.000 | 790,024.17 | 59% | 183,654.28 | 0.000 | 466,114.26 |
| Furnaces - Legacy 2021 Measure | 0.00 | 0.000 | 80,012.24 | 58% [a] | 0.00 | 0.000 | 46,407.10 |
| Heat pump water heaters | 27,362.59 | 3.738 | 0.00 | 58% | 15,870.30 | 2.168 | 0.00 |
| Natural Gas Condensing Water Heater - Legacy 2021 Measure | 0.00 | 0.000 | 47.76 | 58% | 0.00 | 0.000 | 27.70 |
| Natural Gas Tankless Water Heater - Legacy 2021 Measure | 0.00 | 0.000 | 166.50 | 58% [a] | 0.00 | 0.000 | 96.57 |
| Pool pumps | 4,652.51 | 4.233 | 0.00 | 58% | 2,698.45 | 2.455 | 0.00 |
| Wi-Fi thermostats | 102,024.74 | 113.587 | 62,942.88 | 76% | 77,538.80 | 86.326 | 47,836.59 |
| Wi-Fi thermostats - Legacy 2021 Measure | 14,686.35 | 16.390 | 8,049.68 | 72% [a] | 10,574.17 | 11.801 | 5,795.77 |
| Total Savings | 871,102.86 | 763.292 | 959,506.63 | | 543,218.82 | 496.508 | 576,870.76 |

Note: Totals may not sum properly due to rounding.
[a] 2021 NTG estimate applied.

Table 36 shows the net-to-gross ratio for each fuel.

TABLE 36. 2022 EE REBATES PROGRAM NET-TO-GROSS RESULTS BY FUEL TYPE

| SAVINGS TYPE | *EX ANTE* GROSS SAVINGS | *EX POST* GROSS SAVINGS | NTG RATIO (%) | *EX POST* NET SAVINGS |
|---|---|---|---|---|
| Electric Energy Savings (kWh/yr.) | 923,576.70 | 871,102.86 | 62% | 543,218.82 |
| Peak Demand Reduction (kW) | 931.970 | 763.292 | 65% | 496.508 |
| Natural Gas Energy Savings (therms/yr.) | 749,532.69 | 959,506.63 | 60% | 576,870.76 |

# PROCESS EVALUATION

The evaluation team conducted a survey of Energy Efficiency Rebate program participants to answer the following research questions:

- How effective was the program in influencing participant decision making?
- What affected participant decision making?
- How effective were program marketing efforts in driving program participation?
- How do participants become aware of the Energy Efficiency Rebates program? Has it changed over time?
- What drives participation in the program?
- How familiar were participants with other NIPSCO energy efficiency programs?
- What is the customer experience for those who install different measure types (i.e., large HVAC vs. dryers, etc.)?
- What was the customer's experience with the rebate application like?
- What are interactions with installers/retailers like?
- How satisfied were participants with the program, including the participation process, contractor experience, and satisfaction with equipment received?
- How satisfied are customers with NIPSCO?
- Do participants have any recommendations for program improvement?

In the survey we sought to gather responses from those who installed smaller, newer measures, such as dehumidifiers and air purifiers, as well as those who installed typical large equipment, such as air conditioners or furnaces. Below are the detailed findings from the survey.

## PARTICIPANT FEEDBACK

The evaluation team surveyed 332 customers who participated in the Energy Efficiency Rebates program. To understand how participants may experience the program differently based on the type of measure they install, the evaluation team surveyed program participants who received an air conditioner, furnace, Wi-Fi thermostat, and all other program measures, to learn more about the program experience for each of these measure types. The number of responses by measure type is summarized Table 37 below.

TABLE 37. 2022 EE REBATES PARTICIPANT SURVEY DISPOSITION

| INSTALLED MEASURE | RESPONSES |
|---|---|
| Air Conditioner | 89 |
| Furnace | 81 |
| Wi-Fi Thermostat | 81 |
| All Other Measures* | 81 |
| Total | 332 |

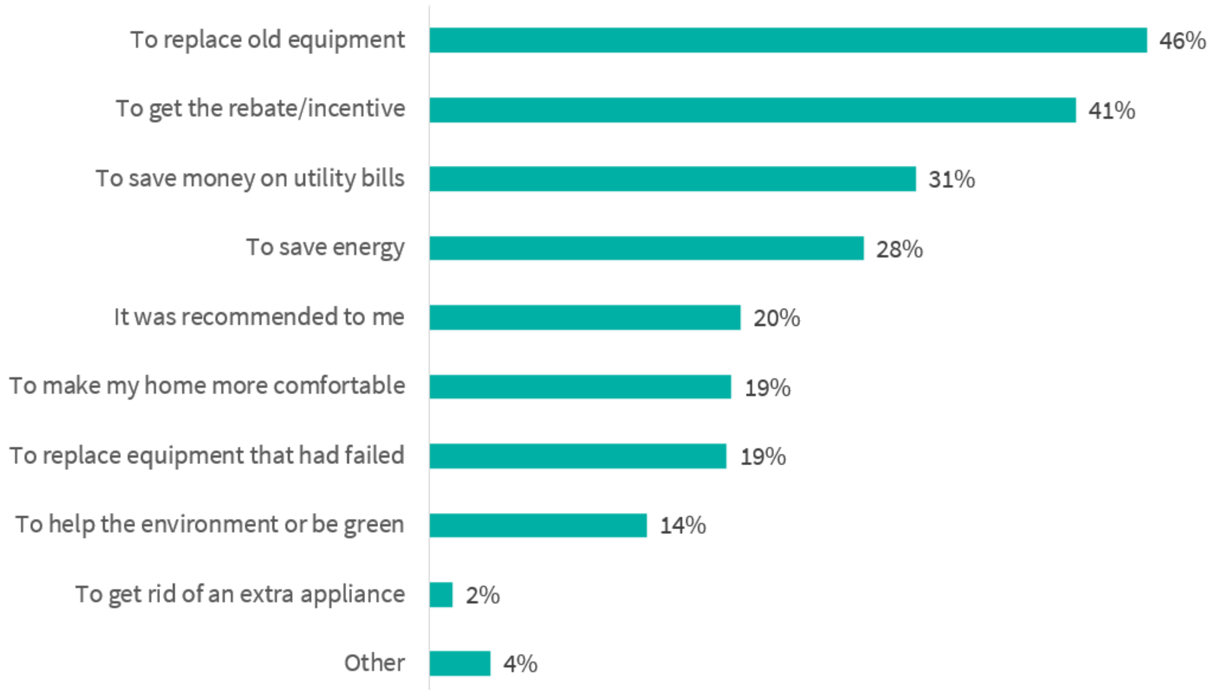
***** Includes air conditioner tune-up (18), dehumidifier (16), boiler (12), mini-split heat pump (11), room air purifier (9), electric clothes dryer (5), pool pump (5), heat pump water heater (4), and air source heat pump (1)

The following sections describe the results related to customer decision making, awareness, experience in the program, satisfaction, and demographics.

## DECISION MAKING

The most common reasons that respondents participated in the Energy Efficiency Rebates program were to replace old equipment (46%), get the rebate/incentive (41%), save money on utility bills (31%), and save energy (28%) (Figure 4).

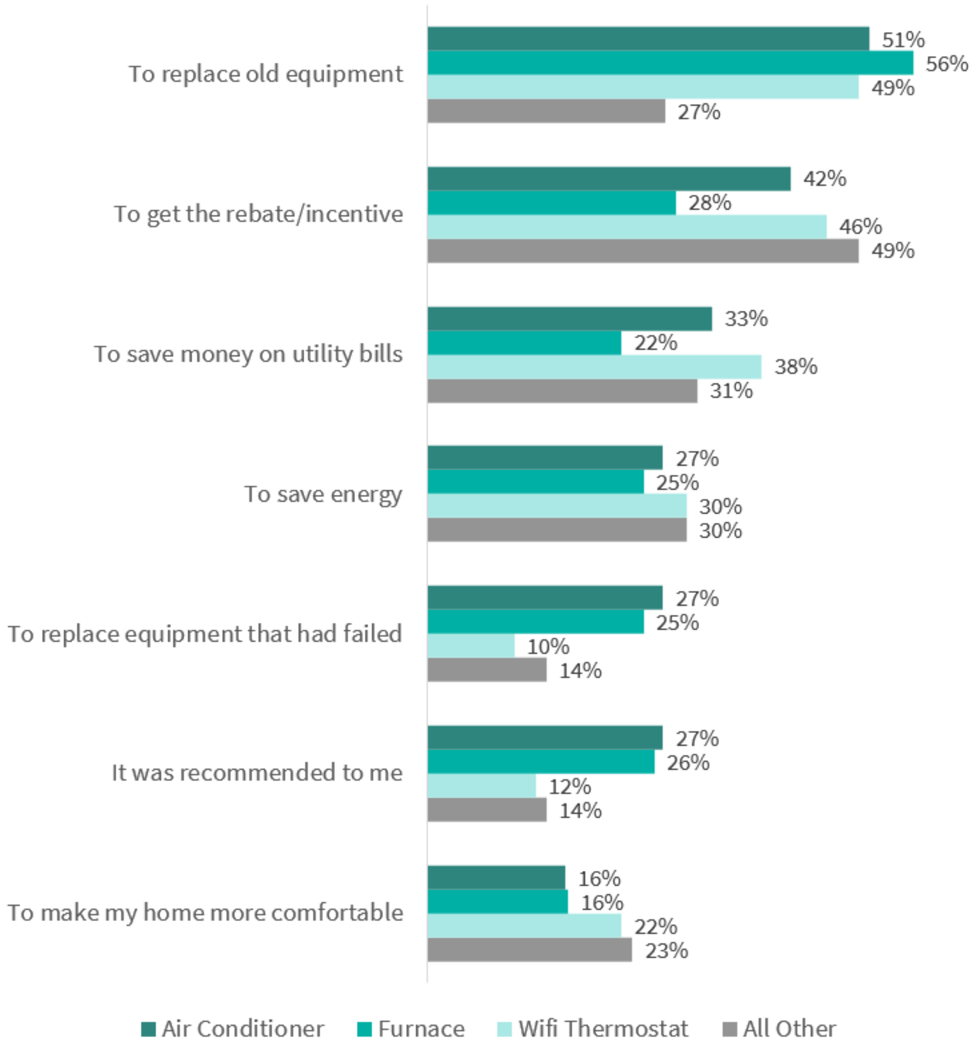
FIGURE 4. REASON FOR PARTICIPATING IN PROGRAM




Source: Participant survey. Question: Why did you decide to participate in NIPSCO's Energy Efficiency Rebate Program? This was a multiple response question (n= 332).

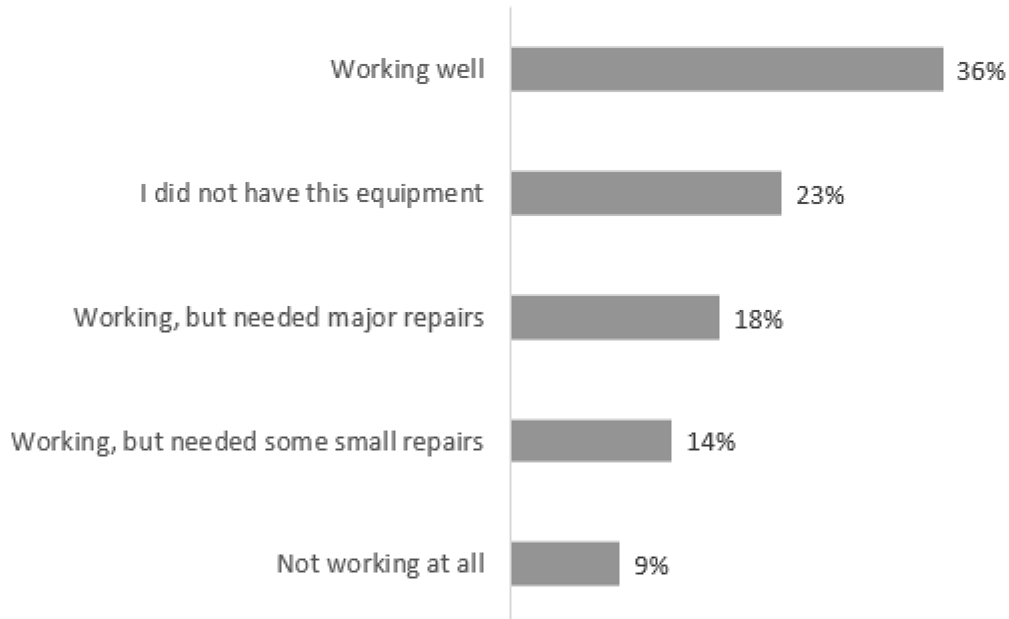
There was some variation in respondents' motivation to participate by the type of measure they installed. The most common reason for respondents who installed air conditioners, furnaces, and Wi-Fi thermostats was to replace old equipment. The most common reason to participate for respondents who installed all other measures was to receive the rebate, which was also the second most common reason for respondents that installed air conditioners, furnaces, and Wi-Fi thermostats (Figure 5).

FIGURE 5. REASON TO PARTICIPATE BY MEASURE TYPE




When asked about the condition of their equipment before they replaced it, many respondents reported that the equipment was working well (36%). Some reported that it was working but needed some small repairs (14%), working but needed major repairs (18%), and others reported that they did not have this equipment before they participated in the program (23%). These results are summarized in Figure 6.

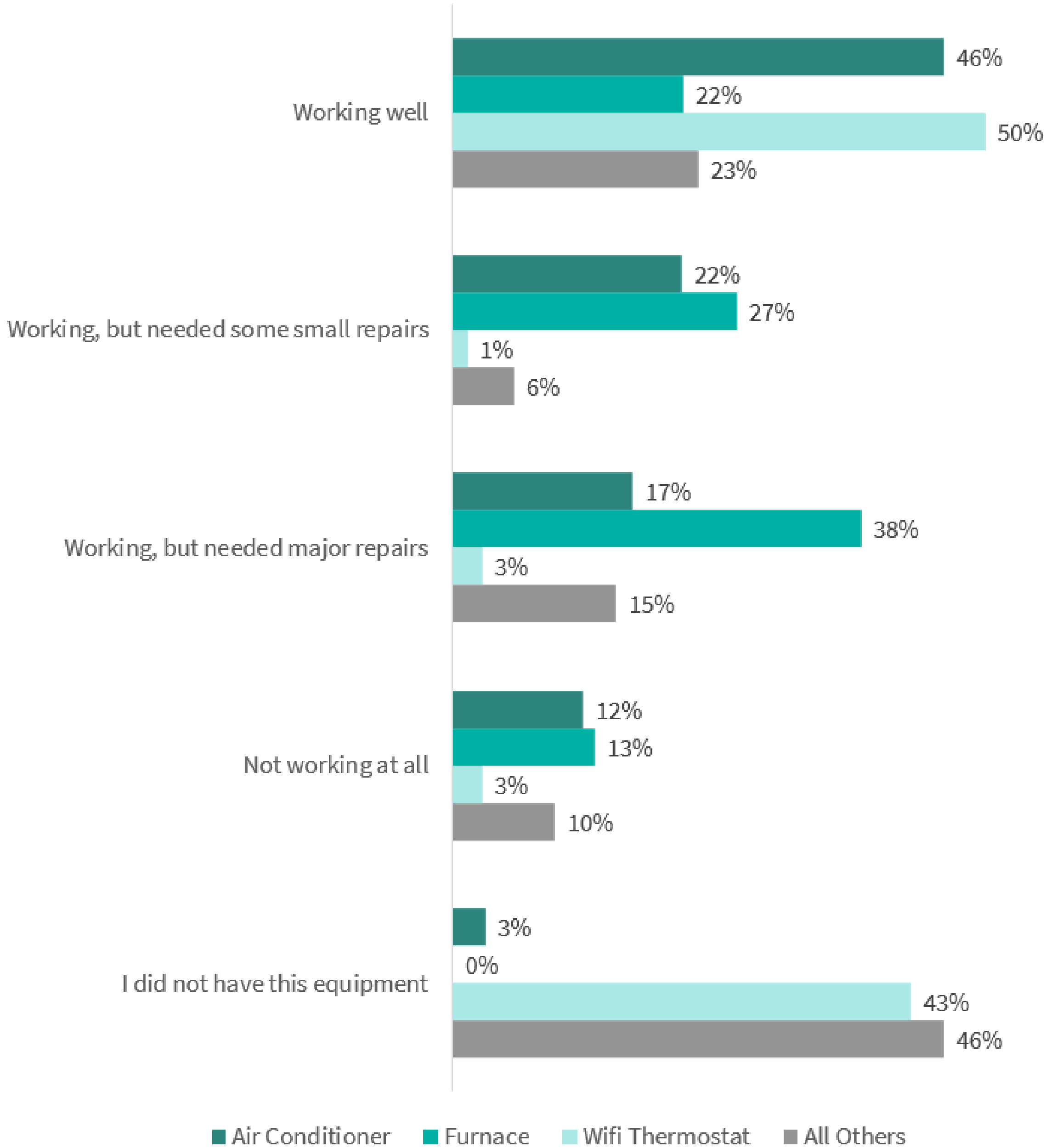
FIGURE 6. CONDITION OF REPLACED EQUIPMENT




Source: Participant survey. Respondents were not asked this question if they did a tune-up through the program. Question: Now, just to confirm, how would you describe the working condition of your [MEASURE_TYPE] when you replaced it?

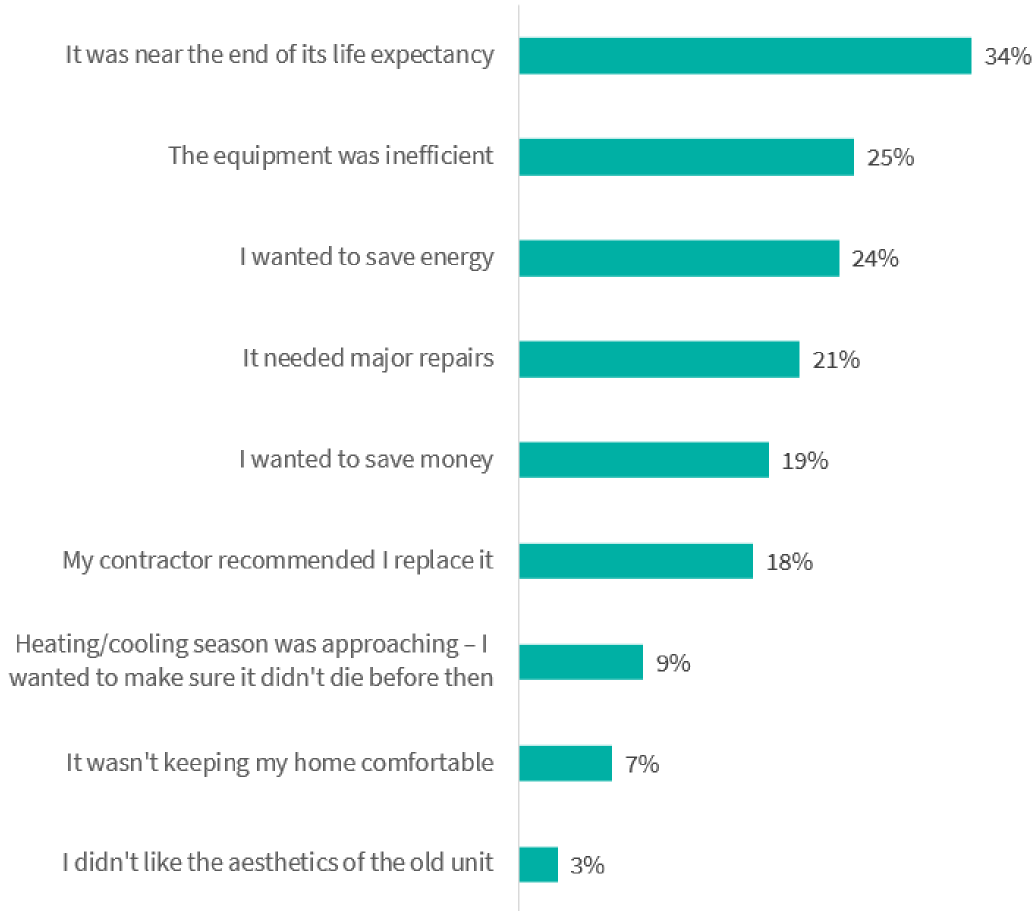
For respondents who installed air conditioners through the program, many reported they were working well (46%). For respondents who installed Wi-Fi thermostats, either they were working well (49%) or they did not have them before the program (42%). Respondents who installed furnaces most reported that they were working but needed repairs (38%). For respondents who installed the other equipment types, they most reported that they did not have that equipment before installing it through the program (46%) (Figure 7).

FIGURE 7. CONDITION OF REPLACED EQUIPMENT BY MEASURE TYPE




Of the respondents whose equipment was working when they replaced it through the program, the most commonly reported reasons respondents decided to replace their equipment were that it was near the end of its life expectancy (34%), the equipment was inefficient (25%), and they wanted to save energy (24%) (Figure 8).

FIGURE 8. REASON TO REPLACE WORKING EQUIPMENT

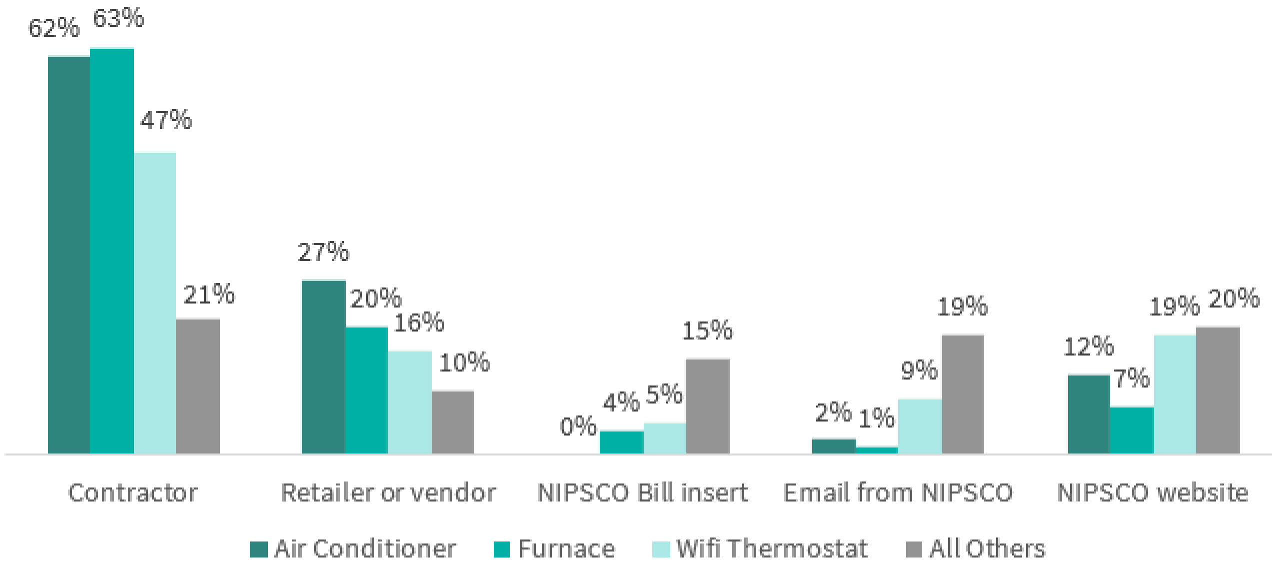



Source: Participant survey. Question: You said that your old [MEASURE_TYPE] was still working. Why did you decide to replace it? This was a multiple response question (n=169). Only customers who did not do a tune-up and answered that their old equipment was still working were shown this question.

## CUSTOMER AWARENESS

Customers most found out about the Energy Efficiency Rebates program through their contractor (43%). They also discovered the program through a retailer or vendor (16%) or through the NIPSCO website (13%). Figure 9 below shows the most common sources of awareness by measure type. Like in 2020, contractors were still the most common source of awareness for customers who installed air conditioners (62%), furnaces (63%), and Wi-Fi thermostats (47%). Contractors as the source of awareness were also common for the other measures (21%) but were comparable to other sources of awareness such as the NIPSCO website (20%) and an email from NIPSCO (19%).

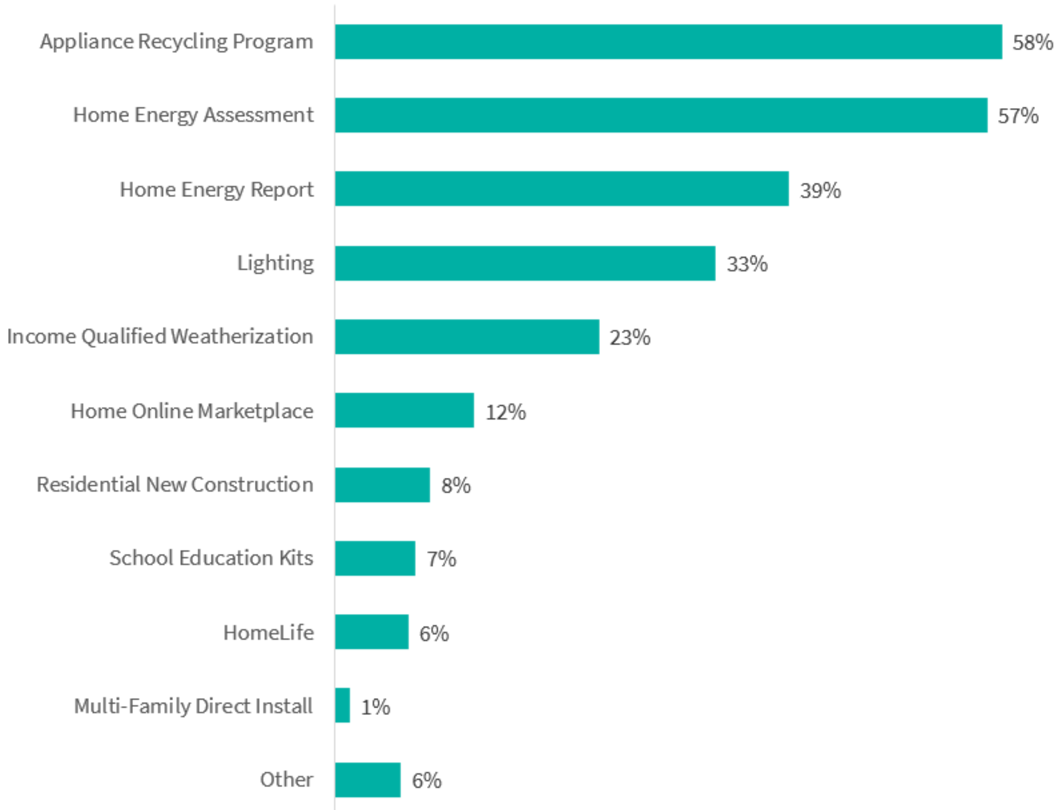
FIGURE 9. SOURCE OF PROGRAM AWARENESS BY MEASURE TYPE [a]




Source: Participant Survey. Question: "How did you learn about NIPSCO's Energy Efficiency Rebate Program?"
[a] This was a multiple response question (n=332).

Almost half (47%) of customers were aware of other NIPSCO energy efficiency programs. Of the respondents who had heard about other NIPSCO programs, they were most commonly aware of the Appliance Recycling program (58%) and the Home Energy Assessment program (57%) (Figure 10). These trends were similar across customers who installed different measure types.

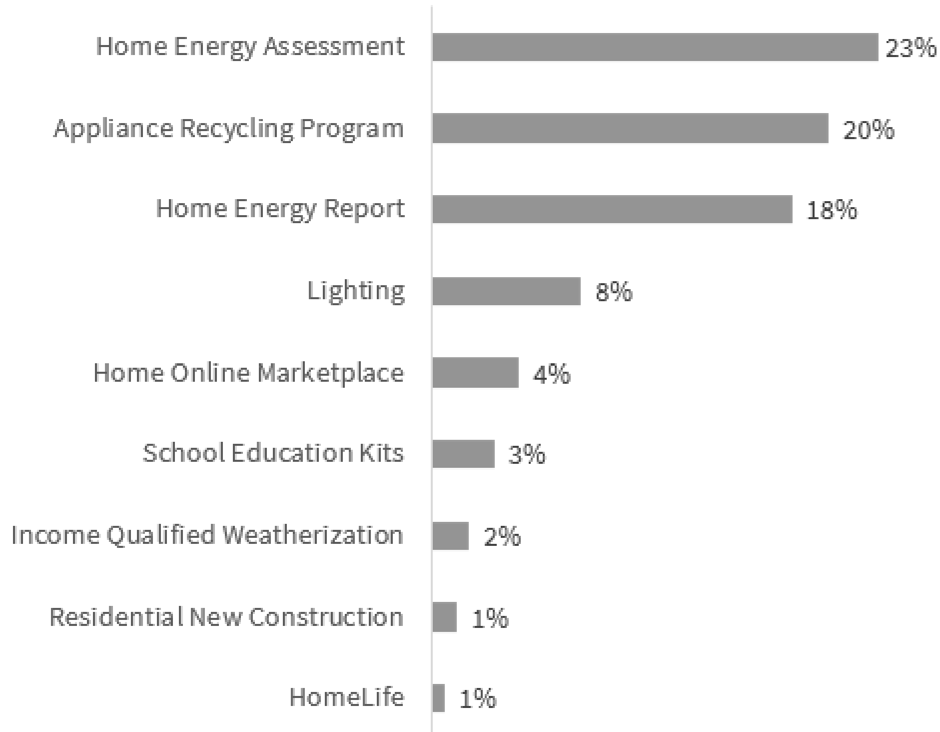
FIGURE 10. AWARENESS OF OTHER NIPSCO PROGRAMS




Source: Participant survey. Question: "What energy efficiency programs are you aware of?"
This was a multiple response question (n=157). Only respondents who said they were aware of other NIPSCO energy efficiency programs were shown this question.

Of the 157 respondents that reported that they were aware of other NIPSCO programs, 81% said they had participated in one or more of these programs. In other words, 38% of the 332 survey respondents had participated in one or more NIPSCO programs in the past, other than the Energy Efficiency Rebates program. The most common programs customers had participated in were the Home Energy Assessment program (23%), the Appliance Recycling program (20%), and the Home Energy Report program (18%) (Figure 11).

FIGURE 11. OTHER NIPSCO PROGRAM PARTICIPATION (N=157)




Source: Participant survey. Question: Have you ever participated in any of the following programs?
This was a multiple response question (n=157). Only respondents who said they were aware of other NIPSCO programs were shown this question.

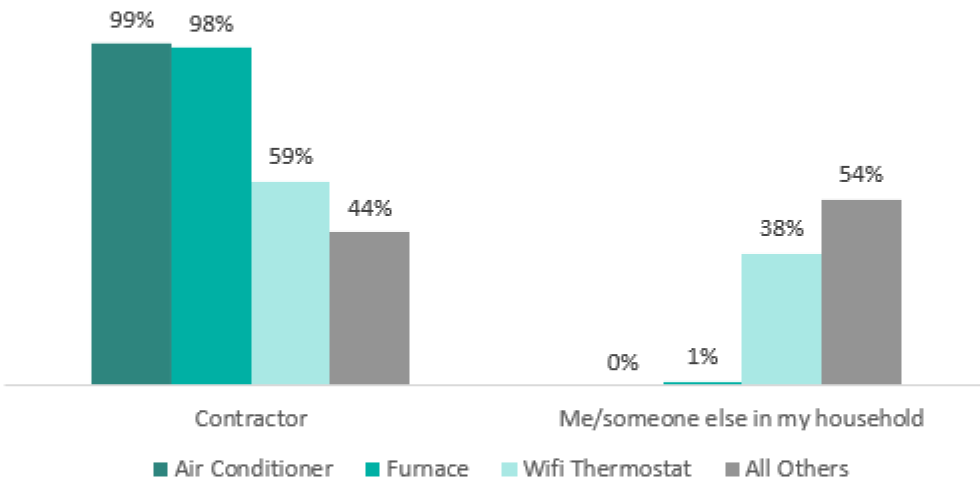
## CUSTOMER EXPERIENCE IN THE PROGRAM

Since participating in the Energy Efficiency Rebates program, most respondents (64%) reported that their home is more comfortable than it was before. Others report that they cannot tell a difference in their comfort level since participating in the program (32%). Reported comfort since participating in the program was similar across measure types.

Of the respondents who installed a Wi-Fi thermostat through the program (n=81), most reported that it replaced a programmable thermostat (60%), while others reported that it replaced a manual thermostat (35%).

Most respondents (77%) used a contractor to install their equipment, and some (21%) installed the equipment themselves. Almost all respondents who installed air conditioners (99%) or furnaces (98%) used a contractor. Most respondents who installed a Wi-Fi thermostat used a contractor (59%), but some installed it themselves (38%). For the respondents who installed the "all other" equipment, over half (54%) installed it themselves, while others (44%) used a contractor (Figure 12). The difference between those who installed air conditioners (99%) and those who installed furnaces (98%) with a contractor was statistically significantly different from the responses of those who installed Wi-Fi thermostats (60%) and "all other" measures (44%) such as dehumidifiers, electric clothes dryers, heat pump water heaters, and pool pumps.

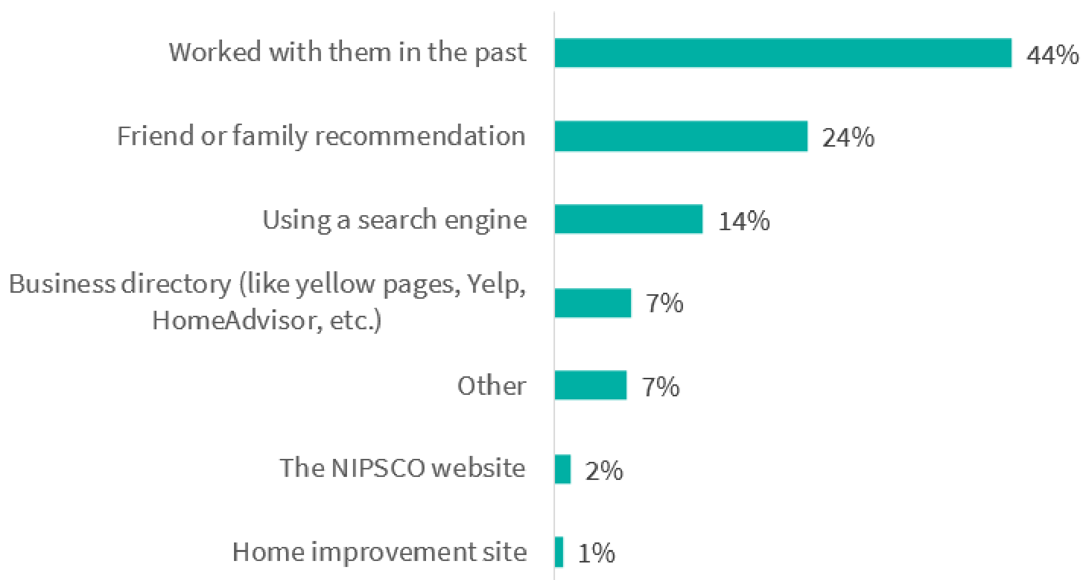
FIGURE 12. WHO INSTALLED EQUIPMENT




Source: Participant survey. Question: Who installed your [MEASURE_TYPE]?
This question was not asked to respondents who did a tune-up through the program. Those respondents were required to use a contractor.

Of the respondents who used a contractor, most found a contractor by working with them in the past (44%). Others found a contractor through a friend or family recommendation (24%) (Figure 13).

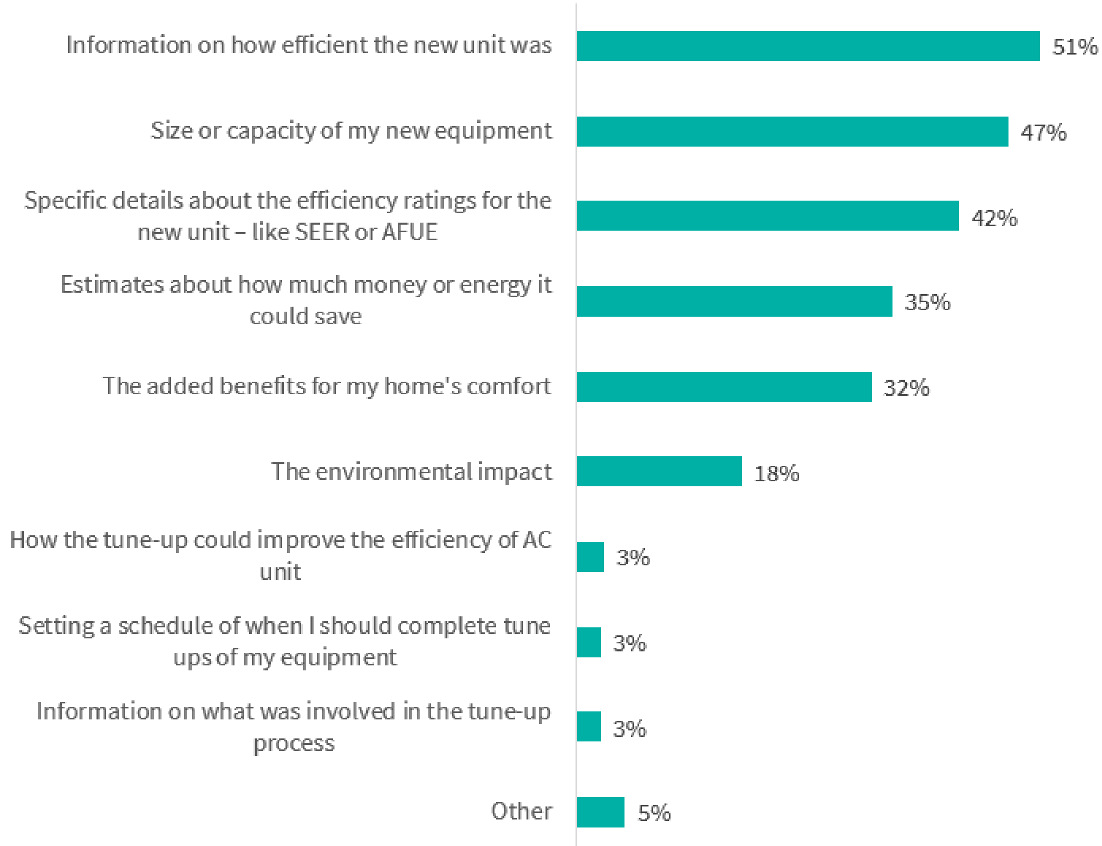
FIGURE 13. METHOD OF FINDING CONTRACTOR




Source: Participant survey. Question: How did you find a contractor?
This question was only asked to respondents who reported that they used a contractor to install their equipment or who did a tune-up in the program. Due to a programing error, two respondents who did tune-ups in the program did not see this question.

Of the respondents who used a contractor, the most common types of information contractors gave respondents was information on how efficient the equipment was (51%), the size or capacity of the equipment (47%), and specific details on the efficiency rating of the equipment (42%) (Figure 14).

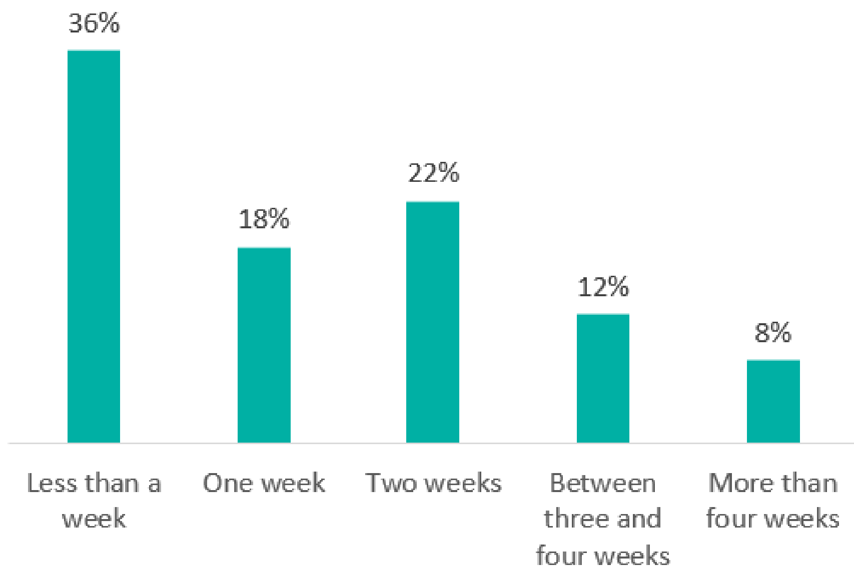
FIGURE 14. INFORMATION PROVIDED BY CONTRACTOR




Source: Participant survey. Question: What kind of information did your contractor provide to you before you purchased the [MEASURE_TYPE]?
This was a multiple response question (n=259). This question was only asked to respondents who reported that they used a contractor to install their equipment or who did a tune-up in the program. Due to a programing error, two respondents who did tune-ups in the program did not see this question.

Of the respondents who used a contractor, most received their equipment/tune-up within a week of scheduling (54%) (Figure 15).

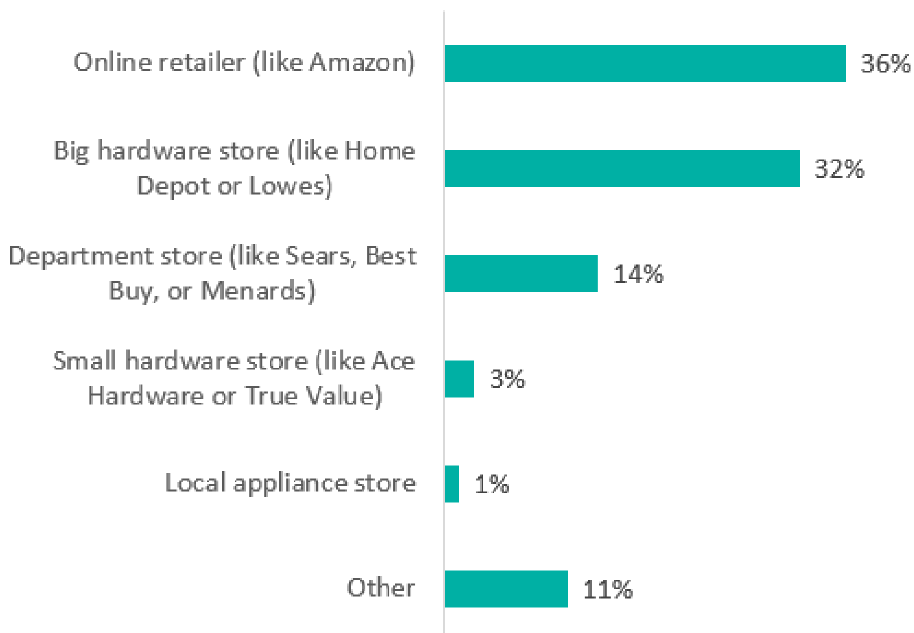
FIGURE 15. WAIT TIME AFTER SCHEDULING




Source: Participant survey (n=259). Question: How long did it take to install your [MEASURE_TYPE]/receive your tune-up after scheduling? This question was only asked to respondents who reported that they used a contractor to install their equipment or who did a tune-up in the program. Due to a programing error, two respondents who did tune-ups in the program did not see this question.

Of the respondents who installed their equipment themselves, the most common places that respondents reported they purchase their equipment from were online retailers (36%) and big hardware stores (32%) (Figure 16).

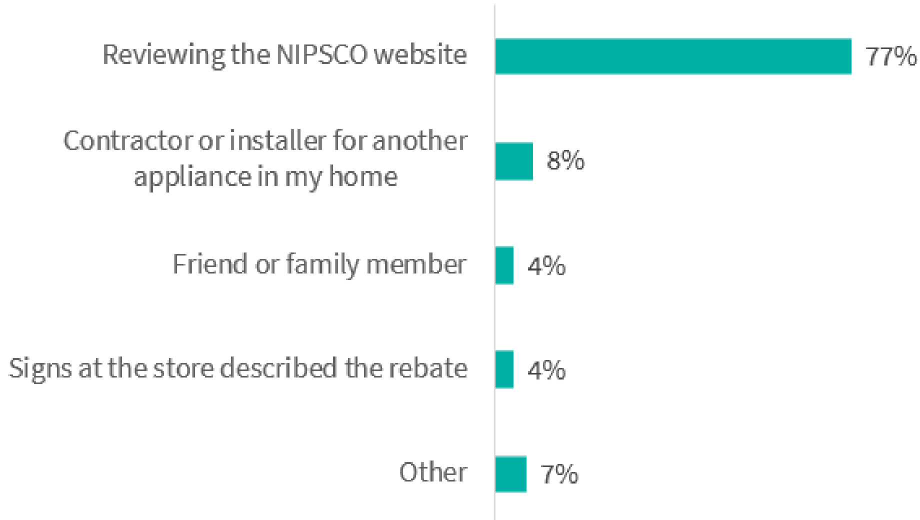
FIGURE 16. WHERE RESPONDENT PURCHASED EQUIPMENT




Source: Participant survey (n=73). Question: Where did you purchase your [MEASURE_TYPE]?
Only respondents who reported that they did not use a contractor or do a tune-up were shown this question.

Of the respondents who installed their equipment themselves, over three quarters (77%) knew the equipment was eligible for a rebate by looking at the NIPSCO website (Figure 17).

FIGURE 17. HOW RESPONDENT FOUND REBATE ELIGIBILITY FOR EQUIPMENT




Source: Participant survey. Question: How did you know the [MEASURE_TYPE] was eligible for a rebate? (n=75)
Only respondents who reported that they did not use a contractor or do a tune-up were shown this question.

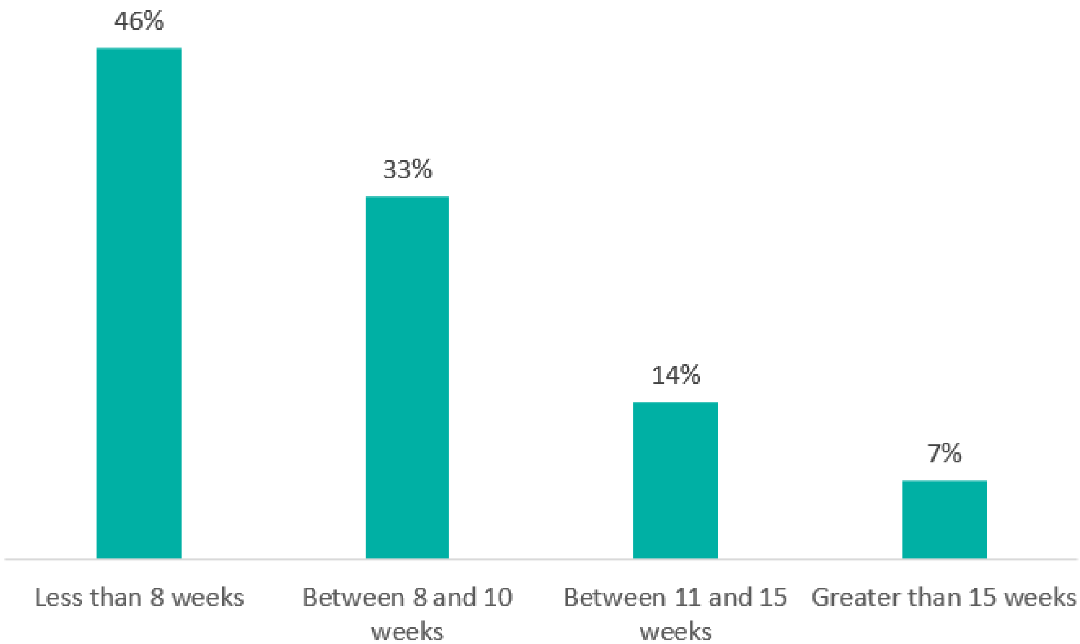
Of the respondents who used a contractor, most (73%) received their rebate in the mail rather than receiving a discount from the contractor upfront (15%). Most respondents reported they filled out a rebate application (81%), although based on data gathered from the contractor interviews, it is plausible that respondents only filled out a portion of the application. As we discuss in the next section, most contractors we interviewed reported that they fill out the application on behalf of the customer but do need to ask them for certain information (i.e., account number). Therefore, there may be misalignment around what customers versus contractors consider to be the role of 'filling out the application.'

Almost half of respondents reported that it took less than eight weeks for them to receive the rebate (46%). For about a third of respondents (33%), it took between eight and ten weeks to receive the rebate, and for some (21%) it took eleven weeks or greater to receive the rebate (Figure 18). Less than half of respondents were very satisfied with the time it took to receive the rebate (40%). Almost a third (32%) were somewhat satisfied with the time it took to receive the rebate. Some were neither satisfied nor dissatisfied (12%), some were not too satisfied (10%), and a few were not at all satisfied (6%). When customers were later asked what NIPSCO could do to improve the program, some responses related to the time it took to receive the rebate. As one respondent explained:

> *"Took a long time to receive the rebate. Longer than NIPSCO stated would be."*

.

FIGURE 18. LENGTH OF TIME TO RECEIVE REBATE




Source: Participant survey. Question: About how long did it take to receive your rebate after you completed the application? (n=269)

## SATISFACTION WITH PROGRAM AND NIPSCO

### OVERALL PROGRAM SATISFACTION

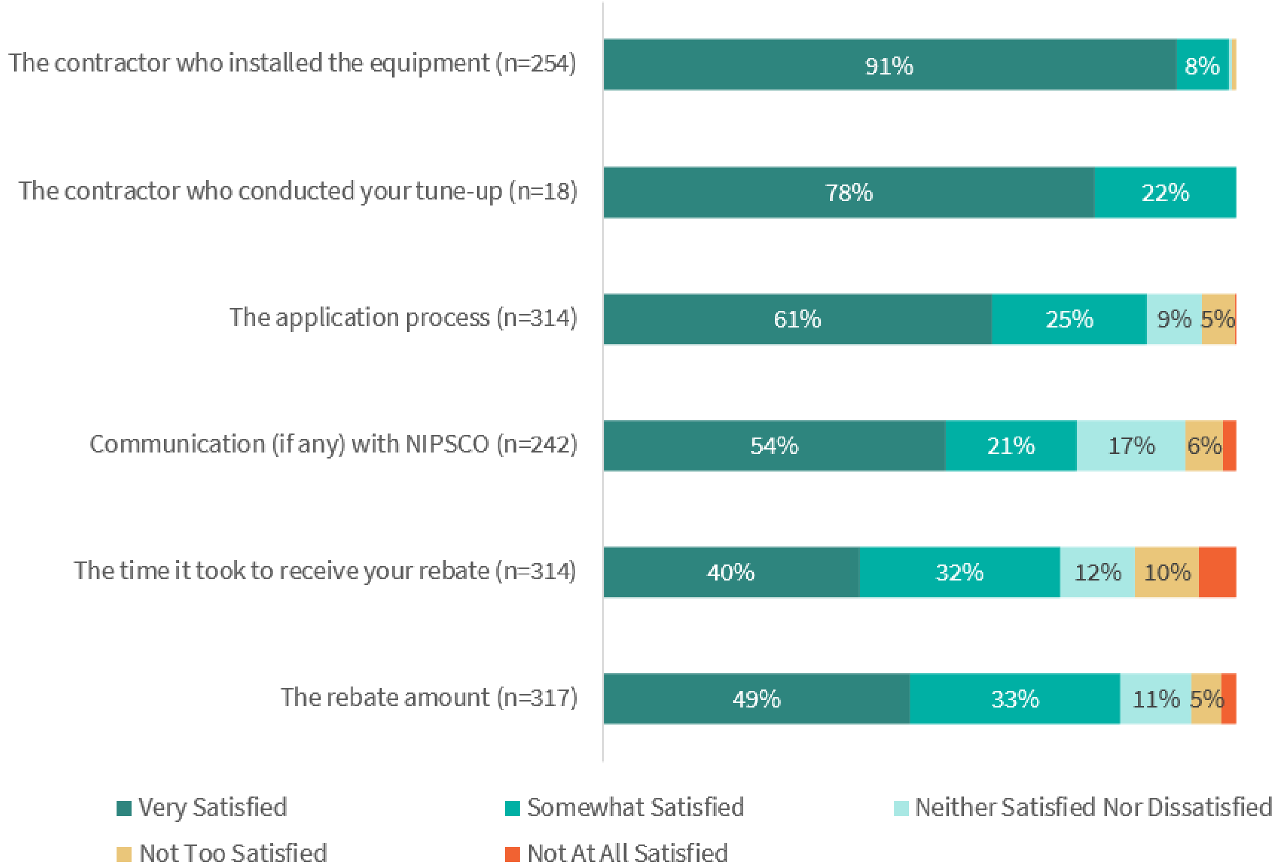
Nearly all respondents would, if given the opportunity, recommend the Energy Efficiency Rebates program to a friend or family member (93%). Most said this because it is nice to save money and decrease bills. Others were satisfied because the program was easy to participate in, the new equipment is more efficient, and they were saving energy. The few respondents that would not recommend the program reported that their friends or family might not live in the NIPSCO service territory, they needed more information on the program, their bills have increased, or it would depend on whether their friends/family would have the means for the upfront cost.

Of the respondents who used a contractor to install their equipment, almost all (91%) were very satisfied with the contractor who installed the equipment. Similarly, most of the respondents who did a tune-up through the program were very satisfied with their contractor (78%). More than half of respondents were very satisfied with the application process (61%). About half of respondents were very satisfied with communication from NIPSCO (54%).

Almost half of respondents were very satisfied with the rebate amount (49%), while 33% were somewhat satisfied. Later, when respondents were asked about their satisfaction with the program overall, the second most common response related to increasing the rebate amount (Figure 19). As one respondent said:

> *"The higher the rebates help people make the switch, the more manufacture charge and/or the contractor [charge is] making it not worth purchasing higher efficiency units."*

FIGURE 19. SATISFACTION WITH PROGRAM COMPONENTS




Source: Participant survey. Question: How satisfied are you with the following aspects of the program? The contractor who installed the [MEASURE TYPE]. The contractor who conducted your tune-up. The application process. Communication (if any) with NIPSCO. The time it took to receive your rebate. The rebate amount.
The "The contractor who installed the [MEASURE TYPE]" part of the question was only shown to those respondents who used a contractor.
The "The contractor who conducted your tune-up" part of the question was only shown to those who did a tune-up through the program.

We asked those who reported they used a contractor or had a tune-up if there was anything the contractor could have done to improve their experience and 102 respondents gave feedback. Most respondents noted there were no improvements they could think of (n=76). Other respondents mentioned the following:

- Improve the rebate application experience, such as not making mistakes on the invoice or application that caused delays in receiving the rebate (n=11)
- Decrease the cost of installation (n=3)

Most respondents were either very satisfied (52%) or somewhat satisfied (30%) with the Energy Efficiency Rebates program overall. When asked why they gave that rating, 219 respondents explained their satisfaction rating. Respondents mentioned the following reasons:

- They enjoyed saving money from the rebate (n=49)
- The program process was simple (n=46). As one respondent said:

*"I feel that the program is an excellent incentive for homeowners to do the right thing. It will help with saving money and is good for the environment."*

For those who were less satisfied, respondents mentioned the following reasons:

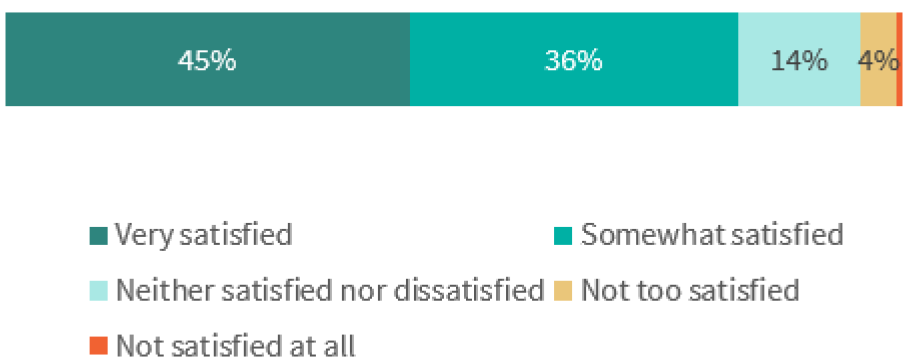
- It took too long to receive the rebate (n=18)
- The rebate requirements were not clear (n=16)
- The rebate was too low (n=13)
- Notably, several respondents explained that the rebate acted as a nice bonus to what they were planning to purchase already (n=9). As one respondent explained:

*"Overall getting money back on something I was already going to buy so it's nice to have some help on the costs."*

## NIPSCO SATISFACTION

When asked how satisfied respondents are with NIPSCO overall as their energy service provider, nearly half (45%) reported they were very satisfied, 36% were somewhat satisfied, and 14% were neither satisfied nor dissatisfied. See Figure 20.

FIGURE 20. SATISFACTION WITH NIPSCO AS ENERGY SERVICE PROVIDER




Source: Participant survey. Question: How satisfied are you with NIPSCO overall as your energy service provider? Would you say you are… (n=321)

## SUGGESTIONS FOR IMPROVEMENT

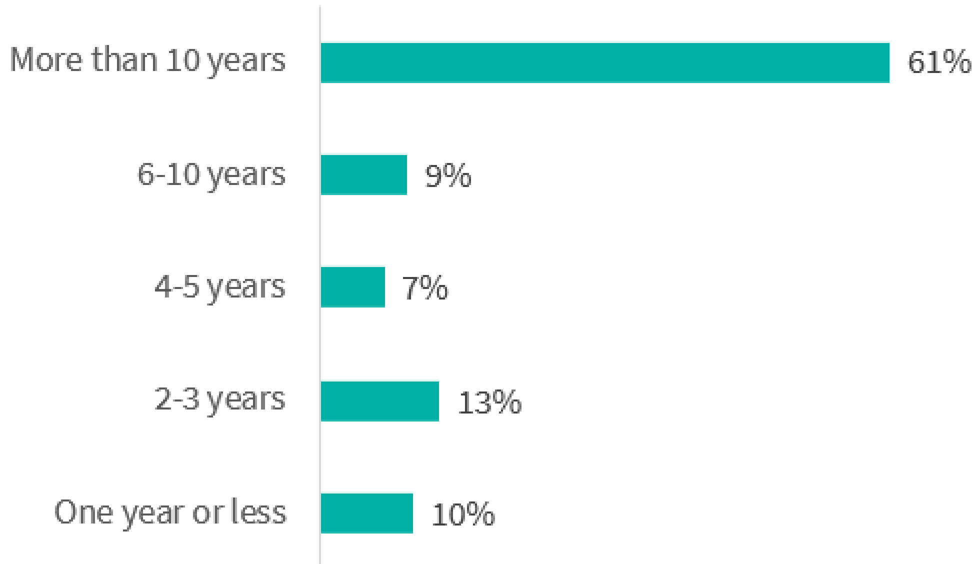
When we asked customers what NIPSCO could do to improve its Energy Efficiency Rebates Program, 164 respondents provided suggestions. The most common responses were as follows:

- Advertise the program more (n=28)
- Increase the rebate (n=26)
- Include more eligible items (n=22)
- Decrease wait time to receive rebate (n=18)
- Make the rebate application easier to complete (n=16)

## PARTICIPANT SURVEY DEMOGRAPHICS

Almost all respondents own their home (99%) and live in a single-family home (98%). Most respondents have lived in their home for more than 10 years (61%). The remainder of respondents most lived in their home for 2-3 years (13%) or one year or less (10%) (Figure 21).

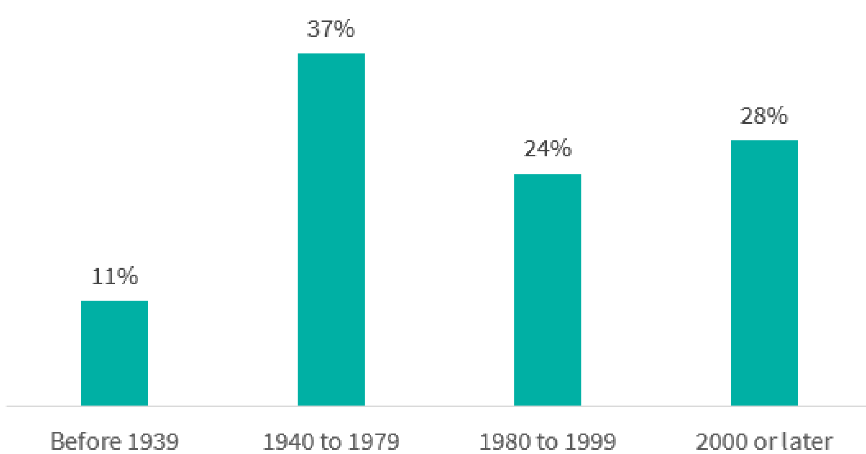
FIGURE 21. TENURE IN HOME




Source: Participant survey. Question: How many years have you lived in your current home? (n=320)

When asked when their home was built, respondents had varying responses. Slightly over half (52%) reported that their home was built in 1980 or sooner, while nearly half (48%) reported that their home was built before 1979 (Figure 22).

FIGURE 22. YEAR HOME BUILT




Source: Participant survey. Question: When was your home built? (n=317)

Slightly more than half of respondents reported that either themselves or an adult in their household work or attend school outside of the home (52%). Almost half of respondents reported that either themselves or someone in their household is retired (43%).

Many respondents were either between 44 and 63 years old (40%) or 64 and 83 years old (40%). More than half of respondents reported they completed a four-year degree or graduate degree (54%). Nearly a third of respondents (30%) did not receive a four-year college degree.

A quarter of respondents (25%) reported a household income of $50,000 or less, while 39% reported a household income between $50,000 and $100,000, and 36% reported a household income of $100,000 or more. Most respondents identified as White (94%) and nearly all respondents reported that they primarily speak English at home (99%).

## EE REBATES CONTRACTOR FEEDBACK

The evaluation team selected the top 120 contractors that had completed the most projects in the program, tracking data to recruit some of them for 30-minute in-depth interviews. The evaluation team sent each contact a recruitment email to invite them to participate, then followed up with a phone call, and then sent another reminder email if applicable. Each interviewee received a $50 electronic gift card after the interview.

There were several factors that caused challenges with recruitment. First, through follow-up phone calls, the evaluation team learned that many of the email addresses were no longer correct. We learned that at least 14 of the 120 contractors had new emails as the best contact, most often because that staff member was no longer with the company. Second, 23 of the 120 contractors told the evaluation team that they were not interested in participating in an interview, primarily during follow-up phone calls. Third, 5 of the 120 contractors told the evaluation team that they don't have the time to speak with us. As one contractor said, "I don't have 30 minutes to do anything." Another told us it was not worth 30 minutes of his time to speak with us. Two contractors said they might be able to answer the questions via email rather than a call, but neither gave their responses after the questions were emailed to them. Notably, many of the contractors we did speak to in interviews were under tight timelines. One contractor had to step away for a few minutes during the interview and another had to end it halfway through because of other issues/obligations that arose.

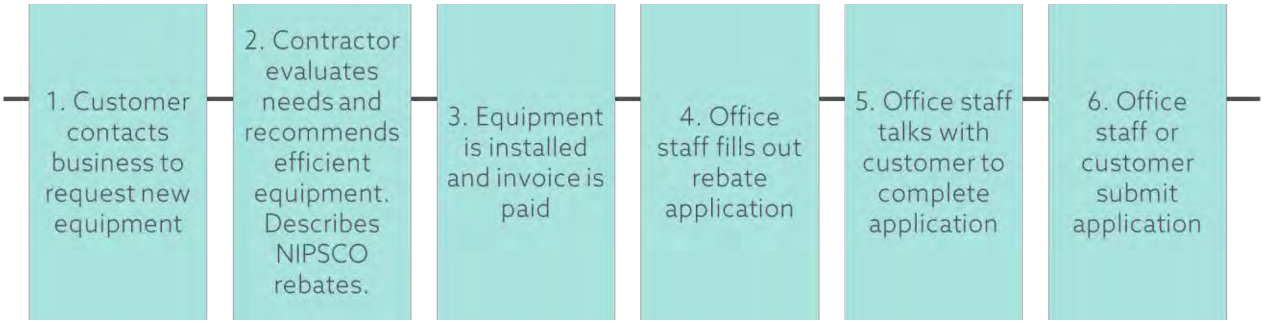
The evaluation team interviewed a total of six HVAC contractors who participated in the Energy Efficiency Rebates program. Like the 2020 evaluation, most of the people we interviewed were administrative staff, rather than contractors that install units in the field. The administrative staff primarily handled utility program rebates.

The following sections describe the results related to the program process, reasons for participation, contractors' experience with the rebate process, satisfaction with the program, and how COVID-19 and other factors have affected contractors' business operations.

### OVERALL PROGRAM SATISFACTION

The process of Energy Efficiency Rebates program participation, as shared by interview respondents, has not changed from our 2020 evaluation of the program. We outline this process in Figure 23.

FIGURE 23. PROGRAM PROCESS SHARED BY CONTRACTORS




This process begins with the customer contacting the contractor to request an HVAC service, which could include a repair, tune-up, or replacement. In some cases, contractors have annual contracts (which include tune-ups) with customers; in this instance, the contractor may contact the customer to notify them it is time for a tune-up.

Next, the contractor goes to the customer's home and evaluates the customer's needs. If new equipment is needed, the contractor may provide options for the customer (i.e., a good/better/best recommendation). The contractor may also explain NIPSCO's Energy Efficiency Rebates program. This may act as an incentive for the customer to choose the most energy efficient option. In some cases, the contractor may offer to complete the rebate application for the customer, which can act as a selling point for the customer. If the customer decides to make this purchase, the contractor schedules an installation date.

Third, the contractor installs the energy efficient equipment. If the contractor completes the rebate application on behalf of the customer, they collect any needed information from the customer (i.e., NIPSCO account number). If the contractor does not complete the rebate application, they may provide any needed information to the customer to help them complete the application themselves. In most cases, the contractor invoices the customer for the full price of installation and the customer receives the rebate directly from NIPSCO. We spoke to one contractor who provides the rebate as an upfront discount and the rebate goes to the contractor.

Fourth, the contractor or the customer completes the rebate application. There may be some back-and-forth between the customer and the contractor to gather the necessary information for the rebate application.

Fifth, the contractor or customer submits the application. No contractors we spoke with said that they cross-promote other NIPSCO programs.

## PARTICIPATION DRIVERS

When asked why they participate in the NIPSCO Energy Efficiency Rebates program, most contractors said it serves as a selling point they can use with customers to help them save money. As one contractor said, "We can make that connection to the rebate that most of our client base are not aware of until we tell [them]. It is a benefit to them." This may cause the customer to choose to work with the contractor, knowing they are receiving a cost-saving rebate and support completing the rebate application.

There was low awareness about the TRC trade ally program, as well as a lack of clarity about engagement with the program. For example, one contractor said they were not a trade ally, another said they didn't know what it was, and another said they don't know for sure if they are a trade ally. Yet another contractor said they thought they might be a trade ally but were not confident about it.

Contractors reported that rebates were received through NIPSCO for 40 – 70% of the installations their business manages. Furnaces were the most common measures contractors installed through the Energy Efficiency Rebates program, with five of the six contractors reporting furnaces as the equipment that they installed most frequently through the program. Two contractors mentioned they installed air conditioners through the program and two mentioned they installed thermostats through the program. When asked what additional measures NIPSCO should include in the program, four of the six contractors did not have any specific suggestions. One contractor suggested a tankless water heater, for which they mentioned NIPSCO used to offer a rebate. Another contractor suggested offering a small rebate for 92% efficient furnaces and increasing the rebate for the 95% furnaces.

### EXPERIENCE WITH THE REBATE PROCESS

Five of the six contractors we interviewed had the rebate sent directly to the customer. One contractor provided the rebate as an upfront discount to the customer. Three of the six contractors filed the rebate for the customer and the rebate went directly to the customer. Two of the six contractors helped the customer fill out the NIPSCO rebate form, then the customer submitted it and received the rebate. This suggests that many of the customers who work with contractors are involved at some level with the rebate application, be it providing information to the contractor or submitting the rebate the contractor helped to complete.

### SATISFACTION WITH PROGRAM AND NIPSCO

The contractors we interviewed reported that customers are generally satisfied with the program. As one contractor said, "I think they are very satisfied… A lot of them say I didn't know NIPSCO did that. They think it's nice that NIPSCO offers it, because most of them didn't know about the program before."

Contractors we interviewed were also generally satisfied with NIPSCO as well. As one contractor said, "People at NIPSCO are always very nice." No respondents had negative feedback about NIPSCO.

### SUGGESTIONS FOR IMPROVEMENT

When asked how NIPSCO might improve the Energy Efficiency Rebates program, one of the most common suggestions contractors had was to decrease the rebate processing time. As one contractor said,

> *"NIPSCO is slow getting the rebate back to the customer. We get calls about how long it is taking to receive the rebate. People think they will get it tomorrow."*

Another contractor mentioned they had five rebate applications approved in October or November, yet customers have not yet received the rebate at the time of their interview (February 2023). Some contractors mentioned how any issues with the application can lead to longer wait times for the customer to receive the rebate; issues could include the customer completing the form incorrectly, using the wrong account number, or having someone other than the homeowner complete the form.

One contractor mentioned that, in the case of thermostats, some customers backed out when they realized it was a Wi-Fi thermostat and opted for something more basic instead. They encountered this situation more often with older customers. In these instances, the contractor had to pay the customer the cost of the rebate, because they already promised the price to the customer. One contractor expressed some frustration with the rebate application, particularly when NIPSCO sends the application back due to inadequate information. This contractor felt that in most cases where this happens, NIPSCO could do more to deduce the missing information themselves based on what is already provided in the application, as opposed to sending it back to the contractor.

Contractors also commonly suggested that NIPSCO increase the rebate amount. One contractor gave the example of how a nearby utility provided rebates of up to $2,000 for a heat pump, while NIPSCO provided rebates of up to $350 for the same system. They noted that, while equipment prices have increased, rebates have not increased in parallel. As one contractor explained,

> *"The average homeowner is going to spend at least $10,000-$12,000 to get a furnace and AC that meets minimum NIPSCO program requirements. They might get $400 back. I realize they don't have to give anything, so that is great. But as far as incentivizing people, if you are going to spend $12,000, $400 seems like [not a lot]. Especially because if you got the minimum that doesn't meet NIPSCO standard now you're talking $8,000 or less. To get to the NIPSCO standard, $4,000 more dollars to get $400 back. So, it doesn't make sense. Either offer a better incentive or broaden the equipment that qualifies."*

All the contractors we interviewed informed their customers about the rebate, rather than the customer learning about the rebate elsewhere. As one contractor said, "I think most people don't know about the NIPSCO programs."

### COVID-19 AND OTHER FACTORS

Three out of the six contractors said that COVID-19 did not impact their business operations. Contractors described that there was more of an impact in 2020 and 2021, especially with PPE precautions and customers being reluctant to have people in their home. One contractor mentioned these precautions affecting them in 2022 as well. Some contractors said they were busier in 2020 and 2021 than in 2022, because they were considered essential. One contractor said that 2022 was not as good of a year for them, because "people [were] able to go out and spend money on other things."

When asked about other factors that may be affecting contractors, they mentioned availability of parts, weather, and inflation. Two contractors noted that because it has been unseasonably warm the last few months, their business has been slower because customers are probably not as concerned about maintaining their furnaces when it is not cold outside. Inflation has also had an impact on most of the contractors we interviewed. One contractor who has been in the industry for over 20 years explained how prices have increased from wholesalers:

> *"Wholesalers typically might increase their prices two times a year and it would be minimal, like maybe 2%. In the last 2 years, there were 6 to 8 increases that were 5-12% increases at a time. It only goes up. It does not go back up. We are printing pricing sheets almost every other month now. We have to re-work everything to accommodate. This last price increase at the end of January, we had stuff going up almost 20%."*

This contractor described how the cost of furnaces and air conditioners has changed since 2017 to present day:

> *""The average person in 2017 could get a high-quality furnace and AC for under $6,000. Now, you can't even get a bare minimum most basic unit in for that. The bottom of the barrel equipment would be $8,000-$10,000. It's insane."*

In short, the contractors we spoke to reported that the impact of COVID-19 is decreasing, while the impact of inflation is increasing. As the quotations above suggest, these impacts from inflation will likely have a long-term effect on customer purchasing decisions as well as contractors’ businesses.

# CONCLUSIONS AND RECOMMENDATIONS

## CONCLUSION 1: PARTICIPANTS AND CONTRACTORS FEEL THAT REBATE LEVELS ARE LOW AND COULD BE OPTIMIZED TO INFLUENCE MORE CUSTOMERS.

When asked what NIPSCO could do to improve the program, survey respondents commonly suggested that they increase the rebate amounts. Several customers explained they participated in the program as a financial bonus to something they have already decided to install. In interviews with contractors, many noted the cost of installing energy efficient equipment increased considerably due to inflation, but incentive levels have not risen accordingly. While some contractors mentioned the rebate is sometimes helpful when the customers deliberate between the standard and high efficiency equipment, other contractors mentioned that the rebate is just nice for customers that will opt for high efficiency equipment anyway. One contractor also mentioned other utilities have rebates much higher than NIPSCO.

Recommendations:

- Explore rebate levels of neighboring utilities and compare them against NIPSCO rebates. Consider increasing rebate levels where cost-effective and feasible.

## CONCLUSION 2: AWARENESS OF THE ENERGY EFFICIENCY REBATES PROGRAM IS PRIMARILY DRIVEN BY CONTRACTORS.

Respondents most often reported they learned about the program through their contractor. This is in alignment with what we found in our contractor interviews. A common suggestion for program improvement among survey respondents was that NIPSCO might increase program advertising. While larger HVAC measures are typically intentionally designed to be marketed through contractors, the EE Rebates program has expanded to include smaller measures like pool pumps and dehumidifiers, which could benefit from more direct marketing to customers.

Recommendations:

- Advertise the program more actively to both residential customers and contractors.
- Cross-promote the program through current participants of other NIPSCO programs.
- Encourage contractors to cross-promote other NIPSCO offerings with customers, including the smaller measures offered through EE Rebates. Consider creating marketing material that contractors could leave behind with customers.

## CONCLUSION 3: WHILE MANY CUSTOMERS AND CONTRACTORS FOUND THE REBATE APPLICATION TO BE EASY TO COMPLETE, SOME STRUGGLED AND WERE NOT AWARE OF THE ONLINE PORTAL.

While many customers reported that it was easy for them to complete the rebate application, this may be due to support from their contractor. Some contractors reported that the application was easy, while others reported it was difficult to complete all the paperwork and they occasionally got incorrect information (i.e., account numbers, names associated with the property) from the customer. While the EE Rebates program offers an online portal for contractors and customers to apply for rebates, many respondents were not aware of it and suggested that NIPSCO offer the rebate application through an online platform.

Recommendations:

- Advertise the online portal to customers – and particularly to contractors – to ensure participants are aware of this option.

## CONCLUSION 4: CUSTOMERS ARE OVERALL VERY SATISFIED WITH THE NIPSCO ENERGY EFFICIENCY REBATE PROGRAM.

Most respondents would recommend participating in the program to a friend or family member and most reported high satisfaction with their contractor.

Recommendations:

- Consider a referral program that rewards participants for engaging others in the program. For example, customers who refer a friend and family member could be entered into a drawing for a gift card. Alternatively, NIPSCO could award customers a cash rebate for every referral they make.

## CONCLUSION 5: THERE IS LOW CONTRACTOR AWARENESS ABOUT THE TRC TRADE ALLY PROGRAM.

Most contractors we spoke to either did not know about the TRC trade ally program or were usure if they were part of it.

Recommendations:

- Advertise the benefits of participating in the TRC Trade Ally Program to contractors. Consider leveraging this to inform contractors about tools they could use to their benefit, such as, the online application or materials to cross-promote other NIPSCO programs to customers.

## CONCLUSION 6: NIPSCO DID NOT MEET ITS SAVINGS GOALS FOR ELECTRIC ENERGY AND PEAK DEMAND BUT EXCEEDED ITS NATURAL GAS SAVINGS GOAL. THE PROGRAM HAD A 114% REALIZATION RATE FOR KWH SAVINGS, A 95% REALIZATION RATE FOR DEMAND SAVINGS, AND A 128% REALIZATION RATE FOR THERM SAVINGS.

NIPSCO did not meet its savings goals for electric energy and peak demand but exceeded the natural gas savings goal.

Recommendations:

- Consider prioritizing program delivery strategies (i.e., targeted outreach) that will bring more electric energy savings through the EE Rebates program.

## CONCLUSION 7: REALIZATION RATES VARIED FOR SOME MEASURES ACROSS THE 2021 AND 2022 EVALUATIONS.

The realization rates at the measure level swung between the 2021 and 2022 evaluations for some measures. The evaluation team has seen this type of swing between evaluation years consistently, due to the nature of the evaluation timelines and evaluation methods. The evaluation team uses custom calculations for each measure. As installed measure specifications change from year to year, and as sample sizes are small, the *ex post* gross savings values can vary widely. In 2022 the evaluation team also adopted the Illinois TRM (v10) for most measures while continuing to use select inputs and thermostat methodology from the Indiana TRM (v2.2).

Recommendations:

- If NIPSCO and TRC are concerned about this year-to-year inconsistency, the implementation team could consider using semi-custom calculations for large HVAC measures, more like the evaluation methods, which would allow the program to more closely estimate savings based on the specific breakdown of measures installed in that year.

### CONCLUSION 8: SOME EQUIPMENT CHARACTERISTICS AND ENERGY PERFORMANCE METRICS ARE NOT INCLUDED CONSISTENTLY OR ARE DIFFICULT TO ACCESS IN THE PROGRAM DOCUMENTATION THAT IS USED AS INPUTS FOR *EX POST* GROSS SAVINGS CALCULATIONS.

There are equipment characteristics and energy performance metrics that are not available that are used to calculate savings for several measures including air conditioners, air conditioner tune ups, air source heat pumps, ductless heat pumps, water heaters, air purifiers, and clothes dryers. For example, some variables are included in the tracking data but are not consistently tracked because they are not required fields, and/or tracked in participant backup documentation in PDF. For these values where we do not have reliable tracked data, the evaluation team makes assumptions based on engineering judgment, program averages, and ENERGY STAR and AHRI database look ups. Although it might not be possible to provide data for some of these equipment characteristics, our calculations will be more tailored to the NIPSCO territory and reflect reported measure data more accurately if the evaluation team can have access to as many of these characteristics as possible. The measures and missing equipment data necessary for calculated savings are detailed below.

Recommendations:

- Encourage program staff to collect non-required fields. And, when possible, include fields for the following within the tracking database, rather than in the program documentation:
  - HVAC characteristics such as SEER, EER, HSPF, and cooling/heating capacities are included in the tracking data for air conditioners, AC tune ups, air source heat pumps, and ductless heat pumps.
  - When including the cooling capacity, provide it in units of Btuh instead of tons, for more accuracy.
  - Water heater uniform energy factor (UEF) in the tracking data.
  - With the ENERGY STAR measures, include the unique ENERGY STAR number for all measures and the clean air delivery rate (CADR), liters of water per kWh consumed, energy factor, and combined energy factor (CEF) for air purifiers, dehumidifiers, pool pumps, and clothes dryers, respectively.
- For future evaluation years, if this information is not able to be tracked consistently in Captures, the evaluation team should consider budgeting for a more in-depth impact evaluation approach for impacted measures, such as sampled desk reviews.

### CONCLUSION 9: CURRENTLY, NIPSCO DOES NOT CLAIM SAVINGS FOR HEAT PUMPS WHEN THEY ARE INSTALLED IN CONJUNCTION WITH FURNACES; HOWEVER, THIS MAY BE LEAVING VIABLE ELECTRIC SAVINGS ON THE TABLE.

In conversations with NIPSCO, they indicated that in situations where a customer installs both a furnace and a heat pump, the customer is only allowed to receive a rebate for the furnace (and similarly, savings are only claimed for the furnace). While there are certainly interactions across these measures, when installed together, that must be considered when estimating savings, the evaluation team recommends that NIPSCO explores whether it is feasible to, at a minimum, claim electric cooling savings from these heat pump installations.

Currently, concurrently installed heat pump measures are not tracked in the database, so the evaluation team is unable to understand the frequency of these installations and the resulting potential magnitude of savings. If desired, the evaluation team can work with NIPSCO to explore this further and better understand what savings could be claimed.

As an important note, when furnaces and heat pumps are installed together, the evaluation team expects that furnace savings in these dual-installation scenarios may be somewhat lower, as these measures are often used to provide periodic back-up heat when it is too cold for a heat pump to function. However, the evaluation team expects that this is already accounted for in our furnace savings estimates, as the evaluation team utilized billing data to provide updated EFLH during the 2020 evaluation, which would have included and reflected any of these situations.

Recommendations:

- Work with the evaluation and implementation teams to determine the frequency and importance of exploring estimating savings for dual installations of furnaces and heat pumps.
- Consider collecting data on the heat pump that is installed. This could be done in multiple ways, given logistical needs. First, the corresponding heat pump information could be collected and included in the tracking data. A section may need to be added to the rebate application for furnaces (or heat pumps, if more logical). Second, a flag could be added to the tracking data, and rebate application, which says whether there was a dual installation.
- Consider creating a unique measure type for heat pumps and furnaces that are installed in conjunction with one another. Calculate a new deemed savings value and incentive level for these measures.

### CONCLUSION 10: CURRENTLY, NIPSCO DOES NOT TRACK OR CLAIM SAVINGS FOR ALL POSSIBLE REPLACEMENT MEASURES; HOWEVER, THIS MAY BE LEAVING VIABLE ELECTRIC SAVINGS ON THE TABLE.

In conversations with NIPSCO and TRC, they indicated that they do not track whether installed equipment is replacing equipment that is still in a condition that qualifies for early replacement savings. Currently, without early replacement scenarios being tracked in the database, the evaluation team is unable to understand the frequency of these installations and the resulting potential magnitude of savings. Participant survey data was used in 2022 to apply an estimate for the saturation of early replacement for applicable measures, however, for measures other than furnaces and air conditioners a blended early replacement rate was used due to limited responses. If desired, the evaluation team can work with NIPSCO to explore this further and better understand what savings could be claimed.

Recommendations:

- Work with the evaluation and implementation teams to determine the frequency and importance of exploring estimating savings for early replacement scenarios.
- Consider collecting data on whether the replaced unit qualifies as early replacement and include detailed tracking of the existing equipment specifications.

# 4. RESIDENTIAL LIGHTING PROGRAM

## PROGRAM DESIGN AND DELIVERY

Through the Residential Lighting program, NIPSCO seeks to reduce electric energy consumption and peak demand through increased awareness and adoption of energy-efficient lighting technologies. By partnering with retailers and manufacturers, NIPSCO provides program customers with instant discounts on efficient lighting purchases that meet standards set forth by the Department of Energy (DOE) ENERGY STAR® program. The Residential Lighting program promotes customer awareness and purchase of program-discounted products through a range of marketing and outreach strategies, such as point-of-purchase marketing and promotional materials, website advertising, and in-store lighting events. NIPSCO also provides program training to store staff at participating retailers.

In 2022, NIPSCO offered program discounts on reflector and specialty light-emitting diodes (LEDs) and LED fixtures across a wide range of applications, package sizes, and wattages. Participating retailers varied and included big-box stores, do-it-yourself stores, club stores, and discount stores.

TRC implemented the program in 2022 and was responsible for maintaining manufacturer and retailer relationships, providing point-of-purchase materials and in-store training, conducting in-store promotional events, and overseeing data tracking, reporting, and invoicing processes.

### CHANGES FROM 2021 DESIGN

There were no major changes to the Residential Lighting program design or delivery in 2022. However, the program implementation team had been ramping down promotions of general service lamps (GSLs) in preparation for future program designs, where GSLs will no longer be offered through the upstream program, and this was completed in 2021. There were no GSLs discounted through the program in 2022.

## PROGRAM PERFORMANCE

Throughout 2022, the Residential Lighting program discounted 299,607 light bulbs and fixtures, reporting *ex ante* program energy savings and peak demand reduction of 8,705 MWh and 1,200 kW, respectively. Table 38 summarizes savings for the full year of program performance, including program savings goals. In terms of *ex post* gross savings, the program achieved 98% of the electric energy savings goal and 110% of the peak demand reduction goal.

TABLE 38. 2022 RESIDENTIAL LIGHTING PROGRAM SAVING SUMMARY

| METRIC | GROSS SAVINGS GOAL | *EX ANTE* | AUDITED | VERIFIED | *EX POST* GROSS | *EX POST* NET | GROSS GOAL ACHIEVEMENT |
|---|---|---|---|---|---|---|---|
| Electric Energy Savings (kWh/yr.) | 12,000,000.00 | 8,704,677.23 | 8,704,677.23 | 8,063,140.76 | 11,810,939.31 | 4,323,112.30 | 98% |
| Peak Demand Reduction (kW) | 1,459.374 | 1,199.826 | 1,199.826 | 1,108.062 | 1,607.623 | 588.431 | 110% |
| Natural Gas Energy Savings (therms/yr.) | N/A | N/A | N/A | N/A | N/A | N/A | N/A |

Table 39 outlines the *ex post* gross and net-to-gross (NTG) adjustment factors for 2022. The evaluation team calculated NTG in 2021 via secondary benchmarking research and is using 2021 values for the 2022 evaluation. The methodology used to develop net-to-gross (NTG) factors in 2021 is described briefly in the *Ex Post* Net Savings section of this chapter.

TABLE 39. 2022 RESIDENTIAL LIGHTING PROGRAM ADJUSTMENT FACTORS

| METRIC | REALIZATION RATE (%)[a] | FREERIDERSHIP | SPILLOVER | NTG (%)[b] |
|---|---|---|---|---|
| Electric Energy Savings (kWh/yr.) | 136% | 63% | 0% | 37% |
| Peak Demand Reduction (kW) | 134% | 63% | 0% | 37% |
| Natural Gas Energy Savings (therms/yr.) | N/A | N/A | N/A | N/A |

[a] Realization rate is defined as *ex post* gross savings divided by *ex ante* savings.
[b] NTG is defined as *ex post* net savings divided by *ex post* gross savings.

Table 40 lists the Residential Lighting program budget and expenditures. In 2022, the program spent 56% of its electric budget.

TABLE 40. 2022 RESIDENTIAL LIGHTING PROGRAM EXPENDITURES

| FUEL | PROGRAM BUDGET | PROGRAM EXPENDITURES | BUDGET SPENT (%) |
|---|---|---|---|
| Electric | $3,001,319.47 | $1,678,471.36 | 56% |
| Natural Gas | N/A | N/A | N/A |

# EVALUATION METHODOLOGY

To inform the 2022 Residential Lighting evaluation, the evaluation team completed the following research activities:

- **Program staff interviews and discussions**, to understand program design and delivery.
- **Documentation and materials review,** to provide context on program implementation.
- **Tracking data analysis,** to audit and verify the accuracy of program participation data.
- **Engineering analysis**, to review available documentation and develop *ex post* gross savings values.

For all measure types, the evaluation team compared its engineering calculations to NIPSCO's *ex ante* savings, basing its savings methodologies and inputs for each measure on several sources: standard engineering practices, the 2015 Indiana TRM (v2.2) and NIPSCO's program tracking database.[6] While the IL TRM v10.0 was used to evaluate most measures within the 2022 programs, the IN TRM (v2.2) was used for the Residential Lighting evaluation. The IL TRM and IN TRM algorithms are identical, except for a leakage consideration in Illinois. Leakage is not appropriate for Indiana, given the prolific and contiguous utility programs, and inputs specific to Indiana's climate/geography (coincidence factor, hours of use, and HVAC interactive effects) are best sourced from the IN TRM.

[6] Cadmus. *Indiana Technical Reference Manual Version 2.2*. July 28, 2015.

# IMPACT EVALUATION

This section details each step of the impact evaluation and its associated electric energy savings and peak demand reduction. The evaluation team conducted research activities to answer the following key research questions for the program:

- What are the program's gross energy and demand savings by lamp type?
- What are the program's net savings estimates?
- What assumptions were used to develop savings estimates? Are there any updates that should be made?
- What are future considerations for the program?

## AUDITED AND VERIFIED SAVINGS

To audit energy savings and demand reduction, the evaluation team reviewed the program tracking database and checked savings estimates and calculations against the Indiana Technical Reference Manual (TRM, v2.2) to confirm accurate application of the assumptions. Following the review, the evaluation team recalculated program energy savings and demand reduction to account for errors, omissions, and inconsistencies identified in the program tracking data.

To confirm consistency in the tracking data, the evaluation team audited bulb quantities by comparing bulb descriptions, numbers of packs, and numbers of units provided in the tracking database. The evaluation team also validated bulb quantities through an analysis of rebate and buy-down dollar amounts, and found that the data were accurate, complete, and comprehensive and did not require any modifications. The evaluation team thoroughly investigated energy savings and demand reduction assumptions. Throughout this investigation, the evaluation team did not identify any significant tracking errors that required adjustments to *ex ante* claimed savings.

The current *ex ante* value assumes an in-service rate (ISR) of 100%, per the Indiana TRM (v2.2). The evaluation team estimated ISRs using first-year ISRs from the 2015 Opinion Dynamics Market Effects Study, the most current research available from Indiana.[7,8] No carryover savings were calculated for this program year. This is because of the upcoming 2023 EISA backstop enforcement, which will effectively shift lighting baselines for many measures to an LED baseline, limiting the savings that can be claimed from future installations. Table 41 lists the ISRs for all program-installed measures.

TABLE 41. 2022 RESIDENTIAL LIGHTING PROGRAM IN-SERVICE RATES RATIOS BY MEASURE

| MEASURE | ISR |
|---|---|
| LED Fixture | 100% |
| LED Reflector | 86% |
| LED Specialty | 86% |

[7] Opinion Dynamics. 2015. *2014 Market Effects Study*. https://www.nrel.gov/docs/fy17osti/68562.pdf

[8] The evaluation team applied first-year ISRs, derived from the 2015 Opinion Dynamics study—the most current research available from Indiana (86%). More recent studies in Maryland (86%, 2016) and New Hampshire (87%, 2016) have similar first-year LED ISRs. ISRs for LEDs typically range between 74% (Wyoming, 2016) and 97% (New Hampshire, 2016).

Table 42 summarizes the tracking data quantity, audited quantity, applied ISRs and resulting verified quantity per measure. To calculate the verified measure quantity, the evaluation team multiplied the audited measure quantity by the ISR.

TABLE 42. 2022 RESIDENTIAL LIGHTING PROGRAM AUDITED AND VERIFIED QUANTITIES

| MEASURE | UNIT OF MEASURE | AUDITED QUANTITY | ISR | VERIFIED QUANTITY |
|---|---|---|---|---|
| LED Fixture | Fixture | 88,524 | 100% | 88,524 |
| LED Reflector | Lamp | 107,112 | 86% | 92,116 |
| LED Specialty | Lamp | 103,971 | 86% | 89,415 |
| Totals | | 299,607 | 90% | 270,055 |

## *EX POST* GROSS SAVINGS

### METHODOLOGY

The evaluation team determined the program's *ex post* gross energy savings and demand reduction through an engineering analysis. Like the *ex ante* calculations, algorithms included hours of use (HOU), interactive effects, coincident factor (CF) for demand reduction from the Indiana TRM (v2.2), and the recommended baseline watts approach prescribed in the most recent version of the UMP Residential Lighting Evaluation Protocol. The evaluation team used a range of data sources to ensure it used the most recent and accurate savings assumptions. 0 contains the detailed equations the evaluation team used to calculate 2022 energy savings and demand reduction for the program and provides a summary table of savings assumptions, their sources, and how they compare to the *ex ante* assumptions.

### 2022 *EX POST* GROSS SAVINGS

Table 43 shows the *ex ante* deemed savings and *ex post* gross per-measure savings for 2022 Residential Lighting program measures. The overall realization rate for the program is 136% for energy savings and 134% for demand reduction (Table 46 and Table 47). The variance in realization rates is largely a product of methodological differences between the evaluation team's calculation of *ex post* savings and the calculation of *ex ante* savings.

*Ex ante* calculations use the post-2020 EISA requirements to establish baseline wattage; however, the 2020 backstop portion of EISA has not yet been implemented and halogen lamps continue to be available in the market.[9] The evaluation team therefore used the UMP-recommended ENERGY STAR lumens binning approach, with halogen lamps serving as the baseline comparison lamps, to determine baseline wattages for each program lamp, consistent with previous evaluation years. This difference in calculation resulted in substantially higher *ex post* per-unit savings for specialty and reflector lamps, while *ex ante* and *ex post* savings aligned closely for LED fixtures.[10] The evaluation team recognizes that market conditions affect savings and accounts for those market conditions through the NTG portion of the evaluation (as discussed later).

[9] The backstop was not enforced by the Trump administration U.S. Department of Energy, and new rules were not yet in force in PY 2022 under the Biden administration. These new rules will be in force starting in 2023.

[10] For lamps with lumen output that exceeds those found in standard residential lighting and that are outside the bins presented in 0, the evaluation team passed through claimed savings for those lamps with stated baselines. Very few of these lamps are present in program data.

TABLE 43. 2022 RESIDENTIAL LIGHTING PROGRAM

*EX ANTE* AND *EX POST* GROSS PER-MEASURE SAVINGS VALUES

| MEASURE | UNIT OF MEASURE | *EX ANTE* DEEMED SAVINGS | | | *EX POST* GROSS PER-MEASURE SAVINGS | | |
|---|---|---|---|---|---|---|---|
| | | kWh | kW | therms | kWh | kW | therms |
| LED Fixture | Fixture | 46.57 | 0.006 | N/A | 46.51 | 0.006 | N/A |
| LED Reflector | Lamp | 28.25 | 0.004 | N/A | 44.62 | 0.006 | N/A |
| LED Specialty | Lamp | 14.97 | 0.002 | N/A | 28.03 | 0.004 | N/A |

Table 44 highlights notable differences between *ex ante* and *ex post* gross estimates.

TABLE 44. 2022 RESIDENTIAL LIGHTING PROGRAM

NOTABLE DIFFERENCES BETWEEN *EX ANTE* AND *EX POST* GROSS ESTIMATES

| MEASURE | *EX ANTE* SOURCES AND ASSUMPTIONS | *EX POST* GROSS SOURCES AND ASSUMPTIONS | PRIMARY REASONS FOR DIFFERENCES |
|---|---|---|---|
| All Bulb Types | Post-2020 EISA baseline wattage | UMP lumen equivalence approach to determine baseline wattage and calculate delta watts | The 2020 backstop portion of EISA has not yet been implemented and halogen lamps continue to be available in the market |

## WASTE HEAT FACTOR - THERM PENALTIES

In program years prior to 2020, the evaluation team did not calculate waste heat factor therm penalties for the Residential Lighting program, as this program is electric-only. In discussions with NIPSCO, starting with the 2020 evaluation year, the evaluation team began addressing waste heat factor therm penalties by calculating and applying them within the electric program cost-effectiveness analysis. The team will not include therm penalties in EM&V reported program savings or performance and will apply this approach consistently to all NIPSCO programs where therm penalties are generated due to LED lighting measures. The evaluation team believes this approach is appropriate, as it accounts for the penalty on the electric side, where it is generated, and will allow our team to show gas program and measure performance more clearly, where applicable. Table 45 shows the therm penalty calculated for the Residential Lighting program.

TABLE 45. 2022 RESIDENTIAL LIGHTING PROGRAM WASTE HEAT FACTOR THERM PENALTY

| MEASURE | EVALUATED *EX POST* SAVINGS (THERMS) |
|---|---|
| LED Fixture | (84,120.71) |
| LED Reflector | (97,636.31) |
| LED Specialty | (59,541.74) |
| **Total** | **(241,298.76)** |

It should be noted that electric waste heat factors, including cooling credits and electric heating penalties, are currently reported within the kilowatt-hour and kilowatt savings for the overall program, as described in 0. This is consistent with evaluation approaches in previous years.

## REALIZATION RATES

The next two tables (Table 46 and Table 47) show the program's *ex ante* reported savings, audited gross electric savings, verified savings, and *ex post* gross savings.

TABLE 46. 2022 RESIDENTIAL LIGHTING PROGRAM *EX ANTE* AND *EX POST* GROSS ELECTRIC ENERGY SAVINGS

| MEASURE | *EX ANTE* [a] ELECTRIC ENERGY SAVINGS (kWh/yr.) | AUDITED GROSS ELECTRIC ENERGY SAVINGS (kWh/yr.) | VERIFIED GROSS ELECTRIC ENERGY SAVINGS (kWh/yr.) | *EX POST* GROSS ELECTRIC ENERGY SAVINGS (kWh/yr.) |
|---|---|---|---|---|
| LED Fixture | 4,122,273.85 | 4,122,273.85 | 4,122,273.85 | 4,117,487.25 |
| LED Reflector | 3,025,767.16 | 3,025,767.16 | 2,602,159.76 | 4,779,040.46 |
| LED Specialty | 1,556,636.22 | 1,556,636.22 | 1,338,707.15 | 2,914,411.60 |
| Total Savings | 8,704,677.23 | 8,704,677.23 | 8,063,140.76 | 11,810,939.31 |
| Total Program Realization Rate | | | | 136% |

Note: Totals may not sum properly due to rounding.

[a] Values presented at a measure-level represent audited values since the scorecard provides only savings totals.

TABLE 47. 2022 RESIDENTIAL LIGHTING PROGRAM *EX ANTE* AND *EX POST* GROSS PEAK DEMAND REDUCTION

| MEASURE | *EX ANTE* [a] PEAK DEMAND REDUCTION (kW/yr.) | AUDITED GROSS PEAK DEMAND REDUCTION (kW/yr.) | VERIFIED GROSS PEAK DEMAND REDUCTION (kW/yr.) | *EX POST* GROSS PEAK DEMAND REDUCTION (kW/yr.) |
|---|---|---|---|---|
| LED Fixture | 544.370 | 544.370 | 544.370 | 560.425 |
| LED Reflector | 437.493 | 437.493 | 376.244 | 650.507 |
| LED Specialty | 217.963 | 217.963 | 187.448 | 396.690 |
| Total Savings | 1,199.826 | 1,199.826 | 1,108.062 | 1,607.623 |
| Total Program Realization Rate | | | | 134% |

Note: Totals may not sum properly due to rounding.

[a] Values presented at a measure-level represent audited values, since the scorecard provides only savings totals.

## *EX POST* NET SAVINGS

The 2022 evaluation used NTG adjustment factors the evaluation team calculated in 2021. In 2021, the evaluation team reviewed publicly available evaluation results to identify the NTG values used by utilities across the United States (including three Indiana utilities: AES Indiana, NIPSCO, and CenterPoint). The team collected the most recent data available to capture current market conditions most accurately for LEDs, using evaluation results that were applied to residential upstream lighting between 2019 and 2021. Ultimately, seven utilities were benchmarked to calculate NTG averages for each LED lamp type.

The NTG estimates reflect broad market acceptance of LEDs among all bulb styles and expectations that halogens will likely be phased out of the market in 2023, due to the implementation of revised EISA regulations currently in progress.

Table 48 lists the resulting net electric savings, demand reduction, and natural gas savings.

TABLE 48. 2022 RESIDENTIAL LIGHTING PROGRAM *EX POST* NET SAVINGS

| MEASURE | *EX POST* GROSS SAVINGS/REDUCTION | | | NTG | *EX POST* NET SAVINGS/REDUCTION | | |
|---|---|---|---|---|---|---|---|
| | kWh | kW | therms | | kWh | kW | therms |
| LED Fixture | 4,117,487.25 | 560.425 | N/A | 39% | 1,595,526.31 | 217.165 | N/A |
| LED Reflector | 4,779,040.46 | 650.507 | N/A | 31% | 1,500,618.70 | 204.259 | N/A |
| LED Specialty | 2,914,411.60 | 396.690 | N/A | 42% | 1,226,967.29 | 167.007 | N/A |
| Total Savings | 11,810,939.31 | 1,607.623 | N/A | 37% | 4,323,112.30 | 588.431 | N/A |

# CONCLUSIONS AND RECOMMENDATIONS

**CONCLUSION 1: THE ELIMINATION OF STANDARD LEDS FROM THE 2022 OFFERING REDUCED OVERALL PROGRAM SAVINGS. THE EXPANDED DEFINITION OF GENERAL SERVICE LAMPS IN THE BACKSTOP LEGISLATION WILL SIGNIFICANTLY REDUCE RESIDENTIAL LIGHTING SAVINGS GOING FORWARD.**

On April 26, 2022, the U.S. Department of Energy (DOE) issued an enforcement notice that imposes the lighting backstop, a date by which certain general service lamps (GSLs) will no longer be legally manufactured or imported into the United States. This backstop expands to all screw-based lighting, including specialty and reflector lamps currently offered through Indiana utility programs.[11] This backstop will functionally eliminate screw-in incandescent and halogen lamps from the market by mid-year 2023, raising the efficiency baseline for available lighting in the market.

Recommendations:

- For the 2023 program year, continue to follow *ex post* baseline calculations implemented in 2022 for LEDs incentivized from January 2023 through the end of June 2023, in anticipation of full enforcement of retail sales rules beginning in July 2023. Discontinue buy downs of all EISA-impacted lamp types beginning in July 2023.

[11] U.S. Department of Energy. April 26, 2022. *Enforcement Policy Statement—General Service Lamps*: https://www.energy.gov/sites/default/files/2022-04/GSL_EnforcementPolicy_4_25_22.pdf

# 5. HOME ENERGY ASSESSMENT (HEA) PROGRAM

## PROGRAM DESIGN AND DELIVERY

Through the Home Energy Assessment (HEA) program in 2022, NIPSCO provided Comprehensive Home Assessments (CHA) with direct installations of energy efficiency measures. The HEA program targets single-family homeowners or renters (with landlord approval) and is designed to help participants improve the efficiency and comfort of their homes, as well as deliver an immediate reduction in electricity and/or natural gas consumption and promote additional efficiency work through other NIPSCO programs.

TRC administers the HEA Program on behalf of NIPSCO. This includes program design and management, processing incentive payments, quality assurance and quality control (QA/QC), technical training, and providing subcontractor support to facilitate the quality installation of energy-efficient measures. In addition to the energy-efficient measures installed during the initial site visit, the CHA illustrates to the homeowner the value of selecting recommended follow-on work, such as additional measures designed to achieve deeper energy savings that may be eligible for a rebate. TRC also offers virtual home energy assessments (VHEAs) to eligible NIPSCO residential customers. Virtual home energy assessments will be performed by TRC, while the in-home assessments will be done by a subcontractor. Though the virtual option was offered by NIPSCO in 2022, there was no customer demand for this pathway.

During 2022, TRC recruited participants through a variety of marketing efforts, including bill inserts, direct mail, word-of-mouth, advertising through local newspapers, newsletters, and web ads. The program was also promoted through community outreach, and content for the NIPSCO website and social media sites. The subcontractor marketed HEA by leaving door hangtags for residents of no-show appointments and at adjacent homes and by placing a yard sign in the front yard of participating homes while the assessment was performed.

Interested customers could enroll in the HEA program by calling the NIPSCO Residential Energy Efficiency program hotline or by signing up through the website. Subcontractors were also encouraged to discuss the program and schedule assessments for customers while performing other work for them.

## IN-PERSON ASSESSMENTS

During an in-person assessment, an energy advisor analyzes the efficiency of the heating and cooling systems and insulation levels in the home and installs energy-saving lighting, water conservation, and other energy-saving measures. The assessment concludes with the energy advisor providing a report of findings and energy-saving recommendations. Depending on the conditions, account type (i.e., combo, gas only, or electric only), and current equipment in the home, the energy advisor installs any or all the following measures during the assessment:

- ENERGY STAR certified light bulbs (9W A-Line, 5W Candelabra, 6W Globe, 15W PAR 38) – up to 22 units
- Bathroom faucet aerator (1.0 gpm) – up to 2 units
- Kitchen aerator (1.5 gpm) – up to 1 unit
- Low-flow showerhead (1.5 gpm) – up to 2 units
- Shower Start (valve only) – up to 2 units
- Low-flow showerhead/shower Start combo – up to 2 units
- Pipe wrap – up to 10 feet
- Water heater wrap (electric only) – up to 1 unit
- Duct sealing –$150

Qualifying program participants can also receive a rebate of up to $700 on attic insulation. If the customer is eligible for the follow-on attic insulation rebate, the subcontractor's technician will fill out key information on the HEA Insulation Rebate Application for the customer, such as the total square footage of the attic and pre-existing R-value of the attic insulation and advise the customer on how to obtain and submit for the insulation rebate prior to leaving the home. The customer may choose to use any licensed insulation contractor to perform the additional work.

### CHANGES FROM 2021 DESIGN

In 2021, NIPSCO offered virtual assessments through the HEA program. While the option remained for customers in 2022, no customers opted for the virtual assessments. Otherwise, there were no major program design changes in 2022.

## PROGRAM PERFORMANCE

In 2022, the HEA Program exceeded its goals for electric energy savings, peak demand reduction, and natural gas energy savings.

Table 49 summarizes savings for the full year of program performance, including program savings goals.

TABLE 49. 2022 HEA PROGRAM SAVING SUMMARY

| METRIC | GROSS SAVINGS GOAL | *EX ANTE* | AUDITED | VERIFIED | *EX POST* GROSS | *EX POST* NET | GROSS GOAL ACHIEVEMENT |
|---|---|---|---|---|---|---|---|
| Electric Energy Savings (kWh/yr.) | 612,071.84 | 730,910.13 | 730,910.13 | 721,802.78 | 751,047.34 | 534,180.89 | 123% |
| Peak Demand Reduction (kW) | 196.376 | 463.241 | 463.241 | 461.559 | 470.310 | 386.990 | 239% |
| Natural Gas Energy Savings (therms/yr.) | 57,979.94 | 164,402.15 | 164,402.15 | 162,247.50 | 201,908.24 | 173,456.95 | 348% |

As documented in Table 49, *ex ante* savings align with audited savings, indicating no discrepancies in the tracking data. Verified savings were lower than claimed values due to in-service rates (ISR) for select measures. The engineering analysis completed for the *ex post* gross analysis increased the savings values across the board. Finally, the net-to-gross (NTG) analysis reduced *ex post* net results due to the calculated NTG values.

Table 50 outlines the *ex post* gross and NTG adjustment factors.

TABLE 50. 2022 HEA ADJUSTMENT FACTORS

| METRIC | REALIZATION RATE (%)[a] | FREERIDERSHIP | SPILLOVER | NTG (%)[b] |
|---|---|---|---|---|
| Electric Energy Savings (kWh/yr.) | 103% | 29% | 0% | 71% |
| Peak Demand Reduction (kW) | 102% | 18% | 0% | 82% |
| Natural Gas Energy Savings (therms/yr.) | 123% | 14% | 0% | 86% |

[a] Realization Rate is defined as *ex post* Gross savings divided by *ex ante* savings.

[b] NTG is defined as *ex post* net savings divided by *ex post* gross savings.

Program spending exceeded planned program budgets for 2022. Table 51 lists the 2022 program budget and expenditures by fuel type.

TABLE 51. 2022 HEA PROGRAM EXPENDITURES

| FUEL | PROGRAM BUDGET | PROGRAM EXPENDITURES | BUDGET SPENT (%) |
|---|---|---|---|
| Electric | $449,990.10 | $574,187.88 | 128% |
| Natural Gas | $152,417.07 | $392,583.19 | 258% |

# EVALUATION METHODOLOGY

To inform the 2022 NIPSCO impact and process evaluation, the evaluation team completed the following research activities:

- **Program staff interviews and discussions,** to understand the program process, delivery, and design.
- **Documentation and materials review,** to provide context on program implementation.
- **Tracking data analysis**, to audit and verify the accuracy of program participation data.
- **Engineering analysis**, to review program savings assumptions and algorithms for reasonableness and accuracy.
- **Telephone and web survey of HEA participants**, to understand source of awareness, reasons for participation, experience with IQW, satisfaction with the program, program impacts on customers, and to inform the NTG analysis.
- **Auditor interviews**, to understand their perspectives on customer experiences and barriers to participation.
- **Census data mapping**, to identify geographic areas for targeting outreach.

# IMPACT EVALUATION

The evaluation team completed the impact evaluation to answer the following research questions:

- What assumptions were used to develop savings estimates? Are there any updates that should be made?
- What are *ex post* program savings? Do these suggest any needed updates to program design, delivery, or savings assumptions?
- How effective was the program in influencing participant decision making? What are the program's freeridership estimates (net savings)?

For all measure types, the evaluation team compared its engineering calculations to NIPSCO's *ex ante* savings, basing its savings methodologies and inputs for each measure on several sources: standard engineering practices, the 2015 Indiana TRM (v2.2), the Illinois TRM (v10.0) and NIPSCO's program tracking database.[12] It should be noted that prior to this evaluation year, the evaluation team used the Indiana TRM as our primary source and supplemented with other sources as needed. The Indiana TRM is out-of-date, and currently in the process of being updated to align more closely with the Illinois TRM. After discussions with NIPSCO, the evaluation team felt it would be best practice to use the Illinois TRM as our primary source while the Indiana TRM is in the process of being updated, as the Illinois TRM is updated annually and should align closely with the new version of the Indiana TRM.

## AUDITED AND VERIFIED SAVINGS

To develop an audited measure quantity and savings, the evaluation team first analyzed the program tracking data for duplicates or other data quality issues and found none. The evaluation team also ensured documented deemed savings were applied correctly and looked for any discrepancies between the program tracking data and the program scorecard and found no issues.

To calculate the verified measure quantity for direct install measures, the evaluation team multiplied the audited measure quantity by the in-service rate. The evaluation team established ISRs for HEA measures using the 2022 HEA survey for all direct install measures, except attic insulation which was sourced from the 2022 IQW survey (the HEA survey did not have respondents who received the attic insulation measure, so data from the IQW survey was used instead). Table 52 lists the ISRs for all program-installed measures.

TABLE 52. 2022 HEA PROGRAM IN-SERVICE RATES RATIOS BY MEASURE

| MEASURE | ISR | SOURCE |
|---|---|---|
| Assessment Recommendations | 95% | 2022 HEA Survey |
| Attic Insulation | 100% | 2022 IQW Survey |
| Bathroom Aerators | 92% | 2022 HEA Survey |
| Duct Sealing Package | 100% | 2022 HEA Survey |
| Kitchen Aerators | 93% | 2022 HEA Survey |
| LEDs | 99% | 2022 HEA Survey |
| Pipe Wrap | 95% | 2022 HEA Survey |
| Low-Flow Showerheads/Shower Start | 86% | 2022 HEA Survey |

The ISRs fell below 100% because respondents reported removing items after the program installed them. The ISR for assessment recommendations is based on the number of survey respondents who indicated they received an assessment report.

Table 53 summarizes the tracking data quantity, audited quantity, applied installation rates, and resulting verified quantity per measure. To calculate the verified measure quantity, the evaluation team multiplied the audited measure quantity by the installation rate.

[12] Cadmus. *Indiana Technical Reference Manual Version 2.2*. July 28, 2015.

TABLE 53. 2022 HEA PROGRAM AUDITED & VERIFIED QUANTITIES

| MEASURE | UNIT OF MEASURE | AUDITED QUANTITY | ISR | VERIFIED QUANTITY |
|---|---|---|---|---|
| Assessment Recommendations - Electric and Gas Savings | Home | 1,144 | 95% | 1,091 |
| Assessment Recommendations - Electric Only | Home | 41 | 95% | 39 |
| Assessment Recommendations - Gas Only | Home | 394 | 95% | 376 |
| Attic Insulation (Uninsulated Hatch) - Electric Cooling and Gas Heating Savings | Per ksf | 16 | 100% | 16 |
| Attic Insulation (Uninsulated Hatch) - Gas Heating Only Savings (Gas Only Customer) | Per ksf | 2 | 100% | 2 |
| Bathroom Aerator 1.0 gpm - Electric | Aerator | 21 | 92% | 19 |
| Bathroom Aerator 1.0 gpm - Gas | Aerator | 475 | 92% | 438 |
| Duct Sealing Package - Electric Cooling and Gas Heating Savings | Home | 1,024 | 100% | 1,024 |
| Duct Sealing Package - Electric Cooling and Heating Savings | Home | 9 | 100% | 9 |
| Duct Sealing Package - Electric Cooling Only Savings | Home | 34 | 100% | 34 |
| Duct Sealing Package - Electric Heating Only Savings | Home | 1 | 100% | 1 |
| Duct Sealing Package - Gas Heating Only Savings | Home | 406 | 100% | 406 |
| Kitchen Aerator 1.5 gpm - Electric | Aerator | 13 | 93% | 12 |
| Kitchen Aerator 1.5 gpm - Gas | Aerator | 262 | 93% | 243 |
| A-Line LEDs - Electric and Gas Savings | Lamp | 8,613 | 99% | 8,520 |
| A-Line LEDs - Electric Only Savings | Lamp | 372 | 99% | 368 |
| Candelabra LEDs - Electric and Gas Savings | Lamp | 3,155 | 99% | 3,121 |
| Candelabra LEDs - Electric Only Savings | Lamp | 83 | 99% | 82 |
| Globe LEDs - Electric and Gas Savings | Lamp | 2,068 | 99% | 2,046 |
| Globe LEDs - Electric Only Savings | Lamp | 91 | 99% | 90 |
| PAR38 LEDs - Electric and Gas Savings | Lamp | 1,238 | 99% | 1,225 |
| PAR38 LEDs - Electric Only Savings | Lamp | 28 | 99% | 28 |
| Pipe Wrap - Electric (per foot) | Per foot | 425 | 95% | 403 |
| Pipe Wrap - Gas (per foot) | Per foot | 9,474 | 95% | 8,984 |
| Low-flow Showerhead 1.5 gpm - Electric | Showerhead | 18 | 86% | 16 |
| Low-flow Showerhead 1.5 gpm - Gas | Showerhead | 257 | 86% | 222 |
| Low-flow Showerhead with Shower Start - Electric | Showerhead with Shower Start | 10 | 86% | 9 |
| Low-flow Showerhead with Shower Start - Gas | Showerhead with Shower Start | 328 | 86% | 283 |
| Shower Start Only - Electric | Shower Start | 2 | 86% | 2 |
| Shower Start Only - Gas | Shower Start | 41 | 86% | 35 |
| | | 30,045 | | 29,142 |

## *EX POST* GROSS SAVINGS

The evaluation team reviewed the program's *ex ante* assumptions, sources, and algorithms for reasonableness and updates. Below are detailed *ex post* gross analysis results.

### ENGINEERING REVIEWS

The evaluation team primarily referred to the Indiana TRM (v2.2) and the Illinois TRM (v10) for variable assumptions to calculate *ex post* gross electric energy savings, demand reduction, and natural gas savings. Where appropriate, the evaluation team referenced the Illinois TRM for PY 2022 analysis, as it is updated annually. The IN TRM (v2.2) was referenced for geographic or weather-specific inputs. The evaluation team revised assumptions for savings estimates applicable to the NIPSCO service territory, as needed. *Appendix 3* contains more details on the specific algorithms, variable assumptions, and references for all program measure *ex post* gross calculations.

At the program level, realization rates were relatively close to 100% across fuels, although they varied at the measure level. Through the engineering review, the evaluation team identified notable differences between *ex ante* and *ex post* for faucet aerator, showerhead, shower start, and pipe wrap measures. These differences were primarily driven by the following overarching factors:

- For faucet aerator and showerhead/shower start measures, the evaluation team updated inputs from the IL TRM (v10.0), which adjusted the realization rates downwards. The most impactful changes were the updates to the baseline and low-flow GPM values.

- Pipe wrap *ex ante* savings used input values from the Indiana TRM (v2.2), whereas *ex post* calculations used values from the IL TRM (v10). The largest changes came from differing pre- and post-installation insulation values, which resulted in higher realization rates.

Minor differences between *ex ante* and *ex post* gross savings were uncovered for most measures. These differences were driven by the following factors:

- The evaluation team calculated *ex post* gross savings using updated sources, including data from the 2022 survey, as well as the Illinois TRM (v10). The planning and reporting assumptions NIPSCO used to calculate *ex ante* savings referenced the Indiana TRM (v2.2) and the 2019 Evaluation, Measurement, and Verification (EM&V) results, and sometimes included an average of the savings values provided in each source.

- The evaluation team used the installation zip code to match each customer to the closest city from the Indiana TRM (v2.2)—for example, South Bend and Fort Wayne—to more precisely account for variations in climate for measures including LED bulbs, faucet aerators, low-flow showerheads, duct sealing, and attic insulation.

### *EX POST* GROSS SAVINGS

Table 54 shows the *ex ante* deemed savings and *ex post* gross per-measure savings for 2022 HEA program measures.

TABLE 54. 2022 HEA PROGRAM *EX ANTE* & *EX POST* GROSS PER-MEASURE SAVINGS VALUES

| MEASURE | UNIT OF MEASURE | *EX ANTE* DEEMED PER-MEASURE SAVINGS | | | *EX POST* GROSS PER-MEASURE SAVINGS | | |
|---|---|---|---|---|---|---|---|
| | | KWH | KW | THERMS | KWH | KW | THERMS |
| Assessment Recommendations - Electric and Gas Savings | Home | 21.60 | 0.012 | 2.74 | 21.60 | 0.012 | 2.74 |
| Assessment Recommendations - Electric Only | Home | 21.60 | 0.012 | 0.00 | 21.60 | 0.012 | 0.00 |
| Assessment Recommendations - Gas Only | Home | 0.00 | 0.000 | 2.74 | 0.00 | 0.000 | 3.16 |
| Attic Insulation (Uninsulated Hatch) - Electric Cooling and Gas Heating Savings | Per ksf | 236.00 | 0.116 | 207.00 | 236.05 | 0.102 | 206.75 |
| Attic Insulation (Uninsulated Hatch) - Gas Heating Only Savings (Gas Only Customer) | Per ksf | 0.00 | 0.000 | 217.00 | 0.00 | 0.000 | 212.38 |
| Bathroom Aerator 1.0 gpm - Electric | Aerator | 31.64 | 0.003 | 0.00 | 20.64 | 0.002 | 0.00 |
| Bathroom Aerator 1.0 gpm - Gas | Aerator | 0.00 | 0.000 | 1.38 | 0.00 | 0.000 | 0.89 |
| Duct Sealing Package - Electric Cooling and Gas Heating Savings | Home | 118.97 | 0.354 | 93.96 | 121.31 | 0.354 | 94.14 |
| Duct Sealing Package - Electric Cooling and Heating Savings | Home | 1,189.56 | 0.354 | 0.00 | 1,248.13 | 0.354 | 0.00 |
| Duct Sealing Package - Electric Cooling Only Savings | Home | 49.02 | 0.112 | 0.00 | 119.37 | 0.354 | 0.00 |
| Duct Sealing Package - Electric Heating Only Savings | Home | 1,245.82 | 0.000 | 0.00 | 1,142.62 | 0.000 | 0.00 |
| Duct Sealing Package - Gas Heating Only Savings | Home | 0.00 | 0.000 | 93.63 | 0.00 | 0.000 | 94.27 |
| Kitchen Aerator 1.5 gpm - Electric | Aerator | 183.13 | 0.008 | 0.00 | 200.70 | 0.006 | 0.00 |
| Kitchen Aerator 1.5 gpm - Gas | Aerator | 0.00 | 0.000 | 7.95 | 0.00 | 0.000 | 8.59 |
| A-Line LEDs - Electric and Gas Savings | Lamp | 28.49 | 0.004 | 0.00 | 28.51 | 0.004 | 0.00 |
| A-Line LEDs - Electric Only Savings | Lamp | 28.49 | 0.004 | 0.00 | 28.45 | 0.004 | 0.00 |
| Candelabra LEDs - Electric and Gas Savings | Lamp | 29.33 | 0.004 | 0.00 | 29.77 | 0.004 | 0.00 |
| Candelabra LEDs - Electric Only Savings | Lamp | 29.33 | 0.004 | 0.00 | 29.70 | 0.004 | 0.00 |
| Globe LEDs - Electric and Gas Savings | Lamp | 28.49 | 0.004 | 0.00 | 28.51 | 0.004 | 0.00 |
| Globe LEDs - Electric Only Savings | Lamp | 28.49 | 0.004 | 0.00 | 28.44 | 0.004 | 0.00 |
| PAR38 LEDs - Electric and Gas Savings | Lamp | 103.24 | 0.014 | 0.00 | 88.08 | 0.012 | 0.00 |
| PAR38 LEDs - Electric Only Savings | Lamp | 103.24 | 0.014 | 0.00 | 88.08 | 0.012 | 0.00 |
| Pipe Wrap - Electric (per foot) | Per foot | 24.82 | 0.003 | 0.00 | 138.59 | 0.016 | 0.00 |
| Pipe Wrap - Gas (per foot) | Per foot | 0.00 | 0.000 | 1.11 | 0.00 | 0.000 | 5.94 |
| Low-flow Showerhead 1.5 gpm - Electric | Showerhead | 310.61 | 0.017 | 0.00 | 137.12 | 0.002 | 0.00 |
| Low-flow Showerhead 1.5 gpm - Gas | Showerhead | 0.00 | 0.000 | 13.51 | 0.00 | 0.000 | 5.90 |
| Low-flow Showerhead with Shower Start - Electric | Showerhead with Shower Start | 357.86 | 0.066 | 0.00 | 167.68 | 0.006 | 0.00 |
| Low-flow Showerhead with Shower Start - Gas | Showerhead with Shower Start | 0.00 | 0.000 | 15.57 | 0.00 | 0.000 | 7.20 |
| Shower Start Only - Electric | Shower Start | 82.84 | 0.007 | 0.00 | 46.83 | 0.007 | 0.00 |
| Shower Start Only - Gas | Shower Start | 0.00 | 0.000 | 3.60 | 0.00 | 0.000 | 2.01 |

Table *55* highlights notable differences between *ex ante* and *ex post* gross estimates.

TABLE 55. 2022 HEA NOTABLE DIFFERENCES BETWEEN *EX ANTE* & *EX POST* GROSS

| MEASURE | *EX ANTE* SOURCES AND ASSUMPTIONS | *EX POST* GROSS SOURCES AND ASSUMPTIONS | PRIMARY REASONS FOR DIFFERENCES |
|---|---|---|---|
| PAR38 LED | *Ex ante* savings are based on the Indiana TRM (v2.2). Baseline wattage Hours per TRM. WHF values assume weighted average from South Bend per TRM tables. | *Ex post* savings are based on the Indiana TRM (v2.2), the UMP, and information in program tracking data. Efficient wattage is based on the actual bulb wattage. Baseline wattage value per the EISA guidelines and WHFs averaged across customer location, per customer type. | Discrepancies in baseline wattage. |
| Faucet Aerator | *Ex ante* savings are based on the Indiana TRM (v2.2). | *Ex post* savings are based on the Indiana TRM (v2.2) and the Illinois TRM (v10). The IL TRM was used for values that don't change from state to state and the IN TRM was used for state specific values (incoming water temperature, people per household, coincidence factor, and hours). | Differing values between the IL and IN TRMs. |
| Low-Flow Showerhead | *Ex ante* savings are based on the Indiana TRM (v2.2). | *Ex post* savings are based on the Illinois TRM (v10) for all inputs besides shower events per day which is based on the 2022 NIPSCO survey and water temperature (IN TRM v2.2). | Gpm assumptions, shower events per day, recovery efficiency for gas water heaters, and showerheads per household. |
| Shower Start | *Ex ante* savings are based on the IL TRM (v10). | *Ex post* savings are based on the Illinois TRM (v10) for all inputs besides shower events per day which is based on the 2022 NIPSCO survey and water temperature (IN TRM v2.2). | Gpm assumptions, shower events per day, recovery efficiency for gas water heaters, and showerheads per household. |
| Pipe Wrap | Average of Indiana TRM (v2.2) and 2015 EM&V savings values for natural gas and electric water heaters. | Illinois TRM (v10) used for all inputs. | Bare pipe and insulation R-values. |

## WASTE HEAT FACTOR – THERM PENALTIES

Consistent with the 2020 and 2021 evaluation years, the evaluation team is not including therm penalties when calculating evaluated savings for the 2022 HEA program. However, cost-effectiveness results for both the gas and electric programs will include these penalties. The evaluation team believes this approach is appropriate, as it accounts for the penalty on the electric side (where it is generated) and allows the evaluation team to show gas program performance and measure performance more clearly.

These values are not included in the *ex post* analysis and the evaluation team is reporting these below, to be used in the cost-effectiveness analysis. *Ex ante* therm penalties from lighting totaled -10,700.16 (from the tracking data). In total, the therm penalty for cost-effectiveness analysis is -10,369.74 therms (Table 56).

TABLE 56. 2022 HEA PROGRAM WASTE HEAT FACTOR THERM PENALTY

| MEASURE | WASTE HEAT FACTOR THERM PENALTY |
|---|---|
| A-Line LEDs - Dual Fuel | (5,018.33) |
| Candelabra LEDs - Dual Fuel | (1,918.83) |
| Globe LEDs - Dual Fuel | (1,025.01) |
| PAR38 LEDs – Dual Fuel | (2,227.58) |

## REALIZATION RATES

The next three tables (Table *57* through Table *59*) show the program's *ex ante* reported savings, verified savings, and *ex post* gross savings.

TABLE 57. 2022 HEA PROGRAM *EX ANTE* & *EX POST* GROSS ELECTRIC ENERGY SAVINGS

| MEASURE | *EX ANTE*[a] ELECTRIC ENERGY SAVINGS (kWh/yr.) | AUDITED GROSS ELECTRIC ENERGY SAVINGS (kWh/yr.) | VERIFIED GROSS ELECTRIC ENERGY SAVINGS (kWh/yr.) | *EX POST* GROSS ELECTRIC ENERGY SAVINGS (kWh/yr.) |
|---|---|---|---|---|
| Assessment Recommendations - Electric and Gas Savings | 24,710.40 | 24,710.40 | 23,571.25 | 23,571.25 |
| Assessment Recommendations - Electric Only | 885.60 | 885.60 | 844.77 | 844.77 |
| Assessment Recommendations - Gas Only | 0.00 | 0.00 | 0.00 | 0.00 |
| Attic Insulation (Uninsulated Hatch) - Electric Cooling and Gas Heating Savings | 3,776.48 | 3,776.48 | 3,776.48 | 3,777.21 |
| Attic Insulation (Uninsulated Hatch) - Gas Heating Only Savings (Gas Only Customer) | 0.00 | 0.00 | 0.00 | 0.00 |
| Bathroom Aerator 1.0 gpm - Electric | 664.44 | 664.44 | 612.35 | 399.50 |
| Bathroom Aerator 1.0 gpm - Gas | 0.00 | 0.00 | 0.00 | 0.00 |
| Duct Sealing Package - Electric Cooling and Gas Heating Savings | 121,825.28 | 121,825.28 | 121,825.28 | 124,216.88 |
| Duct Sealing Package - Electric Cooling and Heating Savings | 10,706.04 | 10,706.04 | 10,706.04 | 11,233.19 |
| Duct Sealing Package - Electric Cooling Only Savings | 1,666.68 | 1,666.68 | 1,666.68 | 4,058.72 |
| Duct Sealing Package - Electric Heating Only Savings | 1,245.82 | 1,245.82 | 1,245.82 | 1,142.62 |
| Duct Sealing Package - Gas Heating Only Savings | 0.00 | 0.00 | 0.00 | 0.00 |
| Kitchen Aerator 1.5 gpm - Electric | 2,380.69 | 2,380.69 | 2,204.28 | 2,415.74 |
| Kitchen Aerator 1.5 gpm - Gas | 0.00 | 0.00 | 0.00 | 0.00 |
| A-Line LEDs - Electric and Gas Savings | 245,384.37 | 245,384.37 | 242,734.22 | 242,870.03 |
| A-Line LEDs - Electric Only Savings | 10,598.28 | 10,598.28 | 10,483.82 | 10,470.20 |
| Candelabra LEDs - Electric and Gas Savings | 92,536.15 | 92,536.15 | 91,536.76 | 92,923.94 |
| Candelabra LEDs - Electric Only Savings | 2,434.39 | 2,434.39 | 2,408.10 | 2,438.16 |
| Globe LEDs - Electric and Gas Savings | 58,917.32 | 58,917.32 | 58,281.01 | 58,315.80 |
| Globe LEDs - Electric Only Savings | 2,592.59 | 2,592.59 | 2,564.59 | 2,560.49 |
| PAR38 LEDs - Electric and Gas Savings | 127,811.12 | 127,811.12 | 126,430.76 | 107,859.75 |
| PAR38 LEDs - Electric Only Savings | 2,890.72 | 2,890.72 | 2,859.50 | 2,439.61 |
| Pipe Wrap - Electric (per foot) | 10,548.50 | 10,548.50 | 10,003.14 | 55,855.45 |

| MEASURE | *EX ANTE*[a] ELECTRIC ENERGY SAVINGS (kWh/yr.) | AUDITED GROSS ELECTRIC ENERGY SAVINGS (kWh/yr.) | VERIFIED GROSS ELECTRIC ENERGY SAVINGS (kWh/yr.) | *EX POST* GROSS ELECTRIC ENERGY SAVINGS (kWh/yr.) |
|---|---|---|---|---|
| Pipe Wrap - Gas (per foot) | 0.00 | 0.00 | 0.00 | 0.00 |
| Low-flow Showerhead 1.5 gpm - Electric | 5,590.98 | 5,590.98 | 4,819.98 | 2,127.75 |
| Low-flow Showerhead 1.5 gpm - Gas | 0.00 | 0.00 | 0.00 | 0.00 |
| Low-flow Showerhead with Shower Start - Electric | 3,578.60 | 3,578.60 | 3,085.11 | 1,445.54 |
| Low-flow Showerhead with Shower Start - Gas | 0.00 | 0.00 | 0.00 | 0.00 |
| Shower Start Only - Electric | 165.68 | 165.68 | 142.83 | 80.75 |
| Shower Start Only - Gas | 0.00 | 0.00 | 0.00 | 0.00 |
| Total Savings | 730,910.13 | 730,910.13 | 721,802.78 | 751,047.34 |
| Total Program Realization Rate | | | | 103% |

Note: Totals may not sum properly due to rounding.

## TABLE 58. 2022 HEA PROGRAM *EX ANTE* & *EX POST* GROSS PEAK DEMAND REDUCTION

| MEASURE | *EX ANTE* PEAK DEMAND REDUCTION (kW/yr.) | AUDITED GROSS PEAK DEMAND REDUCTION (kW/yr.) | VERIFIED GROSS PEAK DEMAND REDUCTION (kW/yr.) | *EX POST* GROSS PEAK DEMAND REDUCTION (kW/yr.) |
|---|---|---|---|---|
| Assessment Recommendations - Electric and Gas Savings | 13.728 | 13.728 | 13.095 | 13.095 |
| Assessment Recommendations - Electric Only | 0.492 | 0.492 | 0.469 | 0.469 |
| Assessment Recommendations - Gas Only | 0.000 | 0.000 | 0.000 | 0.000 |
| Attic Insulation (Uninsulated Hatch) - Electric Cooling and Gas Heating Savings | 1.857 | 1.857 | 1.857 | 1.634 |
| Attic Insulation (Uninsulated Hatch) - Gas Heating Only Savings (Gas Only Customer) | 0.000 | 0.000 | 0.000 | 0.000 |
| Bathroom Aerator 1.0 gpm - Electric | 0.063 | 0.063 | 0.058 | 0.030 |
| Bathroom Aerator 1.0 gpm - Gas | 0.000 | 0.000 | 0.000 | 0.000 |
| Duct Sealing Package - Electric Cooling and Gas Heating Savings | 362.496 | 362.496 | 362.496 | 362.526 |
| Duct Sealing Package - Electric Cooling and Heating Savings | 3.186 | 3.186 | 3.186 | 3.186 |
| Duct Sealing Package - Electric Cooling Only Savings | 3.808 | 3.808 | 3.808 | 12.037 |
| Duct Sealing Package - Electric Heating Only Savings | 0.000 | 0.000 | 0.000 | 0.000 |
| Duct Sealing Package - Gas Heating Only Savings | 0.000 | 0.000 | 0.000 | 0.000 |
| Kitchen Aerator 1.5 gpm - Electric | 0.104 | 0.104 | 0.096 | 0.071 |
| Kitchen Aerator 1.5 gpm - Gas | 0.000 | 0.000 | 0.000 | 0.000 |
| A-Line LEDs - Electric and Gas Savings | 34.452 | 34.452 | 34.080 | 33.077 |
| A-Line LEDs - Electric Only Savings | 1.488 | 1.488 | 1.472 | 1.429 |
| Candelabra LEDs - Electric and Gas Savings | 12.620 | 12.620 | 12.484 | 12.652 |
| Candelabra LEDs - Electric Only Savings | 0.332 | 0.332 | 0.328 | 0.333 |
| Globe LEDs - Electric and Gas Savings | 8.272 | 8.272 | 8.183 | 7.942 |
| Globe LEDs - Electric Only Savings | 0.364 | 0.364 | 0.360 | 0.349 |
| PAR38 LEDs - Electric and Gas Savings | 17.332 | 17.332 | 17.145 | 14.682 |

| MEASURE | *EX ANTE* PEAK DEMAND REDUCTION (kW/yr.) | AUDITED GROSS PEAK DEMAND REDUCTION (kW/yr.) | VERIFIED GROSS PEAK DEMAND REDUCTION (kW/yr.) | *EX POST* GROSS PEAK DEMAND REDUCTION (kW/yr.) |
|---|---|---|---|---|
| PAR38 LEDs - Electric Only Savings | 0.392 | 0.392 | 0.388 | 0.332 |
| Pipe Wrap - Electric (per foot) | 1.275 | 1.275 | 1.209 | 6.372 |
| Pipe Wrap - Gas (per foot) | 0.000 | 0.000 | 0.000 | 0.000 |
| Low-flow Showerhead 1.5 gpm - Electric | 0.306 | 0.306 | 0.264 | 0.026 |
| Low-flow Showerhead 1.5 gpm - Gas | 0.000 | 0.000 | 0.000 | 0.000 |
| Low-flow Showerhead with Shower Start - Electric | 0.660 | 0.660 | 0.569 | 0.056 |
| Low-flow Showerhead with Shower Start - Gas | 0.000 | 0.000 | 0.000 | 0.000 |
| Shower Start Only - Electric | 0.014 | 0.014 | 0.012 | 0.012 |
| Shower Start Only - Gas | 0.000 | 0.000 | 0.000 | 0.000 |
| Total Savings | 463.241 | 463.241 | 461.559 | 470.310 |
| Total Program Realization Rate | | | | 102% |

Note: Totals may not sum properly due to rounding.

### TABLE 59. 2022 HEA PROGRAM *EX ANTE* & *EX POST* GROSS NATURAL GAS ENERGY SAVINGS

| MEASURE | *EX ANTE* NATURAL GAS ENERGY SAVINGS (THERMS/YR.) | AUDITED GROSS NATURAL GAS ENERGY (THERMS/YR.) | VERIFIED GROSS NATURAL GAS ENERGY SAVINGS (THERMS/YR.) | *EX POST* GROSS NATURAL GAS ENERGY SAVINGS (THERMS/YR.) |
|---|---|---|---|---|
| Assessment Recommendations - Electric and Gas Savings | 3,134.56 | 3,134.56 | 2,990.06 | 2,990.06 |
| Assessment Recommendations - Electric Only | 0.00 | 0.00 | 0.00 | 0.00 |
| Assessment Recommendations - Gas Only | 1,076.82 | 1,243.48 | 1,186.16 | 1,186.16 |
| Attic Insulation (Uninsulated Hatch) - Electric Cooling and Gas Heating Savings | 3,312.42 | 3,312.42 | 3,312.42 | 3,308.45 |
| Attic Insulation (Uninsulated Hatch) - Gas Heating Only Savings (Gas Only Customer) | 668.36 | 501.70 | 501.70 | 491.03 |
| Bathroom Aerator 1.0 gpm - Electric | 0.00 | 0.00 | 0.00 | 0.00 |
| Bathroom Aerator 1.0 gpm - Gas | 655.50 | 655.50 | 604.11 | 390.07 |
| Duct Sealing Package - Electric Cooling and Gas Heating Savings | 96,215.04 | 96,215.04 | 96,215.04 | 96,396.53 |
| Duct Sealing Package - Electric Cooling and Heating Savings | 0.00 | 0.00 | 0.00 | 0.00 |
| Duct Sealing Package - Electric Cooling Only Savings | 0.00 | 0.00 | 0.00 | 0.00 |
| Duct Sealing Package - Electric Heating Only Savings | 0.00 | 0.00 | 0.00 | 0.00 |
| Duct Sealing Package - Gas Heating Only Savings | 38,013.78 | 38,013.78 | 38,013.78 | 38,273.36 |
| Kitchen Aerator 1.5 gpm - Electric | 0.00 | 0.00 | 0.00 | 0.00 |
| Kitchen Aerator 1.5 gpm - Gas | 2,082.90 | 2,082.90 | 1,928.56 | 2,083.51 |
| A-Line LEDs - Electric and Gas Savings | 0.00 | 0.00 | 0.00 | 0.00 |
| A-Line LEDs - Electric Only Savings | 0.00 | 0.00 | 0.00 | 0.00 |
| Candelabra LEDs - Electric and Gas Savings | 0.00 | 0.00 | 0.00 | 0.00 |
| Candelabra LEDs - Electric Only Savings | 0.00 | 0.00 | 0.00 | 0.00 |

| MEASURE | *EX ANTE* NATURAL GAS ENERGY SAVINGS (THERMS/YR.) | AUDITED GROSS NATURAL GAS ENERGY (THERMS/YR.) | VERIFIED GROSS NATURAL GAS ENERGY SAVINGS (THERMS/YR.) | *EX POST* GROSS NATURAL GAS ENERGY SAVINGS (THERMS/YR.) |
|---|---|---|---|---|
| Globe LEDs - Electric and Gas Savings | 0.00 | 0.00 | 0.00 | 0.00 |
| Globe LEDs - Electric Only Savings | 0.00 | 0.00 | 0.00 | 0.00 |
| PAR38 LEDs - Electric and Gas Savings | 0.00 | 0.00 | 0.00 | 0.00 |
| PAR38 LEDs - Electric Only Savings | 0.00 | 0.00 | 0.00 | 0.00 |
| Pipe Wrap - Electric (per foot) | 0.00 | 0.00 | 0.00 | 0.00 |
| Pipe Wrap - Gas (per foot) | 10,516.14 | 10,516.14 | 9,972.46 | 53,376.55 |
| Low-flow Showerhead 1.5 gpm - Electric | 0.00 | 0.00 | 0.00 | 0.00 |
| Low-flow Showerhead 1.5 gpm - Gas | 3,472.07 | 3,472.07 | 2,993.27 | 1,306.58 |
| Low-flow Showerhead with Shower Start - Electric | 0.00 | 0.00 | 0.00 | 0.00 |
| Low-flow Showerhead with Shower Start - Gas | 5,106.96 | 5,106.96 | 4,402.71 | 2,034.82 |
| Shower Start Only - Electric | 0.00 | 0.00 | 0.00 | 0.00 |
| Shower Start Only - Gas | 147.60 | 147.60 | 127.25 | 71.11 |
| Total Savings | 164,402.15 | 164,402.15 | 162,247.50 | 201,908.24 |
| Total Program Realization Rate | | | | 123% |

Note: Totals may not sum properly due to rounding.

## *EX POST* NET SAVINGS

The evaluation team based NTG ratios for most direct install measures on self-reported responses to participant survey questions.

The 2022 participant survey net-to-gross questions for direct install measures asked what customers would have done in the absence of the program. The questions addressed the likelihood that participants would have changed their equipment to energy-efficient equipment in the absence of the program, and the timing associated with this change. For LEDs, the evaluation team also considered the presence of LEDs already in the home.

For two measures, the evaluation team deemed the NTG ratios for the following reasons:

- Attic insulation: There were no survey responses from participants that received attic insulation. The team deemed the NTG ratio at 80% for the attic insulation, which is consistent with previous evaluation results (2018 – 2021).
- Assessment recommendations: As in previous evaluations (2015 – 2021), the evaluation team used a NTG ratio of 100% for the assessment recommendations measure because participants would not have received the recommendations if they had not participated in the program.

Participant spillover represents savings that result from purchases and actions taken outside of the program due to program influence. Because NIPSCO claims savings for energy-saving behavior and/or subsequent installation of energy-efficient equipment associated with the energy assessment recommendations measure, calculating participant spillover would be redundant to those savings. Therefore, spillover is not included in the NTG ratio for the HEA program.

Table 60 shows the NTG ratios by measure.

TABLE 60. 2022 HEA PROGRAM NET-TO-GROSS RATIOS BY MEASURE

| MEASURE | NTG | Source |
|---|---|---|
| Assessment Recommendations | 100% | Deemed |
| Attic Insulation | 80% | Deemed |
| Bathroom Aerators | 97% | HEA 2022 Survey |
| Duct Sealing Package | 85% | HEA 2022 Survey |
| Kitchen Aerators | 97% | HEA 2022 Survey |
| LEDs | 64% | HEA 2022 Survey |
| Pipe Wrap | 87% | HEA 2022 Survey |
| Low-flow Showerhead/Shower Start | 86% | HEA 2022 Survey |

Table 60 presents the resulting net electric savings, demand reduction, and natural gas savings.

TABLE 61. 2022 HEA PROGRAM *EX POST* NET SAVINGS

| MEASURE | *EX POST* GROSS SAVINGS/REDUCTION | | | NTG | *EX POST* NET SAVINGS/REDUCTION | | |
|---|---|---|---|---|---|---|---|
| | kWh | kW | therms | | kWh | kW | therms |
| Assessment Recommendations - Electric and Gas Savings | 23,571.25 | 13.095 | 2,990.06 | 100% | 23,571.25 | 13.095 | 2,990.06 |
| Assessment Recommendations - Electric Only | 844.77 | 0.469 | 0.00 | 100% | 844.77 | 0.469 | 0.00 |
| Assessment Recommendations - Gas Only | 0.00 | 0.000 | 1,186.16 | 100% | 0.00 | 0.000 | 1,186.16 |
| Attic Insulation (Uninsulated Hatch) - Electric Cooling and Gas Heating Savings | 3,777.21 | 1.634 | 3,308.45 | 80% | 3,021.77 | 1.307 | 2,646.76 |
| Attic Insulation (Uninsulated Hatch) - Gas Heating Only Savings (Gas Only Customer) | 0.00 | 0.000 | 491.03 | 80% | 0.00 | 0.000 | 392.82 |
| Bathroom Aerator 1.0 gpm - Electric | 399.50 | 0.030 | 0.00 | 97% | 387.52 | 0.029 | 0.00 |
| Bathroom Aerator 1.0 gpm - Gas | 0.00 | 0.000 | 390.07 | 97% | 0.00 | 0.000 | 378.37 |
| Duct Sealing Package - Electric Cooling and Gas Heating Savings | 124,216.88 | 362.526 | 96,396.53 | 85% | 105,584.34 | 308.147 | 81,937.05 |
| Duct Sealing Package - Electric Cooling and Heating Savings | 11,233.19 | 3.186 | 0.00 | 85% | 9,548.21 | 2.708 | 0.00 |
| Duct Sealing Package - Electric Cooling Only Savings | 4,058.72 | 12.037 | 0.00 | 85% | 3,449.91 | 10.231 | 0.00 |
| Duct Sealing Package - Electric Heating Only Savings | 1,142.62 | 0.000 | 0.00 | 85% | 971.23 | 0.000 | 0.00 |
| Duct Sealing Package - Gas Heating Only Savings | 0.00 | 0.000 | 38,273.36 | 85% | 0.00 | 0.000 | 32,532.36 |
| Kitchen Aerator 1.5 gpm - Electric | 2,415.74 | 0.071 | 0.00 | 97% | 2,343.26 | 0.069 | 0.00 |
| Kitchen Aerator 1.5 gpm - Gas | 0.00 | 0.000 | 2,083.51 | 97% | 0.00 | 0.000 | 2,021.01 |
| A-Line LEDs - Electric and Gas Savings | 242,870.03 | 33.077 | 0.00 | 64% | 155,436.82 | 21.169 | 0.00 |
| A-Line LEDs - Electric Only Savings | 10,470.20 | 1.429 | 0.00 | 64% | 6,700.93 | 0.914 | 0.00 |
| Candelabra LEDs - Electric and Gas Savings | 92,923.94 | 12.652 | 0.00 | 64% | 59,471.32 | 8.097 | 0.00 |
| Candelabra LEDs - Electric Only Savings | 2,438.16 | 0.333 | 0.00 | 64% | 1,560.43 | 0.213 | 0.00 |
| Globe LEDs - Electric and Gas Savings | 58,315.80 | 7.942 | 0.00 | 64% | 37,322.11 | 5.083 | 0.00 |

| MEASURE | *EX POST* GROSS SAVINGS/REDUCTION | | | NTG | *EX POST* NET SAVINGS/REDUCTION | | |
|---|---|---|---|---|---|---|---|
| | kWh | kW | therms | | kWh | kW | therms |
| Globe LEDs - Electric Only Savings | 2,560.49 | 0.349 | 0.00 | 64% | 1,638.71 | 0.224 | 0.00 |
| PAR38 LEDs - Electric and Gas Savings | 107,859.75 | 14.682 | 0.00 | 64% | 69,030.24 | 9.397 | 0.00 |
| PAR38 LEDs - Electric Only Savings | 2,439.61 | 0.332 | 0.00 | 64% | 1,561.35 | 0.213 | 0.00 |
| Pipe Wrap - Electric (per foot) | 55,855.45 | 6.372 | 0.00 | 87% | 48,594.25 | 5.543 | 0.00 |
| Pipe Wrap - Gas (per foot) | 0.00 | 0.000 | 53,376.55 | 87% | 0.00 | 0.000 | 46,437.60 |
| Low-flow Showerhead 1.5 gpm - Electric | 2,127.75 | 0.026 | 0.00 | 86% | 1,829.86 | 0.022 | 0.00 |
| Low-flow Showerhead 1.5 gpm - Gas | 0.00 | 0.000 | 1,306.58 | 86% | 0.00 | 0.000 | 1,123.66 |
| Low-flow Showerhead with Shower Start - Electric | 1,445.54 | 0.056 | 0.00 | 86% | 1,243.16 | 0.048 | 0.00 |
| Low-flow Showerhead with Shower Start - Gas | 0.00 | 0.000 | 2,034.82 | 86% | 0.00 | 0.000 | 1,749.95 |
| Shower Start Only - Electric | 80.75 | 0.012 | 0.00 | 86% | 69.45 | 0.011 | 0.00 |
| Shower Start Only - Gas | 0.00 | 0.000 | 71.11 | 86% | 0.00 | 0.000 | 61.15 |
| Total Savings | 751,047.34 | 470.310 | 201,908.24 | | 534,180.89 | 386.990 | 173,456.95 |

Note: Totals may not sum properly due to rounding.

Table 62 shows the net-to-gross ratios for each fuel.

TABLE 62. 2022 HEA NET-TO-GROSS RESULTS BY FUEL TYPE

| SAVINGS TYPE | *EX ANTE* GROSS SAVINGS | *EX POST* GROSS SAVINGS | NTG RATIO (%) | *EX POST* NET SAVINGS |
|---|---|---|---|---|
| Electric Energy Savings (kWh/yr.) | 730,910.13 | 751,047.34 | 71% | 534,180.89 |
| Peak Demand Reduction (kW) | 463.241 | 470.310 | 82% | 386.990 |
| Natural Gas Energy Savings (therms/yr.) | 164,402.15 | 201,908.24 | 86% | 173,456.95 |

# PROCESS EVALUATION

The evaluation team completed program staff interviews, HEA auditor/installers interviews, a participant survey, and a census data mapping exercise to answer the following research questions:

- How do auditors communicate about and deliver the program to participants? How do they qualify customers for HEA vs IQW?
- What are auditors' perspectives on the program? What is working well, and where is there room for improvement?
- What are auditors' perspectives on various audit approaches, including virtual audits?
- How do participants become aware of the program? Has it changed over time?
- What drives participation in the program? Why were participants motivated to get a home energy assessment?
- What was the customer's experience with the audit like?
- How easy was it to schedule the audit and answer the questions?
- How do contractors provide findings and recommendations from the audit to the participant? How do they discuss and provide the report?
- How do customers decide to move on and install additional measures? What is their experience like?

- How useful are the information and recommendations provided through the program?
- What energy-savings actions do participants take because of the assessment, if any? Did they participate in any other programs?
- What are customer experiences with the DI measures? Are customers satisfied with the quality of work provided by the contractors?
- How satisfied were participants with the program, including the participation process, audit experience, and satisfaction with equipment received?
- How satisfied are customers with NIPSCO?
- Do participants have any recommendations for program improvement?

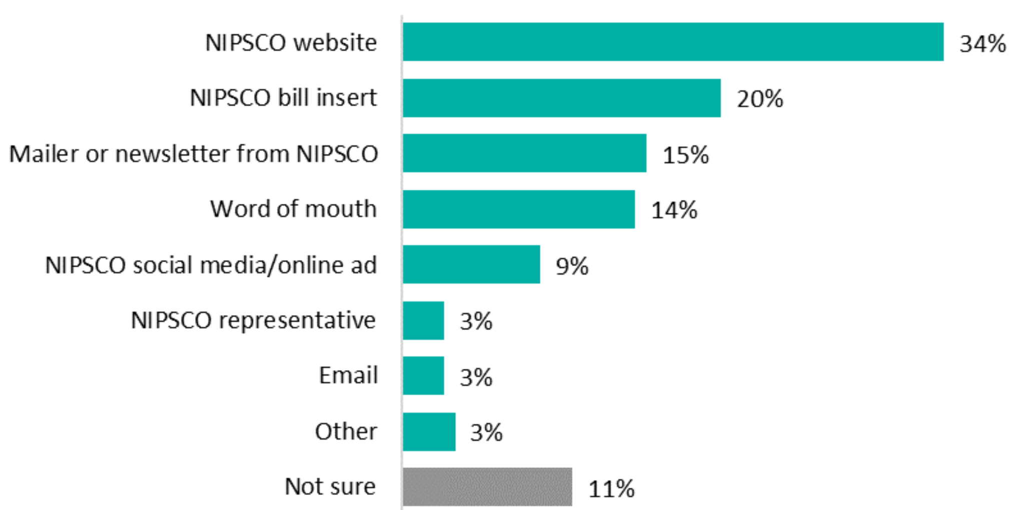
## PARTICIPANT FEEDBACK

The evaluation team invited the census of 1,348 unique customers who participated in the HEA program (from January 2022 until the end of November 2022) to complete a survey about their experience with the program and received 152 responses. The team fielded the survey via phone (24%) and web (76%) in January 2023. The following sections describe the results related to source of awareness, reasons for participation, experience with the in-home assessment, satisfaction with the program, and program impacts on customers.

### ENERGY EFFICIENCY AWARENESS AND MARKETING

The NIPSCO website was the most common way in which respondents learned about the HEA program (34%) in 2022 (Figure 24). Respondents also frequently learned about the program through a NIPSCO bill insert (20%) and by receiving a mailer or newsletter from NIPSCO (15%). Survey responses indicate that most customers are learning about the HEA Program directly through NIPSCO's marketing channels. Additionally, word-of-mouth accounted for 14% of respondents learning about the program. A few respondents also noted that they'd participated in a previous home assessment, and one learned to look for programs like HEA through a home remodeling TV show.

FIGURE 24. HOW RESPONDENTS LEARNED ABOUT THE HEA PROGRAM

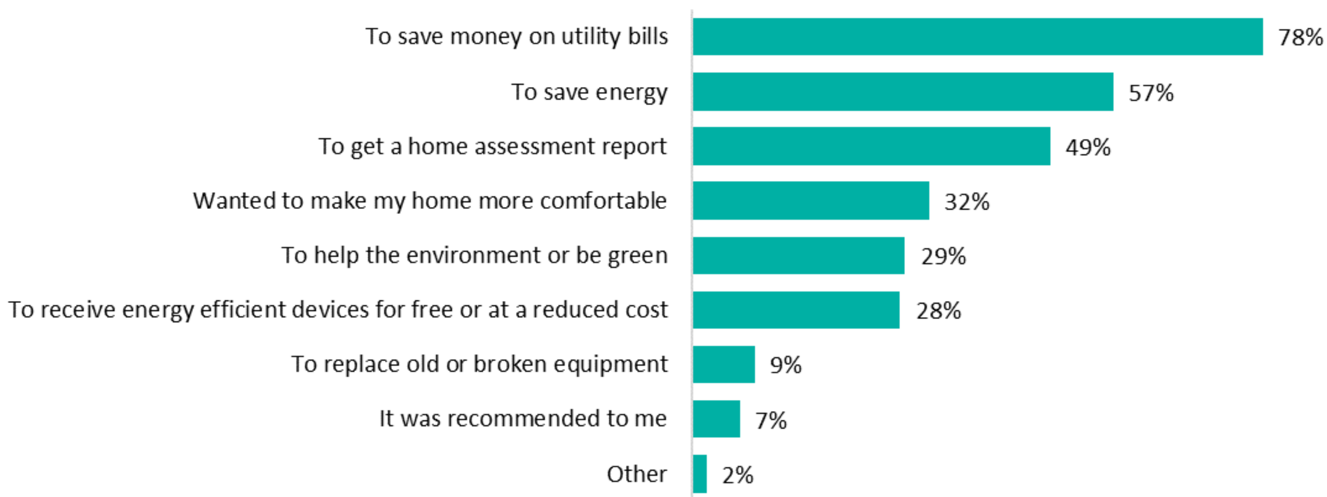



Source: Participant survey. Question: "How did you learn about NIPSCO's HEA program?" (Multiple responses allowed) (n=152)

## PARTICIPATION DRIVERS

Respondents indicated they most often participated in the HEA program to save money on utility bills (78%), to save energy (57%), and to get a home assessment report (49%) as shown in Figure 25. These were also the top three participation drivers in 2020 and 2021. The percentage of respondents that participated to save money on utility bills is 11% higher than last year, perhaps driven by ongoing economic uncertainty and higher energy prices in 2022.

FIGURE 25. REASONS FOR PARTICIPATING IN THE HEA PROGRAM



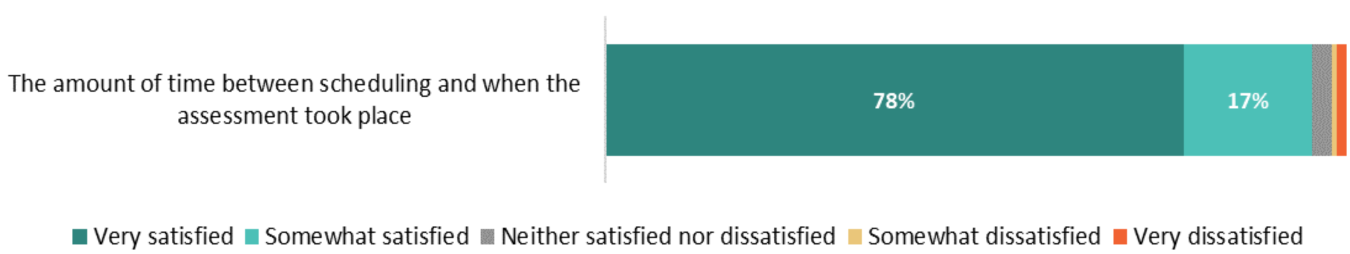

Source: Participant survey. Question: "Why did you decide to participate in NIPSCO's HEA program?" (Multiple responses allowed) (n=152)

## ASSESSMENT EXPERIENCE AND DIRECT INSTALL MEASURES

### SCHEDULING EXPERIENCE

Most respondents were very satisfied with the time between scheduling and when the assessment took place (77%) (Figure 26). In addition, most respondents (84%) found the scheduling process to be very or somewhat easy. However, some dissatisfied respondents explained they experienced long waits between scheduling and the assessment.

FIGURE 26. SCHEDULING EXPERIENCE SATISFACTION

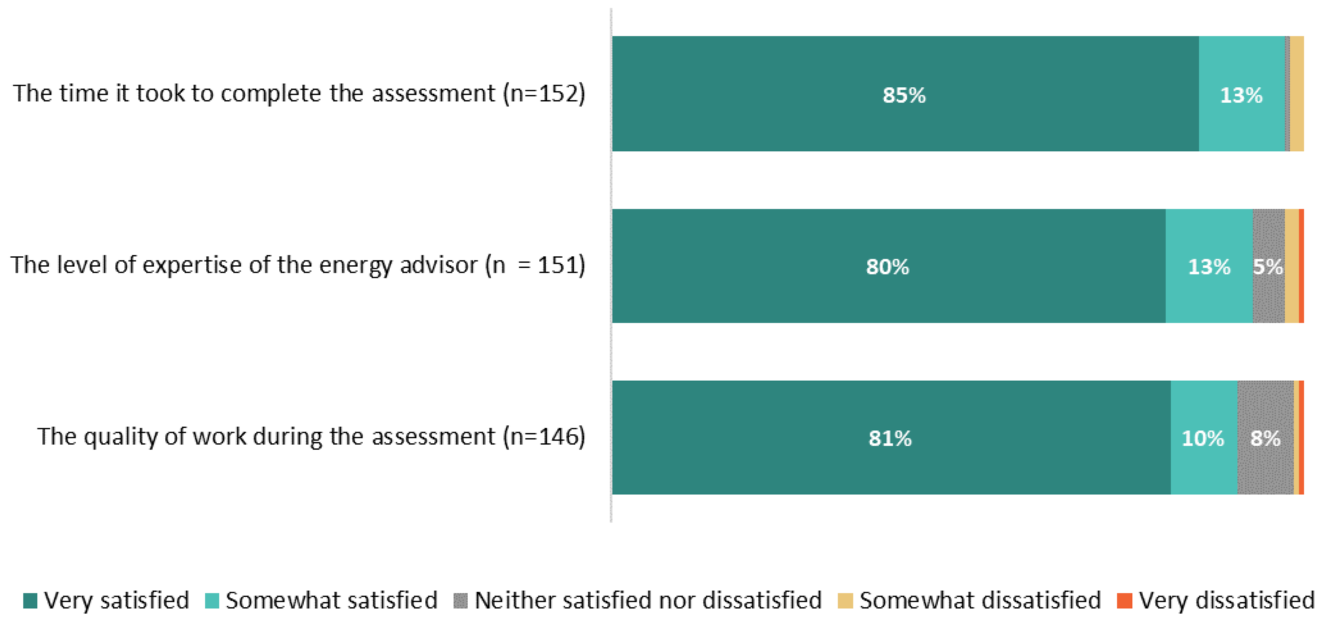


Source: Participant survey. Question: "How satisfied were you with each of the following? The amount of time between scheduling and when the assessment took place." (n = 151)

### ASSESSMENT EXPERIENCE

Most respondents were very satisfied with the time it took to complete the assessment (85%), the level of expertise of the energy advisor (80%), and the quality of work during the assessment (79%) (Figure 27). Satisfied respondents described the energy advisors as friendly, informative, and professional. One shared, "The advisor was incredibly knowledgeable. He was able to answer our questions with superb explanations." About half of the respondents (53%) had specific questions for their energy advisor during their assessment, and of those (n=81), 90% were able to get those questions answered by the energy advisor. Additionally, most HEA participants (93%) reported that the auditor discussed the assessment findings and recommendations with them. Almost 90% of HEA participants felt like the energy advisor provided them with helpful information about their home or equipment.

FIGURE 27. SATISFACTION WITH ASSESSMENT LENGTH, EXPERTISE OF AUDITOR, AND QUALITY OF WORK

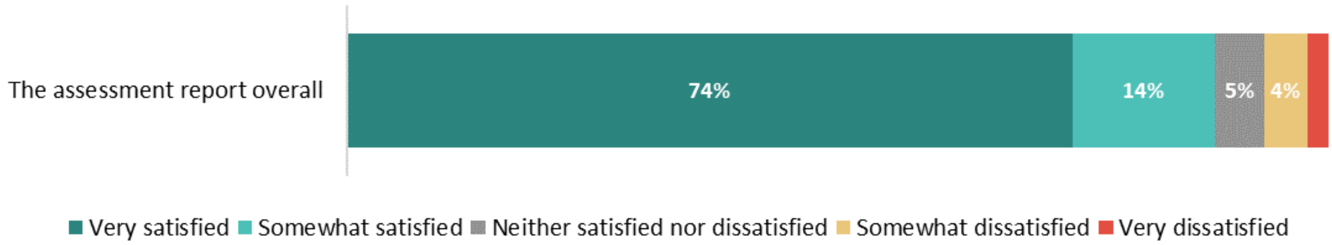



Source: Participant survey. Question: "How satisfied were you with each of the following? The time it took to complete the assessment. The level of expertise of the energy advisor. The quality of work during the assessment."

### ASSESSMENT REPORT AND FINDINGS

Per the program description, participants should receive a report via email during the assessment (if the participants have email addresses) or a physical copy in the mail after the assessment is complete. Most respondents (91%) reported receiving a report. Respondents who received the report were satisfied with it overall (Figure 28). Customers that were dissatisfied with the report wanted more information about their home as well as steps they could take to make their home more energy efficient. These customers felt the report wasn't in-depth enough or didn't provide new information.

FIGURE 28. SATISFACTION WITH ASSESSMENT REPORT

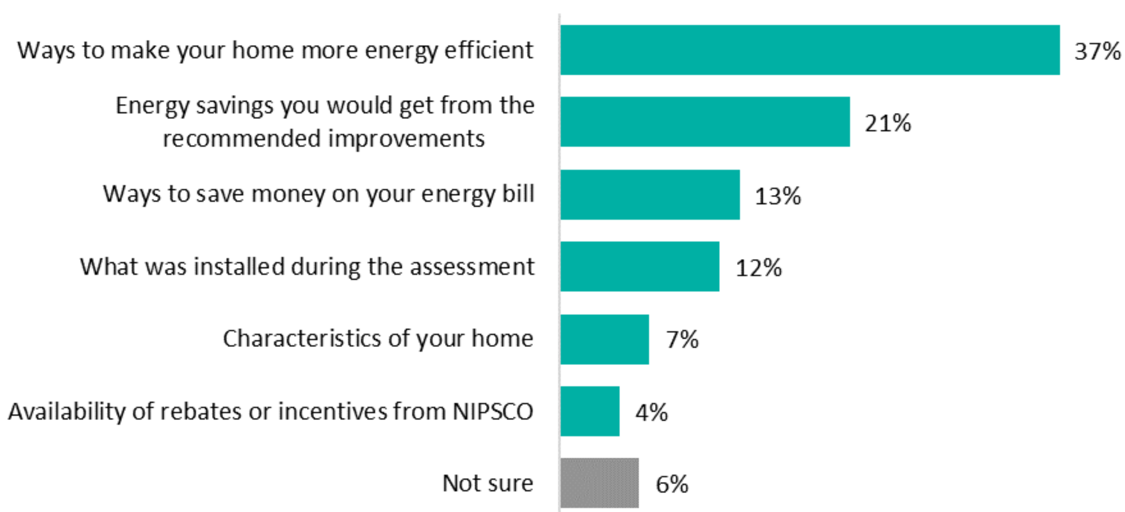



Source: Participant survey. Question: "How satisfied were you with each of the following? The assessment report overall." (n=138)

Most HEA respondents that received the report found it very easy (69%) or somewhat easy (23%) to understand the information provided in the report. Most respondents found the information they received from the energy advisor and the report to be very or somewhat useful (83%). Respondents shared that the most useful pieces of information in the report were ways to make their homes more energy efficient, energy savings they would get from the recommended improvements, and ways to save money on their energy bills (Figure 29. Usefulness rating of information in the report).

It should be noted that a quarter of HEA respondents found the information provided by the program to be not very or not at all useful. Respondents that did not find the information provided to be very or at all useful shared that the audit was not as in-depth as they'd expected, that it didn't meet their expectations, that their energy bill has gone up since participating, or that there weren't specific recommendations.

FIGURE 29. USEFULNESS RATING OF INFORMATION IN THE REPORT




Source: Participant survey. Question "What information in the report did you find most useful?" (n=152)

Nineteen percent of respondents provided suggestions to improve the information provided in the assessment or the report (n=29). Some respondents wanted a more thorough assessment, including a blower door test (n=2), thermal camera imaging (n=2), and other work to understand where the home is losing heat (n=4). Respondents also requested more specific recommendations and equipment information, including information on how old their equipment and appliances are and what condition they are in.

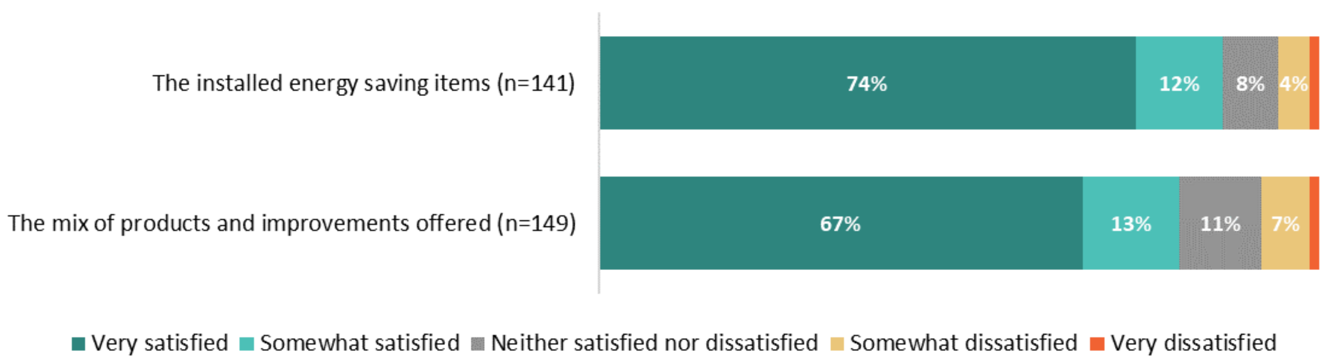
Respondents said they need help learning how to heat and cool their homes more efficiently and that it would be helpful to have links to a website with suggested energy-efficient products and brands that NIPSCO recommends. Customers also wanted information on what rebate programs are available and how to access them. A few respondents (n=2) wanted their windows and doors replaced. In addition, two respondents were interested in information about solar PV. Two respondents shared they wanted a copy of the report because they never received one.

### DIRECT INSTALL MEASURES

According to the program tracking data, 98% of respondents who received an energy assessment also received direct install measures in their home during the assessment. As shown in Figure 30. Satisfaction with direct install measures, respondents were generally satisfied with the energy-saving items they received. Two-thirds of respondents were very satisfied with the mix of products and improvements offered.

Dissatisfied respondents shared that the installed products didn't help decrease their monthly bill and that they weren't eligible for all products or didn't receive any measures.

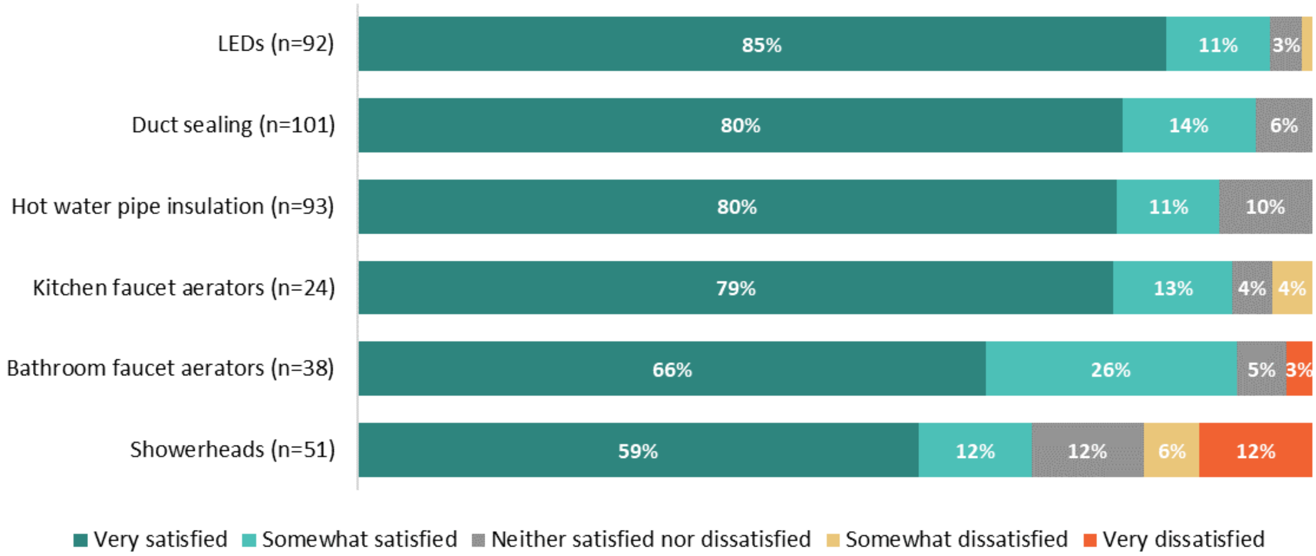
FIGURE 30. SATISFACTION WITH DIRECT INSTALL MEASURES




Source: Participant survey. Question: "How satisfied were you with each of the following? The energy saving items that were directly installed in your home. The mix of products and improvements offered."

Regarding specific measures, most respondents were very or somewhat satisfied with the LEDs (96%), the duct sealing (94%), and the hot water pipe insulation (91%). While fewer respondents received other measures, they reflected that they were generally satisfied with the direct-install measures (Figure 31).

FIGURE 31. SATISFACTION WITH DIRECT INSTALL MEASURES




Source: Participant survey. Question: "How satisfied are you with the [measure(s)] installed? Are you…"

Very few respondents reported removing LEDs, bathroom aerators, or kitchen aerators. However, 15% of customers that reported having showerheads installed reported removing one or more. Customers that removed LEDs did so most commonly because they stopped working. A few respondents removed the water saving measures because they did not like the water pressure (most common with the showerhead).

Some respondents did not have certain measures installed and shared information on why they did not receive them. The top reason respondents did not receive LEDs and water saving measures was because they already had them or did not need them. Over a quarter of respondents that did not receive LEDs reported that they weren't offered any. Two respondents noted that they couldn't receive LEDs because NIPSCO is only their gas provider. About one-fifth of the respondents who did not receive water saving measures reported that the technicians did not offer them: 20% for showerheads, 19% for bathroom faucet aerators, and 19% for kitchen faucet aerators. Table 63 provides additional details on the reasons for not receiving measures.

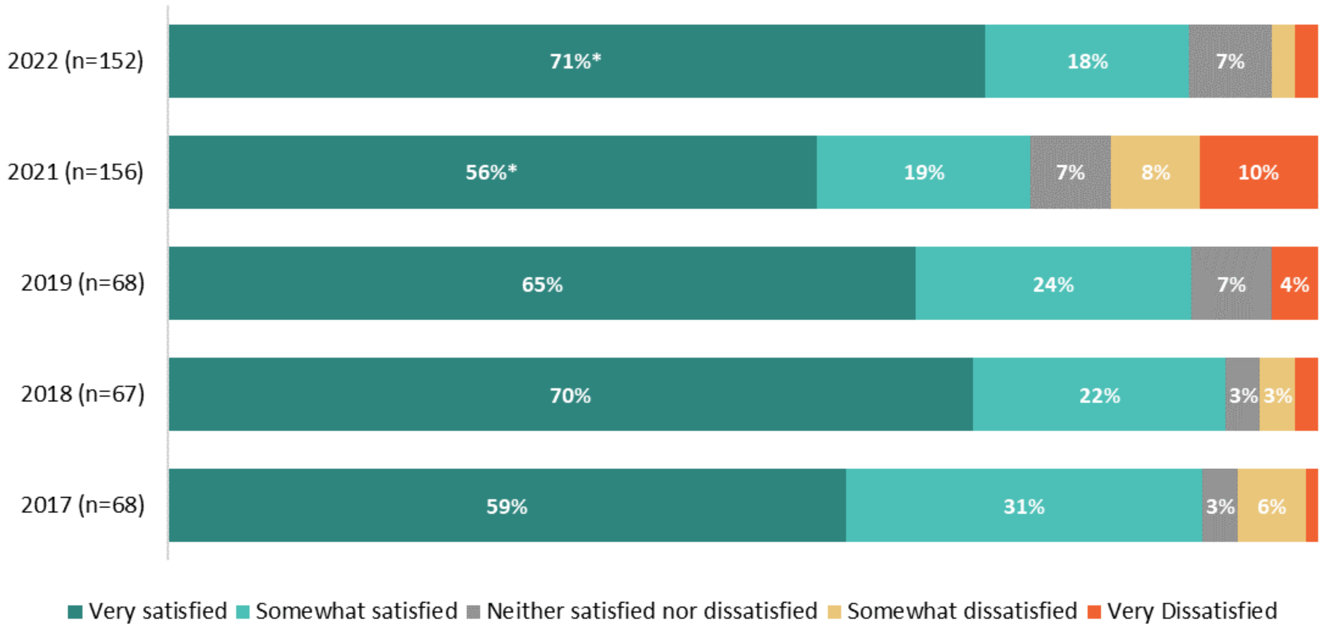
TABLE 63. REASONS DIRECT INSTALL MEASURES WERE NOT RECEIVED

| REASON | LEDS (N=51) | BATHROOM FAUCET AERATORS (N=101) | KITCHEN FAUCET AERATORS (N=116) | SHOWERHEADS (N=92) |
|---|---|---|---|---|
| Already had one/ didn't need one | 57% | 44% | 47% | 49% |
| Wasn't offered one | 28% | 19% | 19% | 20% |
| Didn't fit on fixture | 2% | 4% | 14% | 8% |
| Concerned about changes in water pressure | N/A | 5% | 2% | 6% |
| Don't like them | 2% | - | - | 1% |
| Didn't match current fixture color | N/A | 2% | 2% | 1% |
| Other | 9% | 6% | 5% | 2% |
| Not sure | 11% | 22% | 17% | 14% |

## SATISFACTION

Most respondents (89%) were very or somewhat satisfied with the energy assessment, a significant increase from 2021 (75%). Additionally, the percentage of respondents who were very or somewhat dissatisfied was lower in 2022 compared with 2021. Figure 32 shows the satisfaction ratings respondents gave to the in-person energy assessment overall by year.

FIGURE 32. SATISFACTION WITH ENERGY ASSESSMENT[13]




Source: Participant survey. Question: "How satisfied were you with each of the following? The in-person assessment overall."
Note: * indicates difference from previous year is significant at p≤0.10 (90% confidence).

Respondents who were satisfied with the assessment appreciated the information provided (n=17), that the program was free (n=4) or saving them energy and money (n=9), and the knowledge or professionalism of the energy advisor (n=33). Dissatisfied customers wanted a more in-depth assessment (n=4), didn't learn anything new from their assessment (n=3), and didn't think the assessment they received would help lower their energy bill (n=4).

## PREFERENCE FOR ASSESSMENT TYPE

About a quarter (26%) of HEA respondents shared that the program offered them a choice in the type of assessment, while around 60% reported they did not think they had a choice. None of the HEA respondents, who reported they were not offered a choice, would have preferred a virtual assessment.

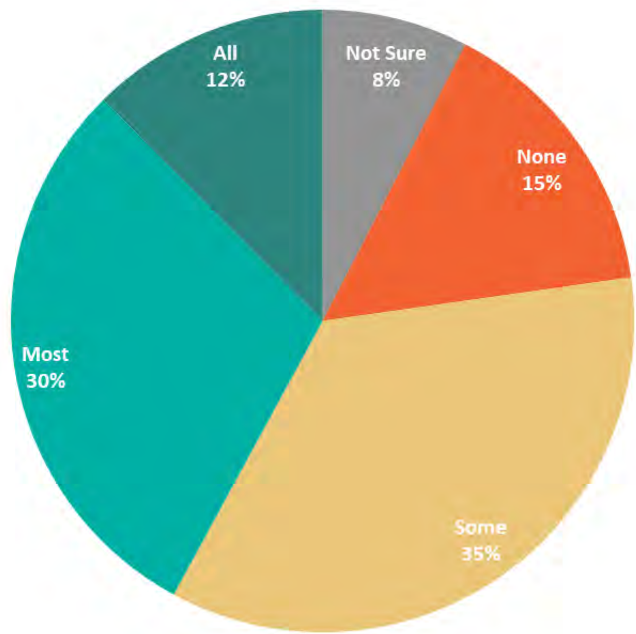
[13] The evaluation team is not including 2020 respondent program satisfaction, since the number of respondents from the 2020 virtual program is too low to draw a meaningful comparison.

## RECOMMENDED IMPROVEMENTS AND ADDITIONAL PROGRAM PARTICIPATION

### POST-ASSESSMENT IMPROVEMENTS

Most respondents (77%) made at least some of the energy-saving improvements recommended in the assessment report they received (Figure 33). Less than a quarter of respondents (23%) reported they did not make any of the improvements or were not sure if they made improvements.

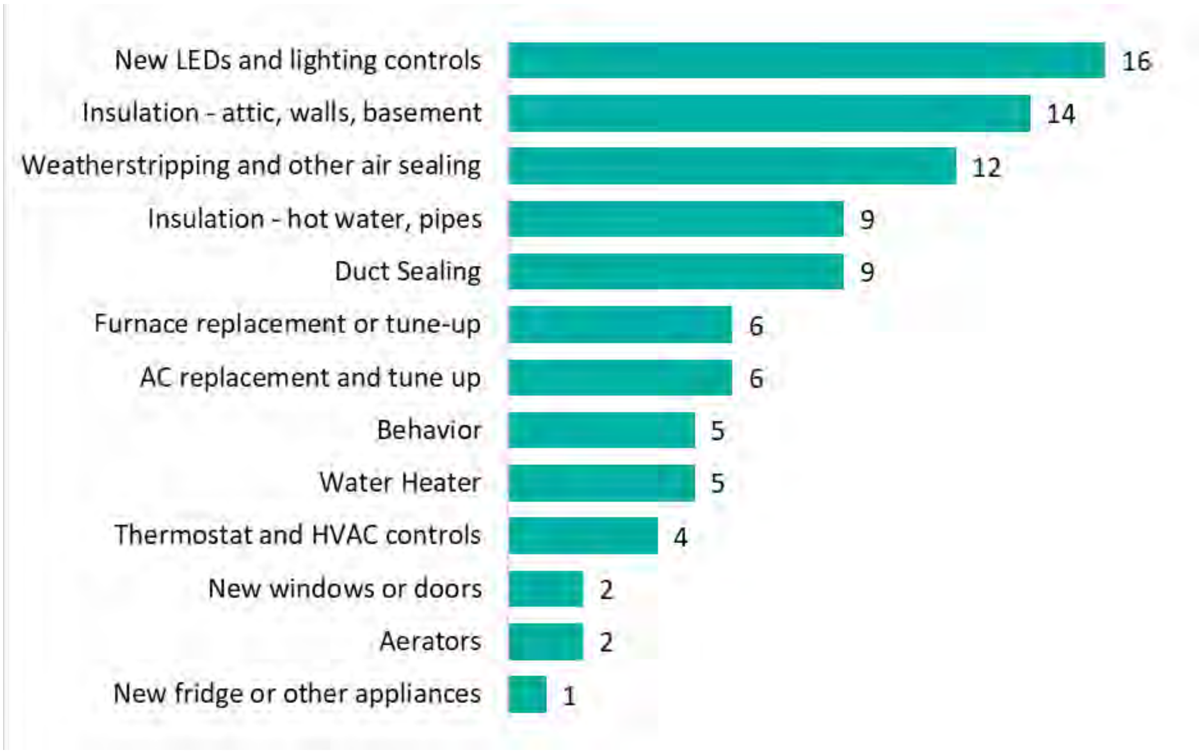
Figure 33. FOLLOW THROUGH ON RECOMMENDED IMPROVEMENTS




Source: Participant survey. Question: "After participating in NIPSCO's Home Energy Assessment program, would you say you have made all, most, some, or none of the energy-saving recommendations made in the assessment report you received?" (n=145)

The improvements respondents made included installing energy-saving measures, most commonly LEDs, and adding insulation or weatherstripping (Figure 34). Fifty-five respondents made additional improvements or installed products after participating in HEA that they did not receive a rebate for.

Figure 34. INSTALLED RECOMMENDED MEASURES[14]




Participant survey. Questions: “What improvements did you make?” (n=78)

Of the respondents who made no improvements (n=22), some said they were still planning on making improvements (n=9), improvements were too expensive (n=7), or recommendations were not relevant (n=6).

## ADDITIONAL PROGRAM PARTICIPATION

Just over a third of HEA respondents (34%) were aware that NIPSCO offers other energy-efficiency programs. Awareness has risen since 2021 when 20% of respondents were aware that NIPSCO offers other programs. Of those respondents that were aware that NIPSCO offers other programs (n=42), they were most often aware of the Energy Efficiency Rebate program (76%), Appliance Recycling (52%), Home Energy Report (36%), and Home Online Marketplace (21%).

Only four respondents participated in other NIPSCO energy efficiency programs, including the Energy Efficiency Rebate Program (n=2), Lighting Discounts (n=2), and Home Online Marketplace (n=1).

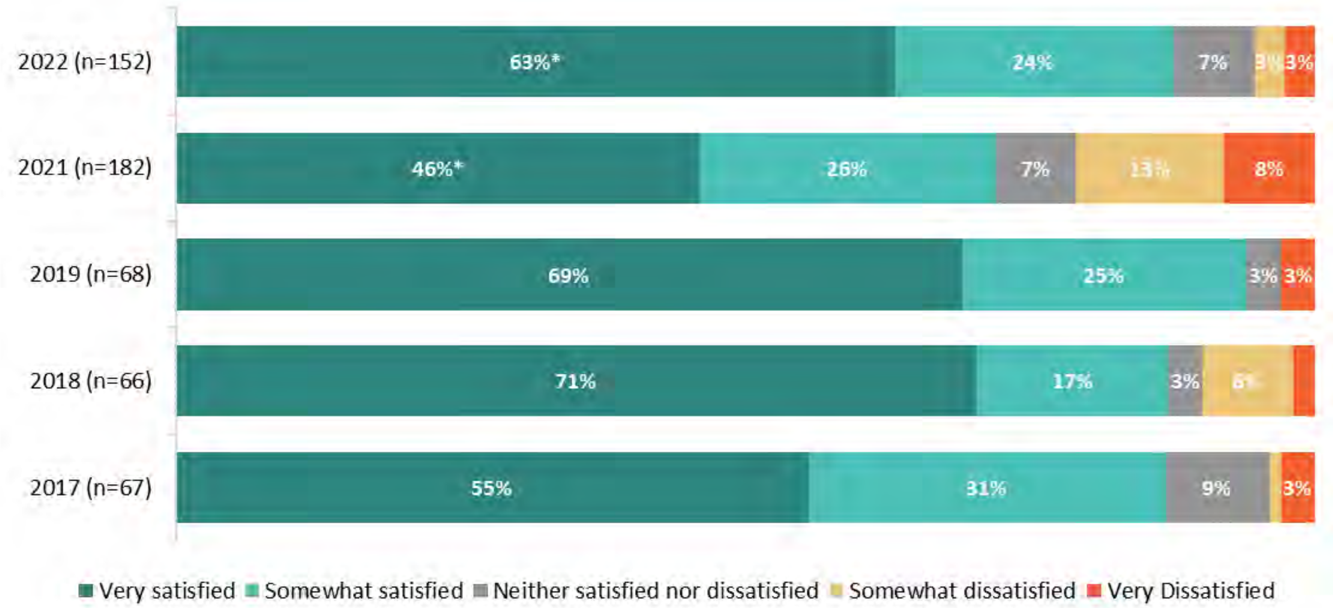
[14] It is unclear from the survey data if customers are including LEDs they received through the program in their answers to this question.

## SATISFACTION WITH PROGRAM AND NIPSCO

### OVERALL PROGRAM SATISFACTION

Many respondents (87%) said they were very or somewhat satisfied with the HEA program overall (Figure 35). The percentage of respondents who were very satisfied overall is significantly higher than in 2021.

FIGURE 35. SATISFACTION WITH THE HEA PROGRAM[15]




Note: * indicates difference between program years is significant at p≤0.10 (90% confidence).
Source: Participant survey. Questions: "How satisfied are you with NIPSCO's HEA program?"

Respondents who were satisfied with the program noted they appreciated receiving information and new suggestions on how to be energy efficient, the knowledge and professionalism of the assessor, and that the program was free. Dissatisfied customers said that they wanted a more in-depth audit, that the program didn't help with their energy bill, and that they would like more information on other NIPSCO programs and more help participating.

[15] The evaluation team is not including 2020 respondent program satisfaction, since the number of respondents from the 2020 virtual program is too low to draw a meaningful comparison.

### Very or Somewhat Satisfied

*" It was nice to have someone come out and do a few simple things like insulate pipes and change lightbulbs. It saved me time and money. I also like that he gave a report and went over a few other things that I could do to save energy and money. The guy that came out was very friendly and helpful."*

*"The assessor was a nice guy and offered some good advice."*

*"We never received a final report, that would have been helpful. I also would have liked them to look at the house with thermal imaging camera, to show any heat leaks in house."*

*"Good information, insulation of pipe, duct sealing, free light bulbs."*

### Neither Satisfied nor Dissatisfied

*" I just feel it didn't and will not make a difference on my bill. And lowering my bill was the reason I had the thing done."*

*"Wish it was more thorough. would like to see infrared camera to find leaks and blower door testing."*

*"I would like to have been advised about specific rebates and incentive programs that would have been applicable. Including real cost data and payback information (return on investment)."*

### Somewhat or Very Dissatisfied

*"It was a waste of my time.  I gained nothing from the [assessment]."*

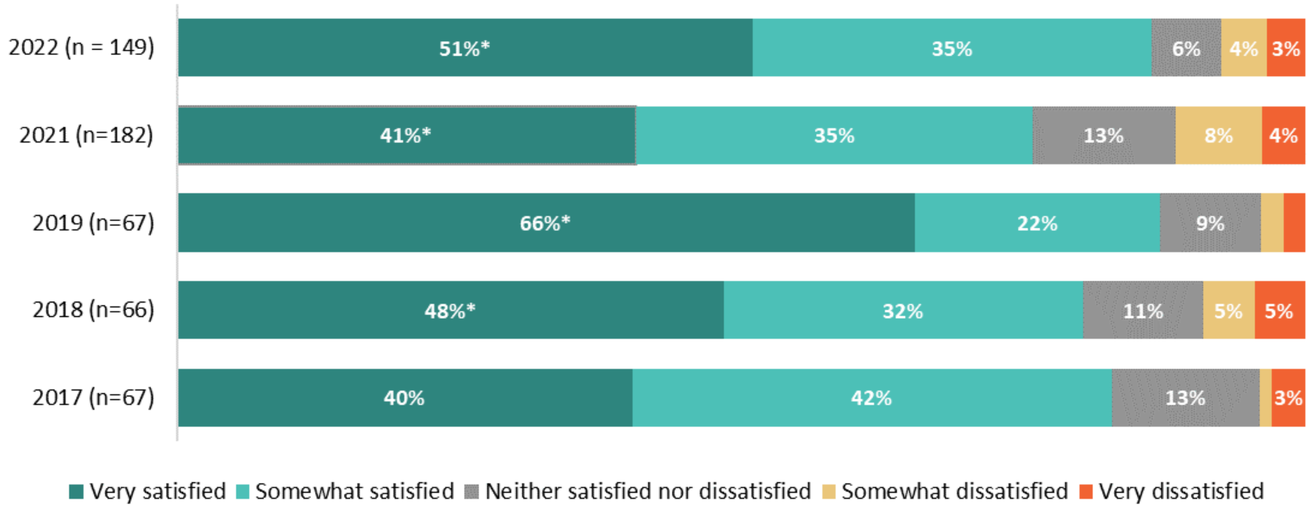
*"Didn't help with monthly bill."*

*" The advisor did not make any of the suggestions that have been brought up on the survey."*

## NIPSCO SATISFACTION

Most respondents were satisfied with NIPSCO as their utility service provider, with 86% of respondents either very or somewhat satisfied (Figure 36. Satisfaction with NIPSCO). The evaluation team did not collect comments related to respondent satisfaction with NIPSCO as their utility service provider, and the reasons for satisfaction and dissatisfaction could be due to a variety of factors.

FIGURE 36. SATISFACTION WITH NIPSCO[16]




Note: * indicates differences between program years that are significant at p≤0.10 (90% confidence).
Source: Participant survey. Question: "How satisfied are you with NIPSCO overall as your utility service provider?

### SUGGESTIONS FOR IMPROVEMENT

Thirty customers made suggestions to improve NIPSCO's HEA program. Thirteen customers expressed interest in a more in-depth audit. Some requested thermal imaging to see where heat is escaping. Other customers suggested making the written report more accessible, sharing more information on rebates, and providing more information to customers on their appliances and energy efficient options. One customer suggested offering a $20 credit on the account for participating since they are participating to try to save money on their bills. In addition, some customers recommended better communication to set expectations and better follow-up communication. One customer said:

> *"Tell the homeowner at the beginning of the survey everything that is going to be done, that the faucet will get aerators, the shower should get a new head. None of that was told to me during the assessment."*

## PARTICIPANT SURVEY DEMOGRAPHICS

Most HEA respondents live in single family detached homes (82%) and almost all (98%) own their home. There is a spread in the years respondents have lived in their current home and in the year their home was built. Most HEA respondents live in households of one or two people (66%). Most respondents (58%) live in medium sized homes that are 1,500 – 2,999 square feet. Table 64 contains more detail on respondent's home characteristics.

[16] The evaluation team is not including 2020 respondent satisfaction with NIPSCO, since the number of respondents from the 2020 virtual program is too low to draw a meaningful comparison.

TABLE 64. HEA PROGRAM RESPONDENT HOME CHARACTERISTICS

| DEMOGRAPHICS | PERCENTAGE |
|---|---|
| Home Ownership (n=151) | |
| Own | 98% |
| Rent | 1% |
| Other | 1% |
| Not Sure | 1% |
| Type of Residence (n=151) | |
| Single-family detached home | 90% |
| Multifamily apartment or condo building (with 4 or more units) | 2% |
| Attached house (townhouse, row house, or twin) | 6% |
| Mobile or manufactured home | 2% |
| Years Lived in Current Home (n=150) | |
| One year or less | 17% |
| 2-3 years | 19% |
| 4-5 years | 8% |
| 6-10 years | 15% |
| More than 10 years | 40% |
| Not Sure | 1% |
| Number of People in the Home (n=142) | |
| One | 25% |
| Two | 41% |
| Three | 13% |
| Four | 11% |
| Five or more | 10% |
| Not Sure | 1% |
| Square Feet of Home (n=161) | |
| 0 – 1,499 | 19% |
| 1,500 – 2,999 | 58% |
| 3,000+ | 16% |
| Not Sure | 7% |
| Year Home Built (n=172) | |
| Before 1900 | 3% |
| 1900 to 1939 | 10% |
| 1940 to 1959 | 18% |
| 1960 to 1979 | 23% |
| 1980 to 1989 | 7% |
| 1990 to 1999 | 14% |
| 2000 to 2004 | 14% |
| 2005 or later | 11% |

Source: Participant survey. Questions: "What type of residence do you live in?" "Do you own or rent your residence?" "How many years have you lived in your current home?" "Including yourself, how many people live in your home?" "About how many square feet is your home? Use your best guess." "When was your home built?"

Most respondents who participated in the HEA program (82%) reported household incomes at or above $35,000, and 38% reported household incomes at or above $75,000. Just over half of respondents (52%) have either a four-year college degree or a graduate or professional degree (Table 65).

TABLE 65. HEA PROGRAM RESPONDENT DEMOGRAPHICS

| DEMOGRAPHICS | PERCENTAGE |
|---|---|
| Annual Household Income (n=137) | |
| Under $25,000 | 8% |
| $25,000 to under $35,000 | 9% |
| $35,000 to under $50,000 | 12% |
| $50,000 to under $75,000 | 20% |
| $75,000 to under $100,000 | 18% |
| $100,000 to under $150,000 | 18% |
| Over $150,000 | 13% |
| Not Sure | 2% |
| Year Respondent was Born (n=167) | |
| 1900 to 1939 | 1% |
| 1940 to 1959 | 40% |
| 1960 to 1979 | 34% |
| 1980 to 1989 | 21% |
| 1990 to 1999 | 5% |
| Education Level Completed (n=171) | |
| Some high school or less | 0% |
| High school graduate or equivalent | 14% |
| Some college, no degree | 19% |
| Technical college degree or certificate | 3% |
| Two-year college degree | 9% |
| Four-year college degree | 29% |
| Graduate or professional degree | 28% |

Source: Participant survey. Questions: "Which of the following best represents your annual household income from all sources in 2021, before taxes?" "In what year were you born?" "What is the highest level of education you have completed?"

## AUDITOR FEEDBACK

The evaluation team interviewed six team members from the HEA and IQW auditor and direct-install team. These interviews covered communication and coordination with program implementation staff; audit and direct install processes; customer feedback; and areas for program growth. This section details a summary of interview findings.

### COMMUNICATION WITH PROGRAM IMPLEMENTATION STAFF

The program auditors reflected that communication with program implementation staff was clear and productive. Program implementation staff are responsible for customer in-take and qualification as well as scheduling the audits and ensuring that auditors have sufficient equipment for direct-installs. The auditors overall felt that the implementer's communication practices were working well. One auditor indicated that the implementer was "easy to deal with" and another said, "[the implementer] is the easiest to get along with and the most cooperative that I've ever worked with. They're fabulous to work with."

## COMMUNICATION WITH CUSTOMERS

Auditors are not responsible for customer marketing or initial customer in-take. However, they are the boots on the ground for the program and directly interface with participants. After receiving their scheduled site visits, auditors typically call the customers a day in advance to confirm the appointment. If the customer does not answer, auditors will email or text. The next point of contact is the day of the scheduled appointment. Some auditors prefer to call the customer right before they arrive to make sure customers are home. Additionally, all auditors reflected that their goal is to listen to customer concerns, help them learn about ways to improve their home's energy efficiency, and answer any questions that customers might have about measures or report findings.

## AUDIT AND DIRECT INSTALL PROCESSES

In the interviews, auditors reflected a structured approach to performing the audits, suggesting a thorough process that ensures standardization. Auditors indicated that they typically start the inspection with the exterior, then move inside. Once inside they work from bottom to top. They also encourage customers to accompany them through the audit so that customers can ask questions and learn. One auditor reflected that it is important to engage the customer during the audit process to make the audit worthwhile.

All auditors indicated that they use the Snugg Pro platform to document existing conditions, upload site photos, and input recommended measures. The platform calculates energy savings based on auditor inputs and can generate a report on site. Reports are directly emailed to customers, and auditors confirm receipt before leaving the home. Customers can also request that a paper copy be mailed to them.

## IN-PERSON AND VIRTUAL AUDITS

None of the auditors were involved with the program during the time when virtual audits were offered. However, some auditors indicated that they thought in-person audits were far more useful than virtual audits. One reflected that virtual audits might prevent their team from identifying health and safety issues and that it's very difficult to see everything with cameras used in virtual audits. Another auditor reflected that one of the key benefits of the program for NIPSCO is creating a personal connection to the customers; that outcome is only possible with in-person visits.

## FEEDBACK FROM CUSTOMERS

The evaluation team asked auditors about how customers perceive the program. Overall, auditors indicated that customers were highly satisfied with the program and are appreciative of the free direct-install measures. One auditor indicated that their team often gets thank you notes or calls from participants. Auditors experience very few callbacks to replace direct install measures.

Occasionally, auditors will hear concerns from customers on the direct-install measures. For example, they indicated that some customers do not like the color of the LED bulbs. Additionally, some customers have faulty wiring in their homes and when they replace incandescent bulbs with LEDs, the switches bleed enough electricity that the LEDs never actually turn off. Another common complaint is about the showerheads with the shower start valves – this measure sometimes causes issues for people who are unfamiliar with how they work. Also, the direct-install showerheads typically do not work with certain specialty bath fixtures like handheld showerheads.

## AREAS FOR PROGRAM GROWTH

Auditors had some suggestions for program growth and improvements. First, they indicated that they would like to see dryer vents added to the HEA Program. Many auditors indicated that this measure was available for IQW participants, but not HEA participants, and that it is an important health and safety measure and could avert potential fire hazards. Another measure that auditors indicated they would like to see is energy efficient showerheads that work with hand-held showers. Some customers decline the existing showerhead measure because it does not work with their current fixtures.

For the add-on attic insulation measures, auditors noted that many HEA customers were not inclined to pursue it. They indicated that the incentive cap of $700 was likely not enough to motivate customers to upgrade their attic insulation, especially if there is a relatively large area to insulate. Insulation projects could cost thousands of dollars and auditors suggested increasing the cap to entice more customers.

# CONCLUSIONS AND RECOMMENDATIONS

### CONCLUSION 1: THE PROGRAM EXCEEDED SAVINGS GOALS IN 2022.

The program exceeded savings goals in 2022, representing a rebound from 2021 participation rates. However, it should be noted that the program also exceeded its planned budget.

### CONCLUSION 2: *EX POST* GROSS SAVINGS WERE CONSISTENT WITH *EX ANTE* SAVINGS FOR ELECTRIC ENERGY SAVINGS AND DEMAND REDUCTION, AND SLIGHTLY HIGHER FOR NATURAL GAS ENERGY SAVINGS.

Overall, realization rates for the HEA program were aligned or slightly higher than 100%. Through the engineering review, the evaluation team identified notable measure-level differences between *ex ante* and *ex post* savings for faucet aerator, showerhead, shower start, and pipe wrap measures.

**Recommendations:**

- Update savings approaches to the Illinois TRM to anticipate the upcoming Indiana TRM update. Where applicable, use Indiana location specific input assumptions from Indiana TRM (v2.2) until an updated Indiana TRM is provided.

### CONCLUSION 3: MOST RESPONDENTS WERE SATISFIED WITH THE HEA PROGRAM AND SATISFACTION IS HIGHER THAN 2021.

A significantly higher percentage of respondents were very or somewhat satisfied with the HEA program (87%) compared to last year (72%). Respondents who were satisfied with the program noted they appreciated receiving information and new suggestions on how to be energy efficient, the knowledge and professionalism of the assessor, and that the program was free. Dissatisfied customers said that they wanted a more in-depth audit, that the program didn’t help with their energy bill, and that they would like more information on other NIPSCO programs and help participating.

**Recommendations:**

- Set clear expectations about what the program does in program marketing materials, on the website, and when scheduling.
- Consider offering additional support to customers with air sealing to help customers concerned about losing heat (e.g., thermal camera analysis or blower door test offerings).
- Continue to emphasize that auditors share details on other rebate programs with participants. This could include providing additional collateral material on complementary programs or specific information on what to look for when purchasing efficient home appliances.

### CONCLUSION 4: MOST RESPONDENTS WERE SATISFIED WITH THE DIRECT-INSTALL MEASURES. SOME RESPONDENTS REPORTED NOT BEING OFFERED MEASURES.

Overall, 83% of respondents were very or somewhat satisfied with the energy savings items that were directly installed in their homes. About one-fifth of respondents reported not being offered each of the water measures. This is lower than about a third of respondents who answered similarly in 2021. More respondents reported not being offered LEDs in 2022 (28%) compared to 2021 (11%); this may be due to more customers having LEDs already installed in applicable fixtures given the shifting LED market.

**Recommendations:**

- Make sure auditors are explaining the available measures to customers and explaining why they aren't eligible to receive certain measures. Continue to ensure energy advisors are trained to offer and install all applicable measures to each customer.
- Consider reviewing or increasing the educational aspect of the direct install measures to help contractors explain to customers how these measures will save energy and money on their bill. Some customers noted they were skeptical that the installed measures would save them money on their energy bills.
- Continue to consider having the assessment team track reasons for not installing measures by adding checkboxes on the assessment form such as "customer already has efficient equipment", "customer faucets not compatible with aerators", "customer refused measure", etc. With this additional data, NIPSCO and the evaluation team can better determine how to improve the acceptance rate, if needed.

### CONCLUSION 5: RESPONDENTS PREFERRED THE IN-PERSON VISIT OPTION.

None of the respondents who reported they were not offered a choice in assessment type would have preferred to receive a virtual assessment. Auditors also strongly prefer the in-person visit option.

Recommendations:

- Continue to focus efforts on the in-person visit but offer virtual options on a case-by-case basis due to health and safety issues.

### CONCLUSION 6: CONSIDER ENHANCED OFFERINGS TO UNLOCK GREATER ENERGY SAVINGS, ESPECIALLY WITH REGULATORY CHANGES REDUCING SAVINGS FOR LIGHTING MEASURES IN UPCOMING PROGRAM YEARS.

On April 26, 2022, the U.S. Department of Energy (DOE) issued an enforcement notice that imposes the lighting backstop, a date by which certain general service lamps (GSLs) will no longer be legally manufactured or imported into the United States. This backstop expands to all screw-based lighting, including specialty and reflector lamps currently offered through Indiana utility programs. This backstop will functionally eliminate screw-in incandescent and halogen lamps from the market, likely in the first half of 2023, raising the efficiency baseline for available lighting in the market. As HEA is a direct-install program, which replaced inefficient lights currently installed in homes, the evaluation team recommends that HEA continue early-replacing inefficient lights in customers' homes (with reduced measure life assumptions) through 2023, but that this option will likely be exhausted by 2024. Additionally, an increasing number of customers are indicating that they already have LEDs. Though most customers were satisfied with the direct install measures, the program could look to provide enhanced incentives for additional measures and/or weatherization to unlock deeper savings.

**Recommendations:**

- Consider adding new measures or adjusting current measures to increase participation and savings.
- Consider whether low-flow handheld showerheads are a cost-effective measure that could be added to the program, to make them available to more customers.
- Consider whether the program could cost-effectively incorporate enhanced audit practices, such as thermal camera analyses or blower door tests, to encourage more customers to take on home weatherization projects.
- Consider if there are opportunities to optimize the incentive to pursue attic insulation to help more customers be able to afford it (e.g., promoting federal tax credits and other incentives).

# 6. INCOME-QUALIFIED WEATHERIZATION (IQW) PROGRAM

## PROGRAM DESIGN AND DELIVERY

Through the Income-Qualified Weatherization (IQW) program, NIPSCO provides a Comprehensive Home Assessment (CHA) and direct installations of energy efficiency measures to income-qualified, single-family homeowners or renters (with landlord approval). To participate in IQW, a customer must have an active NIPSCO natural gas and/or electric account, must not have previously participated in the Home Energy Assessment (HEA) program or IQW program with NIPSCO in the past three years at the same address. Customers must also be income-qualified. To be income-qualified, the NIPSCO account holder must receive one of the following or the total household income must be at or below 200% of current federal poverty guidelines:

- Low-income Home Energy Assistance (LIHEAP or EAP), or
- Temporary Assistance for Needy Families (TANF), or
- Supplemental Security Income (SSI).

Additionally, customers can be income-qualified even if they do not receive the above assistance but have a household income at or below 200% of federal poverty guidelines. Income qualified residents of manufactured homes/mobile homes are also eligible, but the home must be individually metered.

TRC administers the IQW program and is responsible for program design and management, processing incentive payments, quality assurance and quality control (QA/QC), technical training, and providing subcontractor support to facilitate the quality installation of energy efficiency measures. TRC partners with subcontractors Threshold Energy Solutions and Appliance Recycling Center of American (ARCA) to implement the IQW program. TRC trains the subcontractors to ensure that work quality and customer service meet program standards. Threshold performs the in-home assessments and direct installation of measures. ARCA is responsible for managing a call center to handle customer calls, scheduling refrigerator replacement appointments, delivering and installing the new refrigerator, proper removal and disposal of the old refrigerator, and providing customers with the owner's manual and warranty information for their new refrigerator.

TRC markets the program through a variety of channels including word-of-mouth, direct outreach from the utility, and posting flyers in community centers, libraries, and targeted retail stores. The implementer also engages customers through direct mail, email, program collateral, social media, and the NIPSCO website.

Energy advisors conduct the home assessment and identify any health and safety measures to be installed. Depending on the conditions and current equipment in the home, they also install any or all the following measures during the assessment visit:

- ENERGY STAR certified light bulbs (9W A-Line, 5W Candelabra, 6W Globe, 15W Par 38) – up to 22 units
- Bathroom faucet aerator (1.0 gpm) – up to 2 units
- Kitchen aerator (1.5 gpm) – up to 1 unit
- Low-flow showerhead (1.5 gpm), Shower Start (valve only), low-flow showerhead/shower start combo – any combination of measures but up to 2 units only
- Pipe wrap- up to 10 feet
- Water heater wrap (electric only) – up to 1 unit
- Duct sealing – up to $150
- Programmable thermostat- up to 1 unit

Participants may also qualify for a refrigerator replacement, air sealing, and attic insulation after the assessment, provided the baseline refrigerator, infiltration reduction, and insulation meet specific criteria.

- Air sealing: Program participants can receive an incentive toward air sealing in their homes if they can achieve at least a 20% infiltration reduction.
- Attic insulation: Participants can receive attic insulation up to R-38, replacing current insulation below R-11. They can receive up to $1,500 worth of insulation to a maximum of 1,000 sq. ft.
- Refrigerator: IQW participants with a primary refrigerator that is at least 10 years old may qualify for a refrigerator replacement. After a visual inspection, the energy advisor indicates eligibility on the application form submitted to TRC. TRC then processes the application and submits the request for the refrigerator replacement to its subcontractor, who contacts the customer to schedule a delivery date.

At the end of the assessment, the energy advisor provides a CHA report, responding to any participants' concerns that led to their participation, information about the home's existing conditions and measures installed, as well as recommendations specific to the home that may or may not be eligible for incentives through other NIPSCO programs. The report includes a few low-cost recommendations throughout, such as adjusting thermostat setpoints, installing LEDs, lowering the water heater setpoint, and installing weather stripping. The report also includes details about other NIPSCO energy efficiency programs and incentives, where applicable.

The energy advisor reviews the CHA report with the customer and discusses the findings and recommendations. This ensures that customers understand the information provided and the next steps they can take. In addition to the CHA report, TRC stated that the energy advisors also leave behind promotional materials for other programs and discuss low- or no-cost improvements homeowners can make to improve their home's efficiency.

### CHANGES FROM 2021 DESIGN

Program design remained largely the same as in 2021, except for the removal of the filter whistle measure.

## PROGRAM PERFORMANCE

In 2022, IQW fell short of program goals for electric energy savings, peak demand reduction, and natural gas energy savings. Audited savings aligned with *ex ante* savings, indicating no issues with tracking data. Verified savings were somewhat lower than claimed values due to in-service rates (ISR) of select measures. The engineering analysis completed for the *ex post* gross analysis increased electric energy savings and thermal energy savings but decreased peak demand reduction.

Table 66 summarizes savings for the full year of program performance, including program savings goals.

TABLE 66. 2022 IQW PROGRAM SAVING SUMMARY

| METRIC | GROSS SAVINGS GOAL | EX ANTE | AUDITED | VERIFIED | *EX POST* GROSS | *EX POST* NET | GROSS GOAL ACHIEVEMENT |
|---|---|---|---|---|---|---|---|
| Electric Energy Savings (kWh/yr.) | 1,523,491.86 | 554,699.08 | 554,699.08 | 540,632.18 | 566,297.28 | 566,297.28 | 37% |
| Peak Demand Reduction (kW) | 415.536 | 267.032 | 267.032 | 265.151 | 258.070 | 258.070 | 62% |
| Natural Gas Energy Savings (therms/yr.) | 323,411.94 | 204,126.94 | 204,126.94 | 197,704.62 | 209,675.17 | 209,675.17 | 65% |

Table 67 outlines the *ex post* gross and NTG adjustment factors. Note that net-to-gross (NTG) is deemed at 100%, as is common practice for income-qualified programs.

TABLE 67. 2022 IQW ADJUSTMENT FACTORS

| METRIC | REALIZATION RATE (%)[a] | FREERIDERSHIP | SPILLOVER | NTG (%)[b] |
|---|---|---|---|---|
| Electric Energy Savings (kWh/yr.) | 102% | 0% | 0% | 100% |
| Peak Demand Reduction (kW) | 97% | 0% | 0% | 100% |
| Natural Gas Energy Savings (therms/yr.) | 103% | 0% | 0% | 100% |

[a] Realization Rate is defined as *ex post* Gross savings divided by *Ex ante* savings.

[b] NTG is defined as *ex post* net savings divided by *ex post* gross savings.

Both electric and natural gas spending were below planned program budgets for Program Year 2022, due to limited participation. Table 68 lists the 2022 program budget and expenditures by fuel type.

TABLE 68. 2022 IQW PROGRAM EXPENDITURES

| FUEL | PROGRAM BUDGET | PROGRAM EXPENDITURES | BUDGET SPENT (%) |
|---|---|---|---|
| Electric | $1,133,565.22 | $556,651.47 | 49% |
| Natural Gas | $1,978,842.05 | $1,153,461.44 | 58% |

## EVALUATION METHODOLOGY

To inform the 2022 NIPSCO impact and process evaluation, the evaluation team completed the following research activities:

- **Program staff interviews and discussions,** to understand the program process, delivery, and design.
- **Documentation and materials review,** to provide context on program implementation.
- **Tracking data analysis**, to audit and verify the accuracy of program participation data.
- **Engineering analysis**, to review program savings assumptions and algorithms for reasonableness and accuracy.
- **Telephone and web survey of IQW participants**, to understand source of awareness, reasons for participation, experience with IQW, satisfaction with the program, and program impacts on customers.
- **Auditor interviews**, to understand their perspectives on customer experiences and barriers to participation.
- **Census data mapping**, to identify geographic areas for targeting outreach.

## IMPACT EVALUATION

The evaluation team completed the impact evaluation to answer the following research questions:

- What assumptions were used to develop savings estimates? Are there any updates that should be made?
- What are ex post program savings? Do these suggest any needed updates to program design, delivery, or savings assumptions?

For all measure types, the evaluation team compared its engineering calculations to NIPSCO's *ex ante* savings, basing its savings methodologies and inputs for each measure on several sources: standard engineering practices, the 2015 Indiana TRM (v2.2), the Illinois TRM (v10.0) and NIPSCO's program tracking database.[17] It should be noted that prior to this evaluation year, the evaluation team used the Indiana TRM as our primary source and supplemented with other sources as needed. The Indiana TRM is out-of-date, and currently in the process of being updated to align more closely with the Illinois TRM. After discussions with NIPSCO, the evaluation team felt it would be best practice to use the Illinois TRM as our primary source while the Indiana TRM is in the process of being updated, as the Illinois TRM is updated annually and should align closely with the new version of the Indiana TRM.

## AUDITED AND VERIFIED SAVINGS

To develop an audited measure quantity and savings, the evaluation team first checked the implementer tracking data for duplicates or other data quality issues and ensured documented deemed savings were applied correctly. The evaluation team also looked for any discrepancies between program tracking data and the program scorecard, but ultimately did not identify any issues during the tracking data audit.

The evaluation team established ISRs for all IQW measures using a combination of results from the 2022 participant survey. Table 69 lists the ISRs and their sources for all program-installed measures.

TABLE 69. 2022 IQW PROGRAM IN-SERVICE RATES RATIOS BY MEASURE

| MEASURE | ISR | SOURCE |
|---|---|---|
| Air Sealing | 100% | 2022 IQW Survey |
| Assessment Recommendations | 92% | 2022 IQW Survey |
| Attic Insulation | 100% | 2022 IQW Survey |
| Bathroom Aerator | 96% | 2022 IQW Survey |
| Duct Sealing | 100% | 2022 IQW Survey |
| Kitchen Aerator | 93% | 2022 IQW Survey |
| LED | 97% | 2022 IQW Survey |
| Pipe Wrap | 89% | 2022 IQW Survey |
| Refrigerator | 100% | 2022 IQW Survey |
| Low-flow Showerhead | 86% | 2022 IQW Survey |
| Programmable Thermostat | 76% | 2022 IQW Survey |

The ISRs fall below 100% since respondents report removing items after the program installed them. The ISR for assessment recommendations is based on the number of survey respondents who indicated they received an assessment report.

Table 70 summarizes the tracking data quantity, audited quantity, applied installation rates, and resulting verified quantity per measure. To calculate the verified measure quantity, the evaluation team multiplied the audited measure quantity by the installation rate.

[17] Cadmus. *Indiana Technical Reference Manual Version 2.2*. July 28, 2015.

TABLE 70. 2022 IQW PROGRAM AUDITED & VERIFIED QUANTITIES

| MEASURE | UNIT OF MEASURE | AUDITED QUANTITY | ISR | VERIFIED QUANTITY |
|---|---|---|---|---|
| Air Sealing - Electric Cooling and Gas Heating Savings | Home | 249 | 100% | 249 |
| Air Sealing - Electric Cooling and Heating Savings | Home | 8 | 100% | 8 |
| Air Sealing - Electric Cooling Only Savings | Home | 1 | 100% | 1 |
| Air Sealing - Gas Heating Only Savings (Combo Customer) | Home | 21 | 100% | 21 |
| Air Sealing - Gas Heating Only Savings (Gas Only Customer) | Home | 60 | 100% | 60 |
| Assessment Recommendations - Electric and Gas Savings | Home | 651 | 92% | 599 |
| Assessment Recommendations - Electric Only | Home | 17 | 92% | 16 |
| Assessment Recommendations - Gas Only | Home | 225 | 92% | 207 |
| Attic Insulation (Uninsulated Hatch) - Electric Cooling and Gas Heating Savings | Per ksf | 235 | 100% | 235 |
| Attic Insulation (Uninsulated Hatch) - Electric Cooling and Heating Savings | Per ksf | 5 | 100% | 5 |
| Attic Insulation (Uninsulated Hatch) - Electric Cooling Only Savings | Per ksf | 1 | 100% | 1 |
| Attic Insulation (Uninsulated Hatch) - Gas Heating Only Savings (Combo Customer) | Per ksf | 18 | 100% | 18 |
| Attic Insulation (Uninsulated Hatch) - Gas Heating Only Savings (Gas Only Customer) | Per ksf | 48 | 100% | 48 |
| Bathroom Aerator 1.0 gpm - Electric | Aerator | 24 | 96% | 23 |
| Bathroom Aerator 1.0 gpm - Gas | Aerator | 275 | 96% | 265 |
| Duct Sealing Package - Electric Cooling and Gas Heating Savings | Home | 456 | 100% | 456 |
| Duct Sealing Package - Electric Cooling and Heating Savings | Home | 2 | 100% | 2 |
| Duct Sealing Package - Electric Cooling Only Savings | Home | 9 | 100% | 9 |
| Duct Sealing Package - Gas Heating Only Savings | Home | 322 | 100% | 322 |
| Kitchen Aerator 1.5 gpm - Electric | Aerator | 17 | 93% | 16 |
| Kitchen Aerator 1.5 gpm - Gas | Aerator | 250 | 93% | 233 |
| A-Line LEDs - Electric and Gas Savings | Lamp | 4,867 | 97% | 4,724 |
| A-Line LEDs - Electric Only Savings | Lamp | 115 | 97% | 112 |
| Candelabra LEDs - Electric and Gas Savings | Lamp | 1,417 | 97% | 1,375 |
| Candelabra LEDs - Electric Only Savings | Lamp | 35 | 97% | 34 |
| Globe LEDs - Electric and Gas Savings | Lamp | 947 | 97% | 919 |
| Globe LEDs - Electric Only Savings | Lamp | 18 | 97% | 17 |
| PAR38 LEDs - Electric and Gas Savings | Lamp | 425 | 97% | 413 |
| PAR38 LEDs - Electric Only Savings | Lamp | 4 | 97% | 4 |
| Pipe Wrap - Electric (per foot) | Per foot | 323 | 89% | 287 |
| Pipe Wrap - Gas (per foot) | Per foot | 4,917 | 89% | 4,371 |
| ENERGY STAR Refrigerator replace non-ENERGY STAR refrigerator (Old Model Year: <1993, New Capacity: 18 CF) - ARCA | Refrigerator | 3 | 100% | 3 |
| ENERGY STAR Refrigerator replace non-ENERGY STAR refrigerator (Old Model Year: <1993, New Capacity: 20 CF) - ARCA | Refrigerator | 1 | 100% | 1 |
| ENERGY STAR Refrigerator replace non-ENERGY STAR refrigerator (Old Model Year: 1993-2010, New Capacity: 14 CF) - ARCA | Refrigerator | 1 | 100% | 1 |
| ENERGY STAR Refrigerator replace non-ENERGY STAR refrigerator (Old Model Year: 1993-2010, New Capacity: 16 CF) - ARCA | Refrigerator | 10 | 100% | 10 |

| MEASURE | UNIT OF MEASURE | AUDITED QUANTITY | ISR | VERIFIED QUANTITY |
|---|---|---|---|---|
| ENERGY STAR Refrigerator replace non-ENERGY STAR refrigerator (Old Model Year: 1993-2010, New Capacity: 16 CF) - HD | Refrigerator | 5 | 100% | 5 |
| ENERGY STAR Refrigerator replace non-ENERGY STAR refrigerator (Old Model Year: 1993-2010, New Capacity: 18 CF) - ARCA | Refrigerator | 73 | 100% | 73 |
| ENERGY STAR Refrigerator replace non-ENERGY STAR refrigerator (Old Model Year: 1993-2010, New Capacity: 18 CF) - HD | Refrigerator | 6 | 100% | 6 |
| ENERGY STAR Refrigerator replace non-ENERGY STAR refrigerator (Old Model Year: 1993-2010, New Capacity: 20 CF) - ARCA | Refrigerator | 35 | 100% | 35 |
| ENERGY STAR Refrigerator replace non-ENERGY STAR refrigerator (Old Model Year: 1993-2010, New Capacity: 20 CF) - HD | Refrigerator | 24 | 100% | 24 |
| Low-flow Showerhead 1.5 gpm - Electric | Showerhead | 5 | 86% | 4 |
| Low-flow Showerhead 1.5 gpm - Gas | Showerhead | 129 | 86% | 111 |
| Low-flow Showerhead with Shower Start - Electric | Showerhead with Shower Start | 7 | 86% | 6 |
| Low-flow Showerhead with Shower Start - Gas | Showerhead with Shower Start | 179 | 86% | 154 |
| Shower Start Only - Electric | Shower Start | 2 | 86% | 2 |
| Shower Start Only - Gas | Shower Start | 14 | 86% | 12 |
| Programmable Thermostat - Electric Cooling and Gas Heating Savings | Thermostat | 150 | 76% | 114 |
| Programmable Thermostat - Electric Cooling Only Savings | Thermostat | 3 | 76% | 2 |
| Programmable Thermostat - Gas Heating Only Savings | Thermostat | 118 | 76% | 90 |
| | | 16,727 | | 15,704 |

## *EX POST* GROSS SAVINGS

The evaluation team reviewed the program's *ex ante* assumptions, sources, and algorithms for reasonableness and updates. Below are detailed *ex post* gross analysis results.

### ENGINEERING REVIEWS

The evaluation team primarily referred to the Indiana TRM (v2.2) and the Illinois TRM (v10) for variable assumptions to calculate *ex post* gross electric energy savings, demand reduction, and natural gas savings. Where appropriate, the evaluation team referenced the Illinois TRM for PY2022 analysis, as it is updated annually. The IN TRM (v2.2) was referenced for geographic or weather-specific inputs. The evaluation team revised assumptions for savings estimates applicable to the NIPSCO service territory, as needed. *Appendix 4* contains more details on the specific algorithms, variable assumptions, and references for the program measure *ex post* gross calculations.

Through the engineering review, the evaluation team identified notable differences between *ex ante* and *ex post* gross savings for faucet aerator, showerhead, showerstart, pipe wrap measures, programmable thermostat, and attic insulation measures. These differences were primarily driven by the following overarching factors:

- For faucet aerator and showerhead/showerstart measures, the evaluation team updated inputs from the IL TRM (v10), which adjusted realization rates downwards. The most impactful changes were the updates to the baseline and low-flow GPM values.
- Pipe wrap *ex ante* savings used input values from the IN TRM (v2.2), whereas *ex post* calculations used values from the IL TRM (v10). The largest changes came from differing pre- and post-installation insulation values which resulted in higher realization rates.
- *Ex ante* programmable thermostat therms savings were lower in the *ex post* savings because of heating hours informed by 2021 average HVAC usage.
- *Ex ante* attic insulation measures use averaged deemed values from the 2019 and 2020 EM&V plan. *Ex post* values are calculated using insulation assumptions and IN TRM (v2.2) deemed per thousand square feet values. This caused a discrepancy with demand savings.

Minor differences between *ex ante* and *ex post* gross savings were uncovered for most measures. These differences were driven by the following factors:

- The evaluation team calculated *ex post* gross savings using updated sources, including data from the 2022 survey as well as the Illinois TRM (v10). The planning and reporting assumptions NIPSCO used to calculate *ex ante* savings referenced the Indiana TRM (v2.2) and the 2019 Evaluation, Measurement, and Verification (EM&V) results, and sometimes included an average of the savings values provided in each source.
- The evaluation team used the installation zip code to match each customer to the closest city from the Indiana TRM (v2.2)—for example, South Bend and Fort Wayne—to more precisely account for variations in climate for measures including LED bulbs, faucet aerators, low-flow showerheads, duct sealing, and attic insulation.
- *Ex ante* refrigerator replacement savings used TRC data from 2019 to inform the existing unit energy usage, while *ex post* used the IL TRM (v10) and a baseline assumption of an inefficient unit, either existing in the home (early replacement) or being purchased or acquired via the secondary market. Realization rates for refrigerators replacing <1993 were low due to a lower *ex post* baseline assumption. *Ex ante* and *ex post* savings for refrigerators replacing 1993 – 2010 were closely aligned.

## *EX POST* GROSS SAVINGS

Table 71 shows the *ex ante* deemed savings and *ex post* gross per-measure savings for 2022 IQW program measures.

TABLE 71. 2022 IQW PROGRAM EX ANTE & EX POST GROSS PER-MEASURE SAVINGS VALUES

| MEASURE | UNIT OF MEASURE | *EX ANTE* DEEMED SAVINGS | | | *EX POST* GROSS PER-MEASURE SAVINGS | | |
|---|---|---|---|---|---|---|---|
| | | KWH | KW | THERMS | KWH | KW | THERMS |
| Air Sealing - Electric Cooling and Gas Heating Savings | Home | 83.76 | 0.043 | 98.54 | 85.81 | 0.044 | 100.96 |
| Air Sealing - Electric Cooling and Heating Savings | Home | 1,966.71 | 0.109 | 0.00 | 2,014.97 | 0.112 | 0.00 |
| Air Sealing - Electric Cooling Only Savings | Home | 80.93 | 0.126 | 0.00 | 82.91 | 0.129 | 0.00 |
| Air Sealing - Gas Heating Only Savings (Combo Customer) | Home | 53.89 | 0.000 | 113.19 | 55.22 | 0.000 | 115.97 |

| MEASURE | UNIT OF MEASURE | *EX ANTE* DEEMED SAVINGS | | | *EX POST* GROSS PER-MEASURE SAVINGS | | |
|---|---|---|---|---|---|---|---|
| | | KWH | KW | THERMS | KWH | KW | THERMS |
| Air Sealing - Gas Heating Only Savings (Gas Only Customer) | Home | 0.00 | 0.000 | 113.19 | 0.00 | 0.000 | 115.97 |
| Assessment Recommendations - Electric and Gas Savings | Home | 21.60 | 0.012 | 2.74 | 21.60 | 0.012 | 2.74 |
| Assessment Recommendations - Electric Only | Home | 21.60 | 0.012 | 0.00 | 21.60 | 0.012 | 0.00 |
| Assessment Recommendations - Gas Only | Home | 0.00 | 0.000 | 2.74 | 0.00 | 0.000 | 2.74 |
| Attic Insulation (Uninsulated Hatch) - Electric Cooling and Gas Heating Savings | Per ksf | 237.50 | 0.150 | 207.00 | 235.87 | 0.103 | 206.93 |
| Attic Insulation (Uninsulated Hatch) - Electric Cooling and Heating Savings | Per ksf | 4,942.52 | 0.068 | 0.00 | 4942.52 | 0.060 | 0.00 |
| Attic Insulation (Uninsulated Hatch) - Electric Cooling Only Savings | Per ksf | 204.08 | 0.116 | 0.00 | 236.05 | 0.102 | 0.00 |
| Attic Insulation (Uninsulated Hatch) - Gas Heating Only Savings (Combo Customer) | Per ksf | 102.15 | 0.000 | 210.31 | 102.23 | 0.000 | 209.91 |
| Attic Insulation (Uninsulated Hatch) - Gas Heating Only Savings (Gas Only Customer) | Per ksf | 0.00 | 0.000 | 210.31 | 0.00 | 0.000 | 212.00 |
| Bathroom Aerator 1.0 gpm - Electric | Aerator | 32.18 | 0.003 | 0.00 | 20.63 | 0.002 | 0.00 |
| Bathroom Aerator 1.0 gpm - Gas | Aerator | 0.00 | 0.000 | 1.38 | 0.00 | 0.000 | 0.89 |
| Duct Sealing Package - Electric Cooling and Gas Heating Savings | Home | 118.97 | 0.354 | 93.96 | 121.02 | 0.354 | 94.14 |
| Duct Sealing Package - Electric Cooling and Heating Savings | Home | 1,189.56 | 0.354 | 0.00 | 1,189.00 | 0.354 | 0.00 |
| Duct Sealing Package - Electric Cooling Only Savings | Home | 49.02 | 0.112 | 0.00 | 119.39 | 0.354 | 0.00 |
| Duct Sealing Package - Gas Heating Only Savings | Home | 0.00 | 0.000 | 93.63 | 0.00 | 0.000 | 94.27 |
| Kitchen Aerator 1.5 gpm - Electric | Aerator | 182.12 | 0.008 | 0.00 | 199.15 | 0.006 | 0.00 |
| Kitchen Aerator 1.5 gpm - Gas | Aerator | 0.00 | 0.000 | 7.95 | 0.00 | 0.000 | 8.56 |
| A-Line LEDs - Electric and Gas Savings | Lamp | 28.52 | 0.004 | 0.00 | 28.51 | 0.004 | 0.00 |
| A-Line LEDs - Electric Only Savings | Lamp | 28.42 | 0.004 | 0.00 | 28.44 | 0.004 | 0.00 |
| Candelabra LEDs - Electric and Gas Savings | Lamp | 29.35 | 0.004 | 0.00 | 29.78 | 0.004 | 0.00 |
| Candelabra LEDs - Electric Only Savings | Lamp | 29.26 | 0.004 | 0.00 | 29.72 | 0.004 | 0.00 |
| Globe LEDs - Electric and Gas Savings | Lamp | 28.52 | 0.004 | 0.00 | 28.51 | 0.004 | 0.00 |
| Globe LEDs - Electric Only Savings | Lamp | 28.42 | 0.004 | 0.00 | 28.15 | 0.004 | 0.00 |
| PAR38 LEDs - Electric and Gas Savings | Lamp | 103.24 | 0.014 | 0.00 | 88.08 | 0.012 | 0.00 |
| PAR38 LEDs - Electric Only Savings | Lamp | 103.24 | 0.014 | 0.00 | 88.08 | 0.012 | 0.00 |
| Pipe Wrap - Electric (per foot) | Per foot | 24.82 | 0.003 | 0.00 | 138.59 | 0.016 | 0.00 |
| Pipe Wrap - Gas (per foot) | Per foot | 0.00 | 0.000 | 1.11 | 0.00 | 0.000 | 5.94 |
| ENERGY STAR Refrigerator replace non-ENERGY STAR refrigerator (Old | Refrigerator | 1,487.33 | 0.218 | 0.00 | 471.65 | 0.071 | 0.00 |

| MEASURE | UNIT OF MEASURE | *EX ANTE* DEEMED SAVINGS | | | *EX POST* GROSS PER-MEASURE SAVINGS | | |
|---|---|---|---|---|---|---|---|
| | | KWH | KW | THERMS | KWH | KW | THERMS |
| Model Year: <1993, New Capacity: 18 CF) - ARCA | | | | | | | |
| ENERGY STAR Refrigerator replace non-ENERGY STAR refrigerator (Old Model Year: <1993, New Capacity: 20 CF) - ARCA | Refrigerator | 1,618.24 | 0.238 | 0.00 | 532.39 | 0.080 | 0.00 |
| ENERGY STAR Refrigerator replace non-ENERGY STAR refrigerator (Old Model Year: 1993-2010, New Capacity: 14 CF) - ARCA | Refrigerator | 395.94 | 0.058 | 0.00 | 400.96 | 0.060 | 0.00 |
| ENERGY STAR Refrigerator replace non-ENERGY STAR refrigerator (Old Model Year: 1993-2010, New Capacity: 16 CF) - ARCA | Refrigerator | 396.73 | 0.058 | 0.00 | 421.11 | 0.064 | 0.00 |
| ENERGY STAR Refrigerator replace non-ENERGY STAR refrigerator (Old Model Year: 1993-2010, New Capacity: 16 CF) - HD | Refrigerator | 379.94 | 0.056 | 0.00 | 421.11 | 0.064 | 0.00 |
| ENERGY STAR Refrigerator replace non-ENERGY STAR refrigerator (Old Model Year: 1993-2010, New Capacity: 18 CF) - ARCA | Refrigerator | 441.26 | 0.065 | 0.00 | 438.54 | 0.066 | 0.00 |
| ENERGY STAR Refrigerator replace non-ENERGY STAR refrigerator (Old Model Year: 1993-2010, New Capacity: 18 CF) - HD | Refrigerator | 439.87 | 0.065 | 0.00 | 450.26 | 0.068 | 0.00 |
| ENERGY STAR Refrigerator replace non-ENERGY STAR refrigerator (Old Model Year: 1993-2010, New Capacity: 20 CF) - ARCA | Refrigerator | 470.73 | 0.070 | 0.00 | 499.28 | 0.075 | 0.00 |
| ENERGY STAR Refrigerator replace non-ENERGY STAR refrigerator (Old Model Year: 1993-2010, New Capacity: 20 CF) - HD | Refrigerator | 473.62 | 0.070 | 0.00 | 480.42 | 0.072 | 0.00 |
| Low-flow Showerhead 1.5 gpm - Electric | Showerhead | 310.61 | 0.017 | 0.00 | 138.43 | 0.002 | 0.00 |
| Low-flow Showerhead 1.5 gpm - Gas | Showerhead | 0.00 | 0.000 | 13.51 | 0.00 | 0.000 | 5.89 |
| Low-flow Showerhead with Shower Start - Electric | Showerhead with Shower Start | 357.86 | 0.066 | 0.00 | 167.68 | 0.002 | 0.00 |
| Low-flow Showerhead with Shower Start - Gas | Showerhead with Shower Start | 0.00 | 0.000 | 15.57 | 0.00 | 0.000 | 7.20 |
| Shower Start Only - Electric | Shower Start | 82.84 | 0.007 | 0.00 | 46.83 | 0.007 | 0.00 |
| Shower Start Only - Gas | Shower Start | 0.00 | 0.000 | 3.60 | 0.00 | 0.000 | 2.03 |
| Programmable Thermostat - Electric Cooling and Gas Heating Savings | Thermostat | 99.88 | 0.000 | 75.09 | 110.45 | 0.000 | 34.73 |
| Programmable Thermostat - Electric Cooling Only Savings | Thermostat | 99.88 | 0.000 | 0.00 | 110.45 | 0.000 | 0.00 |
| Programmable Thermostat - Gas Heating Only Savings | Thermostat | 0.00 | 0.000 | 74.66 | 0.00 | 0.000 | 34.73 |

Table 72 highlights notable differences between *ex ante* and *ex post* gross estimates.

TABLE 72. 2022 IQW NOTABLE DIFFERENCES BETWEEN *EX ANTE* & EX POST *GROSS*

| MEASURE | *EX ANTE* SOURCES AND ASSUMPTIONS | *EX POST* GROSS SOURCES AND ASSUMPTIONS | PRIMARY REASONS FOR DIFFERENCES |
|---|---|---|---|
| PAR38 LED | *Ex ante* savings are based on the Indiana TRM (v2.2). Baseline wattage Hours per TRM. WHF values assume weighted average from South Bend per TRM tables. | *Ex post* savings are based on the Indiana TRM (v2.2), the UMP, and information in program tracking data. Efficient wattage is based on the actual bulb wattage. Baseline wattage value per the EISA guidelines and WHFs averaged across customer location, per customer type. | Discrepancies in baseline wattage. |
| Faucet Aerator | *Ex ante* savings are based on the Indiana TRM (v2.2). | *Ex post* savings are based on the Indiana TRM (v2.2) and the Illinois TRM (v10). The IL TRM was used for values that don't change from state to state and the IN TRM was used for state specific values (incoming water temperature, people per household, coincidence factor, and hours). | Differing values between the IL and IN TRMs. |
| Low-Flow Showerhead | *Ex ante* savings are based on the Indiana TRM (v2.2). | *Ex post* savings are based on the Illinois TRM (v10) for all inputs besides shower events per day which is based on the 2022 NIPSCO survey and water temperature (IN TRM v2.2). | GPM assumptions, shower events per day, recovery efficiency for gas water heaters, and showerheads per household. |
| Showerstart | *Ex ante* savings are based on the IL TRM (v10). | *Ex post* savings are based on the Illinois TRM (v10) for all inputs besides shower events per day which is based on the 2022 NIPSCO survey and water temperature (IN TRM v2.2). | GPM assumptions, shower events per day, recovery efficiency for gas water heaters, and showerheads per household. |
| Pipe Wrap | Average of Indiana TRM (v2.2) and 2015 EM&V savings values for natural gas and electric water heaters. | Illinois TRM (v10) used for all inputs. | Bare pipe and insulation R-values. |
| Programmable Thermostat | *Ex ante* savings based off the Indiana TRM (v2.2) for all inputs. | *Ex post* savings use the IN TRM (v2.2) algorithm with 2021 HVAC average inputs. | Discrepancy in EFLH for heating. |
| Refrigerator Replacement | *Ex ante* savings are based off historical electricity usage data. | *Ex post* savings are based off the actual refrigerator specs, the IL TRM (v10), and tracking data. | *Ex ante* savings assume existing models (pre 1993) are significantly less efficient than the IL TRM (v10). |
| Attic Insulation | *Ex ante* savings are based off 2019 and 2020 EM&V results. | *Ex post* savings are calculated using IN TRM (v2.2) algorithms and appendix data alongside 2019 survey data. | *Ex ante* demand savings differ from *ex post* due to *ex post* using prior program averages. |

### WASTE HEAT FACTOR – THERM PENALTIES

Consistent with the 2021 evaluation year, the evaluation team is not including therm penalties when calculating evaluated savings for the 2022 IQW program. However, cost-effectiveness results for both the gas and electric programs will include these penalties. The evaluation team believes this approach is appropriate, as it accounts for the penalty on the electric side (where it is generated) and allows the evaluation team to show gas program performance and measure performance more clearly.

These values are not included in the *ex post* analysis and the evaluation team is reporting these below, to be used in the cost-effectiveness analysis. The *ex* ante therm penalty from lighting measures totaled -5,119.07 therms (from tracking data). In total, the therm penalty for cost-effectiveness analysis is -5,014.41 therms (Table 73).

TABLE 73. 2022 IQW PROGRAM WASTE HEAT FACTOR THERM PENALTY

| MEASURE | WASTE HEAT FACTOR THERM PENALTY |
|---|---|
| A-Line LEDs - Dual Fuel | (2,835.81) |
| Candelabra LEDs - Dual Fuel | (862.01) |
| Globe LEDs - Dual Fuel | (551.81) |
| PAR38 LEDs – Dual Fuel | (764.78) |

## REALIZATION RATES

The next three tables (Table 74 through Table 76) show the program's *ex ante* reported savings, verified savings, and *ex post* gross savings.

TABLE 74. 2022 IQW PROGRAM *EX ANTE* & *EX POST* GROSS ELECTRIC ENERGY SAVINGS

| MEASURE | *EX ANTE* ELECTRIC ENERGY SAVINGS (kWh/yr.) | AUDITED GROSS ELECTRIC ENERGY SAVINGS (kWh/yr.) | VERIFIED GROSS ELECTRIC ENERGY SAVINGS (kWh/yr.) | *EX POST* GROSS ELECTRIC ENERGY SAVINGS (kWh/yr.) |
|---|---|---|---|---|
| Air Sealing - Electric Cooling and Gas Heating Savings | 20,856.24 | 20,856.24 | 20,856.24 | 21,367.14 |
| Air Sealing - Electric Cooling and Heating Savings | 15,733.68 | 15,733.68 | 15,733.68 | 16,119.75 |
| Air Sealing - Electric Cooling Only Savings | 80.93 | 80.93 | 80.93 | 82.91 |
| Air Sealing - Gas Heating Only Savings (Combo Customer) | 1,131.69 | 1,131.69 | 1,131.69 | 1,159.71 |
| Air Sealing - Gas Heating Only Savings (Gas Only Customer) | 0.00 | 0.00 | 0.00 | 0.00 |
| Assessment Recommendations - Electric and Gas Savings | 14,061.60 | 14,061.60 | 12,936.67 | 12,936.67 |
| Assessment Recommendations - Electric Only | 367.20 | 367.20 | 337.82 | 337.82 |
| Assessment Recommendations - Gas Only | 0.00 | 0.00 | 0.00 | 0.00 |
| Attic Insulation (Uninsulated Hatch) - Electric Cooling and Gas Heating Savings | 55,881.89 | 55,881.89 | 55,881.89 | 55,498.86 |
| Attic Insulation (Uninsulated Hatch) - Electric Cooling and Heating Savings | 24,524.78 | 24,524.78 | 24,524.78 | 24,524.80 |
| Attic Insulation (Uninsulated Hatch) - Electric Cooling Only Savings | 209.18 | 209.18 | 209.18 | 241.95 |

| MEASURE | *EX ANTE* ELECTRIC ENERGY SAVINGS (kWh/yr.) | AUDITED GROSS ELECTRIC ENERGY SAVINGS (kWh/yr.) | VERIFIED GROSS ELECTRIC ENERGY SAVINGS (kWh/yr.) | *EX POST* GROSS ELECTRIC ENERGY SAVINGS (kWh/yr.) |
|---|---|---|---|---|
| Attic Insulation (Uninsulated Hatch) - Gas Heating Only Savings (Combo Customer) | 1,856.07 | 1,856.07 | 1,856.07 | 1,857.60 |
| Attic Insulation (Uninsulated Hatch) - Gas Heating Only Savings (Gas Only Customer) | 0.00 | 0.00 | 0.00 | 0.00 |
| Bathroom Aerator 1.0 gpm - Electric | 772.32 | 772.32 | 743.74 | 476.69 |
| Bathroom Aerator 1.0 gpm - Gas | 0.00 | 0.00 | 0.00 | 0.00 |
| Duct Sealing Package - Electric Cooling and Gas Heating Savings | 54,250.32 | 54,250.32 | 54,250.32 | 55,184.32 |
| Duct Sealing Package - Electric Cooling and Heating Savings | 2,379.12 | 2,379.12 | 2,379.12 | 2,378.00 |
| Duct Sealing Package - Electric Cooling Only Savings | 441.18 | 441.18 | 441.18 | 1,074.54 |
| Duct Sealing Package - Gas Heating Only Savings | 0.00 | 0.00 | 0.00 | 0.00 |
| Kitchen Aerator 1.5 gpm - Electric | 3,096.04 | 3,096.04 | 2,889.53 | 3,159.71 |
| Kitchen Aerator 1.5 gpm - Gas | 0.00 | 0.00 | 0.00 | 0.00 |
| A-Line LEDs - Electric and Gas Savings | 138,806.84 | 138,806.84 | 134,739.80 | 134,684.63 |
| A-Line LEDs - Electric Only Savings | 3,268.30 | 3,268.30 | 3,172.54 | 3,174.55 |
| Candelabra LEDs - Electric and Gas Savings | 41,588.95 | 41,588.95 | 40,370.39 | 40,959.53 |
| Candelabra LEDs - Electric Only Savings | 1,024.10 | 1,024.10 | 994.09 | 1,009.88 |
| Globe LEDs - Electric and Gas Savings | 27,008.44 | 27,008.44 | 26,217.09 | 26,211.80 |
| Globe LEDs - Electric Only Savings | 511.56 | 511.56 | 496.57 | 491.91 |
| PAR38 LEDs - Electric and Gas Savings | 43,877.00 | 43,877.00 | 42,591.40 | 36,337.31 |
| PAR38 LEDs - Electric Only Savings | 412.96 | 412.96 | 400.86 | 342.00 |
| Pipe Wrap - Electric (per foot) | 8,016.86 | 8,016.86 | 7,126.19 | 39,791.14 |
| Pipe Wrap - Gas (per foot) | 0.00 | 0.00 | 0.00 | 0.00 |
| ENERGY STAR Refrigerator replace non-ENERGY STAR refrigerator (Old Model Year: <1993, New Capacity: 18 CF) - ARCA | 4,461.99 | 4,461.99 | 4,461.99 | 1,414.94 |
| ENERGY STAR Refrigerator replace non-ENERGY STAR refrigerator (Old Model Year: <1993, New Capacity: 20 CF) - ARCA | 1,618.24 | 1,618.24 | 1,618.24 | 532.39 |
| ENERGY STAR Refrigerator replace non-ENERGY STAR refrigerator (Old Model Year: 1993-2010, New Capacity: 14 CF) - ARCA | 395.94 | 395.94 | 395.94 | 400.96 |
| ENERGY STAR Refrigerator replace non-ENERGY STAR refrigerator (Old Model Year: 1993-2010, New Capacity: 16 CF) - ARCA | 3,967.26 | 3,967.26 | 3,967.26 | 4,211.09 |
| ENERGY STAR Refrigerator replace non-ENERGY STAR refrigerator (Old Model Year: 1993-2010, New Capacity: 16 CF) - HD | 1,899.70 | 1,899.70 | 1,899.70 | 2,105.55 |
| ENERGY STAR Refrigerator replace non-ENERGY STAR refrigerator (Old Model Year: 1993-2010, New Capacity: 18 CF) - ARCA | 32,211.76 | 32,211.76 | 32,211.76 | 32,013.71 |
| ENERGY STAR Refrigerator replace non-ENERGY STAR refrigerator (Old Model Year: 1993-2010, New Capacity: 18 CF) - HD | 2,639.22 | 2,639.22 | 2,639.22 | 2,701.58 |

| MEASURE | *EX ANTE* ELECTRIC ENERGY SAVINGS (kWh/yr.) | AUDITED GROSS ELECTRIC ENERGY SAVINGS (kWh/yr.) | VERIFIED GROSS ELECTRIC ENERGY SAVINGS (kWh/yr.) | *EX POST* GROSS ELECTRIC ENERGY SAVINGS (kWh/yr.) |
|---|---|---|---|---|
| ENERGY STAR Refrigerator replace non-ENERGY STAR refrigerator (Old Model Year: 1993-2010, New Capacity: 20 CF) - ARCA | 16,475.45 | 16,475.45 | 16,475.45 | 17,474.94 |
| ENERGY STAR Refrigerator replace non-ENERGY STAR refrigerator (Old Model Year: 1993-2010, New Capacity: 20 CF) - HD | 11,366.88 | 11,366.88 | 11,366.88 | 11,530.06 |
| Low-flow Showerhead 1.5 gpm - Electric | 1,553.05 | 1,553.05 | 1,338.88 | 596.70 |
| Low-flow Showerhead 1.5 gpm - Gas | 0.00 | 0.00 | 0.00 | 0.00 |
| Low-flow Showerhead with Shower Start - Electric | 2,505.02 | 2,505.02 | 2,159.58 | 1,011.88 |
| Low-flow Showerhead with Shower Start - Gas | 0.00 | 0.00 | 0.00 | 0.00 |
| Shower Start Only - Electric | 165.68 | 165.68 | 142.83 | 80.75 |
| Shower Start Only - Gas | 0.00 | 0.00 | 0.00 | 0.00 |
| Programmable Thermostat - Electric Cooling and Gas Heating Savings | 14,982.00 | 14,982.00 | 11,365.35 | 12,568.14 |
| Programmable Thermostat - Electric Cooling Only Savings | 299.64 | 299.64 | 227.31 | 251.36 |
| Programmable Thermostat - Gas Heating Only Savings | 0.00 | 0.00 | 0.00 | 0.00 |
| Total Savings | 554,699.08 | 554,699.08 | 540,632.18 | 566,297.28 |
| Total Program Realization Rate | | | | 102% |

Note: Totals may not sum properly due to rounding.

## TABLE 75. 2022 IQW PROGRAM *EX ANTE* & *EX POST* GROSS PEAK DEMAND REDUCTION

| MEASURE | *EX ANTE* PEAK DEMAND REDUCTION (kW/yr.) | AUDITED GROSS PEAK DEMAND REDUCTION (kW/yr.) | VERIFIED GROSS PEAK DEMAND REDUCTION (kW/yr.) | *EX POST* GROSS PEAK DEMAND REDUCTION (kW/yr.) |
|---|---|---|---|---|
| Air Sealing - Electric Cooling and Gas Heating Savings | 10.707 | 10.707 | 10.707 | 11.061 |
| Air Sealing - Electric Cooling and Heating Savings | 0.872 | 0.872 | 0.872 | 0.894 |
| Air Sealing - Electric Cooling Only Savings | 0.126 | 0.126 | 0.126 | 0.129 |
| Air Sealing - Gas Heating Only Savings (Combo Customer) | 0.000 | 0.000 | 0.000 | 0.000 |
| Air Sealing - Gas Heating Only Savings (Gas Only Customer) | 0.000 | 0.000 | 0.000 | 0.000 |
| Assessment Recommendations - Electric and Gas Savings | 7.812 | 7.812 | 7.187 | 7.187 |
| Assessment Recommendations - Electric Only | 0.204 | 0.204 | 0.188 | 0.188 |
| Assessment Recommendations - Gas Only | 0.000 | 0.000 | 0.000 | 0.000 |
| Attic Insulation (Uninsulated Hatch) - Electric Cooling and Gas Heating Savings | 35.296 | 35.296 | 35.296 | 24.143 |
| Attic Insulation (Uninsulated Hatch) - Electric Cooling and Heating Savings | 0.337 | 0.337 | 0.337 | 0.297 |
| Attic Insulation (Uninsulated Hatch) - Electric Cooling Only Savings | 0.119 | 0.119 | 0.119 | 0.105 |
| Attic Insulation (Uninsulated Hatch) - Gas Heating Only Savings (Combo Customer) | 0.000 | 0.000 | 0.000 | 0.000 |

| MEASURE | *EX ANTE* PEAK DEMAND REDUCTION (kW/yr.) | AUDITED GROSS PEAK DEMAND REDUCTION (kW/yr.) | VERIFIED GROSS PEAK DEMAND REDUCTION (kW/yr.) | *EX POST* GROSS PEAK DEMAND REDUCTION (kW/yr.) |
|---|---|---|---|---|
| Attic Insulation (Uninsulated Hatch) - Gas Heating Only Savings (Gas Only Customer) | 0.000 | 0.000 | 0.000 | 0.000 |
| Bathroom Aerator 1.0 gpm - Electric | 0.072 | 0.072 | 0.069 | 0.036 |
| Bathroom Aerator 1.0 gpm - Gas | 0.000 | 0.000 | 0.000 | 0.000 |
| Duct Sealing Package - Electric Cooling and Gas Heating Savings | 161.424 | 161.424 | 161.424 | 161.437 |
| Duct Sealing Package - Electric Cooling and Heating Savings | 0.708 | 0.708 | 0.708 | 0.708 |
| Duct Sealing Package - Electric Cooling Only Savings | 1.008 | 1.008 | 1.008 | 3.186 |
| Duct Sealing Package - Gas Heating Only Savings | 0.000 | 0.000 | 0.000 | 0.000 |
| Kitchen Aerator 1.5 gpm - Electric | 0.136 | 0.136 | 0.127 | 0.093 |
| Kitchen Aerator 1.5 gpm - Gas | 0.000 | 0.000 | 0.000 | 0.000 |
| A-Line LEDs - Electric and Gas Savings | 19.468 | 19.468 | 18.898 | 18.341 |
| A-Line LEDs - Electric Only Savings | 0.460 | 0.460 | 0.447 | 0.433 |
| Candelabra LEDs - Electric and Gas Savings | 5.668 | 5.668 | 5.502 | 5.576 |
| Candelabra LEDs - Electric Only Savings | 0.140 | 0.140 | 0.136 | 0.138 |
| Globe LEDs - Electric and Gas Savings | 3.788 | 3.788 | 3.677 | 3.569 |
| Globe LEDs - Electric Only Savings | 0.072 | 0.072 | 0.070 | 0.068 |
| PAR38 LEDs - Electric and Gas Savings | 5.950 | 5.950 | 5.776 | 4.946 |
| PAR38 LEDs - Electric Only Savings | 0.056 | 0.056 | 0.054 | 0.047 |
| Pipe Wrap - Electric (per foot) | 0.969 | 0.969 | 0.861 | 4.539 |
| Pipe Wrap - Gas (per foot) | 0.000 | 0.000 | 0.000 | 0.000 |
| ENERGY STAR Refrigerator replace non-ENERGY STAR refrigerator (Old Model Year: <1993, New Capacity: 18 CF) - ARCA | 0.654 | 0.654 | 0.654 | 0.213 |
| ENERGY STAR Refrigerator replace non-ENERGY STAR refrigerator (Old Model Year: <1993, New Capacity: 20 CF) - ARCA | 0.238 | 0.238 | 0.238 | 0.080 |
| ENERGY STAR Refrigerator replace non-ENERGY STAR refrigerator (Old Model Year: 1993-2010, New Capacity: 14 CF) - ARCA | 0.058 | 0.058 | 0.058 | 0.060 |
| ENERGY STAR Refrigerator replace non-ENERGY STAR refrigerator (Old Model Year: 1993-2010, New Capacity: 16 CF) - ARCA | 0.584 | 0.584 | 0.584 | 0.635 |
| ENERGY STAR Refrigerator replace non-ENERGY STAR refrigerator (Old Model Year: 1993-2010, New Capacity: 16 CF) - HD | 0.280 | 0.280 | 0.280 | 0.318 |
| ENERGY STAR Refrigerator replace non-ENERGY STAR refrigerator (Old Model Year: 1993-2010, New Capacity: 18 CF) - ARCA | 4.760 | 4.760 | 4.760 | 4.829 |
| ENERGY STAR Refrigerator replace non-ENERGY STAR refrigerator (Old Model Year: 1993-2010, New Capacity: 18 CF) - HD | 0.390 | 0.390 | 0.390 | 0.407 |
| ENERGY STAR Refrigerator replace non-ENERGY STAR refrigerator (Old Model Year: 1993-2010, New Capacity: 20 CF) - ARCA | 2.435 | 2.435 | 2.435 | 2.636 |

| MEASURE | *EX ANTE* PEAK DEMAND REDUCTION (kW/yr.) | AUDITED GROSS PEAK DEMAND REDUCTION (kW/yr.) | VERIFIED GROSS PEAK DEMAND REDUCTION (kW/yr.) | *EX POST* GROSS PEAK DEMAND REDUCTION (kW/yr.) |
|---|---|---|---|---|
| ENERGY STAR Refrigerator replace non-ENERGY STAR refrigerator (Old Model Year: 1993-2010, New Capacity: 20 CF) - HD | 1.680 | 1.680 | 1.680 | 1.739 |
| Low-flow Showerhead 1.5 gpm - Electric | 0.085 | 0.085 | 0.073 | 0.007 |
| Low-flow Showerhead 1.5 gpm - Gas | 0.000 | 0.000 | 0.000 | 0.000 |
| Low-flow Showerhead with Shower Start - Electric | 0.462 | 0.462 | 0.398 | 0.013 |
| Low-flow Showerhead with Shower Start - Gas | 0.000 | 0.000 | 0.000 | 0.000 |
| Shower Start Only - Electric | 0.014 | 0.014 | 0.012 | 0.012 |
| Shower Start Only - Gas | 0.000 | 0.000 | 0.000 | 0.000 |
| Programmable Thermostat - Electric Cooling and Gas Heating Savings | 0.000 | 0.000 | 0.000 | 0.000 |
| Programmable Thermostat - Electric Cooling Only Savings | 0.000 | 0.000 | 0.000 | 0.000 |
| Programmable Thermostat - Gas Heating Only Savings | 0.000 | 0.000 | 0.000 | 0.000 |
| Total Savings | 267.032 | 267.032 | 265.151 | 258.070 |
| Total Program Realization Rate | | | | 97% |

Note: Totals may not sum properly due to rounding.

## TABLE 76. 2022 IQW PROGRAM *EX ANTE* & *EX POST* GROSS NATURAL GAS SAVINGS

| MEASURE | *EX ANTE* NATURAL GAS ENERGY SAVINGS (therms/yr.) | AUDITED GROSS NATURAL GAS ENERGY (therms/yr.) | VERIFIED GROSS NATURAL GAS ENERGY SAVINGS (therms/yr.) | *EX POST* GROSS NATURAL GAS ENERGY SAVINGS (therms/yr.) |
|---|---|---|---|---|
| Air Sealing - Electric Cooling and Gas Heating Savings | 24,536.46 | 24,536.46 | 24,536.46 | 25,137.82 |
| Air Sealing - Electric Cooling and Heating Savings | 0.00 | 0.00 | 0.00 | 0.00 |
| Air Sealing - Electric Cooling Only Savings | 0.00 | 0.00 | 0.00 | 0.00 |
| Air Sealing - Gas Heating Only Savings (Combo Customer) | 2,376.99 | 2,376.99 | 2,376.99 | 2,435.40 |
| Air Sealing - Gas Heating Only Savings (Gas Only Customer) | 6,791.40 | 6,791.40 | 6,791.40 | 6,958.28 |
| Assessment Recommendations - Electric and Gas Savings | 1,783.74 | 1,783.74 | 1,641.04 | 1,641.04 |
| Assessment Recommendations - Electric Only | 0.00 | 0.00 | 0.00 | 0.00 |
| Assessment Recommendations - Gas Only | 616.50 | 616.50 | 567.18 | 567.18 |
| Attic Insulation (Uninsulated Hatch) - Electric Cooling and Gas Heating Savings | 48,705.28 | 48,705.28 | 48,705.28 | 48,688.17 |
| Attic Insulation (Uninsulated Hatch) - Electric Cooling and Heating Savings | 0.00 | 0.00 | 0.00 | 0.00 |
| Attic Insulation (Uninsulated Hatch) - Electric Cooling Only Savings | 0.00 | 0.00 | 0.00 | 0.00 |
| Attic Insulation (Uninsulated Hatch) - Gas Heating Only Savings (Combo Customer) | 3,821.35 | 3,821.35 | 3,821.35 | 3,814.01 |
| Attic Insulation (Uninsulated Hatch) - Gas Heating Only Savings (Gas Only Customer) | 10,022.13 | 10,022.13 | 10,022.13 | 10,102.74 |
| Bathroom Aerator 1.0 gpm - Electric | 0.00 | 0.00 | 0.00 | 0.00 |
| Bathroom Aerator 1.0 gpm - Gas | 379.50 | 379.50 | 365.46 | 234.63 |

| MEASURE | *EX ANTE* NATURAL GAS ENERGY SAVINGS (therms/yr.) | AUDITED GROSS NATURAL GAS ENERGY (therms/yr.) | VERIFIED GROSS NATURAL GAS ENERGY SAVINGS (therms/yr.) | *EX POST* GROSS NATURAL GAS ENERGY SAVINGS (therms/yr.) |
|---|---|---|---|---|
| Duct Sealing Package - Electric Cooling and Gas Heating Savings | 42,845.76 | 42,845.76 | 42,845.76 | 42,926.58 |
| Duct Sealing Package - Electric Cooling and Heating Savings | 0.00 | 0.00 | 0.00 | 0.00 |
| Duct Sealing Package - Electric Cooling Only Savings | 0.00 | 0.00 | 0.00 | 0.00 |
| Duct Sealing Package - Gas Heating Only Savings | 30,148.86 | 30,148.86 | 30,148.86 | 30,354.73 |
| Kitchen Aerator 1.5 gpm - Electric | 0.00 | 0.00 | 0.00 | 0.00 |
| Kitchen Aerator 1.5 gpm - Gas | 1,987.50 | 1,987.50 | 1,854.93 | 1,996.99 |
| A-Line LEDs - Electric and Gas Savings | 0.00 | 0.00 | 0.00 | 0.00 |
| A-Line LEDs - Electric Only Savings | 0.00 | 0.00 | 0.00 | 0.00 |
| Candelabra LEDs - Electric and Gas Savings | 0.00 | 0.00 | 0.00 | 0.00 |
| Candelabra LEDs - Electric Only Savings | 0.00 | 0.00 | 0.00 | 0.00 |
| Globe LEDs - Electric and Gas Savings | 0.00 | 0.00 | 0.00 | 0.00 |
| Globe LEDs - Electric Only Savings | 0.00 | 0.00 | 0.00 | 0.00 |
| PAR38 LEDs - Electric and Gas Savings | 0.00 | 0.00 | 0.00 | 0.00 |
| PAR38 LEDs - Electric Only Savings | 0.00 | 0.00 | 0.00 | 0.00 |
| Pipe Wrap - Electric (per foot) | 0.00 | 0.00 | 0.00 | 0.00 |
| Pipe Wrap - Gas (per foot) | 5,457.87 | 5,457.87 | 4,851.50 | 25,967.16 |
| ENERGY STAR Refrigerator replace non-ENERGY STAR refrigerator (Old Model Year: <1993, New Capacity: 18 CF) - ARCA | 0.00 | 0.00 | 0.00 | 0.00 |
| ENERGY STAR Refrigerator replace non-ENERGY STAR refrigerator (Old Model Year: <1993, New Capacity: 20 CF) - ARCA | 0.00 | 0.00 | 0.00 | 0.00 |
| ENERGY STAR Refrigerator replace non-ENERGY STAR refrigerator (Old Model Year: 1993-2010, New Capacity: 14 CF) - ARCA | 0.00 | 0.00 | 0.00 | 0.00 |
| ENERGY STAR Refrigerator replace non-ENERGY STAR refrigerator (Old Model Year: 1993-2010, New Capacity: 16 CF) - ARCA | 0.00 | 0.00 | 0.00 | 0.00 |
| ENERGY STAR Refrigerator replace non-ENERGY STAR refrigerator (Old Model Year: 1993-2010, New Capacity: 16 CF) - HD | 0.00 | 0.00 | 0.00 | 0.00 |
| ENERGY STAR Refrigerator replace non-ENERGY STAR refrigerator (Old Model Year: 1993-2010, New Capacity: 18 CF) - ARCA | 0.00 | 0.00 | 0.00 | 0.00 |
| ENERGY STAR Refrigerator replace non-ENERGY STAR refrigerator (Old Model Year: 1993-2010, New Capacity: 18 CF) - HD | 0.00 | 0.00 | 0.00 | 0.00 |
| ENERGY STAR Refrigerator replace non-ENERGY STAR refrigerator (Old Model Year: 1993-2010, New Capacity: 20 CF) - ARCA | 0.00 | 0.00 | 0.00 | 0.00 |
| ENERGY STAR Refrigerator replace non-ENERGY STAR refrigerator (Old Model Year: 1993-2010, New Capacity: 20 CF) - HD | 0.00 | 0.00 | 0.00 | 0.00 |
| Low-flow Showerhead 1.5 gpm - Electric | 0.00 | 0.00 | 0.00 | 0.00 |
| Low-flow Showerhead 1.5 gpm - Gas | 1,742.79 | 1,742.79 | 1,502.46 | 654.69 |

| MEASURE | *EX ANTE* NATURAL GAS ENERGY SAVINGS (therms/yr.) | AUDITED GROSS NATURAL GAS ENERGY (therms/yr.) | VERIFIED GROSS NATURAL GAS ENERGY SAVINGS (therms/yr.) | *EX POST* GROSS NATURAL GAS ENERGY SAVINGS (therms/yr.) |
|---|---|---|---|---|
| Low-flow Showerhead with Shower Start - Electric | 0.00 | 0.00 | 0.00 | 0.00 |
| Low-flow Showerhead with Shower Start - Gas | 2,787.03 | 2,787.03 | 2,402.70 | 1,111.04 |
| Shower Start Only - Electric | 0.00 | 0.00 | 0.00 | 0.00 |
| Shower Start Only - Gas | 50.40 | 50.40 | 43.45 | 24.52 |
| Programmable Thermostat - Electric Cooling and Gas Heating Savings | 11,263.50 | 11,263.50 | 8,544.49 | 3,951.60 |
| Programmable Thermostat - Electric Cooling Only Savings | 0.00 | 0.00 | 0.00 | 0.00 |
| Programmable Thermostat - Gas Heating Only Savings | 8,809.88 | 8,809.88 | 6,683.17 | 3,108.59 |
| Total Savings | 204,126.94 | 204,126.94 | 197,704.62 | 209,675.17 |
| Total Program Realization Rate | | | | 103% |

Note: Totals may not sum properly due to rounding.

# PROCESS EVALUATION

The evaluation team completed program staff interviews, IQW auditor/installers interviews, a participant survey, and a census data mapping exercise to answer the following research questions to answer the following research questions:

- How do auditors communicate about and deliver the program to participants? How do they qualify customers for HEA vs IQW?
- What are auditors' perspectives on the program? What is working well, and where is there room for improvement?
- What are auditors' perspectives on various audit approaches, including virtual audits?
- How do participants become aware of the program? Has it changed over time?
- What drives participation in the program? Why were participants motivated to get a home energy assessment?
- What was the customer's experience with the audit like?
- How easy was it to schedule the audit and answer the questions?
- How do contractors provide findings and recommendations from the audit to the participant? How do they discuss and provide the report?
- How do customers decide to move on and install additional measures? What is their experience like?
- How useful are the information and recommendations provided through the program?
- What energy-savings actions do participants take because of the assessment, if any? Did they participate in any other programs?
- What are customer experiences with the DI measures? Are customers satisfied with the quality of work provided by the contractors?
- How satisfied were participants with the program, including the participation process, audit experience, and satisfaction with equipment received?
- How satisfied are customers with NIPSCO?
- Do participants have any recommendations for program improvement?

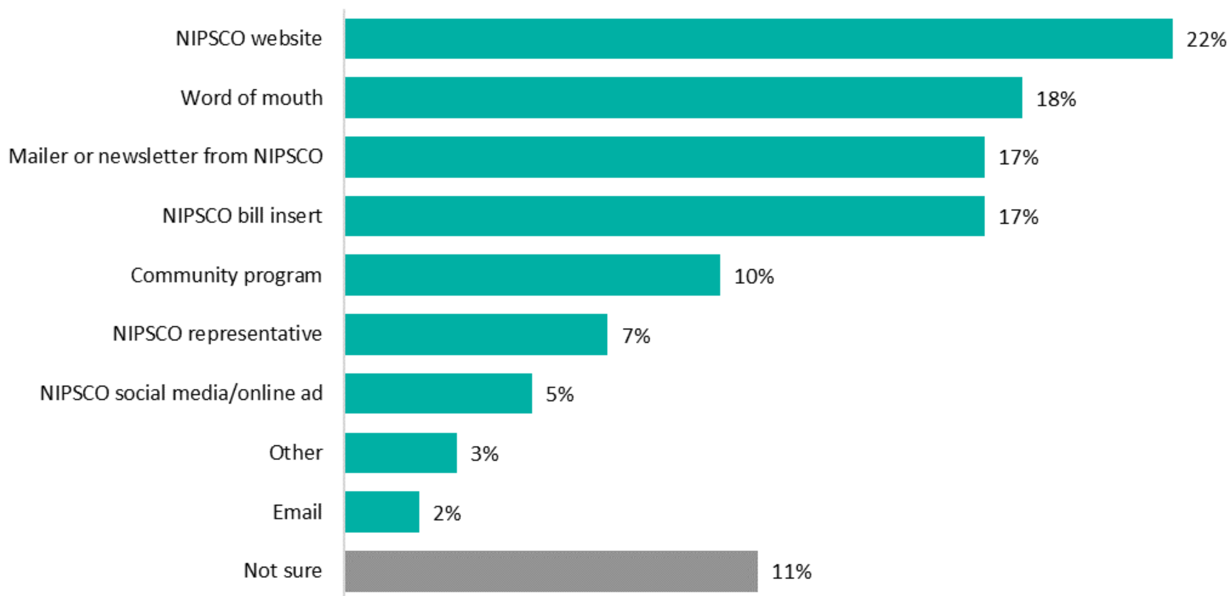
## PARTICIPANT FEEDBACK

The evaluation team invited the census of 828 program participants (from tracking data including participants from January 2022 until the end of November 2022) to complete the survey and received 100 responses. The team fielded the survey via phone and web in January 2023. The following sections describe the results related to source of awareness, reasons for participation, experience with the in-home assessment, satisfaction with the program, and program impacts on customers.

## ENERGY EFFICIENCY AWARENESS AND MARKETING

Respondents most frequently learned about IQW directly from NIPSCO (68%), through both digital and non-digital sources, including the website, bill insert, mailer/newsletter, a NIPSCO representative, or social media (Figure 37). Word-of-mouth was another common source of program awareness, like previous program years (2021, 2019, and 2018). Eleven percent of customers were not sure where they learned about the program.

FIGURE 37. HOW PARTICIPANTS LEARNED ABOUT THE IQW PROGRAM

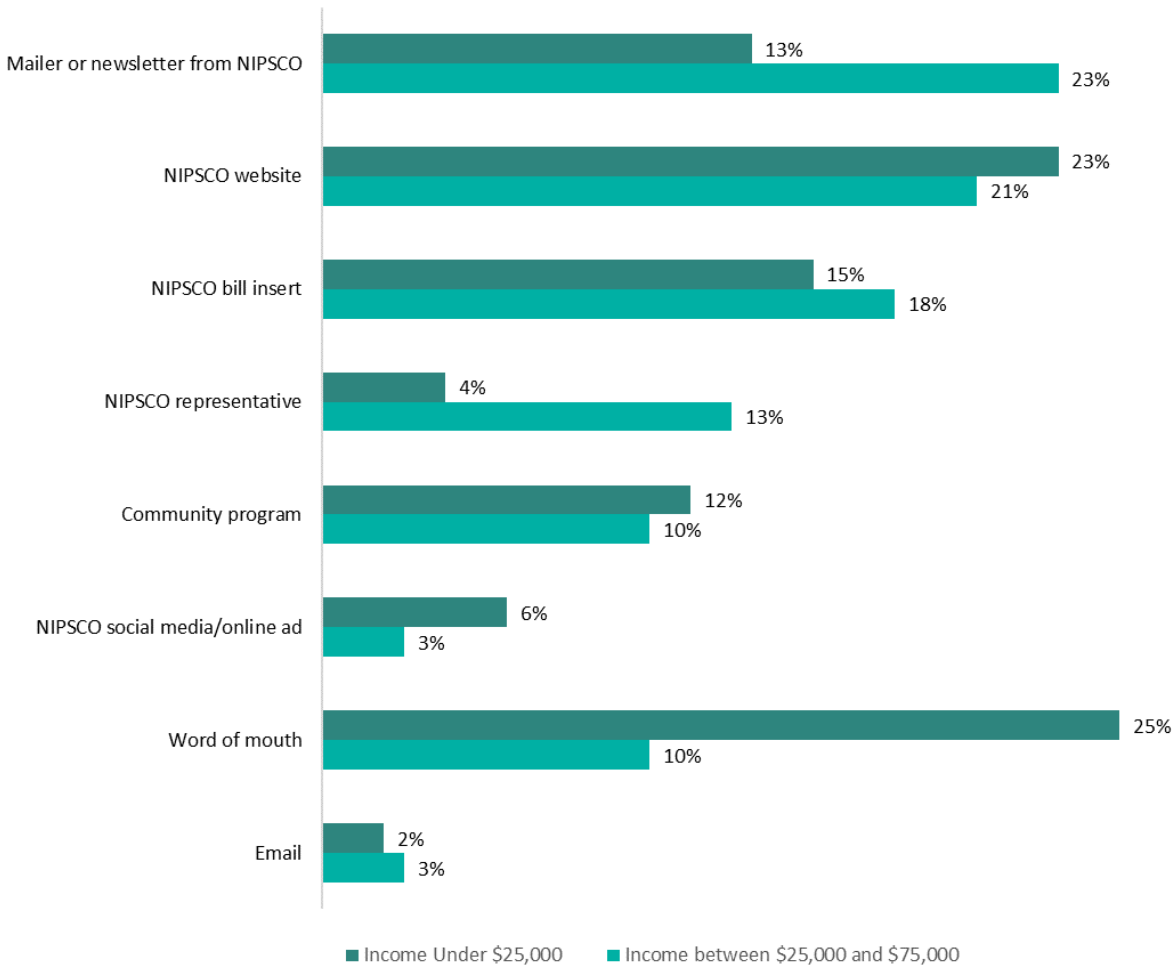



Source: Participant survey. Question: "How did you learn about NIPSCO's IQW program?" (Multiple responses allowed) (n=100)

There were differences in source of awareness between respondents born before 1980 (n=80) and those born in 1980 or later (n=15). Notably, 40% of respondents born in 1980 or later learned about the program through NIPSCO's website compared to 19% of those born before 1980. One-fifth (19%) of respondents born before 1980 learned about the program through bill inserts while none of the younger respondent group did.

There were also differences in how customers learned about the program for those with an income of below \$25,000 (n=52) compared with those with an income of \$25,000 to \$75,000 (n=39). About one quarter (23%) of customers with an income at or above \$25,000 learned about the program through a mailer or newsletter. Only 13% of those with an income less than \$25,000 learned about the program through a NIPSCO mailer or newsletter. Of those customers with an income below \$25,000, 25% learned about the program through word of mouth compared to 10% of customers with a higher income (Figure 38).

FIGURE 38. HOW PARTICIPANTS LEARNED ABOUT THE IQW PROGRAM BY INCOME LEVEL

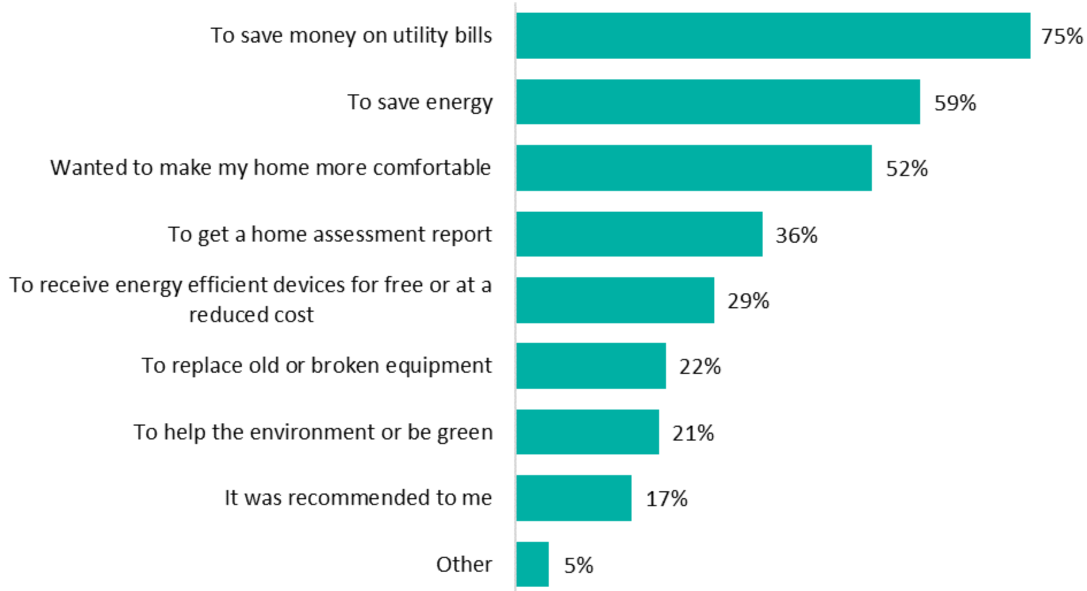



Source: Participant survey. Question: "Why did you decide to participate in NIPSCO's IQW program?" (Multiple responses allowed) (n=100)

## PARTICIPATION DRIVERS

Respondents indicated that they most often participated in the IQW program to save money on utility bills (75%), which has been the top participation driver for the last five program years. The other reasons respondents mentioned most often included saving energy (59%) and making their home more comfortable (52%) (Figure 39).

FIGURE 39. TOP REASONS FOR PARTICIPATING IN IQW PROGRAM

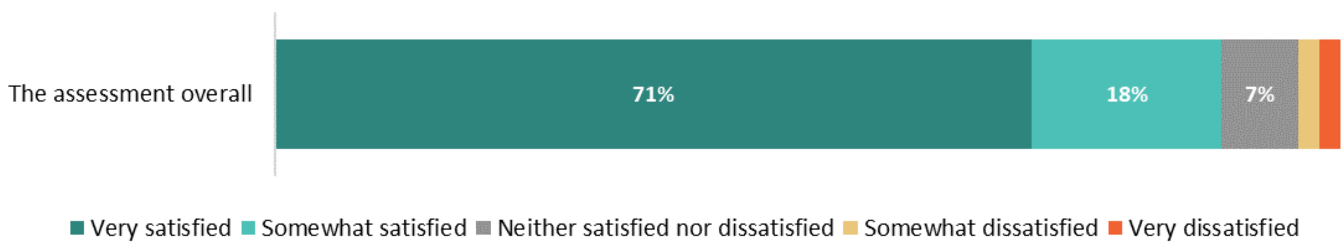



Source: Participant survey. Question: “Why did you decide to participate in NIPSCO’s IQW program?” (Multiple responses allowed) (n=100)

## ASSESSMENT EXPERIENCE AND DIRECT INSTALL MEASURE EXPERIENCE

Most respondents (89%) were very satisfied or somewhat satisfied with the assessment overall, as show in Figure 40.

FIGURE 40. ASSESSMENT SATISFACTION OVERALL

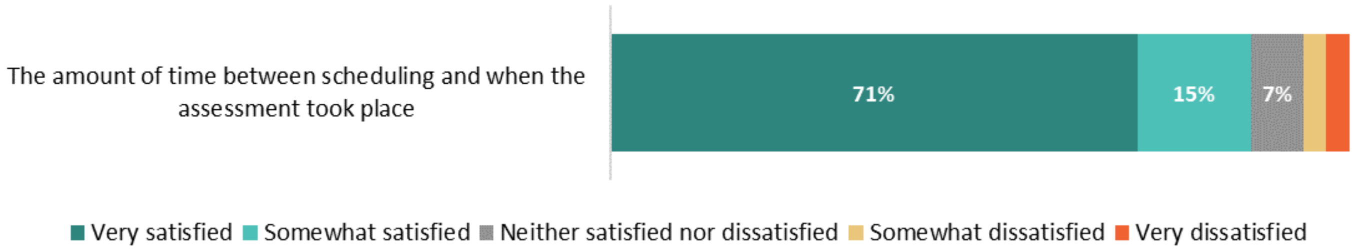



Source: Participant survey. Question: “How satisfied were you with each of the following? The in-person assessment overall.” (n=99)

### SCHEDULING EXPERIENCE

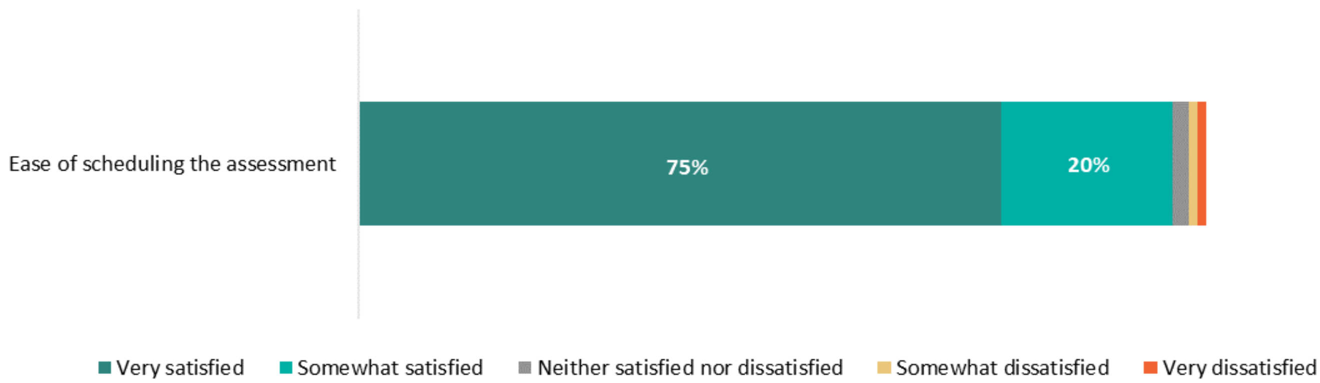
Most respondents (71%) were very satisfied with the amount of time between scheduling and when the assessment took place (Figure 41). Most respondents (95%) found the scheduling process to be very or somewhat easy (Figure 42).

FIGURE 41. SCHEDULING EXPERIENCE SATISFACTION




Source: Participant survey. Question: "How satisfied were you with each of the following? The amount of time between scheduling and when the assessment took place. (n=97)

FIGURE 42. SATISFACTION WITH EASE OF SCHEDULING ASSESSMENT

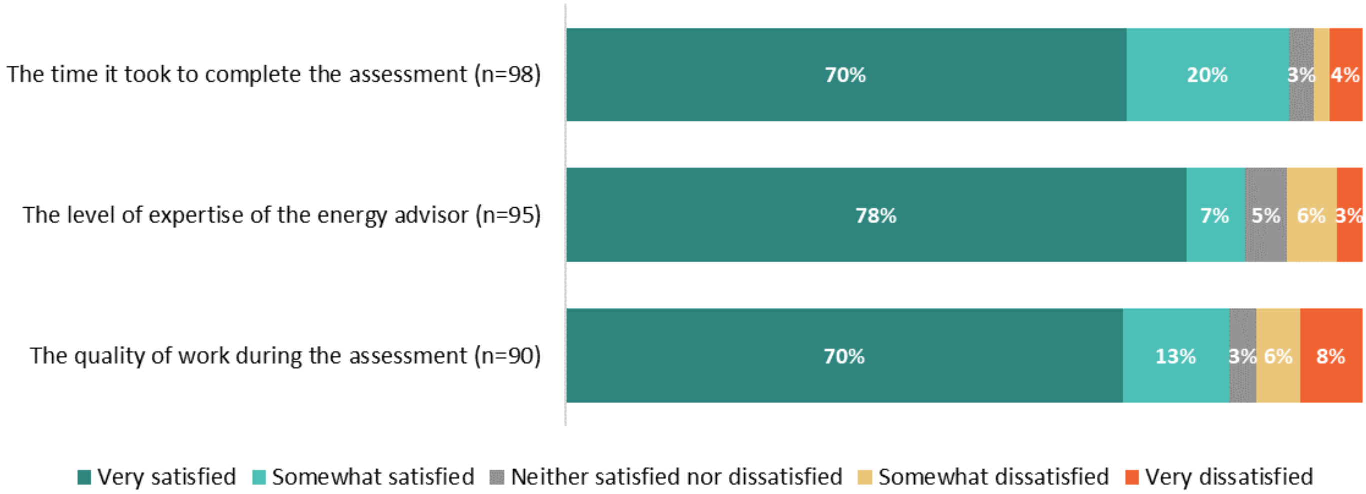



Source: Participant survey. Question: "How satisfied were you with each of the following? The amount of time between scheduling and when the assessment took place. (n=99)

## ASSESSMENT EXPERIENCE

Many respondents were somewhat or very satisfied with the time it took to complete the assessment (90%), the level of expertise of the energy advisor (85%), and the quality of work during the assessment (83%). One satisfied respondent was satisfied with their auditor and said, "[the] guys that came in were great." However, 14% of respondents were somewhat or very dissatisfied with the quality of work (Figure 43). A few dissatisfied respondents indicated that they were unhappy with the assessment because they felt the auditor did not take enough time or missed opportunities for energy savings.

FIGURE 43. SATISFACTION WITH ASSESSMENT LENGTH, EXPERTISE OF AUDITOR, AND QUALITY OF WORK

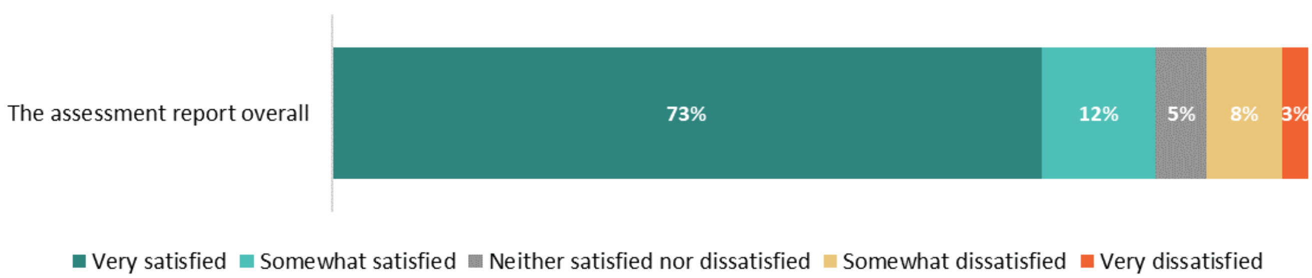



Source: Participant survey. Questions: "How satisfied were you with each of the following? The time it took to complete the assessment. The level of expertise of the energy advisor. The quality of the work performed during the assessment."

## ASSESSMENT REPORT AND FINDINGS

Participants should receive a report via email during the assessment as applicable (if the participants have email addresses) or a physical copy in the mail after the assessment is complete. Just over three-fourths of respondents (77%) reported receiving a report including findings and recommendations, and most respondents (83%) reported their energy advisor discussed the findings and recommendations with them. As seen in Figure 44, most respondents (73%) who received the report were very satisfied with it. This represents an increase in assessment report satisfaction compared to the 2021 IQW survey (65% very satisfied, n=43).

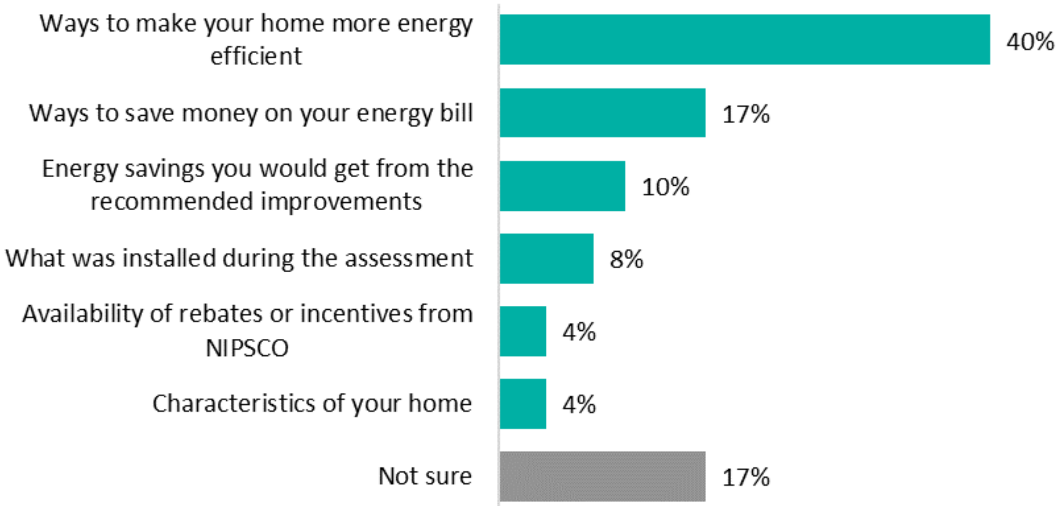
FIGURE 44. SATISFACTION WITH ASSESSMENT REPORT




Source: Participant survey. Question: "How satisfied were you with each of the following? The assessment report overall." (n=77)

Most respondents who received a report (87%) felt the information included was at least somewhat easy to understand, with 64% sharing it was very easy to understand. Only 5% of respondents felt that the information was not very or not at all easy to understand. Respondents reported that the most useful information in the report included ways to ways to make their homes more energy efficient (40%) and ways to save money on their energy bill (17%) (Figure 45). A lower percentage of respondents in 2022 (17%) reported that the most useful information was about ways to save money on their energy bill than in 2021 (38%).

FIGURE 45. USEFULNESS OF REPORT INFORMATION




Source: Participant survey. Question: "What information in the report did you find most useful?" (n=77)

One-fifth of respondents offered suggestions for improving information that was provided during the assessment or in the report. Multiple respondents asked for more specific and detailed information on suggestions and resources, or programs to help low-income residents.

Suggestions for improving the information in the report included:

> *"Have the Representative EXPLAIN THOROUGHLY what needs to be fixed and suggestions on what needs to be purchased and where."*
>
> *"That when there are things that needs to be repaired, I feel that suggestions would help disabled and seniors in the process and help them not to be taken advantage of."*
>
> *"Help with information on programs that could help with low-income residents."*

Some respondents also noted that they didn't get a report, or the assessor didn't discuss the findings with them. One respondent suggested that they would have liked a mailed copy of the report.

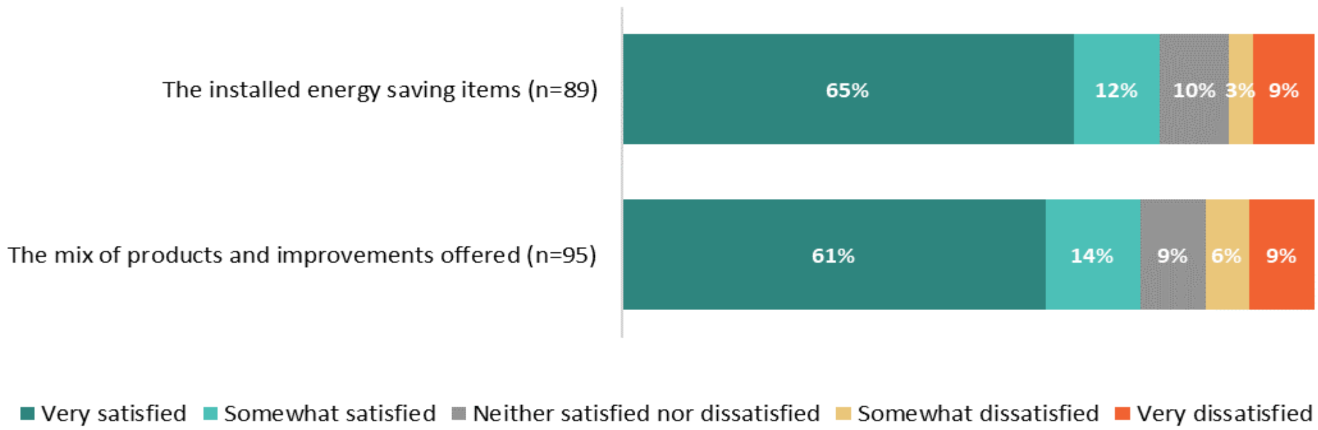
## ASSESSMENT TYPE

Around one-fifth (21%) of respondents remember being offered a choice in assessment type (in-person or virtual), and 41% indicated that they were not sure if they were offered a choice. Of the 38% of respondents that did not recall being offered a choice in type of assessment, only 8% would have preferred a virtual assessment. Respondents shared that this is because they are ill or have a disability, which makes it infeasible to host the energy advisor in their homes.

DIRECT INSTALL MEASURES

According to the program tracking data, 92% of respondents received direct install measures in their home during the assessment. Respondents who received direct install measures or services were generally satisfied with the installed energy saving items and the mix of products and improvements offered (Figure 46).

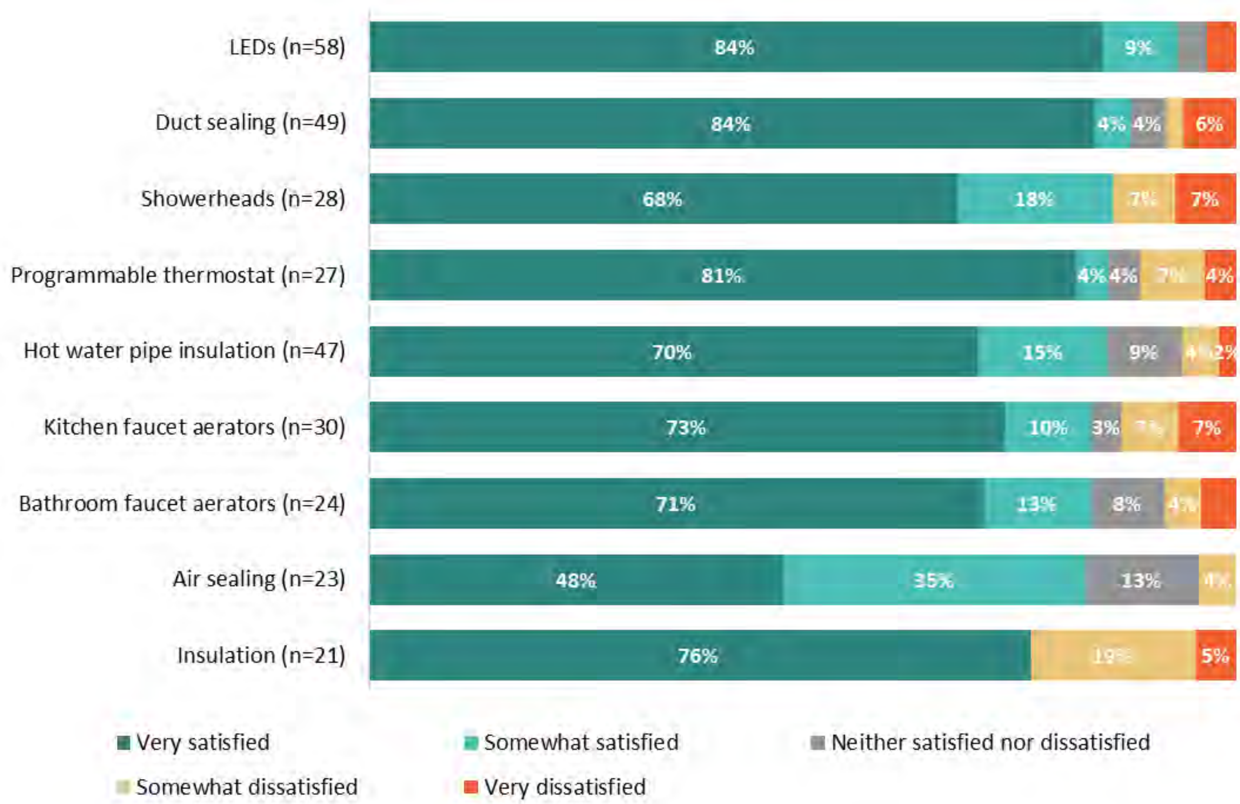
FIGURE 46. SATISFACTION WITH DIRECT INSTALL MEASURES




Source: Participant survey. Questions: "How satisfied were you with each of the following? The energy saving items that were directly installed in your home. The mix of home energy-savings products and efficiency improvements offered.

Satisfaction with all direct install measures was high, ranging from 76% for insulation to 93% for LEDs (Figure 47). Seven respondents received refrigerators, and all were very satisfied.

FIGURE 47. RESPONDENT SATISFACTION WITH DIRECT INSTALL MEASURES




Source: Participant survey. Question: "How satisfied are you with the [measure(s)] installed? Are you…"

Overall, few respondents reported removing direct install measures. Seven respondents removed LEDs because they stopped working, were not bright enough, or they flickered. One respondent removed a kitchen faucet aerator because it stopped working. Five respondents removed showerheads because they stopped working or respondents didn't like the water pressure. No respondents removed thermostats or refrigerators.

Many of the respondents who reported they did not receive measures indicated that the energy advisors did not offer them these measures (ranging from 32% for LEDs to 41% for kitchen faucet aerators). About half (55%) of the respondents who did not receive LEDs shared they did not need them or already had all LEDs, and between 26% and 42% of respondents that did not receive water-savings measures noted that they already had them or didn't need them. Almost 20% of customers reported that the kitchen faucet aerators didn't fit on their fixture. Table 77 provides additional detail on the reasons for not receiving measures.

TABLE 77. REASONS MEASURES WERE NOT RECEIVED

| REASON | LEDS (N=22) | BATHROOM FAUCET AERATORS (N=66) | KITCHEN FAUCET AERATORS (N=59) | SHOWERHEADS (N=62) |
|---|---|---|---|---|
| Already had on/ didn't need one | 55% | 26% | 31% | 42% |
| Wasn't offered one | 32% | 39% | 41% | 36% |
| Didn't fit on fixture | - | 14% | 19% | 8% |
| Didn't match current fixture color | - | 3% | - | - |
| Concerned about changes in water pressure | N/A | - | - | 2% |
| Don't like them | - | - | - | - |
| Other | 9% | 3% | 2% | 3% |
| Not sure | 5% | 14% | 7% | 10% |

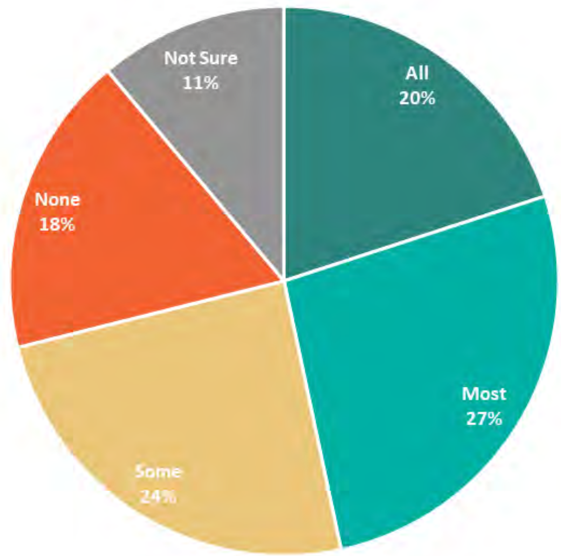
Source: Participant survey. Question: "Why didn't you have [equipment] installed?" (Multiple answers allowed)
Ns refer to people that did not receive measures or indicated that they did not receive the measures.

## RECOMMENDED IMPROVEMENTS AND ADDITIONAL PROGRAM PARTICIPATION

### POST-ASSESSMENT IMPROVEMENTS

Seventy-one percent of respondents who recalled receiving an assessment report or discussing assessment findings with their energy advisor made at least some of the energy-saving improvements recommended in the report (Figure 48). This is like the 2021 survey results. Respondents' main reasons for not completing recommended improvements include that they were too expensive, they are still planning to make the improvements, and the recommendations were not relevant. Some customers noted that there were no recommendations made or that they were waiting for information from NIPSCO about insulation.

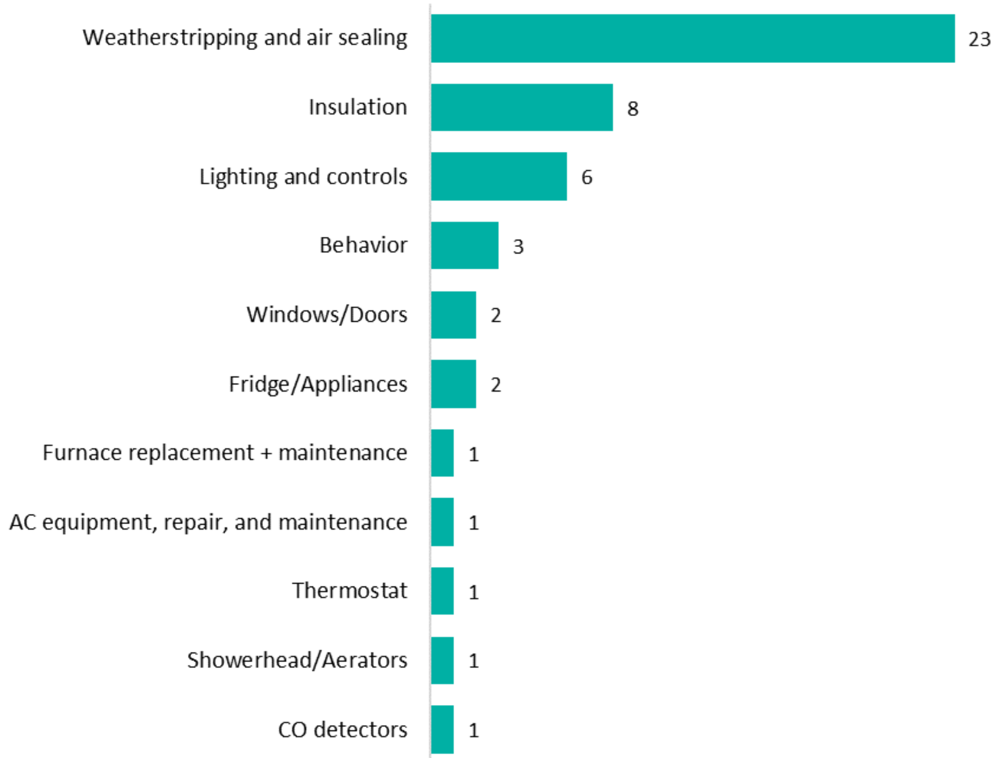
FIGURE 48. FOLLOW THROUGH ON RECOMMENDED IMPROVEMENTS




Source: Participant survey. Question: "After participating in NIPSCO's Income-Qualified Weatherization program, would you say you have made all, most, some, or none of the energy-saving recommendations made in the assessment report you received?" (n=90)

The improvements respondents made included installing measures, such as weatherstripping and other air sealing, insulation, and lighting (Figure 49). Some customers also reported making behavior changes, such as changing thermostat setpoints or unplugging electric items when away from home.

FIGURE 49. INSTALLED RECOMMENDED MEASURES




Participant survey. Question: "What improvements did you make?" (n=40)

### ADDITIONAL PROGRAM PARTICIPATION

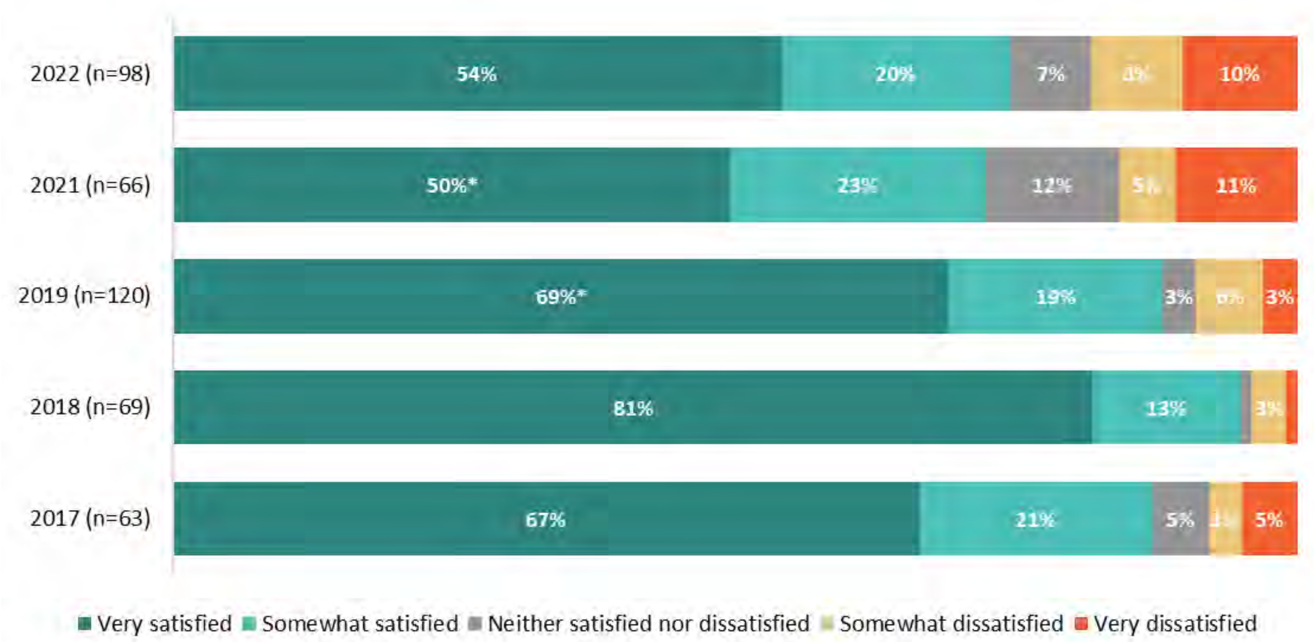
Like 2021, about one-quarter (25%) of respondents were aware that NIPSCO offered other energy efficiency programs in 2022. These respondents (n=21) were most often aware of the Appliance Recycling Program (71%) and the Energy Efficiency Rebate Program (62%). Some were aware of Home Energy Reports and Lighting Discounts (38% for both). Respondents had participated in the Appliance Recycling (n=1) or Home Energy Reports (n=2) programs.

## SATISFACTION WITH PROGRAM AND NIPSCO

### OVERALL PROGRAM SATISFACTION

Most respondents (74%) were very or somewhat satisfied with the IQW program (Figure 50). The percentage of very satisfied respondents decreased significantly from 2019 to 2021. That percentage increased slightly in 2022 but is still significantly lower than in the 2019 IQW survey.

FIGURE 50. SATISFACTION WITH THE IQW PROGRAM




Note: * Indicates significant difference between marked year and previous year at p≤0.10 (90% confidence).
Source: Participant survey. Question: "How satisfied are you with NIPSCO's Income-Qualified Weatherization program?"
Note: 2020 data is not included due to COVID-19.

Satisfied respondents were appreciative of the services provided, especially attic insulation, refrigerators, and air sealing. They shared that the energy advisors were professional, kind, efficient, and knowledgeable. Some noted that they noticed their house was more comfortable or that their energy bills had gone down. Respondents were grateful for the program, especially because it's free.

> *"I've enjoyed the benefits of the energy efficient improvements. I am low-income and disabled I would not have been able to do these improvements on my own."*
>
> *"The gentlemen doing the work were very professional, respectful, and answered all my questions!"*
>
> *"They were very knowledgeable and handled everything well. They wore booties on their feet and made sure they took care of my property, and they cleaned up after themselves."*

However, even satisfied respondents still had some outstanding concerns or questions.

*"Happy to have attic insulation but landlord said it was a messy job."*

*"It was a great help to have the items looked at and fixed by the very professional NIPSCO employee that came out to my home! Will save money in the long run, he did mention I qualified for an Energy saving Refrigerator? I can't find how to get a report, however? Would recommend this to everyone!"*

*"Overall, it's a great program I just wish that the light bulbs and the shower head had been better quality. I also would have liked the assessor to have been honest about sealing our ducts or even doing a duct assessment. I don't believe that that ever happened either and I believe that we do have issues with our air ducts. So, if it would be possible to have someone do an air duct assessment and repair that would be really helpful."*

*"Because the crew was in and out of house I expected, but they should have worn booties over their footwear when they were in the house. They also left some messes around the areas where they were working that I had to clean up or ask someone else to clean for me I was not prepared to have dust flying out of the ceilings onto furniture or clothes or of other items around the house."*

Respondents that were dissatisfied were unhappy with the measures offered, felt there wasn't much done, or that assessors were in a hurry. One customer in a mobile home was disappointed that the assessor couldn't do anything for them because they have a large outstanding NIPSCO balance.

*"Thought I would get more relevant information/products. Seems like we just got some lightbulbs. Assessor offered additional insulation for the attic, but it is the sprayed on, loose, insulation that is messy. I didn't want that type of insulation. It is messy, itches, and gets in breathing passageways."*

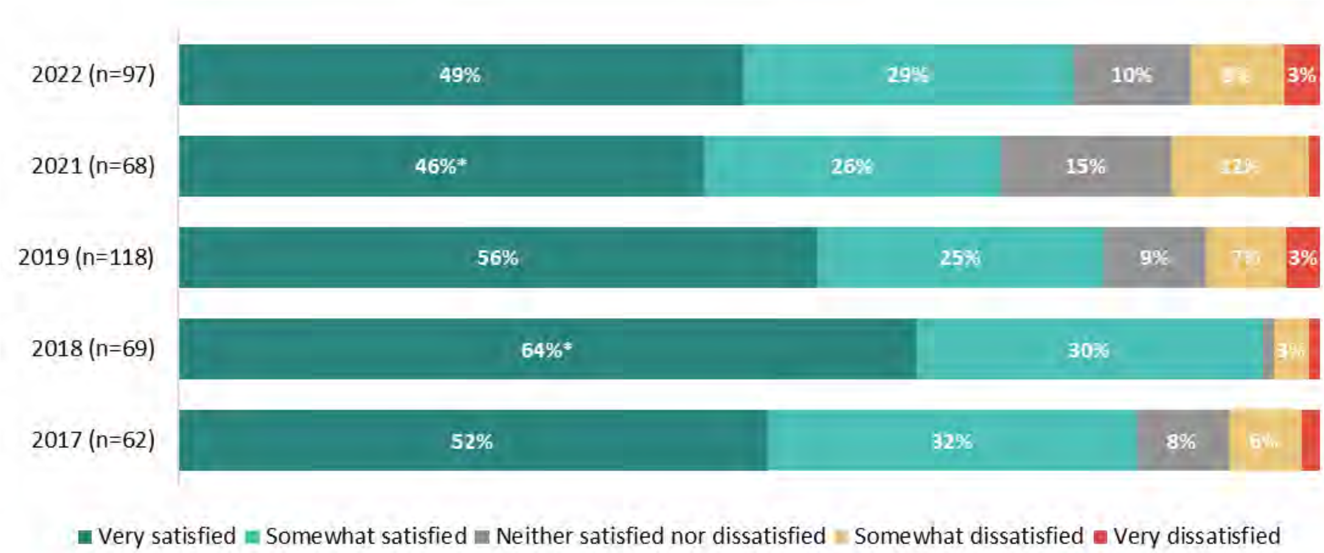
*"I cannot deadbolt my exterior doors because they will not close properly. I feel unsafe with my doors not fully shut and locked. I am now trying to find a way to correct the weatherstripping without having to pay someone a large sum to redo the work."*

*"The guy came in and blew me off, he said he couldn't get under the trailer. and he walked out and did nothing. I owe over $466."*

## NIPSCO SATISFACTION

Most respondents (78%) were somewhat or very satisfied with NIPSCO in 2022 (Figure 51). Specifically, 49% of respondents said they were very satisfied with NIPSCO. This was lower than the percentage of very satisfied participants in 2017 through 2019, but higher than in 2021. The evaluation team did not collect comments related to respondent satisfaction with NIPSCO as their utility service provider, and the reasons for satisfaction and dissatisfaction could be due to a variety of factors.

FIGURE 51. SATISFACTION WITH NIPSCO




Note: * indicates difference between 2018 and 2021 is significant at p≤0.10 (90% confidence).
Source: Participant survey. Question: "How satisfied are you with NIPSCO overall as your utility service provider?
Note: 2020 data is not included due to COVID-19.

## SUGGESTIONS FOR IMPROVEMENT

About a third of IQW respondents (n=32) had suggestions to improve the program. Several customers (n=5) shared that their expectations weren't met, some because NIPSCO is not their electric provider but believe they should qualify for a full inspection since they use NIPSCO for their heating. Other customers (n=6) commented that their experience with the contractors could have been improved. They also requested that the contractors show them what they're talking about to make sure the homeowner understands. In some cases, respondents were unhappy with the work that contractors did and didn't feel listened to:

> *"When weatherstripping entry doors make sure they are completely shut. I cannot deadbolt my doors because the team leader did not listen to my suggestion. I am not very pleased with the outcome."*

Some customers had recommendations for the assessment, requesting that more be done to assess heat loss, especially weatherstripping or caulking to address heat loss around windows. Respondents were also interested in receiving new windows, help with uninsulated ductwork, nicer insulation, and a fire extinguisher. In addition, respondents shared additional information that they would like to help address energy efficiency in their homes:

*"You need to offer suggestions for products, contractors, or discounts that apply to fixing heat source losses."*

*"If there are other programs, I don't believe they informed me about that enough. So maybe they should do better about initiatives of other programs."*

Finally, respondents requested better follow-up and made recommendations for better communication for marketing and outreach as well. Four respondents commented that they were waiting for follow-up on refrigerators or insulation. Some were confused about next steps:

*"He did say we qualified for an Energy-efficient refrigerator, and someone would be calling? I have tried to reach out, but haven't been able to find where yet?"*

## PARTICIPANT SURVEY DEMOGRAPHICS

The majority of IQW respondents live in single-family detached homes (82%), though 10% live in mobile or manufactured homes. Almost half (43%) of IQW respondents have lived in their current home for more than 10 years. Also, most respondents (82%) live in small to medium sized homes that are less than 3,000 square feet. Most respondents (72%) live in homes built before 1970. Table 78 contains more detail on respondent's home characteristics.

TABLE 78. IQW PROGRAM RESPONDENT HOME CHARACTERISTICS

| DEMOGRAPHICS | PERCENTAGE |
|---|---|
| Home Ownership (n=99) | |
| Own | 89% |
| Rent | 10% |
| Other | 1% |
| Not Sure | |
| Type of Residence (n=99) | |
| Single-family detached home | 82% |
| Multifamily apartment or condo building (with 4 or more units) | 5% |
| Attached house (townhouse, row house, or twin) | 3% |
| Mobile or manufactured home | 10% |
| Years Lived in Current Home (n=98) | |
| One year or less | 5% |
| 2-3 years | 19% |
| 4-5 years | 12% |
| 6-10 years | 20% |
| More than 10 years | 43% |

| DEMOGRAPHICS | PERCENTAGE |
|---|---|
| **Number of People in Home (n=96)** | |
| One | 44% |
| Two | 28% |
| Three | 14% |
| Four | 7% |
| Five or more | 6% |
| Not Sure | 1% |
| **Square Feet of Home (n=98)** | |
| 0 – 1,499 | 42% |
| 1,500 – 2,999 | 40% |
| 3,000+ | 2% |
| Not Sure | 16% |
| **Year Home Built (n=99)** | |
| Before 1900 | 4% |
| 1900 to 1939 | 16% |
| 1940 to 1959 | 29% |
| 1960 to 1979 | 22% |
| 1980 to 1989 | 5% |
| 1990 to 1999 | 3% |
| 2000 to 2004 | 2% |
| 2005 or later | 5% |
| Not Sure | 13% |

Source: Participant survey. Questions: "What type of residence do you live in?" "Do you own or rent your residence?" "How many years have you lived in your current home?" "Including yourself, how many people live in your home?" "About how many square feet is your home? Use your best guess." "When was your home built?"

Most (86%) of IQW customers reported that their household income from all sources was under $35,000 in 2022 before taxes. Two-thirds of respondents (66%) are in the following educational attainment categories: have some high school or less; high school graduate or equivalent; or some college, no degree. Table 79 contains more detail on respondent demographics.

TABLE 79. IQW PROGRAM RESPONDENT DEMOGRAPHICS

| DEMOGRAPHICS | PERCENTAGE |
|---|---|
| **Annual Household Income (n=93)** | |
| Under $25,000 | 56% |
| $25,000 to under $35,000 | 30% |
| $35,000 to under $50,000 | 8% |
| $50,000 to under $75,000 | 4% |
| Not Sure | 2% |
| **Year Respondent was Born (n=96)** | |
| 1900 to 1939 | 2% |
| 1940 to 1959 | 43% |

| DEMOGRAPHICS | PERCENTAGE |
|---|---|
| 1960 to 1979 | 39% |
| 1980 to 1989 | 13% |
| 1990 to 1999 | 2% |
| 2000 or later | 1% |
| Education Level Completed (n=94) | |
| Some high school or less | 6% |
| High school graduate or equivalent | 32% |
| Some college, no degree | 28% |
| Technical college degree or certificate | 9% |
| Two-year college degree | 10% |
| Four-year college degree | 10% |
| Graduate or professional degree | 5% |

Source: Participant survey. Questions: “Which of the following best represents your annual household income from all sources in 2021 before taxes?” “In what year were you born?” “What is the highest level of education you have completed?”

## ENERGY ADVISOR FEEDBACK

The evaluation team interviewed six team members from the HEA and IQW energy advisor and direct-install team. These interviews covered communication and coordination with program implementation staff, audit and direct install processes, customer feedback, and areas for program growth. This section details a summary of interview findings.

### COMMUNICATION WITH CUSTOMERS

Energy advisors are not responsible for customer marketing or initial customer in-take. However, they are the boots on the ground for the program and directly interface with participants. After receiving their scheduled site visits, energy advisors typically call the customers a day in advance to confirm the appointment. If the customer does not answer, advisors will email or text. The next point of contact is the day of the scheduled appointment. Some advisors prefer to call the customer right before they arrive to make sure customers are home. Additionally, all advisors reflected that their goal is to listen to customer concerns, help them learn about ways to improve their home’s energy efficiency, and answer any questions that customers might have about measures or report findings.

### AUDIT AND DIRECT INSTALL PROCESSES

In the interviews, advisors reflected a structured approach to performing the audits, suggesting a thorough process that ensures standardization. Advisors indicated that they typically start the inspection with the exterior, then move inside. Once inside they work from bottom to top. They also encourage customers to accompany them through the audit so that customers can ask questions and learn. One advisor reflected that it is important to engage the customer during the audit process to make the audit worthwhile.

All advisors indicated that they use the Snugg Pro platform to document existing conditions, upload site photos, and input recommended measures. The platform calculates energy savings based on advisor inputs and can generate a report on site. Reports are directly emailed to customers, and advisors confirm receipt before leaving the home. Customers can also request that a paper copy be mailed to them.

## IN-PERSON AND VIRTUAL AUDITS

None of the advisors were involved with the program during the time when virtual audits were offered. However, some advisors indicated that they thought in-person audits were far more useful than virtual audits. One reflected that virtual audits might prevent their team from identifying health and safety issues and that it's very difficult to see everything with cameras used in virtual audits. Another advisor reflected that one of the key benefits of the program for NIPSCO is creating a personal connection with the customers; that outcome is only possible with in-person visits.

## FEEDBACK FROM CUSTOMERS

The evaluation team asked advisors about how customers perceive the program. Overall, advisors indicated that customers were highly satisfied with the program and appreciative of the free, direct-install measures. One advisor indicated that their team often gets thank you notes or calls from participants. Advisors experience very few callbacks to replace direct install measures.

Occasionally, advisors will hear concerns from customers on the direct-install measures. For example, they indicated that some customers do not like the color of the LED bulbs. Additionally, some customers have faulty wiring in their homes and when they replace incandescent bulbs with LEDs, the switches bleed enough electricity that the LEDs never actually turn off. Another common complaint is about the showerheads with the shower start valves – this measure sometimes causes issues for people who are unfamiliar with how they work. Also, the direct-install showerheads typically do not work with certain specialty bath fixtures like handheld showerheads.

For IQW customers in particular, advisors reported that many customers ask if the program will replace windows, and some are disappointed that this measure is not part of the IQW program. Some respondents also turn down thermostats if they are not comfortable using them. The advisors also indicated that they keep a list of other community partners that can assist IQW customers with other issues that might arise in their home, that are not covered by the IQW program.

## AREAS FOR PROGRAM GROWTH

Advisors had some suggestions for program growth and improvements. For IQW customers, advisors indicated that CO monitors would be a helpful health and safety measure. Some customers can get these from their local fire department, but advisors noted that many customers do not already have these monitors. Another measure that advisors indicated they would like to see is energy efficient showerheads that work with hand-held showers. Some customers decline the existing showerhead measure because it does not work with their current fixtures.

For the attic insulation measure, one advisor indicated that the program should consider raising the R-value for IQW customers, since existing attic spaces are generally poorly insulated.

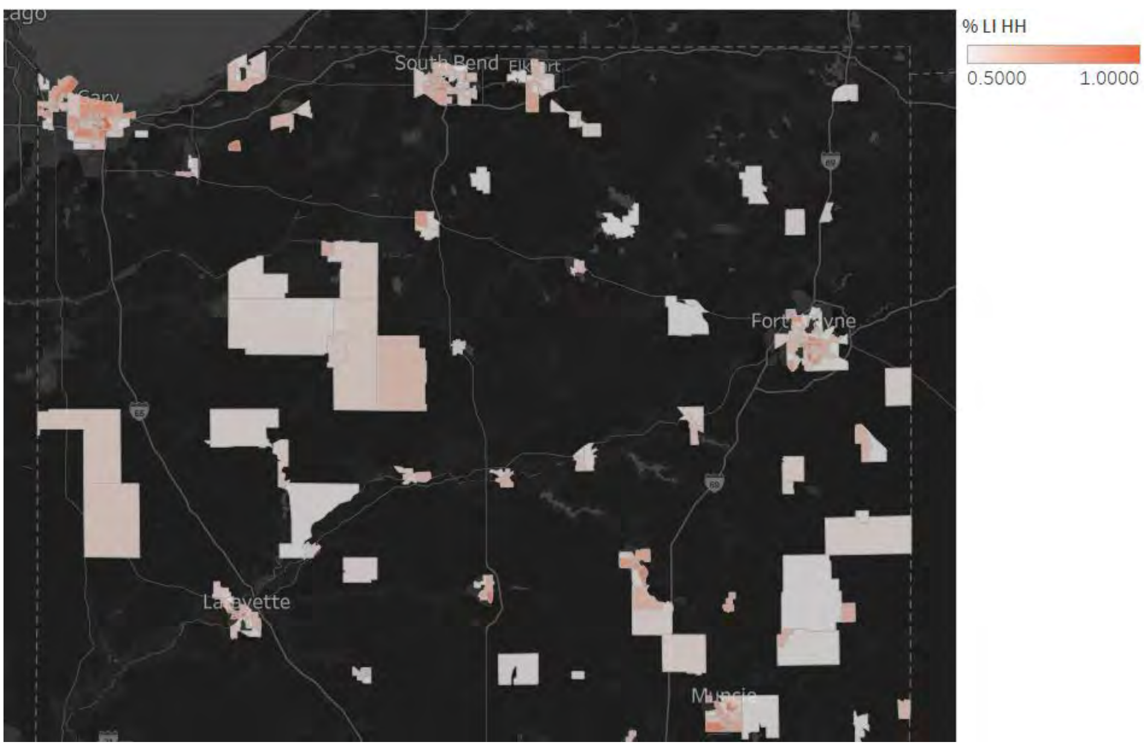
Another advisor pointed out that some IQW customers expect the program to replace windows and doors since that is what they associate with the term "weatherization." They suggested that the program provide additional clarity around what they mean by "weatherization" so that customers are not disappointed with the offering. This advisor also expressed interest in the program targeting customers in manufactured/mobile homes as these customers could really benefit from increased energy efficiency. In general, advisors expressed that increasing program awareness would greatly benefit the program.

## CENSUS DATA MAPPING

The evaluation team also looked at Census data to examine at a high level if there are geographic areas of interest for the IQW program.[18] In 2022, the IQW program did not meet its goals, suggesting that enhanced or targeted marketing could benefit the program. There might be specific geographic areas of interest for the program.

The evaluation team looked at Census tracts where more than 50% of families were considered low-income.[19] These areas might be home to a greater proportion of IQW-eligible customers than other areas. This is shown in Figure 52.

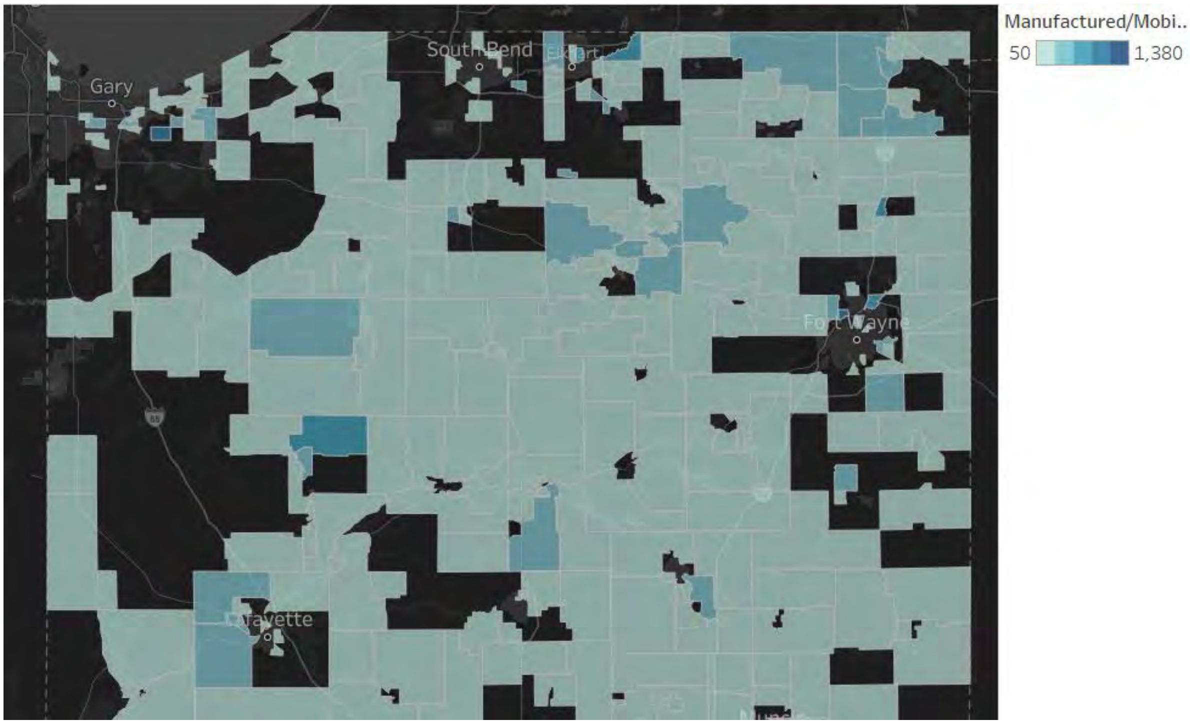
FIGURE 52. CENSUS TRACTS WITH MORE THAN 50% OF HOUSEHOLDS LOW-INCOME




[18] The evaluation team used the 2016-2020 5-Year American Community Survey estimates to inform this analysis.
[19] Low-income was defined as less than 200% of the federal poverty line (FPL).

Another potential subset of customers that the IQW program could target is those living in mobile or manufactured homes. Figure 53 shows Census tracts where there are over 50 mobile or manufactured homes.

FIGURE 53. CENSUS TRACTS WITH OVER 50 MOBILE/MANUFACTURED HOUSING UNITS




By layering these different elements of Census data, the program might consider identifying Census tracts or areas for targeted outreach to IQW-eligible customers. Relationships with community-based organizations in those areas might help increase customer awareness of the programs and foster trust.

# CONCLUSIONS AND RECOMMENDATIONS

### CONCLUSION 1: THE PROGRAM DID NOT MEET SAVINGS GOALS IN 2022.

The program did not meet savings goals in 2022. Savings might have been lower than expected as the program garnered lower savings per household served. Program implementers noted that there was less opportunity for air sealing/insulation and lighting and some delays in refrigerator replacements, which might have impacted savings. Energy advisors also noted that increasing program awareness will be needed to increase program participation.

**Recommendations:**

- Increase targeted marketing efforts to drive participation in the program. This could include geographic targeting and working with community-based organizations to promote the program. Targeted marketing efforts and outreach should be specific to IQW-eligible customers, instead of general home assessment marketing that relies on triaging customers between HEA and IQW.
- Consider adding more measures that are applicable to manufactured homes, to provide more savings to those customers (10% of respondents in 2022).
- Ensure that energy advisors provide detailed guidance to customers for follow-on measures such as air sealing/insulation.

- Ensure that assessment reports include information on how to properly use programmable thermostats and encourage energy advisors to explain usage so that customers do not remove or decline that measure.

## CONCLUSION 2: *EX ANTE* ENERGY STAR REFRIGERATOR SAVINGS USE EXISTING UEC FOR ALL AGES OF REFRIGERATOR REPLACED, IRRESPECTIVE OF REMAINING USEFUL LIFE.

The tracking data categorizes replaced refrigerators as either <1993 or 1993-2010. These categories are too broad and do not align with the 17-year EUL in both the IN TRM (v2.2) and the IL TRM v10.0. Therefore, age assumptions must be made during the evaluation.

Recommendations:

- Consider changing the age ranges annually in the tracking data to align with the program eligibility requirements (10 years old) and EUL in the TRM or tracking actual age of replaced appliances if possible. The IL TRM allows for a significant boost in savings for refrigerators older than 1990 vintage. Therefore, strata for PY2023 would be 2006-2013, 1990-2006 and <1990.
- If NIPSCO is considering expanding income qualified refrigerator replacements, a survey of TRMs outside of IL and IN for low-income baseline approaches would be advised.

## CONCLUSION 3: OVERALL, CUSTOMERS WERE VERY SATISFIED WITH THE PROGRAM, BUT WERE LESS SO THAN COMPARED TO PRE-PANDEMIC YEARS.

Most respondents (74%) were very or somewhat satisfied with the IQW program. The percentage of very satisfied respondents decreased significantly from 2019 to 2021. That percentage increased slightly in 2022 compared to 2021 but is still significantly lower than in the 2019 IQW survey. A few dissatisfied customers indicated that they felt that not enough work was done on the home. Advisors also pointed out that some customers are disappointed when they learn that windows and doors cannot be replaced through the program.

Recommendations:

- Ensure that program materials sufficiently explain what weatherization services are offered so that customers are not disappointed when they receive measures.
- Continue to train advisors to explain rules around health and safety issues that might lead to fewer measures being installed.
- Continue to train advisors to provide detailed guidance on follow-on measures such as air sealing and insulation.
- Include information in the assessment reports that connect customers with other funding resources for energy efficiency and health and safety upgrades (including federal funding sources).

## CONCLUSION 4: RESPONDENTS PREFERRED THE IN-PERSON VISIT OPTION, BUT SOME COULD BENEFIT FROM A VIRTUAL IQW ASSESSMENT.

Currently the program does not offer a virtual inspection option for IQW participants. Surveyed participants indicated that they generally prefer the in-person visit. Advisors also agree that in-person assessments are instrumental at identifying health and safety issues and ensuring that customers have a good experience. However, a few IQW participants indicated that a virtual option would be ideal for customers who cannot host visitors in their homes.

Recommendations:

- Continue to offer in-person assessments for IQW but continue to offer a virtual assessment on a case-by-case basis to accommodate health and safety concerns.

### CONCLUSION 5: MOST RESPONDENTS RECEIVED DIRECT-INSTALL MEASURES, BUT SOME RESPONDENTS REPORTED THEY WERE NOT OFFERED PARTICULAR MEASURES.

Some customers reported that they weren't offered LEDs (32%), bathroom faucet aerators (39%), kitchen faucet aerators (41%), or showerheads (36%). Some customers also indicated that they were confused when they weren't eligible for some measures because NIPSCO doesn't provide their electricity. About half (55%) of the respondents who did not receive LEDs shared they did not need them or already had all LEDs; this may be due to more customers having LEDs already installed in applicable fixtures given the shifting LED market.

Recommendations:

- Make sure advisors are explaining the available measures to customers and explaining why they aren't eligible or able to receive certain measures. Continue to ensure energy advisors are trained to offer and install all applicable measures to each customer.
- Continue to consider having the assessment team track reasons for not installing measures by adding checkboxes on the assessment form such as "customer already has efficient equipment," "customer faucets not compatible with aerators," "customer refused measure," etc. With this additional data, NIPSCO and the evaluation team can better determine how to improve the acceptance rate, if needed.

### CONCLUSION 6: SOME CUSTOMERS WERE CONFUSED ABOUT HOW TO RECEIVE ATTIC INSULATION AND REFRIGERATOR MEASURES OR ADDITIONAL ENERGY EFFICIENCY OPPORTUNITIES.

Several respondents left comments that they thought they were going to receive more information about insulation or a new refrigerator but were confused about how and when they would receive that information. These measures are installed after the initial site assessment and require additional coordination and scheduling. Overall, customers that received refrigerators through IQW were all very satisfied with them.

Recommendations:

- Continue to provide clear information about the next steps for each follow-up measure (when installation does not occur during the assessment). The program already includes pamphlets with qualification and contact information but could also encourage advisors to emphasize the estimated timeline for how long the delivery will take for each measure.

### CONCLUSION 7: CONSIDER ENHANCED OFFERINGS TO UNLOCK GREATER ENERGY SAVINGS, ESPECIALLY WITH REGULATORY CHANGES REDUCING SAVINGS FOR LIGHTING MEASURES IN UPCOMING PROGRAM YEARS.

On April 26, 2022, the U.S. Department of Energy (DOE) issued an enforcement notice that imposes the lighting backstop, a date by which certain general service lamps (GSLs) will no longer be legally manufactured or imported into the United States. This backstop expands to all screw-based lighting, including specialty and reflector lamps currently offered through Indiana utility programs. This backstop will functionally eliminate screw-in incandescent and halogen lamps from the market, likely in the first half of 2023, raising the efficiency baseline for available lighting in the market. As IQW is a direct-install program, which replaces inefficient lights currently installed in homes, the evaluation team recommends that IQW continue early-replacing inefficient lights in customers' homes (with reduced measure life assumptions) through 2023, but that this option will likely be exhausted by 2024. Additionally, an increasing number of customers are indicating that they already have LEDs. Though most customers were satisfied with the direct install measures, the program could look to provide enhanced incentives for additional measures and/or weatherization to unlock deeper savings.

**Recommendations:**

- Consider adding new measures or adjusting current measures to increase participation and savings.
- Consider whether low-flow handheld showerheads are a cost-effective measure that could be added to the program, to make them available to more customers.

# 7. MULTIFAMILY DIRECT INSTALL (MFDI) PROGRAM

## PROGRAM DESIGN AND DELIVERY

The Multi-family Direct Install (MFDI) Program targets property owners and building managers to assist them with tenant-area and common-area energy efficiency upgrades. The MFDI Program includes a no-cost full building energy assessment, including both common areas and tenant spaces. The program provides free in-unit upgrades and identifies common area projects that might receive rebates from NIPSCO's C&I Small Business Direct Install (SBDI) program.

TRC is the program administrator, and they subcontract to Threshold Energy Solutions for the direct-install measures. TRC's responsibilities include program design and management, processing contractor payments, quality assurance and quality control (QA/QC), technical training, and providing contractor support to facilitate the quality installation of energy-efficient measures.

The program is available on a first-come, first-served basis to qualified multi-family buildings that meet the following criteria:

- Have three or more residential units.
- Are a NIPSCO electric and/or natural gas customer with active, individually metered, residential unit service (master metered residential buildings do not qualify).
- Are more than five years old.
- Did not receive a utility-sponsored energy assessment in the past three years.

Eligibility to receive SBDI measures is outlined by that program's rules.

Customers (building owners or property managers) can enroll in the program by calling NIPSCO's Residential Energy Efficiency Program hotline or through direct outreach by TRC staff.

Once TRC determines program eligibility, TRC staff complete an initial site visit to conduct the whole building energy assessment. During the assessment, they conduct a walk-through of one of each type (i.e., studio, one-bedroom, two-bedroom) of residential units in the building, as well as all commercially metered common areas to determine measure quantities needed for installation. They also identify potential savings and rebates that can be incentivized through NIPSCO's Small Business Direct Install (SBDI) program. TRC staff review the results of the energy assessment with the property owner or building manager to determine interest in continuing with the direct install portion of the program.

Once a multi-family building owner or manager decides to proceed with direct install measures in residential units, TRC staff work with building management and the subcontractor to schedule the installation visit. It is up to the building owner or manager to notify residents of the installation, but TRC provides posters, emails, door hangers, yard signs, and other tools to support them.

On the day of the MFDI visit (which may extend over multiple days, depending on the number of units in the building and building management availability), the subcontractor arrives at the multi-family building and works with property management to gain access to residential units. The subcontractor records the type and quantity of the measures installed in each individual apartment. The subcontractor removes and properly disposes of any light bulbs being replaced. Any SBDI measures need to be applied for through the standard SBDI rebate application process later.

Direct-install measures include the following:

- ENERGY STAR certified light bulbs (9W A-Line, 5W Candelabra, 6W Globe, 15W PAR 38)
- Bathroom faucet aerator (1.0 gpm)
- Kitchen aerator (1.5 gpm)
- Low-flow showerhead (1.5 gpm) *
- Shower Start (valve only) *
- Low-flow showerhead/shower start combo*
- Pipe wrap
- Programmable thermostat

** This can be a combination of either measure (low-flow showerhead, low-flow w/shower start combo and/or shower start valve) but the maximum number of units to be installed is two (2).*

## PROGRAM PERFORMANCE

In 2022, the MFDI program fell short of its goals. The program saw limited participation in 2022, and per the implementer this was due to difficulties in reaching the correct contacts at property management companies, field team staff turnover, and property management teams not having enough bandwidth to engage with the program. Additionally, the implementer indicated that they are not doing focused targeting for potential MFDI customers, but rather focusing on overarching outreach.

Table 80 summarizes savings for the full year of program performance, including program savings goals.

TABLE 80. 2022 MFDI PROGRAM SAVING SUMMARY

| METRIC | GROSS SAVINGS GOAL | *EX ANTE* | AUDITED | VERIFIED | *EX POST* GROSS | *EX POST* NET | *EX POST* GROSS GOAL ACHIEVEMENT |
|---|---|---|---|---|---|---|---|
| Electric Energy Savings (kWh/yr.) | 2,342,017.08 | 60,783.87 | 60,783.87 | 52,069.96 | 49,039.31 | 46,711.03 | 2% |
| Peak Demand Reduction (kW) | 297.409 | 6.856 | 6.856 | 5.965 | 12.489 | 11.574 | 4% |
| Natural Gas Energy Savings (therms/yr.) | 108,739.71 | 4,186.16 | 4,186.16 | 3,925.82 | 2,884.01 | 2,921.44 | 3% |

As documented in the table above, audited savings aligned with the claimed *ex ante* savings; the evaluation team did not identify any issues through the tracking system analysis that warranted adjustments to either the savings or quantity. Verified savings were somewhat lower than claimed values due to applied ISRs of select measures. *Ex post* gross electric and gas savings were slightly lower than *ex ante* savings, and *ex post* gross demand savings were significantly higher than *ex ante* savings (more detail is documented in the *Ex Post Gross Savings Section).*

Table 81 outlines the *ex post* gross and NTG adjustment factors.

TABLE 81. 2022 MFDI ADJUSTMENT FACTORS

| METRIC | REALIZATION RATE (%)[a] | FREERIDERSHIP | SPILLOVER | NTG (%)[b] |
|---|---|---|---|---|
| Electric Energy Savings (kWh/yr.) | 81% | 5% | 0% | 95% |
| Peak Demand Reduction (kW) | 182% | 7% | 0% | 93% |
| Natural Gas Energy Savings (therms/yr.) | 69% | 0% | 1% | 101% |

[a] Realization Rate is defined as *ex post* Gross savings divided by *ex ante* savings.
[b] NTG is defined as *ex post* net savings divided by *ex post* gross savings.

Both electric and natural gas spending was below planned expenditures due to limited program participation. Table 82 lists the 2022 program budget and expenditures by fuel type.

TABLE 82. 2022 MFDI PROGRAM EXPENDITURES

| FUEL | PROGRAM BUDGET | PROGRAM EXPENDITURES | BUDGET SPENT (%) |
|---|---|---|---|
| Electric | $799,487.50 | $60,489.91 | 8% |
| Natural Gas | $212,636.12 | $18,309.16 | 9% |

# EVALUATION METHODOLOGY

To inform the 2022 NIPSCO impact and process evaluation, the evaluation team completed the following research activities:

- **Program staff interviews and discussions,** to understand the program process, delivery, and design.
- **Documentation and materials review,** to provide context on program implementation.
- **Tracking data analysis**, to audit and verify the accuracy of program participation data.
- **Engineering analysis**, to review program savings assumptions and algorithms for reasonableness and accuracy.
- **Multifamily program literature review**, to provide a snapshot of other programs' best practices as well as document available in-service rates and net-to-gross ratios.
- **Auditor interviews**, to understand their perspectives on customer experiences and barriers to participation.
- **Census data mapping**, to visualize geographic areas of interest for the MFDI program.

# IMPACT EVALUATION

The evaluation team completed the impact evaluation to answer the following research questions:

- What assumptions were used to develop savings estimates? Are there any updates that should be made based on other, similar programs?
- What are *ex post* program savings? Do these suggest any needed updates to program design, delivery, or savings assumptions?

For all measure types, the evaluation team compared its engineering calculations to NIPSCO's *ex ante* savings, basing its savings methodologies and inputs for each measure on several sources: standard engineering practices, the Illinois TRM (v10.0), the 2015 Indiana TRM (v2.2), and NIPSCO's program tracking database.[20,21] It should be noted that prior to this evaluation year, the evaluation team used the Indiana TRM as our primary source and supplemented with other sources as needed. The Indiana TRM is out-of-date, and currently in the process of being updated to align more closely with the Illinois TRM. After discussions with NIPSCO, our team felt it would be best practice to use the Illinois TRM as our primary source while the Indiana TRM is in process of being updated, as the Illinois TRM is updated annually and should align closely with the new version of the Indiana TRM.

## AUDITED AND VERIFIED SAVINGS

To develop an audited measure quantity and savings, the evaluation team first checked the implementer tracking data for duplicates or other data quality issues and ensured documented deemed savings were applied correctly. The evaluation team also looked for any discrepancies between program tracking data and the program scorecard, but ultimately did not identify any issues during the tracking data audit.

Table 83 lists the ISRs for all program-installed measures. As part of our evaluation, the evaluation team conducted a secondary literature review of recent evaluations of multifamily programs both to inform impact inputs and process findings. Due to the limited participation in 2022, in-service rates and net-to-gross ratios were sourced from secondary sources to provide more useful values for future program planning. For the 2022 evaluation, the evaluation team referenced in-service rates from the NYSEG/RG&E PY2019-2020 Impact and Process Evaluation.[22] The evaluation team utilized this source because of its recency and since the evaluation reported ISRs for in-unit measures relevant to MFDI. ISRs might be less than 100% in certain cases. For example, tenants might have removed lighting measures or faucet aerators after the initial installation or requested that property management remove a programmable thermostat. Additionally, ISRs might be less than 100% due to equipment failure.

TABLE 83. 2022 MFDI PROGRAM IN-SERVICE RATES RATIOS BY MEASURE

| MEASURE | ISR | SOURCE |
|---|---|---|
| A-Line LEDs – Electric and Gas | 87% | NYSEG/RG&E PY2019-2020 Impact and Process Evaluation |
| A-Line LEDs – Electric Only Savings | 87% | NYSEG/RG&E PY2019-2020 Impact and Process Evaluation |
| Candelabra LEDs – Electric and Gas | 87% | NYSEG/RG&E PY2019-2020 Impact and Process Evaluation |
| Candelabra LEDs – Electric Only Savings | 87% | NYSEG/RG&E PY2019-2020 Impact and Process Evaluation |
| Globe LEDs – Electric and Gas | 87% | NYSEG/RG&E PY2019-2020 Impact and Process Evaluation |
| Globe LEDs – Electric Only Savings | 87% | NYSEG/RG&E PY2019-2020 Impact and Process Evaluation |
| Bathroom Aerator 1.0 gpm – Gas | 91% | NYSEG/RG&E PY2019-2020 Impact and Process Evaluation |
| Kitchen Aerator 1.5 gpm – Gas | 91% | NYSEG/RG&E PY2019-2020 Impact and Process Evaluation |

[20] Illinois Energy Efficiency Stakeholder Advisory Group. *2022 Illinois Statewide Technical Reference Manual for Energy Efficiency Version 10.0. Volume 3: Residential Measures.* September 24, 2021.

[21] Cadmus. *Indiana Technical Reference Manual Version 2.2*. July 28, 2015.

[22] NYSEG and RG&E. *Multifamily Program Evaluation Report, Program Years 2019-20.* December 30, 2021.

| MEASURE | ISR | SOURCE |
|---|---|---|
| Low-flow Showerhead 1.5 gpm – Gas | 100% | NYSEG/RG&E PY2019-2020 Impact and Process Evaluation |
| Low-flow Showerhead with Shower Start – Gas | 100% | NYSEG/RG&E PY2019-2020 Impact and Process Evaluation |
| Programmable Thermostat – Electric Cooling and Gas Heating Savings | 80% | NYSEG/RG&E PY2019-2020 Impact and Process Evaluation |
| Programmable Thermostat – Electric Cooling Only Savings | 80% | NYSEG/RG&E PY2019-2020 Impact and Process Evaluation |

Table 84 summarizes the tracking data quantity, audited quantity, applied installation rates, and resulting verified quantity per measure. To calculate the verified measure quantity, the evaluation team multiplied the audited measure quantity by the installation rate.

TABLE 84. 2022 MFDI PROGRAM AUDITED & VERIFIED QUANTITIES

| MEASURE | UNIT OF MEASURE | AUDITED QUANTITY | ISR | VERIFIED QUANTITY |
|---|---|---|---|---|
| A-Line LEDs – Electric and Gas | Lamp | 93 | 87% | 81 |
| A-Line LEDs – Electric Only Savings | Lamp | 826 | 87% | 719 |
| Candelabra LEDs – Electric and Gas | Lamp | 58 | 87% | 50 |
| Candelabra LEDs – Electric Only Savings | Lamp | 361 | 87% | 314 |
| Globe LEDs – Electric and Gas | Lamp | 48 | 87% | 42 |
| Globe LEDs – Electric Only Savings | Lamp | 328 | 87% | 285 |
| Bathroom Aerator 1.0 gpm – Gas | Aerator | 151 | 91% | 137 |
| Kitchen Aerator 1.5 gpm – Gas | Aerator | 84 | 91% | 76 |
| Low-flow Showerhead 1.5 gpm – Gas | Showerhead | 13 | 100% | 13 |
| Low-flow Showerhead with Shower Start – Gas | Showerhead | 137 | 100% | 137 |
| Programmable Thermostat – Electric Cooling and Gas Heating Savings | Thermostat | 12 | 80% | 10 |
| Programmable Thermostat – Electric Cooling Only Savings | Thermostat | 103 | 80% | 82 |
| | | 2,214 | | 1,947 |

## *EX POST* GROSS SAVINGS

### ENGINEERING REVIEWS

The evaluation team referred to the Indiana TRM (v2.2) and Illinois TRM (v10) for variable assumptions to calculate *ex post* gross electric energy, demand reduction, and natural gas energy savings. The evaluation team also used data from the ENERGY STAR QPL and the NREL Residential Lighting Evaluation Protocol to calculate savings for lighting measures. The evaluation team revised assumptions for savings estimates applicable to the NIPSCO service territory as needed. *Appendix 5* contains details on the specific algorithms, variable assumptions, and references used for all program measure *ex post* gross calculations.

### *EX POST* GROSS SAVINGS

Table 85 shows the *ex ante* deemed savings and *ex post* gross per-measure savings for 2022 MFDI program measures.

TABLE 85. 2022 MFDI PROGRAM *EX ANTE* & *EX POST* GROSS PER-MEASURE SAVINGS VALUES

| MEASURE | UNIT OF MEASURE | *EX ANTE* DEEMED SAVINGS | | | *EX POST* GROSS PER-MEASURE SAVINGS | | |
|---|---|---|---|---|---|---|---|
| | | kWh | kW | therms | kWh | kW | therms |
| A-Line LEDs – Electric and Gas | Lamp | 28.49 | 0.004 | 0.00 | 28.52 | 0.004 | 0.00 |
| A-Line LEDs – Electric Only Savings | Lamp | 28.49 | 0.004 | 0.00 | 28.52 | 0.004 | 0.00 |
| Candelabra LEDs – Electric and Gas | Lamp | 29.33 | 0.004 | 0.00 | 29.78 | 0.004 | 0.00 |
| Candelabra LEDs – Electric Only Savings | Lamp | 29.33 | 0.004 | 0.00 | 29.78 | 0.004 | 0.00 |
| Globe LEDs – Electric and Gas | Lamp | 28.49 | 0.004 | 0.00 | 28.52 | 0.004 | 0.00 |
| Globe LEDs – Electric Only Savings | Lamp | 28.49 | 0.004 | 0.00 | 28.52 | 0.004 | 0.00 |
| Bathroom Aerator 1.0 gpm – Gas | Aerator | 0.00 | 0.000 | 1.49 | 0.00 | 0.000 | 1.28 |
| Kitchen Aerator 1.5 gpm – Gas | Aerator | 0.00 | 0.000 | 7.92 | 0.00 | 0.000 | 6.27 |
| Low-flow Showerhead 1.5 gpm – Gas | Showerhead | 0.00 | 0.000 | 14.02 | 0.00 | 0.000 | 11.92 |
| Low-flow Showerhead with Shower Start – Gas | Showerhead | 0.00 | 0.000 | 16.15 | 0.00 | 0.000 | 14.04 |
| Programmable Thermostat – Electric Cooling and Gas Heating Savings | Thermostat | 100.87 | 0.000 | 75.09 | 65.76 | 0.075 | 15.67 |
| Programmable Thermostat – Electric Cooling Only Savings | Thermostat | 100.87 | 0.000 | 0.00 | 65.76 | 0.075 | 0.00 |

Table 86 highlights notable differences between *ex ante* and *ex post* gross estimates, which are primarily driven by:

- Differences in input assumptions used by *ex ante* and *ex post* gross savings.
- Differences in installed lighting assumptions used by *ex ante* and *ex post* gross savings.

TABLE 86. 2022 MFDI NOTABLE DIFFERENCES BETWEEN *EX ANTE* & *EX POST* GROSS

| MEASURE | *EX ANTE* SOURCES AND ASSUMPTIONS | *EX POST* GROSS SOURCES AND ASSUMPTIONS | PRIMARY REASONS FOR DIFFERENCES |
|---|---|---|---|
| LED | *Ex ante* savings are based on the Indiana TRM (v2.2) and use post-EISA baseline wattages from the NREL Residential Lighting Protocol | Indiana TRM (v2.2) algorithm and WHFs. Installed LED wattage verified during model number look up. Baseline wattage value per NREL Residential Lighting Protocol based on installed lumens verified during model number look up. | kWh and kW savings increase slightly from *ex ante* for candelabras; primary reason for the difference is due to different installed wattages. During a model number look up, the installed wattage for candelabras was found to be 4.5 W compared with the 5 W assumed by *ex ante*. |
| Kitchen aerator | Indiana TRM (v2.2). Average per household occupancy of 2.64 (SFH). | Illinois TRM (v10). Average per household occupancy of 1.83 (Indiana TRM v2.2). Inlet water temperature of 57.4°F (South Bend assumption in the Indiana TRM v2.2) | Therm savings decreased from *ex ante*. This is largely due to the difference in algorithms and assumptions between the Illinois TRM (v10) and the Indiana TRM (v2.2). A specific assumption between these TRMs that had a significant impact was the base flow of 1.63 gpm in the Illinois TRM (v10) compared with 2.44 gpm in the Indiana TRM (v2.2). For assumptions sourced from the Indiana TRM, *ex ante* assumes a household occupancy of 2.64 which is for single-family homes (SFH) while evaluated uses 1.83 which is for multifamily (MFDI). |

| MEASURE | *EX ANTE* SOURCES AND ASSUMPTIONS | *EX POST* GROSS SOURCES AND ASSUMPTIONS | PRIMARY REASONS FOR DIFFERENCES |
|---|---|---|---|
| Bathroom aerator | Indiana TRM (v2.2). Average per household occupancy of 2.64 (SFH). | Illinois TRM (v10). Average per household occupancy of 1.83 (MFH assumptions in the Indiana TRM v2.2). Inlet water temperature of 57.4°F (South Bend assumption in the Indiana TRM v2.2). | Although RRs are closer to 100% than kitchen aerators, the main drivers are the same and is largely due to the difference in algorithms and assumptions between the Illinois TRM (v10) and the Indiana TRM (v2.2). The base flow of 1.53 gpm in the Illinois TRM (v10) compared with 1.9 gpm in the Indiana TRM (v2.2) was also the most significant difference in values for inputs used between the two. For assumptions sourced from the Indiana TRM, *ex ante* assumes a household occupancy of 2.64 which is for single-family homes (SFH) while evaluated uses 1.83 which is for multifamily (MFDI). |
| Low-flow showerhead | *Ex ante* savings are based on Indiana TRM (v2.2). TRM multifamily assumed people per home, showerheads per home, $GPM_{base}$, and actual $GPM_{low}$ | Illinois TRM (v10). Average per household occupancy of 1.83 (MFH assumptions in the Indiana TRM v2.2). Inlet water temperature of 57.4°F (South Bend assumption in the Indiana TRM v2.2). | For showerheads, the main drivers are similar to aerators and largely due to the difference in algorithms and assumptions between the Illinois TRM (v10) and the Indiana TRM (v2.2). The base flow of 2.24 gpm in the Illinois TRM (v10) compared with 2.63 gpm in the Indiana TRM (v2.2) was also the most significant difference in values for inputs used between the two. |
| Programmable Thermostat | *Ex ante* savings may have been calculated using Indiana TRM (v2.2) and a combination of 2016, 2018, and 2019 EM&V values. EFLH was assumed to be South Bend. Savings factors strictly follow the Indiana TRM (v2.2), which assumes a manual thermostat baseline. | For heating and cooling savings, Indiana TRM (v2.2) algorithm with billing-analysis derived savings fractions and 2021 HVAC program tracking data for equipment capacities and efficiencies were assumed. EFLH was assumed to be South Bend. Applied multifamily heating and cooling adjustments assumed from the 2022 CenterPoint MFDI evaluation. | Based on a review of the Illinois TRM (v10), Indiana TRM (v2.2), and the 2013-2014 Vectren/CenterPoint programmable and smart thermostat program evaluation results, it was determined that the 2020 smart thermostat billing analysis results are comparable and applicable to programmable thermostats in this year's evaluation. The 2020 Billing analysis sourced for the programmable thermostats measure indicated gas baseline consumption much lower and savings fractions lower than the Indiana TRM (v2.2). The billing analysis also indicated a slightly lower cooling savings fraction than the Indiana TRM (v2.2). The Indiana TRM (v2.2) does not include demand reduction associated with cooling for thermostats, however, aligning with the HVAC program evaluation approach and findings from a 2020 billing analysis, a halved cooling coincidence factor was used to apply evaluated demand reduction. Finally, the largest drivers are the multifamily adjustment factors which reduce savings significantly from what are assumed in the TRM, which doesn't consider the reduced heating and cooling demands for multifamily units. |

### WASTE HEAT FACTOR – THERM PENALTIES

The evaluation team is not including therm penalties when calculating evaluated savings for the 2022 MFDI program. However, cost-effectiveness results for both the gas and electric programs will include these penalties. The evaluation team believes this approach is appropriate, as it accounts for the penalty on the electric side (where it is generated) and allows the evaluation team to show gas program performance and measure performance more clearly. The *ex ante* therm penalties estimated in the tracking data are -116.58 therms. In total, the *ex post* therm penalty for cost-effectiveness analysis is also -116.58 therms (Table 87).

TABLE 87. 2022 MFDI PROGRAM WASTE HEAT FACTOR THERM PENALTY

| MEASURE | WASTE HEAT FACTOR THERM PENALTY |
|---|---|
| A-line LEDs – Electric and Gas | (53.94) |
| Candelabra LEDs – Electric and Gas | (34.80) |
| Globe LEDs – Electric and Gas | (27.84) |
| Total | (116.58) |

It should be noted that electric waste heat factors, including cooling credits and electric heating penalties, are currently reported within the kWh and kw savings for the overall program.

## REALIZATION RATES

The next three tables (Table 88 through Table 90) show the program's *ex ante* reported savings, verified savings, and *ex post* gross savings. The program achieved an 81% realization rate for electric energy savings, 182% for peak demand savings, and 69% for gas savings. The deviation of *ex post* electric energy and peak demand saving from *ex ante* is driven by the differences between *ex ante* and *ex post* for the programmable thermostat measure–-specifically, the lack of *ex ante* peak demand savings, the evaluation team's use of 2020 billing analysis results, and the application of a multifamily adjustment factor. Similarly, the largest driver for the low gas savings realization rate is the combination of the 2020 billing analysis heating savings factor and the application of a multifamily heating load reduction factor. Other contributing factors to the low gas savings rate include hot water heating measures where a difference between *ex post* and *ex ante* input assumptions resulted in less evaluated gas savings.

TABLE 88. 2022 MFDI PROGRAM *EX ANTE* & *EX POST* GROSS ELECTRIC ENERGY SAVINGS

| MEASURE | *EX ANTE* ELECTRIC ENERGY SAVINGS (kWh/yr.) | AUDITED GROSS ELECTRIC ENERGY SAVINGS (kWh/yr.) | VERIFIED GROSS ELECTRIC ENERGY SAVINGS (kWh/yr.) | *EX POST* GROSS ELECTRIC ENERGY SAVINGS (kWh/yr.) |
|---|---|---|---|---|
| A-Line LEDs – Electric and Gas | 2,649.57 | 2,649.57 | 2,305.13 | 2,307.65 |
| A-Line LEDs – Electric Only Savings | 23,532.74 | 23,532.74 | 20,473.48 | 20,495.93 |
| Candelabra LEDs – Electric and Gas | 1,701.14 | 1,701.14 | 1,479.99 | 1,502.68 |
| Candelabra LEDs – Electric Only Savings | 10,588.13 | 10,588.13 | 9,211.67 | 9,352.86 |
| Globe LEDs – Electric and Gas | 1,367.52 | 1,367.52 | 1,189.74 | 1,191.05 |
| Globe LEDs – Electric Only Savings | 9,344.72 | 9,344.72 | 8,129.91 | 8,138.82 |
| Bathroom Aerator 1.0 gpm – Gas | 0.00 | 0.00 | 0.00 | 0.00 |
| Kitchen Aerator 1.5 gpm – Gas | 0.00 | 0.00 | 0.00 | 0.00 |
| Low-flow Showerhead 1.5 gpm – Gas | 0.00 | 0.00 | 0.00 | 0.00 |
| Low-flow Showerhead with Shower Start – Gas | 0.00 | 0.00 | 0.00 | 0.00 |
| Programmable Thermostat – Electric Cooling and Gas Heating Savings | 1,210.44 | 1,210.44 | 968.35 | 631.34 |
| Programmable Thermostat – Electric Cooling Only Savings | 10,389.61 | 10,389.61 | 8,311.69 | 5,418.98 |
| Total Savings | 60,783.87 | 60,783.87 | 52,069.96 | 49,039.31 |
| Total Program Realization Rate | | | | 81% |

Note: Totals may not sum properly due to rounding.

TABLE 89. 2022 MFDI PROGRAM *EX ANTE* & *EX POST* GROSS PEAK DEMAND REDUCTION

| MEASURE | *EX ANTE* PEAK DEMAND REDUCTION (kW/yr.) | AUDITED GROSS PEAK DEMAND REDUCTION (kW/yr.) | VERIFIED GROSS PEAK DEMAND REDUCTION (kW/yr.) | *EX POST* GROSS PEAK DEMAND REDUCTION (kW/yr.) |
|---|---|---|---|---|
| A-Line LEDs – Electric and Gas | 0.372 | 0.372 | 0.324 | 0.302 |
| A-Line LEDs – Electric Only Savings | 3.304 | 3.304 | 2.874 | 2.683 |
| Candelabra LEDs – Electric and Gas | 0.232 | 0.232 | 0.202 | 0.197 |
| Candelabra LEDs – Electric Only Savings | 1.444 | 1.444 | 1.256 | 1.224 |
| Globe LEDs – Electric and Gas | 0.192 | 0.192 | 0.167 | 0.156 |
| Globe LEDs – Electric Only Savings | 1.312 | 1.312 | 1.141 | 1.065 |
| Bathroom Aerator 1.0 gpm – Gas | 0.000 | 0.000 | 0.000 | 0.000 |
| Kitchen Aerator 1.5 gpm – Gas | 0.000 | 0.000 | 0.000 | 0.000 |
| Low-flow Showerhead 1.5 gpm – Gas | 0.000 | 0.000 | 0.000 | 0.000 |
| Low-flow Showerhead with Shower Start – Gas | 0.000 | 0.000 | 0.000 | 0.000 |
| Programmable Thermostat – Electric Cooling and Gas Heating Savings | 0.000 | 0.000 | 0.000 | 0.716 |
| Programmable Thermostat – Electric Cooling Only Savings | 0.000 | 0.000 | 0.000 | 6.147 |
| Total Savings | 6.856 | 6.856 | 5.965 | 12.489 |
| Total Program Realization Rate | | | | 182% |

Note: Totals may not sum properly due to rounding.

TABLE 90. 2022 MFDI PROGRAM *EX ANTE* & *EX POST* GROSS NATURAL GAS SAVINGS

| MEASURE | *EX ANTE* NATURAL GAS ENERGY SAVINGS (THERMS/YR.) | AUDITED GROSS NATURAL GAS ENERGY (THERMS/YR.) | VERIFIED GROSS NATURAL GAS ENERGY SAVINGS (THERMS/YR.) | *EX POST* GROSS NATURAL GAS ENERGY SAVINGS (THERMS/YR.) |
|---|---|---|---|---|
| A-Line LEDs – Electric and Gas | 0 | 0 | 0 | 0 |
| A-Line LEDs – Electric Only Savings | 0 | 0 | 0 | 0 |
| Candelabra LEDs – Electric and Gas | 0 | 0 | 0 | 0 |
| Candelabra LEDs – Electric Only Savings | 0 | 0 | 0 | 0 |
| Globe LEDs – Electric and Gas | 0 | 0 | 0 | 0 |
| Globe LEDs – Electric Only Savings | 0 | 0 | 0 | 0 |
| Bathroom Aerator 1.0 gpm – Gas | 224.99 | 224.99 | 204.74 | 175.73 |
| Kitchen Aerator 1.5 gpm – Gas | 665.28 | 665.28 | 605.40 | 479.23 |
| Low-flow Showerhead 1.5 gpm – Gas | 182.26 | 182.26 | 182.26 | 154.97 |
| Low-flow Showerhead with Shower Start – Gas | 2,212.55 | 2,212.55 | 2,212.55 | 1,923.68 |
| Programmable Thermostat – Electric Cooling and Gas Heating Savings | 901.08 | 901.08 | 720.86 | 150.40 |
| Programmable Thermostat – Electric Cooling Only Savings | 0.00 | 0.00 | 0.00 | 0.00 |
| Total Savings | 4,186.16 | 4,186.16 | 3,925.82 | 2,884.01 |
| Total Program Realization Rate | | | | 69% |

Note: Totals may not sum properly due to rounding.

## *EX POST* NET SAVINGS

The *ex post* net savings values reflect savings attributed to the program after adjusting for freeridership and spillover by applying a NTG ratio. Evaluators typically calculate NTG using survey participants' self-reported responses to questions related to what they would have done in the absence of the program (freeridership) and the influence the program had on their decision to implement additional energy efficiency projects after participating (spillover). Because of the limited number of unique property managers that participated in the MFDI program during 2022, performing a full NTG analysis for this program was not possible for this evaluation. The evaluation team utilized NTG values from other evaluation reports for the MFDI program measures in 2022 (Table 91). The team chose the NTG values from various reports based on how closely the measures in those reports mapped to measures in the MFDI program.

Table 91 shows the NTG ratios by measure.

TABLE 91. 2022 MFDI PROGRAM NET-TO-GROSS RATIOS BY MEASURE

| MEASURE | NTG | SOURCE |
|---|---|---|
| A-Line LEDs – Electric and Gas | 96% | Ameren Illinois 2018[23] |
| A-Line LEDs – Electric Only Savings | 96% | Ameren Illinois 2018[24] |
| Candelabra LEDs – Electric and Gas | 96% | Ameren Illinois 2018 |
| Candelabra LEDs – Electric Only Savings | 96% | Ameren Illinois 2018[25] |
| Globe LEDs – Electric and Gas | 96% | Ameren Illinois 2018 |
| Globe LEDs – Electric Only Savings | 96% | Ameren Illinois 2018[26] |
| Bathroom Aerator 1.0 gpm – Gas | 103 % | ComEd, Nicor Gas, Peoples Gas, North Shore Gas 2018[27] |
| Kitchen Aerator 1.5 gpm – Gas | 103 % | ComEd, Nicor Gas, Peoples Gas, North Shore Gas 2018 |
| Low-flow Showerhead 1.5 gpm – Gas | 101 % | Nicor Gas, Peoples Gas, North Shore Gas 2018[28] |
| Low-flow Showerhead with Shower Start – Gas | 101 % | Nicor Gas, Peoples Gas, North Shore Gas 2018 |
| Programmable Thermostat – Electric Cooling and Gas Heating Savings | 98% | Ameren Illinois 2018 |
| Programmable Thermostat – Electric Cooling Only Savings | 89% | Ameren Illinois 2018 |

Table 92 presents the resulting net electric savings, demand reduction, and natural gas savings.

[23] Ameren Illinois Company. *2018 Multifamily Initiative Tenant and Property Manager Survey NTGR Results.* September 4, 2019.

[24] Ameren Illinois Company. *2018 Multifamily Initiative Tenant and Property Manager Survey NTGR Results.* September 4, 2019.

[25] Ameren Illinois Company. *2018 Multifamily Initiative Tenant and Property Manager Survey NTGR Results.* September 4, 2019.

[26] Ameren Illinois Company. *2018 Multifamily Initiative Tenant and Property Manager Survey NTGR Results.* September 4, 2019.

[27] ComEd. *Net-to-Gross Research Results for ComEd Multifamily Market Rate Program PY9 and CY2018.* September 12, 2019.

[28] Nicor Gas, Peoples Gas, North Shore Gas. *Net-to-Gross Research Results for the Market Rate Multi-Family Program for Nicor Gas, Peoples Gas, and North Shore Gas GPY6 and CY2018.* August 28, 2019.

TABLE 92. 2022 MFDI PROGRAM EX POST NET SAVINGS

| MEASURE | *EX POST* GROSS SAVINGS/REDUCTION | | | NTG | *EX POST* NET SAVINGS/REDUCTION | | |
|---|---|---|---|---|---|---|---|
| | kWh | kW | therms | | kWh | kW | therms |
| A-Line LEDs–- Electric and Gas | 2,307.65 | 0.302 | 0.00 | 96% | 2,215.35 | 0.290 | 0.00 |
| A-Line LEDs–- Electric Only Savings | 20,495.93 | 2.683 | 0.00 | 96% | 19,676.10 | 2.575 | 0.00 |
| Candelabra LEDs–- Electric and Gas | 1,502.68 | 0.197 | 0.00 | 96% | 1,442.57 | 0.189 | 0.00 |
| Candelabra LEDs–- Electric Only Savings | 9,352.86 | 1.224 | 0.00 | 96% | 8,978.74 | 1.175 | 0.00 |
| Globe LEDs–- Electric and Gas | 1,191.05 | 0.156 | 0.00 | 96% | 1,143.41 | 0.150 | 0.00 |
| Globe LEDs–- Electric Only Savings | 8,138.82 | 1.065 | 0.00 | 96% | 7,813.27 | 1.023 | 0.00 |
| Bathroom Aerator 1.0 gpm–- Gas | 0.00 | 0.000 | 175.73 | 103% | 0.00 | 0.000 | 181.00 |
| Kitchen Aerator 1.5 gpm–- Gas | 0.00 | 0.000 | 479.23 | 103% | 0.00 | 0.000 | 493.61 |
| Low-flow Showerhead 1.5 gpm–- Gas | 0.00 | 0.000 | 154.97 | 101% | 0.00 | 0.000 | 156.52 |
| Low-flow Showerhead with Shower Start–-Gas | 0.00 | 0.000 | 1,923.68 | 101% | 0.00 | 0.000 | 1,942.92 |
| Programmable Thermostat–- Electric Cooling and Gas Heating Savings | 631.34 | 0.716 | 150.40 | 98% | 618.71 | 0.702 | 147.39 |
| Programmable Thermostat–- Electric Cooling Only Savings | 5,418.98 | 6.147 | 0.00 | 89% | 4,822.90 | 5.471 | 0.00 |
| Total Savings | 49,039.31 | 12.489 | 2,884.01 | | 46,711.03 | 11.574 | 2,921.44 |

Note: Totals may not sum properly due to rounding.

Table 93 shows the NTG values for each fuel.

TABLE 93. 2022 MFDI NET-TO-GROSS RESULTS BY FUEL TYPE

| SAVINGS TYPE | *EX ANTE* GROSS SAVINGS | *EX POST* GROSS SAVINGS | NTG RATIO (%) | *EX POST* NET SAVINGS |
|---|---|---|---|---|
| Electric Energy Savings (kWh/yr.) | 60,783.87 | 49,039.31 | 95% | 46,711.03 |
| Peak Demand Reduction (kW) | 6.856 | 12.489 | 93% | 11.574 |
| Natural Gas Energy Savings (therms/yr.) | 4,186.16 | 2,884.01 | 101% | 2,921.44 |

# PROCESS EVALUATION

The evaluation team completed program staff interviews and discussions, documentation and materials review, a multifamily program literature review, auditor interviews, and a census data mapping exercise to answer the following research questions:

- How are other utilities running similar programs? What aspects of these could NIPSCO incorporate into their program design?
- What strategies do other utilities use to increase participation in their Multifamily programs?
- How do auditors view the MFDI program? What do they think is key to engaging property managers/landlords?

# MULTIFAMILY PROGRAM LITERATURE REVIEW

The evaluation team reviewed 6 other multifamily energy efficiency programs across the country to investigate marketing practices, delivery channels, and other program strategies. Table 94shows the programs used for comparisons with a snapshot of customers served.

TABLE 94. COMPARISON PROGRAMS

| PROGRAM | STATE | CUSTOMERS | FUEL TYPES |
|---|---|---|---|
| Puget Sound Energy Multifamily Retrofit | WA | 1.2M electric; 900,000 gas | Electric and gas |
| NYSEG/RG&E Multifamily Energy Efficiency Program | NY | NYSEG: 900,000 electric; 270,000 gas<br>RG&E: 386,000 electric; 320,000 gas | Electric and gas |
| National Grid RI Energy Multifamily Program | RI | N.D.* | Electric and gas |
| Ameren Illinois Multifamily Program | IL | 1.2M electric; 816,000 gas | Electric and gas |
| Com Ed Multifamily Energy Savings (in conjunction with Peoples Gas, North Shore Gas, NICOR) | IL | 4M electric | Electric |
| Consumers Energy Multifamily Property Energy Efficiency Program | MI | 6.8M customers | Electric and gas |

*No data.

## DELIVERY CHANNELS

Below are summarized findings on peer utility delivery channels.

**Free building assessments and direct-install components are common practices among these programs.** All six programs reviewed offer a free building assessment as the entry point for the program. The assessment helps program staff establish a relationship with the property manager and allows for a comprehensive review of potential energy saving measures. Additionally, direct-install measures provide free energy saving opportunities to eligible buildings. NIPSCO's program also features these components.

**Property managers seeking deeper savings can also access common area incentives in a variety of ways.** While all 6 programs offered in-unit direct install measures for tenants, programs varied in how they approached common area measures. While some programs leveraged other utility business programs such as C&I or small business offerings, others preferred a single-program approach.

- Puget Sound Energy offers a variety of incentivized measures through their Multifamily Retrofit Program. Property managers can request bids from the program's trade ally network for projects like air sealing, insulation, common area lighting, furnaces, boilers, and HVAC equipment.[29]

[29] Puget Sound Energy Multifamily Retrofit Brochure. https://www.pse.com/-/media/PDFs/REBATES/4111_wb_MF_Retrofit.pdf?sc_lang=en&modified=20221215155136&hash=FDC3521504A186E40CF36A2B3C1B8DB1. Accessed 11 Apr. 2023.

- NYSEG and RG&E's Multifamily Energy Efficiency program offers common area lighting measures through the program as well as air sealing and insulation. Common area lighting (including exterior and interior) and occupancy sensors receive up to a 70% incentive, and air sealing and insulation measures are incentivized based on predicted energy savings. In program years 2019 and 2020, the program implementer conducted the direct install measures and program-approved trade allies were engaged by property managers for common area lighting measures. In program year 2021, the program took a whole-building approach with the new program implementer conducting the assessment, direct install in-unit measures (through subcontractor installers), and common area lighting measures.[30] For non-lighting measures such as HVAC or controls, property managers are directed to other utility programs such as the C&I or SBDI Program.
- National Grid RI Energy Multifamily program offers additional common area measures through the program. In addition to the in-unit direct-install measures, common area lighting, refrigerator rebates, weatherization, and heating system measures are available. The program implementer uses a model where buildings over 20 units that receive an assessment are bid out to a group of contractors for the package of work available, including both in-unit and common area measures. For buildings with fewer units, the program implementer manages the installation process.[31]
- Ameren Illinois Multifamily program began taking a "one-stop shop" approach in 2020. In this model, multifamily property managers have a single point of contact within the program that leads them through the assessment and direct install process, and then guides them through a variety of multifamily initiatives that make the most sense for their properties. Additional offerings include accessing bulk appliance rebates as well as base-building equipment retrofits. The program-supported Energy Advisor helps navigate the process with the property manager.[32]
- ComEd Multifamily Energy Savings program, like Ameren Illinois, offers a one-stop shop approach where a single point of contact guides property managers through the assessment phase, direct-install phase, and common area/deeper savings phase. Incentives for boiler upgrades, variable speed drive (VSD) motor upgrades, select appliances, and HVAC improvements are available through the program, and the point of contact helps property managers connect with approved Energy Efficiency service providers to scope and install these projects.
- Consumers Energy Multifamily Property Energy Efficiency program offers prescriptive rebates for deeper measures such as programmable thermostats, boilers/furnaces, insulation, windows, HVAC, and water heating through the program. In addition to prescriptive rebates, property managers can also opt for custom projects. The custom pathway can include projects outside of the direct install and prescriptive offerings, and these projects are covered at up to 50% of the cost. [33]

These programs range from the more comprehensive "one-stop shop" approach used by Ameren Illinois to the more narrowly focused model used by programs like NYSEG and RG&E's Multifamily Energy Efficiency program, where measures beyond common area lighting are handled through separate programs. NIPSCO's approach most closely aligns with NYSEG and RG&E's approach, with the notable exception that for NIPSCO multifamily customers, the common area lighting is handled by a separate program. It should be noted that NYSEG and RG&E's evaluation report indicated that the program administrators are interested in moving towards a more whole-building focused/comprehensive program.

[30] NYSEG and RG&E. *Multifamily Program Evaluation Report, Program Years 2019-20.* December 30, 2021.
[31] National Grid RI. *Impact and Process Evaluation: EnergyWise and Income Eligible Multifamily Programs.* September 2020.
[32] Ameren Illinois Company. *Summary of Findings from 2021 Property Manager Interviews.* July 25, 2022.
[33] Consumers Energy Multifamily Savings Program FAQ. https://www.consumersmultifamilysavings.com/faq. Accessed 11 Apr. 2023.

Low-income pathways provide additional options that mitigate cost barriers for buildings that serve income-eligible tenants. Several programs offer specific pathways for low-income multifamily buildings to enhance their participation. Puget Sound Energy, National Grid RI Energy, Ameren Illinois, and ComEd offer specific pathways for low- or moderate-income multifamily buildings. Puget Sound Energy offers enhanced common area rebates for windows, air sealing, HVAC measures, common area lighting, water heaters, clothes dryers, boilers, and furnaces as well as free thermostat and in-unit lighting for income-eligible properties. National Grid RI Energy's program offers income-eligible multifamily properties 100% of project costs for deeper retrofit measures. Ameren Illinois' program uses the one-stop shop approach to triage multifamily buildings between their market rate offering and their Income Qualified and Public Housing initiatives. Similarly, ComEd's program offers free upgrades to income eligible and public housing buildings. Though NYSEG and RG&E do not have a specific low-income pathway, the utilities are administering the New York State Affordable Multifamily Energy Efficiency Program along with NYSERDA and other New York utilities; this offering features comprehensive and non-comprehensive pathways for eligible buildings. Currently NIPSCO does not offer a separate low-income pathway.

## MARKETING STRATEGIES AND CHALLENGES

Below are some highlighted marketing strategies and challenges identified by peer utility program evaluations.

Direct outreach and word-of-mouth marketing channels are most effective at attracting property managers to the program. NYSEG and RG&E's programs and National Grid RI Energy's programs both noted that direct outreach to landlords and property managers was the most effective way to recruit customers to the program. The process evaluation for NYSEG and RG&E's programs indicated that 86% of property managers were introduced to the program through word-of-mouth or one-on-one marketing channels. Those one-on-one channels included a variety of market actors including trade allies, utility representatives/program implementers, energy consultants, other property managers, and professional organizations. For National Grid RI Energy's program, the utility takes on mass marketing such as targeted email campaigns to property managers. They also engage in networking at trade shows such as the Rhode Island Home Show. However, process evaluation findings for the National Grid RI Energy program note that direct outreach by the program implementer to property managers gets the most traction. NIPSCO program implementers are currently using a variety of outreach strategies, including direct outreach and industry events, which is like other comparable programs.

Some programs also use marketing to tenants to increase awareness of program benefits. Puget Sound Energy's program noted that they host energy fairs in the lobby of multifamily buildings. This provides education opportunities for tenants and helps them understand the value of the in-unit direct install measures. Additionally, NYSEG and RG&E's multifamily programs also reported that they reach tenants through mailers, bill-inserts, or flyers; however, it should be noted that property managers and landlords are the prime avenue for tenants' awareness of the program and receptivity to in-unit measures.

Program models that include trade allies leverage these partners for additional marketing channels. Specifically, Puget Sound Energy and Consumers Energy called out leveraging trade ally networks to increase the reach of the program. Puget Sound Energy's program uses trade allies to install common area measures that achieve deeper savings. The program uses the trade allies' existing marketing channels to educate a broader set of property managers, and the program focuses on early involvement from these trade allies. The program also noted that they collaborate with energy professionals on limited time offers to enhance program traction. Consumers Energy also leveraged trade allies to increase program reach. The program uses trade allies for prescriptive and custom projects beyond direct-install measures, and program staff trained trade allies on the program benefits so that they could communicate that to their existing customer base.

The "one-stop-shop" approach might facilitate deeper savings and appeal to some property managers. For example, the Ameren Illinois Multifamily program transitioned to this approach for its primary customer engagement strategy. In this model, the program provides property managers/owners with a single point of contact (SPOC) to access all program offerings. The SPOC helps guide property managers to solutions and incentives that work best for their property, and the model is meant to streamline the process. The SPOC works with the property to determine which pathway to pursue – market rate, income qualified, or public housing. Additionally, they help properties pursue other efficiency programs including bulk appliance rebates. Program process evaluations found that property managers that participated in the Ameren Illinois Multifamily program were satisfied overall with the one stop shop approach and the energy advisor assigned to their property. Participating property managers reflected that the process was easy to navigate because of the SPOC model.

Other multifamily programs experience similar challenges in reaching property managers and engaging them to participate. A key barrier is promoting program awareness among property managers. For example, the process evaluation for NYSEG/RG&E's programs indicated that program staff and the implementation contractor believe that overall awareness of the program is low. They also expressed the need for devoting resources to outreach and developing creative collateral materials. Relatedly, interviews with participating property managers in Ameren Illinois Multifamily program showed that barriers to participation included pushback from tenants and inadequate staff time to coordinate with the program. The lack of staff time aligns with challenges experienced by NIPSCO's program implementers and underscores the importance of making the process as streamlined as possible.

## DIRECT INSTALL STAFF INTERVIEWS

The evaluation team interviewed staff members at Threshold as part of the process evaluation activities. While these team members were not responsible for the audits of multifamily buildings, they were active in the direct-install portion of the program (i.e., their team was responsible for installing measures in tenant spaces). They provided some limited feedback on the MFDI program including the following observations:

- It remains challenging to reach property managers and engage them in the program. Many do not see the value of allocating maintenance staff time to ensuring the installers can access tenant spaces. One interviewee suggested that finding a champion in upper management (e.g., "above the property manager's head") might be a strategy for the program to gain traction.
- One installer reflected that installing Wi-Fi thermostats in multifamily buildings could have additional benefits such as enabling summer demand response capabilities. If property managers can receive incentives for demand response, the program could provide greater value to the building.
- One installer indicated that they preferred to conduct HEA and IQW audits and installations since they believed that the compensation for these jobs were more lucrative than MFDI installs.

## CENSUS DATA MAPPING

The evaluation team also looked at census data to determine geographic areas of interest for the MFDI program. The American Community Survey provides information on housing units. The map in Figure 54. Census tracts with 25% of Housing Units Renter Occupied below shows census tracts where at least 25% of housing units are renter-occupied. The map in Figure 55. Census Tracts with Over 100 Multifamily Units also shows census tracts where there are at least 100 multifamily units. These tracts might feature more multifamily buildings or units than other census tracts based on the proportion of renter occupied units as well as the number of multifamily units. There are several census tracts concentrated around Gary, South Bend, and Fort Wayne, which feature a higher proportion of renters than other tracts.

These areas might be prime for the program to focus marketing efforts such as community-based outreach or using local elected officials or municipal officials to connect with property managers and to engage tenants.

FIGURE 54. CENSUS TRACTS WITH 25% OF HOUSING UNITS RENTER OCCUPIED

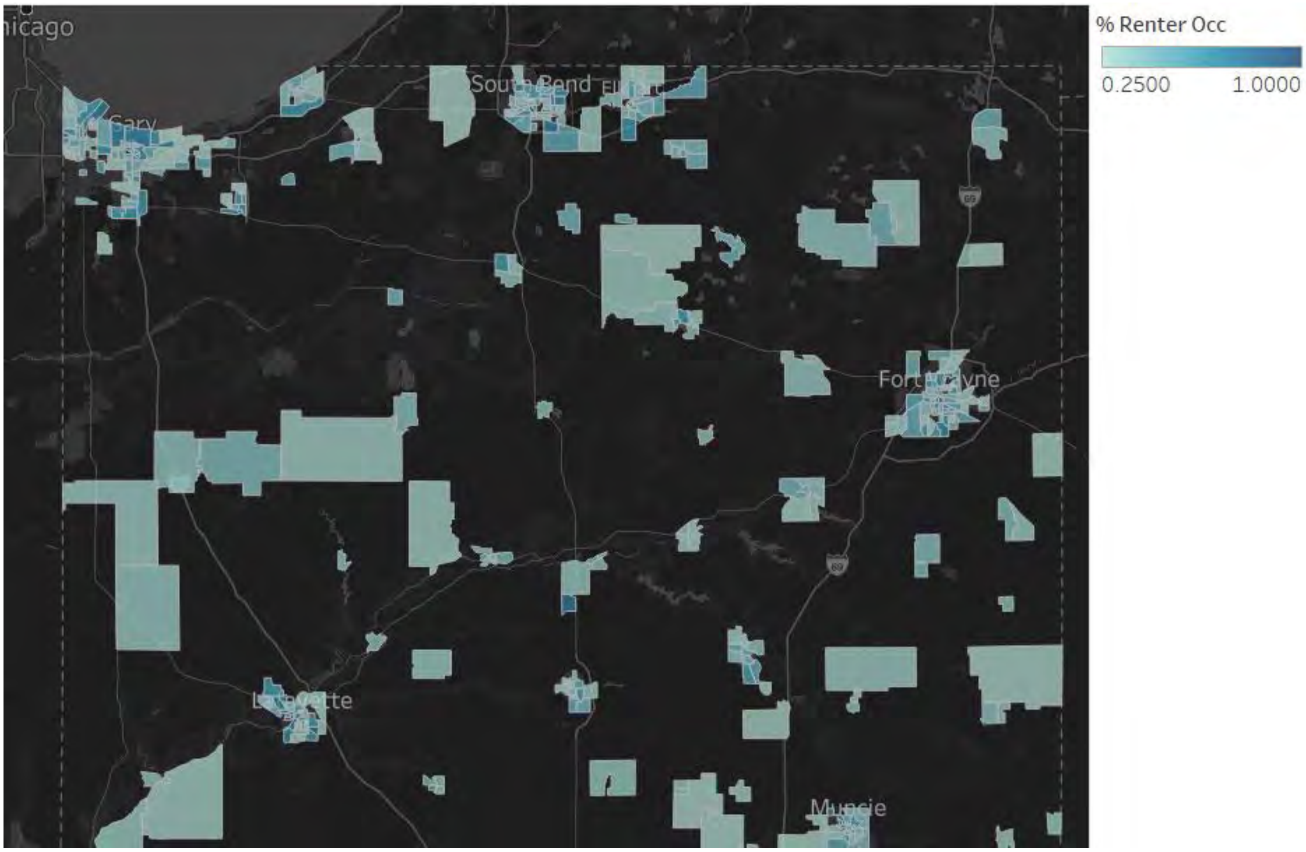
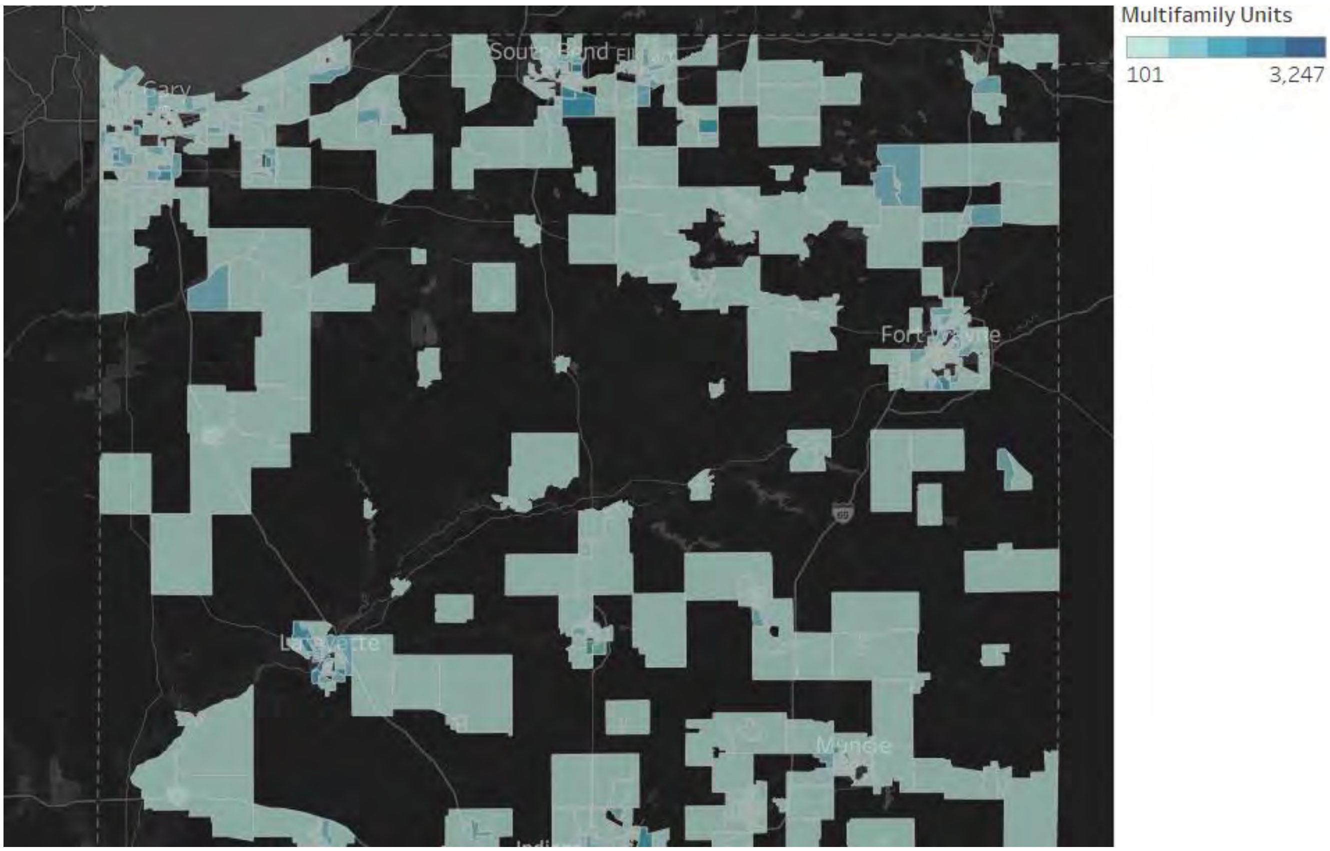


FIGURE 55. CENSUS TRACTS WITH OVER 100 MULTIFAMILY UNITS




## CONCLUSIONS AND RECOMMENDATIONS

**CONCLUSION 1: THE PROGRAM DID NOT MEET SAVINGS GOALS IN 2022.**

Limited participation resulted in the program not meeting 2022 savings goals. This was due to difficulties in engaging property managers and limited property staff time to dedicate to project completion. Savings goals were not met in the previous year, largely due to limited program activity due to COVID-19.

**Recommendations:**

- When planning for future program designs, consider a strategic marketing and outreach plan that uses one-to-one outreach strategies and other community stakeholders or groups to reach eligible property managers.
- In terms of program design and delivery, consider ways to increase the value proposition for participants. Several peer utility programs have transitioned to one-stop-shop participation models, which streamline the process and emphasize both in-unit and common area improvements as part of the same participation experience.
- Additionally, helping buildings unlock deeper savings through partnerships with specialized trade allies might provide additional incentives for property managers to participate, thus enhancing the value proposition.

### CONCLUSION 2: REALIZATION RATES VARIED DUE TO DIFFERENCES IN ASSUMED INPUTS BETWEEN THE TECHNICAL REFERENCE MANUALS USED AND INPUTS SOURCED FROM A 2020 HVAC PROGRAM BILLING ANALYSIS.

Recommendations:

- Update savings approaches to the Illinois TRM to anticipate the upcoming Indiana TRM update. Where applicable, use Indiana location specific input assumptions from Indiana TRM (v2.2) until an updated Indiana TRM is provided. For new programable thermostat measures, utilize the Indiana TRM algorithms and assume savings factors calculated in the most recent NIPSCO HVAC billing analysis. Additionally, apply the provided multifamily adjustment factors to account for reduced heating and cooling loads in multifamily units.

### CONCLUSION 3: OTHER MULTIFAMILY PROGRAM EVALUATIONS INDICATE DIFFICULTIES IN REACHING RELEVANT CONTACTS AT PROPERTY MANAGEMENT FIRMS, BUT ONE-TO-ONE MARKETING EFFORTS SEEM TO BE MOST EFFECTIVE.

Recommendations:

- The program might consider expanding on the evaluation's mapping exercise to home in on key neighborhoods to target for MFDI program marketing.
- The program could consider focusing marketing and outreach efforts on geographic areas with a greater concentration of multifamily units and renters. Enlisting the help of community-based organizations, local elected officials, or city planning agencies might help the program connect to property management firms.
- Using case studies or program materials that emphasize the benefits to property owners (e.g., happier tenants, fewer maintenance issues, bill savings) might help attract property managers to the program.
- One-to-one marketing channels could focus on developing trusted relationships with property owners and on finding project champions within property management organizations.

# 8. APPLIANCE RECYCLING PROGRAM

## PROGRAM DESIGN AND DELIVERY

NIPSCO offers the Appliance Recycling program to incentivize customers to remove their inefficient secondary refrigerators, freezers, room air conditioners, and dehumidifiers. Recycling these secondary units can provide long term energy savings by removing the inefficient appliances from the grid. The program implementer picks up the appliances and recycles them in an environmentally friendly manner. Customers receive a $50 rebate for refrigerators or freezers and a $15 rebate for room air conditioners or dehumidifiers. In the 2022 program year, the program recycled 1,446 appliances. Table 95 describes the number of each appliance type that the program recycled.

TABLE 95. 2022 APPLIANCE RECYCLING *EX ANTE* RECYCLED UNITS

| APPLIANCE TYPE | NUMBER RECYCLED |
|---|---|
| Refrigerator | 1052 |
| Freezer | 260 |
| Dehumidifier | 65 |
| Room Air Conditioner | 69 |

In 2022, NIPSCO continued working with ARCA as the Appliance Recycling implementer. ARCA schedules and picks up appliances, conducts the recycling functions, and processes the rebates for the NIPSCO Appliance Recycling program. In addition, the pick-up crew leaves behind marketing collateral for other NIPSCO programs. ARCA provides in-home appliance pick-up as well as a curbside pick-up option. NIPSCO introduced the curbside option in 2020 due to the COVID-19 pandemic and it has remained as an option since then.

The following describes the steps a customer takes to participate in the program.

1. After the customers learn about the Appliance Recycling program, they can participate by scheduling a pick-up with ARCA through NIPSCO's website or over the phone.
2. Customers can schedule a pick-up date and time after ARCA confirms their eligibility for the program. Customers receive an order confirmation number and an email with the pick-up details from ARCA.
3. ARCA's pick-up crew calls customers the day before their pick-up to provide a two-to-four-hour pick-up window; on the morning of the pick-up ARCA calls customers one stop prior (about 10 – 15 minutes) to notify them again.[34]
4. While on site, ARCA's pick-up crew members maintain a social distance of at least six feet, when possible, wear face masks and gloves, and use hand sanitizer due to the COVID-19 pandemic. If it is a curbside pick-up, the customer must place the appliance on the porch, sidewalk, driveway, or open garage.

[34] The text in the Program Abstract indicates a two-hour window the day before the pick-up while the process flow diagram indicates a four-hour window two days before the pick-up.

5. The pick-up crew confirms the appliances' eligibility (i.e., whether they are plugged in, operational, and the correct size) and then collects the unit's information, including their assessment of the appliance's age and other characteristics.
6. ARCA then permanently disables the appliance and removes it for transport to the processing centers. ARCA sends pick-up tracking data to TRC and then NIPSCO monthly.
7. Customers receive their rebate checks within six weeks of pick-up.

NIPSCO marketed the program to customers in many ways in 2022, including through bill and check inserts, mail, email, community outreach events, public relations, the NIPSCO website, NIPSCO social media, and cross-promotion through other programs such as the kit program.

### CHANGES FROM 2021 DESIGN

There were no changes to the Appliance Recycling Program in 2022.

## PROGRAM PERFORMANCE

The program fell short of meeting its goals for the 2022 program year. Interviews with the TRC implementation team indicate program participation may have been low due to supply chain issues as customers waited to receive their new appliances, and/or ARCA's challenges with staffing for pick up crews. Table 96 summarizes savings for the full year of program performance, including program savings goals.

TABLE 96. 2022 APPLIANCE RECYCLING PROGRAM SAVING SUMMARY

| METRIC | GROSS SAVINGS GOAL | *EX ANTE* | AUDITED | VERIFIED | *EX POST* GROSS | *EX POST* NET | *EX POST* GROSS GOAL ACHIEVEMENT |
|---|---|---|---|---|---|---|---|
| Electric Energy Savings (kWh/yr.) | 2,330,676.00 | 1,181,094.66 | 1,181,094.66 | 1,181,094.66 | 1,151,522.05 | 651,705.08 | 49% |
| Peak Demand Reduction (kW) | 586.602 | 196.153 | 196.153 | 196.153 | 162.045 | 91.467 | 28% |

Table 97 outlines the *ex post* gross and NTG adjustment factors. The evaluation team continued to use the NTG ratio from the 2020 survey of program participants. The NTG ratio was 57% for electric energy and 56% for demand savings.

TABLE 97. 2022 APPLIANCE RECYCLING ADJUSTMENT FACTORS

| METRIC | REALIZATION RATE (%)[a] | FREERIDERSHIP | SPILLOVER | NTG (%)[b] |
|---|---|---|---|---|
| Electric Energy Savings (kWh/yr.) | 97% | 43% | 0% | 57% |
| Peak Demand Reduction (kW) | 83% | 44% | 0% | 56% |

[a] Realization Rate is defined as *ex post* Gross savings divided by *ex ante* savings.
[b] NTG is defined as *ex post* net savings divided by *ex post* gross savings.

The program spent 52% of its budget in the 2022 program year. Table 98 lists the 2022 program budget and expenditures.

TABLE 98. 2022 APPLIANCE RECYCLING PROGRAM EXPENDITURES

| FUEL | PROGRAM BUDGET | PROGRAM EXPENDITURES | BUDGET SPENT (%) |
|---|---|---|---|
| Electric | $370,234.47 | $191,510.59 | 52% |

# EVALUATION METHODOLOGY

To inform the 2022 NIPSCO impact and process evaluation, the evaluation team completed the following research activities:

- **Program staff interviews and discussions,** to understand the program process, delivery, and design.
- **Documentation and materials review,** to provide context on program implementation.
- **Tracking data analysis,** to audit and verify the accuracy of program participation data.
- **Engineering analysis,** to review program savings assumptions and algorithms for reasonableness and accuracy.

# IMPACT EVALUATION

This section details each step of the impact evaluation and its associated electric energy savings and peak demand reduction. The evaluation team completed the impact evaluation to answer the following research questions:

- What assumptions were used to develop savings estimates? Are there any updates that should be made?
- What are *ex post* program savings? Do these suggest any needed updates to program design, delivery, or savings assumptions?

For all measure types, the evaluation team compared its engineering calculations to NIPSCO's *ex ante* savings, basing its savings methodologies and inputs for each measure on several sources: the Illinois TRM (v10.0), the Pennsylvania TRM (2021), and the 2015 Indiana TRM (v2.2).[35] It should be noted that prior to this evaluation year, the evaluation team used the Indiana TRM as our primary source and supplemented with other sources as needed. The Indiana TRM is out-of-date, and currently in the process of being updated to align more closely with the Illinois TRM. After discussions with NIPSCO, our team felt it would be best practice to use the Illinois TRM as our primary source while the Indiana TRM is in process of being updated, as the Illinois TRM is updated annually and should align closely with the new version of the Indiana TRM.

## AUDITED AND VERIFIED SAVINGS

The evaluation team reviewed the program tracking data provided by TRC and audited the program savings and recycled appliances by looking for duplicate records, misapplied deemed savings calculations, and program participants or appliances that did not meet the program requirements.

The 2022 program tracking data included 1,446 records. According to the program tracking data, the program recycled 1,446 appliances in the 2022 program year. Table 99 shows the *ex ante* measure count for the Appliance Recycling program.

[35] Cadmus. *Indiana Technical Reference Manual Version 2.2*. July 28, 2015.

TABLE 99. 2022 APPLIANCE RECYCLING PROGRAM *EX ANTE* COUNT

| MEASURE | *EX ANTE* COUNT |
|---|---|
| Refrigerator | 1,052 |
| Freezer | 260 |
| Dehumidifier | 65 |
| Room Air Conditioner | 69 |
| 2022 PROGRAM TOTAL | 1,446 |

The evaluation team found that no recycled appliances were outside of the program requirements.

Table 100 summarizes the tracking data quantity, audited quantity, and resulting verified quantity per measure. In-service rates are not applicable to appliance recycling programs, but past surveys have verified that participants recall participating in the program and data on recycled measures is correct.

TABLE 100. 2022 APPLIANCE RECYCLING PROGRAM *EX ANTE* THROUGH VERIFIED QUANTITIES

| MEASURE | UNIT OF MEASURE | TRACKING DATA QUANTITY | AUDITED QUANTITY | VERIFIED QUANTITY |
|---|---|---|---|---|
| Refrigerators | Recycled Appliance | 1,052 | 1,052 | 1,052 |
| Freezers | Recycled Appliance | 260 | 260 | 260 |
| Dehumidifiers | Recycled Appliance | 65 | 65 | 65 |
| Room Air Conditioners | Recycled Appliance | 69 | 69 | 69 |
| 2022 PROGRAM TOTAL | | 1,446 | 1,446 | 1,446 |

## *EX POST* GROSS SAVINGS

The evaluation team calculated *ex post* gross per-measure savings for program measures using algorithms and variable assumptions from the Illinois TRM (v10.0) (refrigerator, freezer, and room AC recycling), the Indiana TRM (v2.2) (room AC recycling), and the Pennsylvania TRM (2021) (dehumidifier recycling). Most program *ex post* gross savings continued to be driven by refrigerator and freezer recycling, with room air conditioners and dehumidifiers making up a relatively small proportion of savings and participation, as shown in Table 101 below.

TABLE 101. 2022 APPLIANCE RECYCLING PROGRAM PROPORTION OF VERIFIED COUNTS AND *EX POST* GROSS SAVINGS BY MEASURE

| MEASURE | PROPORTION OF VERIFIED COUNTS | PROPORTION OF *EX POST* GROSS SAVINGS |
|---|---|---|
| Refrigerators | 73% | 76% |
| Freezers | 18% | 18% |
| Dehumidifiers | 4% | 4% |
| Room Air Conditioners | 5% | 2% |

The evaluation team estimated gross and net impact components on a per-unit basis and for the program overall. For the *ex post* gross analysis for refrigerators and freezers, the evaluation team used 2020 participant survey results for the part-use factor, the unit age, the percent of refrigerators that were used as a primary unit, and the percent of units that were in unconditioned spaces. Information is provided in *Appendix 6* on the sources used for room AC and dehumidifier algorithms and inputs.

*Ex post* gross impacts for refrigerators and freezers encompass estimates from the following sources (Table 102).

TABLE 102. 2022 APPLIANCE RECYCLING PROGRAM *EX POST* GROSS IMPACT INPUT SOURCES – REFRIGERATORS AND FREEZERS

| ESTIMATE | PURPOSE | SOURCE |
|---|---|---|
| Per-unit energy consumption | In situ metering-based regression modeling | 2022 Tracking Data |
| Part-use factor | Accounting for units not in use for the entire year | 2020 Participant Survey |
| Average gross per-unit energy savings | Based on per-unit energy consumption and part-use factors | 2022 Tracking Data and 2020 Participant Survey |

*Appendix 6* presents the algorithms, variable assumptions, and specific references for all program measure *ex post* calculations. It also contains detailed descriptions that explain the differences between *ex ante* and *ex post* savings.

## *EX POST* GROSS SAVINGS

Table 103 shows the *ex ante* deemed savings and *ex post* gross per-measure savings for 2022 Appliance Recycling measures.

TABLE 103. 2022 APPLIANCE RECYCLING *EX ANTE* & *EX POST* GROSS PER-MEASURE SAVINGS VALUES

| MEASURE | UNIT OF MEASURE | *EX ANTE* DEEMED SAVINGS | | *EX POST* GROSS PER-MEASURE SAVINGS | |
|---|---|---|---|---|---|
| | | KWH | KW | KWH | KW |
| Refrigerators | Recycled appliance | 901.00 | 0.134 | 836.00 | 0.103 |
| Freezers | Recycled appliance | 671.00 | 0.100 | 801.00 | 0.094 |
| Dehumidifier | Recycled appliance | 711.00 | 0.173 | 711.00 | 0.173 |
| Room Air Conditioners | Recycled appliance | 182.14 | 0.260 | 254.71 | 0.260 |

Table 104 highlights notable differences between *ex ante* and *ex post* gross estimates.

TABLE 104. 2022 APPLIANCE RECYCLING NOTABLE DIFFERENCES BETWEEN *EX ANTE* & *EX POST* GROSS

| MEASURE | *EX ANTE* SOURCES AND ASSUMPTIONS | *EX POST* GROSS SOURCES AND ASSUMPTIONS | PRIMARY REASONS FOR DIFFERENCES |
|---|---|---|---|
| Refrigerators | *Ex ante* savings based on the 2020 evaluation results. | Illinois TRM (V10.0) | The Illinois TRM (V10.0) model specifications to estimate the annual unit energy consumption (UEC) of refrigerators contain different model coefficients than what was used for the 2020 evaluation. The model coefficients specified in the Illinois TRM (V10.0) resulted in a lower UEC compared to using the coefficients specified in the 2020 evaluation. |
| Freezers | *Ex ante* savings based on the 2020 evaluation results. | Illinois TRM (V10.0) | The Illinois TRM (V10.0) model specifications to estimate the annual unit energy consumption (UEC) of freezers contain different model coefficients than what was used for the 2020 evaluation. The model coefficients specified in the Illinois TRM (V10.0) resulted in a higher UEC compared to using the coefficients specified in the 2020 evaluation. |
| Dehumidifiers | *Ex ante* savings are based on Pennsylvania TRM (2021) algorithms and assumptions. | Dehumidifier recycling is not included in the Indiana TRM (v2.2) or the Illinois TRM (v10.0); therefore, the evaluation team used the default values from the Pennsylvania TRM | No differences. |

| MEASURE | *EX ANTE* SOURCES AND ASSUMPTIONS | *EX POST* GROSS SOURCES AND ASSUMPTIONS | PRIMARY REASONS FOR DIFFERENCES |
|---|---|---|---|
| | | (2021) to calculate *ex post* per-measure energy savings and demand reduction for recycled dehumidifiers. | |
| Room Air Conditioners | *Ex ante* savings are based on Illinois TRM (v10.0) algorithms and assumptions. | Illinois TRM (v10.0) and Indiana TRM (v2.2). | The evaluation team mapped room air conditioner recycling participants service address zip code to the closest reference city specific full-load cooling hours default values from the Indiana TRM (v2.2) to develop a weighted average full load hours ($FLH_{RoomAC}$) for cooling value of 294. *Ex ante* savings used the Chicago climate zone ($FLH_{RoomAC}$) default value of 210 from Illinois TRM (v10.0). |

## REALIZATION RATES

The next two tables (Table 105 and Table 106) show the program's *ex ante* reported savings, audited savings, verified savings, and *ex post* gross savings.

TABLE 105. 2022 APPLIANCE RECYCLING PROGRAM *EX ANTE* & *EX POST* GROSS ELECTRIC ENERGY SAVINGS

| MEASURE | *EX ANTE* [a] ELECTRIC ENERGY SAVINGS (kWh/yr.) | AUDITED GROSS ELECTRIC ENERGY SAVINGS (kWh/yr.) [a] | VERIFIED GROSS ELECTRIC ENERGY SAVINGS (kWh/yr.) | *EX POST* GROSS ELECTRIC ENERGY SAVINGS (kWh/yr.) |
|---|---|---|---|---|
| Refrigerators | 947,852.00 | 947,852.00 | 947,852.00 | 879,472.00 |
| Freezers | 174,460.00 | 174,460.00 | 174,460.00 | 208,260.00 |
| Dehumidifier | 46,215.00 | 46,215.00 | 46,215.00 | 46,215.00 |
| Room Air Conditioner | 12,567.66 | 12,567.66 | 12,567.66 | 17,575.05 |
| Total Savings | 1,181,094.66 | 1,181,094.66 | 1,181,094.66 | 1,151,522.05 |
| Total Program Realization Rate | | | | 97% |

Note: Totals may not sum properly due to rounding.

[a] Values presented at a measure-level represent Audited values, since the scorecard provides only savings totals.

TABLE 106. 2022 APPLIANCE RECYCLING PROGRAM *EX ANTE* & *EX POST* GROSS PEAK DEMAND REDUCTION

| MEASURE | *EX ANTE* [a] PEAK DEMAND REDUCTION (kW/yr.) | AUDITED GROSS PEAK DEMAND REDUCTION (kW/yr.) [a] | VERIFIED GROSS PEAK DEMAND REDUCTION (kW/yr.) | *EX POST* GROSS PEAK DEMAND REDUCTION (kW/yr.) |
|---|---|---|---|---|
| Refrigerators | 140.968 | 140.968 | 140.968 | 108.417 |
| Freezers | 26.000 | 26.000 | 26.000 | 24.423 |
| Dehumidifier | 11.245 | 11.245 | 11.245 | 11.252 |
| Room Air Conditioner | 17.940 | 17.940 | 17.940 | 17.954 |
| Total Savings | 196.153 | 196.153 | 196.153 | 162.045 |
| Total Program Realization Rate | | | | 83% |

Note: Totals may not sum properly due to rounding.

| MEASURE | *EX ANTE* [a] PEAK DEMAND REDUCTION (kW/yr.) | AUDITED GROSS PEAK DEMAND REDUCTION (kW/yr.) [a] | VERIFIED GROSS PEAK DEMAND REDUCTION (kW/yr.) | *EX POST* GROSS PEAK DEMAND REDUCTION (kW/yr.) |
|---|---|---|---|---|

[a] Values presented at a measure-level represent Audited values, since the scorecard provides only savings totals.

## *EX POST* NET SAVINGS

The evaluation team used the 2020 evaluation results for the NTG ratio for both refrigerators and freezers. In 2020, the evaluation team found that there was a NTG of 52% for refrigerators and 76% for freezers. Using a savings weighted average of 2022 recycled refrigerator and freezers NTG estimates, the evaluation team found a total program NTG of 57% for energy savings and 56% for demand reduction. The evaluation team applied the total program NTG values as the NTG for dehumidifiers and room air conditioners. **Error! Reference source not found.** shows the NTG ratios by measure.

TABLE 107. 2022 APPLIANCE RECYCLING PROGRAM NET-TO-GROSS RATIOS BY MEASURE

| MEASURE | NTG |
|---|---|
| Refrigerators | 52% |
| Freezers | 76% |
| Dehumidifier | 57% |
| Room Air Conditioner | 57% |

Table 108 presents the resulting net electric savings and peak demand reduction savings by measure.

TABLE 108. 2022 APPLIANCE RECYCLING PROGRAM EX POST NET SAVINGS

| MEASURE | *EX POST* GROSS SAVINGS/REDUCTION | | NTG | *EX POST* NET SAVINGS/REDUCTION | |
|---|---|---|---|---|---|
| | KWH | KW | | KWH | KW |
| Refrigerators | 879,472.00 | 108.417 | 52% | 457,325.44 | 56.377 |
| Freezers | 208,260.00 | 24.423 | 76% | 158,277.60 | 18.561 |
| Dehumidifier | 46,215.00 | 11.252 | 57% | 26,155.43 | 6.368 |
| Room Air Conditioner | 17,575.05 | 17.954 | 57% | 9,946.62 | 10.161 |
| Total Savings | 1,151,522.05 | 162.045 | 57% | 651,705.08 | 91.467 |

Table 109 shows the resulting net electric energy savings and peak demand reduction.

TABLE 109. 2022 APPLIANCE RECYCLING PROGRAM NET-TO-GROSS RESULTS

| SAVINGS TYPE | *EX ANTE* GROSS SAVINGS | *EX POST* GROSS SAVINGS | NTG RATIO (%) | *EX POST* NET SAVINGS |
|---|---|---|---|---|
| Electric Energy Savings (kWh/yr.) | 1,181,094.66 | 1,151,522.05 | 57% | 651,705.08 |
| Peak Demand Reduction (kW) | 196.153 | 162.045 | 56% | 91.467 |

# PROCESS EVALUATION

The evaluation team did not complete any major activities related to evaluating the program process.

# CONCLUSIONS AND RECOMMENDATIONS

## CONCLUSION 1: THE PROGRAM FELL SHORT OF ITS ENERGY SAVINGS AND DEMAND REDUCTION GOALS. THE PROGRAM REACHED A KWH REALIZATION RATE OF 97% AND DEMAND REALIZATION RATE OF 83%.

In the 12 months of program tracking data evaluated, the program saved 651,705.08 kWh and 91.467 kW. The evaluation team used the 2020 program evaluation survey results to calculate the part-use factor, ISR, and NTG values for the 2022 evaluation.

Recommendations:

- NIPSCO and TRC should update the program *ex ante* savings estimates to reflect the most recent evaluated results.

- If TRC is not already doing so, TRC should collect, document, and clearly label in the program tracking data the pints of water per day capacity of the dehumidifier units recycled to provide inputs for the evaluated savings calculations.

- Re-evaluate this program in the next program cycle to re-assess customer experiences and update evaluation metrics (such as part-use factor, ISR, and NTG).

# 9. BEHAVIORAL PROGRAM

## PROGRAM DESIGN AND DELIVERY

First launched in 2011, the Behavioral program provides paper and electronic Home Energy Reports (HERs) to select NIPSCO customers. HERs detail the customer's energy usage—including their historical consumption data as well as a comparison to other households—and provide low-cost and no-cost tips to save energy. Customers participating in the program with a valid email address also receive a monthly electronic HER and access to the program-affiliated web portal to review their energy consumption and see additional energy saving tips. HERs also promote and encourage participation in other NIPSCO energy efficiency programs.

The program uses a randomized control trial (RCT) design where customers are randomly assigned to a treatment or control group. Customers in the treatment group receive an HER while customers in the control group do not receive an HER. The customer population is divided into twelve waves based on when a customer began receiving the HER (Table 110). The initial five waves have respective natural gas and electric populations, known as cohorts. The program launched a sixth wave of gas only customers in September 2017, and a seventh wave of electric only customers in May 2018. Four more waves, the eighth, ninth, tenth, and eleventh waves, were launched with gas and electric customers in April 2019, April 2020, April 2021, and April 2022. The twelfth wave also launched in April 2022, but as a separate wave with electric only customers. Treatment group participants in all twelve waves received paper reports; those with a valid email address on file received email reports and had access to the web portal in 2022. The number of reports a treatment group participant received varied by their fuel type and by availability of a valid email address.

TABLE 110. 2022 CUSTOMER COUNTS BY WAVE

| WAVE | FUEL | NUMBER OF ELECTRIC CUSTOMERS | | NUMBER OF GAS CUSTOMERS | |
|---|---|---|---|---|---|
| | | TREATMENT | CONTROL | TREATMENT | CONTROL |
| Wave 1 (first report March 2011) | Dual | 75,992 | 25,228 | 75,736 | 25,133 |
| Wave 2 (first report June 2012) | Dual | 5,558 | 5,667 | 5,541 | 5,643 |
| Wave 3 (first report July 2014) | Dual | 24,241 | 5,499 | 24,239 | 5,502 |
| Wave 4 (first report March 2015) | Dual | 17,496 | 4,550 | 17,382 | 4,513 |
| Wave 5 (first report June 2017) | Dual | 19,150 | 6,248 | 19,126 | 6,255 |
| Wave 6 (first report September 2017) | Natural Gas | n/a | n/a | 35,546 | 8,487 |
| Wave 7 (first report in May 2018) | Electric | 14,676 | 6,964 | n/a | n/a |
| Wave 8 (first report April 2019) | Dual | 18,187 | 8,954 | 18,232 | 8,976 |
| Wave 9 (first report April 2020) | Dual | 12,606 | 6,281 | 12,617 | 6,284 |
| Wave 10 (first report April 2021) | Dual | 18,831 | 9,308 | 18,867 | 9,317 |
| Wave 11 (first report April 2022) | Dual | 17,773 | 11,258 | 17,763 | 11,260 |
| Wave 12 (first report April 2022) | Electric | 21,661 | 11,446 | n/a | n/a |
| TOTAL | | 246,171 | 101,403 | 245,049 | 91,370 |

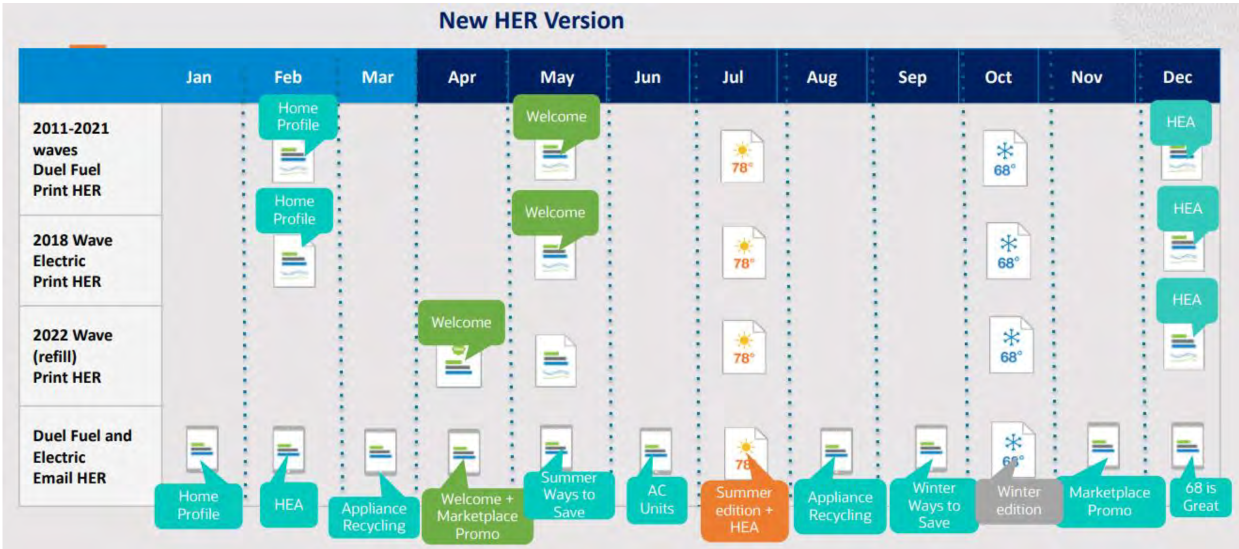
Note: For the dual fuel waves, the same group of customers receive natural gas and electric feedback. The customer counts shown are based on program data. There are differences in counts between electric and natural gas.
Participation for all waves is reported for January 2022, except Waves 11 and 12, which started in April 2022, and are reported for April 2022.
Source: ILLUME analysis of data provided by Oracle

## CHANGES FROM 2021 DESIGN

There were three primary changes from 2021 to 2022:

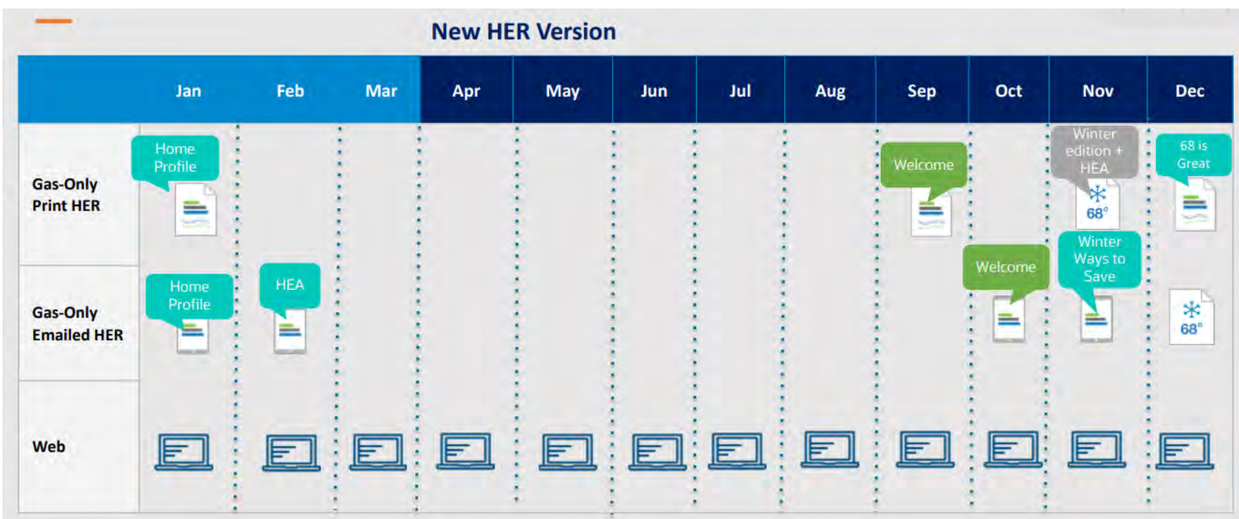
1. In 2022, the Behavioral program introduced two new waves, a dual fuel wave and an electric only wave.
2. The program also transitioned to a new version of the home energy report in April 2022, as shown in Figure 56 and Figure 57, for electric/dual fuel and gas customers.
3. There was no specific LED lighting cross-promotion in 2022.

FIGURE 56. 2022 PROGRAM DESIGN– ELECTRIC AND DUAL FUEL CUSTOMERS




Source: Oracle

FIGURE 57. 2022 PROGRAM DESIGN – GAS ONLY CUSTOMERS




Source: Oracle

## PROGRAM PERFORMANCE

For the 2022 evaluation year, the Behavioral evaluation team examined data from January 2022 through mid-November 2022, which was the date range of data available by the beginning of the evaluation in January 2023. The remainder of this report includes an evaluation of the 10.5 months of data and all evaluation metrics have been developed and extrapolated to the full year based on this.

Table 111 presents a savings summary for the program, including goals. The program achieved 105% of its electric gross savings goal and 178% of its natural gas gross savings goal (aggregate of all twelve waves).

The 2022 electric gross savings goal was 1% higher than the goal in 2021 and the 2022 natural gas gross savings goal was 18% higher than the goal in 2021. NIPSCO did not have a demand reduction goal for the program and did not track *ex ante* demand reduction.

Note that the experimental design and evaluation methods (comparing change in energy use over time between a treatment and control group) means that *ex post* savings are by design net savings. No additional adjustments are needed.

TABLE 111. 2022 BEHAVIORAL PROGRAM SAVING SUMMARY

| METRIC | GROSS SAVINGS GOAL | *EX ANTE* | AUDITED | VERIFIED | *EX POST* GROSS | *EX POST* NET | GROSS GOAL ACHIEVEMENT |
|---|---|---|---|---|---|---|---|
| Electric Energy Savings (kWh/yr.) | 23,120,000.00 | 24,568,838.00 | 24,568,838.00 | 24,568,838.00 | 24,236,774.53 | 24,236,774.53 | 105% |
| Peak Demand Reduction (kW) | 0.000 | 0.000 | 0.000 | 0.000 | 2,848.985 | 2,848.985 | n/a |
| Natural Gas Energy Savings (therms/yr.) | 1,119,213.00 | 2,111,356.00 | 2,111,356.00 | 2,111,356.00 | 1,989,985.51 | 1,989,985.51 | 178% |

Source: ILLUME analysis of data provided by NIPSCO

Table 112 outlines the *ex post* gross and NTG adjustment factors. The evaluation produces a net savings value with an NTG of 100% because the program follows a randomized study design. In this study design, participants would not receive reports in absence of the program (i.e., no freeridership) and any spillover within participants is captured in the evaluation as program savings (i.e., spillover is N/A).

TABLE 112. 2022 BEHAVIORAL PROGRAM ADJUSTMENT FACTORS

| METRIC | REALIZATION RATE (%)[a] | FREERIDERSHIP | SPILLOVER | NTG (%)[b] |
|---|---|---|---|---|
| Electric Energy Savings (kWh/yr) | 99% | 0% | N/A | 100% |
| Peak Demand Reduction (kW) | N/A | 0% | N/A | 100% |
| Natural Gas Energy Savings (therms/yr) | 94% | 0% | N/A | 100% |

[a] Realization Rate is defined as *ex post* gross savings divided by *ex ante* savings.
[b] The appropriate NTG for HER programs is 100%.

As of December 31, 2022, the program spent 97% of its annual electric program budget and 96% of its annual natural gas program budget. Table 113 lists the 2022 program budget and expenditures by fuel type.

TABLE 113. 2022 BEHAVIORAL PROGRAM EXPENDITURES

| FUEL | PROGRAM BUDGET | PROGRAM EXPENDITURES | BUDGET SPENT (%) |
|---|---|---|---|
| Electric | $1,727,710.11 | $1,673,197.91 | 97% |
| Natural Gas | $432,152.25 | $416,727.09 | 96% |

Source: ILLUME analysis of data provided by NIPSCO

## RESEARCH QUESTIONS

The evaluation team conducted qualitative and quantitative research activities to answer the following key research questions for the program:

- What are *ex post* program savings? Do these suggest any needed updates to program design, delivery, or savings assumptions?
- Is the program on track to meet its savings goals?
- Does the program impact participation in other EE programs?
- Are all program years achieving statistically significant savings? How has this changed with terminating old waves or adding new waves?
- What are opt-out rates? Have they changed over time?
- How are treatment and control group sizes changing over time?
- To what extent are treatment customers reading the email HER? Has that changed from last program year?
- Are customers using the online portal? Has customer use changed from last program year?
- Do the tips and marketing messaging align with NIPSCO's channeling goals and with changing consumer habits?
- How have the savings changed over time and what might that indicate for future savings?

# IMPACT EVALUATION

This section details each step of the impact evaluation and its associated electric energy savings and natural gas savings. The evaluation team collected the implementer's data for monthly energy usage and savings for each wave, as well as billing data for all waves from one year prior to the start of the wave through November of the 2022 program year. The evaluation team conducted a billing analysis for the 2022 program year with a cross-program participation analysis, and reviewed Oracle's estimated impacts by wave and month.

## BILLING ANALYSIS

The evaluation team applied several steps for our Behavioral billing analysis:

- Data cleaning: The evaluation team identified respondent data to exclude from the analysis. Reasons for exclusion include an insufficient number of pre-period or program period months or insufficient billing days within a given month to determine a monthly average.
- Equivalency check: The evaluation team verified that the distribution of average monthly energy usage prior to receiving the HERs was sufficiently similar between the treatment and control groups, consistent with the random assignment of customers to treatment and control groups.
- Regression analysis: The evaluation team verified program impacts using two alternative statistical models: a post-program regression (PPR) analysis with lagged participant controls and a linear fixed effects regression (LFER) analysis. Both models control for individual respondent differences, but the PPR achieves this by including lagged participant controls for each participant as an explanatory variable while the LFER removes each participant's average energy consumption before modeling.

The evaluation team applied both models to monthly energy usage data obtained from respondent bill records. The results of the PPR model are reported as the official impact estimates, with the LFER model serving as a check on those results. More details are provided in *Appendix 7*.

- **Cross-program participation analysis:** The evaluation team estimated the cross-program participation in other energy efficiency programs due to actions suggested by HERs through a post-only differences approach applied to tracking data from other programs. Post-only differences are a direct comparison of program uptake in the post-period as a percentage of respondents from treatment and control groups. More details are provided in *Appendix 7*.

## DATA CLEANING

As shown in Table 114 and Table 115, for electric and natural gas customers, respectively, the evaluation team cleaned the billing data to ensure that data used in the billing analysis contained sufficient pre-period (11) and post-period (2) months in the analysis periods, and sufficient billing days. Customers with insufficient post-period data had either moved or disconnected service after their respective waves' inception, but before this evaluation period began. As a result, some of the earlier deployment waves appear to have considerably high numbers of customers removed. Treatment and control customers have shown near identical rates of attrition, as the difference in the percent of treatment and percent of control customers removed from any one wave does not exceed two percentage points.

TABLE 114. PARTICIPANTS FILTERED OUT BY DATA SUFFICIENCY CHECKS FOR ELECTRIC CUSTOMERS

| | WAVE 1 | | WAVE 2 | | WAVE 3 | | WAVE 4 | | WAVE 5 | | WAVE 7 | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | TREAT. | CONTR. | TREAT. | CONTR. | TREAT. | CONTR. | TREAT. | CONTR. | TREAT. | CONTR. | TREAT. | CONTR. |
| Original randomly assigned homes | 148,974 | 51,130 | 14,999 | 15,000 | 51,955 | 11,852 | 41,000 | 10,500 | 36,796 | 12,000 | 25,000 | 12,000 |
| Records in billing data for 2022 evaluation | 128,804 | 43,929 | 11,903 | 11,926 | 43,329 | 9,869 | 33,074 | 8,444 | 34,226 | 11,177 | 23,446 | 11,294 |
| Applied filters: | | | | | | | | | | | | |
| Insufficient post-period data | 53,693 | 18,978 | 6,437 | 6,367 | 19,430 | 4,445 | 15,923 | 3,988 | 15,352 | 5,020 | 9,094 | 4,465 |
| Insufficient pre-period data | 1,206 | 541 | 150 | 159 | 613 | 134 | 966 | 266 | 772 | 249 | 215 | 104 |
| Total Filtered | 54,899 | 19,519 | 6,587 | 6,526 | 20,043 | 4,579 | 16,889 | 4,254 | 16,124 | 5,269 | 9,309 | 4,569 |
| FINAL ESTIMATION SAMPLE | 73,905 | 24,410 | 5,316 | 5,400 | 23,286 | 5,290 | 16,185 | 4,190 | 18,102 | 5,908 | 14,137 | 6,725 |
| ATTRITION RATE | 50% | 52% | 65% | 64% | 55% | 55% | 61% | 60% | 51% | 51% | 43% | 44% |

| | WAVE 8 | | WAVE 9 | | WAVE 10 | | WAVE 11 | | WAVE 12 | |
|---|---|---|---|---|---|---|---|---|---|---|
| | TREAT. | CONTR. | TREAT. | CONTR. | TREAT. | CONTR. | TREAT. | CONTR. | TREAT. | CONTR. |
| Original randomly assigned homes | 30,430 | 14,999 | 18,703 | 9,212 | 23,012 | 11,332 | 17,995 | 11,384 | 21,990 | 11,625 |
| Records in billing data for 2022 evaluation | 28,880 | 14,261 | 18,055 | 8,889 | 22,643 | 11,151 | 17,891 | 11,313 | 21,809 | 11,521 |
| Applied filters: | | | | | | | | | | |
| Insufficient post-period data | 11,089 | 5,501 | 5,791 | 2,764 | 4,390 | 2,101 | 1,485 | 912 | 2,162 | 1,136 |
| Insufficient pre-period data | 754 | 388 | 767 | 377 | 1,053 | 475 | 980 | 671 | 1,077 | 609 |
| Total Filtered | 11,843 | 5,889 | 6,558 | 3,141 | 5,443 | 2,576 | 2,465 | 1,583 | 3,239 | 1,745 |
| FINAL ESTIMATION SAMPLE | 17,037 | 8,372 | 11,497 | 5,748 | 17,200 | 8,575 | 15,426 | 9,730 | 18,570 | 9,776 |
| ATTRITION RATE | 44% | 44% | 39% | 38% | 25% | 24% | 14% | 15% | 16% | 16% |

TABLE 115. PARTICIPANTS FILTERED OUT BY DATA SUFFICIENCY CHECKS FOR NATURAL GAS CUSTOMERS

| | WAVE 1 | | WAVE 2 | | WAVE 3 | | WAVE 4 | | WAVE 5 | | WAVE 6 | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | TREAT. | CONTR. | TREAT. | CONTR. | TREAT. | CONTR. | TREAT. | CONTR. | TREAT. | CONTR. | TREAT. | CONTR. |
| Original randomly assigned homes | 148,974 | 51,130 | 14,999 | 15,000 | 51,955 | 11,852 | 41,000 | 10,500 | 36,796 | 12,000 | 50,000 | 12,000 |
| Records in billing data for 2022 evaluation | 126,379 | 43,102 | 11,532 | 11,561 | 42,414 | 9,655 | 32,091 | 8,179 | 33,387 | 10,902 | 47,439 | 11,404 |
| Applied filters: | | | | | | | | | | | | |
| Insufficient post-period data | 51,544 | 18,242 | 6,075 | 6,029 | 18,530 | 4,231 | 14,990 | 3,729 | 14,553 | 4,730 | 12,358 | 3,018 |
| Insufficient pre-period data | 3,491 | 1,278 | 673 | 690 | 1,992 | 446 | 2,747 | 703 | 1,966 | 658 | 1,594 | 390 |
| Total Filtered | 55,035 | 19,520 | 6,748 | 6,719 | 20,522 | 4,677 | 17,737 | 4,432 | 16,519 | 5,388 | 13,952 | 3,408 |
| FINAL ESTIMATION SAMPLE | 71,344 | 23,582 | 4,784 | 4,842 | 21,892 | 4,978 | 14,354 | 3,747 | 16,868 | 5,514 | 33,487 | 7,996 |
| ATTRITION RATE | 52% | 54% | 68% | 68% | 58% | 58% | 65% | 64% | 54% | 54% | 33% | 33% |

| | WAVE 8 | | WAVE 9 | | WAVE 10 | | WAVE 11 | |
|---|---|---|---|---|---|---|---|---|
| | TREAT. | CONTROL | TREAT. | CONTROL | TREAT. | CONTROL | TREAT. | CONTROL |
| Original randomly assigned homes | 30,430 | 14,999 | 18,703 | 9,212 | 23,012 | 11,332 | 17,995 | 11,384 |
| Records in billing data for 2022 evaluation | 28,366 | 14,011 | 17,731 | 8,736 | 22,455 | 11,030 | 17,819 | 11,265 |
| Applied filters: | | | | | | | | |
| Insufficient post-period data | 10,539 | 5,222 | 5,468 | 2,612 | 4,226 | 1,977 | 1,522 | 937 |
| Insufficient pre-period data | 2,798 | 1,355 | 2,201 | 1,067 | 3,130 | 1,532 | 1,954 | 1,314 |
| Total Filtered | 13,337 | 6,577 | 7,669 | 3,679 | 7,356 | 3,509 | 3,476 | 2,251 |
| FINAL ESTIMATION SAMPLE | 15,029 | 7,434 | 10,062 | 5,057 | 15,099 | 7,521 | 14,343 | 9,014 |
| ATTRITION RATE | 51% | 50% | 46% | 45% | 34% | 34% | 20% | 21% |

## EQUIVALENCY CHECK

Because the treatment and control groups are randomly assigned, pre-treatment energy use should theoretically be equivalent between the groups. The evaluation team performed an equivalency check of the energy usage patterns of the treatment and control groups of each wave in the year preceding the rollout to confirm that the data in each case were consistent with an RCT evaluation approach.

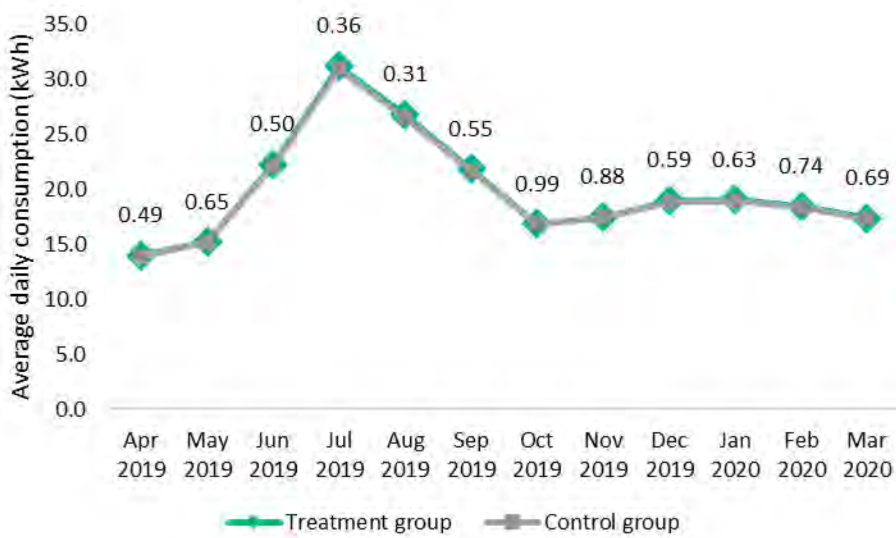
All analyzed groups, except the Wave 1 gas with email group, passed equivalency checks. While 5 of the 12 months of the Wave 1 gas with email group did not pass, the evaluation team considers the results reliable. The post-period regression model helps to control for the differences between the treatment and control groups by using lagged energy use as an explanatory variable. In other words, the model frames energy use in each calendar month of the post-program period as a function of both the treatment variable and energy use in the same calendar month of the pre-program year. The underlying logic is that any small systematic differences between the control and treatment respondents that remain, despite the randomization, will be reflected in differences in their past energy use, which is highly correlated with their current energy use. Including the lagged energy use in the model serves as a control for any such differences.

The evaluation team employed two methods to assess the equivalency of treatment and control energy usage:

- Visual inspection of overlaid plots of monthly mean energy use for treatment and control groups (an example is shown in Figure 58).
- T-tests of the monthly differences in mean energy use between treatment and control groups in each month. A significant difference ($p<0.05$) indicates that pre-period usage is dissimilar between groups.[36]

[36] A t-test is a statistical test of the difference between the mean values of observed characteristics between two populations. In this case, it is a test of the difference in average energy usage in each month between treatment and control group respondents.

FIGURE 58. EQUIVALENCY CHECK FOR 2020 WAVE




This figure represents the equivalency check for the 2022 electric usage of Wave 9, with p-values reported above the data points. The average daily consumption between treatment and control groups is highly similar.

## REGRESSION ANALYSIS

The regression analysis produced savings estimates of 24,275 MWh of electricity and 1,998,144 therms of natural gas in 2022. Note that modeled electric savings for five waves (Wave 2, Wave 5, Wave 8, Wave 9, and Wave 10) and modeled natural gas savings for three waves (Wave 2, Wave 9, and Wave 11) are not statistically significant ($p>0.10$). Since the program is an RCT experimental design, these results are the unbiased, best estimates of true savings values. Although with these waves the evaluation team cannot rule out that savings are unequal to zero, with all the waves the evaluation team cannot rule out that the savings are unequal to a different value in the confidence interval. The evaluation team reports confidence intervals for all waves and for all waves used the point estimate as the best estimate of savings (see Table 116 and Table 117). For example, the Wave 3 confidence interval for electric savings ranges from 1,243 MWh to 5,360 MWh, yet the evaluation team reports the center point (3,302 MWh) as the evaluated savings. The evaluation team applied the same approach across all waves, even if the interval included zero.

These savings values do not account for cross-program participation savings from participation in other NIPSCO offerings; those adjustments were generated through a cross-program participation analysis and are presented in a subsequent section, Cross-Program Participation.

Table 116 displays the claimed and evaluated savings (before cross-program participation analysis) and the per-household electric savings percentage for each wave reporting electric savings. Evaluated savings were typically like the implementer reported savings, exceeding them for five of the twelve waves.

TABLE 116. 2022 BEHAVIORAL PROGRAM CLAIMED AND EVALUATED ELECTRIC SAVINGS

| | ELECTRIC SAVINGS (MWH) | | | | EVALUATED SAVINGS PERCENTAGE PER HOME | | |
|---|---|---|---|---|---|---|---|
| WAVE | CLAIMED | EVALUATED | 90% CI LOWER BOUND | 90% CI UPPER BOUND | HOUSEHOLD | 90% CI LOWER BOUND | 90% CI UPPER BOUND |
| Wave 1 (eHer)[a] | 14,337.86 | 3,094.22 | 1,619.61 | 4,568.83 | 1.4% | 0.7% | 2.1% |
| Wave 1 (No eHer)[a] | | 10,491.42 | 7,551.64 | 13,431.20 | 2.3% | 1.6% | 2.9% |
| Wave 2[±] | 498.07 | 346.61 | -103.32 | 796.55 | 1.1% | -0.3% | 2.5% |
| Wave 3 | 3,110.16 | 3,301.97 | 1,243.51 | 5,360.43 | 1.5% | 0.6% | 2.5% |
| Wave 4 | 1,674.95 | 1,816.92 | 227.93 | 3,405.91 | 1.4% | 0.2% | 2.6% |
| Wave 5[±] | 121.47 | -114.22 | -1,597.62 | 1,369.18 | -0.1% | -1.0% | 0.8% |
| Wave 7 | 1,483.46 | 1,665.57 | 467.73 | 2,863.40 | 1.1% | 0.3% | 1.9% |
| Wave 8[±] | 1,022.78 | 977.34 | -167.74 | 2,122.42 | 0.6% | -0.1% | 1.4% |
| Wave 9[±] | 705.30 | 608.75 | -340.51 | 1,558.00 | 0.6% | -0.3% | 1.6% |
| Wave 10[±] | -305.07 | 2.62 | -1,013.26 | 1,018.49 | 0.0% | -0.7% | 0.7% |
| Wave 11 | 1,118.10 | 1,258.14 | 551.36 | 1,964.92 | 1.3% | 0.6% | 2.1% |
| Wave 12 | 643.24 | 825.78 | 206.77 | 1,444.79 | 0.9% | 0.2% | 1.7% |
| TOTAL UNADJUSTED [b] | 24,410.32[c] | 24,275.10 | 8,646.08 | 39,904.11 | 1.2%[d] | 0.4% [d] | 2.0% [d] |

[a] The eHer and no eHer populations had significantly different baseline consumption numbers such that it was necessary to model them separately to achieve accurate and significant results.

[b] Unadjusted savings do not account for channeling analysis.

[c] The electric scorecard as of 12/31/2022 reported 24,569 MWh of savings. The savings provided from Oracle in Q1 2023 that were broken out by wave totaled 24,410 MWh.

[±] Savings for Wave 2, Wave 5, Wave 8, Wave 9, and Wave 10 were not statistically significant.

[d] Averages are weighted by participant days in analysis.

Table 117displays the claimed and evaluated savings (before cross-program participation analysis) and per-household natural gas savings percentage for each wave reporting natural gas savings. In the evaluation of the 2020 program year, only Wave 6 exceeded 1% savings of per-household natural gas consumption among the natural gas cohorts. In 2022, three waves (Wave 4, Wave 5, and Wave 6), plus the larger, no email portion of Wave 1 exceeded 1% savings.

TABLE 117. 2022 BEHAVIORAL PROGRAM EVALUATED NATURAL GAS SAVINGS

| | GAS SAVINGS (THERMS) | | | | EVALUATED SAVINGS PERCENTAGE PER HOME | | |
|---|---|---|---|---|---|---|---|
| WAVE | CLAIMED | EVALUATED | 90% CI LOWER BOUND | 90% CI UPPER BOUND | HOUSE-HOLD | 90% CI LOWER BOUND | 90% CI UPPER BOUND |
| Wave 1 (eHer) | 632,052.42 | 105,616.46 | 16,759.34 | 194,473.57 | 0.6% | 0.1% | 1.0% |
| Wave 1 (No eHer) | | 492,178.33 | 295,925.42 | 688,431.25 | 1.1% | 0.6% | 1.5% |
| Wave 2[a] | 35,669.00 | 20,066.17 | -15,109.18 | 55,241.53 | 0.5% | -0.4% | 1.4% |

| WAVE | GAS SAVINGS (THERMS) | | | | EVALUATED SAVINGS PERCENTAGE PER HOME | | |
|---|---|---|---|---|---|---|---|
| | CLAIMED | EVALUATED | 90% CI LOWER BOUND | 90% CI UPPER BOUND | HOUSE-HOLD | 90% CI LOWER BOUND | 90% CI UPPER BOUND |
| Wave 3 | 141,235.04 | 142,273.97 | 18,928.61 | 265,619.33 | 0.7% | 0.1% | 1.3% |
| Wave 4 | 158,986.05 | 138,961.59 | 35,200.10 | 242,723.07 | 1.0% | 0.3% | 1.8% |
| Wave 5 | 227,120.33 | 224,536.63 | 132,751.05 | 316,322.20 | 1.5% | 0.9% | 2.1% |
| Wave 6 | 659,734.55 | 600,919.06 | 416,238.43 | 785,599.69 | 1.4% | 1.0% | 1.8% |
| Wave 8 | 94,842.84 | 123,628.87 | 56,934.85 | 190,322.89 | 0.9% | 0.4% | 1.4% |
| Wave 9[a] | 49,851.44 | 50,841.16 | -1,117.12 | 102,799.44 | 0.5% | 0.0% | 1.1% |
| Wave 10 | 97,238.06 | 95,188.83 | 33,781.99 | 156,595.67 | 0.7% | 0.2% | 1.1% |
| Wave 11 [a] | -2,879.45 | 3,933.38 | -23,433.00 | 31,299.76 | 0.1% | -0.6% | 0.9% |
| TOTAL UNADJUSTED [b] | 2,093,850.28[c] | 1,998,144.45 | 966,860.50 | 3,029,428.40 | 0.9%[d] | 0.4% [d] | 1.5% [d] |

[a] Savings for Wave 2, Wave 9, and Wave 11 were not statistically significant for natural gas fuel types.

[b] Unadjusted savings do not account for the channeling analysis.

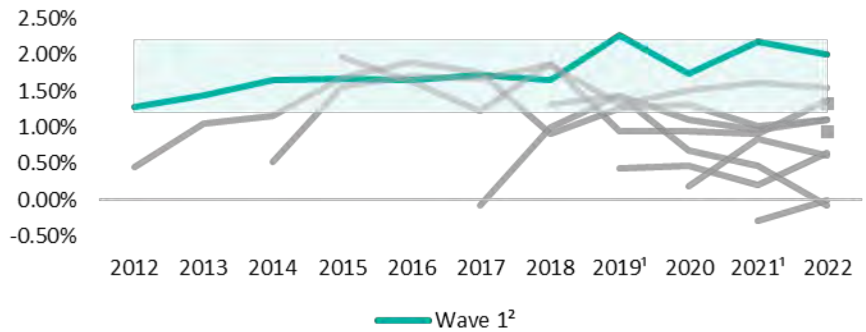
[c] The gas scorecard as of 12/31/2022 reported 2,111,356 therms of savings. The savings provided from Oracle in Q1 2023 were broken out by wave and totaled 2,093,850 therms.

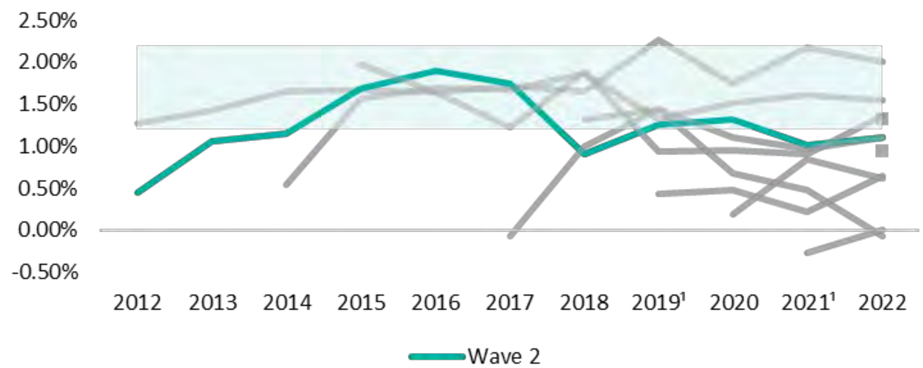
[d] Averages are weighted by participant days in analysis.

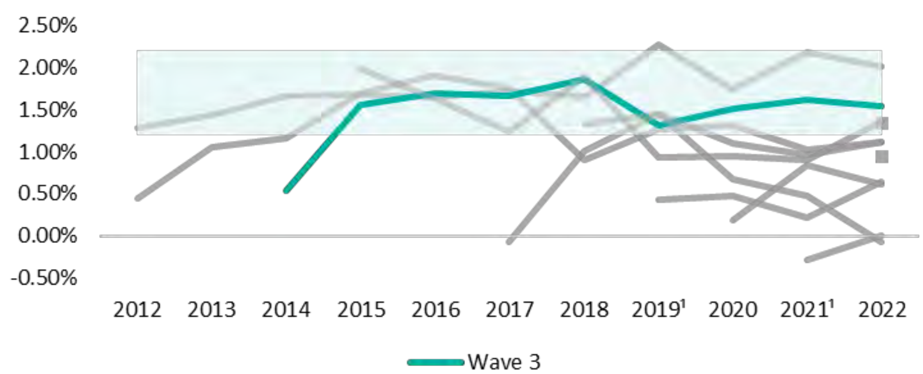
In general, industry research suggests that participants of residential behavior change programs save between 1.2% and 2.2% of household electricity usage per year and save between 0.3% and 1.6% of household natural gas usage per year; most waves exhibit a one- or two-year ramp-up period, with savings continuing at the ramped-up level for at least the following five years.[37] Within that context, the household savings percentage of seven of the electric waves and one of the gas waves fall short of these expectations (see banded areas in each wave of Figure 59 and each wave of Figure 60). While savings may decline earlier than expected, there could be an uptick in savings after a decline, as seen in Wave 2, Wave 4, and Wave 8, for example, and these waves have stable or increasing gas savings. Wave 5, however, continues to decline. The following figures show average household-level electric savings as a percentage of usage for all 11 Behavioral program waves from 2012 to 2022.

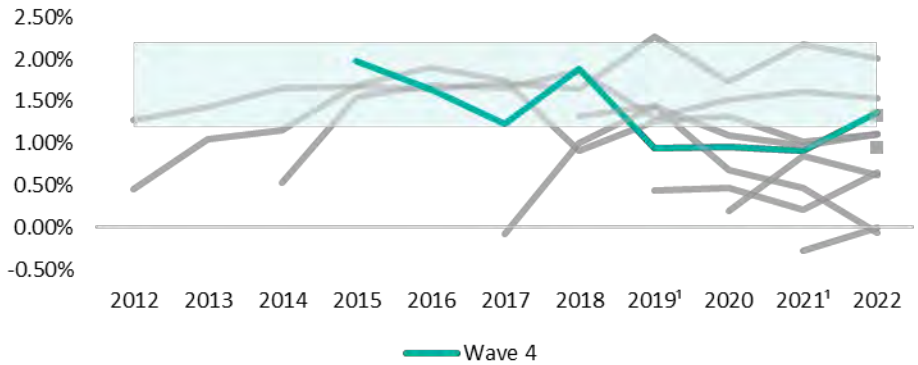
[37] Sussman, R., and M. Chikumbo. 2016. "Behavior Change Programs: Status and Impact." American Council for an Energy-Efficient Economy. https://aceee.org/sites/default/files/publications/researchreports/b1601.pdf

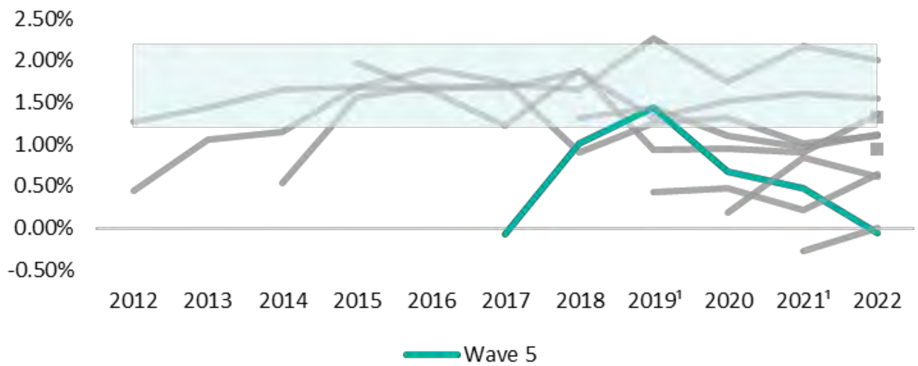
FIGURE 59. HOUSEHOLD-LEVEL PERCENTAGE SAVINGS OF ELECTRICITY FOR BEHAVIORAL PROGRAM PARTICIPANTS, BY WAVE AND YEAR

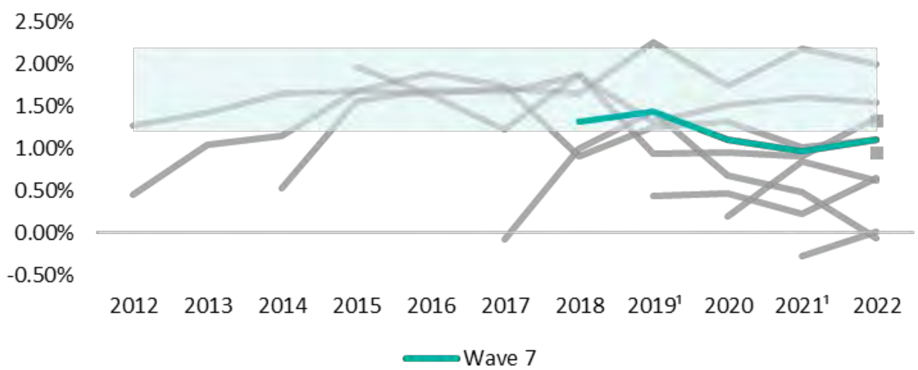


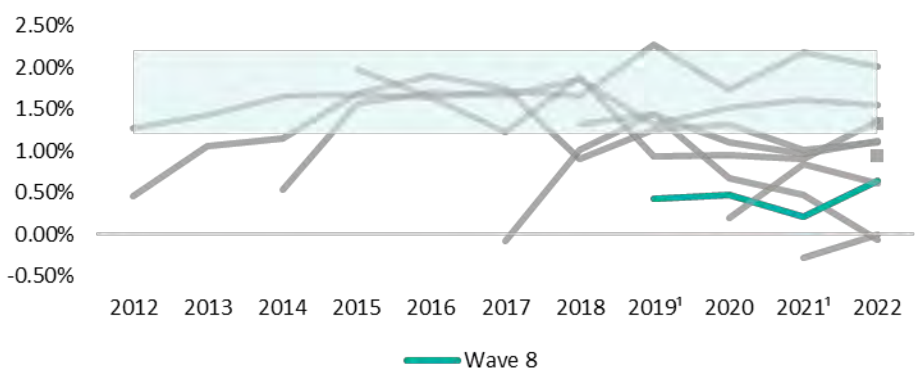



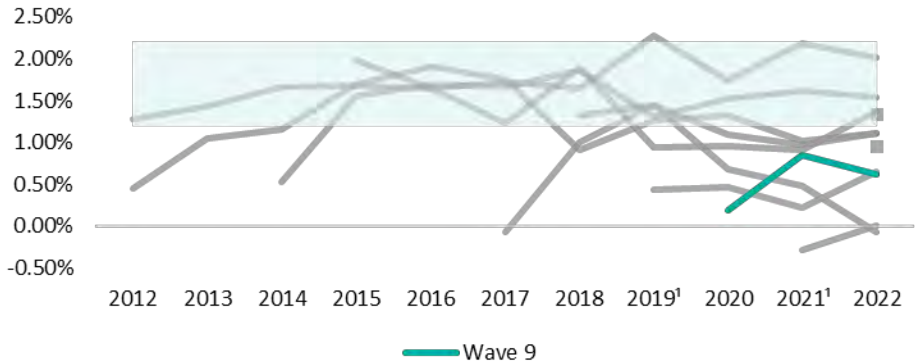



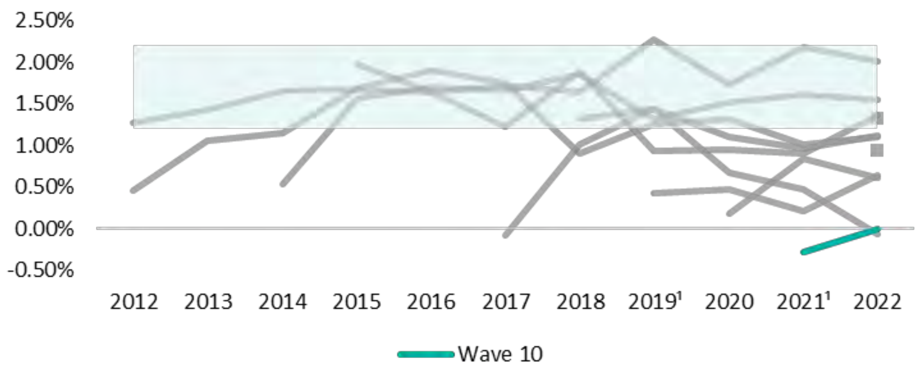

2.50%
2.00%
1.50%
1.00%
0.50%
0.00%
-0.50%
2012 2013 2014 2015 2016 2017 2018 2019¹ 2020 2021¹ 2022
Wave 4

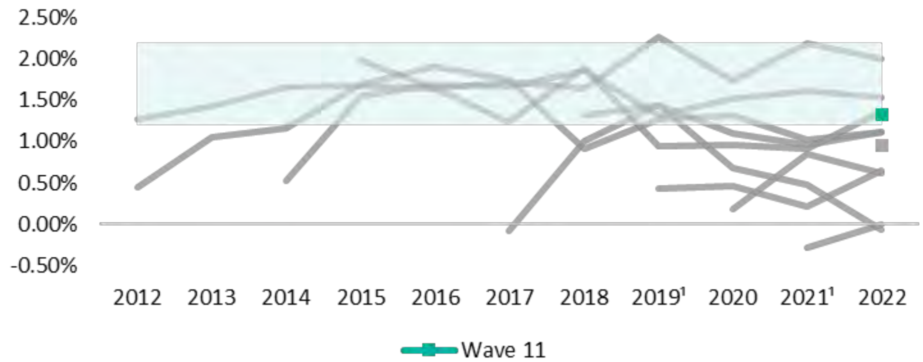

2.50%
2.00%
1.50%
1.00%
0.50%
0.00%
-0.50%
2012 2013 2014 2015 2016 2017 2018 2019¹ 2020 2021¹ 2022
Wave 5

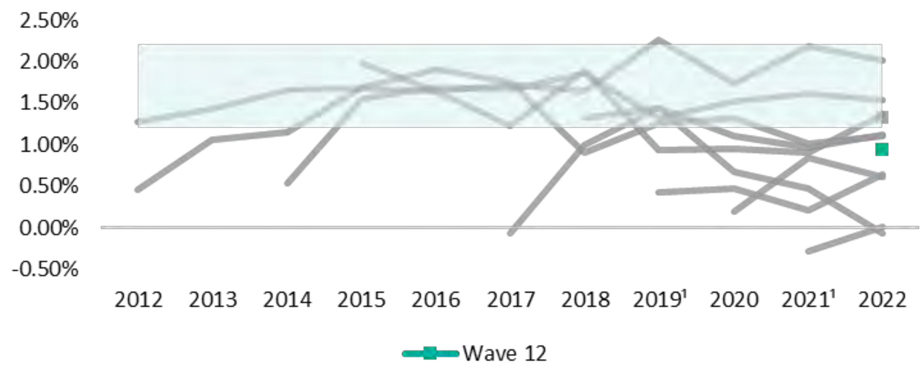

2.50%
2.00%
1.50%
1.00%
0.50%
0.00%
-0.50%
2012 2013 2014 2015 2016 2017 2018 2019¹ 2020 2021¹ 2022
Wave 7


2.50%
2.00%
1.50%
1.00%
0.50%
0.00%
-0.50%
2012 2013 2014 2015 2016 2017 2018 2019¹ 2020 2021¹ 2022
Wave 8


2.50%
2.00%
1.50%
1.00%
0.50%
0.00%
-0.50%
2012
2013
2014
2015
2016
2017
2018
2019[1]
2020
2021[1]
2022
Wave 9


2.50%
2.00%
1.50%
1.00%
0.50%
0.00%
-0.50%
2012
2013
2014
2015
2016
2017
2018
2019[1]
2020
2021[1]
2022
Wave 10



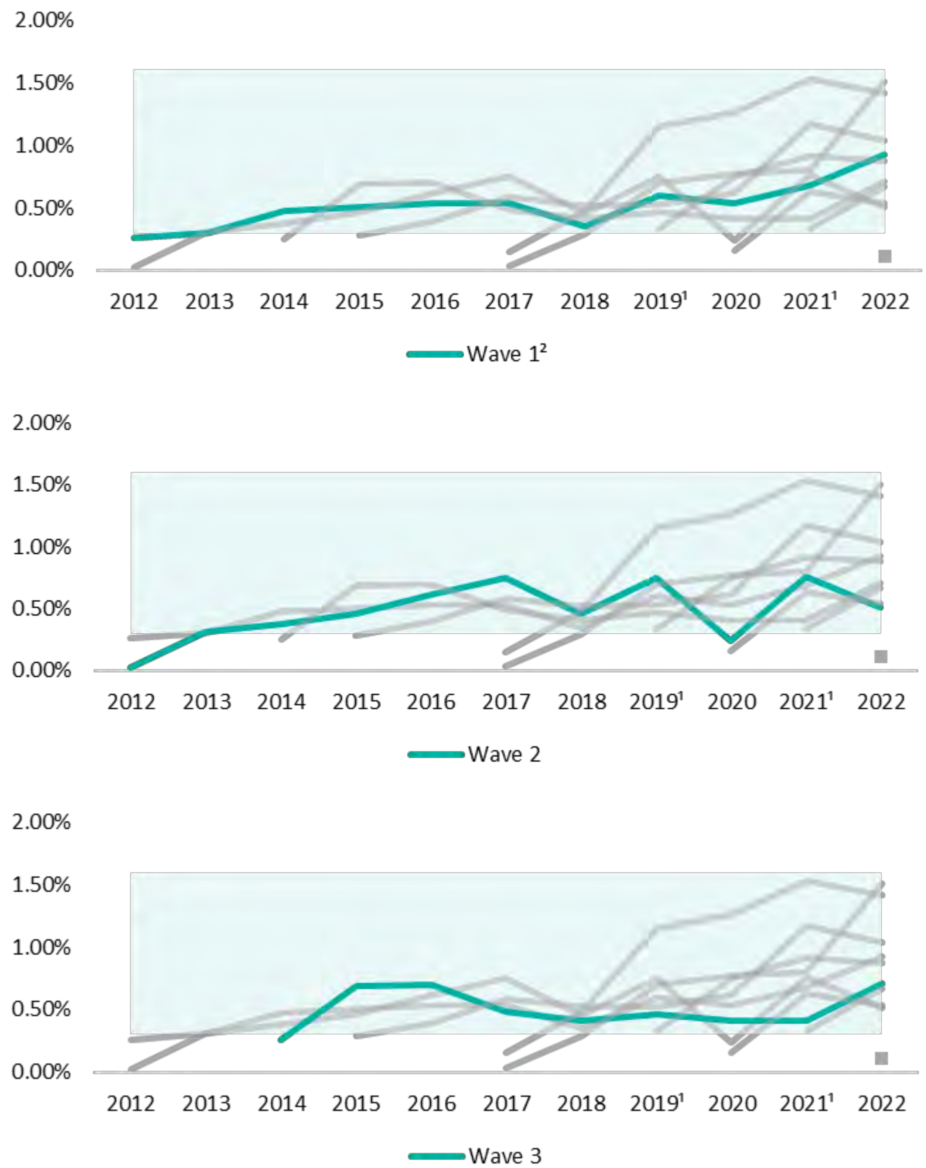



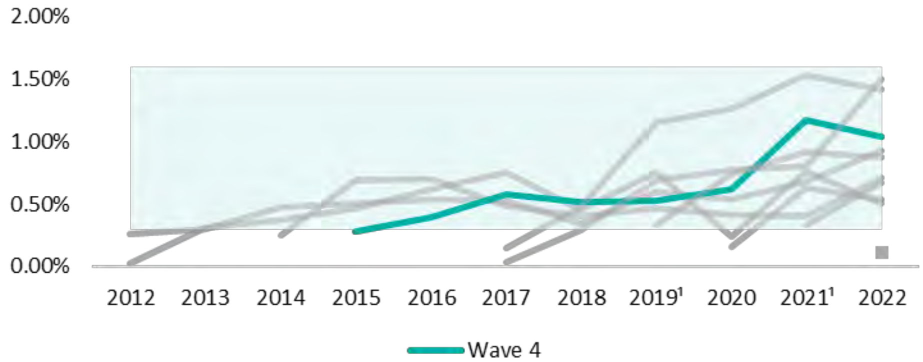

Source: ILLUME analysis of data provided by Oracle and NIPSCO

[1] The 2019 and 2021 results are based on Oracle's percent savings estimates as they were not modeled as part of those evaluations.

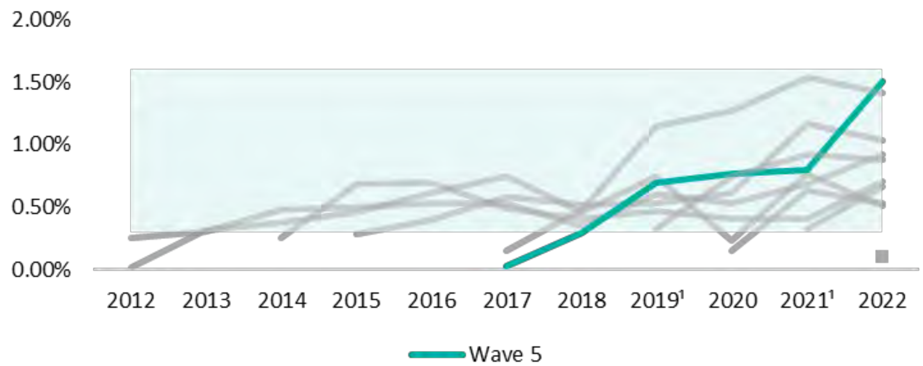
[2] Wave 1 results are presented as weighted averages of the eHer and non-eHer waves.

FIGURE 60. HOUSEHOLD-LEVEL PERCENTAGE SAVINGS OF NATURAL GAS FOR BEHAVIORAL PROGRAM PARTICIPANTS, BY WAVE AND YEAR

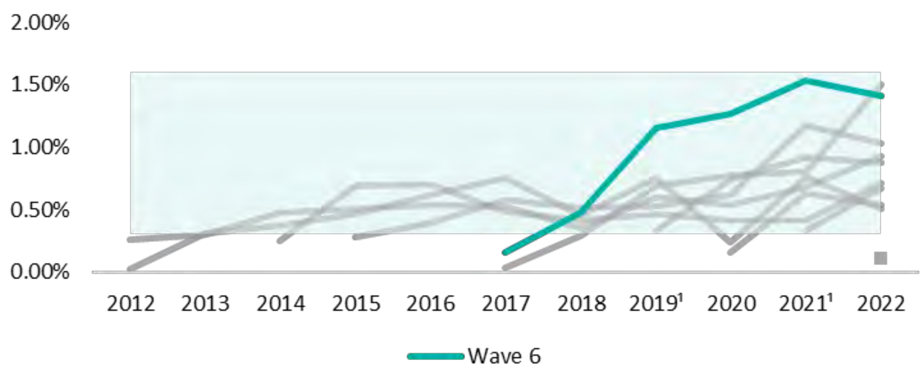




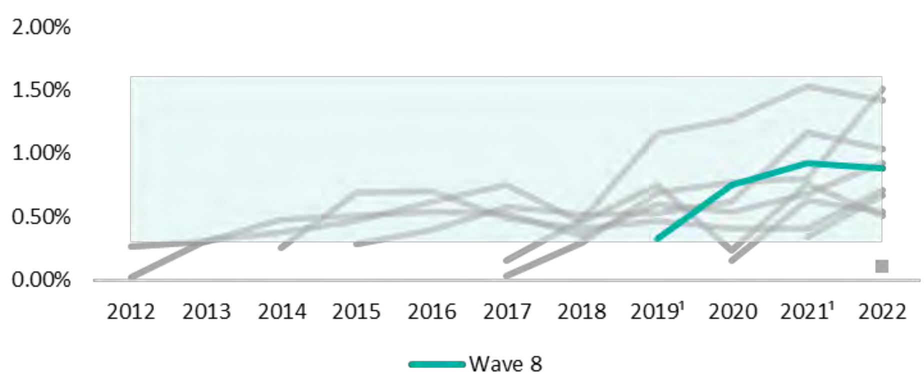
2.00%
1.50%
1.00%
0.50%
0.00%
2012
2013
2014
2015
2016
2017
2018
2019¹
2020
2021¹
2022
Wave 4

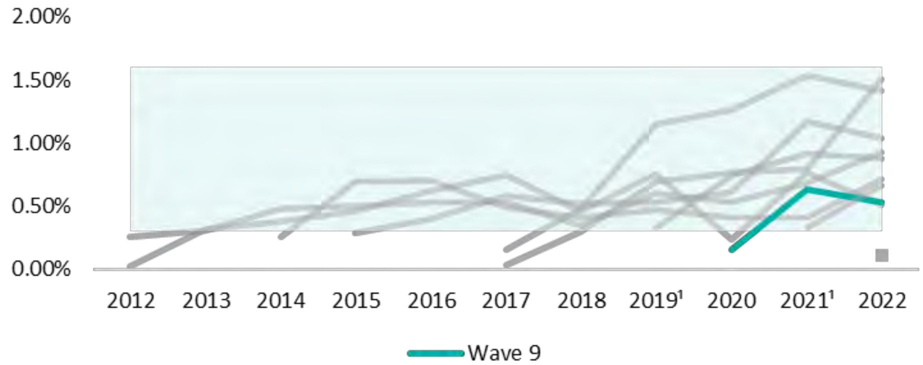
2.00%
1.50%
1.00%
0.50%
0.00%
2012
2013
2014
2015
2016
2017
2018
2019¹
2020
2021¹
2022
Wave 5

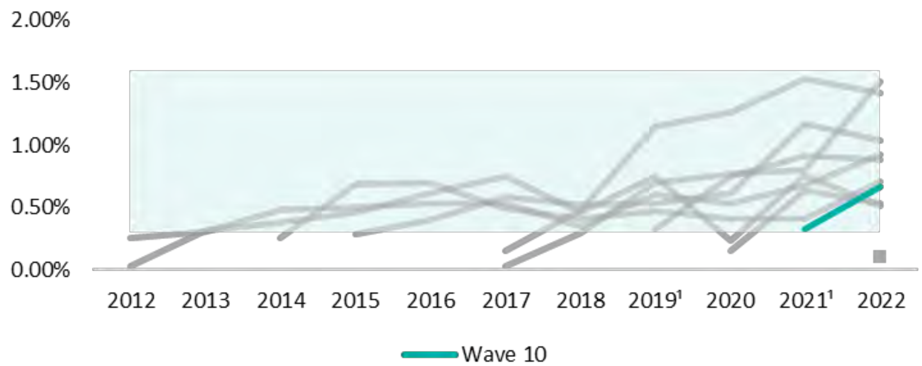



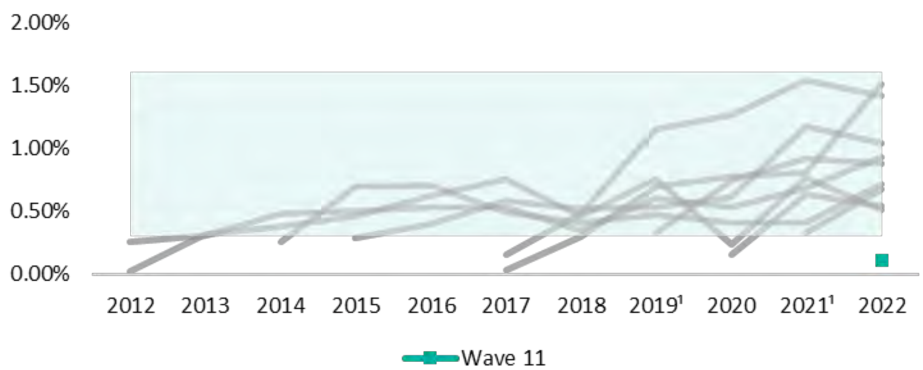
2.00%
1.50%
1.00%
0.50%
0.00%
2012
2013
2014
2015
2016
2017
2018
2019¹
2020
2021¹
2022
Wave 6

2.00%
1.50%
1.00%
0.50%
0.00%
2012
2013
2014
2015
2016
2017
2018
2019¹
2020
2021¹
2022
Wave 8




Source: ILLUME analysis of data provided by Oracle and NIPSCO

[1] The 2019 and 2021 results are based on Oracle's percent savings estimates as they were not modeled as part of this evaluation.

[2] Wave 1 results are presented as weighted averages of the eHer and non-eHer waves.

## CROSS-PROGRAM PARTICIPATION

Table 118 and Table 119 show electric and natural gas savings, respectively, for savings that can be attributed to participation in other NIPSCO energy efficiency programs. The team found higher savings from other energy efficiency programs among treatment customers than control customers, i.e., positive cross-program participation savings. More specifically, the team estimates cross-program savings of 38,322 kWh for electric and 8,159 therms for natural gas (shown in Table 120). Some waves (Wave 1 without email, Wave 2, Wave 4, and Wave 9 for gas) had negative cross-program participation savings, but the total savings across all waves were positive. In the 2018 and 2020 reports, negative cross-program savings were observed for some waves. In 2018 and 2020, the evaluation team excluded the cross-program savings to reflect a conservative approach and ensure the evaluation did not overestimate total behavioral program savings. For 2022, the evaluation team has included the cross-program effects in the savings and looked at cross-program participation more thoroughly below (in the process evaluation cross-program participation section). The recommendation to net out cross-program savings from total program savings remains consistent with the prior years in that it is the most conservative approach to showing total program savings.

The tables below show the cross-program participation savings by wave and energy efficiency program for electric and gas home energy report participants. Note that Table 118 and Table 119 calculate a per-home value for comparison to average per-home savings from the Behavioral program, though only a subset of treatment households participated in energy efficiency programs.

TABLE 118. CROSS-PROGRAM PARTICIPATION ELECTRIC SAVINGS

| PROGRAM | WAVE 1 (EHER) SAVINGS | | WAVE 1 (NO EHER) SAVINGS | | WAVE 2 SAVINGS | | WAVE 3 SAVINGS | | WAVE 4 SAVINGS | | WAVE 5 SAVINGS | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | PER HOME (KWH) | TOTAL (MWH) | PER HOME (KWH) | TOTAL (MWH) | PER HOME (KWH) | TOTAL (MWH) | PER HOME (KWH) | TOTAL (MWH) | PER HOME (KWH) | TOTAL (MWH) | PER HOME (KWH) | TOTAL (MWH) |
| Appliance Recycling | 0.59 | 13.08 | -0.28 | -15.14 | -0.55 | -3.06 | 0.45 | 10.85 | -0.72 | -12.55 | -0.12 | -2.27 |
| HEA | -0.10 | -2.30 | 0.15 | 8.19 | -0.07 | -0.41 | -0.19 | -4.70 | 0.02 | 0.29 | 0.22 | 4.27 |
| Home Rebates | 0.23 | 5.12 | -0.25 | -13.19 | -0.47 | -2.58 | 0.20 | 4.81 | -0.16 | -2.77 | 0.41 | 7.90 |
| Marketplace | 0.22 | 4.82 | 0.03 | 1.86 | -0.05 | -0.28 | 0.08 | 2.02 | 0.28 | 4.91 | 0.02 | 0.39 |
| TOTAL | 0.94 | 20.72 | -0.34 | -18.28 | -1.15 | -6.33 | 0.54 | 12.98 | -0.58 | -10.12 | 0.54 | 10.29 |

| PROGRAM | WAVE 7 SAVINGS | | WAVE 8 SAVINGS | | WAVE 9 SAVINGS | | WAVE 10 SAVINGS | | WAVE 11 SAVINGS | | WAVE 12 SAVINGS | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | PER HOME (KWH) | TOTAL (MWH) | PER HOME (KWH) | TOTAL (MWH) | PER HOME (KWH) | TOTAL (MWH) | PER HOME (KWH) | TOTAL (MWH) | PER HOME (KWH) | TOTAL (MWH) | PER HOME (KWH) | TOTAL (MWH) |
| Appliance Recycling | 0.07 | 1.01 | 0.10 | 1.89 | 0.07 | 0.84 | -0.09 | -1.66 | 0.21 | 3.59 | 0.05 | 1.03 |
| HEA | 0.09 | 1.38 | 0.49 | 8.79 | 0.26 | 3.29 | 0.35 | 6.49 | 0.33 | 5.74 | (0.01) | -0.26 |
| Home Rebates | 0.11 | 1.62 | -0.03 | -0.53 | -0.33 | -4.09 | 0.00 | -0.07 | 0.02 | 0.29 | (0.02) | -0.51 |
| Marketplace | -0.19 | -2.76 | 0.04 | 0.67 | 0.00 | -0.02 | -0.03 | -0.48 | 0.14 | 2.40 | 0.02 | 0.41 |
| TOTAL | 0.09 | 1.25 | 0.60 | 10.82 | 0.00 | 0.02 | 0.23 | 4.28 | 0.70 | 12.02 | 0.03 | 0.67 |

TABLE 119. CROSS-PROGRAM PARTICIPATION NATURAL GAS SAVINGS

| PROGRAM | WAVE 1 (EHER) SAVINGS | | WAVE 1 (NO EHER) SAVINGS | | WAVE 2 SAVINGS | | WAVE 3 SAVINGS | | WAVE 4 SAVINGS | | WAVE 5 SAVINGS | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | PER HOME (THERMS) | TOTAL (THERMS) | PER HOME (THERMS) | TOTAL (THERMS) | PER HOME (THERMS) | PER HOME (THERMS) | PER HOME (THERMS) | TOTAL (THERMS) | PER HOME (THERMS) | TOTAL (THERMS) | PER HOME (THERMS) | TOTAL (THERMS) |
| HEA | 0.04 | 852.97 | 0.00 | 176.37 | -0.02 | -128.89 | -0.03 | -687.08 | 0.00 | -4.81 | 0.01 | 148.64 |
| Home Rebates | 0.02 | 415.13 | -0.07 | -3,827.66 | -0.15 | -801.23 | 0.09 | 2,248.14 | 0.03 | 446.21 | 0.04 | 838.56 |
| Marketplace | 0.05 | 1,007.93 | 0.01 | 364.44 | 0.00 | 6.25 | 0.00 | 56.54 | -0.03 | -599.22 | 0.02 | 308.22 |
| TOTAL | 0.10 | 2,276.03 | -0.06 | -3,286.85 | -0.17 | -923.87 | 0.07 | 1,617.61 | -0.01 | -157.81 | 0.07 | 1,295.43 |

| PROGRAM | WAVE 6 SAVINGS | | WAVE 8 SAVINGS | | WAVE 9 SAVINGS | | WAVE 10 SAVINGS | | WAVE 11 SAVINGS | |
|---|---|---|---|---|---|---|---|---|---|---|
| | PER HOME (THERMS) | TOTAL (THERMS) | PER HOME (THERMS) | TOTAL (THERMS) | PER HOME (THERMS) | TOTAL (THERMS) | PER HOME (THERMS) | TOTAL (THERMS) | PER HOME (THERMS) | TOTAL (THERMS) |
| HEA | 0.04 | 1,508.20 | 0.06 | 1,132.84 | 0.10 | 1,290.04 | 0.09 | 1,760.19 | 0.03 | 476.95 |
| Home Rebates | 0.05 | 1,688.28 | 0.01 | 250.35 | -0.10 | -1,198.04 | -0.02 | -339.80 | 0.00 | 83.63 |
| Marketplace | 0.01 | 200.49 | 0.02 | 309.80 | -0.06 | -720.46 | 0.05 | 910.94 | 0.00 | -14.99 |
| TOTAL | 0.10 | 3,396.97 | 0.09 | 1,692.98 | -0.05 | -628.45 | 0.12 | 2,331.32 | 0.03 | 545.58 |

TABLE 120. CROSS-PROGRAM PARTICIPATION ELECTRIC AND NATURAL GAS SAVINGS AS A PERCENTAGE OF TOTAL WAVE SAVINGS

| WAVE | ELECTRICITY SAVINGS | | NATURAL GAS SAVINGS | |
|---|---|---|---|---|
| | CROSS-PROGRAM PARTICIPATION SAVINGS (KWH) | PERCENTAGE OF TOTAL BEHAVIORAL PROGRAM SAVINGS | CROSS-PROGRAM PARTICIPATION SAVINGS (THERMS) | PERCENTAGE OF TOTAL BEHAVIORAL PROGRAM SAVINGS |
| Wave 1 (eHer) | 20,717.03 | 0.7% | 2,276.03 | 2.2% |
| Wave 1 (No eHer) | -18,279.60 | -0.2% | -3,286.85 | -0.7% |
| Wave 2 | -6,331.21 | -1.8% | -923.87 | -4.6% |
| Wave 3 | 12,975.76 | 0.4% | 1,617.61 | 1.1% |
| Wave 4 | -10,120.82 | -0.6% | -157.81 | -0.1% |
| Wave 5 | 10,289.80 | -9.0% | 1,295.43 | 0.6% |
| Wave 6 | - | - | 3,396.97 | 0.6% |
| Wave 7 | 1,245.59 | 0.1% | - | - |
| Wave 8 | 10,824.23 | 1.1% | 1,692.98 | 1.4% |
| Wave 9 | 23.49 | 0.0% | -628.45 | -1.2% |
| Wave 10 | 4,284.13 | 163.8% | 2,331.32 | 2.4% |
| Wave 11 | 12,023.51 | 1.0% | 545.58 | 13.9% |
| Wave 12 | 670.00 | 0.1% | - | - |
| TOTAL UNADJUSTED | 38,321.90 | 0.16% | 8,158.94 | 0.41% |

## UPSTREAM LIGHTING CROSS-PROGRAM PARTICIPATION

The cross-program participation savings analysis does not include NIPSCO's upstream lighting program. In upstream lighting programs, utilities work directly with manufacturers, distributors, retailers, or a combination to offer built-in discounts on energy-efficient products, rather than paying incentives directly to program participants. Because of this design, these programs do not track detailed participation data such as respondent names and billing account numbers, which are typically available for utility rebate programs. Consequently, the evaluation team could not identify HER treatment and control group respondents who participated in an upstream lighting program. Obtaining the data necessary to adjust for upstream programs requires expensive primary data collection that relies on home visits or customer surveys and requires respondents to recall their lighting purchases.

In a recent secondary literature review presented to the Michigan utilities, an evaluation team found 10 evaluations of HER programs from 2013 to 2018 that addressed the effects of upstream lighting.[38] Five of these evaluations relied on surveys (three phone, one online, one in person), one relied on an onsite home inventory, three on secondary literature, and one used a deemed savings factor. The onsite inventory found the highest rate of cross-program participation savings at 2.6%. Three reported no difference in purchases between treatment and control customers. Others ranged from -0.9 kWh/household/year to 11.1 kWh/household/year. The evaluators that presented to Michigan utilities concluded that most efforts to calculate the cross-program participation rate of upstream programs result in 0% or negative results or the differences are statistically insignificant.

[38] *Avoiding the Double-Counting of Savings in Michigan's Behavioral EWR Programs: Current Practice & Future Options.* April 16, 2019. https://www.michigan.gov/documents/mpsc/Avoiding_Double_Counting_-_20190416_652854_7.pdf

Given these data limitations, the evaluation team did not estimate cross-program participation savings from upstream programs. Because adjustments to electric savings due to other programs are small, this omission should not affect the total claimed savings significantly.

## DEMAND REDUCTION

The evaluation team used the conservative estimate of equally distributing savings across all 8,760 annual hours (except for Wave 11 and Wave 12, which used 6,600 hours because the waves started in April) to estimate demand reduction.[39] As such, the demand reduction estimates are directly proportional to the electric savings estimates calculated above. Table 121 displays the demand reduction estimates for all waves in 2022, at both the individual level and the program level. The 90% confidence intervals are also shown. The total demand reduction is calculated at 2,849 kW and does not net out the cross-program savings.

TABLE 121. DEMAND REDUCTION ESTIMATES FOR ALL WAVES

| WAVE | ESTIMATED PEAK DEMAND REDUCTION (KW) | | 90% CONFIDENCE INTERVAL | |
|---|---|---|---|---|
| | PER HOME | TOTAL | LOWER BOUND | UPPER BOUND |
| Wave 1 (eHer) | 0.016 | 353.221 | 184.887 | 521.556 |
| Wave 1 (No eHer) | 0.022 | 1,197.650 | 862.059 | 1,533.242 |
| Wave 2 [a] | 0.007 | 39.568 | -11.795 | 90.930 |
| Wave 3 | 0.016 | 376.937 | 141.953 | 611.921 |
| Wave 4 | 0.012 | 207.411 | 26.019 | 388.803 |
| Wave 5 [a] | -0.001 | -13.039 | -182.377 | 156.299 |
| Wave 7 | 0.013 | 190.133 | 53.394 | 326.873 |
| Wave 8 [a] | 0.006 | 111.569 | -19.148 | 242.286 |
| Wave 9 [a] | 0.006 | 69.492 | -38.870 | 177.854 |
| Wave 10 [a] | 0.000 | 0.299 | -115.669 | 116.266 |
| Wave 11 | 0.011 | 190.627 | 83.539 | 297.715 |
| Wave 12 | 0.006 | 125.118 | 31.328 | 218.908 |
| TOTAL UNADJUSTED | - | 2,848.985 | 1,015.319 | 4,682.650 |

[a] Savings for Wave 2, Wave 5, Wave 8, Wave 9, and Wave 10 were not statistically significant.

# PROCESS EVALUATION

ILLUME performed the 2022 Behavioral program process evaluation using a desk review. The evaluation team reviewed:

- Monthly energy savings by wave and fuel type
- Monthly customer counts and opt-out rates by wave and fuel type
- Cross-program participation analysis
- Email engagement (e.g., open rates)
- Web portal engagement (e.g., number of log ins)

[39] Demand reduction estimates from AMI data are as high as 2.3 times the 8,760 model estimate, because electric savings are usually weighted to the summer and likely correspond to changes in peak air conditioner usage. See also: Stewart, James, and Pete Cleff. November 2013. "Are You Leaving Peak Demand Savings on the Table? Estimates of Peak-Coincident Demand Savings from PPL Electric's Residential Behavior-Based Program." Oracle Utilities Opower Whitepaper.

- Sample printed and electronic HER

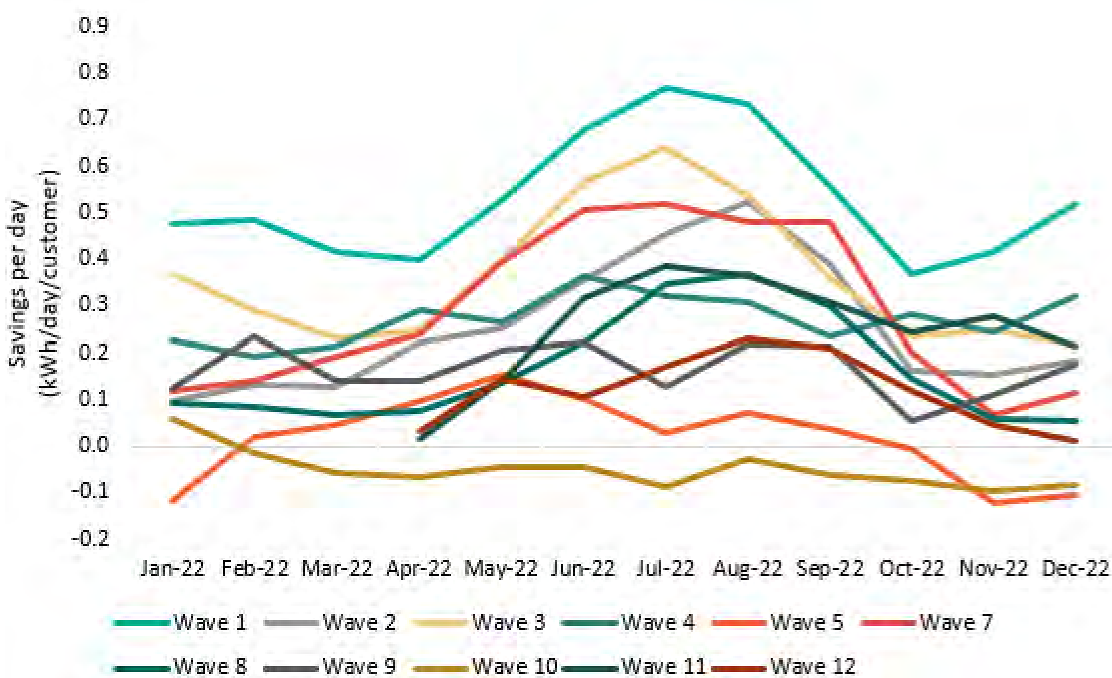
The following sections describe results related to trends in savings over time and between waves, customer counts during 2022, email engagement, and web portal engagement.

## SAVINGS TRENDS

The evaluation team reviewed monthly savings for each wave to identify interesting trends over time and between waves. In summary, the program savings in 2022 were steady, clearly identifiable and there were no signs that savings will decline substantially in 2023.

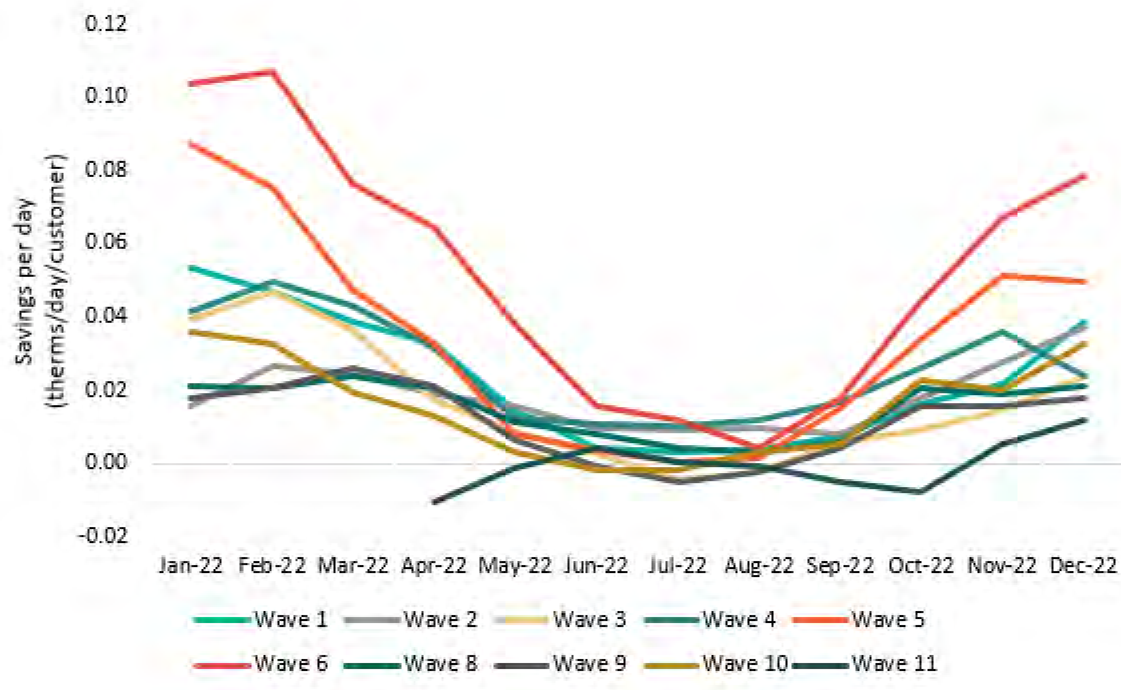
As shown in Figure 61, electric savings were relatively consistent throughout 2022, although highest in the summer across most waves. Wave 1 had the highest average household savings and Wave 10 (launched in 2021) showed savings in January, but otherwise negative savings in 2022. Savings for new waves typically build up over time but Wave 10 has been consistently negative since its inception.

FIGURE 61. AVERAGE DAILY ELECTRIC SAVINGS BY WAVE AND MONTH




As shown in Figure 62, natural gas savings demonstrate the typical heating load shape with higher savings in the winter and lower savings in the summer. Wave 6 (a gas only wave) follows that general shape, but with higher shoulder season savings than other waves. Wave 11 (the new wave launched in 2022) shows relatively low savings until later in the year. The delayed savings for Wave 11 is partially due to seasonality and the typical delayed effect of HER in new waves, where savings start to build over time.

FIGURE 62. AVERAGE DAILY GAS SAVINGS BY WAVE AND MONTH




## CUSTOMER COUNT TRENDS

In 2022, NIPSCO's Behavioral program lost 10% (electric) and 9% (gas) treatment participants on average, which was the same as in 2020 and 2021. Available data suggests these participants left the program by moving during 2022, rather than by opting out. Based on Oracle's data, only 0.004% of participants left the program voluntarily by opting out this year. The highest months for opting out were January through March 2022, notably before the transition to the new home energy report format and before the new waves were launched. As shown in Table 122, customers in more recent waves are moving at a higher rate than older waves, thus leaving the program.

TABLE 122. JANUARY AND DECEMBER 2022 CUSTOMER COUNTS BY WAVE AND FUEL TYPE

| WAVE | ELECTRIC | | | GAS | | |
|---|---|---|---|---|---|---|
| | NUMBER OF PARTICIPANTS JANUARY 2022 | NUMBER OF PARTICIPANTS DECEMBER 2022 | ATTRITION RATE (%) | NUMBER OF PARTICIPANTS JANUARY 2022 | NUMBER OF PARTICIPANTS DECEMBER 2022 | ATTRITION RATE (%) |
| Wave 1 (first report March 2011) | 75,992 | 72,454 | 4.7% | 75,736 | 72,295 | 4.5% |
| Wave 2 (first report June 2012) | 5,558 | 5,216 | 6.2% | 5,541 | 5,178 | 6.6% |
| Wave 3 (first report July 2014) | 24,241 | 22,855 | 5.7% | 24,239 | 22,868 | 5.7% |
| Wave 4 (first report March 2015) | 17,496 | 16,283 | 6.9% | 17,382 | 16,173 | 7.0% |
| Wave 5 (first report June 2017) | 19,150 | 17,782 | 7.1% | 19,126 | 17,753 | 7.2% |
| Wave 6 (first report September 2017) | - | - | - | 35,546 | 33,613 | 5.4% |
| Wave 7 (first report in May 2018) | 14,676 | 13,493 | 8.1% | - | - | - |

| WAVE | ELECTRIC<br>NUMBER OF PARTICIPANTS JANUARY 2022 | NUMBER OF PARTICIPANTS DECEMBER 2022 | ATTRITION RATE (%) | GAS<br>NUMBER OF PARTICIPANTS JANUARY 2022 | NUMBER OF PARTICIPANTS DECEMBER 2022 | ATTRITION RATE (%) |
|---|---|---|---|---|---|---|
| Wave 8 (first report April 2019) | 18,187 | 16,348 | 10.1% | 18,232 | 16,433 | 9.9% |
| Wave 9 (first report April 2020) | 12,606 | 10,996 | 12.8% | 12,617 | 10,972 | 13.0% |
| Wave 10 (first report April 2021) | 18,831 | 16,014 | 15.0% | 18,867 | 16,048 | 14.9% |
| Wave 11 (first report April 2022) [1] | 17,773 | 15,003 | 15.6% | 17,763 | 15,023 | 15.4% |
| Wave 12 (first report April 2022) [1] | 21,661 | 17,480 | 19.3% | - | - | - |
| AVERAGE | - | - | 10.1% | - | - | 9.0% |

Source: ILLUME analysis of data provided by Oracle and NIPSCO

[1]Wave 11 (dual fuel) and Wave 12 (electric only) started in April 2022. Its participants in the start date column are its participants as of April 2022.

## CROSS-PROGRAM PARTICIPATION ANALYSIS

Table 123 indicates the percentage difference in program participation of treatment recipients relative to their respective control groups, for four applicable programs in the 2022 program year. Consistent with the overall positive cross-program participation savings, most waves exhibit positive cross-program participation in at least one of the evaluated programs; only Wave 3 exhibits negative cross-program participation in all programs. These results corroborate the impact analysis, where cross-program participation savings show that HERs are sometimes encouraging participation in other programs, but to a relatively small degree compared to the total program size and total program savings. This is typical compared to past findings and the nature of HER cross-messaging, which is typically not able to be very targeted in terms of target audiences or timing. One way to be more specific in messaging could be to leverage the online portal, which has the potential to provide more targeted cross-promotion with more detailed customer information.

TABLE 123. CROSS-PROGRAM PARTICIPATION DUE TO HOME ENERGY REPORTS

| PROGRAM | WAVE 1 | WAVE 2 | WAVE 3 | WAVE 4 | WAVE 5 | WAVE 6 | WAVE 7 | WAVE 8 | WAVE 9 |
|---|---|---|---|---|---|---|---|---|---|
| Appliance Recycling | 0.10% | -0.01% | -0.09% | 0.11% | -0.03% | -0.06% | -0.01% | 0.05% | 0.12% |
| HEA | 0.05% | 0.02% | -0.11% | -0.07% | 0.03% | 0.08% | 0.09% | 0.09% | 0.18% |
| Home Rebates | 0.20% | 0.06% | -0.32% | 0.01% | -0.12% | -0.05% | 0.03% | -0.11% | 0.05% |
| Marketplace | -0.01% | 0.01% | -0.06% | 0.19% | 0.20% | -0.22% | 0.01% | -0.16% | -0.09% |

## EMAIL HER ENGAGEMENT

Behavioral programs drive savings by influencing customer behavior through paper and electronic messaging. As such, metrics around email engagement (e.g., open rates) may correlate with savings and provide an indication of program engagement. All participants received five emails per year on average, the same as in 2021.

As shown in Table 124, NIPSCO's Behavioral program participants opened 44% of program emails in 2022, on average over the year. Participants opened between 39% and 51% of program emails each month in 2022. The email engagement metrics for NIPSCO's Behavioral program show that the program is successfully engaging participants who receive emails consistently throughout the year. While participants opened emails at a relatively consistent rate throughout the year, the highest open rates were in February and March. Participants may have opened more program emails in the winter than other months because of high winter gas bills.

Oracle transitioned from Version 2 to Version 3 of the email HERs in April 2022. The new report had its own welcome report for all customers receiving email HERs, and subsequent reports had brighter colors and bolder types. April 2022 is also when the two new waves began. Still, the open rate of those who received emails was average in April (44%). Throughout the year the percentage of customers receiving emails was relatively similar, most often between 21% and 29%. A technical issue caused fewer emails to be sent in September and October. In October, Oracle completed an email refresh, adding 16,000 new email addresses into its customer database, and December had the highest percentage of customers receiving emails.

TABLE 124. EMAIL ENGAGEMENT BY MONTH AND YEAR

| MONTH | CUSTOMERS RECEIVING EMAILS (%) [1] | EMAILS SUCCESSFULLY RECEIVED (% OF SENT) | EMAILS OPENED (% OF RECEIVED) | EMAILS CLICKED THROUGH (% OF OPENED) |
|---|---|---|---|---|
| Jan. 2022 | 24% | 99% | 49% | 2% |
| Feb. 2022 | 27% | 99% | 51% | 2% |
| Mar. 2022 | 21% | 99% | 51% | 2% |
| Apr. 2022 | 26% | 98% | 44% | 3% |
| May 2022 | 28% | 99% | 43% | 3% |
| Jun. 2022 | 24% | 99% | 45% | 3% |
| Jul. 2022 | 27% | 99% | 43% | 1% |
| Aug. 2022 | 28% | 99% | 43% | 2% |
| Sep. 2022 | 0.03% | 98% | 41% | 4% |
| Oct. 2022 | 4% | 98% | 40% | 3% |
| Nov. 2022 | 29% | 99% | 39% | 2% |
| Dec. 2022 | 34% | 99% | 43% | 2% |
| 2022 AVERAGE | 27%[2] | 99% | 44% | 2% |
| 2021 AVERAGE | 24% | 99% | 41% | 3% |

Source: ILLUME analysis of email analytics data provided by Oracle

[1]Customers receiving emails is defined as the total number of emails sent divided by the total number of gas and electric treatment customers across waves in each month.

[2]The 2022 average excludes September and October, when customers received fewer emails due to a data issue.

## WEB PORTAL ENGAGEMENT

Like the 2021 program year evaluation findings, very few of NIPSCO's Behavioral program participants are engaging with the online portal; participants who do engage with it appear to value the portal. On average, 0.01% of NIPSCO's Behavioral program participants log into the web portal each month, but when they do, they stay on the site for an average of 9 minutes (see Table 125). Due to the low number of log ins, it is unlikely that the portal is currently driving additional savings.

TABLE 125. WEB PORTAL ANALYTICS BY MONTH

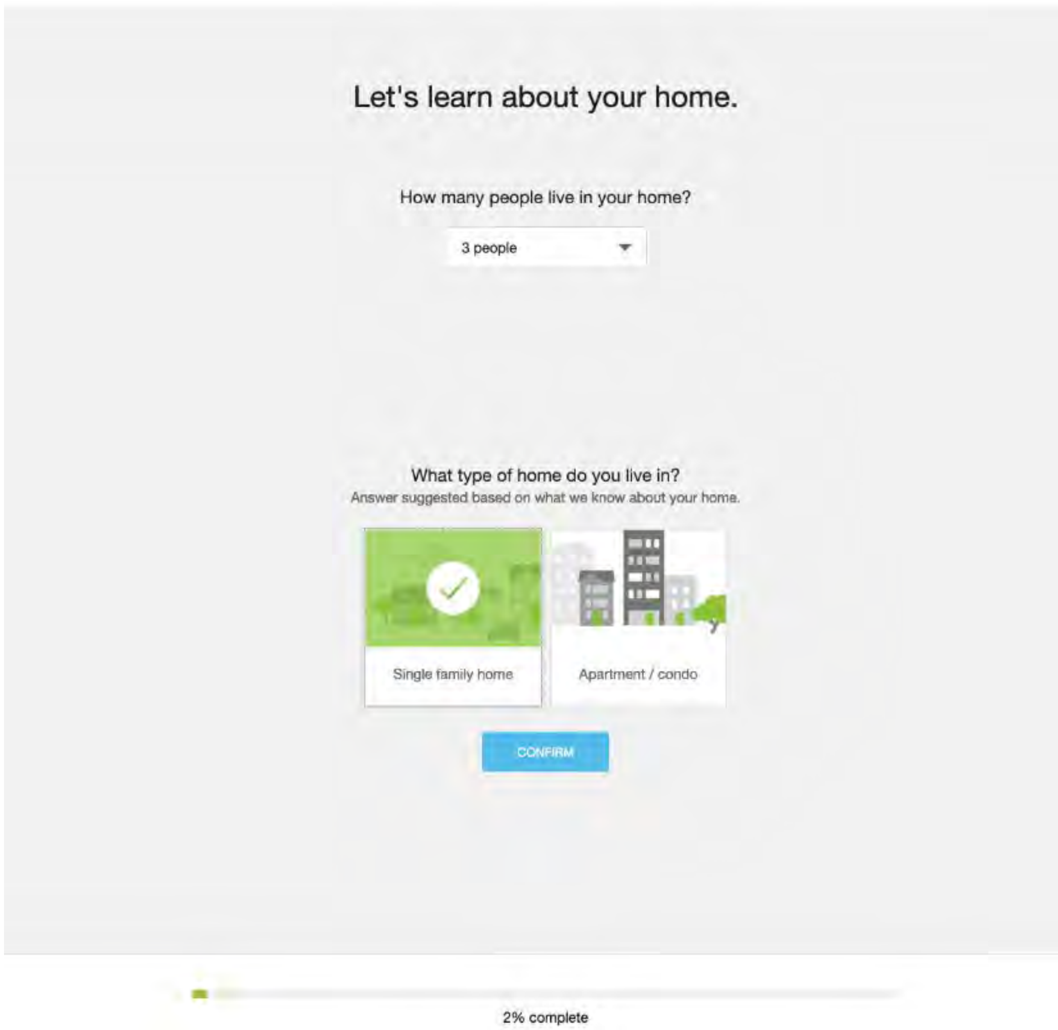
| MONTH | UNIQUE PARTICIPANT LOG INS (%) | AVERAGE TIME ON PORTAL (MINUTES) |
|---|---|---|
| Jan. 2022 | 0.02% | 10.6 |
| Feb. 2022 | 0.02% | 9.2 |
| Mar. 2022 | 0.02% | 11.9 |
| Apr. 2022 | 0.01% | 6.1 |
| May 2022 | 0.01% | 4.2 |
| Jun. 2022 | 0.01% | 6.6 |
| Jul. 2022 | 0.00% | 12.7 |
| Aug. 2022 | 0.01% | 13.5 |
| Sep. 2022 | 0.01% | 6.8 |
| Oct. 2022 | 0.01% | 6.1 |
| Nov. 2022 | 0.02% | 9.2 |
| Dec. 2022 | 0.04% | 11.3 |
| AVERAGE | 0.01% | 9.0 |

Source: ILLUME analysis of web portal analytics data provided by Oracle

## REPORT CHANGES

In 2018, the evaluation team surveyed Behavioral program participants and received feedback that customers wanted a way to improve the accuracy of their reports. On the web, portal customers can improve the accuracy of their reports by updating their Home Profiles (see Figure 63). While few participants are logging into the portal regularly, this messaging may be helpful for the participants who are interested in improving the accuracy of their reports.

FIGURE 63. HER MESSAGING SAMPLE: REPORT ACCURACY




## CHANNELING

In 2018 and 2020, the evaluation team found overall negative cross-program participation savings and recommended a more thorough look at channeling messaging in the subsequent uplift analysis in 2022. NIPSCO's Behavioral program updates its tip library once per year to ensure the energy savings tips that are provided on the reports correctly channel to other Energy Efficiency programs. Of the 55 tips in the tip library, 10 mention specific NIPSCO programs, measures, and/or rebates, and 9 generally point customers to the NIPSCO energy efficiency website.

While eHERs are sent every month, only about 27% of customers on average receive eHERs each month. Therefore, it is difficult to understand which types of messages are more likely to drive engagement with customers. A survey in a subsequent program year would help to understand customer recall of the reports, if repeating channeling to the same programs is more helpful than switching program channeling, and more specific engagement preferences.

Testing different formats could also help NIPSCO understand if more prominent placement could boost channeling. Currently, program channeling for a Home Energy Assessment or air conditioner rebate, for example, is on the second (back) page of a print report, or the second lowest placement in an email report.

The following figures demonstrate that messaging. Figure 64 is a sample print HER that channels to NIPSCO's Home Energy Assessment program. Figure 65 is the section of a sample eHER promoting the appliance rebate program with a link to NIPSCO's residential online marketplace. There were similar messages in print and email HERs for NIPSCO's appliance recycling program and a short-term promotion for wi-fi thermostats. Based on the small uplift effect in 2022 and similar channeling messaging, it is likely that the efficacy of NIPSCO's Behavioral program's channeling efforts is like past years.

FIGURE 64. HER MESSAGING SAMPLE: GENERAL CHANNELING (PRINT VERSION)

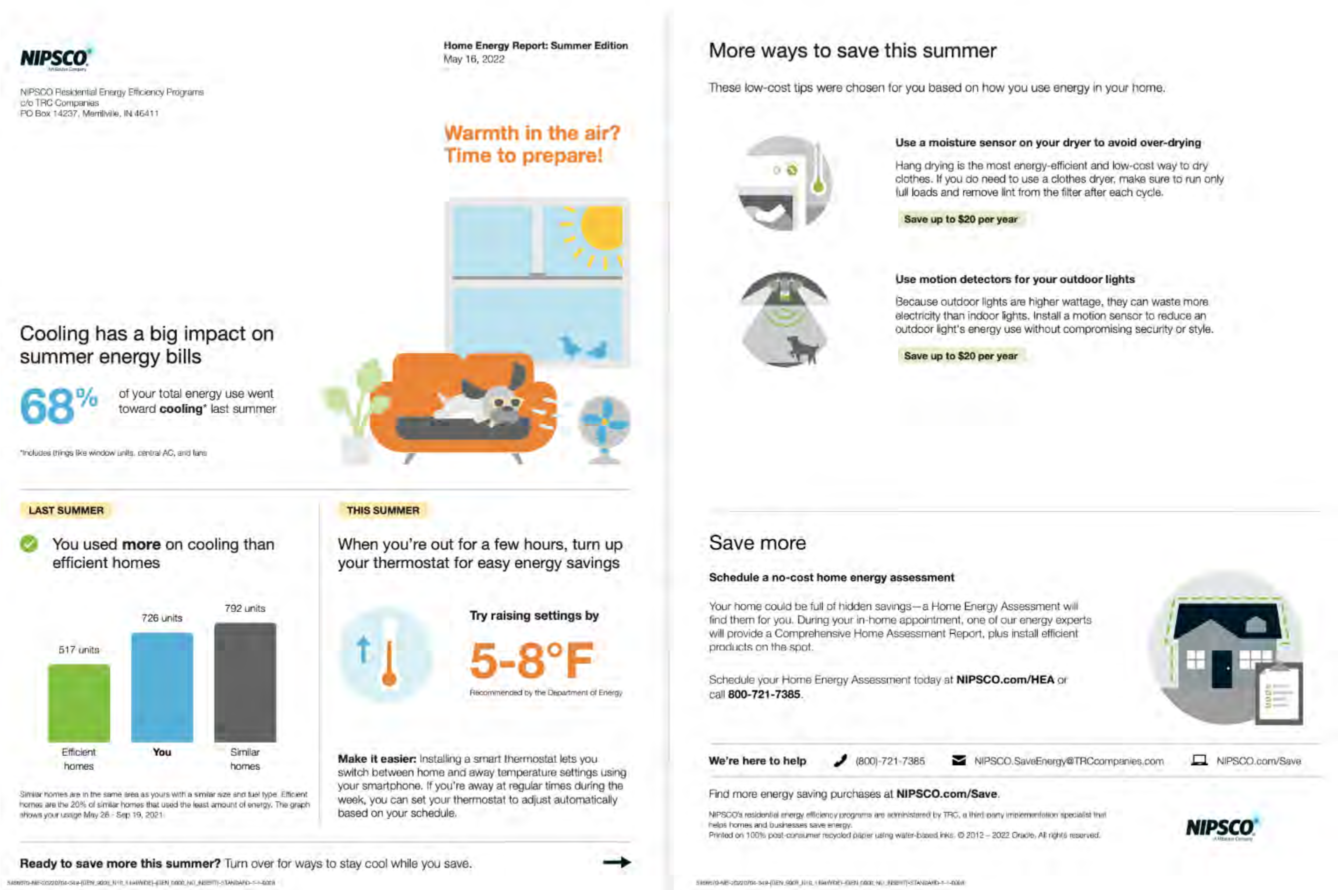


FIGURE 65. HER MESSAGING SAMPLE: GENERAL CHANNELING (EMAIL VERSION)

## An easy way to save


If your central AC unit is more than 12 years old, replacing it with an ENERGY STAR® certified model can cut your cooling costs by as much as 30%. NIPSCO offers rebates of up to $300 on qualifying new air conditioners.

**Learn more about rebates**

# CONCLUSIONS AND RECOMMENDATIONS

### CONCLUSION 1: THE BEHAVIORAL PROGRAM IS CONSISTENTLY EXCEEDING PLANNING ESTIMATES.

In the past four program years the gross goal achievements have consistently exceeded planned program goals. The gross goal achievement for electricity ranged from 105% in 2022 to 149% in 2019. Similarly for natural gas, the gross goal achievement ranged from 156% in 2018 to 211% in 2021. Electric savings were relatively consistent across the year, although highest in the summer across most waves. Natural gas savings demonstrated the typical heating load shape, with higher savings in the winter and lower savings in the summer. There are no signs that savings will decline substantially in 2023.

### CONCLUSION 2: PARTICIPANTS ARE ENGAGING WITH PROGRAM EMAILS.

Oracle acquired more than 16,000 new email addresses in an email refresh, sending emails to an annual high of 34% of customers in December. Participants opened 44% of electronic HERs on average in 2022, which was three percentage points higher than 2021, but click-through rates did not increase, averaging 2% this year.

### CONCLUSION 3: SIMILAR TO 2020 AND 2021, FEW PARTICIPANTS ARE ENGAGING WITH THE WEB PORTAL, BUT THOSE WHO DO SPEND CONSIDERABLE TIME ON IT.

On average, 0.01% of NIPSCO's Behavioral program participants log into the web portal each month, but when they do, they stay on the site for an average of nine minutes. Due to the low number of log ins, it is unlikely that the portal is currently driving savings. However, based on the average length of time that customers stay on the website, the customers who log in appear to engage with the web portal.

Recommendations:

- Consider ways to boost engagement with the portal if this is a priority for NIPSCO. Boosting engagement with the portal may be a way to provide more targeted cross-channeling to other programs.

### CONCLUSION 4: PARTICIPANT COUNTS ARE DECLINING AS CUSTOMERS MOVE.

In 2022, NIPSCO's Behavioral program lost 10% (electric) and 9% (gas) treatment participants on average. Available data suggests that most of these participants left the program because they moved during 2022; they did not opt out. Based on Oracle's data, a wave-average of only 0.004% of participants left the program voluntarily by opting out this year, and the monthly number of opt outs was lower after the new version of the report in April was introduced. Customer attrition rates, which impact statistical significance, are consistent year over year, typically less than 10% for older waves and more than 10% for newer waves. Wave 2, which does not have statistically significant savings, has had a 65% attrition rate since its launch in 2012.

Recommendations:

- Consider two options for Wave 2 savings in 2023: a) group Wave 2 with another wave during evaluation or b) consider filling Wave 2 with new randomly assigned treatment and control group customers. Increasing the sample size will increase the statistical power and hedge the risk of random variation in the modeling results (the risk that the program would see negative savings when there are positive savings or positive savings when there are negative savings).

- If new waves need more treatment customers, consider looking at how to re-use control customers across waves to minimize the number of total control customers across the program.

## CONCLUSION 5: WAVE 10 IMPACTS CONTINUED TO BE NEGATIVE AND SEVERAL WAVES WERE AGAIN NOT STATISTICALLY SIGNIFICANT.

Three electric waves were not statistically significant in 2020 or in 2022 (Wave 5, Wave 8, and Wave 9). Two gas waves were not statistically significant in 2020 or in 2022 (Wave 2, Wave 9). Wave 10, a new wave for program year 2021, was negative, as is typical for new waves. However, the savings for Wave 10 persisted as negative in program year 2022.

### Recommendations:

- If Wave 10 continues to see negative savings, consider doing a more in-depth look at the baseline used, which was during 2020, and could have been impacted by unusual usage during the height of COVID-19 restrictions.

# 10. RESIDENTIAL NEW CONSTRUCTION PROGRAM

## PROGRAM DESIGN AND DELIVERY

The Residential New Construction (RNC) Program provides prescriptive incentives to residential home builders that are building new detached single-family, duplex, or multifamily end unit new construction to high efficiency standards. These standards are defined by the Residential Energy Services Network (RESNET) Home Energy Rating System (HERS) Index. Incentives are paid directly to home builders, or HERS rating companies, that submit incentive applications. Participating homes must have NIPSCO residential electric and/or natural gas service.

Homes that only receive one fuel service from NIPSCO (either electric only or gas only) are only eligible for incentives for that respective fuel type. Homes with both NIPSCO natural gas and electric service are eligible for both incentives. Incentives are tiered by the HERS Index score range. Homes with lower HERS Index scores receive higher incentives, as these homes are more energy efficient. To qualify for the electric incentive, homes with central AC must be rated 15 SEER or higher. To qualify for the gas incentive, homes must only utilize a natural gas system for space heating.

NIPSCO develops marketing collateral to promote the program and markets the program to builders and HERS raters directly and through industry organizations, such as builder associations. NIPSCO also sends builders and HERS raters emails with updates about the program. NIPSCO does not currently market the program directly to prospective homebuyers. The Residential New Construction program was introduced in 2019.

### CHANGES FROM 2021 DESIGN

There have been no changes to program design since mid-year 2021. In July 2021, the Residential New Construction program shifted HERS tiers to align with the new 2020 Indiana Residential Code. The code changes increased the minimum energy efficiency requirements for new homes in Indiana, which effectively raised the baseline from which savings were measured. Because the 2020 building code change rendered incremental electric savings difficult to achieve, the incentive structure was flipped mid-year, to offer the larger incentive to natural gas customers instead of electric customers, but the overall incentive for a combined-fuel customer remained unchanged. This flipped incentive structure continued through 2022, with the larger incentive going to gas customers and the smaller incentive going to electric customers. The overall incentive amounts remain the same. The incentive tiers based on HERS scores remained the same in 2022 from the second half change of 2021.

Table 126 outlines program tiers and incentives for 2022.

TABLE 126: PROGRAM INCENTIVES

| HERS INDEX SCORE | ELECTRIC INCENTIVE | NATURAL GAS INCENTIVE |
|---|---|---|
| Platinum ≤ 56 | $60 | $450 |
| Gold 57-58 | $50 | $400 |
| Silver 59-62 | $40 | $350 |

# PROGRAM PERFORMANCE

Throughout 2022, the program processed 872 incentives: 21 homes received both the electric and gas incentives, one home received the electric incentive only, and 829 homes received the gas incentive only, reporting *ex ante* program electric energy savings of 4,216.08 kWh and peak demand reduction of 9.768 kW. The program also reported *ex ante* natural gas energy savings of 204,090.28 therms. For *ex post* gross savings, the program achieved 55% of the electric energy savings goal, 12% of the peak demand reduction goal, and 68% of the natural gas savings goal.

The Residential New Construction Program fell short of its electric energy and gas savings targets, and significantly underachieved electric demand targets. The drivers of the low achievement rates were measure-level realization rates (especially for demand savings) and program participation.[40] Table 127 summarizes savings for the full year of program performance, including program savings goals.

TABLE 127. 2022 RESIDENTIAL NEW CONSTRUCTION PROGRAM SAVING SUMMARY

| METRIC | GROSS SAVINGS GOAL | *EX ANTE* | AUDITED | VERIFIED | *EX POST* GROSS | *EX POST* NET | *EX POST* GROSS GOAL ACHIEVEMENT |
|---|---|---|---|---|---|---|---|
| Electric Energy Savings (kWh/yr.) | 22,671.01 | 4,216.08 | 4,216.08 | 4,216.08 | 12,399.20 | 2,603.83 | 55% |
| Peak Demand Reduction (kW) | 52.525 | 9.768 | 9.768 | 9.768 | 6.160 | 1.294 | 12% |
| Natural Gas Energy Savings (therms/yr.) | 311,062.63 | 204,090.28 | 204,090.28 | 204,090.28 | 210,100.08 | 44,121.02 | 68% |

Table 128 outlines the *ex post* gross and NTG adjustment factors. Realization rates for electric energy savings were significantly higher, electric demand savings were lower, and gas savings were slightly higher.

TABLE 128. 2022 RESIDENTIAL NEW CONSTRUCTION ADJUSTMENT FACTORS

| METRIC | REALIZATION RATE (%)[a] | FREERIDERSHIP | SPILLOVER | NTG (%)[b] |
|---|---|---|---|---|
| Electric Energy Savings (kWh/yr.) | 294% | 79% | 0% | 21% |
| Peak Demand Reduction (kW) | 63% | 79% | 0% | 21% |
| Natural Gas Energy Savings (therms/yr.) | 103% | 79% | 0% | 21% |

[a] Realization Rate is defined as *ex post* gross savings divided by *ex ante* savings.
[b] NTG is defined as *ex post* net savings divided by *ex post* gross savings.

Table 129 lists the 2022 program budget and expenditures by fuel type. The low expenditures reflect the low program participation and therefore fewer incentives delivered.

[40] In the context of the Residential New Construction program, "measure-level" refers to the incentive tier and fuel type.

TABLE 129. 2022 RESIDENTIAL NEW CONSTRUCTION PROGRAM EXPENDITURES

| FUEL | PROGRAM BUDGET | PROGRAM EXPENDITURES | BUDGET SPENT (%) |
|---|---|---|---|
| Electric | $8,898.52 | $1,753.67 | 20% |
| Natural Gas | $688,381.53 | $439,210.37 | 64% |

# EVALUATION METHODOLOGY

To inform the 2022 Residential New Construction evaluation, the evaluation team completed the following research activities:

- **Program staff interviews and discussions,** to understand the program process, delivery, and design.
- **Documentation and materials review,** to provide context on program implementation.
- **Tracking data analysis,** to audit and verify the accuracy of program participation data.
- **Engineering analysis**, to review available documentation and develop *ex post* gross savings values.
- **Participating builder and rater interviews,** to understand their experience and satisfaction with the program, as well as to inform the impact evaluation.

# IMPACT EVALUATION

The evaluation team completed the impact evaluation to answer the following research questions:

- What assumptions were used to develop savings estimates? Are there any updates that should be made?
- What are *ex post* program savings? Do these suggest any needed updates to program design, delivery, or savings assumptions?
- How effective was the program in influencing participant decision making? What are the program's spillover and freeridership estimates (net savings)?
- Is the program on track to meet its participation and savings goals?
- Are there any opportunities to improve program data tracking?

For all measure types, the evaluation team compared its engineering calculations to NIPSCO's *ex ante* savings, basing its savings methodologies and inputs for each measure on standard engineering practices and NIPSCO's program tracking database.

## AUDITED AND VERIFIED SAVINGS

To audit energy savings and demand reduction, the evaluation team conducted a careful review of the program tracking data, creating multiple data summaries, and checking measure identifiers for duplicates. The team sampled 67 projects from the 2022 data and confirmed the HERS documentation verifying the rebate amount, HERS scores, and program tier. The evaluation team found no inconsistencies in the data and applied an in-service rate (ISR) of 100% to all projects, as seen in Table 130.

TABLE 130. 2022 RESIDENTIAL NEW CONSTRUCTION PROGRAM IN-SERVICE RATES RATIOS BY MEASURE

| MEASURE | ISR |
|---|---|
| Silver Star (HERS 62-59) Electric | 100% |
| Silver Star (HERS 62-59) Gas | 100% |
| Gold Star (HERS 58-57) Electric | 100% |
| Gold Star (HERS 58-57) Gas | 100% |
| Platinum Star (HERS <=56) Electric | 100% |
| Platinum Star (HERS <=56) Gas | 100% |

Table 131 summarizes the tracking data quantity, audited quantity, applied installation rates, and resulting verified quantity per measure. To calculate the verified measure quantity, the evaluation team multiplied the audited measure quantity by the installation rate.

TABLE 131. 2022 RESIDENTIAL NEW CONSTRUCTION PROGRAM AUDITED & VERIFIED QUANTITIES

| MEASURE | UNIT OF MEASURE | AUDITED QUANTITY | ISR | VERIFIED QUANTITY |
|---|---|---|---|---|
| Silver Star (HERS 62-59) Electric | Home | 11 | 100% | 11 |
| Silver Star (HERS 62-59) Gas | Home | 606 | 100% | 606 |
| Gold Star (HERS 58-57) Electric | Home | 9 | 100% | 9 |
| Gold Star (HERS 58-57) Gas | Home | 138 | 100% | 138 |
| Platinum Star (HERS <=56) Electric | Home | 2 | 100% | 2 |
| Platinum Star (HERS <=56) Gas | Home | 106 | 100% | 106 |
| | | 872 | | 872 |

## *EX POST* GROSS SAVINGS

The evaluation team created 13 prototypes (11 natural gas and 2 electric) to model savings in 2022 in REM/Rate (version 16.3.2) software by comparing the prototype home energy savings relative to the requirements of the 2020 Indiana statewide residential energy code. The evaluation team updated the baseline user defined reference home (UDRH) template to be compatible with REM/Rate version 16.3.2 and eliminated savings or penalties associated with appliances that were present in the previous UDRH template.

The evaluation team used prototype home characteristics based on a random sample of HERS certificates from PY 2022 Program homes combined with incentive types (fuel types and tiers) from program data. These HERS certificates provided key model inputs, including home square footage, insulation levels, home tightness, duct tightness, and mechanical equipment efficiency. The team developed prototypes according to the nearest weather station, water heater type and fuel, and foundation type.

The evaluation team used a sample of 66 HERS Certificates to develop inputs for the model prototypes. Silver, gold, and platinum rated homes can have a myriad of different home characteristics within each grouping, and therefore it is not preferable to group prototypes by those ratings but instead by the actual home characteristics. The team modeled homes that reflect how the homes are constructed, given the available information, to generate an overall analysis of the population of homes. The overall weighted realization rate, based on the random sample, ensures correct overall adjustments.

Appendix 8 provides a full description of the methods used to calculate gross energy and demand savings.

## *EX POST* GROSS SAVINGS

The significant differences between estimates of *ex ante* and *ex post* electric and natural gas savings likely result from different methodologies used by the program implementer and the evaluation team to estimate measure savings. While the evaluation team used program home-specific inputs to model savings for homes, the implementer calculated its deemed electric energy and demand savings for 15+ SEER cooling systems only using a TRM-based algorithm. The implementer's approach used 2019 EM&V results for cooling capacity (34,682 Btu/h), TRM equivalent full load hours for South Bend (431 hours/yr.), code minimum baseline efficiencies (13.0 SEER/11.7 EER) and assumed 15.6 SEER / 14.1 EER (from 2019 EM&V data) in the proposed condition.

Deemed gas savings used inputs from 2019 EM&V data, and then extrapolated savings based on the HERS score of the NIPSCO program home. This misalignment in methods and possible differences between the implementer's assumption about program homes, such as square footage, cooling capacity, cooling efficiencies, etc., likely resulted in the discrepancy in *ex ante* and *ex post* savings.

Table 132 shows the *ex ante* deemed savings and *ex post* gross per-measure savings for the 2022 Residential New Construction program measures.

TABLE 132. 2022 RESIDENTIAL NEW CONSTRUCTION PROGRAM *EX ANTE* & *EX POST* GROSS PER-MEASURE SAVINGS VALUES

| MEASURE | UNIT OF MEASURE | EX ANTE DEEMED SAVINGS | | | EX POST GROSS PER-MEASURE SAVINGS | | |
|---|---|---|---|---|---|---|---|
| | | KWH | KW | THERMS | KWH | KW | THERMS |
| Silver Star (HERS 62-59) Electric | Home | 191.64 | 0.444 | 0.00 | 563.60 | 0.280 | 0.00 |
| Silver Star (HERS 62-59) Gas | Home | 0.00 | 0.000 | 235.00 | 0.00 | 0.000 | 241.92 |
| Gold Star (HERS 58-57) Electric | Home | 191.64 | 0.444 | 0.00 | 563.60 | 0.280 | 0.00 |
| Gold Star (HERS 58-57) Gas | Home | 0.00 | 0.000 | 247.21 | 0.00 | 0.000 | 254.49 |
| Platinum Star (HERS <=56) Electric | Home | 191.64 | 0.444 | 0.00 | 563.60 | 0.280 | 0.00 |
| Platinum Star (HERS <=56) Gas | Home | 0.00 | 0.000 | 260.05 | 0.00 | 0.000 | 267.71 |

Table 133 highlights notable differences between *ex ante* and *ex post* gross estimates.

TABLE 133. 2022 RESIDENTIAL NEW CONSTRUCTION NOTABLE DIFFERENCES BETWEEN *EX ANTE* & EX POST *GROSS*

| MEASURE | *EX ANTE* SOURCES AND ASSUMPTIONS | *EX POST* GROSS SOURCES AND ASSUMPTIONS | PRIMARY REASONS FOR DIFFERENCES |
|---|---|---|---|
| Electric | TRM-based calculation using inputs from 2019 EM&V data, IN TRM, and 2020 IN Residential Code. Electric savings reflect only cooling savings. | Program data and HERS certificate data from random sample used to generate prototypes. Savings based on REMRate prototype model analysis with code-minimum baseline home. Electric savings reflect whole home. | kWh savings differ due to different savings calculation approach and *ex ante* value reflect only cooling savings.<br>kW savings differ due to different savings calculation approach and *ex ante* over-estimating EER values (90% of SEER). |
| Gas | Inputs from 2019 EM&V data used to extrapolate savings based on the HERS score of the NIPSCO program home. | Program data and HERS certificate data from random sample used to generate prototypes. Savings based on REMRate prototype model analysis with code-minimum baseline home. | Gas savings closely align but differ due to different savings calculation approach. |

## REALIZATION RATES

The next three tables (Table 134 through Table 136) show the program's *ex ante* reported savings, verified savings, and *ex post* gross savings. The realization rates were very high for electric energy and very low for peak demand savings, at 294% and 63%, respectively. The realization rate for natural gas savings was 103%.

**Electric energy and demand savings:**

- kWh savings were primarily driven by the marginal difference between the code-minimum 90% efficient lighting requirement and the assumption that program-participating homes are not installing incandescent lighting.[41]
- In addition, as required by the program, all electric homes installed 15+ SEER cooling systems.[42]
- *Ex ante* savings were based on cooling savings only using TRM-based algorithms and excluded other sources.
  - Omitting other sources of electric energy savings like lighting contributed to the very high kWh realization rate.
  - *Ex ante* kW savings assumed EERs were 90% of SEER, which established higher EER values used in the algorithm. As a result, deemed kW savings were high compared to evaluated savings resulting in a lower realization rate.

**Natural gas savings:**

- There are minimal differences between *ex ante* and *ex post* savings, and realization rates are aligned.

TABLE 134. 2022 RESIDENTIAL NEW CONSTRUCTION PROGRAM *EX ANTE* & *EX POST* GROSS ELECTRIC ENERGY SAVINGS

| MEASURE | EX ANTE ELECTRIC ENERGY SAVINGS (KWH/YR.) | AUDITED GROSS ELECTRIC ENERGY SAVINGS (KWH/YR.) | VERIFIED GROSS ELECTRIC ENERGY SAVINGS (KWH/YR.) | EX POST GROSS ELECTRIC ENERGY SAVINGS (KWH/YR.) |
|---|---|---|---|---|
| Silver Star (HERS 62-59) Electric | 2,108.04 | 2,108.04 | 2,108.04 | 6,199.60 |
| Silver Star (HERS 62-59) Gas | 0.00 | 0.00 | 0.00 | 0.00 |
| Gold Star (HERS 58-57) Electric | 1,724.76 | 1,724.76 | 1,724.76 | 5,072.40 |
| Gold Star (HERS 58-57) Gas | 0.00 | 0.00 | 0.00 | 0.00 |
| Platinum Star (HERS <=56) Electric | 383.28 | 383.28 | 383.28 | 1,127.20 |
| Platinum Star (HERS <=56) Gas | 0.00 | 0.00 | 0.00 | 0.00 |
| Total Savings | 4,216.08 | 4,216.08 | 4,216.08 | 12,399.20 |
| Total Program Realization Rate | | | | 294% |

[41] Based on interview findings, the models were updated with the assumption that interior, garage, and exterior lightbulbs in homes built through the program were 100% efficient (99% LED/1% fluorescent).
[42] Sampled electric projects had an average 15.3 SEER. For comparison, gas projects had average 13.8 SEER in 2022.

TABLE 135. 2022 RESIDENTIAL NEW CONSTRUCTION PROGRAM *EX ANTE* & *EX POST* GROSS PEAK DEMAND REDUCTION

| MEASURE | *EX ANTE* PEAK DEMAND REDUCTION (kW/yr.) | AUDITED GROSS PEAK DEMAND REDUCTION (kW/yr.) | VERIFIED GROSS PEAK DEMAND REDUCTION (kW/yr.) | *EX POST* GROSS PEAK DEMAND REDUCTION (kW/yr.) |
|---|---|---|---|---|
| Silver Star (HERS 62-59) Electric | 4.884 | 4.884 | 4.884 | 3.080 |
| Silver Star (HERS 62-59) Gas | 0.000 | 0.000 | 0.000 | 0.000 |
| Gold Star (HERS 58-57) Electric | 3.996 | 3.996 | 3.996 | 2.520 |
| Gold Star (HERS 58-57) Gas | 0.000 | 0.000 | 0.000 | 0.000 |
| Platinum Star (HERS <=56) Electric | 0.888 | 0.888 | 0.888 | 0.560 |
| Platinum Star (HERS <=56) Gas | 0.000 | 0.000 | 0.000 | 0.000 |
| Total Savings | 9.768 | 9.768 | 9.768 | 6.160 |
| Total Program Realization Rate | | | | 63% |

TABLE 136. 2022 RESIDENTIAL NEW CONSTRUCTION PROGRAM *EX ANTE* & *EX POST* GROSS GAS SAVINGS

| MEASURE | *EX ANTE* NATURAL GAS ENERGY SAVINGS (therms/yr.) | AUDITED GROSS NATURAL GAS ENERGY (therms/yr.) | VERIFIED GROSS NATURAL GAS ENERGY SAVINGS (therms/yr.) | *EX POST* GROSS NATURAL GAS ENERGY SAVINGS (therms/yr.) |
|---|---|---|---|---|
| Silver Star (HERS 62-59) Electric | 0.00 | 0.00 | 0.00 | 0.00 |
| Silver Star (HERS 62-59) Gas | 142,410.00 | 142,410.00 | 142,410.00 | 146,603.52 |
| Gold Star (HERS 58-57) Electric | 0.00 | 0.00 | 0.00 | 0.00 |
| Gold Star (HERS 58-57) Gas | 34,114.98 | 34,114.98 | 34,114.98 | 35,119.56 |
| Platinum Star (HERS <=56) Electric | 0.00 | 0.00 | 0.00 | 0.00 |
| Platinum Star (HERS <=56) Gas | 27,565.30 | 27,565.30 | 27,565.30 | 28,377.01 |
| Total Savings | 204,090.28 | 204,090.28 | 204,090.28 | 210,100.08 |
| Total Program Realization Rate | | | | 103% |

## *EX POST* NET SAVINGS

The evaluation team estimated freeridership and spillover using data collected from 2022 builder interviews. Table 137 shows the NTG ratio for the Residential New Construction Program.

TABLE 137. 2022 RESIDENTIAL NEW CONSTRUCTION PROGRAM NET-TO-GROSS RATIO

| MEASURE | RESPONSES (n) | FREERIDERSHIP | PARTICIPANT SPILLOVER | NTG |
|---|---|---|---|---|
| Total Program | 8 | 79% | 0% | 21% |

The evaluation team collected data for the net-to-gross (NTG) analysis via builder interviews and encountered several challenges that should be considered when interpreting these results. In previous years, the evaluation team had attempted to capture this information via surveys but achieved very low response rates and incomplete data on freeridership. Therefore, we determined that attempting to reach builders via more focused, one-on-one interviews should be attempted to potentially gather better data.

However, the team encountered similar challenges this year. The evaluation team targeted builders who represented the highest savings contributions through the program, and while we were able to reach most of these builders, we found that calculating NTG for the program was again a challenge based on the limited amount of data the team was able to collect via builder and rater interviews. Builders reported varying levels of engagement with the program, with several indicating that they have very limited interactions with the program and were therefore reluctant or unable to provide feedback on program influence. One builder indicated they were not aware they were participating.

Similarly, some builders were able to provide detailed information on their building practices, but importantly, several builders refused to complete full interviews with the evaluation team due to busy schedules and the team was unable to ask detailed freeridership questions. For these builders, the team asked high level, qualitative questions to understand the program's influence on the builder's intent and building practices.

After considerable review and sensitivity analyses, the evaluation team determined that the NTG ratio resulting from the 2022 primary interview data is the best source that should be used, but that this research should be repeated in future years with additional coordination with program implementation staff to encourage builder participation and engagement in this research.[43] Both in qualitative feedback provided and within the data used for the NTG analysis, the primary data gathered in 2022 suggests that there is high freeridership in the Residential New Construction program. Builders generally reported low engagement with the program implementation team and that program incentives were too low to affect their decision-making. The low engagement with the program is a likely contributor to the difficulties in reaching builders for this research.

## FREERIDERSHIP

Below we provide details on the freeridership approach and results for the Residential New Construction program.

### INTENTION FREERIDERSHIP

The evaluation team calculated an intention freeridership score for responding builders using the following question:

- FR1. Thinking about the NIPSCO Residential New Construction program homes you built in 2022, what would have happened if you had not received incentives and assistance from NIPSCO?

FR1 was administered as an open-ended question during the interviews. All respondents indicated that if the incentives and assistance were not available from NIPSCO in 2022, they would not have changed their building practices for the homes built in 2022 that qualified for the NIPSCO program. Table 138 shows the *intention* freeridership score for the Residential New Construction Program.

[43] The evaluation team considered applying a NTG value from a secondary source, but NTG values from secondary data sources (gathered from evaluations of peer utilities' residential new construction programs) were ultimately determined to be not comparable due to different program design or incentive structures, and therefore could not be used as a proxy.

TABLE 138. 2022 RESIDENTIAL NEW CONSTRUCTION PROGRAM INTENTION FREERIDERSHIP

| MEASURE | INTENTION FREERIDERSHIP SCORE (%) |
| --- | --- |
| Total Program | 100% |

### INFLUENCE FREERIDERSHIP

The evaluation team assessed *influence* freeridership by asking participant builders how important the following program elements were in their decision-making process:

- The NIPSCO program incentives
- NIPSCO's program marketing
- Information about energy efficient building practices that NIPSCO provided
- Obtaining information from HERS rater who rates homes
- Previous participation in a NIPSCO energy efficiency program

The evaluation team determined each respondent's *influence* freeridership score using the maximum rating provided for any program element, as shown in Table 139.

TABLE 139. 2022 RESIDENTIAL NEW CONSTRUCTION PROGRAM INTENTION FREERIDERSHIP SCORING

| MAXIMUM RATING | INFLUENCE FREERIDERSHIP SCORE (%) |
|---|---|
| 1– Not at all important | 100% |
| 2 –Not too important | 75% |
| 3 –Somewhat important | 25% |
| 4 – Very important | 0% |
| Don't know | 50% |
| Not applicable | 50% |

Table 140 shows the *influence* freeridership score for Residential New Construction Program.

TABLE 140. 2022 RESIDENTIAL NEW CONSTRUCTION PROGRAM INFLUENCE FREERIDERSHIP SCORING

| MEASURE | INFLUENCE FREERIDERSHIP SCORE (%) |
|---|---|
| Total Program | 57% |

### FINAL FREERIDERSHIP

The evaluation team calculated the mean of the *intention* and the *influence* of freeridership components to estimate final freeridership for the Residential New Construction Program. A higher freeridership score translates to more savings that are deducted from the gross savings estimates. Table 141 lists the intention, influence, and final freeridership scores for the 2022 Residential New Construction Program.

TABLE 141. 2022 RESIDENTIAL NEW CONSTRUCTION PROGRAM FREERIDERSHIP SCORE

| MEASURE | INTENTION SCORE [a] | INFLUENCE SCORE [a] | FREERIDERSHIP SCORE |
|---|---|---|---|
| Total Program | 100% | 57% | 79% |

[a] Weighted by *ex post* gross energy savings.

## PARTICIPANT SPILLOVER

The 2022 Residential New Construction Program spillover estimate is 0%, as shown in Table 142. None of the interviewed builders reported voluntarily raising the energy efficiency standard of the equipment or materials they used to build homes that did not participate in NIPSCO's program.

TABLE 142. 2022 RESIDENTIAL NEW CONSTRUCTION PROGRAM PARTICIPANT SPILLOVER RESULTS

| MEASURE | SPILLOVER SAVINGS (MMBTU) | PARTICIPANT PROGRAM SAVINGS (MMBTU) | PARTICIPANT SPILLOVER |
|---|---|---|---|
| Total Program | 0.0 | 2,863.2 | 0% |

## RESULTING NET SAVINGS

Table 143 presents the resulting net electric savings, demand reduction, and natural gas savings.

TABLE 143. 2022 RESIDENTIAL NEW CONSTRUCTION PROGRAM *EX POST* NET SAVINGS

| MEASURE | *EX POST* GROSS SAVINGS/REDUCTION | | | NTG | *EX POST* NET SAVINGS/REDUCTION | | |
|---|---|---|---|---|---|---|---|
| | KWH | KW | THERMS | | KWH | KW | THERMS |
| Silver Star (HERS 62-59) Electric | 6,199.60 | 3.080 | 0.00 | 21% | 1,301.92 | 0.647 | 0.00 |
| Silver Star (HERS 62-59) Gas | 0.00 | 0.000 | 146,603.52 | 21% | 0.00 | 0.000 | 30,786.74 |
| Gold Star (HERS 58-57) Electric | 5,072.40 | 2.520 | 0.00 | 21% | 1,065.20 | 0.529 | 0.00 |
| Gold Star (HERS 58-57) Gas | 0.00 | 0.000 | 35,119.56 | 21% | 0.00 | 0.000 | 7,375.11 |
| Platinum Star (HERS <=56) Electric | 1,127.20 | 0.560 | 0.00 | 21% | 236.71 | 0.118 | 0.00 |
| Platinum Star (HERS <=56) Gas | 0.00 | 0.000 | 28,377.01 | 21% | 0.00 | 0.000 | 5,959.17 |
| Total Savings | 12,399.20 | 6.160 | 210,100.08 | | 2,603.83 | 1.294 | 44,121.02 |

Note: Totals may not sum properly due to rounding.

Table 144 shows the NTG for each fuel type.

TABLE 144. 2022 RESIDENTIAL NEW CONSTRUCTION NET-TO-GROSS RESULTS BY FUEL TYPE

| SAVINGS TYPE | *EX ANTE* GROSS SAVINGS | *EX POST* GROSS SAVINGS | NTG RATIO (%) | *EX POST* NET SAVINGS |
|---|---|---|---|---|
| Electric Energy Savings (kWh/yr.) | 4,216.08 | 12,399.20 | 21% | 2,603.83 |
| Peak Demand Reduction (kW) | 9.768 | 6.160 | 21% | 1.294 |
| Natural Gas Energy Savings (therms/yr.) | 204,090.28 | 210,100.08 | 21% | 44,121.02 |

# PROCESS EVALUATION

The evaluation team completed the process evaluation to answer the following research questions:

- What program design changes could be made to increase participation? What program design changes could be made to increase the depth of participation (i.e., encourage more, higher tier homes to be built)?
- How satisfied are builders and raters with their program experience overall?
- What type of housing markets are participating in the program? What, if any, gaps exist?
- How do builders and raters participate in the program (i.e., what's their process)? What aspects of the process work well? What aspects do not work well?
- How have program changes (especially those in response to the 2020 building code change) impacted builders' and raters' experience with the program? How, if at all, have these changes impacted the way in which builders/raters participate in the program (e.g., building techniques, housing types, volume of program homes)?

## SECONDARY RESEARCH REVIEW

The evaluation team conducted a secondary research peer utility benchmarking review of residential new construction programs as part of the NIPSCO 2022 program evaluation cycle. In conducting the review, the evaluation team relied on its existing research and evaluation activities as well as publicly available white papers, market assessments, evaluation reports, industry publications, and online sources. The evaluation team used this information to find representative examples of residential new construction program design, performance, incentives, and market factors, drawn from program administrators in the region and across the country. Where relevant, insights from the secondary research are incorporated into the following sections. The detailed findings are included in the Appendix.

## BUILDER AND RATER INTERVIEWS

The evaluation team attempted to contact 28 builders who participated in the 2022 Residential New Construction Program but faced challenges with recruiting. The evaluation team attempted to contact either the person most familiar with the building company's participation in the program, or if that person was hard to identify, the evaluation team tried to get in touch with someone that was most familiar with the company's building practices in NIPSCO's service territory. However, even though the team was sometimes able to contact the most appropriate person at the building company, sometimes they did not have a lot of knowledge or awareness of NIPSCO program participation.

The evaluation team was able to connect with nine builders in total: the team completed three full interviews and six partial interviews. One builder refused to participate in the full interview but was able to provide us with some insight into their building practices. Partial interviews were completed when builders did not want to participate in the full interview because they were either unaware of their own program participation or did not feel that they had anything to say because they "just build the houses and see what they qualify for." The evaluation team also interviewed two energy raters that participated in the program, who were able to provide more detailed and complete information about their experiences.

The following sections describe the results related to motivations for participation, program experience and building practices, and satisfaction with the program and NIPSCO.

# OVERVIEW OF PARTICIPATING BUILDERS AND RATERS

Builders submitted 851 homes to the program in 2022, of which, 21 homes received both a gas and electric incentive, one received the electric incentive only, and 829 received the gas incentive only. Most of the homes (71%) that participated in the program qualified for the silver tier; only 17% qualified for the gold tier and 12% qualified for the platinum tier. About half (49%) of the therm savings were generated by two builders who primarily built silver tier homes and some gold and platinum homes. The one builder who generated most of the kWh savings (68%) built 18 program homes (three homes received the gas incentive only and 15 received both a gas and electric incentive) – about half of their homes qualified for the silver tier and the other half qualified for the gold tier. Although the program provides incentives to builders who construct single-family homes, duplexes, and multifamily homes, building type is not currently included in the tracking data, so participation across building types is unclear.

## OVERVIEW OF BUILDERS INTERVIEWED

All the builders contacted for interviews built single-family homes. Of these builders, two were small scale production builders, two were larger scale production builders, and four were custom home builders. Like the program overall, most of these builders' projects only applied for the gas incentive; these builders also represented 17 of the 21 projects that received both the gas and electric incentive. In total, the builders we contacted generated 82% of the program's total energy savings and 64% of the program's total therm savings. The eight builders who completed at least a portion of the interview generated a total of 77% of program kWh savings and 38% of program therm savings. These eight builders submitted 229 incentives under the silver tier, 68 incentives under the gold tier, and 41 incentives under the platinum tier for a total of 338 incentives.

## OVERVIEW OF RATERS INTERVIEWED

There were seven raters across three companies that participated in the program in 2022. The evaluation team was able to speak to two raters from two different companies. These raters were responsible for rating 533 program homes. One rater, when speaking about their business overall, said that they work with anyone who wants to work with them, but the ideal builder is more of a production builder that builds around 100 new homes a year. The other rater said that they mostly work with new construction homes, and within the NIPSCO program estimated that about 35% are custom homes and 65% are production homes.

# PARTICIPATION PROCESS AND DRIVERS

The evaluation team asked participating raters and builders when they first began participating in the Residential New Construction Program, why they decided to participate, and what the benefits of participation were.

## GETTING CONNECTED TO THE PROGRAM AND RATERS

Overall, the raters and builders interviewed did not recall how they got involved with NIPSCO's program because most thought they had been participating for years. One builder did recall someone from NIPSCO visiting their office years ago to introduce them to the program, but others thought their company's involvement predated their employment.

In interviews with builders, we heard about long-standing, positive relationships between themselves and their raters that have lasted for years. Of the builders we asked (n=3), none remembered how they originally got connected to the rater that they worked with. One builder said they learn of all program changes and code changes through their rater and said that they have been working closely with them for 15 years. According to one rater, their company is the main rating company in their area. This same rater stated they have been working with their builders for a long time and have a sales team that works to find new builders to work with. The other rater said that the best thing they had ever done for their business was join their local builders association, to develop connections with builders "face to face."

### PARTICIPATING IN THE PROGRAM

The builders interviewed had a range of awareness and direct involvement in the program and incentive application process. Of the nine builders we connected with, one person was completely unaware of their program participation, one was vaguely aware of their participation, and seven were aware of the program. The following details program knowledge among the builders with some level of program awareness:

- One did not know program details because their rating company took care of it and said their "work in that area is subcontracted out."
- Two, generally knew about the program details but declined to do the full interview because they indicated general disengagement from program processes, and that they do not build to meet program standards.
- Five were knowledgeable of program details. Two of those builders filled out their incentive applications themselves, once they had the information they needed from their raters.

Even with the varying levels of awareness of program details, a common thread among the builders we spoke to was that none of them built their homes in a special way to meet the program requirements. They build as usual and then see what they qualify for once they are rated.

Based on our interviews, a reason for the low program awareness among builders might be that the relationship between builders and raters is not centered on NIPSCO's program. The raters we spoke to describe the primary reason they engage with one another is basic code compliance, as described in the quote below. The raters we spoke to view NIPSCO's program as an add-on service they provide builders.

The raters explained that the current incentives do not cover the full cost of their rating fee for program homes. One rater explained that basic code compliance costs about $250 and completing the HERS rating for the program is an additional $250; if the home is eligible for a gas incentive, then it will cover the HERS rating and part of the code compliance verification but does not cover incremental costs for more energy efficient building practices and systems. This potentially explains part of why, in 2022, all homes, except one, received a gas incentive, since the electric incentive alone would not cover the HERS rating fee or the incremental cost between a 13 SEER and 15 SEER AC unit required for the electric incentive.

*"I work with builders to prove energy code compliance. If it's within NIPSCO territory, I do additional testing and software work and apply for the rebates for them."*

Builders that participate in the program hire raters to come in once the new home is complete to assess the home for code compliance. If the home is in NIPSCO's territory, the rater completes the HERS rating. Once the home has a HERS rating, the home can be submitted for an incentive based on which incentive tier it falls under. For some builders, they fill out the incentive form themselves. For others, the rater takes care of this process for them, and the incentive check goes directly to the builders.

### REASONS FOR PARTICIPATING

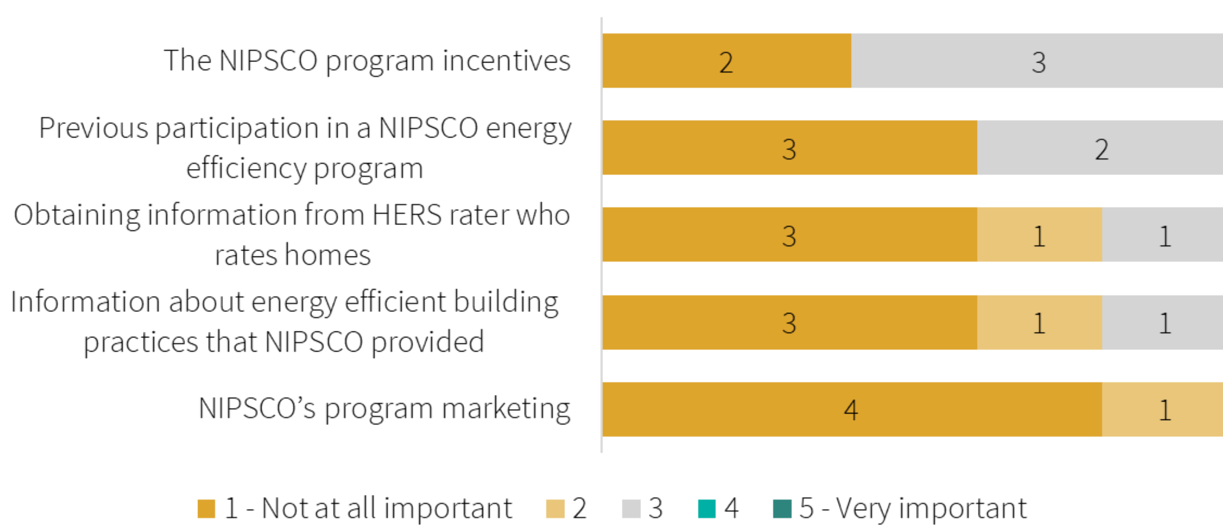
Generally, builders view the program incentives as "free money", since they typically just build their homes and then see which incentive tier they qualify for, and the incentive helps them recoup some of their code compliance costs. One builder also noted that they like having the HERS score as a marketing tool for prospective homebuyers to convey the home's quality.

The raters that participate in the program consider their participation part of their business model. These raters often provide a range of services for builders and submitting qualifying homes for incentives is a standard offering. One rater mentioned that they enjoyed being able to save the builders they work for money. The quote below highlights this.

> *"We always want to get money back for our builders. So, this falls into our core values."*

The evaluation team asked builders to rate how important various aspects of the program were to their decision to build homes to program standards for the tier that they submitted under in 2022. We asked these questions on a scale from 1 to 5 where 1 means "not at all important" and 5 means" very important." As seen in Figure 66 below, no builder rated any program aspect above a 3. The least important factor for builders was NIPSCO's program marketing, and while the most important were the program incentives, two builders still rated them a 1 out of 5, while the other three builders rated them a 3 out of 5 – a neutral score.

FIGURE 66: IMPORTANCE OF PROGRAM ASPECTS TO DECISION TO BUILD HOMES TO TIER STANDARDS



## PROGRAM INFLUENCE

None of the builders we spoke to said they changed their building practices in recent years to qualify for NIPSCO's program. Instead, builders interviewed stated they build their homes the same and whether the home goes through the program primarily depends on whether it is in NIPSCO's territory. Builders interviewed also noted that they don't strive for a particular incentive tier – they build the home, the rater develops the HERS score, and the application is submitted for whichever incentive tier the home is eligible. Some builders emphasized that their goal is to build quality homes, and aligning with the incentive tiers is a byproduct of that mission.

*In general, builders indicated that NIPSCO rebates were minimally important in their decision making. One builder said that the incentive helps them recoup some of their costs for building an efficient home. Another builder mentioned that they believe that their homes qualify for the program when they are built to code. One builder described the incentive as "free money" since they already build their homes to the standards under the program. One builder we spoke to did mention that getting a lower HERS score would not be cost-effective for them given the current incentive levels. Another builder mentioned that if they wanted to move up a tier it was cost prohibitive and discussed how installing a higher efficiency air conditioner unit that cost more "didn't really make sense." However, this builder did mention that they can promote the HERS rating of the home when it is time to sell. "[If we had not received an incentive from NIPSCO] we would have built the houses like we do. It doesn't make a difference of what I would be doing."*

Both raters confirmed that the builders they work with would likely not change their construction practices if the program did not exist. The quotes below highlight this.

*"Most of our builders do build to HERS standards anyways. We provide them with a packet [on what the HERS rating means] to provide to homeowners at closing. They use it as a marketing tool. Most builders do this even if they don't participate."*

*"Homes are not built to any special level for your program. You can get a 56 HERS score without doing much. [Builders] can do the bare minimum code wise, but then have decent windows and infiltration and duct leakage numbers but other than that they don't need to do a whole lot more."*

## SATISFACTION WITH PROGRAM AND NIPSCO

### OVERALL PROGRAM SATISFACTION

All the builders we spoke to were satisfied with the program but seemed to be passive participants. Overall, builders could not speak in detail about their satisfaction with specific program elements; however, one builder that answered satisfaction scale questions on various elements of the program rated all elements a 10 out of 10. Builders did not rate their interactions with TRC staff members because they said that they do not interact with them.

Raters were also satisfied with the program and highlighted that the application process was easy and smooth. One rater was happy with the fact that NIPSCO provides incentives for gas homes since some other utilities they work with only offer incentives for electric homes. The evaluation team asked raters to rate their satisfaction with various program elements on a scale from 1 to 10, where 1 means "not at all satisfied" and 10 means "very satisfied." Raters were very satisfied with the program, with most elements receiving a 9 or 10. The lowest rater program elements were the rebate amounts and the time it takes to receive the rebates, as seen below in Table 145.

TABLE 145: RATER SATISFACTION SCORES

| PROGRAM ELEMENT | RATER 1 SCORE | RATER 2 SCORE |
|---|---|---|
| The time it takes to receive rebates | 5<br>*"I don't know when they get them"* | 6<br>*"For the builders, we don't receive anything"* |
| The rebate amounts | 7<br>*"I would love for there to be a wash between the cost of my services and the rebate"* | 8 |
| Your overall satisfaction with the program | 10 | 9 |
| Communication with program staff | 10 | 9 |
| The rebate application process | 10 | 10 |

### INCENTIVE AND APPLICATION SATISFACTION

Raters and the builders that fill out the application said that the application process was smooth and simple, and they generally do not have any problems with it. This was sometimes highlighted as an administrative burden in peer utility programs, but raters in NIPSCO's program did not report any administrative issues with this process. Sometimes there are minor issues with account numbers, names, or signatures, but they usually get resolved quickly. One rater mentioned that participating in NIPSCO's program is very easy for them, and they "wish it was this easy everywhere." One builder mentioned liking the fillable PDF form but thought that if it was online, it would be a simpler process than emailing it. One rater was curious if there were any issues with the builders receiving their incentive check, since they generally did not know what happens after they submitted the paperwork.

### NIPSCO AND IMPLEMENTER SATISFACTION

None of the builders we spoke to said that they directly interact with NIPSCO or TRC as part of their program participation. The raters had only positive things to say about their interactions with TRC and had no suggestions for improving those interactions. One rater said that TRC "has been very helpful and responsive."

## SUGGESTIONS FOR IMPROVEMENT

Suggestions for improvement were minimal. None of the builders we spoke to had any suggestions, besides increasing the incentive amounts, as discussed previously.

When we asked raters about suggestions for improving the program, one rater we spoke to suggested that NIPSCO *not* use an online portal and keep the application the way it is. This rater also was curious to know more about how many homes were built under the program in the region. Another rater mentioned the fact that some builders they work with get frustrated with the 8-week turnaround time for the incentive and felt that it was too long.

### PROGRAM DESIGN CONSIDERATIONS

In the literature review, cost concerns around building new homes to achieve higher efficiency and thus above-code savings were a barrier found in many peer utility programs. This was echoed in interviews for NIPSCO's program, where two builders and one rater mentioned that the incremental cost of building more efficiently was not justifiable based on the current incentive amount. The evaluation team found that peer utility programs often required lower HERS scores to receive an incentive. While NIPSCO's HERS scores for incentives range from 56 to 62, in Michigan, Consumers Energy requires a HERS score at least as low as 56 to qualify, while DTE requires a HERS score of at least as low as 60. PPL in Pennsylvania requires their program homes to be built at least 15% above code, with a higher incentive for ENERGY STAR homes or homes that receive a HERS rating. Incentives in peer programs were also typically higher than the NIPSCO program incentives. For example, DTE in Michigan offers an incentive for HERS scores equal to or under 60 at $1,500 for electric service only (compared to $60 for NIPSCO), $2,100 for electric and gas service (compared to $510 for NIPSCO), and $1,300 for gas service (compared to $450 for NIPSCO). However, it is important to caveat that the NTG value in Michigan is stipulated, so connection between NTG and incentive values should be interpreted with caution.

For many of the peer programs the evaluation team researched, stacking incentives was also a common approach and those that offered stacked incentives saw higher electric savings. Including incentives for add-ons like electric vehicle chargers or offering bonus incentives for cold climate heat pumps were also common in these programs. The evaluation team found that these offerings can add value and additional ways for the utility to engage with the customer.

In addition, the evaluation team also found that there may be opportunities for NIPSCO to expand what types of homes are being served by the program. Currently, the program serves primarily single-family homes, even though other housing types are eligible. The evaluation team found that there may be other savings opportunities by engaging multifamily and duplex homebuilders, whose homes might be eligible for the program incentive but are not currently participating. In addition, there may also be new savings opportunities by expanding what homes are eligible by incentivizing manufactured, mobile, or modular homes.

## CONCLUSIONS AND RECOMMENDATIONS

In addition to the following conclusions and recommendations, the evaluation team performed a benchmarking literature review of eight peer utility residential new construction programs. That review is included in the Appendix and contains several additional high-level insights and conclusions for NIPSCO program management's consideration.

### CONCLUSION 1: GAS REBATE PARTICIPATION INCREASED SIGNIFICANTLY OVER PARTICIPATION IN THE SECOND HALF OF 2021, BUT ELECTRIC PARTICIPATION REMAINED LOW.

In the second half of 2021, after the program change, there were 12 electric incentives and 248 gas incentives. In 2022, there were 21 homes that received an electric and gas incentive, one home that only received an electric incentive, and 829 homes that only received a gas incentive. This is a 170% increase in gas program participation if you extrapolate 2021's second half to a full year. However, electric incentives remain exceedingly low (< 3% of program participation). Low electric participation may mean there are likely additional saving opportunities in NIPSCO's electric service territory. Unlike the gas incentives, the electric incentives do not cover the costs of any program requirements – the HERS rating or the incremental cost of installing a 15 SEER AC unit – which is likely impacting electric participation.

Recommendations:

- Consider increasing the electric rebate value to incentivize more builders to move to 15+ SEER (or higher) equipment, offsetting the upfront cost of higher efficiency.
- Consider adding an ENERGY STAR bonus tier. Utilities programs in Michigan and Pennsylvania that rebated ENERGY STAR certified new homes, had average claimed electric savings 24-335% higher than NIPSCO *ex post* savings.
- Consider the possibility of offering prescriptive rebates for high efficiency HVAC equipment and appliances that can be stacked with builder gas and/or electric HERS tier rebates. There is room for improvement in efficiency, especially on the gas side. In 2022, sampled electric projects had an average 15.3 SEER, while gas projects had an average 13.8 SEER. The average furnace AFUE was 96.4% for electric projects and 94.9% for gas projects. Additionally, rebates could be offered for energy recovery ventilation (ERV) and above-code envelope measures, including roof/wall insulation and windows to reduce heating and cooling losses. Table 19 in the Appendix provides various home efficiency characteristics for the 2022 participating homes.

## CONCLUSION 2: LIGHTING SAVINGS COMPRISE THE MAJORITY OF ELECTRIC SAVINGS.

Lighting represented 77.9% of all *ex post* kWh savings in 2022. This is due in large part to the evaluation team's assumption that 100% of the installed lighting was efficient (modeled as 99% LED, 1% fluorescent). The federal lighting standard EISA, which will be fully enforced starting mid-year 2023, functionally eliminates screw-in incandescent and halogen lamps from the market, raising the efficiency baseline for available lighting in the market. This means that, while the 2020 Indiana Residential Building code stipulates a baseline of 90% efficient lighting, programs will be evaluated with 100% efficient lighting as a baseline in future years, eliminating a large percentage of electric savings in the Residential New Construction program as it's currently structured.

Recommendations:

- In addition to the recommendations outlined in Conclusion 1, which would all potentially increase electric savings, look to expand the program into new markets, such as home renovations and remodels. High demand and cost for new housing will cause homeowners to stay in their homes longer and thus pursue renovation or additional projects. Home addition projects offer opportunities for energy savings by installing efficient building shell measures like insulation and windows, as well as targeting upgrades to HVAC, water heating, and appliances.

## CONCLUSION 3: *EX ANTE* ESTIMATES FOR RESIDENTIAL NEW CONSTRUCTION ELECTRIC DEMAND DID NOT REFLECT EVALUATED SAVINGS. HOMES SAVED LESS ELECTRIC DEMAND THAN ESTIMATED.

Reported *ex ante* savings used a TRM-based algorithm with 14.1 $EER_{ee}$ (from 2019 EM&V) and 11.7 $EER_{baseline}$ (based on 90% of 13.0 $SEER_{baseline}$) assumptions.

**Recommendations:**

The evaluation team recommends the following:

- Equation to calculate EER from a given SEER[44]: $EER = -0.0228 \times (SEER)^2 + 1.1522 \times (SEER)$
- Updating EERs:
    - 11.35 $EER_{baseline}$ from 2023 federal minimum efficiency standard 13.4 SEER
    - 12.29 $EER_{ee}$ from weighted average of 2022 electric prototypes of 15.3 SEER
- Resulting in 0.207 kW savings to be considered for 2023 deemed savings.

## CONCLUSION 4: THE PROGRAM SEEMS TO BE PRIMARILY REACHING SINGLE-FAMILY HOME BUILDERS.

Based on the interviews, it seems that the program is primarily reaching single-family home builders. Given that other housing types are eligible to participate in the program, there might be a savings opportunity for the program by including other housing segments and types.

**Recommendations:**

- Add to the tracking data an indicator for housing type (e.g., single-family, multifamily, duplex, etc.) so that the participation across the housing segments is clear. This can help inform program engagement activities.
- Explore the needs of builders in other housing segments that are currently eligible under the program. This work could also explore engagement needs for manufactured home builders in advance of the program's plan to incorporate that housing segment in the next program cycle.

## CONCLUSION 5: THE CURRENT INCENTIVE STRUCTURE IS NOT MOTIVATING FOR BUILDERS AND IS NOT COMPETITIVE WITH PEER UTILITY PROGRAM INCENTIVES.

In interviews, builders highlighted that they would build their homes the same way with or without the incentives, and raters corroborated this in their interviews. Builders and raters also both mentioned that the incentives were too low to cover the incremental cost of building more efficiently or installing higher efficiency equipment to meet a higher incentive tier.

**Recommendations:**

- Review the incentive levels and consider opportunities to stack incentives to encourage builders to install certain high efficiency equipment (e.g., a 15 SEER air conditioner, heat pumps, etc.).
- Consider what opportunities there might be to funnel builders towards other offerings that might be relevant (e.g., incentives for EV chargers, solar, etc.).

[44] Source: State of Pennsylvania Technical Reference Manual, Vol. 2: Residential Measures; Rev Date: Feb. 2021; Section 2.2 Table 2-10.

# 11. SCHOOL EDUCATION PROGRAM

## PROGRAM DESIGN AND DELIVERY

The School Education program is designed to produce cost-effective electric and gas savings by influencing fifth grade students and their families to focus on the efficient use of electricity and gas. It provides classroom instruction, posters, and activities aligned with national and state learning standards and energy education kits filled with energy saving products and advice. Students participate in an energy education presentation at school, learning about basic energy concepts through class lessons and activities. Students also receive an energy education kit of quality, high-efficiency products and are instructed to install the energy-efficient products at home, with their families, as well as complete a worksheet. The experience at home completes the learning cycle started at school.

TRC was the program implementer and managed the overall program and acted as a liaison between NIPSCO and program subcontractors. To deliver the program, TRC contracted with the National Energy Foundation (NEF). NEF was responsible for several key program components, including:

- Maintaining a program website
- Marketing and outreach
- Creating educational collateral and kit materials
- Engaging teachers and explaining to them how to use the program's educational materials in their classrooms
- Distributing kits to students
- Reporting on the number of kits shipped
- Collecting student responses to the Home Energy Worksheet (HEW)
- Dispersing teacher mini grants when students returned the target percentage of HEWs

NEF distributed the kits and curriculum materials to teachers who formally committed to participate in the program. They distributed two types of kits:

1. Combo kits for schools in NIPSCO's natural gas and electric territory.
2. Gas-only kits for schools in NIPSCO's natural gas territory, but not in NIPSCO's electric territory.

The kits contained the following energy-saving measures, along with the other educational materials and activities:

- Measures in Combo Kits
    - 2 candelabra LEDs (5 watt)
    - 1 bathroom faucet aerator (1.0 gpm)
    - 1 kitchen faucet aerator (1.5 gpm)
    - 1 low-flow showerhead (1.5 gpm)
    - 1 LED night-light (0.5 watt)
    - 1 advanced power strip (Tier 1)
    - 8 light switch gaskets
    - 18 power outlet gaskets
    - 1 plumber's tape

- Measures in Gas-Only Kits
  - 2 bathroom faucet aerators (1.0 gpm)
  - 1 kitchen faucet aerator (1.5 gpm)
  - 2 low-flow showerheads (1.5 gpm)
  - 8 light switch gaskets
  - 18 power outlet gaskets
  - 1 plumber's tape

In general, program participation is driven by direct outreach to schools that have participated in the program in prior years. The implementation team also used community outreach, direct mail, and social media to promote the School Education program.

### CHANGES FROM 2021 DESIGN

For program year 2022, the kit information card was updated to include a QR code to connect participants with program information on the thinkenergy.org website, including the HEW, parent letter, program presentation, installation guides, and games. Additionally, in anticipation of the EISA backstop, the combo kits for program year 2022 included two 5-watt candelabra LEDs instead of four 9W LEDs. Lastly, the furnace whistle in each of the combo and gas kits was replaced with one advanced power strip, eight light switch gaskets, and eighteen power outlet gaskets.

## PROGRAM PERFORMANCE

In 2022, the program distributed 11,752 combo kits and 284 gas kits and exceeded its peak demand savings goal. Table 146 summarizes savings for the full year of program performance, including program savings goals.

TABLE 146. 2022 SCHOOL EDUCATION PROGRAM SAVING SUMMARY

| METRIC | GROSS SAVINGS GOAL | *EX ANTE* | AUDITED | VERIFIED | *EX POST* GROSS | *EX POST* NET | *EX POST* GROSS GOAL ACHIEVEMENT |
|---|---|---|---|---|---|---|---|
| Electric Energy Savings (kWh/yr.) | 1,986,455.00 | 1,986,793.12 | 1,986,760.11 | 2,264,629.51 | 1,943,592.35 | 1,877,561.14 | 98% |
| Peak Demand Reduction (kW) | 141.000 | 141.024 | 138.146 | 178.413 | 180.716 | 164.860 | 128% |
| Natural Gas Energy Savings (therms/yr.) | 190,520.00 | 191,277.76 | 191,264.53 | 166,154.04 | 96,790.94 | 98,615.59 | 51% |

Table 147 outlines the *ex post* gross and NTG adjustment factors. Given that the School Education program evaluation did not include participant follow-up surveys for program year 2022, the evaluation team referenced the spillover and freeridership for continuing measures from the 2021 School Education program, and freeridership from the 2022 HomeLife Calculator program for new measures (5W candelabra, advanced power strips, and gaskets) to determine the NTG adjustment factors.

Realization rates overall are most significantly impacted by differences between the *ex ante* and *ex post* gross assumptions for the light switch and power outlet gaskets. The higher realization rate for peak demand reduction is driven by demand savings assigned to light switch and power outlet gaskets based on the presence of central air conditioning in the *ex post* gross calculation, aligning with the Illinois TRM (v10) approach for gaskets. The *ex ante* calculation does not assign demand savings to the gasket measure. Relatedly, the lower realization rate for natural gas is driven by the in-service rates (ISRs) and fuel saturation rates for power outlet gaskets in the *ex post* gross calculations, which are lower than the *ex ante* assumptions.

TABLE 147. 2022 SCHOOL EDUCATION PROGRAM ADJUSTMENT FACTORS

| METRIC | REALIZATION RATE (%)[a] | FREERIDERSHIP | SPILLOVER | NTG (%)[b] |
|---|---|---|---|---|
| Electric Energy Savings (kWh/yr.) | 98% | 12% | 9% | 97% |
| Peak Demand Reduction (kW) | 128% | 18% | 9% | 91% |
| Natural Gas Energy Savings (therms/yr.) | 51% | 7% | 9% | 102% |

[a] Realization Rate is defined as *ex post* Gross savings divided by *ex ante* savings.
[b] NTG is defined as *ex post* net savings divided by *ex post* gross savings.

The School Education program came in slightly under budget in 2022. As shown in Table 148, the program spent 97% of the allocated electric and natural gas budgets.

TABLE 148. 2022 SCHOOL EDUCATION PROGRAM EXPENDITURES

| FUEL | PROGRAM BUDGET | PROGRAM EXPENDITURES | BUDGET SPENT (%) |
|---|---|---|---|
| Electric | $755,050.61 | $731,346.84 | 97% |
| Natural Gas | $332,201.07 | $322,114.47 | 97% |

# EVALUATION METHODOLOGY

To inform the 2022 NIPSCO impact evaluation, the evaluation team completed the following research activities:

- **Program staff interviews and discussions,** to understand the program design and delivery.
- **Documentation and materials review,** to provide context on program implementation.
- **Engineering analysis**, to review program savings assumptions and algorithms for reasonableness and accuracy.

# IMPACT EVALUATION

The evaluation team completed the impact evaluation to answer the following research questions:

- What assumptions were used to develop deemed savings estimates? Are there any updates that should be made?
- What are *ex post* program savings? Do these suggest any needed updates to program design, delivery, or savings assumptions?

For all measure types, the evaluation team compared its engineering calculations to NIPSCO's *ex ante* savings, basing its savings methodologies and inputs for each measure on several sources: standard engineering practices, the Illinois TRM (v10.0), the 2015 Indiana TRM (v2.2), the 2021 NIPSCO School Education program evaluation, 2022 HomeLife Calculator survey data, and NIPSCO's program tracking database.[45,46] It should be noted that prior to this evaluation year, the evaluation team used the Indiana TRM as our primary source and supplemented with other sources as needed. The Indiana TRM is out-of-date, and currently in the process of being updated to align more closely with the Illinois TRM. After discussions with NIPSCO, our team felt it would be best practice to use the Illinois TRM as our primary source while the Indiana TRM is in process of being updated, as the Illinois TRM is updated annually and should align closely with the new version of the Indiana TRM.

[45] Illinois Energy Efficiency Stakeholder Advisory Group. *2022 Illinois Statewide Technical Reference Manual for Energy Efficiency Version 10.0. Volume 3: Residential Measures.* September 24, 2021.
[46] Cadmus. *Indiana Technical Reference Manual Version 2.2*. July 28, 2015.

## AUDITED AND VERIFIED SAVINGS

To audit program savings, the evaluation team performed the following reviews to verify alignment with the program's scorecard:

1. **Audited Kits Quantity.** Reviewed program tracking data provided by the implementer and audited the number of kits distributed.
2. **Confirm Measure-Level Savings Calculations.** Reviewed per-measure and per-kit savings in the documentation provided by NIPSCO.
3. **Savings Estimate Review.** Confirmed program-level total savings.

NIPSCO reported a total of 11,752 combo kits and 284 gas-only kits distributed through the School Education program. These reported scorecard values were checked against the program tracking data. The audit of the tracking data mirrored the totals reported by NIPSCO.

To verify the savings, the evaluation team reviewed the kit savings documentation which contained measure-level and kit-level savings. Importantly, NIPSCO included in-service rates from past EM&V efforts in their *ex ante* assumptions for the kit program. The program documentation included rates to adjust savings for both installation practices and water heater fuel saturation.

Upon review of this document, measure-level savings values in the tracking data aligned with NIPSCO's kit savings documentation. However, program tracking data savings were reported at the kit-level with a rounded total kit value, and NIPSCO's measure calculation file savings were reported at the measure-level with un-rounded per measure values. This difference in the unit of analysis resulted in rounding errors, meaning that the sum of total measure savings was slightly off from the tracking data savings. These rounding errors will be noted where applicable in the remainder of this report.

### IN-SERVICE RATES

Parents whose children participated in the School Education program were asked to fill out HEWs, which collect information on home characteristics, energy behavior, and initial measure installation rates. The HEWs are voluntary; not all parents complete them. HEWs are completed very shortly after kit distribution and likely do not reflect long-term ISRs, as participants may install or uninstall measures as time passes. To capture more representative ISRs, the team referred to the 2021 School Education program evaluation for continuing measures (aerators, showerheads, and nightlights) and the 2022 HomeLife Calculator survey for new measures (5W candelabra LEDs, advanced power strips, and gaskets). Table 149 provides the ISRs and sources.

TABLE 149. 2022 SCHOOL EDUCATION PROGRAM IN-SERVICE RATES

| MEASURE | ISR | SOURCE |
| --- | --- | --- |
| LEDs | 61% | 2022 Homelife Calculator Survey |
| Kitchen Aerator | 35% | 2021 Schools evaluation |
| Bathroom Aerator | 28% | 2021 Schools evaluation |
| Low-flow Showerhead | 30% | 2021 Schools evaluation |
| LED Night Light | 70% | 2021 Schools evaluation |
| Advanced Power Strip | 81% | 2022 Homelife Calculator Survey |
| Light Switch Gaskets (Exterior Wall) | 17% | 2022 Homelife Calculator Survey |
| Power Outlet Gaskets (Exterior Wall) | 15% | 2022 Homelife Calculator Survey |

As noted in Table 149, the ISRs for gaskets are for those installed on exterior walls because savings are based on reduced infiltration. Gaskets installed on interior walls do not generate savings.

## WATER HEATER SATURATION

The evaluation team adjusted the *ex ante* electric and natural gas saturation rates for water-saving measures by analyzing data from the 2022 HEW results from the School Education Program, which provides a large sample of customers who report their water heater fuel, shown in Table 150. Results indicate a slight discrepancy between *ex ante* and verified electric and natural gas domestic water heating saturation rates.

TABLE 150. 2022 SCHOOL EDUCATION PROGRAM WATER HEATER FUEL SATURATION

| SAVINGS TYPE | ELECTRIC WATER HEATING SATURATION RATE (%) | NATURAL GAS WATER HEATING SATURATION RATE (%) |
| --- | --- | --- |
| Reported *ex ante* | 23% | 64% |
| Verified | 20% | 65% |

[a] Electric and natural gas saturation rates do not total 100% because 9% of respondents selected “Other” and 5% selected “Propane” on the HEW

Table 151 summarizes the *ex ante* and verified savings per measure.

TABLE 151. 2022 2022 SCHOOL EDUCATION PROGRAM *EX ANTE* AND VERIFIED PER-UNIT SAVINGS

| MEASURE | ISRs | *EX ANTE* KWH SAVINGS[a] | VERIFIED KWH SAVINGS | *EX ANTE* KW SAVINGS | VERIFIED KW SAVINGS | *EX ANTE* THERM SAVINGS | VERIFIED THERM SAVINGS |
| --- | --- | --- | --- | --- | --- | --- | --- |
| LED (5W Candelabra) – Combo Kit | 61% | 21.03 | 15.45 | 0.002 | 0.002 | 0.00 | 0.00 |
| Bathroom Aerator – Combo Kit | 28% | 3.95 | 3.70 | 0.000 | 0.000 | 0.48 | 0.53 |
| Bathroom Aerator – Gas Only Kit | 28% | 0.00 | 0.00 | 0.000 | 0.000 | 0.48 | 0.53 |
| Kitchen Aerator – Combo Kit | 35% | 35.18 | 31.49 | 0.001 | 0.001 | 4.31 | 4.50 |
| Kitchen Aerator – Gas Only Kit | 35% | 0.00 | 0.00 | 0.000 | 0.000 | 4.31 | 4.50 |
| Low-flow Showerhead – Combo Kit | 30% | 41.81 | 41.95 | 0.001 | 0.001 | 5.12 | 6.00 |

| MEASURE | ISRs | *EX ANTE* KWH SAVINGS[a] | VERIFIED KWH SAVINGS | *EX ANTE* KW SAVINGS | VERIFIED KW SAVINGS | *EX ANTE* THERM SAVINGS | VERIFIED THERM SAVINGS |
|---|---|---|---|---|---|---|---|
| Low-flow Showerhead – Gas Only Kit | 30% | 0.00 | 0.00 | 0.000 | 0.000 | 5.12 | 6.00 |
| LED Nightlight – Combo Kit | 70% | 2.27 | 0.83 | 0.000 | 0.000 | 0.00 | 0.00 |
| Advanced Power Strip – Combo Kit | 81% | 41.20 | 83.43 | 0.005 | 0.009 | 0.00 | 0.00 |
| Light Switch Gaskets – Combo Kit | 17% | 0.10 | 0.02 | 0.000 | 0.000 | 0.23 | 0.10 |
| Light Switch Gaskets – Gas Only Kit | 17% | 0.00 | 0.00 | 0.000 | 0.000 | 0.23 | 0.10 |
| Power Outlet Gaskets – Combo Kit | 15% | 0.10 | 0.02 | 0.000 | 0.000 | 0.23 | 0.10 |
| Power Outlet Gaskets – Gas Only Kit | 15% | 0.00 | 0.00 | 0.000 | 0.000 | 0.23 | 0.10 |

[a] Values presented at a measure-level represent Audited values, since the scorecard provides only savings totals.

## *EX POST* GROSS SAVINGS

The evaluation team reviewed the programs *ex ante* assumptions, sources, and algorithms for reasonableness and updates. Below are detailed *ex post* gross analysis results.

### ENGINEERING REVIEWS

The evaluation team referred to the Illinois TRM (v10.0) and the Indiana TRM (v2.2) to calculate *ex post* gross electric energy savings, demand reduction, and natural gas savings. *Appendix 9* contains details on the specific algorithms, variable assumptions, and references for all program measure *ex post* gross calculations.

Through the engineering review, the evaluation team found differences between *ex ante* and *ex post* gross savings. These differences were primarily driven by the following overarching factors:

- The evaluation team used Illinois TRM (v10.0) algorithms and non-climate-related assumptions to calculate *ex post* while *ex ante* was calculated using the Indiana TRM (v2.2) algorithms and assumptions. Where needed, climate-specific inputs for *ex post* savings were sourced from the Indiana TRM (v2.2) to provide Indiana specific data.
- The evaluation team used 2022 HomeLife survey findings to calculate the *ex post* baseline wattage for candelabras.
- The evaluation team used updated in-service rates, water heater saturation, and other algorithm inputs (such as people-per-home), based on the 2022 HEW worksheet (water heater saturation), the 2021 NIPSCO School Education program evaluation for continuing measures (ISRs for aerators, showerheads, and nightlights) and information captured in the 2022 HomeLife Calculator survey for new measures (ISRs for 5W candelabra LEDs, advanced power strips, and gaskets), which adjusted savings across measures.

The following sections summarize the team’s findings and recommendations based on the engineering review.

## *EX POST* GROSS SAVINGS

*Ex post* savings reflect the engineering adjustments made to the verified measure savings. The evaluation team calculated *ex post* electric energy, peak demand, and natural gas energy savings for each measure kit using algorithms from the Illinois TRM (v10.0). The evaluation team estimated people per household, and water and space heating fuel type saturation from the 2022 HEW. The team sourced the 2022 HomeLife Calculator survey for continuing measure ISRs, and type of light bulb replaced from, and referred to the 2021 NIPSCO School Education program evaluation for continuing measure ISRs, then used this information to inform *ex post* gross savings calculations.

Table 152 shows the *ex ante* deemed savings and *ex post* gross per-measure savings for the 2022 School Education program measures. *Ex post* savings calculations differed from *ex ante* analysis for the following overarching reasons:

- LED candelabra: Updated hours of use and ISR for the LED candelabra. The 2022 *ex ante* analysis applies 1,135 annual hours of use from the Indiana TRM (v2.2), whereas the *ex post* analysis applies 763 annual hours of use from the Illinois TRM (v10.0). The HomeLife Calculator *ex post* ISR of 61% is lower than the *ex ante* assumption of 83%; the *ex ante* ISR corresponds to the 2020 program year ISR for 9W LEDs, not 5W candelabras. Interestingly, the *ex ante* EISA baseline wattage of 29 watts and the 2022 HomeLife Calculator participant survey weighted average baseline wattage of 29 watts align.
- Advanced power strip: *Ex post* ISR of 81% from the 2022 HomeLife Calculator survey is much higher than the *ex ante* assumption of 40%.
- LED Nightlight: Updated baseline wattage and hours of use from the Illinois TRM (v10.0) for *ex post* analysis increased energy savings compared to *ex ante*. Updated ISR from the 2021 School Education evaluation.
- Low-flow faucet aerators and showerheads: Updated water heating fuel saturation percentages and household demographics based on 2022 HEW results, and updated ISRs based on the 2021 School Education evaluation. Updated baseline and efficient flow rate assumptions to match the Illinois TRM (v10.0). As reported in Table 150, the verified natural gas and electric water heater saturation rates were like *ex ante*. The average number of people per home reported in the 2022 HEW was slightly higher compared to *ex ante*. The updated Illinois TRM (v10.0) inputs were the main driver of the lower realization rates.
- Outlet and switch gaskets: Updated to Illinois TRM (v10.0) and incorporated space heating fuel type saturations and assigned demand savings based on the presence of central air conditioning from the 2022 HEW results. Updated ISRs based on the 2022 HomeLife Calculator survey. For these measures, the *ex ante* savings are evaluated by sourcing an online calculator that excludes demand savings and assumes natural gas heating and air conditioning for all homes. *Ex post* savings source the Illinois TRM (v10), consistent with the approach for other measures in the program. The Illinois TRM (v10) assigns savings based on industry studies and the American Society of Heating, Refrigerating, and Air Conditioning Engineers (ASHRAE) findings. Demand savings are assigned based on the presence of central air conditioning, and electric and gas savings are based on heating system type. The high electric realization rates for these measures are driven by the addition of electric heating savings, using actual heating fuel saturation. While a minority of customers heat their homes electrically, and in-service rates are low, these savings are comparably large, driving up electric savings for these measures.

Table 152 shows the *ex ante* deemed savings and *ex post* gross per-measure savings for the 2022 School Education program.

TABLE 152. 2022 SCHOOL EDUCATION PROGRAM *EX ANTE* & *EX POST* GROSS PER-KIT SAVINGS VALUES

| MEASURE | QUANTITY PER KIT | *EX ANTE* DEEMED SAVINGS | | | *EX POST* GROSS PER-KIT SAVINGS | | |
|---|---|---|---|---|---|---|---|
| | | KWH | KW | THERMS | KWH | KW | THERMS |
| LED (5W Candelabra) – Combo Kit | 2 | 42.05 | 0.005 | 0.00 | 20.78 | 0.003 | 0.00 |
| Bathroom Aerator – Combo Kit | 1 | 3.95 | 0.000 | 0.48 | 2.42 | 0.000 | 0.34 |
| Bathroom Aerator – Gas Only Kit | 2 | 0.00 | 0.000 | 0.97 | 0.00 | 0.000 | 0.67 |
| Kitchen Aerator – Combo Kit | 1 | 35.18 | 0.001 | 4.31 | 25.77 | 0.000 | 3.59 |
| Kitchen Aerator – Gas Only Kit | 1 | 0.00 | 0.000 | 4.31 | 0.00 | 0.000 | 3.59 |
| Low-flow Showerhead – Combo Kit | 1 | 41.81 | 0.001 | 5.12 | 23.14 | 0.000 | 3.22 |
| Low-flow Showerhead – Gas Only Kit | 2 | 0.00 | 0.000 | 10.24 | 0.00 | 0.000 | 6.45 |
| LED Nightlight – Combo Kit | 1 | 2.27 | 0.000 | 0.00 | 1.84 | 0.000 | 0.00 |
| Advanced Power Strip – Combo Kit | 1 | 41.20 | 0.005 | 0.00 | 83.43 | 0.006 | 0.00 |
| Light Switch Gaskets – Combo Kit | 8 | 0.80 | 0.000 | 1.80 | 2.68 | 0.002 | 0.27 |
| Light Switch Gaskets – Gas Only Kit | 8 | 0.00 | 0.000 | 1.80 | 0.00 | 0.000 | 0.27 |
| Power Outlet Gaskets – Combo Kit | 18 | 1.80 | 0.000 | 4.05 | 5.33 | 0.003 | 0.54 |
| Power Outlet Gaskets – Gas Only Kit | 18 | 0.00 | 0.000 | 4.05 | 0.00 | 0.000 | 0.54 |

Table 153 highlights notable differences between *ex ante* and *ex post* gross estimates.

TABLE 153. 2022 SCHOOL EDUCATION NOTABLE DIFFERENCES BETWEEN *EX ANTE* & *EX POST* GROSS

| MEASURE | *EX ANTE* SOURCES AND ASSUMPTIONS | *EX POST* GROSS SOURCES AND ASSUMPTIONS | PRIMARY REASONS FOR DIFFERENCES |
|---|---|---|---|
| LED candelabra | *Ex ante* savings use IN TRM (v2.2) assumptions, EISA baseline wattage of 29W, and 2020 ISR for 9W LEDs. | *Ex post* savings use IL TRM (v10.0) assumptions, 2022 HomeLife participant survey for baseline wattage of 29W, and 2022 HomeLife Calculator ISR. | Hours of use and ISR differences. |
| Bathroom Aerator | *Ex ante* savings use IN TRM (v2.2) assumptions. | *Ex post* savings use IL TRM (v10.0) assumptions. 2022 HEW for fuel saturation percentages and demographics | Different TRM assumptions for flow rates and drain factor. Updated ISR. |
| Kitchen Aerator | *Ex ante* savings use IN TRM (v2.2) assumptions. | *Ex post* savings use IL TRM (v10.0) assumptions. 2022 HEW for fuel saturation percentages and demographics | Different TRM assumptions for flow rates and drain factor. Updated ISR. |
| Low-Flow Showerhead | *Ex ante* savings use IN TRM (v2.2) assumptions. | *Ex post* savings use IL TRM (v10.0) assumptions. 2022 HEW for fuel saturation percentages and demographics | Different TRM assumption for baseline flow rate. Updated ISR. |
| LED Nightlights | *Ex ante* savings use IN TRM (v2.2) assumptions. | *Ex post* savings use IL TRM (v10.0) assumptions. | Different TRM assumptions for baseline wattage and hours of use. Updated incandescent replacement factor. |
| Advanced Power Strips | *Ex ante* savings use IL TRM (v10.0) assumptions. | *Ex post* savings use IL TRM (v10.0) assumptions and 2022 HomeLife survey ISR. | *Ex post* ISR is much higher than *ex ante* |
| Light Switch Gaskets | *Ex ante* savings uses online calculator at EnergyEarth.com | *Ex post* savings use IL TRM (v10.0) assumptions. 2022 HEW for fuel | Methodology differences. *Ex ante* does not include an adjustment for |

| MEASURE | *EX ANTE* SOURCES AND ASSUMPTIONS | *EX POST* GROSS SOURCES AND ASSUMPTIONS | PRIMARY REASONS FOR DIFFERENCES |
|---|---|---|---|
| | | saturation percentages and 2022 HomeLife survey ISR. | space heating fuel type saturation assign demand savings based on the presence of central air conditioning. Updated ISR. |
| Power Outlet Gaskets | *Ex ante* savings uses online calculator at EnergyEarth.com | *Ex post* savings use IL TRM (v10.0) assumptions. 2022 HEW for fuel saturation percentages and 2022 HomeLife survey for ISR. | Methodology differences. *Ex ante* does not include an adjustment for space heating fuel type saturation or assign demand savings based on the presence of central air conditioning. Updated ISR. |

**WASTE HEAT FACTOR – THERM PENALTIES**

Consistent with the 2021 evaluation year, the evaluation team is not including therm penalties when calculating evaluated savings for the 2022 School Education program. However, cost-effectiveness results for both the gas and electric programs will include these penalties. The evaluation team believes this approach is appropriate, as it accounts for the penalty on the electric side (where it is generated) and allows the evaluation team to show gas program performance and measure performance more clearly.

*Ex ante* program data for School kits does not include a therm penalty. In total, the *ex post* therm penalty for cost-effectiveness analysis is -4,988.40 therms (Table 154).

TABLE 154. 2022 SCHOOL EDUCATION PROGRAM WASTE HEAT FACTOR THERM PENALTY

| MEASURE | WASTE HEAT FACTOR THERM PENALTY |
|---|---|
| LED (5W Candelabra) – Combo Kit | (4,988.40) |

It should be noted that electric waste heat factors, including cooling credits and electric heating penalties, are currently reported within the kWh and kw savings for the overall program.

## REALIZATION RATES

The next three tables (Table 155 through Table 157) show the program's *ex ante* reported savings, verified savings, and *ex post* gross savings. Across all measures, the differences between *ex ante* and *ex post* savings are primarily driven by the sources referenced to calculate savings and updated ISRs, as indicated in Table 153.

TABLE 155. 2022 SCHOOL EDUCATION PROGRAM *EX ANTE* & *EX POST* GROSS ELECTRIC ENERGY SAVINGS

| MEASURE | *EX ANTE*[A] ELECTRIC ENERGY SAVINGS (kWh/yr.) | AUDITED GROSS ELECTRIC ENERGY SAVINGS (kWh/yr.) | VERIFIED GROSS ELECTRIC ENERGY SAVINGS (kWh/yr.) | *EX POST* GROSS ELECTRIC ENERGY SAVINGS (kWh/yr.) |
|---|---|---|---|---|
| LED (5W Candelabra) – Combo Kit | | 494,208.17 | 363,213.24 | 244,168.90 |
| Bathroom Aerator – Combo Kit | | 46,374.99 | 43,428.08 | 28,402.74 |
| Bathroom Aerators – Gas Only Kit | | 0.00 | 0.00 | 0.00 |
| Kitchen Aerator – Combo Kit | | 413,393.56 | 370,045.39 | 302,832.61 |
| Kitchen Aerator – Gas Only Kit | | 0.00 | 0.00 | 0.00 |
| Showerhead – Combo Kit | | 491,408.12 | 493,051.62 | 271,903.17 |

| MEASURE | *EX ANTE*[A] ELECTRIC ENERGY SAVINGS (kWh/yr.) | AUDITED GROSS ELECTRIC ENERGY SAVINGS (kWh/yr.) | VERIFIED GROSS ELECTRIC ENERGY SAVINGS (kWh/yr.) | *EX POST* GROSS ELECTRIC ENERGY SAVINGS (kWh/yr.) |
|---|---|---|---|---|
| Showerheads – Gas Only Kit | | 0.00 | 0.00 | 0.00 |
| LED Nightlight – Combo Kit | | 26,637.67 | 9,728.54 | 21,629.79 |
| Advanced Power Strip – Combo Kit | | 484,182.40 | 980,469.36 | 980,469.36 |
| Light Switch Gaskets – Combo Kit | | 9,401.60 | 1,444.09 | 31,549.92 |
| Light Switch Gaskets – Gas Only Kit | | 0.00 | 0.00 | 0.00 |
| Power Outlet Gaskets – Combo Kit | | 21,153.60 | 3,249.19 | 62,635.87 |
| Power Outlet Gaskets – Gas Only Kit | | 0.00 | 0.00 | 0.00 |
| Total Savings | 1,986,793.12 | 1,986,760.11 | 2,264,629.51 | 1,943,592.35 |
| Total Program Realization Rate | | | | 98% |

Note: Totals may not sum properly due to rounding.

[a] *Ex ante* savings in the tracking data do not report savings at the individual measure level, therefore only the summary of savings is included.

### TABLE 156. 2022 SCHOOL EDUCATION PROGRAM *EX ANTE* & *EX POST* GROSS PEAK DEMAND REDUCTION

| MEASURE | *EX ANTE* [a] PEAK DEMAND REDUCTION (kW/yr.) | AUDITED GROSS PEAK DEMAND REDUCTION (kW/yr.) | VERIFIED GROSS PEAK DEMAND REDUCTION (kW/yr.) | *EX POST* GROSS PEAK DEMAND REDUCTION (kW/yr.) |
|---|---|---|---|---|
| LED (5W Candelabra) – Combo Kit | | 53.459 | 39.289 | 39.289 |
| Bathroom Aerator – Combo Kit | | 3.168 | 2.967 | 1.383 |
| Bathroom Aerators – Gas Only Kit | | 0.000 | 0.000 | 0.000 |
| Kitchen Aerator – Combo Kit | | 10.580 | 9.471 | 5.217 |
| Kitchen Aerator – Gas Only Kit | | 0.000 | 0.000 | 0.000 |
| Showerhead – Combo Kit | | 16.605 | 16.660 | 4.343 |
| Showerheads – Gas Only Kit | | 0.000 | 0.000 | 0.000 |
| LED Nightlight – Combo Kit | | 0.000 | 0.000 | 0.000 |
| Advanced Power Strip – Combo Kit | | 54.334 | 110.026 | 68.766 |
| Light Switch Gaskets – Combo Kit | | 0.000 | 0.000 | 20.674 |
| Light Switch Gaskets – Gas Only Kit | | 0.000 | 0.000 | 0.000 |
| Power Outlet Gaskets – Combo Kit | | 0.000 | 0.000 | 41.044 |
| Power Outlet Gaskets – Gas Only Kit | | 0.000 | 0.000 | 0.000 |
| Total Savings | 141.024 | 138.146 | 178.413 | 180.716 |
| Total Program Realization Rate | | | | 128% |

Note: Totals may not sum properly due to rounding.

[a] *Ex ante* savings in the tracking data do not report savings at the individual measure level, therefore only the summary of savings is included.

TABLE 157. 2022 SCHOOL EDUCATION PROGRAM *EX ANTE* & *EX POST* GROSS GAS SAVINGS

| MEASURE | *EX ANTE* [a] NATURAL GAS ENERGY SAVINGS (therms/yr.) | AUDITED GROSS NATURAL GAS ENERGY (therms/yr.) | VERIFIED GROSS NATURAL GAS ENERGY SAVINGS (therms/yr.) | *EX POST* GROSS NATURAL GAS ENERGY SAVINGS (therms/yr.) |
|---|---|---|---|---|
| LED (5W Candelabra) – Combo Kit | | 0.00 | 0.00 | 0.00 |
| Bathroom Aerator – Combo Kit | | 5,677.50 | 6,209.77 | 3,957.16 |
| Bathroom Aerators – Gas Only Kit | | 274.41 | 300.13 | 191.26 |
| Kitchen Aerator – Combo Kit | | 50,610.12 | 52,912.69 | 42,191.65 |
| Kitchen Aerator – Gas Only Kit | | 1,223.05 | 1,278.69 | 1,019.61 |
| Showerhead – Combo Kit | | 60,161.13 | 70,501.32 | 37,882.46 |
| Showerheads – Gas Only Kit | | 2,907.72 | 3,407.48 | 1,830.94 |
| LED Nightlight – Combo Kit | | 0.00 | 0.00 | 0.00 |
| Advanced Power Strip – Combo Kit | | 0.00 | 0.00 | 0.00 |
| Light Switch Gaskets – Combo Kit | | 21,153.60 | 9,476.81 | 3,178.43 |
| Light Switch Gaskets – Gas Only Kit | | 511.20 | 229.02 | 76.81 |
| Power Outlet Gaskets – Combo Kit | | 47,595.60 | 21,322.83 | 6,310.12 |
| Power Outlet Gaskets – Gas Only Kit | | 1,150.20 | 515.29 | 152.49 |
| Total Savings | 191,277.76 | 191,264.53 | 166,154.04 | 96,790.94 |
| Total Program Realization Rate | | | | 51% |

Note: Totals may not sum properly due to rounding.

[a] *Ex ante* savings in the tracking data do not report savings at the individual measure level, therefore only the summary of savings is included.

## *EX POST* NET SAVINGS

Since the 2022 School Education program evaluation did not include a participant survey, the team assumed freeridership based on results of the 2021 School Education evaluation for continuing measures (aerators, showerhead, and nightlight) and results from the 2022 HomeLife Calculator evaluation for new program measures (5W candelabras, power strips, and gaskets), and spillover based on the 2021 School Education Program.

Table 158 shows the NTG ratios by measure.

TABLE 158. 2022 SCHOOL EDUCATION PROGRAM NET-TO-GROSS RATIOS BY MEASURE

| MEASURE | NTG |
|---|---|
| LED (5W Candelabra) – Combo Kit | 96% |
| Bathroom Aerator – Combo Kit | 104% |
| Bathroom Aerators – Gas Only Kit | 104% |
| Kitchen Aerator – Combo Kit | 103% |
| Kitchen Aerator – Gas Only Kit | 103% |
| Showerhead – Combo Kit | 105% |
| Showerheads – Gas Only Kit | 105% |
| LED Nightlight – Combo Kit | 95% |
| Advanced Power Strip – Combo Kit | 94% |

| MEASURE | NTG |
|---|---|
| Light Switch Gaskets – Combo Kit | 83% |
| Light Switch Gaskets – Gas Only Kit | 83% |
| Power Outlet Gaskets – Combo Kit | 83% |
| Power Outlet Gaskets – Gas Only Kit | 83% |

Table 159 presents the resulting net electric savings, demand reduction, and natural gas savings.

TABLE 159. 2022 SCHOOL EDUCATION PROGRAM *EX POST* NET SAVINGS

| MEASURE | *EX POST* GROSS SAVINGS/REDUCTION | | | NTG | *EX POST* NET SAVINGS/REDUCTION | | |
|---|---|---|---|---|---|---|---|
| | KWH | KW | THERMS | | KWH | KW | THERMS |
| LED (5W Candelabra) – Combo Kit | 244,168.90 | 39.289 | 0.00 | 96% | 234,768.39 | 37.777 | 0.00 |
| Bathroom Aerator – Combo Kit | 28,402.74 | 1.383 | 3,957.16 | 104% | 29,538.85 | 1.438 | 4,115.45 |
| Bathroom Aerators – Gas Only Kit | 0.00 | 0.000 | 191.26 | 104% | 0.00 | 0.000 | 198.91 |
| Kitchen Aerator – Combo Kit | 302,832.61 | 5.217 | 42,191.65 | 103% | 311,917.59 | 5.373 | 43,457.40 |
| Kitchen Aerator – Gas Only Kit | 0.00 | 0.000 | 1,019.61 | 103% | 0.00 | 0.000 | 1,050.20 |
| Showerhead – Combo Kit | 271,903.17 | 4.343 | 37,882.46 | 105% | 285,498.33 | 4.560 | 39,776.58 |
| Showerheads – Gas Only Kit | 0.00 | 0.000 | 1,830.94 | 105% | 0.00 | 0.000 | 1,922.49 |
| LED Nightlight – Combo Kit | 21,629.79 | 0.000 | 0.00 | 95% | 20,548.30 | 0.000 | 0.00 |
| Advanced Power Strip – Combo Kit | 980,469.36 | 68.766 | 0.00 | 94% | 916,836.90 | 64.303 | 0.00 |
| Light Switch Gaskets – Combo Kit | 31,549.92 | 20.674 | 3,178.43 | 83% | 26,279.75 | 17.221 | 2,647.50 |
| Light Switch Gaskets – Gas Only Kit | 0.00 | 0.000 | 76.81 | 83% | 0.00 | 0.000 | 63.98 |
| Power Outlet Gaskets – Combo Kit | 62,635.87 | 41.044 | 6,310.12 | 83% | 52,173.03 | 34.188 | 5,256.07 |
| Power Outlet Gaskets – Gas Only Kit | 0.00 | 0.000 | 152.49 | 83% | 0.00 | 0.000 | 127.02 |
| Total Savings | 1,943,592.35 | 180.716 | 96,790.94 | | 1,877,561.14 | 164.860 | 98,615.59 |

Table 160 shows the net-to-gross ratio for each fuel.

TABLE 160. 2022 SCHOOL EDUCATION PROGRAM NET-TO-GROSS RESULTS BY FUEL TYPE

| SAVINGS TYPE | *EX ANTE* GROSS SAVINGS | *EX POST* GROSS SAVINGS | NTG RATIO (%) | *EX POST* NET SAVINGS |
|---|---|---|---|---|
| Electric Energy Savings (kWh/yr.) | 1,986,793.12 | 1,943,592.35 | 97% | 1,877,561.14 |
| Peak Demand Reduction (kW) | 141.024 | 180.716 | 91% | 164.860 |
| Natural Gas Energy Savings (therms/yr.) | 191,277.76 | 96,790.94 | 102% | 98,615.59 |

# PROCESS EVALUATION

The evaluation team did not complete any major activities related to evaluating the program process.

# CONCLUSIONS AND RECOMMENDATIONS

### CONCLUSION 1: OVERALL, PARENTS PROVIDED POSITIVE COMMENTS IN THE HEW.

Although the evaluation team did not conduct a process evaluation this year, the HEW provides some preliminary satisfaction and process information. Several participants commented in the HEW that the School Education program is “great,” and they appreciated the opportunity to “learn about energy consumption” as a family. Several respondents mentioned that the advanced power strip was their favorite item, and others mentioned they were unaware of outlet and light switch gaskets before receiving the kit. Two respondents mentioned that they did not know “what the light switch and outlet gaskets did.”

Recommendations:

- Continue providing high in-service rate items in kits and include additional information about gaskets, such as potential energy savings and infiltration reduction benefits, in the program materials.
- Like other programs offering lighting, follow plans to phase out non-exempt lighting measures from kit programs due to the upcoming EISA backstop.

### CONCLUSION 2: UPDATE IN-SERVICE AND SATURATION RATES FOR NEW MEASURES.

The *ex ante* energy savings calculation for LEDs includes an ISR that corresponds to 2020 program findings for 9W LED bulbs, rather than for 5W candelabras, and is higher than the 2022 HomeLife Calculator survey indicated for the 5W candelabras (83% vs 61%). The *ex ante* ISR for advanced power strips is based on information in Illinois TRM v8.0 and is lower than the 2022 HomeLife Calculator survey (40% vs. 81%). *Ex ante* calculations for light switch and power outlet gaskets do not account for space heating fuel saturation, whereas *ex post* calculations do account for this.

Recommendations:

- Consider updating the ISRs for new measures, such as the 5W candelabras, advanced power strips, and gaskets, based on the 2021 School Education program and the 2022 Homelife Calculator survey findings. Include space heating fuel saturation in the *ex ante* savings calculations for gaskets.

### CONCLUSION 3: GASKETS COULD PROVIDE ADDITIONAL SAVINGS, BUT IN-SERVICE RATES ARE LOW.

In-service rates for gaskets were less than 20%, inclusive only of gaskets installed on exterior walls. The evaluation team found higher realization rates for these measures after updating key metrics, including space heating fuel saturation.

Recommendations:

- Consider ways to increase education around the light switch and power gasket measures to promote higher in-service rates, specifically providing clear directions to install gaskets on exterior walls.

# 12. HOMELIFE ENERGY EFFICIENCY CALCULATOR PROGRAM

## PROGRAM DESIGN AND DELIVERY

The HomeLife Energy Efficiency Calculator (HomeLife Calculator) program offers residential customers a free, online 'do-it-yourself' home audit and a free energy savings kit to carry out this audit. The intent of this program is to 1) identify low-cost/no-cost measures that a NIPSCO residential customer can easily implement to manage their gas and electric consumption; 2) allow eligible customers to request a free home energy kit; 3) educate customers about the variety of programs available to them through NIPSCO's residential energy efficiency portfolio. This program is implemented by TRC.

The online calculator is available to individuals with a NIPSCO account number who log onto NIPSCO's website. To receive a kit, customers must be an active electric and/or gas NIPSCO customer and meet the other eligibility requirements. The calculator provides tips on low-to-no cost improvements that will save customers energy and money and provides an analysis of their energy consumption along with recommendations to improve the efficiency of their homes. In addition, the tips shared with customers, as well as the customers' usage analyses, are based on customer responses to the calculator's survey questions.

All customers – combo, electric-only, and gas-only – who have not had an assessment through the HEA or IQW programs, and who have not received an energy efficiency kit in the last three years, are eligible to receive a kit. Electric-only customers receive the combo kit, but NIPSCO does not claim savings for the gas measures. Gas-only customers receive a kit that has additional water saving devices:

- Combo and Electric Only Kit Measures
  - 2 candelabra LEDs (5 watt)
  - 1 bathroom faucet aerator (1.0 gpm)
  - 1 kitchen faucet aerator (1.5 gpm)
  - 1 low-flow showerhead (1.5 gpm)
  - 1 LED night-light (0.5 watt)
  - 1 advanced power strip (Tier 1)
  - 8 light switch gaskets
  - 18 power outlet gaskets
  - 1 plumbers tape
- Gas Only Kit Measures
  - 2 bathroom faucet aerators (1.0 gpm)
  - 1 kitchen faucet aerator (1.5 gpm)
  - 2 low-flow showerheads (1.5 gpm)
  - 8 light switch gaskets
  - 18 power outlet gaskets
  - 1 plumbers tape

### CHANGES FROM 2021 DESIGN

In anticipation of the EISA backstop, the combo and electric kits for program year 2022 included two, 5-watt candelabra LEDs, instead of four 9W LEDs. Additionally, the furnace whistle measure was replaced with an advanced power strip, 8 light switch gaskets, and 18 power outlet gaskets.

## PROGRAM PERFORMANCE

The HomeLife Calculator program exceeded program goals in 2022, driven by the program implementer, TRC, reaching a wider audience with program information. In previous years, TRC reached out to NIPSCO customers using past participant data, but in 2022, TRC received mailing lists from NIPSCO, encompassing more customers.

Additionally, all customer-facing email communications are now coming from NIPSCO, to be sure customers who have opted out of receiving email are not solicited.

In 2022, the program distributed 1,763 combo kits, 126 electric kits, and 870 gas kits, for a total of 2,759 kits. The program exceeded all goals; electric, peak demand, and gas savings. Table 161 summarizes results for the full year of program performance.

TABLE 161. 2022 HOMELIFE CALCULATOR PROGRAM SAVING SUMMARY

| METRIC | GROSS SAVINGS GOAL | *EX ANTE* | AUDITED | VERIFIED | *EX POST* GROSS | *EX POST* NET | GROSS GOAL ACHIEVEMENT |
|---|---|---|---|---|---|---|---|
| Electric Energy Savings (kWh/yr.) | 133,833.90 | 266,196.67 | 266,192.80 | 275,443.06 | 266,915.04 | 260,074.57 | 199% |
| Peak Demand Reduction (kW) | 11.400 | 22.668 | 22.951 | 26.970 | 30.077 | 28.132 | 264% |
| Natural Gas Energy Savings (therms/yr.) | 12,250.90 | 35,714.78 | 37,523.02 | 33,270.40 | 23,521.47 | 23,377.30 | 192% |

Table 162 outlines the *ex post* gross and NTG adjustment factors. The HomeLife Calculator program continues to influence energy efficient decisions, as indicated by the spillover rate, and the 2022 spillover rate is slightly higher than in 2021 (9%).

TABLE 162. 2022 HOMELIFE CALCULATOR PROGRAM ADJUSTMENT FACTORS

| METRIC | REALIZATION RATE (%)[a] | FREERIDERSHIP | SPILLOVER | NTG (%)[b] |
|---|---|---|---|---|
| Electric Energy Savings (kWh/yr.) | 100% | 15% | 12% | 97% |
| Peak Demand Reduction (kW) | 133% | 18% | 12% | 94% |
| Natural Gas Energy Savings (therms/yr.) | 66% | 13% | 12% | 99% |

[a] Realization Rate is defined as *ex post* Gross savings divided by *ex ante* savings.
[b] NTG is defined as *ex post* net savings divided by *ex post* gross savings.

With the higher participation and popularity of the HomeLife Calculator program in 2022, the expenditure goals by fuel type were above budgeted values, as shown in Table 163.

TABLE 163. 2022 HOMELIFE CALCULATOR PROGRAM EXPENDITURES

| FUEL | PROGRAM BUDGET | PROGRAM EXPENDITURES | BUDGET SPENT (%) |
|---|---|---|---|
| Electric | $58,579.75 | $112,528.37 | 192% |
| Natural Gas | $26,329.58 | $84,049.40 | 319% |

# EVALUATION METHODOLOGY

To inform the 2022 NIPSCO impact and process evaluation, the evaluation team completed the following research activities:

- **Program staff interviews and discussions,** to understand the program process, delivery, and design.
- **Documentation and materials review,** to provide context on program implementation.
- **Engineering analysis**, to review program savings assumptions and algorithms for reasonableness and accuracy.
- **Phone and web surveys with HomeLife Calculator program participants**, to provide insight on the customer experience and processes, and to inform savings estimates.

# IMPACT EVALUATION

The evaluation team completed the impact evaluation to answer the following research questions:

- What assumptions were used to develop deemed savings estimates? Are there any updates that should be made?
- What are *ex post* program savings? Do these suggest any needed updates to program design, delivery, or savings assumptions?
- What are installation rates for kit measures? Are there certain measures that are installed most often? Least often?
- How effective was the program in influencing participant decision making? What are the program's spillover and freeridership estimates (net savings)?

For all measure types, the evaluation team compared its engineering calculations to NIPSCO's *ex ante* savings, basing its savings methodologies and inputs for each measure on several sources: standard engineering practices, the Illinois TRM (v10.0), the 2015 Indiana TRM (v2.2), and NIPSCO's program tracking database.[47,48] It should be noted that prior to this evaluation year, the evaluation team used the Indiana TRM as our primary source and supplemented with other sources as needed. The Indiana TRM is out-of-date, and currently in the process of being updated to align more closely with the Illinois TRM. After discussions with NIPSCO, the evaluation team felt it would be best practice to use the Illinois TRM as our primary source while the Indiana TRM is in process of being updated, as the Illinois TRM is updated annually and should align closely with the new version of the Indiana TRM.

## AUDITED AND VERIFIED SAVINGS

To audit program savings, the evaluation team performed the following reviews to verify alignment with the program's scorecard:

- **Audited Kits Quantity.** Reviewed program tracking data provided by the implementer and audited the number of kits distributed.
- **Confirm Measure-Level Savings Calculations.** Reviewed per-measure and per-kit savings in the documentation provided by NIPSCO.

[47] Illinois Energy Efficiency Stakeholder Advisory Group. *2022 Illinois Statewide Technical Reference Manual for Energy Efficiency Version 10.0. Volume 3: Residential Measures.* September 24, 2021.
[48] Cadmus. *Indiana Technical Reference Manual Version 2.2*. July 28, 2015.

- **Savings Estimate Review.** Confirmed program-level total savings.

NIPSCO reported a total of 1,763 combo kits, 870 gas-only kits, and 126 electric-only kits distributed through the HomeLife Calculator Program. These reported scorecard values were checked against the program tracking data. The audit of the tracking data by measure description mirrored the totals reported by NIPSCO. However, the evaluation team noticed discrepancies between the Measure Description, Energy Type, and Material Description fields in the tracking data. For example, the Measure Description of a particular record is Total Home Life EE Calculator and Kits – Combo Kit, the Energy Type is recorded as electric and gas, and the Material Description is recorded as Electric Only Kit. In another instance, the Measure Description is recorded as a Combo Kit, the Energy Type is recorded as electric, and the Material Description is recorded as Electric Only Kit. In these instances of misalignment, the evaluation team deferred to the Measure Description.

To verify the savings, the evaluation team reviewed the kit savings documentation, which contained measure-level and kit-level savings. Importantly, NIPSCO included installation rates from past EM&V efforts in its *ex ante* assumptions for the kit program. The program documentation included rates to adjust savings for both installation practices and water heater fuel saturation.

Upon review of this document, measure-level savings values in the tracking data aligned with NIPSCO's kit savings documentation. However, program tracking data savings were reported at the kit-level, with a rounded total kit value, and NIPSCO's measure calculation file savings were reported at the measure-level, with un-rounded per measure values. This difference in the unit of analysis resulted in rounding errors, meaning that the sum of total measure savings was slightly off from the tracking data savings. These rounding errors will be noted where applicable in the remainder of this report.

## IN-SERVICE RATES

The evaluation team referred to HomeLife Calculator participant survey results to calculate in-service rates (ISRs). In 2022, the evaluation team completed 142 surveys. Table 164 lists the ISRs for all program-installed measures.

TABLE 164. 2022 HOMELIFE CALCULATOR PROGRAM IN-SERVICE RATES BY MEASURE

| MEASURE | ISR |
|---|---|
| LED (5W Candelabra) | 61% |
| Bathroom Aerator | 46% |
| Kitchen Aerator | 42% |
| Showerhead | 38% |
| LED Nightlight | 77% |
| Advanced Power Strip | 81% |
| Light Switch Gaskets (Exterior wall) | 17% |
| Power Outlet Gaskets (Exterior wall) | 15% |

As noted in Table 164, the ISRs for the gaskets are for those installed on exterior walls because savings are claimed based on reduced infiltration. Gaskets installed on interior walls do not generate savings.

## WATER HEATER SATURATION

The evaluation team adjusted the *ex ante* electric and natural gas saturation rates for water-saving measures by analyzing data from the 2022 HomeLife Calculator survey, which provides a sample of customers who report their water heater fuel, shown in Table 165. Previous evaluations reported water heater saturation from the School Education Program HEW because of the large size of the dataset, but this year, the evaluation team opted to rely upon HomeLife participant survey data, given more robust sample sizes in PY2022.

Results indicate discrepancies between *ex ante* and verified electric and natural gas domestic water heating saturation rates.

TABLE 165. 2022 HOMELIFE CALCULATOR PROGRAM WATER HEATER FUEL SATURATION

| SAVINGS TYPE | ELECTRIC WATER HEATING SATURATION RATE (%) | NATURAL GAS WATER HEATING SATURATION RATE (%) |
|---|---|---|
| Reported *ex ante* | 23% | 64% |
| Verified Combo/Electric Kits | 14% | 86% |
| Verified Gas Only Kits | 17% | 83% |

Table 166 summarizes the *ex ante* and verified savings per measure.

TABLE 166. 2022 HOMELIFE CALCULATOR PROGRAM *EX ANTE* AND VERIFIED PER-UNIT SAVINGS

| MEASURE | ISRs | *EX ANTE* KWH SAVINGS[a] | VERIFIED KWH SAVINGS | *EX ANTE* KW SAVINGS | VERIFIED KW SAVINGS | *EX ANTE* THERM SAVINGS | VERIFIED THERM SAVINGS |
|---|---|---|---|---|---|---|---|
| LED (5W Candelabra) – Combo Kit | 61% | 22.02 | 15.44 | 0.002 | 0.002 | 0.00 | 0.00 |
| LED (5W Candelabra) – Electric Only Kit | 61% | 22.02 | 15.44 | 0.002 | 0.002 | 0.00 | 0.00 |
| Bathroom Aerator – Combo Kit | 46% | 2.38 | 2.02 | 0.000 | 0.000 | 0.29 | 0.55 |
| Bathroom Aerator – Electric Only Kit | 46% | 2.43 | 2.06 | 0.000 | 0.000 | 0.00 | 0.00 |
| Bathroom Aerator – Gas Only Kit | 46% | 0.00 | 0.00 | 0.000 | 0.000 | 0.29 | 0.54 |
| Kitchen Aerator – Combo Kit | 42% | 18.29 | 10.63 | 0.001 | 0.000 | 2.24 | 2.87 |
| Kitchen Aerator – Electric Only Kit | 42% | 18.58 | 10.80 | 0.001 | 0.000 | 0.00 | 0.00 |
| Kitchen Aerator – Gas Only Kit | 42% | 0.00 | 0.00 | 0.000 | 0.000 | 4.48 | 2.83 |
| *Low-flow* Showerhead – Combo Kit | 38% | 30.91 | 16.19 | 0.002 | 0.001 | 3.78 | 4.38 |
| *Low-flow* Showerhead – Electric Only Kit | 38% | 31.31 | 16.40 | 0.002 | 0.001 | 0.00 | 0.00 |
| *Low-flow* Showerhead – Gas Only Kit | 38% | 0.00 | 0.00 | 0.000 | 0.000 | 3.78 | 4.29 |
| LED Nightlight – Combo Kit | 77% | 1.45 | 2.43 | 0.000 | 0.000 | 0.00 | 0.00 |
| LED Nightlight – Electric Only Kit | 77% | 1.45 | 2.43 | 0.000 | 0.000 | 0.00 | 0.00 |
| Advanced Power Strip – Combo Kit | 81% | 41.20 | 83.43 | 0.005 | 0.009 | 0.00 | 0.00 |
| Advanced Power Strip – Electric Only Kit | 81% | 41.20 | 83.43 | 0.005 | 0.009 | 0.00 | 0.00 |
| Light Switch Gaskets – Combo Kit | 17% | 0.10 | 0.01 | 0.000 | 0.000 | 0.23 | 0.13 |
| Light Switch Gaskets – Electric Only Kit | 17% | 0.10 | 0.01 | 0.000 | 0.000 | 0.00 | 0.00 |
| Light Switch Gaskets – Gas Only Kit | 17% | 0.00 | 0.00 | 0.000 | 0.000 | 0.23 | 0.13 |
| Power Outlet Gaskets – Combo Kit | 15% | 0.10 | 0.01 | 0.000 | 0.000 | 0.23 | 0.13 |

| MEASURE | ISRs | *EX ANTE* KWH SAVINGS[a] | VERIFIED KWH SAVINGS | *EX ANTE* KW SAVINGS | VERIFIED KW SAVINGS | *EX ANTE* THERM SAVINGS | VERIFIED THERM SAVINGS |
|---|---|---|---|---|---|---|---|
| Power Outlet Gaskets – Electric Only Kit | 15% | 0.10 | 0.01 | 0.000 | 0.000 | 0.00 | 0.00 |
| Power Outlet Gaskets – Gas Only Kit | 15% | 0.00 | 0.00 | 0.000 | 0.000 | 0.23 | 0.13 |

[a] Values presented at a measure-level represent Audited values, since the scorecard provides only savings totals.

## *EX POST* GROSS SAVINGS

The evaluation team reviewed the program's *ex ante* assumptions, sources, and algorithms for reasonableness and updates. Below are detailed *ex post* gross analysis results.

### ENGINEERING REVIEWS

The evaluation team referred to the Illinois TRM (v10.0) and the Indiana TRM (v2.2) to calculate *ex post* gross electric energy savings, demand reduction, and natural gas savings. *Appendix 10* contains details on the specific algorithms, variable assumptions, and references for all program measure *ex post* gross calculations.

Through the engineering review, the evaluation team found differences between *ex ante* and *ex post* gross savings. These differences were primarily driven by the following overarching factors:

- The evaluation team used Illinois TRM (v10.0) algorithms and non-climate-related assumptions to calculate *ex post* while *ex ante* was calculated using the Indiana TRM (v2.2) algorithms and assumptions. Where needed, climate-specific inputs for *ex post* savings were sourced from the Indiana TRM (v2.2) to provide Indiana-specific data.
- The evaluation team used the 2022 HomeLife survey findings to calculate the *ex post* baseline wattage for candelabras.
- The evaluation team used updated in-service rates, water heater saturation, and other algorithm inputs (such as type of bulb replaced), based on participant survey findings, which adjusted savings across measures.

The following sections summarize the team's findings and recommendations based on the engineering review.

### *EX POST* GROSS SAVINGS

*Ex post* savings reflect the engineering adjustments made to verified measure savings. The evaluation team calculated *ex post* electric energy, peak demand, and natural gas energy savings for each kit measure using algorithms and inputs from the Illinois TRM (v10.0) and the Indiana TRM (v2.2), as well as customer location, to account for weather effects. The evaluation team leveraged HomeLife Calculator participant survey information to calculate the baseline wattage for LEDs, faucets, and showerheads per home, and heating system and water heater fuel type saturation values, then used this information to inform *ex post* gross savings calculations.

*Ex post* savings calculations differed from *ex ante* analysis as follows:

- LED candelabra: Updated baseline wattage and hours of use for the LED candelabra. The 2022 *ex ante* analysis applies the EISA baseline wattage of 29 watts and 1,135 annual hours of use from the Indiana TRM (v2.2), whereas the *ex post* analysis uses the 2022 HomeLife survey weighted average of 29 watts and 763 annual hours of use from the Illinois TRM (v10.0). Interestingly, the EISA baseline wattage and the survey-based weighted average baseline wattage align.

- Advanced power strip: *ex post* ISR of 81% from the 2022 participant follow-up survey is higher than the *ex ante* assumption of 40%.
- LED nightlight: Updated baseline wattage and hours of use from the Illinois TRM (v10.0) for *ex post* analysis increase energy savings compared to *ex ante*.
- Low-flow faucet aerators and showerheads: Updated water heating fuel saturation percentages and household demographics based on 2022 survey results. Updated baseline and efficient flow rate assumptions to match the Illinois TRM (v10.0). As reported in Table 150, the verified natural gas and electric water heater saturation rates were different than *ex ante,* with more gas and fewer electric units. The updated Illinois TRM (v10.0) inputs were the main driver of the lower realization rates.
- Outlet and switch gaskets: Updated to Illinois TRM (v10.0) and incorporated space heating fuel type saturations from the 2022 survey results. For these measures, the *ex ante* savings are evaluated by sourcing an online calculator that excludes demand savings and assumes natural gas heating and air conditioning for all homes. *Ex post* savings source the Illinois TRM (v10), consistent with the approach for other measures in the program. The Illinois TRM (v10) assigns savings based on industry studies and the American Society of Heating, Refrigerating, and Air Conditioning Engineers (ASHRAE) findings. Demand savings are assigned based on the presence of central air conditioning, while electric and gas savings are based on heating system type. The high electric realization rates for these measures are driven by the addition of electric heating savings, using actual heating fuel saturation. While a minority of customers heat their homes electrically, and in-service rates are low, these savings are comparably large, driving up electric savings for these measures.

Table 167 shows the *ex ante* deemed savings and *ex post* gross per-measure savings for the 2022 HomeLife Calculator program.

TABLE 167. 2022 HOMELIFE CALCULATOR PROGRAM *EX ANTE* & *EX POST* GROSS PER KIT SAVINGS VALUES

| MEASURE | QUANTITY PER KIT | *EX ANTE* DEEMED SAVINGS | | | *EX POST* GROSS PER-KIT SAVINGS | | |
|---|---|---|---|---|---|---|---|
| | | KWH | KW | THERMS | KWH | KW | THERMS |
| LED (5W Candelabra) - Combo Kit | 2 | 44.04 | 0.005 | 0.00 | 20.78 | 0.003 | 0.00 |
| LED (5W Candelabra) - Electric Only Kit | 2 | 44.04 | 0.005 | 0.00 | 20.78 | 0.003 | 0.00 |
| Bathroom Aerator - Combo Kit | 1 | 2.38 | 0.000 | 0.29 | 1.72 | 0.000 | 0.45 |
| Bathroom Aerator - Electric Only Kit | 1 | 2.43 | 0.000 | 0.00 | 1.72 | 0.000 | 0.00 |
| Bathroom Aerator - Gas Only Kit | 2 | 0.00 | 0.000 | 0.60 | 0.00 | 0.000 | 0.87 |
| Kitchen Aerator - Combo Kit | 1 | 18.29 | 0.001 | 2.24 | 11.71 | 0.000 | 3.08 |
| Kitchen Aerator - Electric Only Kit | 1 | 18.58 | 0.001 | 0.00 | 11.71 | 0.000 | 0.00 |
| Kitchen Aerator - Gas Only Kit | 1 | 0.00 | 0.000 | 2.28 | 0.00 | 0.000 | 2.98 |
| Low-flow Showerhead - Combo Kit | 1 | 30.91 | 0.002 | 3.78 | 12.43 | 0.000 | 3.27 |
| Low-flow Showerhead - Electric Only Kit | 1 | 31.31 | 0.002 | 0.00 | 12.43 | 0.000 | 0.00 |
| Low-flow Showerhead - Gas Only Kit | 2 | 0.00 | 0.000 | 7.69 | 0.00 | 0.000 | 6.32 |
| LED Nightlight - Combo Kit | 1 | 1.45 | 0.000 | 0.00 | 5.40 | 0.000 | 0.00 |
| LED Nightlight - Electric Only Kit | 1 | 1.45 | 0.000 | 0.00 | 5.40 | 0.000 | 0.00 |

| MEASURE | QUANTITY PER KIT | *EX ANTE* DEEMED SAVINGS | | | *EX POST* GROSS PER-KIT SAVINGS | | |
|---|---|---|---|---|---|---|---|
| | | KWH | KW | THERMS | KWH | KW | THERMS |
| Advanced Power Strip - Combo Kit | 1 | 41.20 | 0.005 | 0.00 | 83.43 | 0.006 | 0.00 |
| Advanced Power Strip - Electric Only Kit | 1 | 41.20 | 0.005 | 0.00 | 83.43 | 0.006 | 0.00 |
| Light Switch Gaskets - Combo Kit | 8 | 0.80 | 0.000 | 1.80 | 1.96 | 0.002 | 0.34 |
| Light Switch Gaskets - Electric Only Kit | 8 | 0.80 | 0.000 | 0.00 | 1.96 | 0.002 | 0.00 |
| Light Switch Gaskets - Gas Only Kit | 8 | 0.00 | 0.000 | 1.80 | 0.00 | 0.000 | 0.35 |
| Power Outlet Gaskets - Combo Kit | 18 | 1.80 | 0.000 | 4.05 | 3.88 | 0.004 | 0.67 |
| Power Outlet Gaskets - Electric Only Kit | 18 | 1.80 | 0.000 | 0.00 | 3.88 | 0.004 | 0.00 |
| Power Outlet Gaskets - Gas Only Kit | 18 | 0.00 | 0.000 | 4.05 | 0.00 | 0.000 | 0.69 |

Table 168 highlights notable differences between *ex ante* and *ex post* gross estimates.

TABLE 168. 2022 HOMELIFE CALCULATOR NOTABLE DIFFERENCES BETWEEN *EX ANTE* & *EX POST GROSS*

| MEASURE | *EX ANTE* SOURCES AND ASSUMPTIONS | *EX POST* GROSS SOURCES AND ASSUMPTIONS | PRIMARY REASONS FOR DIFFERENCES |
|---|---|---|---|
| LED candelabra | *Ex ante* savings use IN TRM (v2.2) assumptions, EISA baseline wattage of 29W and 2020 ISR for 9W LEDs | *Ex post* savings use IL TRM (v10.0) assumptions, and participant survey findings for baseline wattage of 29W and ISR. | Hours of use and ISR differences |
| Bathroom Aerator | *Ex ante* savings use IN TRM (v2.2) assumptions. | *Ex post* savings use IL TRM (v10.0) assumptions. 2022 survey for fuel saturation percentages and demographics | Different TRM assumptions for flow rates and drain factor. |
| Kitchen Aerator | *Ex ante* savings use IN TRM (v2.2) assumptions. | *Ex post* savings use IL TRM (v10.0) assumptions. 2022 survey for fuel saturation percentages and demographics | Different TRM assumptions for flow rates and drain factor. |
| Low-Flow Showerhead | *Ex ante* savings use IN TRM (v2.2) assumptions. | *Ex post* savings use IL TRM (v10.0) assumptions. 2022 survey for fuel saturation percentages and demographics | Different TRM assumption for baseline flow rate. |
| LED Nightlights | *Ex ante* savings use IN TRM (v2.2) assumptions. | *Ex post* savings use IL TRM (v10.0) assumptions. | Different TRM assumptions for baseline wattage and hours of use. Updated incandescent replacement factor |
| Advanced Power Strips | *Ex ante* savings use IL TRM (v10.0) assumptions. | *Ex post* savings use IL TRM (v10.0) assumptions. | *Ex post* ISR is higher than *ex ante* |
| Light Switch Gaskets | *Ex ante* savings uses online calculator at EnergyEarth.com | *Ex post* savings use IL TRM (v10.0) assumptions. | Methodological differences. *Ex ante* does not include an adjustment for space heating fuel type saturation |
| Power Outlet Gaskets | *Ex ante* savings uses online calculator at EnergyEarth.com | *Ex post* savings use IL TRM (v10.0) assumptions. 2022 participant survey for fuel saturation percentages | Methodological differences. *Ex ante* does not include an adjustment for space heating fuel type saturation |

**WASTE HEAT FACTOR – THERM PENALTIES**

Consistent with the 2021 evaluation year, the evaluation team is not including therm penalties when calculating evaluated savings for the 2022 HomeLife Calculator program. However, cost-effectiveness results for both the gas and electric programs will include these penalties. The evaluation team believes this approach is appropriate, as it accounts for the penalty on the electric side (where it is generated) and allows the evaluation team to show gas program performance and measure performance more clearly.

*Ex ante* program data for HomeLife kits does not include a therm penalty. In total, the *ex post* therm penalty for cost-effectiveness analysis is -748.34 therms (Table 169).

TABLE 169. 2022 HOMELIFE CALCULATOR PROGRAM WASTE HEAT FACTOR THERM PENALTY

| MEASURE | WASTE HEAT FACTOR THERM PENALTY |
|---|---|
| LED (9W) - Combo Kit | (748.34) |

It should be noted that electric waste heat factors, including cooling credits and electric heating penalties, are currently reported within the kWh and kw savings for the overall program.

## REALIZATION RATES

The next three tables (Table 170 through Table 172) show the program's *ex ante* reported savings, audited savings, verified savings, and *ex post* gross savings. Across all measures, the differences between *ex ante* and *ex post* savings are primarily driven by the sources referenced to calculate savings and updated ISRs, as indicated in Table 168.

TABLE 170. 2022 HOMELIFE CALCULATOR PROGRAM *EX ANTE* & *EX POST* GROSS ELECTRIC ENERGY SAVINGS

| MEASURE | *EX ANTE*[A] ELECTRIC ENERGY SAVINGS (kWh/yr.) | AUDITED GROSS ELECTRIC ENERGY SAVINGS (kWh/yr.) | VERIFIED GROSS ELECTRIC ENERGY SAVINGS (kWh/yr.) | *EX POST* GROSS ELECTRIC ENERGY SAVINGS (kWh/yr.) |
|---|---|---|---|---|
| LED (5W Candelabra) - Combo Kit | | 77,637.43 | 54,435.44 | 36,629.49 |
| LED (5W Candelabra) - Electric Only Kit | | 5,548.68 | 3,890.45 | 2,617.88 |
| Bathroom Aerator - Combo Kit | | 4,194.09 | 3,558.62 | 3,026.07 |
| Bathroom Aerator - Electric Only Kit | | 305.69 | 259.38 | 216.27 |
| Bathroom Aerator - Gas Only Kit | | 0.00 | 0.00 | 0.00 |
| Kitchen Aerator - Combo Kit | | 32,248.98 | 18,737.55 | 20,644.60 |
| Kitchen Aerator - Electric Only Kit | | 2,341.57 | 1,360.52 | 1,475.45 |
| Kitchen Aerator - Gas Only Kit | | 0.00 | 0.00 | 0.00 |
| Low-flow Showerhead - Combo Kit | | 54,490.26 | 28,539.89 | 21,914.14 |
| Low-flow Showerhead - Electric Only Kit | | 3,945.13 | 2,066.31 | 1,566.18 |
| Low-flow Showerhead - Gas Only Kit | | 0.00 | 0.00 | 0.00 |
| LED Nightlight - Combo Kit | | 2,559.82 | 4,281.04 | 9,518.19 |
| LED Nightlight - Electric Only Kit | | 182.95 | 305.96 | 680.26 |
| Advanced Power Strip - Combo Kit | | 72,635.60 | 147,087.09 | 147,087.09 |
| Advanced Power Strip - Electric Only Kit | | 5,191.20 | 10,512.18 | 10,512.18 |
| Light Switch Gaskets - Combo Kit | | 1,410.40 | 117.35 | 3,447.47 |
| Light Switch Gaskets - Electric Only Kit | | 100.80 | 8.39 | 246.39 |
| Light Switch Gaskets - Gas Only Kit | | 0.00 | 0.00 | 0.00 |

| MEASURE | *EX ANTE*[A] ELECTRIC ENERGY SAVINGS (kWh/yr.) | AUDITED GROSS ELECTRIC ENERGY SAVINGS (kWh/yr.) | VERIFIED GROSS ELECTRIC ENERGY SAVINGS (kWh/yr.) | *EX POST* GROSS ELECTRIC ENERGY SAVINGS (kWh/yr.) |
|---|---|---|---|---|
| Power Outlet Gaskets - Combo Kit | | 3,173.40 | 264.03 | 6,844.24 |
| Power Outlet Gaskets - Electric Only Kit | | 226.80 | 18.87 | 489.15 |
| Power Outlet Gaskets - Gas Only Kit | | 0.00 | 0.00 | 0.00 |
| Total Savings | 266,196.67 | 266,192.80 | 275,443.06 | 266,915.04 |
| Total Program Realization Rate | | | | 100% |

Note: Totals may not sum properly due to rounding.

[a] *Ex ante* savings in the tracking data do not report savings at the individual measure level, therefore only the summary of savings is included.

TABLE 171. 2022 HOMELIFE CALCULATOR PROGRAM *EX ANTE* & *EX POST* GROSS PEAK DEMAND REDUCTION

| MEASURE | *EX ANTE*[A] PEAK DEMAND REDUCTION (kW/yr.) | AUDITED GROSS PEAK DEMAND REDUCTION (kW/yr.) | VERIFIED GROSS PEAK DEMAND REDUCTION (kW/yr.) | *EX POST* GROSS PEAK DEMAND REDUCTION (kW/yr.) |
|---|---|---|---|---|
| LED (5W Candelabra) - Combo Kit | | 8.406 | 5.894 | 5.894 |
| LED (5W Candelabra) - Electric Only Kit | | 0.601 | 0.421 | 0.421 |
| Bathroom Aerator - Combo Kit | | 0.433 | 0.367 | 0.239 |
| Bathroom Aerator - Electric Only Kit | | 0.032 | 0.027 | 0.017 |
| Bathroom Aerator - Gas Only Kit | | 0.000 | 0.000 | 0.000 |
| Kitchen Aerator - Combo Kit | | 1.473 | 0.856 | 0.657 |
| Kitchen Aerator - Electric Only Kit | | 0.107 | 0.062 | 0.047 |
| Kitchen Aerator - Gas Only Kit | | 0.000 | 0.000 | 0.000 |
| *Low-flow* Showerhead - Combo Kit | | 2.951 | 1.546 | 0.562 |
| *Low-flow* Showerhead - Electric Only Kit | | 0.214 | 0.112 | 0.040 |
| *Low-flow* Showerhead - Gas Only Kit | | 0.000 | 0.000 | 0.000 |
| LED Nightlight - Combo Kit | | 0.000 | 0.000 | 0.000 |
| LED Nightlight - Electric Only Kit | | 0.000 | 0.000 | 0.000 |
| Advanced Power Strip - Combo Kit | | 8.151 | 16.506 | 10.316 |
| Advanced Power Strip - Electric Only Kit | | 0.583 | 1.180 | 0.737 |
| Light Switch Gaskets - Combo Kit | | 0.000 | 0.000 | 3.484 |
| Light Switch Gaskets - Electric Only Kit | | 0.000 | 0.000 | 0.249 |
| Light Switch Gaskets - Gas Only Kit | | 0.000 | 0.000 | 0.000 |
| Power Outlet Gaskets - Combo Kit | | 0.000 | 0.000 | 6.917 |
| Power Outlet Gaskets - Electric Only Kit | | 0.000 | 0.000 | 0.494 |
| Power Outlet Gaskets - Gas Only Kit | | 0.000 | 0.000 | 0.000 |

| MEASURE | *EX ANTE*[A] PEAK DEMAND REDUCTION (kW/yr.) | AUDITED GROSS PEAK DEMAND REDUCTION (kW/yr.) | VERIFIED GROSS PEAK DEMAND REDUCTION (kW/yr.) | *EX POST* GROSS PEAK DEMAND REDUCTION (kW/yr.) |
|---|---|---|---|---|
| Total Savings | 22.668 | 22.951 | 26.970 | 30.077 |
| Total Program Realization Rate | | | | 133% |

Note: Totals may not sum properly due to rounding.

[a] *Ex ante* savings in the tracking data do not report savings at the individual measure level, therefore only the summary of savings is included.

TABLE 172. 2022 HOMELIFE CALCULATOR PROGRAM *EX ANTE* & *EX POST* GROSS GAS SAVINGS

| MEASURE | *EX ANTE*[A] NATURAL GAS ENERGY SAVINGS (therms/yr.) | AUDITED GROSS NATURAL GAS ENERGY (therms/yr.) | VERIFIED GROSS NATURAL GAS ENERGY SAVINGS (therms/yr.) | *EX POST* GROSS NATURAL GAS ENERGY SAVINGS (therms/yr.) |
|---|---|---|---|---|
| LED (5W Candelabra) - Combo Kit | | 0.00 | 0.00 | 0.00 |
| LED (5W Candelabra) - Electric Only Kit | | 0.00 | 0.00 | 0.00 |
| Bathroom Aerator - Combo Kit | | 513.47 | 961.78 | 796.87 |
| Bathroom Aerator - Electric Only Kit | | 0.00 | 0.00 | 0.00 |
| Bathroom Aerator - Gas Only Kit | | 506.77 | 937.80 | 759.04 |
| Kitchen Aerator - Combo Kit | | 3,948.11 | 5,064.13 | 5,436.48 |
| Kitchen Aerator - Electric Only Kit | | 0.00 | 0.00 | 0.00 |
| Kitchen Aerator - Gas Only Kit | | 3,896.61 | 2,457.76 | 2,589.19 |
| *Low-flow* Showerhead - Combo Kit | | 6,671.02 | 7,713.37 | 5,770.79 |
| *Low-flow* Showerhead - Electric Only Kit | | 0.00 | 0.00 | 0.00 |
| *Low-flow* Showerhead - Gas Only Kit | | 6,583.99 | 7,461.43 | 5,496.82 |
| LED Nightlight - Combo Kit | | 0.00 | 0.00 | 0.00 |
| LED Nightlight - Electric Only Kit | | 0.00 | 0.00 | 0.00 |
| Advanced Power Strip - Combo Kit | | 0.00 | 0.00 | 0.00 |
| Advanced Power Strip - Electric Only Kit | | 0.00 | 0.00 | 0.00 |
| Light Switch Gaskets - Combo Kit | | 3,173.40 | 1,766.95 | 592.62 |
| Light Switch Gaskets - Electric Only Kit | | 0.00 | 0.00 | 0.00 |
| Light Switch Gaskets - Gas Only Kit | | 1,566.00 | 902.02 | 302.53 |
| Power Outlet Gaskets - Combo Kit | | 7,140.15 | 3,975.64 | 1,176.52 |
| Power Outlet Gaskets - Electric Only Kit | | 0.00 | 0.00 | 0.00 |
| Power Outlet Gaskets - Gas Only Kit | | 3,523.50 | 2,029.54 | 600.61 |
| Total Savings | 35,714.78 | 37,523.02 | 33,270.40 | 23,521.47 |
| Total Program Realization Rate | | | | 66% |

Note: Totals may not sum properly due to rounding.

[a] *Ex ante* savings in the tracking data do not report savings at the individual measure level, therefore only the summary of savings is included.

## *EX POST* NET SAVINGS

The evaluation team calculated freeridership and participant spillover using the survey data collected from 2022 respondents. Like previous evaluation results, the evaluation team found varying levels of freeridership by measure.

Table 173 shows the NTG ratios by measure.

TABLE 173. 2022 HOMELIFE CALCULATOR PROGRAM NET-TO-GROSS RATIOS BY MEASURE

| MEASURE | NTG |
|---|---|
| LED (5W Candelabra) - Combo Kit | 99% |
| LED (5W Candelabra) - Electric Only Kit | 99% |
| Bathroom Aerator - Combo Kit | 102% |
| Bathroom Aerator - Electric Only Kit | 102% |
| Bathroom Aerator - Gas Only Kit | 102% |
| Kitchen Aerator - Combo Kit | 102% |
| Kitchen Aerator - Electric Only Kit | 102% |
| Kitchen Aerator - Gas Only Kit | 102% |
| Low-flow Showerhead - Combo Kit | 100% |
| Low-flow Showerhead - Electric Only Kit | 100% |
| Low-flow Showerhead - Gas Only Kit | 100% |
| LED Nightlight - Combo Kit | 99% |
| LED Nightlight - Electric Only Kit | 99% |
| Advanced Power Strip - Combo Kit | 97% |
| Advanced Power Strip - Electric Only | 97% |
| Light Switch Gaskets - Combo Kit | 86% |
| Light Switch Gaskets - Electric Only Kit | 86% |
| Light Switch Gaskets - Gas Only Kit | 86% |
| Power Outlet Gaskets - Combo Kit | 86% |
| Power Outlet Gaskets - Electric Only Kit | 86% |
| Power Outlet Gaskets - Gas Only Kit | 86% |

Table 174 presents the resulting net electric savings, demand reduction, and natural gas savings.

TABLE 174. 2022 HOMELIFE CALCULATOR PROGRAM *EX POST* NET SAVINGS

| MEASURE | *EX POST* GROSS SAVINGS/REDUCTION | | | NTG | *EX POST* NET SAVINGS/REDUCTION | | |
|---|---|---|---|---|---|---|---|
| | KWH | KW | THERMS | | KWH | KW | THERMS |
| LED (5W Candelabra) - Combo Kit | 36,629.49 | 5.894 | 0.00 | 99% | 36,317.37 | 5.844 | 0.00 |
| LED (5W Candelabra) - Electric Only Kit | 2,617.88 | 0.421 | 0.00 | 99% | 2,595.57 | 0.418 | 0.00 |
| Bathroom Aerator - Combo Kit | 3,026.07 | 0.239 | 796.87 | 102% | 3,101.51 | 0.244 | 816.74 |
| Bathroom Aerator - Electric Only Kit | 216.27 | 0.017 | 0.00 | 102% | 221.66 | 0.017 | 0.00 |
| Bathroom Aerator - Gas Only Kit | 0.00 | 0.000 | 759.04 | 102% | 0.00 | 0.000 | 777.97 |
| Kitchen Aerator - Combo Kit | 20,644.60 | 0.657 | 5,436.48 | 102% | 21,158.65 | 0.674 | 5,571.84 |
| Kitchen Aerator - Electric Only Kit | 1,475.45 | 0.047 | 0.00 | 102% | 1,512.23 | 0.048 | 0.00 |
| Kitchen Aerator - Gas Only Kit | 0.00 | 0.000 | 2,589.19 | 102% | 0.00 | 0.000 | 2,653.74 |
| Low-flow Showerhead - Combo Kit | 21,914.14 | 0.562 | 5,770.79 | 100% | 21,881.73 | 0.562 | 5,762.26 |
| Low-flow Showerhead - Electric Only Kit | 1,566.18 | 0.040 | 0.00 | 100% | 1,563.87 | 0.040 | 0.00 |

| MEASURE | *EX POST* GROSS SAVINGS/REDUCTION | | | NTG | *EX POST* NET SAVINGS/REDUCTION | | |
|---|---|---|---|---|---|---|---|
| | KWH | KW | THERMS | | KWH | KW | THERMS |
| Low-flow Showerhead - Gas Only Kit | 0.00 | 0.000 | 5,496.82 | 100% | 0.00 | 0.000 | 5,488.70 |
| LED Nightlight - Combo Kit | 9,518.19 | 0.000 | 0.00 | 99% | 9,437.08 | 0.000 | 0.00 |
| LED Nightlight - Electric Only Kit | 680.26 | 0.000 | 0.00 | 99% | 674.46 | 0.000 | 0.00 |
| Advanced Power Strip - Combo Kit | 147,087.09 | 10.316 | 0.00 | 97% | 141,949.40 | 9.956 | 0.00 |
| Advanced Power Strip - Electric Only Kit | 10,512.18 | 0.737 | 0.00 | 97% | 10,144.99 | 0.712 | 0.00 |
| Light Switch Gaskets - Combo Kit | 3,447.47 | 3.484 | 592.62 | 86% | 2,975.02 | 3.007 | 511.40 |
| Light Switch Gaskets - Electric Only Kit | 246.39 | 0.249 | 0.00 | 86% | 212.62 | 0.215 | 0.00 |
| Light Switch Gaskets - Gas Only Kit | 0.00 | 0.000 | 302.53 | 86% | 0.00 | 0.000 | 261.07 |
| Power Outlet Gaskets - Combo Kit | 6,844.24 | 6.917 | 1,176.52 | 86% | 5,906.29 | 5.970 | 1,015.29 |
| Power Outlet Gaskets - Electric Only Kit | 489.15 | 0.494 | 0.00 | 86% | 422.12 | 0.427 | 0.00 |
| Power Outlet Gaskets - Gas Only Kit | 0.00 | 0.000 | 600.61 | 86% | 0.00 | 0.000 | 518.30 |
| Total Savings | 266,915.04 | 30.077 | 23,521.47 | | 260,074.57 | 28.132 | 23,377.30 |

Table 175 shows the net to gross ratio for each fuel.

TABLE 175. 2022 HOMELIFE CALCULATOR PROGRAM NET-TO-GROSS RESULTS BY FUEL TYPE

| SAVINGS TYPE | *EX ANTE* GROSS SAVINGS | *EX POST* GROSS SAVINGS | NTG RATIO (%) | *EX POST* NET SAVINGS |
|---|---|---|---|---|
| Electric Energy Savings (kWh/yr.) | 266,196.67 | 266,915.04 | 97% | 260,074.57 |
| Peak Demand Reduction (kW) | 22.668 | 30.077 | 94% | 28.132 |
| Natural Gas Energy Savings (therms/yr.) | 35,714.78 | 23,521.47 | 99% | 23,377.30 |

# PROCESS EVALUATION

The evaluation team conducted qualitative and quantitative research activities to answer the following key research questions for the program:

- What is the process like for participants?
- How do customers become aware of the program?
- What is the primary motivator(s) for customers to participate?
- What information within the calculator did participants find most useful? Least useful?
- Is the calculator easy to find? Are there barriers to finding the web page?
- Are all the questions within the calculator clear to customers? Is the calculator itself easy to use?
- What are key customer takeaways from using the calculator? Do they remember any energy tips? Do they remember any other programs?
- How do customers feel about the kit they received? Which measures do they like most?
- How satisfied are customers with their overall experiences with the program?
- Are participants aware of other NIPSCO programs? Have they participated?

## PARTICIPANT FEEDBACK

The evaluation team took a census of all available program participants with contact information and 142 program participants completed surveys. The following sections describe surveyed participants' experience with the kit and program satisfaction.

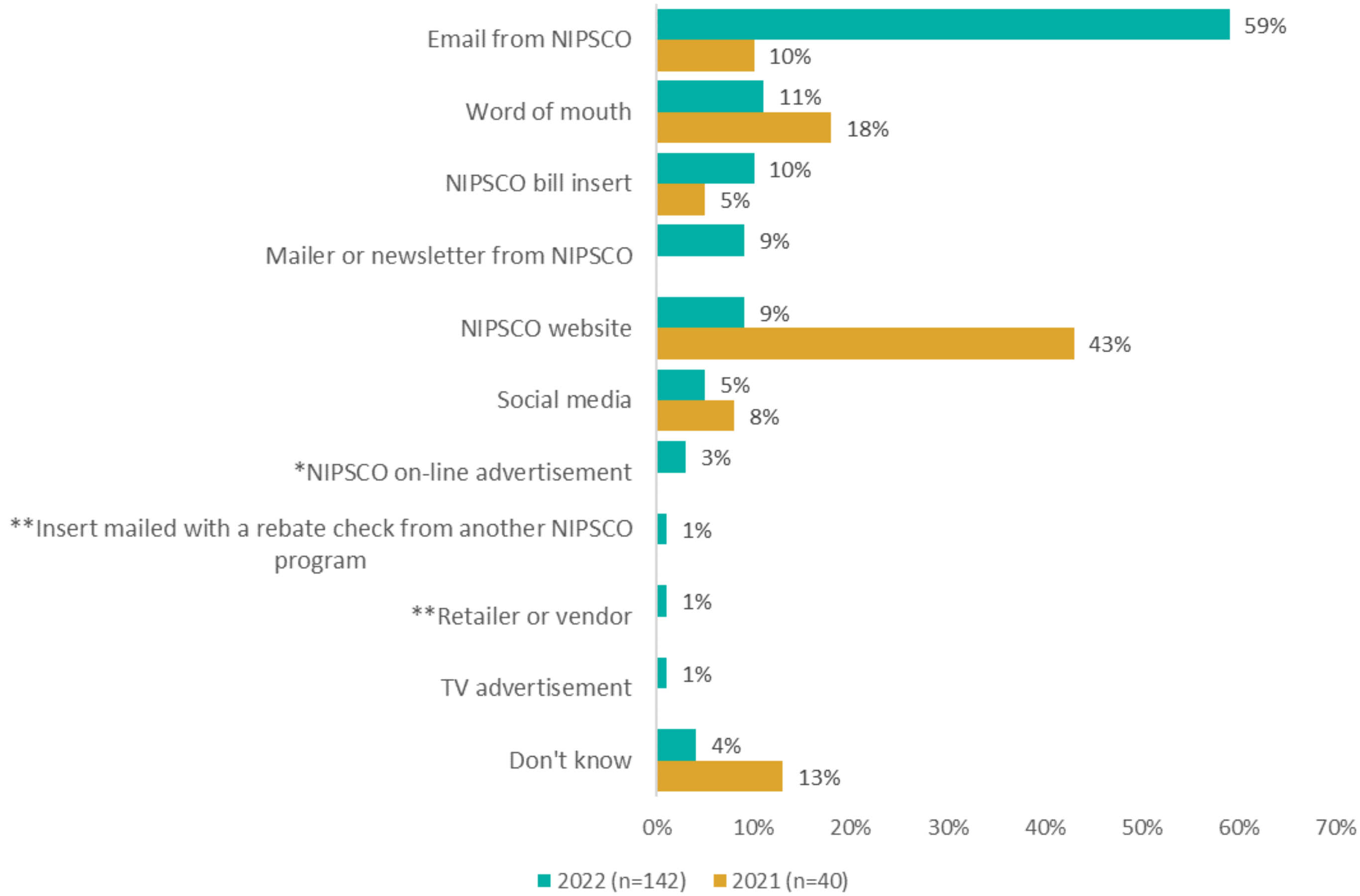
## ENERGY EFFICIENCY AWARENESS AND MARKETING

Like 2021, in 2022, participants learned about the program through various channels but largely from an email from NIPSCO. Respondents cited the following as the top four channels for learning about the HomeLife Calculator program:

- Email from NIPSCO (59%)
- Word of mouth (11%)
- NIPSCO bill insert (10%)
- Mailer or newsletter from NIPSCO (9%).

Only 5% of respondents reported hearing about the program via social media, and very few reported they heard about the program through a TV advertisement, retailer, or vendor, or insert mailed with a rebate check from another NIPSCO program (less than 1% each). In 2021, the top channel for learning about the HomeLife Calculator was the NIPSCO website (43%) and only 10% of participants learned about the program via email. (Figure 67).

FIGURE 67. 2021 AND 2022 HOMELIFE CALCULATOR PROGRAM: CHANNELS FOR LEARNING ABOUT HOMELIFE CALCULATOR PROGRAM[49]




Source: 2021 and 2022 HomeLife survey. Question: "How did you learn about NIPSCO's HomeLife Energy Efficiency Calculator program?"
*Responses to this option are captured in the social media category for the 2021 survey. Option presented to respondents in 2021 was "social media/on-line ad."
**These options were only presented in the 2022 survey.

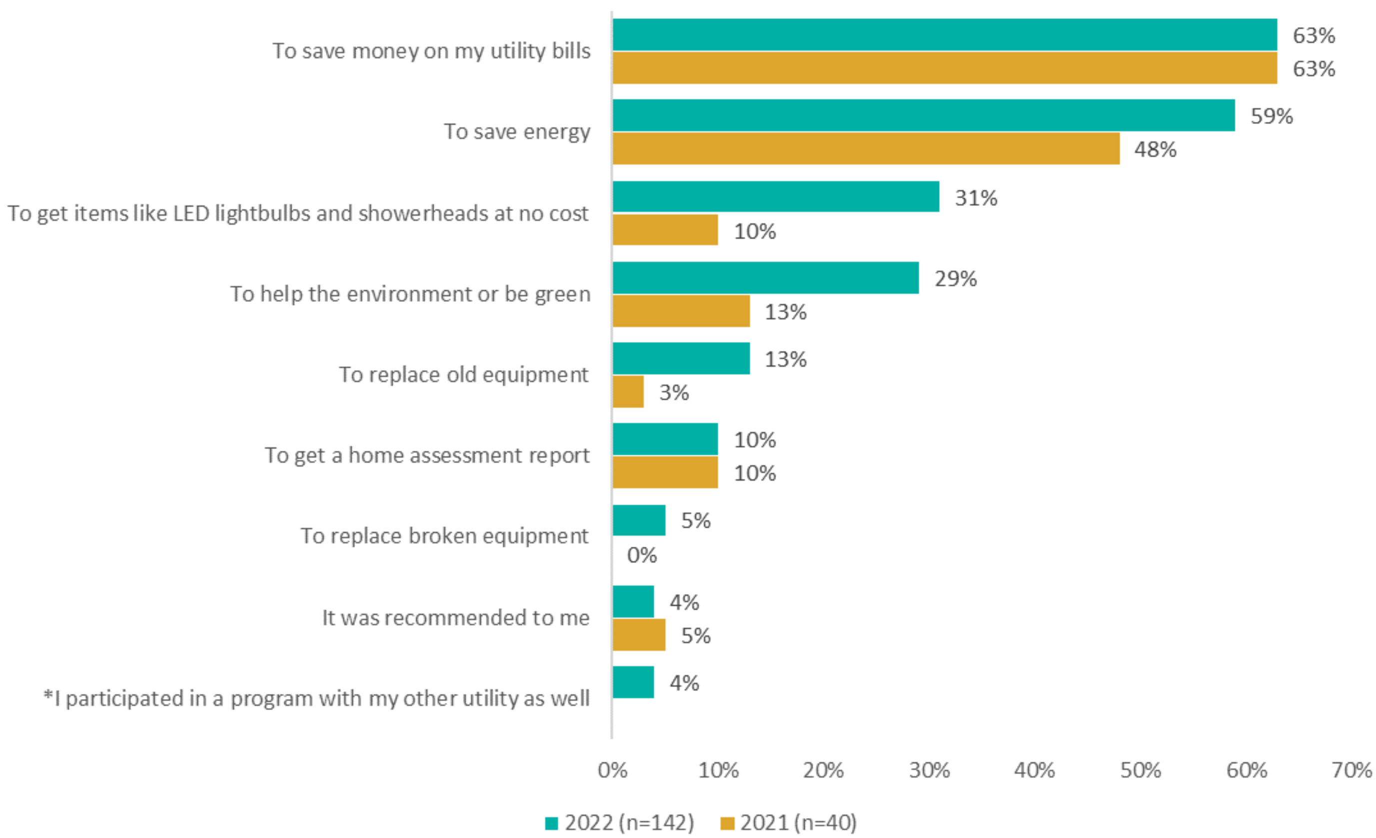
[49] The options of "Billboard", "Contractor", and "Radio advertisement" were presented in the 2022 survey only, no respondents selected these options as channels for learning about the HomeLife Calculator program. The option of "Called NIPSCO" was presented only in the 2021 survey, no respondents selected this option.

## PARTICIPATION DRIVERS

Nearly two-thirds of respondents (63%) participated in the program to save money on their utility bill and more than half (59%) to save energy (Figure 68). Additional reasons for participating included:

- To get items like LED lightbulbs and showerheads at no cost (31%).
- To help the environment or "be green" (29%).
- To replace old equipment (13%).

FIGURE 68. 2022 AND 2021 HOMELIFE CALCULATOR PROGRAM: PARTICIPATION DRIVERS




Source: 2021 and 2022 HomeLife survey. Question: "Why did you decide to participate in NIPSCO's HomeLife Energy Efficiency Calculator program?"
*This option was only presented in the 2022 survey.

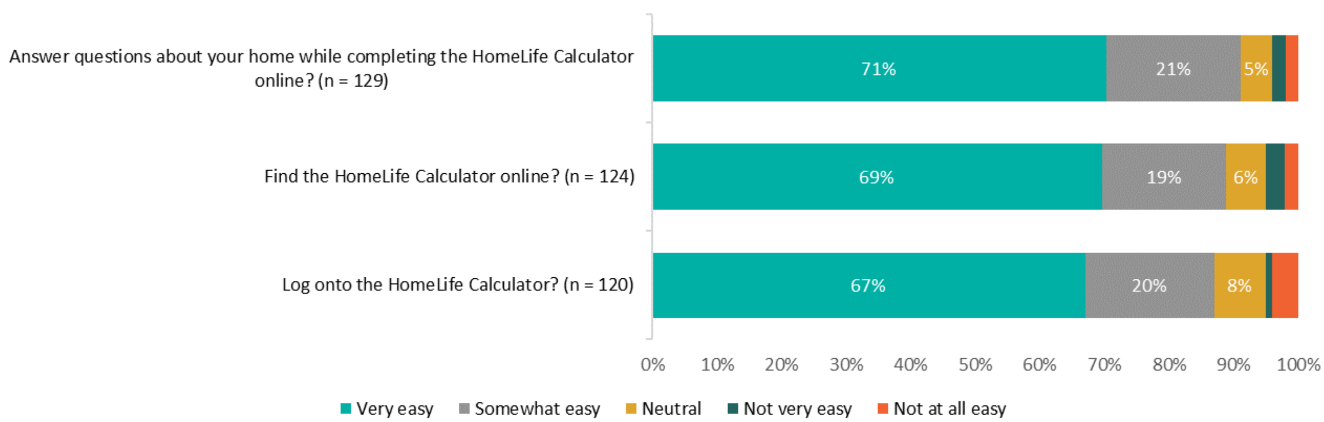
## PROGRAM PROCESS

### PROGRAM EXPERIENCE

Most respondents were satisfied with the overall process of the HomeLife Energy Efficiency Calculator Program (91%); 65% reported being very satisfied and 26% were somewhat satisfied.

More than three-quarters of respondents said it was very or somewhat easy to find the HomeLife Calculator online (88%), and just 5% said it was not very or not at all easy (Figure 69). Respondents also found that logging onto the HomeLife Calculator and answering questions about their homes was very or somewhat easy (87% and 92%, respectively). In open-ended responses, only seven respondents expressed issues with finding the calculator online or logging in. Reasons provided included: "[The] link didn't work," "I had to call NIPSCO to assist," The site wouldn't work," and "I couldn't log in several times."

FIGURE 69. 2022 HOMELIFE CALCULATOR PROGRAM: HOW EASY WAS IT TO DO THE FOLLOWING?

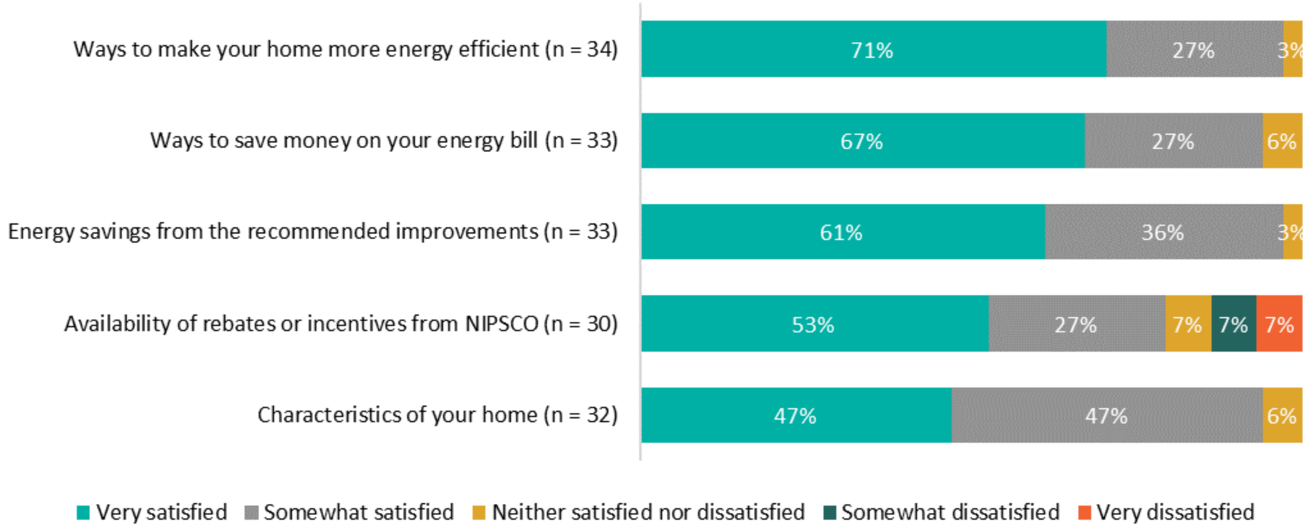



Source: HomeLife survey. Question: "How easy was it to...?"

A quarter of respondents recalled receiving personalized recommendations after completing the HomeLife Energy Efficiency Calculator. However, 75% of respondents reported not receiving personalized recommendations, or not knowing if they did. More respondents recalled receiving personalized recommendations in 2021 (28%).

Overall, respondents who recalled receiving personalized recommendations (n=34) were satisfied with how the personalized recommendations were explained after completing the online audit (Figure 70). In fact, respondents only reported dissatisfaction with how the personalized recommendations explained the availability of rebates or incentives from NIPSCO (14% somewhat or very dissatisfied).

FIGURE 70. 2022 HOMELIFE CALCULATOR PROGRAM: SATISFACTION WITH PERSONALIZED RECOMMENDATIONS

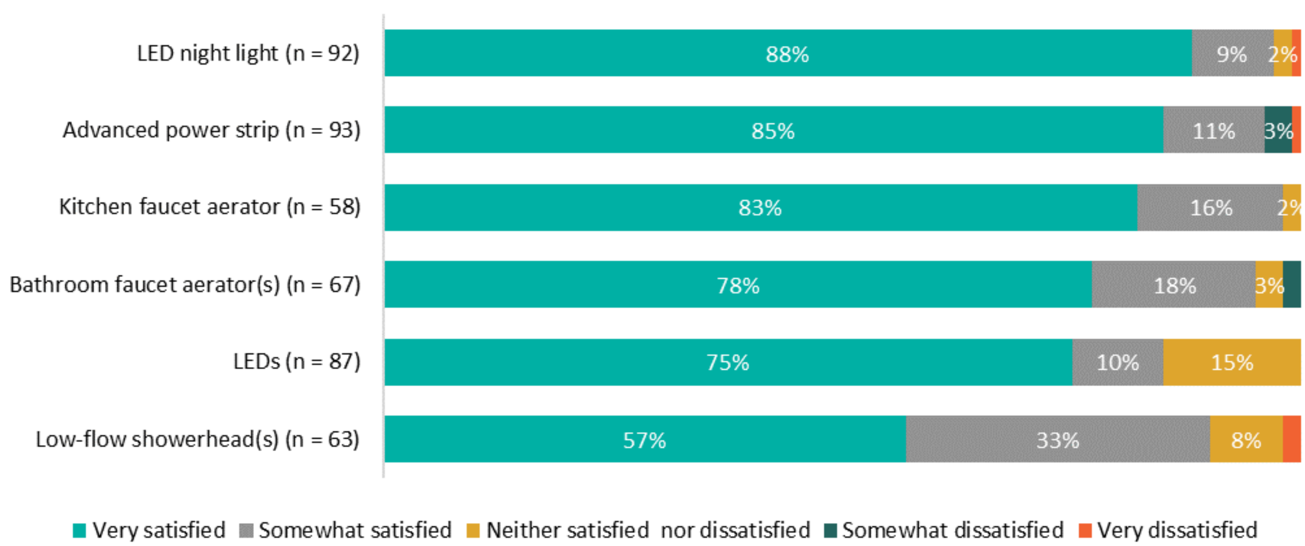



Source: HomeLife survey. Question: "How satisfied were you with how the personalized recommendations explained each of the following?"

## MEASURE EXPERIENCE

Generally, respondents were satisfied with all kit measures. LED night lights and advanced power strips received the most "very satisfied" ratings. (Figure 71).

FIGURE 71. 2022 HOMELIFE CALCULATOR PROGRAM: MEASURE SATISFACTION




Source: HomeLife survey. Question: "How satisfied are you with the [...] overall?"

Respondents who said their water saving devices were not installed said that they either already had one of these measures installed, it did not fit their fixture, or they did not know how to install it. One respondent mentioned, *"I think plumbing is intimidating thing and I was unsure and thought that I would break something. I would like step by step pictures with words on those pictures or a QR code link to a video that can show me how to install any plumbing items."*

### OTHER NIPSCO PROGRAMS

Only nine respondents reported participating in additional NIPSCO programs since receiving the kit. When asked which programs they participated in, the respondents said:

- Energy Efficiency Rebates (n=1)
- Home Energy Assessment, in-person or virtual (n=2)
- Energy Efficient School Kits Program (n=1)

One respondent was unsure, and the other respondents said: "furnace repair," "help with monthly bills," and "help with payments."

## SATISFACTION WITH PROGRAM AND NIPSCO

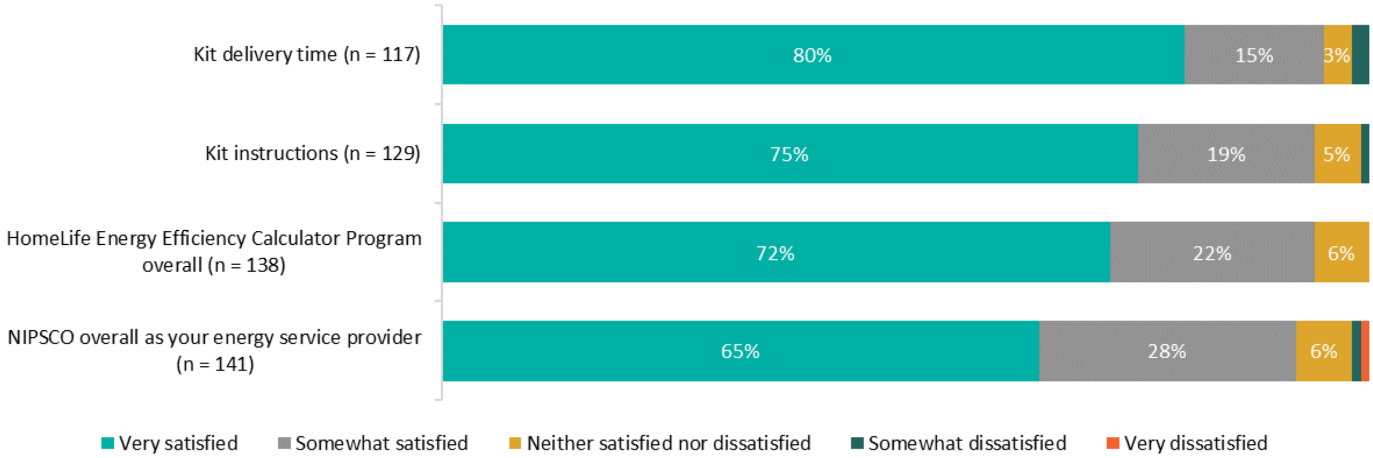
### OVERALL PROGRAM SATISFACTION

As shown in Figure 72, overall satisfaction with the HomeLife Calculator program was high. Most respondents (94%) reported being very or somewhat satisfied with the program overall. Just eight respondents were neutral, and no respondents reported being somewhat or very dissatisfied with the program. Among reasons for respondents feeling neutral, a couple of respondents stated: "can't check if it helps", and "haven't saved any money".

The evaluation team asked participants about their satisfaction with the instructions that came with the kit. Most respondents (94%) were very or somewhat satisfied with the instructions. Only seven respondents were either neutral or somewhat dissatisfied, two due to issues with installation.

The evaluation team also asked participants about their satisfaction with the amount of time it took to receive the kit. Most respondents (95%) were very satisfied or somewhat satisfied with the delivery time. Only six respondents were either neutral or somewhat dissatisfied.

FIGURE 72. 2022 HOMELIFE CALCULATOR PROGRAM: PROGRAM AND UTILITY SATISFACTION




Source: HomeLife survey. Questions: "How satisfied are you with […]?"

### NIPSCO SATISFACTION

Satisfaction with NIPSCO as a service provider is also high, with most respondents (93%) stating that they were very or somewhat satisfied. Reasons for those that gave dissatisfactory or neutral ratings (n=10) included:

- "Cost is high"
- "They're the only provider in the area so I don't really have options."
- "They are doing away with all the union employees, and this is increasing the outage times by having less experienced people doing the work."

## PARTICIPANT SURVEY DEMOGRAPHICS

Most survey respondents own their home (85%) and live in single-family detached houses (88%). Most individuals live with another person (42%), followed by living alone (27%). Survey respondents tend to be older, with almost half being between the ages of 63 and 82 (48%) followed by 43 – 62 years of age (30%).

Almost a quarter of survey respondents have earned a high school degree or equivalent (23%), followed by a four-year college degree (22%), and some college but no degree (21%). Many survey respondents refused to report their 2021 household income (27%). However, of respondents that did report their 2021 household income, most earn between $50,000 and $75,000 (27%), followed by earning under $25,000 (17%), and then between $100,000 to $150,000 (14%).

# CONCLUSIONS AND RECOMMENDATIONS

## CONCLUSION 1: LIGHT SWITCH AND POWER OUTLET GASKETS EXPERIENCED THE LOWEST INSTALLATION RATES ACROSS ALL MEASURES.

The evaluation team found that many respondents did not install the light switch or power outlet gaskets. Only 17% of light switch gaskets and 15% of power outlet gaskets were installed on exterior walls, which is where savings are generated. These measures could contribute more savings to the program if in-service rates could be increased.

Recommendations:

- Given that most respondents appear to be very or somewhat satisfied with the kit contents overall, continue to offer gasket measures. Include information about potential energy savings and infiltration reduction benefits resulting from gasket installation, as well as instructions for installation, in program collateral to raise awareness and increase in-service rates.

## CONCLUSION 2: PARTICIPANTS WERE GENERALLY SATISFIED WITH THE HOMELIFE CALCULATOR PROGRAM, THE MEASURES INCLUDED IN THE KIT, AND NIPSCO OVERALL.

Participants reported high satisfaction with the program overall, and most respondents found the online participation process to be easy. In comparison to 2021, there was an increase in satisfaction with NIPSCO overall as a service provider (from 76% to 93%; respective n's = 40 and 141).

Additionally, all measures received more than 50% "very satisfied" ratings. The highest satisfaction ratings were for the kitchen faucet aerator and LED night light. A few participants expressed an interest in hand-held showerheads.

Recommendations:

- Continue to offer high-satisfaction measures. Investigate whether there are opportunities to elevate satisfaction and in-service rates across all measures. Respondents who did not install water savings measures stated they already had a device installed, it did not fit, or they did not know how to install the device. There may be opportunities to clarify installation instructions or include QR or website links in program collateral that connect participants to installation videos.
- Like other programs offering lighting, follow plans to phase out non-exempt lighting measures from kit programs due to the upcoming EISA backstop.

## CONCLUSION 3: CUSTOMERS LEARNED ABOUT THE HOMELIFE CALCULATOR PROGRAM THROUGH NIPSCO COMMUNICATIONS, SPECIFICALLY EMAILS.

The HomeLife Calculator program participation increased dramatically this year and email from NIPSCO was the top cited channel for learning about the HomeLife Energy Efficiency Calculator (59%), followed by word of mouth (11%). This is much higher than past years. Rather than relying upon past participation data, TRC was able to leverage NIPSCO communication lists, which increased the number of touchpoints, and the number of opt-outs reduced because communications were funneled through NIPSCO.

Only 5% of respondents reported learning about the HomeLife Energy Efficiency Calculator through social media. Television advertisement, retailer or vendor, and insert mailed with rebate from another NIPSCO program were less common forms of reaching participants (less than 1% each).

The top two motivators to participate in the HomeLife Energy Efficiency Calculator remained the same as in 2021. In 2022, participants reporting saving money on their utility bill (63%) and saving energy (59%) as reasons to participate in the program. In addition to these motivators, in open-ended responses some individuals mentioned a drive to participate because the program was free or because they were curious.

Recommendations:

- Continue to use NIPSCO communication lists and NIPSCO-driven emails to maximize customer reach and engagement. Curate content to capture customer interest and motivators, indicating energy and money saving opportunities in messaging.
- Television, retailer, and vendor communications and rebate inserts are the lowest recalled forms of reaching participants. Continue to leverage low-cost pathways to reach customers, such as emails, newsletters, and social media posts, as they appear to be effective.

**CONCLUSION 4: THREE-QUARTERS OF RESPONDENTS DID NOT RECALL RECEIVING PERSONALIZED RECOMMENDATIONS AFTER COMPLETING THE HOMELIFE ENERGY EFFICIENCY CALCULATOR.**

While 25% of respondents remembered receiving personalized recommendations after filling out the HomeLife Energy Efficiency Calculator, 75% of respondents reported not receiving recommendations or did not recall if they did.

Recommendations:

- Consider following-up with participants after sending out personalized recommendations to remind participants about the existence of recommendations and encourage them to act.

**CONCLUSION 5: CUSTOMERS ARE INTERESTED IN DETAILED INSTALLATION INSTRUCTIONS.**

A few customers expressed an interest in detailed instructions because they were unsure of how to install measures or were worried about breaking something when installing water saving devices. Some measures had low in-service rates, like gaskets, indicating there may be a need for more support on how to install.

Recommendations:

- Investigate ways to provide detailed instructions for installing measures, such as including step-by-step photos in the kits, or providing website links or QR codes in the program collateral that connect participants to online instructions and videos.

**CONCLUSION 6: THE PROGRAM IS GENERATING SOME CROSS-PROGRAM PARTICIPATION.**

Approximately 6% of HomeLife Calculator participants (n=9) reported participating in other programs.

Recommendations:

- Overall, participants are satisfied with the HomeLife Calculator program, NIPSCO, and the energy efficiency measures. Build upon this satisfaction to increase awareness of and participation in other NIPSCO offerings through various communication channels, including outreach follow-up and program collateral in kits.

### CONCLUSION 7: MEASURE LEVEL REALIZATION RATES VARIED ACROSS FUELS, WITH LOWER OVERALL GAS REALIZATION RATES.

The lower realization rate for gas savings is primarily driven by the *ex post* savings calculation for light switch and power outlet gaskets, which accounts for space heating fuel saturation, but the *ex ante* calculations do not account for saturation. Variations are also driven by in-service rates for new measures. The *ex ante* energy savings calculation for LEDs includes an ISR that corresponds to 2020 program findings for 9W LED bulbs, rather than for 5W candelabras, and is higher than the 2022 survey results indicated for the 5W candelabras (83% vs 61%). The *ex ante* ISR for advanced power strips is based on information in Illinois TRM v8.0 and is lower than the 2022 HomeLife survey results (40% vs. 81%).

Recommendations:

- Update the ISRs for new measures based on 2022 survey results, which capture measure information from NIPSCO customers participating in the HomeLife Calculator program.

### CONCLUSION 8: THE EVALUATION TEAM FOUND DISCREPANCIES BETWEEN THE MEASURE DESCRIPTION, ENERGY TYPE, AND MATERIAL IN THE TRACKING DATA.

For certain measures, there was misalignment between Measure Description, Energy Type, and Material Description fields within the tracking data. For example, within a particular record, the Measure Description is Total Home Life EE Calculator and Kits – Combo Kit, the Energy Type is recorded as electric and gas, and the Material Description is recorded as Electric Only Kit.

Recommendations:

- Consistently track customer fuel type and kit type, and confirm the agreement between Measure Description, Energy Type, and Material Description fields in the tracking data to limit risk for errors in savings calculations.

# 13. RESIDENTIAL ONLINE MARKETPLACE PROGRAM

## PROGRAM DESIGN AND DELIVERY

The Online Marketplace (OLM) program, launched in late 2020, provides instant discounts on energy-saving products and energy-saving kits that are shipped directly to the customer's home. These measures are paid per-unit purchased, instantly reimbursing the customer for a portion of their cost. The program's intent is to help remove the financial barrier associated with the initial cost of these energy-efficient alternatives. The OLM provides instant discounts for Smart Wi-Fi thermostats, LED lighting, advanced power strips, smart plugs, air purifiers, water-saving products, and Limited Time Offer (LTO) deals for thermostats, air purifiers, and kits containing energy efficient products. Each measure has a prescriptive incentive amount that is paid on a per-unit basis. Additional manufacturer discounts may further reduce the end-cost to customers.

This program is implemented by TRC, who partners with TechniArt to implement the online marketplace. TechniArt is responsible for building, hosting, and maintaining the OLM website, verifying customer accounts, handling customer orders, shipping products to customers, and answering customer questions and concerns. To participate, customers visit the OLM website, add the items they would like to receive to their shopping cart, and provide their account information at checkout to receive the discount. Participants must be active NIPSCO residential electric customers. Products purchased through the OLM are not eligible for rebates through other NIPSCO programs.

The energy efficient items are fulfilled by the OLM vendor within two to three days of placing the order and shipped directly to the customer's home. Shipping typically takes about three to five days (unless impacted by the COVID-19 pandemic). The supplier accepts returns for products purchased up to 30 days from the date of receipt. Each product comes with a minimum manufacturer's warranty of one year from the date of purchase. Customers must retain their sales receipt to file a warranty claim.

The measures offered through the OLM are listed below. For certain measures, there are caps on the number of items a customer can purchase in a calendar year:

- Advanced power strip *(limit of 4 advanced power strips per residential account per calendar year)*
- Bathroom aerator 1.0 gpm
- Kitchen aerator 1.5 gpm
- LED light bulbs *(limit of 24 total LED light bulbs of any combination per residential account per calendar year)*
- LED indoor and outdoor string lighting *(limit of 4 LED string light sets of any combination per residential account per calendar year)*
- Low-flow showerhead and handheld showerhead
- Low-flow showerhead and handheld showerhead w/ ShowerStart
- Pipe wrap
- ShowerStart
- Wi-Fi thermostat (including LTO specials) *(limit of 1 smart thermostat per residential account per calendar year)*
- Smart plug *(limit of 8 smart plugs per residential account per calendar year)*
- Energy Star air purifier/cleaner *(limit of 2 air purifiers per residential account per calendar year)*
- LTO Home Office kit *(limit of one kit per residential account per calendar year)*:

- 2 Smart LEDs
- 1 Tier 1 APS
- 1 Desk Lamp
- 1 Nightlight
- Optional 3 pack – 40W candelabra LED and/or 3 pack – 65W BR30 reflector LED

In 2022, the OLM promoted certain offerings through limited time offerings (LTOs), including Home Office kits (also known as Back-to-School kits and Halloween kits), thermostats, and air purifiers. The kit products were only available during the LTOs. Other products, such as Wi-Fi thermostats and air purifiers, were offered at an additional discount from the manufacturer during the LTO. The Online Marketplace ran a total of eleven LTOs during 2022, eight for thermostats, two for Home Office kits, and one for air purifiers.

### CHANGES FROM 2021 DESIGN

In 2022, the OLM moved from being offered to customers who received either electric service, gas service, or combination electric and gas service to being offered only to electric and combination customers. NIPSCO made this change because they did not claim gas savings in 2022 for the OLM program, except for a small number of gas savings carried over from thermostats and water saving devices purchased in late 2021. Gas savings were not claimed because they were not cost-effective in 2022. Rollover savings are designated as such in tables throughout the report.

Co-pays were also added for the Home Office kits and LED add-on measures in 2022. These measures were offered free of charge in 2021, but in 2022 a $10 co-pay was added for the kit and a $2 co-pay for each of the add-on LED bulb options. The program also discontinued bathroom kits in 2022, which included eight globe LEDs, a showerhead, a nightlight, and a bathroom aerator.

## PROGRAM PERFORMANCE

In 2022, the program exceeded its electric, peak demand, and natural gas energy savings goals. The program achieved 137% of its gross electric savings goal, 144% of its peak demand reduction goal, and 26% of its gas savings goal. Electric savings were driven by kits, thermostats, and add-on lighting, which accounted for 50%, 29%, and 13% of program savings, respectively. Demand savings came largely from thermostats, which drove 71% of demand savings.

Table 176 summarizes savings for the full year of program performance, including program savings goals.

TABLE 176. 2022 RESIDENTIAL ONLINE MARKETPLACE PROGRAM SAVINGS SUMMARY

| METRIC | GROSS SAVINGS GOAL | *EX ANTE* | AUDITED | VERIFIED | *EX POST* GROSS | *EX POST* NET | GROSS GOAL ACHIEVEMENT |
|---|---|---|---|---|---|---|---|
| Electric Energy Savings (kWh/yr.) | 558,569.01 | 941,926.94 | 941,936.19 | 845,699.29 | 764,906.61 | 742,656.70 | 137% |
| Peak Demand Reduction (kW) | 154.425 | 249.836 | 250.376 | 223.320 | 221.753 | 217.000 | 144% |
| Natural Gas Energy Savings (therms/yr.) | 11,085.00 | 11,085.00 | 11,085.00 | 8,764.39 | 2,849.02 | 2,617.23 | 26% |

Table 177 outlines the *ex post* gross and NTG adjustment factors.

TABLE 177. 2022 RESIDENTIAL ONLINE MARKETPLACE ADJUSTMENT FACTORS

| METRIC | REALIZATION RATE (%)[a] | FREERIDERSHIP | SPILLOVER | NTG (%)[b] |
|---|---|---|---|---|
| Electric Energy Savings (kWh/yr.) | 81% | 13% | 10% | 97% |
| Peak Demand Reduction (kW) | 89% | 12% | 10% | 98% |
| Natural Gas Energy Savings (therms/yr.) | 26% | 15% | 7% | 92% |

[a] Realization Rate is defined as *ex post* Gross savings divided by *ex ante* savings.
[b] NTG is defined as *ex post* net savings divided by *ex post* gross savings.

The program exceeded its electric budget and spent just below its natural gas budget in 2022. The higher electric spend was driven by the increased cost of kits in 2022, which were the measure with the highest participation. Table 178 lists the 2022 program budget and expenditures by fuel type.

TABLE 178. 2022 RESIDENTIAL ONLINE MARKETPLACE PROGRAM EXPENDITURE

| FUEL | PROGRAM BUDGET | PROGRAM EXPENDITURES | BUDGET SPENT (%) |
|---|---|---|---|
| Electric | $160,225.62 | $421,860.71 | 263% |
| Natural Gas | $10,757.94 | $10,373.95 | 96% |

# EVALUATION METHODOLOGY

To inform the 2022 NIPSCO impact and process evaluation, the evaluation team completed the following research activities:

- **Program staff interviews and discussions,** to understand the program design and delivery.
- **Documentation and materials review,** to provide context on program design and implementation.
- **Tracking data audit**, to audit and verify the accuracy of program participation data.
- **Engineering analysis**, to review program savings assumptions and algorithms for reasonableness and accuracy.
- **Mixed-mode customer survey (n=285),** to assess sources of install rates, net-to-gross, and awareness, motivations, perceptions, experience, and satisfaction with the OLM.

# IMPACT EVALUATION

The evaluation team completed the impact evaluation to answer the following research questions:

- What assumptions were used to develop deemed savings estimates? Are there any updates that should be made?
- What are *ex post* program savings? Do these suggest any needed updates to program design, delivery, or savings assumptions?
- What are installation rates for kit measures? Are there certain measures that are installed most often? Least often?
- How effective was the program in influencing customer decision making (net savings)?

For all measure types, the evaluation team compared its engineering calculations to NIPSCO's *ex ante* savings, basing its savings methodologies and inputs for each measure on several sources: standard engineering practices, the Illinois TRM (v10.0) , the 2015 Indiana TRM (v2.2), and NIPSCO's program tracking database.[50,51] It should be noted that prior to this evaluation year, the evaluation team used the Indiana TRM as our primary source and supplemented with other sources as needed. The Indiana TRM is out-of-date, and currently in the process of being updated to align more closely with the Illinois TRM. After discussions with NIPSCO, our team felt it would be best practice to use the Illinois TRM as our primary source while the Indiana TRM is in process of being updated, as the Illinois TRM is updated annually and should align closely with the new version of the Indiana TRM.

## AUDITED AND VERIFIED SAVINGS

### AUDITED QUANTITY

According to the 2022 tracking data, the program rebated a total of 27,428 items, distributed to 4,392 customers. The evaluation team audited measure quantities by looking for duplicate records, ensuring measures followed program guidelines, and making sure the proper deemed savings values were applied.

When conducting the tracking data audit, we identified the following anomalies:

- 322 records had end dates in January 2023. These were mostly thermostats.
- There were 25 items listed as "Gas Only" savings. Of these:
    - 3 were low-flow showerheads
    - 2 were bathroom aerators
    - 2 were kitchen aerators
    - The rest (n=18) were smart thermostats

All the "gas only" items were distributed in January 2022. The thermostat items were considered "roll-over" from the previous program year. Given that these values matched the 2022 scorecard, no records were removed from the tracking data.

#### CONFIRM MEASURE-LEVEL SAVINGS

The evaluation team reviewed the kit savings documentation ("NIPSCO Residential 22-23 Program Design v2.3.1"), which contained measure-level savings for stand-alone measures and measures included in kits sold through the marketplace. The evaluation team also pulled measure-level savings for gas only measures from the 2021 program design file ("NIPSCO Residential 19-21 Program Design v4.3").

The evaluation team found that measure-level and kit-level savings values in the tracking data aligned with NIPSCO's savings documentation. However, in the tracking data, kit savings were reported at the kit level and used a rounded value, while savings in the Measure Calculation file were reported both at the kit and measure-level values and used un-rounded values. Throughout the report, the evaluation team has split kit items into individual rows, to reflect in-service rates and *ex post* gross adjustments, which were applied at the measure level. Splitting items into multiple rows and applying unrounded measure-level savings resulted in a rounding discrepancy, meaning that the

[50] Illinois Energy Efficiency Stakeholder Advisory Group. *2022 Illinois Statewide Technical Reference Manual for Energy Efficiency Version 10.0. Volume 3: Residential Measures.* September 24, 2021.
[51] Cadmus. *Indiana Technical Reference Manual Version 2.2*. July 28, 2015.

sum of total measure savings was slightly off from the tracking data savings. These rounding discrepancies will be noted where applicable in the remainder of this report.

Measures for which gas savings were claimed were rollover measures, which were sold in 2021, but whose savings were applied in January 2022. For these measures, the tracking data referenced 2021 *ex ante* savings values. The evaluation team likewise applied 2021 assumptions to the verified, *ex post* gross, and *ex post* net calculations. These measures are designated as "Rollover" measures throughout the report.

### SAVINGS ESTIMATE REVIEW

Measure-level and total savings values were also reviewed. Savings values in the program tracking data were summed and compared to savings values reported in the scorecard. The savings values in the scorecard and unaudited tracking data aligned. There were minor discrepancies between the scorecard and the audited tracking data due to the six records removed and rounding discrepancies, as described in the previous two sections.

## VERIFIED SAVINGS

As in previous evaluation years, the evaluation team prioritized updating in-service rates for measures with higher participation rates. In 2022, Home Office kits, add-on LED reflector and candelabra bulbs, and Wi-Fi thermostats had sufficient participation to survey for these measures. The evaluation team reviewed program participation data from January through November of 2022 to develop a sampling plan and surveyed customers to assess in-service rates for Home Office kits, add-on LED reflector and candelabra bulbs, and Wi-Fi thermostats. The team fielded a mixed-mode online and phone survey and achieved targets for all measures.

The participant survey measured a lower in-service rate for advanced power strips included in kits than the in-service rate reported in *ex ante* savings, which referenced the Illinois TRM v8.0 for time-of-sale advanced power strips. The Illinois TRM v10.0 lists an in-service rate for time-of-sale advanced power strips of 71%. However, the evaluation team applied the kit in-service rate assessed through the 2022 OLM survey, 78%, to remain consistent with the methodology applied for this measure in previous years.

For the remaining standalone measures, there was insufficient participation in 2022 for the evaluation team to assess in-service rates through a survey. The evaluation team developed proxy in-service rates for these measures from similar NIPSCO programs, including Home Energy Assessment and Residential Lighting, or from the TRM as applicable. The evaluation team applied a 0% in-service rate to the thirty-four Smart Plugs, sold through the marketplace, as the team was unable to find a validated source for calculating savings from this measure.

Table 179 lists the ISRs for all program-installed measures.

TABLE 179. 2022 RESIDENTIAL ONLINE MARKETPLACE PROGRAM IN-SERVICE RATES BY MEASURE

| MEASURE | *EX ANTE* ISR | VERIFIED ISR | SOURCE | N[a] |
|---|---|---|---|---|
| Advanced Power Strip Tier 1 | 100% | 78% | 2022 Residential OLM participant survey | 216 |
| Advanced Power Strip Tier 2 | 100% | 78% | 2022 Residential OLM participant survey | 216 |
| Air Purifier | 100% | 100% | IL TRM v10.0 - Air Purifier Deemed Savings | NA |
| Bathroom Aerator 1.0 gpm - Electric | 95% | 92% | 2022 HEA participant survey | 51 |
| Bathroom Aerator 1.0 gpm - Gas (Rollover) | 95% | 95% | 2021 HEA participant survey | 118 |
| Kitchen Aerator 1.5 gpm - Electric | 95% | 93% | 2022 HEA participant survey | 27 |
| Kitchen Aerator 1.5 gpm - Gas (Rollover) | 95% | 86% | 2021 HEA participant survey | 118 |
| LED Reflector | 82% | 86% | 2022 Residential Lighting program evaluation | NA |
| LED Specialty | 82% | 86% | 2022 Residential Lighting program evaluation | NA |
| LED String | 100% | 100% | IL TRM v10.0 | NA |
| Smart LED | 98% | 72% | 2022 Residential OLM participant survey | 202 |
| Low-flow Showerhead 1.5 gpm - Electric | 95% | 86% | 2022 HEA participant survey | 58 |
| Low-flow Showerhead 1.5 gpm - Gas (Rollover) | 95% | 88% | 2021 HEA participant survey | 118 |
| Low-flow Showerhead with ShowerStart 1.5 gpm - Electric | 95% | 86% | 2022 HEA participant survey | 58 |
| ShowerStart - Electric | 95% | 86% | 2022 HEA participant survey | 58 |
| Smart Plug | 100% | 0% | 2022 Residential OLM evaluation | NA |
| Wi-Fi Thermostat - Electric Cooling and Gas Heating Savings (Rollover) | 100% | 79% | 2021 Residential OLM participant survey | 58 |
| Wi-Fi Thermostat - Electric Cooling and Gas Heating Savings | 100% | 91% | 2022 Residential OLM participant survey | 70 |
| Wi-Fi Thermostat - Electric Cooling and Heating Savings | 100% | 91% | 2022 Residential OLM participant survey | 70 |
| Wi-Fi Thermostat - Electric Cooling Only Savings | 100% | 91% | 2022 Residential OLM participant survey | 70 |
| Wi-Fi Thermostat - Electric Heating Only Savings | 100% | 91% | 2022 Residential OLM participant survey | 70 |
| Wi-Fi Thermostat - Gas Heating Only Savings (Rollover) | 100% | 79% | 2021 Residential OLM participant survey | 58 |
| Home Office Kit - Smart LED | 98% | 72% | 2022 Residential OLM participant survey | 202 |
| Home Office Kit - Tier 1 APS | 100% | 78% | 2022 Residential OLM participant survey | 216 |
| Home Office Kit - Desk Lamp | 100% | 82% | 2022 Residential OLM participant survey | 216 |
| Home Office Kit - Nightlight | 67% | 84% | 2022 Residential OLM participant survey | 213 |
| Home Office Kit Add-On - LED Reflector | 100% | 60% | 2022 Residential OLM participant survey | 195 |
| Home Office Kit Add-On - LED Candelabra | 100% | 69% | 2022 Residential OLM participant survey | 207 |

[a] The number of survey responses included in the ISR calculation.

In many cases, the evaluation team assigned lower in-service rates than those assumed in the *ex ante* calculations, although in-service rates are still relatively high across measures. The largest measure-level decrease in in-service rates occurred for the add-on LED reflector and candelabra bulb three-packs, which both had assumed install rates of 100% and saw decreases of 40% and 31% respectively. This result is not unusual, as respondents may not need all the LEDs at once, holding on to these measures to install them in the future. Ninety percent of respondents who did not install the bulbs (n=72) in their three-pack indicated they were planning to install these in the future. The most common reason for not installing all the LED bulbs was that the light bulbs did not fit (n=4).

Kit measures, including the smart LEDs, advanced power strips, and desk lamp also had lower ISRs, which may be due to respondents being interested in some, but not all measures included in the kit.

The in-service rate adjustment for add-on LED reflector bulb three-packs, advanced power strips in the Home Office kits, and Wi-Fi thermostats had the largest impact on program savings, due to the large quantity of LED reflector bulb three-packs and Home Office kits distributed, and the larger per unit savings for power strips and thermostats. Adjustments to the LED reflector bulb three-pack in-service rates contributed to 34% of the decrease in electric savings and 17% of the decrease in demand savings. Adjustments to the advanced power strips in the Home Office kits contributed to 33% of the decrease in electric savings and 20% of the decrease in demand savings. Adjustments to the Wi-Fi thermostat in-service rates contributed to 21% of the decrease in electric savings and 64% of the decrease in demand savings.

Sixty-two percent of respondents who did not install their advanced power strip (n=48) indicated they would install the strip in the future. The most common reasons for not installing the smart strip were that customers disliked the way the smart strip worked (n=6), or they gave the smart strip away (n=4). Of the six respondents who did not install their Wi-Fi thermostat, four indicated that they would install the Wi-Fi thermostats in the future. The two respondents who said they would not install their thermostats in the future specified that they did not install their thermostat because it did not fit (n=1) or they did not like the appearance of it (n=1). The Process Evaluation section contains more information on measure-level satisfaction and drivers of dissatisfaction.

For a few measures, the evaluation team assigned higher verified than *ex ante* in-service rates. These measures included stand-alone LED specialty bulbs and LED reflectors, and the LED nightlights in the Home Office kit.

For the stand-alone LED specialty and reflector bulbs, the evaluation team estimated ISRs using first-year ISRs from the 2015 Opinion Dynamics Market Effects Study, the most current research available from Indiana.[52,53] No carryover savings were calculated for this program year. This is because of the upcoming 2023 EISA backstop enforcement, which will effectively shift lighting baselines for these measures to an LED baseline, limiting the savings that can be claimed from future installations.

Table 180 summarizes the *ex ante* per-unit deemed savings and verified per unit savings. To calculate the verified measure per-unit savings, the evaluation team updated the embedded installation rate in the *ex ante* measure calculations.

[52] Opinion Dynamics. 2015. *2014 Market Effects Study*. https://www.nrel.gov/docs/fy17osti/68562.pdf

[53] The evaluation team applied first-year ISRs, derived from the 2015 Opinion Dynamics study—the most current research available from Indiana (86%). More recent studies in Maryland (86%, 2016) and New Hampshire (87%, 2016) have similar first-year LED ISRs. ISRs for LEDs typically range between 74% (Wyoming, 2016) and 97% (New Hampshire, 2016).

TABLE 180. 2022 RESIDENTIAL ONLINE MARKETPLACE PROGRAM AUDITED & VERIFIED GROSS PER-MEASURE SAVINGS VALUES

| MEASURE | UNIT OF MEASURE | *EX ANTE* PER-UNIT DEEMED SAVINGS | | | VERIFIED PER-UNIT SAVINGS | | |
|---|---|---|---|---|---|---|---|
| | | KWH | KW | THERMS | KWH | KW | THERMS |
| Advanced Power Strip Tier 1 | Power Strip | 103.00 | 0.012 | 0.00 | 80.59 | 0.009 | 0.00 |
| Advanced Power Strip Tier 2 | Power Strip | 174.75 | 0.032 | 0.00 | 136.72 | 0.025 | 0.00 |
| Air Purifier | Unit | 303.00 | 0.035 | 0.00 | 303.00 | 0.035 | 0.00 |
| Bathroom Aerator 1.0 gpm - Electric | Aerator | 30.06 | 0.003 | 0.00 | 29.16 | 0.003 | 0.00 |
| Bathroom Aerator 1.0 gpm - Gas (Rollover) | Aerator | 0.00 | 0.000 | 1.42 | 0.00 | 0.000 | 1.42 |
| Kitchen Aerator 1.5 gpm - Electric | Aerator | 173.97 | 0.008 | 0.00 | 169.56 | 0.008 | 0.00 |
| Kitchen Aerator 1.5 gpm - Gas (Rollover) | Aerator | 0.00 | 0.000 | 7.56 | 0.00 | 0.000 | 6.85 |
| LED Reflector | Bulb | 39.10 | 0.005 | 0.00 | 41.26 | 0.006 | 0.00 |
| LED Specialty | Bulb | 25.18 | 0.003 | 0.00 | 26.57 | 0.004 | 0.00 |
| LED String | Bulb | 31.00 | 0.000 | 0.00 | 31.00 | 0.000 | 0.00 |
| Smart LED | Bulb | 1.83 | 0.000 | 0.00 | 1.34 | 0.000 | 0.00 |
| Low-flow Showerhead 1.5 gpm - Electric | Showerhead | 295.08 | 0.016 | 0.00 | 267.78 | 0.015 | 0.00 |
| Low-flow Showerhead 1.5 gpm - Gas (Rollover) | Showerhead | 0.00 | 0.000 | 11.94 | 0.00 | 0.000 | 11.06 |
| Low-flow Showerhead with ShowerStart 1.5 gpm - Electric | Showerhead | 339.96 | 0.064 | 0.00 | 308.51 | 0.060 | 0.00 |
| ShowerStart - Electric | Valve | 78.70 | 0.006 | 0.00 | 71.41 | 0.005 | 0.00 |
| Smart Plug | Plug | 14.60 | 0.000 | 0.00 | 0.00 | 0.000 | 0.00 |
| Wi-Fi Thermostat - Electric Cooling and Gas Heating Savings (Rollover) | Thermostat | 168.11 | 0.191 | 109.22 | 132.81 | 0.151 | 86.28 |
| Wi-Fi Thermostat - Electric Cooling and Gas Heating Savings | Thermostat | 109.26 | 0.124 | 0.00 | 99.89 | 0.113 | 0.00 |
| Wi-Fi Thermostat - Electric Cooling and Heating Savings | Thermostat | 754.11 | 0.124 | 0.00 | 698.84 | 0.113 | 0.00 |
| Wi-Fi Thermostat - Electric Cooling Only Savings | Thermostat | 109.26 | 0.124 | 0.00 | 99.89 | 0.113 | 0.00 |
| Wi-Fi Thermostat - Electric Heating Only Savings | Thermostat | 644.85 | 0.000 | 0.00 | 589.59 | 0.000 | 0.00 |
| Wi-Fi Thermostat - Gas Heating Only Savings (Rollover) | Thermostat | 0.00 | 0.000 | 109.22 | 0.00 | 0.000 | 86.28 |
| Home Office Kit - Smart LED | Bulb | 1.88 | 0.000 | 0.00 | 1.38 | 0.000 | 0.00 |
| Home Office Kit - Tier 1 APS | Power Strip | 103.00 | 0.012 | 0.00 | 94.17 | 0.011 | 0.00 |
| Home Office Kit - Desk Lamp | Desk Lamp | 10.44 | 0.000 | 0.00 | 8.55 | 0.000 | 0.00 |
| Home Office Kit - Nightlight | Night Light | 3.58 | 0.000 | 0.00 | 4.16 | 0.000 | 0.00 |
| Home Office Kit Add-On - LED Reflector | Bulb | 37.90 | 0.005 | 0.00 | 27.90 | 0.004 | 0.00 |
| Home Office Kit Add-On - LED Candelabra | Bulb | 29.33 | 0.001 | 0.00 | 28.76 | 0.001 | 0.00 |

## *EX POST* GROSS SAVINGS

The evaluation team referred to the Illinois TRM v10.0 and the Indiana TRM (v2.2) to calculate *ex post* gross electric energy savings, demand reduction, and natural gas savings. Where information specific to NIPSCO customers was available, such as for water heater fuel saturation and LED baseline wattages or climate/region-specific variables, the evaluation team revised input assumptions. *Appendix 11* contains details on the specific algorithms, variable assumptions, and references for all program measure *ex post* gross calculations.

### ENGINEERING REVIEWS

Through the engineering review, the evaluation team found differences between the *ex ante* and *ex post* gross savings. These differences were primarily driven by the following factors:

- As determined in conjunction with NIPSCO and the OSB at the beginning of the 2021 evaluation, the evaluation team used in-situ baseline wattages for all bulbs received in kits as opposed to using the baseline watts approach prescribed in the UMP.[54] This resulted in lower savings for the LED candelabras and LED Reflectors included as add-ons to the Home Office/Back to School Kit.
    - For the smart LED measure, both sold as standalone and included in the Home Office kit, the *ex ante* calculation used the Illinois TRM v8.0 connected LED lamps savings algorithm, which assumes an LED baseline. However, to remain consistent with other kit lighting measures, the evaluation team used the LED savings algorithm from the Indiana TRM (v2.2), with the in-situ baseline wattages calculated from survey results for the smart LED included in the Home Office kit. This resulted in higher energy savings since the in-situ baseline wattage was much higher than the assumed LED baseline used in the *ex ante*. The evaluation team applied the UMP baseline to the LED savings algorithm from the Indiana TRM (v2.2) for standalone Smart LEDs, consistent with the approach for other standalone bulbs.
- For Tier 1 and Tier 2 advanced power strips and ShowerStarts, *ex ante* savings were calculated using the Illinois TRM v8.0, but for *ex post* savings the evaluation team used the Illinois TRM v.10.0, which was the most recent and applicable TRM during the 2022 program year. *Ex ante* water measure savings were calculated using the IN TRM v2.2. The evaluation team used the IL TRM v10.0 to calculate *ex post* savings, resulting in lower energy and demand savings for both the kitchen aerators and low-flow showerheads.
- The evaluation team used geolocation for each customer address in the database, then matched each address with the closest city from the IN TRM (v2.2)—for example, South Bend and Fort Wayne—to more precisely account for variations in climate for parameters including waste heat factor and water temperature for measures including faucet aerators, showerheads, and LED bulbs.
- For Wi-Fi thermostats, the evaluation team used inputs from the 2020 HVAC evaluation, including variables from a billing analysis.

[54] For LEDs sold as standalone measures on the NIPSCO OLM, the evaluation team used the baseline watts approach prescribed in the UMP for calculating savings. This was determined to be an appropriate approach because 1) there was no survey data collected for standalone LEDs to calculate in-situ baselines, and 2) the OLM channel for standalone LEDs closely resembles the upstream lighting channel.

The following sections summarize the team's findings and recommendations based on the engineering review.

## *EX POST* GROSS SAVINGS

*Ex post* savings reflect the engineering adjustments made to audited measure savings. The evaluation team calculated *ex post* electric energy, peak demand, and natural gas energy savings for each measure using algorithms and inputs from the Illinois TRM v10.0, the Indiana TRM (v2.2), customer location to account for weather effects, inputs from other NIPSCO programs, inputs from past evaluation results (including billing analysis), as well as survey data when appropriate. The evaluation team leveraged the survey results from the Residential OLM participant survey to estimate in-situ baselines for LEDs and in-service rates, then used this information to inform *ex post* gross savings calculations. *Ex post* savings calculations differed from *ex ante* analysis as follows:

- Wi-Fi thermostats: Both *ex ante* and *ex post* electric energy savings used the Indiana TRM (v2.2). However, while *ex ante* savings used 2019 NIPSCO EM&V values for several inputs, the evaluation team used the more recent 2020 NIPSCO EM&V report and thermostat billing analysis to calculate *ex post* savings. The 2020 analysis found reduced savings from the prior cited analysis. More information on this billing analysis can be found in the 2020 Evaluation Residential HVAC program chapter. *Ex post* gas savings were calculated, but not included in savings summaries (see more information below).
- Add-On Kit Candelabra and Reflector LEDs: The evaluation team used the Indiana TRM (v2.2) algorithm to calculate energy and demand savings as well as therm penalties. However, inputs varied for baseline watts for kits, ISRs, and waste heat factors, with in-situ baseline wattages and ISRs having a significant negative impact on savings.
    - The in-situ baseline watts were calculated using the 2022 NIPSCO Residential OLM survey. The baseline delta watts for the optional add-on LED candelabras to the kit was 23.19 watts compared to the *ex ante* assumption of 36.00 delta watts. The delta watts for the optional add-on LED reflectors to the kit were 30.38 watts, compared to the *ex ante* assumption of 55.50 delta watts.
    - Survey ISRs were determined to be 69.2% for add-on candelabras and 59.9% for add-on reflectors. This compares to *ex ante* ISRs of 95.00% for both measures.

  With a total of 3,438 LED candelabras and 3,303 LED reflectors distributed with kits, the in-situ baseline watts had a bigger impact on *ex post* savings than other calculation assumptions (Table 181).
- Smart LEDs: The evaluation team used the Indiana TRM (v2.2) and calculated savings using the residential ENERGY STAR lighting algorithm since the smart LED algorithm in the Illinois TRM v10.0 assumes an LED baseline. For smart LEDs distributed through kits, the calculated in-situ watts baseline was used, as several survey respondents indicated that they replaced incandescent and halogen bulbs with their smart LED. With an in-situ baseline of 33 watts, this *ex post* approach increased smart LED savings significantly. For the smart LEDs sold as a standalone product, the evaluation team also used IN TRM (v2.2) so that the algorithm was consistent for the same measures. However, since an in-situ baseline was not calculated due to a lack of survey responses, the evaluation team used the UMP protocol for baseline wattage (Table 181).

TABLE 181. RESIDENTIAL ONLINE MARKETPLACE PROGRAM – LED PER MEASURE SAVINGS

| MEASURE | TRACKING DATA MEASURE NAME | UNITS | *EX ANTE* BASELINE WATTS | *EX POST* BASELINE WATTS | *EX POST* PER UNIT kWh | *EX POST* PER UNIT kW |
|---|---|---|---|---|---|---|
| LED Reflector | LED - BR/Par - 10W - 3 pack - (TCP L90P38D2530KFL) - Electric and Gas | 12 | 90 | 90 | 57.71 | 0.008 |
| LED Reflector | LED - BR/Par - 17W - 1 pack - (EarthTronics LP381730D4) - Electric and Gas | 8 | 120 | 120 | 74.31 | 0.010 |
| LED Reflector | LED - BR/Par - 9.5W - 1 pack - (TCP LED9BR30D27K) - Electric and Gas | 275 | 65 | 65 | 40.03 | 0.005 |
| LED Reflector | LED - BR/Par - 9.5W - 1 pack - (TCP LED9BR30D27K) - Electric Only | 15 | 65 | 65 | 39.87 | 0.005 |
| LED Reflector | LED - BR/Par - 9.5W - 1 pack - (TCP LED9BR30D50K) - Electric and Gas | 3 | 65 | 65 | 40.04 | 0.005 |
| LED Reflector | LED - BR/Par - 9.5W - 1 pack - (TCP LED9BR30D50K) - Electric Only | 3 | 65 | 65 | 39.52 | 0.005 |
| LED Reflector | LED - BR/Par - 9.5W - 12 pack - (TCP LED9BR30D27K) - Electric and Gas | 132 | 65 | 65 | 39.94 | 0.005 |
| LED Reflector | LED - BR/Par - 9.5W - 12 pack - (TCP LED9BR30D27K) - Electric Only | 12 | 65 | 65 | 40.04 | 0.005 |
| LED Reflector | LED - BR/Par - 9.5W - 12 pack - (TCP LED9BR30D50K) - Electric and Gas | 156 | 65 | 65 | 40.04 | 0.005 |
| LED Reflector | LED - BR/Par - 9.5W - 6 pack - (TCP LED9BR30D27K) - Electric and Gas | 12 | 65 | 65 | 40.04 | 0.005 |
| LED Reflector | LED - BR/Par - 9.5W - 6 pack - (TCP LED9BR30D50K) - Electric and Gas | 24 | 65 | 65 | 39.91 | 0.005 |
| LED Reflector | LED - BR/Par - 9W - 6 pack - (TCP L75P30D2530KFL) - Electric and Gas | 54 | 75 | 75 | 47.61 | 0.006 |
| LED Specialty | LED - Decorative/Mini - 4W - 6 pack - (TCP LED5G25D27KF) - Electric and Gas | 60 | 40 | 40 | 25.94 | 0.004 |
| LED Specialty | LED - Decorative/Mini - 4W - 6 pack - (TCP LED5G25D27KF) - Electric Only | 42 | 40 | 40 | 25.92 | 0.004 |
| LED Specialty | LED - Decorative/Mini - 5W - 6 pack - (TCP LED5E12B1127K) - Electric and Gas | 48 | 40 | 40 | 25.25 | 0.003 |
| LED Specialty | LED - Decorative/Mini - 6.5W - 6 pack - (EarthTronics LGU10630D7) - Electric and Gas | 36 | 50 | 50 | 31.38 | 0.004 |
| LED Specialty | LED - Decorative/Mini - 6.5W - 6 pack - (EarthTronics LGU10630D7) - Electric Only | 6 | 50 | 50 | 31.38 | 0.004 |
| LED Specialty | LED - Decorative/Mini - 6.5W - 6 pack - (TCP LED712VMR16V27KFL) - Electric and Gas | 6 | 50 | 50 | 31.38 | 0.004 |
| LED Specialty | LED - Decorative/Mini - 6.5W - 6 pack - (TCP LED712VMR16V27KFL) - Electric Only | 6 | 50 | 50 | 31.38 | 0.004 |
| LED Specialty | LED - Filament - 4W - 6 pack - (TCP FB11D4027EC) - Electric and Gas | 54 | 40 | 40 | 25.97 | 0.004 |
| LED Specialty | LED - Filament - 4W - 6 pack - (TCP FB11D4027EC) - Electric Only | 6 | 40 | 40 | 25.97 | 0.004 |
| LED Specialty | LED - Filament - 4W - 6 pack - (TCP FB11D4027EE12C) - Electric and Gas | 108 | 40 | 40 | 25.97 | 0.004 |
| LED Specialty | LED - Filament - 4W - 6 pack - (TCP FG25D4027EC) - Electric and Gas | 30 | 40 | 40 | 25.97 | 0.004 |
| LED Specialty | LED - Filament - 4W - 6 pack - (TCP FG25D4027EC) - Electric Only | 6 | 40 | 40 | 25.97 | 0.004 |
| Smart LED | LED - Smart LED - 8W - 1 pack - (AMC L8W-BR30-CCT-RGBWiFi) | 11 | N/A | 65 | 41.12 | 0.006 |

| MEASURE | TRACKING DATA MEASURE NAME | UNITS | *EX ANTE* BASELINE WATTS | *EX POST* BASELINE WATTS | *EX POST* PER UNIT kWh | *EX POST* PER UNIT kW |
|---|---|---|---|---|---|---|
| Smart LED | LED - Smart LED - 9W - 1 pack - (AMC L9W-A19-CCT-RGBWiFi) | 42 | N/A | 43 | 24.53 | 0.003 |
| LED String | LED String Lighting - C7 - Indoor (78393R-PB24) - Electric and Gas | 14 | 125 | 125 | 25.75 | 0.000 |
| LED String | LED String Lighting - C9 - Indoor (84393R-PB12) - Electric and Gas | 14 | 175 | 175 | 36.25 | 0.000 |
| Home Office/ Back to School Kit Add-On - LED Reflector | LED - BR/Par - 9.5W - 3 pack - (TCP LED9BR30D27K) - Electric Only | 210 | 65 | 39.88 | 21.87 | 0.003 |
| Home Office/ Back to School Kit Add-On - LED Reflector | LED - BR/Par - 9.5W - 3pack - (TCP LED9BR30D27K) - Electric and Gas | 3,093 | 65 | 39.88 | 15.26 | 0.002 |
| Home Office/ Back to School Kit Add-On - LED Candelabra | LED - Candelabra - 4W - 3 pack - (EarthTronics LBA10427DCFIL9) - Electric and Gas Savings | 3,225 | 40 | 28.69 | 13.47 | 0.002 |
| Home Office/ Back to School Kit Add-On - LED Candelabra | LED - Candelabra - 4W - 3 pack - (EarthTronics LBA10427DCFIL9) - Electric Only Savings | 213 | 40 | 28.69 | 13.45 | 0.002 |
| Home Office/Back to School Kit - Smart LEDs (2) | LTO - LED - Smart LED - 9W - (EarthTronics LA199RGBWES) | 7,110 | N/A | 32.99 | 14.49 | 0.002 |
| Home Office/Back to School Kit - Desk Lamp | Home Office/Back to School Kit - Desk Lamp | 3,555 | 38 | 0 | 7.95 | 0.003 |
| Home Office/Back to School Kit - Nightlight | Home Office/Back to School Kit - Nightlight | 3,555 | 5 | 0 | 25.85 | 0.000 |

Table 182 shows the *ex ante* deemed savings and *ex post* gross per-measure savings for the 2022 Residential OLM program measures. *Ex ante* assumptions include ISRs in the calculation, and therefore *ex post* gross per-unit savings algorithms also include ISRs.

TABLE 182. 2022 RESIDENTIAL ONLINE MARKETPLACE PROGRAM *EX ANTE* & *EX POST* GROSS PER-MEASURE SAVINGS VALUES

| MEASURE | UNIT OF MEASURE | *EX ANTE* DEEMED PER-UNIT SAVINGS | | | *EX POST* GROSS PER-UNIT SAVINGS | | |
|---|---|---|---|---|---|---|---|
| | | KWH | KW | THERMS | KWH | KW | THERMS |
| Advanced Power Strip Tier 1 | Power Strip | 103.00 | 0.012 | 0.00 | 57.19 | 0.006 | 0.00 |
| Advanced Power Strip Tier 2 | Power Strip | 174.75 | 0.032 | 0.00 | 113.94 | 0.021 | 0.00 |
| Air Purifier | Unit | 303.00 | 0.035 | 0.00 | 241.73 | 0.028 | 0.00 |
| Bathroom Aerator 1.0 gpm - Electric | Aerator | 30.06 | 0.003 | 0.00 | 17.77 | 0.001 | 0.00 |
| Bathroom Aerator 1.0 gpm - Gas (Rollover) | Aerator | 0.00 | 0.000 | 1.42 | 0.00 | 0.000 | 1.37 |
| Kitchen Aerator 1.5 gpm - Electric | Aerator | 173.97 | 0.008 | 0.00 | 173.05 | 0.006 | 0.00 |
| Kitchen Aerator 1.5 gpm - Gas (Rollover) | Aerator | 0.00 | 0.000 | 7.56 | 0.00 | 0.000 | 6.51 |
| LED Reflector | Bulb | 39.10 | 0.005 | 0.00 | 41.28 | 0.006 | 0.00 |

| MEASURE | UNIT OF MEASURE | *EX ANTE* DEEMED PER-UNIT SAVINGS | | | *EX POST* GROSS PER-UNIT SAVINGS | | |
|---|---|---|---|---|---|---|---|
| | | KWH | KW | THERMS | KWH | KW | THERMS |
| LED Specialty | Bulb | 25.18 | 0.003 | 0.00 | 26.59 | 0.004 | 0.00 |
| LED String | Bulb | 31.00 | 0.000 | 0.00 | 31.00 | 0.000 | 0.00 |
| Smart LED | Bulb | 1.83 | 0.000 | 0.00 | 27.97 | 0.004 | 0.00 |
| Low-flow Showerhead 1.5 gpm - Electric | Showerhead | 295.08 | 0.016 | 0.00 | 169.46 | 0.004 | 0.00 |
| Low-flow Showerhead 1.5 gpm - Gas (Rollover) | Showerhead | 0.00 | 0.000 | 11.94 | 0.00 | 0.000 | 9.88 |
| Low-flow Showerhead with ShowerStart 1.5 gpm - Electric | Showerhead | 339.96 | 0.064 | 0.00 | 216.46 | 0.022 | 0.00 |
| ShowerStart - Electric | Valve | 78.70 | 0.006 | 0.00 | 29.65 | 0.003 | 0.00 |
| Smart Plug | Plug | 14.60 | 0.000 | 0.00 | 0.00 | 0.000 | 0.00 |
| Wi-Fi Thermostat - Electric Cooling and Gas Heating Savings (Rollover) | Thermostat | 168.11 | 0.191 | 109.22 | 86.64 | 0.098 | 27.76 |
| Wi-Fi Thermostat - Electric Cooling and Gas Heating Savings | Thermostat | 109.26 | 0.124 | 0.00 | 100.66 | 0.115 | 0.00 |
| Wi-Fi Thermostat - Electric Cooling and Heating Savings | Thermostat | 754.11 | 0.124 | 0.00 | 1,032.03 | 0.115 | 0.00 |
| Wi-Fi Thermostat - Electric Cooling Only Savings | Thermostat | 109.26 | 0.124 | 0.00 | 98.22 | 0.115 | 0.00 |
| Wi-Fi Thermostat - Electric Heating Only Savings | Thermostat | 644.85 | 0.000 | 0.00 | 933.64 | 0.000 | 0.00 |
| Wi-Fi Thermostat - Gas Heating Only Savings (Rollover) | Thermostat | 0.00 | 0.000 | 109.22 | 0.00 | 0.000 | 27.76 |
| Home Office Kit - Smart LED | Bulb | 1.88 | 0.000 | 0.00 | 14.49 | 0.002 | 0.00 |
| Home Office Kit - Tier 1 APS | Power Strip | 103.00 | 0.012 | 0.00 | 44.36 | 0.005 | 0.00 |
| Home Office Kit - Desk Lamp | Desk Lamp | 10.44 | 0.000 | 0.00 | 7.95 | 0.003 | 0.00 |
| Home Office Kit - Nightlight | Night Light | 3.58 | 0.000 | 0.00 | 25.85 | 0.000 | 0.00 |
| Home Office Kit Add-On - LED Reflector | Bulb | 37.90 | 0.005 | 0.00 | 15.68 | 0.002 | 0.00 |
| Home Office Kit Add-On - LED Candelabra | Bulb | 29.33 | 0.001 | 0.00 | 13.47 | 0.002 | 0.00 |

Table 183 highlights notable differences between *ex ante* and *ex post* gross estimates.

TABLE 183. 2022 RESIDENTIAL ONLINE MARKETPLACE NOTABLE DIFFERENCES BETWEEN *EX ANTE* & *EX POST* GROSS

| MEASURE | *EX ANTE* SOURCES AND ASSUMPTIONS | *EX POST* GROSS SOURCES AND ASSUMPTIONS | PRIMARY REASONS FOR DIFFERENCES |
|---|---|---|---|
| Advanced Power Strip Tier 1 | Illinois TRM v8.0; assumed 7-plug time of sale delta kWh and kW, assumed 100% ISR | Illinois TRM v10.0; assumed 7-plug time of sale delta kWh for standalone measures and 7-plug single-family energy efficiency kit leave behind for kits, 78% ISR from survey | Delta kWh and kW differs substantially for Illinois TRM v8.0 versus v10.0. *Ex ante* assumes time of sale for kits. |
| Advanced Power Strip Tier 2 | Illinois TRM v8.0; assumed average of Energy Reduction Percentage values, assumed 100% ISR | Illinois TRM v10.0; confirmed infrared or infrared and occupancy sensor with model numbers, 78% ISR from survey | Difference in product type binning for delta kWh for Illinois TRM v8.0 versus v10.0. |
| Air Purifier | Illinois TRM v8.0 deemed savings | Illinois TRM v10.0 deemed savings | Delta kWh and kW differs substantially for Illinois TRM v8.0 versus 10.0. *Ex ante* incorrectly binned measure based on Clean Air Delivery Rate (CADR), *ex post* confirmed CADR with ENERGYSTAR Qualified Products List (QPL) and binned appropriately. |
| Bathroom and Kitchen Aerator | Indiana TRM (v2.2) and 2020 EMV; assumed single-family for all applicable measures and 100% water heating saturation; used EMV 2020 value for cold water inlet temperature. With an assumed ISR of 95%. | Illinois TRM v10 with cold water inlet temperature determined by matching to closest city from tracking data (Indiana TRM (v2.2)); 100% water heater saturation value based on customers reporting their water heater fuel type at checkout. | For bathroom aerator *ex post* savings, Illinois TRM v10.0 specifies 1.53 $GPM_{base}$ and 90% water down the drain; whereas Indiana TRM (v2.2) used in *ex ante* specifies 1.9 $GPM_{base}$ and 70% water down the drain. |
| LED | Indiana TRM (v2.2) and ENERGY STAR baseline watts; assumed South Bend as closest city for all weighted average waste heat factors. | Indiana TRM (v2.2) and 2022 NIPSCO Residential OLM survey to determine in-situ baseline watts for all kit lighting. Weighted average waste heat factors determined by matching to closest city from tracking data. Standalone LED ISRs blended from 2022 Residential Lighting | The evaluation team used in-situ baseline wattages for all bulbs received in kits as opposed to using the baseline watts approach prescribed in the UMP. This resulted in much lower savings for the LED candelabras and LED Reflectors included as add-ons to the Home Office Kit |
| Smart LED | Illinois TRM v8.0 savings algorithm is used with some inputs from Indiana TRM (v2.2); assumed time of sale for hours of use and assumed South Bend as closest city for all weighted average waste heat factors from Indiana TRM (v2.2). | Indiana TRM (v2.2); in-situ baseline watts and ISRs from 2022 NIPSCO Residential OLM survey for kit bulbs; UMP baseline and ISRs from 2022 Res Lighting for stand-alone. Weighted average waste heat factors determined by matching to closest city from tracking data. | The evaluation team determined that since an in-situ baseline watts had been calculated from the 2022 NIPSCO Residential OLM survey this measure should be treated as a standard LED since the Illinois TRM v10.0 assumes an LED baseline. |
| Low-flow Showerhead (with and without ShowerStart) | Indiana TRM (v2.2) and 2020 EMV; assumed single-family for all applicable measures and 100% water heating saturation; used EMV 2020 value for cold water inlet temperature. With an assumed ISR of 95%. ShowerStart inputs are sourced from EM&V 2019 and 2020. ShowerStart inputs are sourced from Indiana TRM v2.2 and Illinois TRM v8.0. | Indiana TRM (v2.2), Illinois TRM (v10). 2022 HEA/IQW survey assumed single-family for applicable inputs, calculated showers per household per day from 2022 HEA/IQW survey, as well as showerheads per household. Cold water inlet temperature is determined by matching to closest city from tracking data. 100% water heater saturation value based on customers reporting their water heater fuel type at checkout. | *Ex post* savings used Illinois TRM v10.0 specifying 2.35 $GPM_{base}$, whereas Indiana TRM (v2.2) used in *ex ante* specifies 2.64 $GPM_{base}$. The *ex ante* ISR at 95% differed from the *ex post* ISR at 86%. |

| MEASURE | *EX ANTE* SOURCES AND ASSUMPTIONS | *EX POST* GROSS SOURCES AND ASSUMPTIONS | PRIMARY REASONS FOR DIFFERENCES |
|---|---|---|---|
| Smart Plug | Deemed value from EnergyEarth | Not included in the Illinois TRM v10.0 or the IN TRM v2.2, so *ex post* savings were not granted. | The evaluation team determined no *ex post* savings should be applied as this measure was not found in a relevant TRM. |
| Wi-Fi thermostat | Indiana TRM (v2.2) savings algorithm for energy and Illinois TRM v8.0 for demand with SEER inputs from EMV 2019, all other inputs from EMV 2020; assumed South Bend as closest city for EFLH. Assumed 0 therms for *ex ante* 2022 measures. | Indiana TRM (v2.2) savings algorithm for electric savings, deemed value from 2020 billing analysis for gas savings, and Illinois TRM v9.0 for demand; all inputs from EMV 2021 and billing analysis; EFLH determined by matching to closest city from tracking data and used $EFLH_{heat}$ from 2020 billing analysis. In service rate of 91% from 2022 OLM survey. Deemed therms saving of 35 from 2020 billing analysis for gas savings, which were estimated but not included in reported savings (see further discussion below). | The 2020 billing analysis used by the evaluation team has a much lower cooling energy savings fraction and heating energy savings fraction, as well as a lower deemed gas savings value, and lower $EFLH_{heat}$. |
| LED Nightlight | Indiana TRM (v2.2); EMV 2019 for IRF | Illinois TRM (v10); OLM 2022 survey for IRF | The OLM 2022 survey calculated a lower IRF (26%) than was used in *ex ante* (39%). Indiana TRM (v2.2) and Illinois TRM v10 do not use the same algorithm |
| Desk Lamp | Indiana TRM (v2.2); calculated electric savings as an LED, did not attribute demand savings or therm penalty; baseline watts and HOU from DOE assumptions. | Indiana TRM (v2.2); calculated all savings as an LED; baseline watts and HOU from DOE assumptions. | The evaluation team attributed demand savings and therm penalty as an LED measure. |
| String LED | Illinois TRM (v10.0) deemed values | Illinois TRM (v10.0) deemed values | No difference |

## WATER HEATER SATURATION

During the marketplace checkout process, customers are asked to specify their water heating type, and this determines whether the customer receives savings for the measure. Therefore, *ex ante* saturation rates were assumed to be 100%. The evaluation team was able to use this customer self-report information to assign 100% saturation rates to the *ex post* calculations for electric and gas water-heating measures. *Ex ante* and *ex post* water heater saturations are shown in Table 184.

TABLE 184. 2022 RESIDENTIAL ONLINE MARKETPLACE PROGRAM WATER HEATER FUEL SATURATION

| SAVINGS TYPE | ELECTRIC WATER HEATING SATURATION RATE (%) | NATURAL GAS WATER HEATING SATURATION RATE (%) |
|---|---|---|
| Reported *ex ante* | 100% | 100% |
| *Ex post* | 100% | 100% |

**WASTE HEAT FACTOR - THERM PENALTIES**

In 2019, and prior years, the evaluation team applied waste heat factors to lighting measures, representing kWh, kW, and therm penalties resulting from LED lighting. In discussions with NIPSCO, for the 2020 evaluation year and beyond, the evaluation team is not including therm penalties when calculating evaluated savings. However, cost-effectiveness results will include these penalties and be applied to the electric program cost-effectiveness. The evaluation team believes this approach is appropriate, as it accounts for the penalty on the electric side (where it is generated) and allows the evaluation team to show gas program performance and measure performance more clearly. *Ex ante* savings for most stand-alone LED measures and LED kit add-on packs included therm penalties of -3,732.66 therms. These have been removed from the *ex post* reported savings but included below be used in the cost-effectiveness analysis. In total, the *ex post* therm penalty for cost-effectiveness analysis is -5,036.20 therms (Table 185).

TABLE 185. 2021 RESIDENTIAL ONLINE MARKETPLACE WASTE HEAT FACTOR THERM PENALTY

| MEASURE | WASTE HEAT FACTOR THERM PENALTY | |
|---|---|---|
| | *EX ANTE* | *EX POST* |
| LED Reflector | (518.34) | (595.75) |
| LED Specialty | (148.11) | (221.74) |
| Smart LED | - | (30.29) |
| Home Office/Back to School Kit – Smart LEDs (2) | - | (2,105.53) |
| Home Office/Back to School Kit - Desk Lamp | - | (57.77) |
| Home Office/Back to School Kit Add-On - LED Reflector | (2,402.23) | (1,058.46) |
| Home Office/Back to School Kit Add-On - LED Candelabra | (645.00) | (945.92) |
| LED String | (18.98) | (20.73) |
| Total | (3,732.66) | (5,036.20) |

## REALIZATION RATES

The next three tables (Table 186 through Table 188) show the program's *ex ante* reported savings, verified savings, and *ex post* gross savings.

TABLE 186. 2022 RESIDENTIAL ONLINE MARKETPLACE PROGRAM *EX ANTE* & *EX POST* GROSS ELECTRIC ENERGY SAVINGS

| MEASURE | *EX ANTE*[a] ELECTRIC ENERGY SAVINGS (KWH/YR.) | AUDITED GROSS ELECTRIC ENERGY SAVINGS (KWH/YR.) | VERIFIED GROSS ELECTRIC ENERGY SAVINGS (KWH/YR.) | *EX POST* GROSS ELECTRIC ENERGY SAVINGS (KWH/YR.) |
|---|---|---|---|---|
| Advanced Power Strip Tier 1 | | 6,077.00 | 4,754.64 | 3,374.21 |
| Advanced Power Strip Tier 2 | | 6,291.00 | 4,922.08 | 4,101.84 |
| Air Purifier | | 11,817.00 | 11,817.00 | 9,427.47 |
| Bathroom Aerator 1.0 gpm - Electric | | 661.32 | 641.46 | 391.01 |
| Bathroom Aerator 1.0 gpm - Gas (Rollover) | | 0.00 | 0.00 | 0.00 |
| Kitchen Aerator 1.5 gpm - Electric | | 2,957.49 | 2,882.52 | 2,941.80 |
| Kitchen Aerator 1.5 gpm - Gas (Rollover) | | 0.00 | 0.00 | 0.00 |
| LED Reflector | | 27,606.20 | 29,131.31 | 29,140.36 |
| LED Specialty | | 10,274.62 | 10,842.09 | 10,849.74 |
| LED String | | 868.00 | 867.89 | 867.89 |
| Smart LED | | 96.89 | 71.16 | 1,482.52 |
| Low-flow Showerhead 1.5 gpm - Electric | | 5,016.36 | 4,552.19 | 2,880.89 |
| Low-flow Showerhead 1.5 gpm - Gas (Rollover) | | 0.00 | 0.00 | 0.00 |
| Low-flow Showerhead with ShowerStart 1.5 gpm - Electric | | 2,379.72 | 2,159.56 | 1,515.21 |
| ShowerStart - Electric | | 157.40 | 142.82 | 59.29 |
| Smart Plug | | 496.40 | 0.00 | 0.00 |
| Wi-Fi Thermostat - Electric Cooling and Gas Heating Savings (Rollover) | | 13,953.13 | 11,023.18 | 7,191.32 |
| Wi-Fi Thermostat - Electric Cooling and Gas Heating Savings | | 133,515.72 | 122,069.89 | 123,005.80 |
| Wi-Fi Thermostat - Electric Cooling and Heating Savings | | 6,786.99 | 6,289.59 | 9,288.31 |
| Wi-Fi Thermostat - Electric Cooling Only Savings | | 7,320.42 | 6,692.87 | 6,580.88 |
| Wi-Fi Thermostat - Electric Heating Only Savings | | 50,298.30 | 45,987.75 | 72,824.27 |
| Wi-Fi Thermostat - Gas Heating Only Savings (Rollover) | | 0.00 | 0.00 | 0.00 |
| Home Office Kit - Smart LED | | 13,331.25 | 9,811.80 | 103,026.82 |
| Home Office Kit - Tier 1 APS | | 366,165.00 | 334,784.66 | 157,707.19 |
| Home Office Kit - Desk Lamp | | 37,114.20 | 30,411.38 | 28,269.70 |
| Home Office Kit - Nightlight | | 12,726.90 | 14,792.34 | 91,892.39 |
| Home Office Kit Add-On - LED Reflector | | 125,193.40 | 92,166.92 | 51,794.77 |
| Home Office Kit Add-On - LED Candelabra | | 100,831.49 | 98,884.21 | 46,292.93 |
| Total Savings | 941,926.94 | 941,936.19 | 845,699.29 | 764,906.61 |
| Total Program Realization Rate | | | | 81% |

Note: Totals may not sum properly due to rounding.

[a] *Ex ante* savings in the tracking data do not report savings at the individual measure level for kits, creating rounding errors, therefore only the summary of savings is included.

TABLE 187. 2022 RESIDENTIAL ONLINE MARKETPLACE PROGRAM *EX ANTE* & *EX POST* GROSS PEAK DEMAND REDUCTION

| MEASURE | *EX ANTE*[a] PEAK DEMAND REDUCTION (KW/YR.) | AUDITED GROSS PEAK DEMAND REDUCTION (KW/YR.) | VERIFIED GROSS PEAK DEMAND REDUCTION (KW/YR.) | *EX POST* GROSS PEAK DEMAND REDUCTION (KW/YR.) |
|---|---|---|---|---|
| Advanced Power Strip Tier 1 | | 0.708 | 0.534 | 0.354 |
| Advanced Power Strip Tier 2 | | 1.152 | 0.899 | 0.756 |
| Air Purifier | | 1.365 | 1.365 | 1.092 |
| Bathroom Aerator 1.0 gpm - Electric | | 0.066 | 0.066 | 0.023 |
| Bathroom Aerator 1.0 gpm - Gas (Rollover) | | 0.000 | 0.000 | 0.000 |
| Kitchen Aerator 1.5 gpm - Electric | | 0.136 | 0.132 | 0.095 |
| Kitchen Aerator 1.5 gpm - Gas (Rollover) | | 0.000 | 0.000 | 0.000 |
| LED Reflector | | 3.717 | 3.969 | 4.002 |
| LED Specialty | | 1.396 | 1.477 | 1.563 |
| LED String | | 0.000 | 0.000 | 0.000 |
| Smart LED | | 0.000 | 0.000 | 0.202 |
| Low-flow Showerhead 1.5 gpm - Electric | | 0.272 | 0.251 | 0.065 |
| Low-flow Showerhead 1.5 gpm - Gas (Rollover) | | 0.000 | 0.000 | 0.000 |
| Low-flow Showerhead with ShowerStart 1.5 gpm - Electric | | 0.448 | 0.417 | 0.154 |
| ShowerStart - Electric | | 0.012 | 0.010 | 0.006 |
| Smart Plug | | 0.000 | 0.000 | 0.000 |
| Wi-Fi Thermostat - Electric Cooling and Gas Heating Savings (Rollover) | | 15.853 | 12.504 | 8.158 |
| Wi-Fi Thermostat - Electric Cooling and Gas Heating Savings | | 151.528 | 138.465 | 139.978 |
| Wi-Fi Thermostat - Electric Cooling and Heating Savings | | 1.116 | 1.020 | 1.031 |
| Wi-Fi Thermostat - Electric Cooling Only Savings | | 8.308 | 7.592 | 7.675 |
| Wi-Fi Thermostat - Electric Heating Only Savings | | 0.000 | 0.000 | 0.000 |
| Wi-Fi Thermostat - Gas Heating Only Savings (Rollover) | | 0.000 | 0.000 | 0.000 |
| Home Office Kit - Smart LED | | 0.000 | 0.000 | 14.025 |
| Home Office Kit - Tier 1 APS | | 42.660 | 37.569 | 17.643 |
| Home Office Kit - Desk Lamp | | 0.000 | 0.000 | 11.584 |
| Home Office Kit - Nightlight | | 0.000 | 0.000 | 0.000 |
| Home Office Kit Add-On - LED Reflector | | 17.059 | 12.559 | 7.065 |
| Home Office Kit Add-On - LED Candelabra | | 4.580 | 4.492 | 6.283 |
| Total Savings | 249.836 | 250.376 | 223.320 | 221.753 |
| Total Program Realization Rate | | | | 89% |

Note: Totals may not sum properly due to rounding.

[a] *Ex ante* savings in the tracking data do not report savings at the individual measure level for kits, creating rounding errors, therefore only the summary of savings is included.

TABLE 188. 2022 RESIDENTIAL ONLINE MARKETPLACE PROGRAM *EX ANTE* & *EX POST* GROSS NATURAL GAS ENERGY SAVINGS

| MEASURE | *EX ANTE*[a] NATURAL GAS ENERGY SAVINGS (THERMS/YR.) | AUDITED GROSS NATURAL GAS ENERGY (THERMS/YR.) | VERIFIED GROSS NATURAL GAS ENERGY SAVINGS (THERMS/YR.) | *EX POST* GROSS NATURAL GAS ENERGY SAVINGS (THERMS/YR.) |
|---|---|---|---|---|
| Advanced Power Strip Tier 1 | | 0.00 | 0.00 | 0.00 |
| Advanced Power Strip Tier 2 | | 0.00 | 0.00 | 0.00 |
| Air Purifier | | 0.00 | 0.00 | 0.00 |
| Bathroom Aerator 1.0 gpm - Electric | | 0.00 | 0.00 | 0.00 |
| Bathroom Aerator 1.0 gpm - Gas (Rollover) | | 2.84 | 2.84 | 2.74 |
| Kitchen Aerator 1.5 gpm - Electric | | 0.00 | 0.00 | 0.00 |
| Kitchen Aerator 1.5 gpm - Gas (Rollover) | | 15.12 | 13.69 | 13.02 |
| LED Reflector | | 0.00 | 0.00 | 0.00 |
| LED Specialty | | 0.00 | 0.00 | 0.00 |
| LED String | | 0.00 | 0.00 | 0.00 |
| Smart LED | | 0.00 | 0.00 | 0.00 |
| Low-flow Showerhead 1.5 gpm - Electric | | 0.00 | 0.00 | 0.00 |
| Low-flow Showerhead 1.5 gpm - Gas (Rollover) | | 35.82 | 33.18 | 29.64 |
| Low-flow Showerhead with ShowerStart 1.5 gpm - Electric | | 0.00 | 0.00 | 0.00 |
| ShowerStart - Electric | | 0.00 | 0.00 | 0.00 |
| Smart Plug | | 0.00 | 0.00 | 0.00 |
| Wi-Fi Thermostat - Electric Cooling and Gas Heating Savings (Rollover) | | 9,065.26 | 7,161.56 | 2,303.97 |
| Wi-Fi Thermostat - Electric Cooling and Gas Heating Savings | | 0.00 | 0.00 | 0.00 |
| Wi-Fi Thermostat - Electric Cooling and Heating Savings | | 0.00 | 0.00 | 0.00 |
| Wi-Fi Thermostat - Electric Cooling Only Savings | | 0.00 | 0.00 | 0.00 |
| Wi-Fi Thermostat - Electric Heating Only Savings | | 0.00 | 0.00 | 0.00 |
| Wi-Fi Thermostat - Gas Heating Only Savings (Rollover) | | 1,965.96 | 1,553.11 | 499.66 |
| Home Office Kit - Smart LED | | 0.00 | 0.00 | 0.00 |
| Home Office Kit - Tier 1 APS | | 0.00 | 0.00 | 0.00 |
| Home Office Kit - Desk Lamp | | 0.00 | 0.00 | 0.00 |
| Home Office Kit - Nightlight | | 0.00 | 0.00 | 0.00 |
| Home Office Kit Add-On - LED Reflector | | 0.00 | 0.00 | 0.00 |
| Home Office Kit Add-On - LED Candelabra | | 0.00 | 0.00 | 0.00 |
| Total Savings | 11,085.00 | 11,085.00 | 8,764.39 | 2,849.02 |
| Total Program Realization Rate | | | | 26% |

Note: Totals may not sum properly due to rounding.
[a] *Ex ante* savings in the tracking data do not report savings at the individual measure level for kits, creating rounding errors, therefore only the summary of savings is included.

## GAS SAVINGS GENERATED BY THERMOSTATS

As described above, in January 2022 NIPSCO decided not to claim gas savings for measures through the OLM, due to cost-effectiveness issues. In general, program offerings were limited to electric-only measures for most of the year, except for any "rollover" measures from the prior year. The exception is smart thermostats that were installed by customers with both gas heat and electric and gas service from NIPSCO ("Wi-Fi Thermostat - Electric Cooling and Gas Heating Savings" measures). While these measures do generate therm savings, NIPSCO did not claim them in *ex ante* savings calculations and only claimed electric savings generated by these measures. However, regardless of cost-effectiveness, these measures generated considerable gas savings. The evaluation team estimated these savings as part of the engineering analysis, and a summary of these savings is included in Table 189 below. These are not included in *ex post* reported savings summaries or realization rates.

TABLE 189. *EX POST* GROSS THERMS SAVINGS GENERATED BY THERMOSTATS TO COMBO CUSTOMERS

| MEASURE | *EX POST* GROSS NATURAL GAS ENERGY SAVINGS (THERMS/YR.) |
|---|---|
| Wi-Fi Thermostat - Electric Cooling and Gas Heating Savings Per-Unit Savings | 32.00 |
| Wi-Fi Thermostat - Electric Cooling and Gas Heating Savings Total Savings | 39,104.61 |
| All other OLM gas savings in 2022 (claimed *ex post*) | 2,849.02 |
| **Total *Ex post* Gross Savings, including Combo Thermostats** | **41,953.63** |
| **Gas Realization Rate, including Combo Thermostats** | **378%** |

## *EX POST* NET SAVINGS

The team estimated freeridership and spillover for select measures using survey data collected from 2022 kit and thermostat participants. Table 190 shows the NTG ratios by measure for surveyed measures only.

TABLE 190. 2022 RESIDENTIAL ONLINE MARKETPLACE PROGRAM NET-TO-GROSS RATIOS BY MEASURE (SURVEYED MEASURES)

| MEASURE | RESPONSES (n) | FREERIDERSHIP [a] | PARTICIPANT SPILLOVER | NTG |
|---|---|---|---|---|
| Wi-Fi Thermostats | 64 | 11% | 10% | 99% |
| Home Office/Back to School Kit - Smart LED | 112 | 15% | 10% | 95% |
| Home Office/Back to School Kit - Tier 1 APS | 140 | 11% | 10% | 99% |
| Home Office/Back to School Kit - Desk Lamp | 148 | 8% | 10% | 102% |
| Home Office/Back to School Kit - Nightlight | 156 | 8% | 10% | 102% |
| Home Office/Back to School Kit Add-On - LED Reflector | 43 | 19% | 10% | 91% |
| Home Office/Back to School Kit Add-On - LED Candelabra | 49 | 21% | 10% | 89% |

[a] Freeridership score is an average weighted by verified quantity of measure installed.

2021 Residential Online Marketplace survey results were used for measures surveyed in 2021 but not in 2022. For measures where respondents were not surveyed either program year, including air purifier, smart plug, and ShowerStart, the evaluation team applied the overall program-level NTG ratios, developed from measures with 2021 and 2022 survey respondents, weighted by *ex post* gross population savings. Table 191 shows the NTG ratio by measure for all program measures. Note the spillover estimate for 2022 survey respondents was 10% and the spillover estimate for 2021 survey respondents was 7%.

TABLE 191. 2022 RESIDENTIAL ONLINE MARKETPLACE PROGRAM NET-TO-GROSS RATIOS BY MEASURE

| MEASURE | FREERIDERSHIP | SPILLOVER | NTG | SOURCE |
|---|---|---|---|---|
| Advanced Power Strip Tier 1 | 11% | 10% | 99% | 2022 Residential OLM participant survey |
| Advanced Power Strip Tier 2 | 11% | 10% | 99% | 2022 Residential OLM participant survey |
| Air Purifier | 13% | 10% | 97% [a] | OLM overall electric weighted average parameters |
| Bathroom Aerator 1.0 gpm - Electric | 17% | 7% | 90% | 2021 Residential OLM participant survey |
| Bathroom Aerator 1.0 gpm – Gas (Rollover) | 17% | 7% | 90% | 2021 Residential OLM participant survey |
| Kitchen Aerator 1.5 gpm - Electric | 17% | 7% | 90% | 2021 Residential OLM participant survey |
| Kitchen Aerator 1.5 gpm – Gas (Rollover) | 17% | 7% | 90% | 2021 Residential OLM participant survey |
| LED Reflector | 19% | 10% | 91% | 2022 Residential OLM participant survey |
| LED Specialty | 21% | 10% | 89% | 2022 Residential OLM participant survey |
| LED String | 13% | 10% | 97% [a] | OLM overall electric weighted average parameters |
| Smart LED | 15% | 10% | 95% | 2022 Residential OLM participant survey |
| Low-flow Showerhead 1.5 gpm - Electric | 27% | 7% | 80% | 2021 Residential OLM participant survey |
| Low-flow Showerhead 1.5 gpm – Gas (Rollover) | 27% | 7% | 80% | 2021 Residential OLM participant survey |
| Low-flow Showerhead with ShowerStart 1.5 gpm - Electric | 27% | 7% | 80% | 2021 Residential OLM participant survey |
| ShowerStart Only - Electric | 13% | 10% | 97% [a] | OLM overall electric weighted average parameters |
| Smart Plug | 13% | 10% | 97% [a] | OLM overall electric weighted average parameters |
| Wi-Fi Thermostat - Electric Cooling and Gas Heating Savings (Rollover) | 15% | 7% | 92% | 2021 Residential OLM participant survey |
| Wi-Fi Thermostat - Electric Cooling and Gas Heating Savings | 11% | 10% | 99% | 2022 Residential OLM participant survey |
| Wi-Fi Thermostat - Electric Cooling and Heating Savings | 11% | 10% | 99% | 2022 Residential OLM participant survey |
| Wi-Fi Thermostat - Electric Cooling Only Savings | 11% | 10% | 99% | 2022 Residential OLM participant survey |
| Wi-Fi Thermostat - Electric Heating Only Savings | 11% | 10% | 99% | 2022 Residential OLM participant survey |
| Wi-Fi Thermostat - Gas Heating Only Savings (Rollover) | 15% | 7% | 92% | 2021 Residential OLM participant survey |
| Home Office Kit - Smart LED | 15% | 10% | 95% | 2022 Residential OLM participant survey |
| Home Office Kit - Tier 1 APS | 11% | 10% | 99% | 2022 Residential OLM participant survey |
| Home Office Kit - Desk Lamp | 8% | 10% | 102% | 2022 Residential OLM participant survey |
| Home Office Kit - Nightlight | 8% | 10% | 102% | 2022 Residential OLM participant survey |
| Home Office Kit Add-On - LED Reflector | 19% | 10% | 91% | 2022 Residential OLM participant survey |
| Home Office Kit Add-On - LED Candelabra | 21% | 10% | 89% | 2022 Residential OLM participant survey |

[a] Freeridership score is an average weighted by verified quantity of measure installed.

## FREERIDERSHIP

### INTENTION FREERIDERSHIP

Measure-level *intention* freeridership values for each participant were calculated using the following survey questions:

- **FR1**. If an instant discount from the NIPSCO Online Marketplace had not been available for the kit, would you have purchased a [MEASURE] on your own?
- **FR2.** When would you have purchased the [MEASURE] if the NIPSCO Online Marketplace and instant discount had not been available?

Respondents who gave a response of "No" to FR1 were assigned an *intention* freeridership score of 0%. Those who gave a response of "No, I already have them installed in all locations" were assigned an *intention* freeridership score of 100%. Those who said "Yes" to FR1 were asked FR2 and assigned an *intention* freeridership score based on the timing of their decision (Table 192).

TABLE 192. 2021 RESIDENTIAL ONLINE MARKETPLACE PROGRAM INTENTION FREERIDERSHIP ASSIGNMENT

| FR2. RESPONSE OPTION | ASSIGNED INTENTION FREERIDERSHIP VALUE |
|---|---|
| Around the same time you purchased the kit | 100% |
| Later but within one year | 50% |
| Later but more than one year | 0% |
| Not sure | 25% |

Table 193 shows *intention* freeridership score for each surveyed measure.

TABLE 193. 2022 RESIDENTIAL ONLINE MARKETPLACE PROGRAM INTENTION FREERIDERSHIP BY MEASURE

| MEASURE | INTENTION FREERIDERSHIP SCORE (%) |
|---|---|
| Wi-Fi Thermostats | 18% |
| Home Office/Back to School Kit - Smart LED | 26% |
| Home Office/Back to School Kit - Tier 1 APS | 19% |
| Home Office/Back to School Kit - Desk Lamp | 13% |
| Home Office/Back to School Kit - Nightlight | 13% |
| Home Office/Back to School Kit Add-On - LED Reflector | 33% |
| Home Office/Back to School Kit Add-On - LED Candelabra | 38% |

### INFLUENCE FREERIDERSHIP

The evaluation team assessed *influence* freeridership by asking participants how important the following program elements were in their purchasing decision-making process:

- The NIPSCO instant discount
- Information about energy efficiency that NIPSCO provided
- Previous participation in a NIPSCO energy efficiency program

The evaluation team determined each respondent's *influence* freeridership score for a measure using the maximum rating provided for any program element, as shown in Table 194.

TABLE 194. 2022 RESIDENTIAL ONLINE MARKETPLACE PROGRAM INTENTION FREERIDERSHIP SCORING

| MAXIMUM RATING | INFLUENCE FREERIDERSHIP SCORE (%) |
|---|---|
| 1 - Not at all important | 100% |
| 2 - Not too important | 75% |
| 3 - Somewhat important | 25% |
| 4 - Very important | 0% |
| Don't know | 50% |
| Not applicable | 50% |

Table 195 shows *influence* freeridership score for each surveyed measure.

TABLE 195. 2022 RESIDENTIAL ONLINE MARKETPLACE PROGRAM INFLUENCE FREERIDERSHIP SCORING

| MEASURE | INFLUENCE FREERIDERSHIP SCORE (%) |
|---|---|
| Wi-Fi Thermostats | 4% |
| Home Office/Back to School Kit - Smart LED | 3% |
| Home Office/Back to School Kit - Tier 1 APS | 3% |
| Home Office/Back to School Kit - Desk Lamp | 3% |
| Home Office/Back to School Kit - Nightlight | 3% |
| Home Office/Back to School Kit Add-On - LED Reflector | 5% |
| Home Office/Back to School Kit Add-On - LED Candelabra | 3% |

### FINAL FREERIDERSHIP

The evaluation team calculated the mean of *intention* and the *influence* of freeridership components to estimate final freeridership for each surveyed measure. A higher freeridership score translates to more savings that are deducted from the gross savings estimates. Table 196 lists the intention, influence, and final freeridership scores for the 2022 Residential OLM program.

TABLE 196. 2022 RESIDENTIAL ONLINE MARKETPLACE PROGRAM FREERIDERSHIP SCORE

| MEASURE | INTENTION SCORE | INFLUENCE SCORE | FREERIDERSHIP SCORE |
|---|---|---|---|
| Wi-Fi Thermostats | 18% | 4% | 11% |
| Home Office/Back to School Kit - Smart LED | 26% | 3% | 15% |
| Home Office/Back to School Kit - Tier 1 APS | 19% | 3% | 11% |
| Home Office/Back to School Kit - Desk Lamp | 13% | 3% | 8% |
| Home Office/Back to School Kit - Nightlight | 13% | 3% | 8% |
| Home Office/Back to School Kit Add-On - LED Reflector | 33% | 5% | 19% |
| Home Office/Back to School Kit Add-On - LED Candelabra | 38% | 3% | 21% |

## PARTICIPANT SPILLOVER

The evaluation team estimated participant spillover measure savings using specific information about participants, determined through the evaluation, using 2022 NIPSCO evaluation results and the Illinois TRM v.10 as a baseline reference.[55] The evaluation team estimated the percentage of program participant spillover by dividing the sum of additional spillover savings (as reported by survey respondents) by the total gross savings achieved by all survey respondents. The participant spillover estimates for the Residential OLM program, rounded to the nearest whole percent, can be seen in Table 197.

TABLE 197. 2022 RESIDENTIAL ONLINE MARKETPLACE PROGRAM PARTICIPANT SPILLOVER RESULTS

| MEASURE | SPILLOVER SAVINGS (MMBtu) | PARTICIPANT PROGRAM SAVINGS (MMBtu) | PARTICIPANT SPILLOVER |
|---|---|---|---|
| Total Program | 37.3 | 391.3 [a] | 10% |

[a]Program saving include *ex post* therms savings in MMBtu calculation.

## RESULTING NET SAVINGS

Table 198 presents the resulting net electric savings, demand reduction, and natural gas savings.

TABLE 198. 2022 RESIDENTIAL ONLINE MARKETPLACE PROGRAM *EX POST* NET SAVINGS

| MEASURE | *EX POST* GROSS SAVINGS/REDUCTION | | | NTG | *EX POST* NET SAVINGS/REDUCTION | | |
|---|---|---|---|---|---|---|---|
| | KWH | KW | THERMS | | KWH | KW | THERMS |
| Advanced Power Strip Tier 1 | 3,374.21 | 0.354 | 0.00 | 99% | 3,340.47 | 0.350 | 0.00 |
| Advanced Power Strip Tier 2 | 4,101.84 | 0.756 | 0.00 | 99% | 4,060.82 | 0.748 | 0.00 |
| Air Purifier | 9,427.47 | 1.092 | 0.00 | 97% [a] | 9,153.24 | 1.060 | 0.00 |
| Bathroom Aerator 1.0 gpm - Electric | 391.01 | 0.023 | 0.00 | 90% | 351.91 | 0.021 | 0.00 |
| Bathroom Aerator 1.0 gpm – Gas (Rollover) | 0.00 | 0.000 | 2.74 | 90% | 0.00 | 0.000 | 2.47 |
| Kitchen Aerator 1.5 gpm - Electric | 2,941.80 | 0.095 | 0.00 | 90% | 2,647.62 | 0.086 | 0.00 |
| Kitchen Aerator 1.5 gpm – Gas (Rollover) | 0.00 | 0.000 | 13.02 | 90% | 0.00 | 0.000 | 11.72 |
| LED Reflector | 29,140.36 | 4.002 | 0.00 | 91% | 26,517.73 | 3.642 | 0.00 |
| LED Specialty | 10,849.74 | 1.563 | 0.00 | 89% | 9,656.27 | 1.391 | 0.00 |

[55] Nonparticipant spillover evaluation activities were not conducted for the 2022 program year.

| MEASURE | *EX POST* GROSS SAVINGS/REDUCTION | | | NTG | *EX POST* NET SAVINGS/REDUCTION | | |
|---|---|---|---|---|---|---|---|
| | KWH | KW | THERMS | | KWH | KW | THERMS |
| LED String | 867.89 | 0.000 | 0.00 | 97% [a] | 842.64 | 0.000 | 0.00 |
| Smart LED | 1,482.52 | 0.202 | 0.00 | 95% | 1,408.39 | 0.192 | 0.00 |
| Low-flow Showerhead 1.5 gpm - Electric | 2,880.89 | 0.065 | 0.00 | 80% | 2,304.71 | 0.052 | 0.00 |
| Low-flow Showerhead 1.5 gpm – Gas (Rollover) | 0.00 | 0.000 | 29.64 | 80% | 0.00 | 0.000 | 23.71 |
| Low-flow Showerhead with ShowerStart 1.5 gpm - Electric | 1,515.21 | 0.154 | 0.00 | 80% | 1,212.17 | 0.123 | 0.00 |
| ShowerStart Only - Electric | 59.29 | 0.006 | 0.00 | 97% [a] | 57.57 | 0.006 | 0.00 |
| Smart Plug | 0.00 | 0.000 | 0.00 | 97% [a] | 0.00 | 0.000 | 0.00 |
| Wi-Fi Thermostat - Electric Cooling and Gas Heating Savings (Rollover) | 7,191.32 | 8.158 | 2,303.97 | 92% | 6,616.01 | 7.505 | 2,119.65 |
| Wi-Fi Thermostat - Electric Cooling and Gas Heating Savings | 123,005.80 | 139.978 | 0.00 | 99% | 121,775.75 | 138.578 | 0.00 |
| Wi-Fi Thermostat - Electric Cooling and Heating Savings | 9,288.31 | 1.031 | 0.00 | 99% | 9,195.43 | 1.021 | 0.00 |
| Wi-Fi Thermostat - Electric Cooling Only Savings | 6,580.88 | 7.675 | 0.00 | 99% | 6,515.07 | 7.598 | 0.00 |
| Wi-Fi Thermostat - Electric Heating Only Savings | 72,824.27 | 0.000 | 0.00 | 99% | 72,096.02 | 0.000 | 0.00 |
| Wi-Fi Thermostat - Gas Heating Only Savings (Rollover) | 0.00 | 0.000 | 499.66 | 92% | 0.00 | 0.000 | 459.68 |
| Home Office Kit - Smart LED | 103,026.82 | 14.025 | 0.00 | 95% | 97,875.48 | 13.323 | 0.00 |
| Home Office Kit - Tier 1 APS | 157,707.19 | 17.643 | 0.00 | 99% | 156,130.12 | 17.467 | 0.00 |
| Home Office Kit - Desk Lamp | 28,269.70 | 11.584 | 0.00 | 102% | 28,835.09 | 11.815 | 0.00 |
| Home Office Kit - Nightlight | 91,892.39 | 0.000 | 0.00 | 102% | 93,730.23 | 0.000 | 0.00 |
| Home Office Kit Add-On - LED Reflector | 51,794.77 | 7.065 | 0.00 | 91% | 47,133.24 | 6.429 | 0.00 |
| Home Office Kit Add-On - LED Candelabra | 46,292.93 | 6.283 | 0.00 | 89% | 41,200.71 | 5.592 | 0.00 |
| Total Savings | 764,906.61 | 221.753 | 2,849.02 | | 742,656.70 | 217.000 | 2,617.23 |

Note: Totals may not sum properly due to rounding.
[a] No surveys completed in 2022 or 2021. The evaluation team applied the program-level electric energy savings NTG ratio of 97%.

Table 199 shows the NTG results by fuel type.

TABLE 199. 2022 RESIDENTIAL ONLINE MARKETPLACE NET-TO-GROSS RESULTS BY FUEL TYPE

| SAVINGS TYPE | *EX ANTE* GROSS SAVINGS | *EX POST* GROSS SAVINGS | NTG RATIO (%) | *EX POST* NET SAVINGS |
|---|---|---|---|---|
| Electric Energy Savings (kWh/yr.) | 941,926.94 | 764,906.61 | 97% | 742,656.70 |
| Peak Demand Reduction (kW) | 249.836 | 221.753 | 98% | 217.000 |
| Natural Gas Energy Savings (therms/yr.) | 11,085.00 | 2,849.02 | 92% | 2,617.23 |

# PROCESS EVALUATION

The evaluation team conducted quantitative research activities to answer the following key research questions for the program:

- How do participants learn about the program?
- What motivates participants to use the marketplace instead of another retailer?
- How easy is the marketplace to use?
- Are participants satisfied with the variety and quality of the products in the marketplace?
- For those who didn't install the products, why didn't they install them?
- What is participants' satisfaction with the program and NIPSCO overall?

To answer these research questions, the evaluation team completed a mixed-mode telephone and web survey of program participants (n=285) to understand families' experiences with the materials and kits, satisfaction with the program, and to inform impacts inputs.

ILLUME sampled measures from the online marketplace with sufficient participation in the tracking data to allow the team to receive sufficient responses to calculate install rates and net-to-gross for these measures. In the tracking data through November 2022, the ILLUME team observed sufficient sample for the following measures:

- Home Office kits (referred to as Home Office/Halloween kits in the survey)
- Three-packs of LED candelabra and reflector bulbs distributed with the kits, and
- Wi-Fi thermostats

## PARTICIPANT FEEDBACK

The evaluation team surveyed 285 customers who participated in the program. The following sections describe the results related to program awareness, reasons for participation, experience with the OLM, satisfaction with the program, and program impacts on customers. The following is a summary of survey respondents, per kit or product they received:

- Over three quarters (77%) of respondents received a Home Office kit (n=219)
- Customers who received Wi-Fi thermostats made up 25% of respondents (n=70)

Out of the respondents who received the Home Office kit (n=219):

- 79 of them (36%) also received the 65W BR30 LED three-pack add-on
- 71 of them (32%) also received the 40W candelabra LED three-pack add-on
- 65 of them (30%) did not receive an add-on

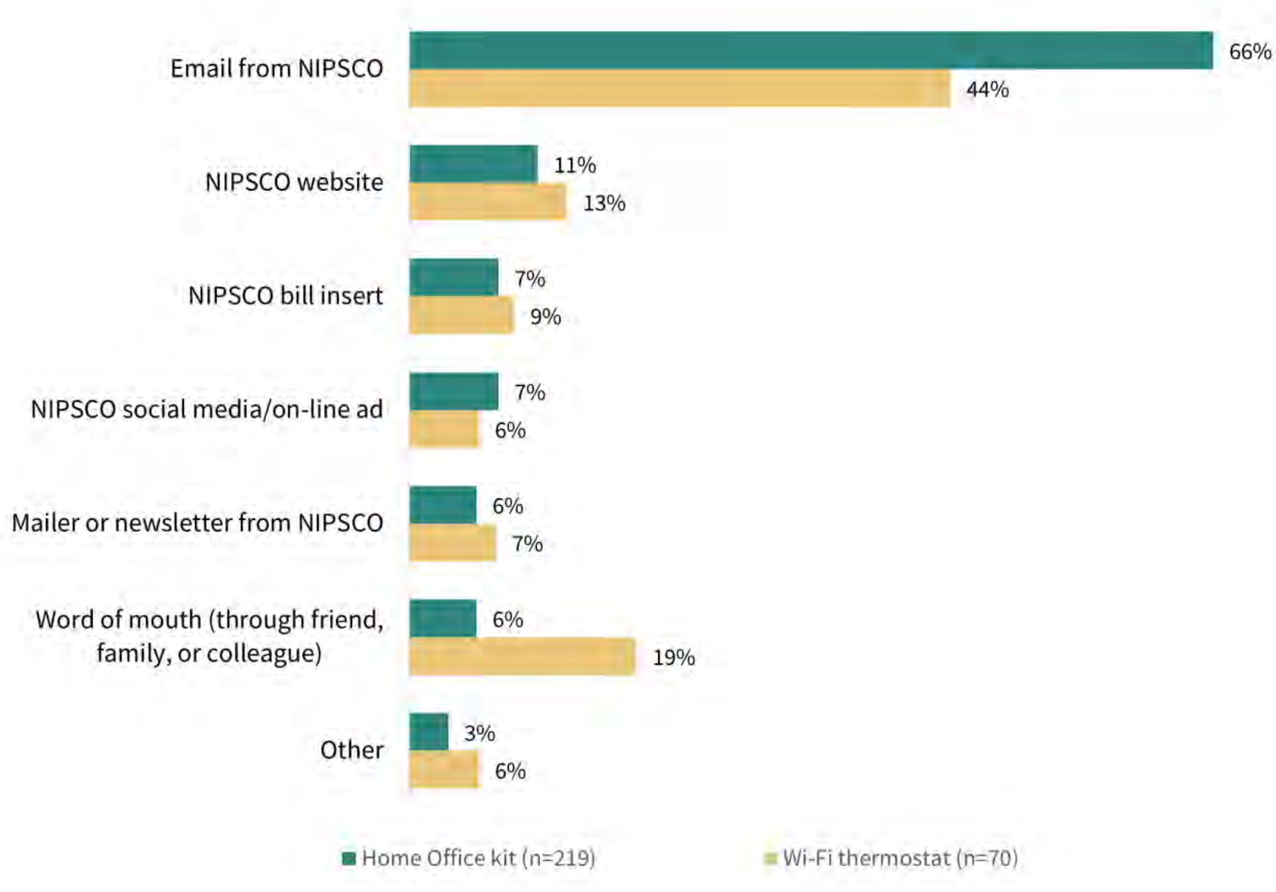
Additionally, there were four survey respondents (~2%) who received a Home Office kit as well as a smart thermostat as a second measure.

## PROGRAM AWARENESS AND MARKETING

The evaluation team asked all respondents how they became aware of the NIPSCO Online Marketplace. Emails from NIPSCO were the leading source of awareness for respondents who received the Home Office kit (66% of Home Office kit recipients learned about the Online Marketplace through email) and Wi-Fi thermostats (44% learned about the Online Marketplace through emails). Furthermore, ~19% of thermostat respondents heard about Online Marketplace via word of mouth (through friends, family, or colleagues). The website was the third most common source of information, with 11% of Home Office kit and 13% of thermostat respondents learning about the program through this channel.

Fewer than 10% of respondents for any measure type reported learning about the Marketplace from NIPSCO bill inserts, social media/online ads, or NIPSCO mailers or newsletters (Figure 73). Less than 1% of respondents reported hearing about the Online Marketplace through the following sources: television advertisements, a contractor, an insert mailed with a rebate check from another NIPSCO program, radio advertisements, or a retailer/vendor.

FIGURE 73. OVERALL PROGRAM AWARENESS (N=309) [a,b]




Source: Participant Survey. Question: "How did you learn about the NIPSCO Online Marketplace?"

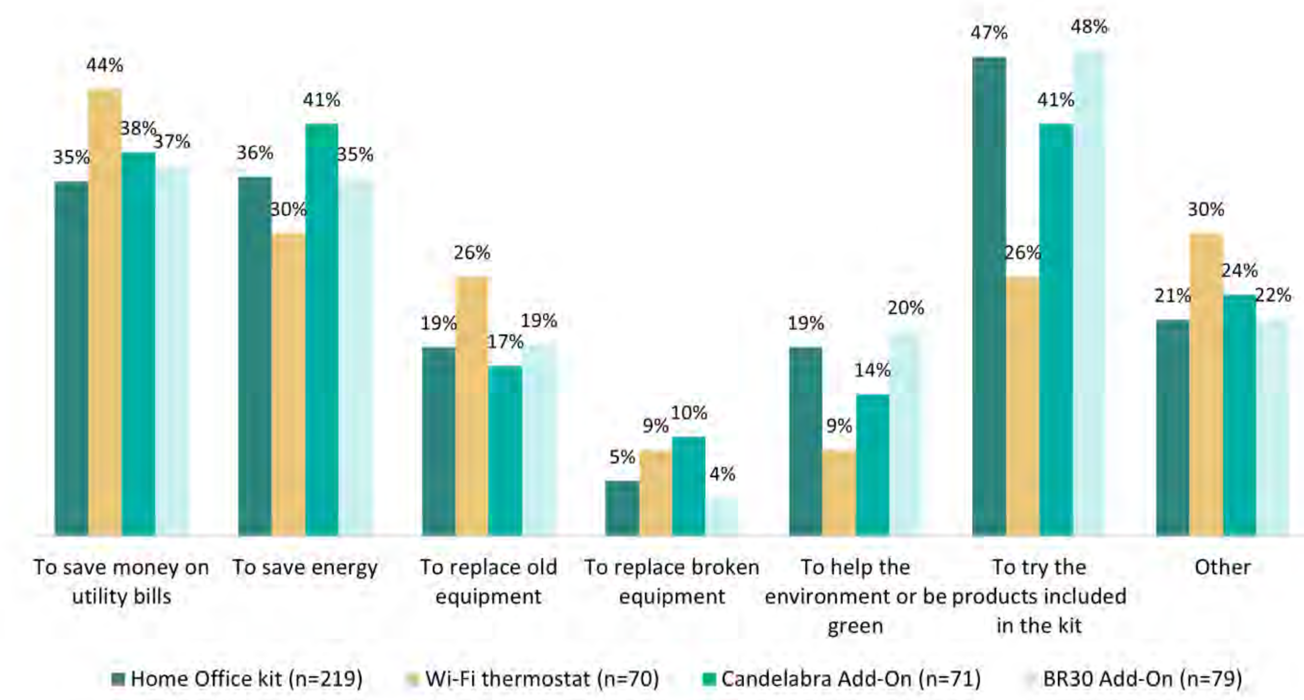
[a] This was a multiple response question (n=309). Less than 1% of respondents reported hearing about the Online Marketplace through the following sources: television advertisements, a contractor, an insert mailed with a rebate check from another NIPSCO program, radio advertisements, or a retailer/vendor.

[b] Four survey respondents received both a kit and a thermostat and therefore are included in both analysis groups. The Home Office and Wi-Fi thermostat groups are therefore not mutually exclusive.

## PARTICIPATION DRIVERS

To understand the motivations behind the purchase of Online Marketplace products, the evaluation team asked respondents why they ordered the different products and kits. As shown in Figure 74, respondents who ordered the Home Office kit most often said they ordered these items to try the products (47%) or to save money on utility bills (35%). Similarly, those who received the add-on three-packs mostly did so to try the products included in the kit (48% for the BR30 reflector add-on, and 41% for the candelabra add-on). Most respondents who received smart thermostats did so to save money on their utility bills (44%).

FIGURE 74. MOTIVATIONS TO ORDER ONLINE MARKETPLACE PRODUCTS BY MEASURE [a,b]




Source: Participant Survey. Question: "Why did you decide to receive the [Home Office kit, Wi-Fi thermostat, Add-on LED 3-pack] from the Marketplace at the time you did?"

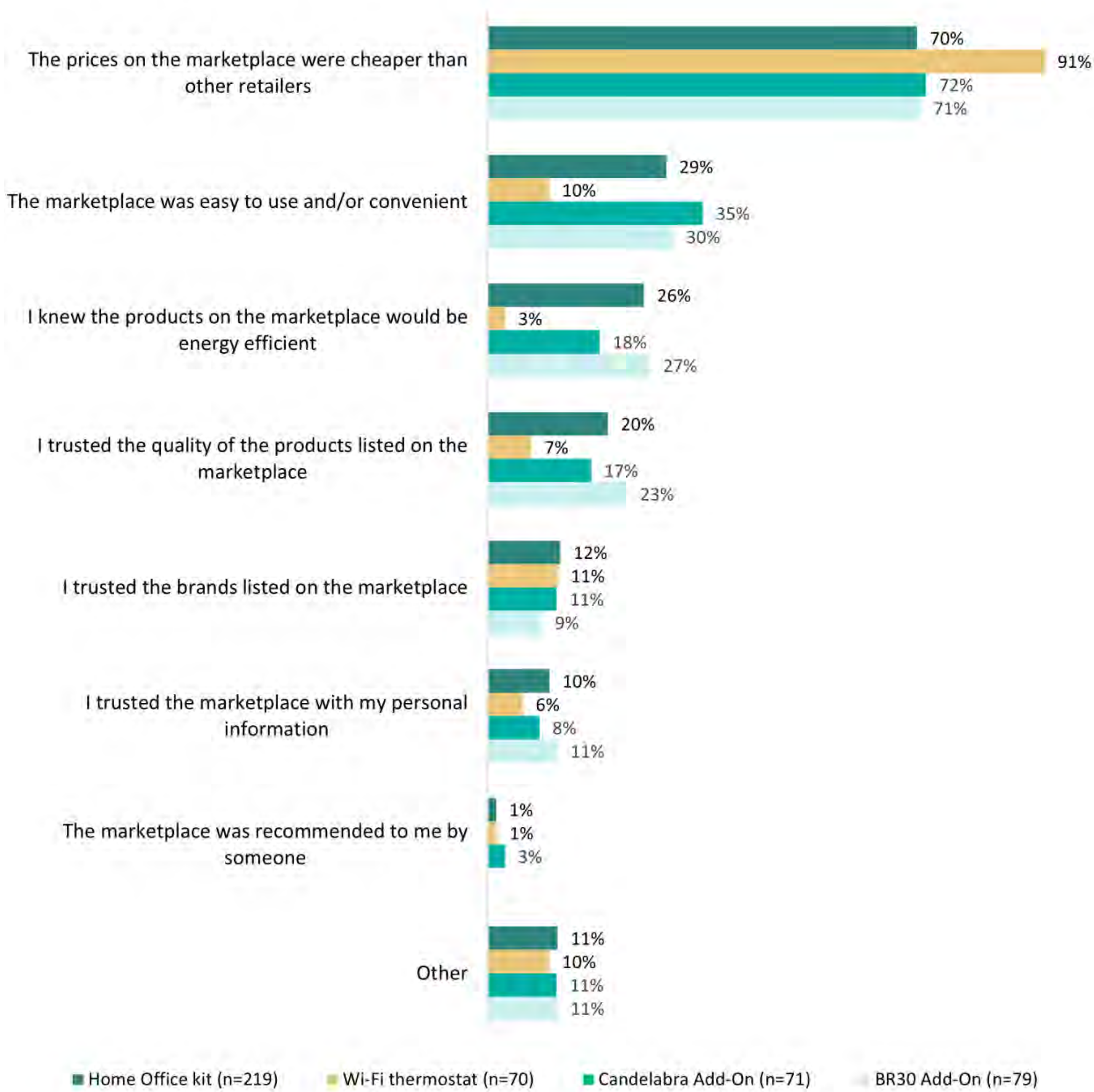
[a] This was a multiple response question (n=285). The Home Office kit respondents were shown the response option "to try the products included in the kit," the LED 3-pack respondents were shown the option "to try the new LED products", and Wi-Fi thermostat recipients were shown the response option "to try the new thermostat products."

[b] Respondents answered the question for up to two measures received from the Marketplace.

Respondents who purchased their items from the Marketplace were asked why they decided to buy the products from the NIPSCO Online Marketplace, as opposed to another retailer. The majority of thermostat (91%) and Home Office kit respondents (70%) expressed that they bought their products from the NIPSCO Marketplace because the prices on the marketplace were cheaper than other retailers (Figure 75). Similarly, most respondents who received add-on LED 3-packs also expressed that they received the add-ons because the prices were cheaper (72% for the candelabra add-on and 71% for the BR30 reflector add-on).

About a third of customers who received the Home Office kits and the add-on LED three-packs indicated that the Marketplace was easy to use/and or convenient, and about a quarter of these respondents reported that that they knew the products purchased on the Online Marketplace would be energy efficient. The least common motivation was that the Marketplace was recommended to the respondent by someone else, at 3% or less between all measures.

FIGURE 75. MOTIVATIONS TO PURCHASE ONLINE MARKETPLACE PRODUCTS BY MEASURE (N=285) [a,b]



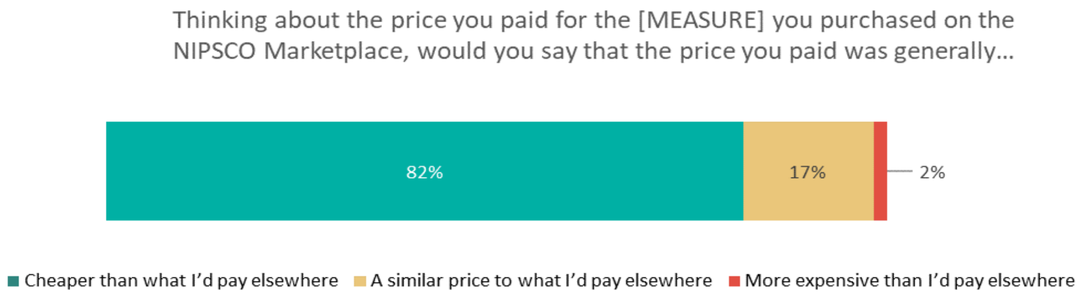

Source: Participant Survey. Question: "Why did you decide to buy the [Home Office kit, Wi-Fi thermostat, Add-on LED 3-pack] from the NIPSCO Marketplace?"

[a] This was a multiple response question.

[b] Respondents answered the question for up to two measures received from the marketplace.

The respondents who did not cite cheaper prices as a motivation to purchase from the NIPSCO Online Marketplace (n=114) were asked about the prices they paid for their measures on the Marketplace, compared to other retailers (Figure 76). Almost all these respondents (82%) expressed that the prices they paid for their products were cheaper on the NIPSCO Online Marketplace than elsewhere.

FIGURE 76. PERCEPTIONS OF MARKETPLACE PRICES VERSUS RETAILERS (N=285)




Most respondents who received the Home Office kits (88%) said that they would use the NIPSCO Online Marketplace again in the future to purchase the products received. Responses were similar for the add-on 3-packs, with 87% saying they would purchase these products from the Online Marketplace over other retailers for the LED candelabra add-on and 86% for the LED reflector add-on. Eighty-one percent of customers who received a smart thermostat said they would use the NIPSCO Online Marketplace to purchase the thermostat again.

Other retailers that respondents would use instead include Menards (n=2), Amazon (n=2), and Home Depot (n=1).

## PROGRAM AND MEASURE EXPERIENCE

The evaluation team asked all respondents (n=285) to provide feedback on their experience with the Marketplace. The following is a snapshot of themes related to their Marketplace experience:

- Almost all respondents (97%) were somewhat or very satisfied with the variety of products available through the Marketplace.
- Eighty-three percent of respondents found the NIPSCO Marketplace very easy to use.
- Over 80% of respondents had no suggestions to improve the Marketplace.

Responses from participants with suggestions on how to improve the Marketplace are summarized in the Suggestions for Improvement section below.

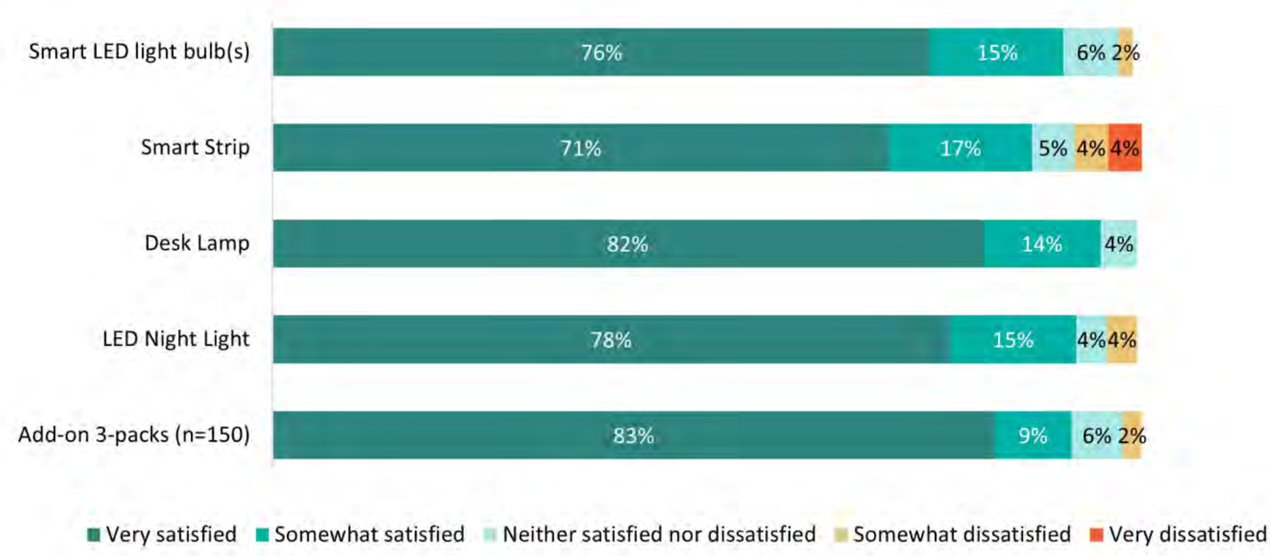
## SATISFACTION WITH MEASURES, PROGRAM, AND NIPSCO

### MEASURE SATISFACTION

#### Home Office kit

Two hundred and nineteen respondents received the Home Office kit. Customers who received the Home Office kit were satisfied with the products provided. The add-on LED 3-packs and desk lamps had the highest satisfaction ratings (FIGURE 77).

FIGURE 77. SATISFACTION WITH THE HOME OFFICE KIT PRODUCTS (N=219)




Source: Participant Survey. Question: "How satisfied are you with the…?"

Customers who were less than satisfied with their Home Office kit products gave several reasons. These are summarized here by kit measure:

- Respondents who were less than satisfied with the smart LED lightbulbs had difficulty with the app used to control the LED bulbs (n=4), said the equipment didn't work properly (n=3), or haven't used the product yet (n=3)
- Most respondents who were dissatisfied with the smart strip found it difficult to use (n=9), or the smart strip did not work properly for them (n=5)
- Half of the respondents (n=4) who were neutral or dissatisfied with their desk lamps had not tried the product yet
- The most common reason for dissatisfaction with the LED night light was that the LED was not bright enough (n=10)

Common reasons that respondents were less than satisfied with their add-on LED light bulbs were, the LED did not fit their structures (n=3) or there was a delay in the light coming on (n=2). Some respondents who gave a neutral rating of satisfaction did so because they had not installed the light bulbs yet (n=2).

## Thermostat

Seventy respondents purchased a Wi-Fi thermostat from the Marketplace. Of these, 64 installed their thermostats. For those who did not install their thermostats (n=6), four respondents said they would install their thermostats in the future. One respondent said they would not install the thermostat in the future, and one said, "Don't Know." The customers who did not install their thermostats cited that the thermostat did not fit (n=1) or they did not like the appearance of the thermostat (n=1). Customers who purchased thermostats were generally satisfied with their purchase, with 80% of respondents stating that they were "very satisfied" with the product (Figure 78).

FIGURE 78. SATISFACTION WITH THE THERMOSTAT PRODUCTS (N=70)


Source: Participant Survey. Question: "How satisfied are you with the thermostat products you purchased from the Marketplace overall?"

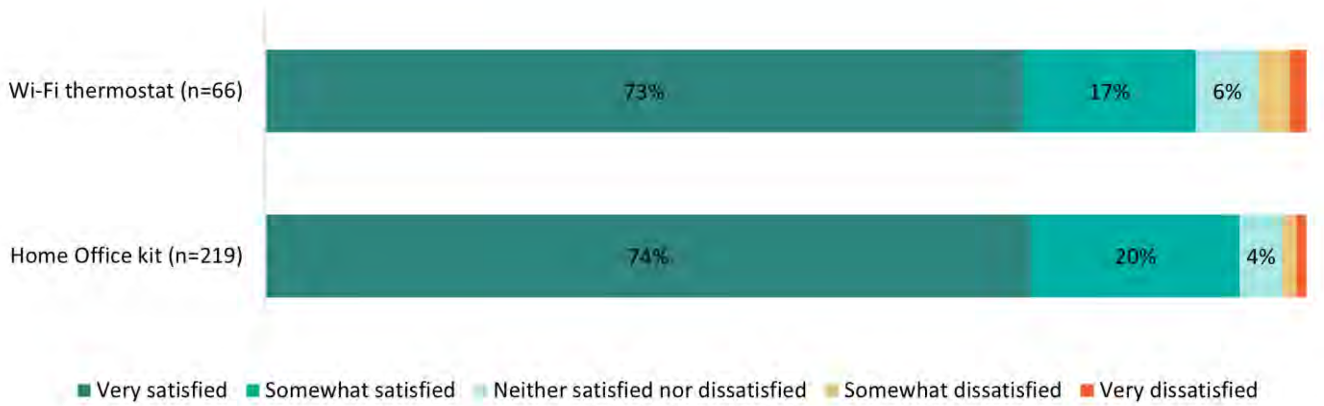
If respondents were less than satisfied with their thermostat, they were asked the open-ended question, *"You gave a less than satisfied rating for the thermostat products. Why was that?"* Respondents who were dissatisfied with their thermostat products (n=4) cited several reasons for their dissatisfaction: the product didn't work the way they thought (n=2), it was expensive (n=1), or they had not tried it yet (n=1). One person responded, "Don't Know."

## MARKETPLACE SATISFACTION

Nearly three quarters of respondents (73%) were very satisfied with the NIPSCO Online Marketplace overall. The distribution of respondents who were "very satisfied" to "very dissatisfied" was similar between those who received thermostats and Home Office kits.

This follows a similar trend to respondent satisfaction with the Marketplace products: on average, 78% of respondents provided "Very Satisfied" ratings for Home Office kit items, and 80% of respondents were "Very Satisfied" with thermostats. Less than 6% of respondents were somewhat or very dissatisfied with the Marketplace, regardless of the measure received (Figure 79).

FIGURE 79. SATISFACTION WITH THE RESIDENTIAL ONLINE MARKETPLACE (N=285)




Source: Participant Survey. Question: How satisfied are you with the NIPSCO Online Marketplace overall?

Respondents who were less than satisfied with the Marketplace (n=15) had several common themes. Some respondents (n=4) explained that the equipment they received did not work or fit, with one respondent saying, *"Not all the equipment works."* Other respondents (n=4) expressed a desire for greater product variety or amount *("Maybe it could use more items and variety.").* There were also respondents who expressed a neutral opinion (n=4).

One respondent said, *"I don't think it's bad. I just never use it unless there is a promotion going on."* Three responses to this question were considered "Other" responses.

### SATISFACTION WITH NIPSCO

The evaluation team also asked respondents about their satisfaction with NIPSCO as their energy service provider (Figure 8). Almost 80% of respondents were either somewhat or very satisfied with NIPSCO overall as their energy service provider.

Customers who were neutral or expressed dissatisfaction with NIPSCO (n=49) were asked why they felt that way. Reasons for neutral and dissatisfied ratings included:

- Rates are increasing (n=18)
- Rates are currently too high (n=7)
- Customers have no choice in their utility (n=7)
- Poor service/reliability issues (related to outages) (n=5)
- Poor customer service (n=3), or
- Other, specific issues

### SUGGESTIONS FOR IMPROVEMENT

Several respondents had suggestions to improve the Marketplace (n=45). The most common suggestion (36%) was a desire for more options or a wider variety of products available on the Online Marketplace, such as other energy efficiency items. These themes are described in more detail in Table 200.

TABLE 200. SUGGESTIONS TO IMPROVE THE MARKETPLACE

| THEME | FREQUENCY | PERCENT | REPRESENTATIVE QUOTE |
|---|---|---|---|
| More options/variety in products on the Marketplace | 16 | 36% | *"I would like to see more energy efficient items to be available."* |
| More product quantity | 8 | 18% | *"Being able to get more than one of the products."* |
| More communication about the Marketplace/offers | 6 | 13% | *"They need to market it so people can know about it not a lot of people know it existed"* |
| More frequent offerings | 5 | 11% | *"Continue to make similar offers occasionally."* |
| Issues with the equipment | 3 | 7% | *"Vet your products better. My outlet bar is already not working."* |
| Issues with shipping | 3 | 7% | *"Faster shipping"* |
| Other | 4 | 9% | |
| TOTAL | 45 | 100% | |

## PARTICIPANT SURVEY DEMOGRAPHICS

Over half of respondents (54%) reported incomes under $75,000 from all sources (Table 201).

TABLE 201. ANNUAL HOUSEHOLD INCOME OF SURVEYED ONLINE MARKETPLACE PARTICIPANTS.

| ANNUAL HOUSEHOLD INCOME FROM ALL SOURCES | COUNT | PERCENT |
|---|---|---|
| Under $25,000 | 18 | 7% |
| $25,000 to under $35,000 | 17 | 7% |
| $35,000 to under $50,000 | 37 | 15% |
| $50,000 to under $75,000 | 62 | 25% |
| $75,000 to under $100,000 | 46 | 18% |
| $100,000 to under $150,000 | 43 | 17% |
| Over $150,000 | 30 | 12% |
| **TOTAL** | **253** | **100%** |

Most respondents (83%) live in a single-family home and almost 90% own their home. Respondents' homes varied in age. Twenty percent of respondents had homes built recently (2005 or later), and 20% of respondents had homes built between 1940 and 1959. Similarly, 18% of respondents had homes built between 1960 and 1979. Most respondents use a furnace to heat their homes (83%) and central air conditioning (87%) to cool their homes (Table 202).

TABLE 202. HOME CHARACTERISTICS OF SURVEYED ONLINE MARKETPLACE PARTICIPANTS.

| HOME CHARACTERISTICS | COUNT | PERCENT |
|---|---|---|
| **Type of residence** | | |
| Single-family detached home | 233 | 83% |
| Multifamily apartment or condo building (with 4 or more units) | 17 | 6% |
| Attached house (townhouse, row house, or twin) | 24 | 9% |
| Mobile or manufactured home | 7 | 2% |
| **TOTAL** | **281** | **100%** |
| **Ownership of residence** | | |
| Own | 246 | 89% |
| Rent | 31 | 11% |
| **TOTAL** | **277** | **100%** |
| **Primary equipment used to heat the home*** | | |
| Central boiler | 14 | 5% |
| Furnace | 252 | 83% |
| Baseboard Heater(s) | 6 | 2% |
| Air Source Heat Pump | 7 | 2% |
| Ductless Mini-Split Heat Pump | 3 | 1% |
| Electric Wall Heater(s) | 10 | 3% |
| Gas/propane | 4 | 1% |
| Space Heater | 2 | 1% |
| Other | 4 | 1% |
| **TOTAL** | **302** | **100%** |
| **Primary cooling system in the home*** | | |
| Central air conditioner | 251 | 87% |
| Air source heat pump | 6 | 2% |
| Room or window air conditioners | 28 | 10% |
| Ductless mini-split air conditioner or heat pump | 2 | 1% |
| Evaporative cooler, or swamp cooler | 1 | 0.3% |
| Other (please specify) | 1 | 0.3% |

| HOME CHARACTERISTICS | COUNT | PERCENT |
|---|---|---|
| None (no cooling system or fans only) | 1 | 0.3% |
| **TOTAL** | **290** | **100%** |
| **Year home was built** | | |
| Before 1900 | 8 | 3% |
| 1900 to 1939 | 31 | 12% |
| 1940 to 1959 | 54 | 20% |
| 1960 to 1979 | 48 | 18% |
| 1980 to 1989 | 18 | 7% |
| 1990 to 1999 | 36 | 14% |
| 2000 to 2004 | 19 | 7% |
| 2005 or later | 52 | 20% |
| **TOTAL** | **266** | **100%** |

Note: Categories with a * indicate questions where multiple responses were permitted (e.g., "Select all that apply."). For this reason, the number of responses may be greater than the number of respondents (n=285).

# CONCLUSIONS AND RECOMMENDATIONS

### CONCLUSION 1: IN-SITU BASELINES AND ISRS CALCULATED FROM THE 2022 NIPSCO RESIDENTIAL OLM SURVEY OVERALL REDUCED EX POST LED KIT SAVINGS.

With the *ex post* gross savings impact evaluation, the evaluation team found that the primary contributing factor to lower savings were the in-situ baseline wattages and ISRs calculated from the 2022 NIPSCO Residential OLM survey and applied to all kit LEDs. *Ex ante* savings were calculated using the UMP protocol. While contributing to lower savings for LEDs, in-situ baselines are a more accurate representation of NIPSCO customer savings because they are based on customer-specific information. Calculating in-situ wattages also led the evaluation team to evaluate smart LEDs as normal LEDs, since a baseline wattage was available (the Illinois TRM v8.0, used for *ex ante*, assumes an LED baseline for smart LEDs), which attributed much higher savings for smart LEDs. *Ex ante* savings used a 100% ISR for add-on LED candelabras and reflectors and a 98% ISR for smart LEDS. Survey participants reported a 69% installation rate for candelabras and a 60% installation rate for reflectors. 72% of the smart LEDs in the kits were installed.

Recommendations:

- For the 2023 program year, continue to follow *ex post* baseline calculations implemented in 2022 for kit LEDs incentivized from January 2023 through the end of June 2023. Consider applying lower ISRs, consistent with survey results.

### CONCLUSION 2: THE EXPANDED DEFINITION OF GENERAL SERVICE LAMPS IN THE BACKSTOP LEGISLATION WILL SIGNIFICANTLY REDUCE RESIDENTIAL LIGHTING SAVINGS GOING FORWARD.

On April 26, 2022, the U.S. Department of Energy (DOE) issued an enforcement notice that imposes the lighting backstop, a date by which certain general service lamps (GSLs) will no longer be legally manufactured or imported into the United States. This backstop expands to all screw-based lighting, including specialty and reflector lamps currently offered through Indiana utility programs.[56] This backstop will functionally eliminate screw-in incandescent and halogen lamps from the market, likely in the first half of 2023, raising the efficiency baseline for available lighting in the market.

Recommendations:

- For the 2023 program year, continue to follow *ex post* baseline calculations implemented in 2022 for LEDs incentivized from January 2023 through the end of June 2023. Discontinue buy downs of all EISA-impacted lamp types in mid-2023.

[56] U.S. Department of Energy. April 26, 2022. *Enforcement Policy Statement—General Service Lamps*: https://www.energy.gov/sites/default/files/2022-04/GSL_EnforcementPolicy_4_25_22.pdf

### CONCLUSION 3: REALIZATION RATES FOR WI-FI THERMOSTATS WERE LOWER DUE TO THE *EX POST* ALGORITHM USING HEATING AND COOLING ENERGY SAVINGS FRACTIONS FROM THE 2020 BILLING ANALYSIS.

The inputs used from the 2020 billing analysis include 8.3% for the cooling energy savings fraction and 5.4% for the heating energy savings fraction, which are lower than the inputs used in the *ex ante.* For gas savings, a deemed value of 35 therms was used from the billing analysis.

The in-service rate for thermostats in 2022 was 91%, up from 79% in 2021.

Recommendations:

- Inputs and deemed savings values from the 2020 billing analysis should be applied to all Wi-Fi thermostats.
- Continue to monitor thermostat in-service rate to ensure thermostats are being installed and customers are satisfied with their thermostat purchase and operation.
- Consider prioritizing a re-evaluation of the thermostat billing analysis within the EE Rebates program in the next two years, to update savings inputs.

### CONCLUSION 4: THE SMART PLUG MEASURE HAD VERY LOW PARTICIPATION AND WAS GRANTED ZERO *EX POST* SAVINGS BECAUSE VALID SOURCES OF SAVINGS COULD NOT BE IDENTIFIED.

The evaluation team could not identify sources to validate the assumptions used to claim savings for this measure. *Ex ante* savings referenced a manufacturer's website. However, the evaluation team was not able to validate the assumptions on the manufacturer website, such as plug load or hours of use, using a TRM or participant survey data. Given this, zero *ex post* savings were granted for the measure. The elimination of savings had a greater impact on 2022 savings because 34 smart plugs were sold through the online marketplace, as opposed to one smart plug sold in 2021. The overall impact of removing these savings was still relatively small in 2022. However, NIPSCO should exercise caution in widespread distribution of smart plugs until savings are substantiated.

Recommendations:

- NIPSCO should exercise caution in widespread distribution of smart plugs unless documented savings can be substantiated. Savings could be substantiated if the measure is added to a TRM or another defensible source.

### CONCLUSION 5: IN THE TRACKING DATA FOR KIT LEDS, THERE WAS NO INDICATION OF THE CUSTOMERS' HEATING FUEL TYPE, MEANING THE EVALUATION TEAM HAD TO MAKE ASSUMPTIONS WITH REGARDS TO ASSIGNING THERM PENALTIES FOR LED MEASURES.

Within the tracking data for this program, there is a lack of clarity on customer fuel types which impacts the evaluation team's ability to correctly assign savings. The field "energy.type" does not consistently identify the customer's actual fuel service from NIPSCO. Because the OLM required a NIPSCO electric account number for eligibility, "energy.type" was always electric, even though customers who receive both electric and gas service can also participate in the program. The field "material.description" describes the measure, and for certain measures like stand-alone LEDS, specifies fuel service as well.

However, for the smart LEDs, desk lamps and night lights in the Home Office kits, as well as all the LED add-on measures, there was no heating fuel designation in the measure name. *Ex ante* therm penalties were also not applied for these measures, although they were applied for the lighting measures where the fuel service was specified in the field "material description." Since therm penalties were not included in the scorecard in 2022, the evaluation team set these savings to zero during the audited savings step. The evaluation team made the conservative assumption that all kit customers were dual fuel customers and therefore assigned therm penalties for all LED kit measures.

Recommendations:

- Create a separate field in the tracking data that documents whether customers receive electric, gas or combo service from NIPSCO, so savings can be accurately assigned. This will allow the evaluation team to more accurately provide QA/QC and assign accurate savings to customers. This should be done consistently across all NIPSCO program tracking datasets.
- Water heating fuel and home heating fuel are both required inputs during the OLM check-out process. Since this information is collected for every customer, include it for every measure in the tracking data.
- Include a separate column in the tracking data to report therm penalties and consistently apply these for all lighting measures installed in natural gas heated homes.

### CONCLUSION 6: THERE WERE SEVERAL INACCURACIES IN THE TRACKING DATA WHICH THE EVALUATION TEAM EITHER CORRECTED OR HAD TO CREATE WORK-AROUNDS TO CONDUCT OUR ANALYSES.

One major tracking data error was that all the add-on kit LED lighting three-packs of candelabras and reflectors were assigned a measure code of "thermostat." As a minor issue, the evaluation team found at least four zip codes that were not accurate in the tracking data, through the process of zip code look-up for closest Indiana cities. Two of the zip codes provided were in central Michigan. For these four instances, the team manually looked up street addresses and overwrote the correct zip codes into the impact workbooks.

Recommendations:

- Conduct periodic quality checks of the data reporting throughout the program year and make corrections when areas for improvement are identified.

### CONCLUSION 7: EMAILS FROM NIPSCO WERE THE LEADING SOURCES OF AWARENESS FOR THE MEASURES PURCHASED AT THE HIGHEST RATES THROUGH THE PROGRAM.

During 2022, NIPSCO promoted the Home Office kits as a limited time offer (LTO). Sixty-six percent of respondents who received Home Office kits learned about the NIPSCO Online Marketplace through emails from NIPSCO. Similarly, 44% of respondents who received thermostats learned about the NIPSCO Online Marketplace through emails from NIPSCO, and ~19% of thermostat respondents heard about NIPSCO OLM via word of mouth (through friends, family, or colleagues).

Customers also want to see more communication about the Marketplace. One respondent said, *"I wish I was reminded that the Marketplace was there for me. It needs to be more advertised."* Additionally, respondents said that more frequent offers on the Marketplace, like the kit bundles, would be a way to improve the Marketplace (e.g., respondents said *"Have [packages] like this more often"* and *"I would like to see more bundles of products"*).

Recommendations:

- Continue to promote the Marketplace through email, as it is the strongest channel for Marketplace participation. Emphasize how Marketplace prices may be cheaper than other retailers, as this was a commonly cited motivator for participants to purchase Marketplace products. Convenience and knowing products were energy efficient were two other benefits commonly highlighted by respondents.
- Consider sending re-engagement emails to respondents who have already purchased marketplace products, reminding them of limited time offers.

## CONCLUSION 8: RESPONDENTS CONTINUE TO BE SATISFIED WITH THE MARKETPLACE OVERALL AND PROVIDED POSITIVE FEEDBACK ON THEIR EXPERIENCE.

In 2021, over 90% of respondents indicated they were "Satisfied" or "Very Satisfied" with the Marketplace overall, and no respondents provided dissatisfied ratings. In 2022, customers were similarly satisfied with their purchases. Ninety percent of respondents who received thermostats were "Satisfied" or "Very Satisfied," and 94% of Home Office kit recipients were "Satisfied" or "Very Satisfied."

## CONCLUSION 9: RESPONDENTS NEED MORE INSTRUCTIONS FOR THE KIT MEASURES.

The Home Office kit measures with the lowest install rates were the Smart LED light bulbs and the Tier 1 APS (smart strip). When asked why they were less than satisfied, respondents indicated that the smart LED light bulbs and smart strip were difficult or confusing to use. For example, four respondents wrote in that they had difficulties connecting their LED light bulbs with the app. Nine respondents said the smart strip was difficult to use, with one respondent saying, *"confusing, won't work properly only certain outlets work with no manual."*

Recommendations:

- Include instructional materials on these measures in the kits. The Marketplace website currently has instructional "resources" at the bottom of the product page (e.g., the Tier 1 TrickleStar 7-outlet Tier 1 Advanced Power Strip page has links to instructional videos and installation PDFs). We recommend that these instructions (in the case of PDF documents) should be included in the kit for customer reference. Alternatively, NIPSCO could include a QR code in the kit, linking respondents to the relevant PDFs and videos on the website.

# 14. COMMERCIAL AND INDUSTRIAL (C&I) PROGRAMS

## PROGRAM DESIGN AND DELIVERY

Through the Commercial and Industrial (C&I) programs, NIPSCO offers incentives for nonresidential customers who install energy efficiency measures in new and existing facilities. The program implementer, TRC, oversees program management, delivery, and marketing to customers and contractors. Contractors are instrumental in identifying energy-saving opportunities and promoting the programs to customers. NIPSCO's major account managers also assist with implementation efforts through direct support and program assistance to customers within the service territory. The following programs are offered to nonresidential customers.

**Prescriptive program.** The Prescriptive program offers a set rebate for one-for-one replacements of dozens of measures including efficient lighting; pumps and drives; and heating, cooling, and refrigeration equipment.

**Custom program.** The Custom program offers incentives for nonprescriptive projects that involve more complex technologies or equipment changes than are covered in the one-for-one replacement offers available through the Prescriptive program. Custom incentives are based on a project's estimated electric or natural gas energy savings.

**New Construction program.** The New Construction program provides financial incentives to C&I new construction facilities that exceed the energy efficiency requirements of statewide building codes. Energy savings are determined using the ASHRAE 90.1 2007 standard as a baseline energy usage. The following types of projects are eligible for the program:

- New buildings
- Additions or expansions to existing buildings
- Gut rehabs for a change of purpose requiring replacement of all electrical and mechanical equipment

**Small Business Direct Install (SBDI) program.** The SBDI program is designed to encourage small business customers—those with peak electric demand of 200 kW or less over the past 12 months—to service or replace standard equipment with higher-efficiency equipment. Incentives available through the SBDI program are typically higher than those offered through the Prescriptive and Custom programs, and customers can also apply for Prescriptive and Custom program incentives for equipment that falls outside the scope of the SBDI program. Although not a program requirement, TRC encourages contractorsto offer walk-through assessments of facilities and support the application process, including submitting the application for payment on a participant's behalf. The program further encourages contractors to include the rebate on their invoice, accepting the rebate on behalf of the customer, thereby reducing the total up-front cost to the customer.

**Schools Strategic Energy Management (SEM) program.** The Schools SEM program, new for 2022, is designed to engage school districts in a process of continuous and evolving improvements at their facilities. School districts form teams that are coached to maximize the performance within their facilities. They are also encouraged to utilize a performance tracking tool, such as ENERGY STAR® Portfolio Manager®, to benchmark and track progress toward their energy conservation goals.

**Commercial Online Marketplace.** This program is discussed in a separate chapter of this report.

### CHANGES FROM 2021 DESIGN

Aside from the addition of the Schools SEM offering, the 2022 program design changes were limited to small adjustments in prescriptive measure savings and adjustments, needed to address operations still affected by the pandemic and economic disruption to supply chain and operations. To limit in-person contact, TRC adjusted its project verification process to allow for virtual inspections or photo submissions where possible, while still reserving onsite verification for larger custom projects. TRC also focused contractor and customer outreach on virtual webinars and phone contact, over face-to-face outreach.

## PROGRAM PERFORMANCE

In 2022, the evaluation team was able to examine the full 12 months (program year) of data. The evaluation team developed all evaluation metrics based on 12 months of program production and this chapter includes an evaluation of that full year of data. The net-to-gross results for this evaluation report reference PY2021 results. Process findings for PY2022 focus on feedback from program contractors.

Comparing the *ex post* gross savings with goals, the C&I portfolio fell short of its goals at the portfolio level, achieving 68% of electric energy savings, 54% of peak electric demand savings, and just short of the therms goal at 93% of natural gas therm savings. The gross goal achievement varied by program and fuel type:

- The **Prescriptive program** had the second lowest gas goal achievement (10%) among these programs. Electric savings goal achievement (61%) was like portfolio level achievement. The electric savings goal for this program remained like PY 2021, while the gas savings goal was dramatically increased from PY 2021.
- The **Custom program** fell short of the peak demand savings goal (27%). Electric savings goal achievement (50%) was less than portfolio level achievement. Gas goal achievement was relatively high (78%). Goal levels for this program decreased slightly from PY 2021.
- The **New Construction program** dramatically overachieved all goals (292% of electric energy savings, 425% of peak demand savings, and 320% of natural gas savings) within the C&I portfolio. The electric savings goal for the New Construction program was decreased significantly from PY 2021.
- The **SBDI program** fell short of the electric energy and natural gas savings goals (52% and 18% respectively). The electric savings goal for this program was decreased and the gas savings goal was increased for this program from PY 2021.
- The **Schools Strategic Energy Management (SEM) program** was new in 2022. The SEM program fell short of the electric energy and natural gas savings goals (13% and 0% respectively).

TRC attributed low participation levels to the continued long-term effects of the COVID-19 pandemic and economic uncertainty. Specifically, TRC reported that workforce and supply chain availability, along with customer hesitation to proceed with capital projects, inhibited participation. The C&I programs attracted 711 unique customer participants in PY2022, as compared to 810 in PY 2021 and 847 in PY2020. TRC reported that PY2022 projects were smaller and less impactful on energy savings on average than projects in PY2021. Unique customer participants have been identified as the count of unique parent project site identification within the 2022 population.

Table 203 summarizes savings for the full year of program performance, including program savings goals. Total *ex ante* savings of 60,086,163 kWh in PY2022 represented an increase over PY2021 *ex ante* savings of 51,755,453 kWh. Total *ex ante* demand reduction of 8,480 kW in PY2022 also demonstrated an increase over PY2021 *ex ante* demand reduction of 6,921 kW. Both PY2022 metrics aligned closely with PY2020 *ex ante* achievement. There was moderate growth in *ex ante* therms savings year over year, growing from 1,117,267 therms in PY 2020 to 1,195,145 therms in PY 2021 and to 1,445,286 therms in PY2022.

TABLE 203. 2022 C&I PROGRAMS SAVING SUMMARY – FULL YEAR 2022

| | GROSS SAVINGS GOAL | *EX ANTE* | AUDITED | VERIFIED | *EX POST* GROSS | *EX POST* NET | GROSS GOAL ACHIEVEMENT |
|---|---|---|---|---|---|---|---|
| Prescriptive Program | | | | | | | |
| Electric Energy Savings (kWh/yr.) | 42,462,503.23 | 26,137,346.44 | 26,137,382.19 | 26,093,617.44 | 25,724,089.20 | 21,865,475.82 | 61% |
| Peak Demand Reduction (kW) | 9,981.446 | 4,970.984 | 4,961.511 | 4,968.698 | 4,918.554 | 4,180.771 | 49% |
| Natural Gas Energy Savings (therms/yr.) | 330,808.81 | 30,722.81 | 30,722.81 | 30,722.81 | 31,519.00 | 26,791.15 | 10% |
| Custom Program | | | | | | | |
| Electric Energy Savings (kWh/yr.) | 37,591,431.00 | 19,386,560.67 | 19,386,559.09 | 19,073,607.79 | 18,735,182.01 | 16,861,663.80 | 50% |
| Peak Demand Reduction (kW) | 4,778.572 | 1,298.454 | 1,298.454 | 1,257.333 | 1,288.479 | 1,159.632 | 27% |
| Natural Gas Energy Savings (therms/yr.) | 620,722.65 | 493,592.50 | 493,830.97 | 491,442.62 | 487,175.97 | 438,458.38 | 78% |
| New Construction Program | | | | | | | |
| Electric Energy Savings (kWh/yr.) | 4,607,350.00 | 13,029,948.12 | 13,029,948.60 | 13,482,556.80 | 13,444,792.21 | 7,260,187.79 | 292% |
| Peak Demand Reduction (kW) | 493.544 | 2,042.457 | 2,050.257 | 2,050.257 | 2,097.238 | 1,132.508 | 425% |
| Natural Gas Energy Savings (therms/yr.) | 246,410.04 | 877,174.46 | 874,729.94 | 879,691.54 | 788,831.56 | 425,969.04 | 320% |
| SBDI Program | | | | | | | |
| Electric Energy Savings (kWh/yr.) | 2,772,601.77 | 1,470,494.50 | 1,470,494.50 | 1,458,784.18 | 1,435,471.64 | 1,349,343.35 | 52% |
| Peak Demand Reduction (kW) | 422.771 | 153.092 | 153.091 | 151.981 | 152.530 | 143.379 | 36% |
| Natural Gas Energy Savings (therms/yr.) | 244,486.85 | 43,795.80 | 43,795.80 | 43,795.80 | 43,795.80 | 41,168.05 | 18% |
| Schools SEM Program | | | | | | | |
| Electric Energy Savings (kWh/yr.) | 460,735.00 | 61,812.96 | 61,812.96 | 61,812.96 | 61,522.63 | 55,370.36 | 13% |
| Peak Demand Reduction (kW) | 58.511 | 15.286 | 15.286 | 15.286 | 14.849 | 13.364 | 25% |
| Natural Gas Energy Savings (therms/yr.) | 7,704.53 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0% |
| Total C&I Portfolio[57] | | | | | | | |
| Electric Energy Savings (kWh/yr.) | 87,894,621.00 | 60,086,162.69 | 60,086,197.33 | 60,170,379.17 | 59,401,057.69 | 47,392,041.13 | 68% |
| Peak Demand Reduction (kW) | 15,734.844 | 8,480.273 | 8,478.599 | 8,443.555 | 8,471.651 | 6,629.654 | 54% |
| Natural Gas Energy Savings (therms/yr.) | 1,450,132.88 | 1,445,285.57 | 1,443,079.52 | 1,445,652.77 | 1,351,322.34 | 932,386.62 | 93% |

[57] C&I Online Marketplace summary values have been excluded from this table of results and from the Total C&I Portfolio summary values shown. C&I Online Marketplace summary values are outlined in a separate chapter.

Table 204 outlines the *ex post* gross and net-to-gross (NTG) adjustment factors. The evaluation team developed these by analyzing survey data collected from the 2021 C&I customer population, as described in the *Ex Post* Gross Savings section. 2021 NTG values were applied to the 2022 program year data.

TABLE 204. 2022 C&I PROGRAMS ADJUSTMENT FACTORS

| METRIC | REALIZATION RATE (%)[a] | FREERIDERSHIP | SPILLOVER | NTG (%)[b] |
|---|---|---|---|---|
| Prescriptive Program | | | | |
| Electric Energy Savings (kWh/yr.) | 98% | 15% | 0% | 85% |
| Peak Demand Reduction (kW) | 99% | | | |
| Natural Gas Energy Savings (therms/yr.) | 103% | | | |
| Custom Program | | | | |
| Electric Energy Savings (kWh/yr.) | 97% | 10% | 0% | 90% |
| Peak Demand Reduction (kW) | 99% | | | |
| Natural Gas Energy Savings (therms/yr.) | 99% | | | |
| New Construction Program | | | | |
| Electric Energy Savings (kWh/yr.) | 103% | 46% | 0% | 54% |
| Peak Demand Reduction (kW) | 103% | | | |
| Natural Gas Energy Savings (therms/yr.) | 90% | | | |
| SBDI Program | | | | |
| Electric Energy Savings (kWh/yr.) | 98% | 6% | 0% | 94% |
| Peak Demand Reduction (kW) | 100% | | | |
| Natural Gas Energy Savings (therms/yr.) | 100% | | | |
| Schools SEM Program[c] | | | | |
| Electric Energy Savings (kWh/yr.) | 100% | 10% | 0% | 90% |
| Peak Demand Reduction (kW) | 97% | | | |
| Natural Gas Energy Savings (therms/yr.) | NA | | | |

[a] The realization rate is defined as *ex post* Gross savings divided by *ex ante* savings.
[b] NTG is defined as *ex post* net savings divided by *ex post* gross savings.
[c] The SEM program used Custom lighting realization rates from randomly sampled lighting projects and Custom NTG ratios.

According to the final 2022 year-end scorecard, NIPSCO spent 65% of its electric and nearly 100% of its natural gas budgets. The proportion of spending aligned with performance towards savings goals. Table 205 lists the 2022 program budget and program trackable expenditures by fuel type.

TABLE 205. 2022 C&I PROGRAMS EXPENDITURES

| FUEL | PROGRAM BUDGET | PROGRAM EXPENDITURES | BUDGET SPENT (%) |
|---|---|---|---|
| Prescriptive Program | | | |
| Electric | $6,041,373.11 | $3,617,204.36 | 60% |
| Natural Gas | $378,091.19 | $50,283.04 | 13% |
| Custom Program | | | |
| Electric | $5,571,339.47 | $2,852,098.57 | 51% |
| Natural Gas | $871,936.93 | $675,315.01 | 77% |
| New Construction Program | | | |
| Electric | $647,415.15 | $1,569,463.89 | 242% |
| Natural Gas | $346,135.28 | $1,148,303.34 | 332% |

| FUEL | PROGRAM BUDGET | PROGRAM EXPENDITURES | BUDGET SPENT (%) |
|---|---|---|---|
| SBDI Program | | | |
| Electric | $366,763.10 | $262,614.11 | 72% |
| Natural Gas | $345,735.42 | $64,891.27 | 19% |
| Schools SEM Program | | | |
| Electric | $64,741.52 | $9,618.15 | 15% |
| Natural Gas | $10,822.65 | $419.72 | 4% |
| Total C&I Programs | | | |
| Electric | $12,691,632.35 | $8,310,999.08 | 65% |
| Natural Gas | $1,952,721.47 | $1,939,212.38 | 99% |

## EVALUATION METHODOLOGY

To inform the impact and process evaluation of NIPSCO's 2022 C&I programs, the evaluation team completed the following research activities:

- **Documentation and materials review,** to provide context on program implementation.
- **Interviews with participating contractors** to provide feedback on process issues, areas for program improvement, and understanding the direction of the market.
- **Engineering analysis,** to audit the performance of individual projects and inform the realization rates for the C&I programs.

## IMPACT EVALUATION

The evaluation team completed the impact evaluation to answer the following research questions:

- Are tracking database savings sourced with proper project documentation?
- Do claimed savings algorithms align with the Illinois Technical Reference Manual v10.0, the 2015 Indiana Technical Reference Manual (TRM) version 2.2 (v2.2), NIPSCO's measure savings database, or other more appropriate secondary sources?[58,59] What assumptions were used to develop savings estimates? Are there any updates that should be made?
- What are *ex post* program savings? Do these suggest any needed updates to program design, delivery, or savings assumptions?

For all measure types, the evaluation team compared its engineering calculations to NIPSCO's *ex ante* savings, basing its savings methodologies and inputs for each measure on several sources: standard engineering practices, the IL TRM v10.0, the 2015 Indiana TRM (v2.2), NIPSCO's measure savings database, and other secondary TRM sources.

### AUDITED AND VERIFIED SAVINGS

To develop an audited measure quantity and savings, the evaluation team first checked the program tracking data for duplicates or other data quality issues. In the verified savings step, the team made minor modifications to quantities and the resulting energy savings values for sampled projects, when it found discrepancies between the measure documentation and the reported values. To determine audited and verified savings, the team used the same method of savings calculation used for the reported *ex ante* savings.

[58] Illinois Energy Efficiency Stakeholder Advisory Group. 9/28/2022. *Illinois Technical Reference Manual Version 10.0 (v10.0).*
[59] Cadmus. July 28, 2015. *Indiana Technical Reference Manual Version 2.2 (v2.2).*

## *EX POST* GROSS SAVINGS

The evaluation team adjusted 2022 measure savings in the *ex post* gross analysis to address discrepancies in quantity, equipment capacity, equipment efficiency, or lighting wattage, discovered during a review of project documents or at virtual site inspections. The team used the following data sources to adjust:

- Annual operating hours from online schedules, posted store schedules, logged data, IL TRM v10.0 or 2015 Indiana TRM (v2.2) values for the building type or equipment type.
- Electric waste heat factors (WHFs) and peak summer coincident factors (CFs) consistent with the IL TRM v10.0.
- Methodologies or simple calculation methods from the 2015 Indiana TRM (v2.2) and IL TRM v10.0.

### IMPACT SAMPLING STRATEGY

The evaluation team sampled 2022 C&I program measures for desk reviews and virtual audits. The evaluation is targeting a minimum of a 90% confidence interval with ±10% precision for each C&I program across the two-year cycle. To achieve this, the team selected a representative sample of measures from each individual program to evaluate. While results are presented at the C&I portfolio and individual program levels, to better illustrate measure-category level trends across all commercial programs, the evaluation team primarily focused on providing sufficient sampling and analysis at the program level.

The evaluation team classified measures into measure types and stratified the sample into two groups: (1) lighting measures and (2) non-lighting measures. The team further defined the measures by type within those groups, but estimated and extrapolated savings within the two broader groups.

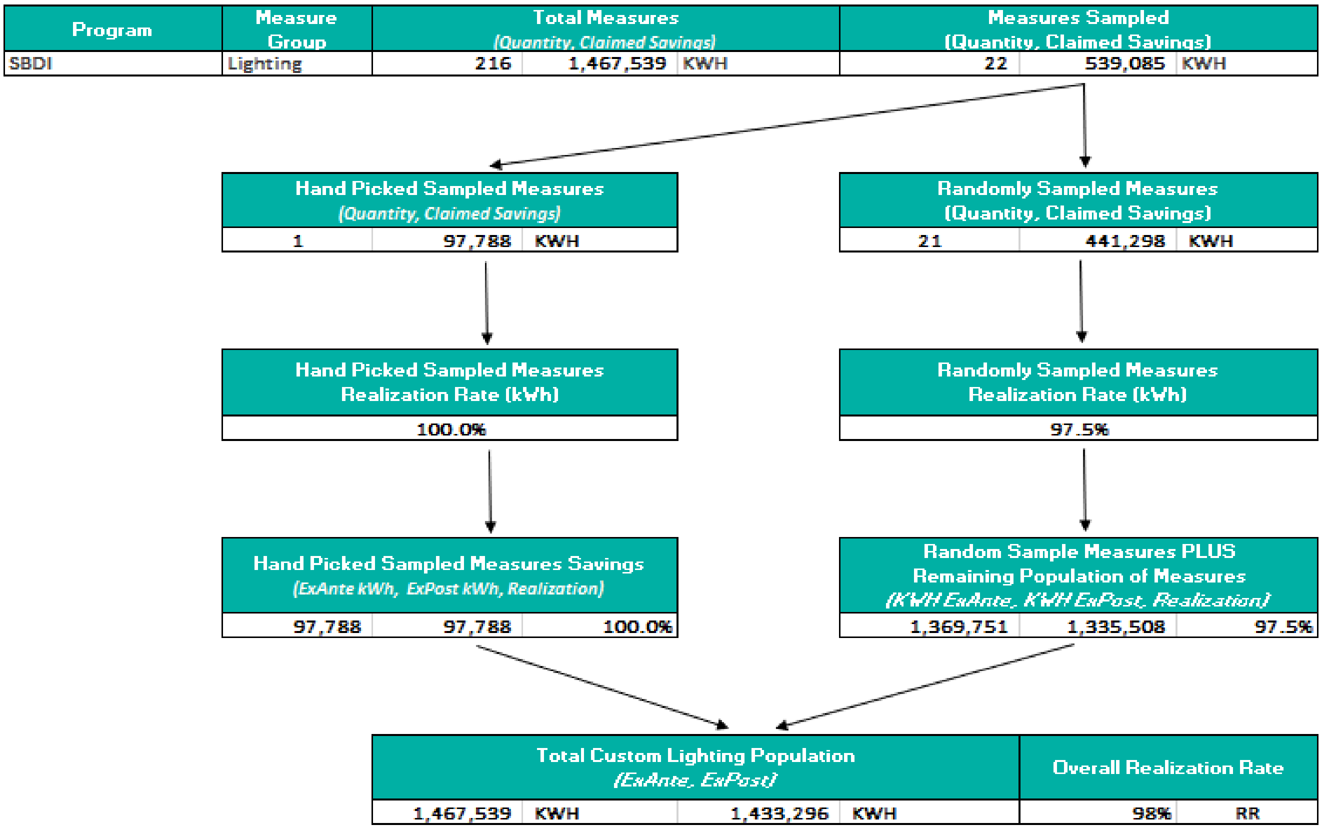
Measures were handpicked (purposive) or randomly (proportional) sampled from each program. Out of the 3,304 unique measures in the population, the evaluation sample included 118 total unique measures.[60] The evaluation team conducted an engineering review of these measures (17 through purposive sampling and 101 through proportional sampling). Of these, all 118 measures received desk reviews and 27 additionally received virtual audits to confirm and support the desk review findings.

- The purposive sampling selected the largest saving measures in a program. For each program, the purposive sampling process selected measures that comprised at least 5% of the cumulative program savings and measures that comprised at least 20% of the measure category savings. Because these measures were sampled with certainty (100% of eligible highest saving measures were sampled) the results *were not* extrapolated to the population. These measures are referred to as **handpicked measures**.
- The proportional sampling measures were randomly selected from the population of the specific program measures, ensuring at least one measure from each measure category was sampled. Findings were extrapolated to the population of savings for the relevant measure categories. These measures are referred to as **randomly sampled measures**.

[60] Measures are defined as a measure type installed by a customer account. One measure could account for multiple pieces of equipment installed and rebated.

An outline of this methodology is shown in Figure 80, using the lighting measure category within the 2022 SBDI program to illustrate the example.

FIGURE 80. EXAMPLE OF 2022 C&I PROGRAMS SAMPLING METHODOLOGY (SBDI PROGRAM)




The evaluation team calculated lighting measure group realization rates from the collective realization rate of the randomly sampled measures for each program. The team then used the lighting realization rates to extrapolate to the full lighting population for each program to determine *ex post* gross savings.

Handpicked sampled measures received a realization rate specific to the individual measure, which did not factor into the extrapolation to the rest of the population. The evaluation team applied the realization rate determined for the handpicked measure, only to that individual measure, to determine the *ex post* gross savings for the measure. The team then added *ex post* gross savings from handpicked measures to *ex post* savings from the rest of the population to determine the cumulative *ex post* savings for the program.

There are many measure types in the non-lighting measure group. The team aggregated the *ex post* gross results from these measure types to create a realization rate for the non-lighting measure group and then extrapolated those rates to the complete non-lighting population for each program.

This report breaks out measures into measure types to provide transparency on results and guidance on how to best improve program savings estimates and activities; however, the sample was not designed to estimate realization rates by measure types beyond lighting and non-lighting groups by program.

Table 206 summarizes the number of evaluated measures and the proportion of *ex ante* program savings the evaluated measures represent. Note that the measure category ‘Bonus’ has been excluded from the sample and the table values represented below. The 2022 C&I programs sample covered 22% of cumulative program electricity savings and 45% of gas savings. The table shows that the lighting measure category was the largest measure category in 2022, and the sample captured 16% of total lighting electricity savings. The non-lighting measure category shows all other measures combined; the cumulative non-lighting sample captured 37% of electricity savings and 45% of gas savings. While not shown in the table, the evaluation team sampled 16% of C&I programs lighting and 8% of C&I programs non-lighting kW demand savings.

TABLE 206. 2022 COMBINED C&I PROGRAMS *EX ANTE* SAMPLED MEASURES

| MEASURE CATEGORY | MEASURE COUNTS | | | | TOTAL *EX ANTE* SAVINGS | | | SAMPLED *EX ANTE* SAVINGS & PROPORTION OF SAVINGS SAMPLED | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | TOTAL | SAMPLED TOTAL | HAND PICKED | RANDOM | KWH | KW | THERMS | KWH | KWH | THERMS | THERMS |
| **Lighting** | **2,693** | **61** | **6** | **55** | **44,492,790.11** | **7,903.857** | **-** | **7,077,588.36** | **16%** | **-** | |
| **Non-Lighting** | **611** | **57** | **11** | **46** | **15,593,372.58** | **576.416** | **1,445,285.57** | **5,830,482.92** | **37%** | **646,594.26** | **45%** |
| Building Redesign | 1 | - | - | - | 976.00 | 0.000 | 0.00 | - | 0% | - | 0% |
| Compressed Air | 227 | 9 | 1 | 8 | 7,136,767.98 | 18.962 | - | 1,228,835.00 | 17% | - | |
| Controls | 15 | 4 | 1 | 3 | 2,403,144.15 | 15.600 | 10,748.50 | 1,586,784.85 | 66% | 6,247.50 | 58% |
| HVAC | 74 | 29 | 7 | 22 | 1,331,788.53 | 272.470 | 1,279,235.07 | 322,751.91 | 24% | 596,330.76 | 47% |
| Kitchen | 2 | 1 | - | 1 | 64,272.00 | 9.433 | - | 36,864.00 | 57% | - | |
| Motors | 25 | 2 | - | 2 | 840,768.16 | 26.948 | - | 98,057.00 | 12% | - | |
| Other | - | - | - | - | - | - | - | - | | - | |
| Process | 8 | 2 | 2 | - | 2,857,314.16 | 110.754 | 15,291.00 | 2,148,954.16 | 75% | - | 0% |
| Refrigeration | 36 | 4 | - | 4 | 778,440.58 | 95.978 | - | 282,012.00 | 36% | - | |
| Ventilation | 12 | 3 | - | 3 | - | - | 129,252.00 | - | | 43,396.00 | 34% |
| Variable Frequency Drive (VFD) | 5 | 2 | - | 2 | 179,901.02 | 26.271 | - | 126,224.00 | 70% | - | |
| Water Heat | 6 | 1 | - | 1 | - | - | 10,759.00 | - | | 620.00 | 6% |
| Total | 3,304 | 118 | 17 | 101 | 60,086,162.69 | 8,480.273 | 1,445,285.57 | 12,908,071.28 | 21% | 646,594.26 | 45% |

## ENGINEERING REVIEWS, REALIZATION RATES AND *EX POST* GROSS SAVINGS

The evaluation team completed engineering desk reviews on 118 measures for the 2022 C&I programs. The team sampled 106 unique customer sites (as defined by NIPSCO tracking data as site codes) as a subset of the 118 evaluated measures.

The following sections summarize the results of the engineering review by lighting and non-lighting measures. For brevity, this section summarizes reasons for adjustments, focusing on those that had the greatest impact on savings or where the evaluation team recommends adjustments in values or calculation methods. Table 207 provides more detailed discussion on the reasons for adjustment by each measure type.

### LIGHTING MEASURES

All five C&I programs contain lighting measures. Four lighting projects were completed by one school in the SEM program. As these were not traditional behavior-based SEM projects, their lighting savings were evaluated within the Custom lighting category, and Custom program adjustment factors were applied to SEM, such as realization rates and NTG. Table 207 documents the number of measures, savings, and sample sizes by each program. The team evaluated 61 lighting measures across the C&I programs.

TABLE 207. 2022 C&I PROGRAMS SAMPLED LIGHTING MEASURES

| PROGRAM | NUMBER OF MEASURES | | | | PROPORTION OF PROGRAM SAVINGS EVALUATED | | |
|---|---|---|---|---|---|---|---|
| | TOTAL | SAMPLED TOTAL | HANDPICKED | RANDOM | KWH | KW | THERMS |
| Prescriptive | 2,073 | 24 | 2 | 22 | 10% | 9% | N/A |
| Custom | 281 | 9 | 2 | 7 | 27% | 27% | N/A |
| New Construction | 132 | 6 | 1 | 5 | 18% | 23% | N/A |
| SBDI | 203 | 22 | 1 | 21 | 37% | 65% | N/A |
| SEM | 4 | 0 | 0 | 0 | 0% | 0% | N/A |
| Total | 2,693 | 61 | 6 | 55 | 16% | 16% | N/A |

Below details the reasons for savings adjustments, organized by interior and exterior lighting measures.

***Lighting - Interior.*** Of the 61 total lighting measures evaluated this year, 41 were interior lighting measures. The evaluation team adjusted measure savings for the following types of issues:

- *Ex ante* calculations excluded waste heat factors (WHFs) for interior lighting measures, which the Illinois TRM v10.0 states should be applied. The *ex post* gross savings integrate WHFs for kW and kWh savings. The team calculated WHF therm penalties for cost-effectiveness testing but did not include them in *ex post* gross savings. The application of electric WHFs has the effect of generally increasing the kW and kWh realization rates across all evaluated projects.
- There were minor operating hour changes based on reviews of the posted schedules for the buildings, interviews with the customer site contact, or reviews of the IL TRM v10.0 hours for the building types.
- There were changes to the CFs to better match the specific building type where measures were installed.
- Changes to the number of baseline fixtures, number of installed fixtures, and wattage of fixtures based on a review of invoices, counts of fixtures during the inspection, and review of lighting specification sheets.

***Lighting - Exterior.*** The evaluation team reviewed 20 exterior lighting measures. Of these, 15 measures achieved a 100% realization rate. The team adjusted the remaining five measures due to slight differences in installed wattage specification or hours of use.

Table 208 shows the complete list of lighting measure subcategories represented by the 2022 C&I population. The number of units refers to the units specified for the measure subcategory algorithms within the IL TRM v10.0. Units can refer to the number of lamps, bulbs, fixtures, watts reduced, or linear feet reduced, depending on the specific measure subcategory algorithm. The number of measures refers to the count of each measure type installed as part of a completed project across all C&I programs. The team completed sampling at the measure level for each program, sampling 61 lighting measures (without consideration of the measure subcategory) from the 3,006 total lighting measures.

TABLE 208. 2022 C&I PROGRAMS LIGHTING MEASURES BY SUBCATEGORY

| MEASURE SUBCATEGORY | SUM OF UNITS | SUM OF MEASURES | SUM OF SAMPLED MEASURES |
|---|---|---|---|
| Interior Lighting | 1,661,466 | 2,075 | 41 |
| 1490-2600 lumens. Omnidirectional (25W) | 284 | 17 | |
| 250-309 lumens. Omnidirectional (3.5W) | 459 | 6 | |
| 2601-3300 lumens. Omnidirectional (37.5W) | 65 | 4 | |
| 310-749 lumens. Omnidirectional (6W) | 540 | 8 | |
| 750-1049 lumens. Omnidirectional (11W) | 1,056 | 14 | |
| BR30. 450-499 lumens. (7W) | 535 | 15 | |
| BR30. 650-1419 lumens. (15W) | 689 | 26 | |
| Decorative. 300-499 lumens (6W) | 169 | 6 | |
| Delamping 4 Ft Fluor. | 825 | 17 | |
| Delamping 8 Ft Fluor. | 29 | 4 | |
| Dual Occupancy & Daylight Sensor (Indoor Only) | 1,196,209 | 102 | 2 |
| Globe. 350-499 lumens. (6W) | 133 | 2 | 1 |
| LED | 776 | 366 | |
| LED (11W) | 13 | 3 | |
| LED (15W) | 119 | 11 | |
| LED (25W) | 20 | 1 | |
| LED (6W) | 3 | 1 | |
| LED (7W) | 76 | 5 | |
| LED <= 12W | 228 | 2 | |
| LED <= 15W | 57 | 6 | |
| LED <= 17W | 114 | 3 | |
| LED <= 20W | 6 | 2 | |
| LED 1x4 Fixture Replacing 1-Lamp Fluor. | 1,013 | 10 | |
| LED 1x4 Fixture Replacing 2-Lamp Fluor. | 1,110 | 47 | |
| LED 1x4 Fixture Replacing 3-Lamp Fluor. | 224 | 6 | |
| LED 2x2 Fixture | 88 | 4 | |
| LED 2x2 Fixture Replacing 2-Lamp Fluor. | 518 | 35 | |
| LED 2x2 Fixture Replacing 3-Lamp Fluor. | 103 | 9 | |
| LED 2x4 Fixture | 363 | 16 | 1 |
| LED 2x4 Fixture Replacing 2-Lamp Fluor. | 772 | 44 | |
| LED 2x4 Fixture Replacing 3-Lamp Fluor. | 1,435 | 22 | |
| LED 2x4 Fixture Replacing 4-Lamp Fluor. | 8,879 | 152 | 2 |
| LED Exit Sign | 89 | 11 | |
| LED Exit Sign Fixture with Battery Backup | 2 | 1 | |
| LED Fixture | 434 | 9 | 2 |
| LED High Bay Replacing 4-Lamp Fluor. | 3,689 | 46 | 1 |
| LED High Bay Replacing 6-Lamp Fluor. | 3,744 | 67 | 1 |
| LED High Bay Replacing 8-Lamp Fluor. | 804 | 14 | |

| MEASURE SUBCATEGORY | SUM OF UNITS | SUM OF MEASURES | SUM OF SAMPLED MEASURES |
|---|---|---|---|
| LED Interior | 8,854 | 200 | 7 |
| LED Interior Replacing HID ≤ 175W | 579 | 18 | |
| LED Interior Replacing HID 1000W | 546 | 11 | 2 |
| LED Interior Replacing HID 176-250W | 392 | 25 | 2 |
| LED Interior Replacing HID 251-400W | 2,342 | 109 | 13 |
| LED Low Bay Replacing 3-Lamp Fluor. | 139 | 2 | |
| LED Tube Relamp Replacing 2 Ft Fluor. | 303 | 16 | |
| LED Tube Relamp Replacing 4 Ft Fluor. | 59,001 | 289 | 1 |
| LED Tube Relamp Replacing 4 Ft HO Fluor. | 12,175 | 49 | |
| LED Tube Relamp Replacing 8 Ft Fluor. | 1,722 | 62 | |
| LED Tube Relamp Replacing T12 | 444 | 7 | |
| LED Tube Relamp Replacing T5HO | 44 | 1 | |
| LED Tube Relamp Replacing T8 | 1,535 | 8 | |
| Lighting System Exceeding ASHRAE 90.1-2007 | 3,604 | 92 | 6 |
| Occupancy Sensor | 342,880 | 24 | |
| Occupancy Sensor 100-199W Connected Load | 377 | 8 | |
| Occupancy Sensor 200-500W Connected Load | 56 | 2 | |
| Others Interior (Please Describe) | 117 | 12 | |
| T12 4ft Delamping | 68 | 1 | |
| Exterior Lighting | 8,249 | 618 | 20 |
| Exterior Occupancy Sensor | 200 | 1 | |
| LED Exterior | 566 | 48 | 2 |
| LED Exterior Replacing HID ≤ 175W | 1,472 | 104 | 1 |
| LED Exterior Replacing HID 1000W | 642 | 53 | 5 |
| LED Exterior Replacing HID 176-250W | 719 | 90 | 2 |
| LED Exterior Replacing HID 251-400W | 2,875 | 281 | 10 |
| Lighting System Exceeding ASHRAE 90.1-2007 | 1,774 | 40 | |
| Others Exterior (Please Describe) | 1 | 1 | |
| Total | 1,669,715 | 2,693 | 61 |

Table 209 shows the *ex ante* savings and the measure-specific realization rates from the sampled lighting measures in the 2022 C&I programs. The team only applied measure-specific realization rates from the handpicked sampled projects to those specific projects. For the lighting measure group, the team extrapolated the randomly sampled realization rates to the rest of the lighting population by program. The extrapolated lighting realization rates for all programs combined is 101% electric energy and 103% for peak demand. Later in this chapter, Table 215shows the complete set of extrapolated realization rates by program.

TABLE 209. 2022 C&I PROGRAMS *EX ANTE* SAVINGS & REALIZATION RATES FOR SAMPLED LIGHTING MEASURES

| PROGRAM | SAMPLED *EX ANTE* | | | REALIZATION RATES (KWH) | | REALIZATION RATES (KW) | |
|---|---|---|---|---|---|---|---|
| | KWH | KW | THERMS | HANDPICKED | RANDOM | HANDPICKED | RANDOM |
| Prescriptive | 2,603,567.11 | 433.899 | - | 100% | 99% | 100% | 101% |
| Custom | 2,114,524.25 | 290.849 | - | 96% | 100% | 110% | 97% |
| New Construction | 1,820,412.16 | 445.621 | - | 100% | 103% | 100% | 109% |
| SBDI | 539,084.84 | 99.772 | - | 100% | 97% | 100% | 99% |
| Total | 7,077,588.36 | 1,270.14 | - | 99% | 101% | 102% | 103% |

Note: SEM projects were not part of the lighting sample. Custom lighting realization rates were applied to SEM lighting projects

Figure 81 shows measure-level results for each project sampled. Each program is represented with a different color. The figure shows the size of the *ex ante* project savings compared with the resulting realization rate. The Prescriptive projects performed with the most consistency, while Custom projects had the most variability. The SBDI projects tended to be smaller, while the New Construction projects were generally the largest. The New Construction program had the three largest lighting projects, which realized at or just over 100% savings.

FIGURE 81. 2022 C&I PROGRAMS SAMPLED LIGHTING MEASURES *EX ANTE* IMPACT AND REALIZATION RATES

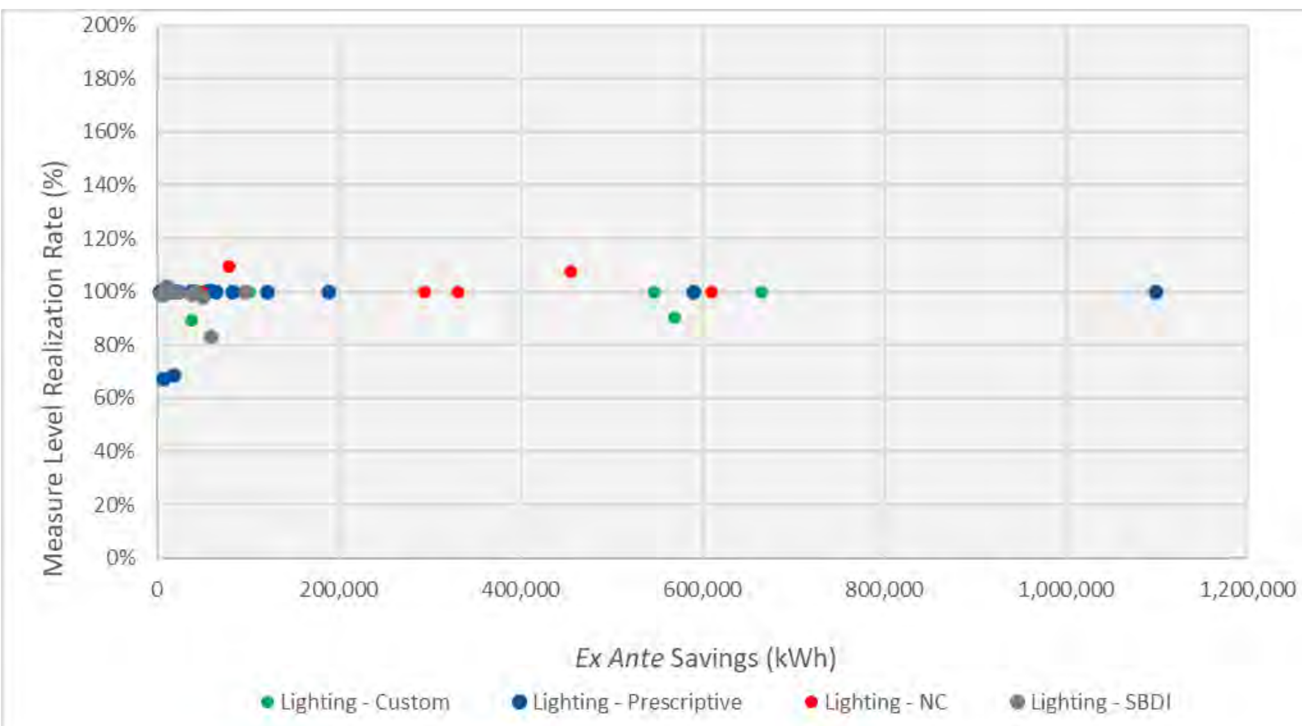


Table 210 summarizes notable differences between *ex ante* and *ex post* gross estimates from the measures sampled.

TABLE 210. 2022 C&I PROGRAMS NOTABLE DIFFERENCES BETWEEN *EX ANTE* AND *EX POST* GROSS LIGHTING MEASURES

| MEASURE CATEGORY | *EX ANTE* SOURCES AND ASSUMPTIONS | *EX POST* GROSS SOURCES AND ASSUMPTIONS | PRIMARY REASONS FOR DIFFERENCES |
|---|---|---|---|
| Lighting | Ex ante savings were determined by the Illinois TRM v10.0, calculated through the application excel tool | Illinois TRM v10.0. All inputs were verified through project documentation or interviews conducted. | The electric penalties attributed to waste heat factors were incorporated into the ex-post gross savings values. Interview data also demonstrated different operating hours and coincidence factors than assumed by the ex-ante calculations in a few instances. Project documentation demonstrated different installed wattages and lighting type misclassification in a few instances. |

**WASTE HEAT FACTOR NATURAL GAS PENALTIES**

In 2020 and prior years, the evaluation team applied WHFs to lighting measures, representing the heating penalties resulting from more efficient lighting. The program does not report therm WHFs in *ex ante* calculations. Electric WHF penalties are minor in comparison with therm WHF penalties and are reported within *ex post* savings.

In discussions with NIPSCO, the evaluation team did not include negative therm WHFs in *ex post* therm calculations. However, Table 211 shows the therm penalties included in cost-effectiveness calculations. This table shows the therm penalties calculated for randomly sampled and handpicked projects and the proportions of those penalties when compared to overall kWh savings. The team applied these to the remaining unsampled interior lighting projects and then summed them to come up with total therm penalty estimates for all programs. Between handpicked and randomly sampled measures, there was a -98,646.93-therm penalty from sampled measures. When the rate found through sampling is extrapolated to the remaining population of interior Lighting measures, the total therm penalty is -616,410.63 therms for the entire C&I portfolio.

TABLE 211. 2022 C&I PROGRAMS WASTE HEAT FACTOR PENALTIES

| PROGRAM | *EX ANTE* SAMPLED INTERIOR LIGHTING | | WHF PENALTIES | | REMAINING INTERIOR LIGHTING POPULATION | | TOTAL INTERIOR LIGHTING POPULATION | | |
|---|---|---|---|---|---|---|---|---|---|
| | RANDOMLY SAMPLED KWH | HAND PICKED KWH | RANDOMLY SAMPLED THERMS | HAND PICKED THERMS | RATIO WHF PENALTY TO KWH | *EX ANTE* KWH | EXTRAPOLATED THERM PENALTY | *EX ANTE* KWH | EXTRAPOLATED THERM PENALTY |
| Prescriptive | 483,514.37 | 1,688,448.37 | (6,163.30) | (27,922.73) | 0.013 | 16,268,630.73 | (207,374.29) | 18,440,593.47 | (241,460.33) |
| Custom | 781,288.44 | 569,498.40 | (9,694.83) | (11,389.97) | 0.012 | 5,047,615.14 | (79,396.30) | 6,398,401.98 | (100,481.10) |
| New Construction | 1,210,143.06 | 610,269.10 | (30,011.93) | (9,764.29) | 0.025 | 7,207,363.38 | (223,891.65) | 9,027,775.54 | (263,667.87) |
| SBDI | 182,675.75 | 97,787.29 | (2,316.10) | (1,383.78) | 0.013 | 279,644.96 | (7,101.46) | 560,108.00 | (10,801.34) |
| SEM [a] | NA | NA | NA | NA | NA | NA | NA | NA | NA |
| Total | 2,657,621.62 | 2,966,003.16 | (48,186.15) | (50,460.78) | 0.018 | 28,803,254.21 | (517,763.70) | 34,426,878.99 | (616,410.63) |

[a] WHF penalties were calculated for sampled projects and then extrapolated to the population. Because SEM projects were not part of the sample, the evaluation team did not assign WHF penalties to the projects.

## NON-LIGHTING MEASURES

Non-lighting measures were present in the 2022 measure population in each of the four C&I programs. The evaluation team sampled at least one measure from most non-lighting measure groups across the four C&I programs. Only building redesign projects were not represented in the random or handpicked samples.

Table 212 lists the number of measures, savings, and sample sizes for each program. The team evaluated 57 non-lighting measures, representing a range of measure types. HVAC measures constituted the greatest proportion of non-lighting measure types (n=29), followed by compressed air (n=9), refrigeration (n=4), and controls (n=4).

TABLE 212. 2022 C&I PROGRAMS SAMPLED NON-LIGHTING MEASURES

| MEASURE GROUP | PROGRAM | NUMBER OF MEASURES | | | | PROPORTION OF PROGRAM SAVINGS EVALUATED | | |
|---|---|---|---|---|---|---|---|---|
| | | TOTAL | SAMPLED TOTAL | HAND PICKED | RANDOM | KWH | KW | THERMS |
| Building Redesign | Prescriptive | - | | | | | | |
| | Custom | - | | | | | | |
| | New Construction | 1 | - | - | - | 0% | 0% | 0% |
| | SBDI | - | | | | | | |
| Compressed Air | Prescriptive | - | | | | | | |
| | Custom | 222 | 8 | 1 | 7 | 16% | 0% | N/A |
| | New Construction | 5 | 1 | - | 1 | 38% | 0% | N/A |
| | SBDI | - | | - | - | | | |
| Controls | Prescriptive | - | - | - | - | | | |
| | Custom | 14 | 4 | 1 | 3 | 66% | 100% | 68% |
| | New Construction | 1 | - | - | | 0% | 0% | 0% |
| | SBDI | - | - | - | - | | | |
| HVAC | Prescriptive | 111 | 3 | 1 | 2 | 13% | 7% | 14% |
| | Custom | 52 | 8 | 2 | 6 | 0% | 0% | 61% |
| | New Construction | 106 | 13 | 3 | 10 | 53% | 29% | 39% |
| | SBDI | 5 | 5 | 1 | 4 | 100% | 100% | 100% |
| Kitchen | Prescriptive | 2 | 1 | - | 1 | 57% | 63% | N/A |
| | Custom | - | | | | | | |
| | New Construction | - | | | | | | |
| | SBDI | - | | | | | | |
| Motors | Prescriptive | - | | | | | | |
| | Custom | 11 | 1 | - | 1 | 8% | N/A | N/A |
| | New Construction | 14 | 1 | - | 1 | 21% | 0% | N/A |
| | SBDI | - | | | | | | |
| Process | Prescriptive | - | | | | | | |
| | Custom | 5 | 1 | 1 | - | 40% | 28% | N/A |
| | New Construction | 3 | 1 | 1 | | 100% | N/A | 0% |
| | SBDI | - | | | | | | |
| Refrigeration | Prescriptive | 28 | 2 | - | 2 | 30% | 20% | N/A |
| | Custom | 4 | 1 | - | 1 | 87% | N/A | N/A |
| | New Construction | 4 | 1 | - | 1 | 41% | N/A | N/A |
| | SBDI | - | | | | | | |
| Ventilation | Prescriptive | - | | | | | | |
| | Custom | 12 | 3 | - | 3 | N/A | N/A | 34% |
| | New Construction | - | | | | | | |
| | SBDI | - | | | | | | |
| VFD | Prescriptive | 5 | 2 | - | 2 | 70% | 51% | N/A |
| | Custom | - | | | | | | |
| | New Construction | - | | | | | | |
| | SBDI | - | | | | | | |
| Water Heat | Prescriptive | 2 | 1 | - | 1 | N/A | N/A | 80% |
| | Custom | 1 | - | - | - | 0% | 0% | 0% |
| | New Construction | 3 | - | - | - | 0% | 0% | 0% |
| | SBDI | - | | | | | | |

The evaluation team adjusted savings for several of the sampled measures, which resulted in realization rates that deviated from 100%. The appendix includes a complete discussion of the adjustments.

The following paragraphs summarize the reasons for the most high-impact adjustments the evaluation team made in the 2022 evaluation.

### COMPRESSED AIR

Most compressed air sampled measures in PY2022 related to compressed air leak repairs; all eight of these measures received a 100% realization rate. One compressed air replacement measure was adjusted with customer provided loading data, confirming slightly reduced hours of use and demand on the equipment than projected in *ex ante* electric savings calculations (80%).

### CONTROLS

Four controls measures were sampled in the PY 2022 population, all of which related to building automation system upgrades. Two measures were unadjusted (one electric, one gas). One large measure was adjusted by incorporating normalized metered data from the equipment being controlled, demonstrating an electric realization rate of 87% and a demand savings realization rate of 138%. The final measure was adjusted to reflect effective full load hours (EFLH), which is a standardized metric in the IL and IN TRMs for climate areas. *Ex ante* calculations utilized operational hours, which do not consider partial loading for weather dependent HVAC equipment. The modification resulted in an electric realization rate of 58%.

### HVAC

Furnace installations made up 13 of the sampled measures, and nearly all measures had slight deviations due to an evaluator calculator being used in place of vendor calculations provided with the project documentation. Most evaluations resulted in minor deviations from *ex ante* therms savings (82% - 105%). Two of the furnace projects had larger deviations due to the *ex ante* calculations not accounting for setback savings (137%), and a correction made to total building square footage served (63%).

There were seven boiler replacement measures evaluated, of which two realized 100% *ex ante* therms savings. One measure was adjusted slightly due to a different specified efficiency of equipment (91%), while another was evaluated against normalized utility bill analysis and demonstrated slightly less savings than projected in the *ex ante* therms calculations (93%). Three boiler measures were adjusted to reflect the prescriptive deemed savings found in the IN TRM v2.2. The three measures were adjusted to have therms realization rates of 60%, 107% and 0%. The 0% realization rate was due to the performance boiler having a specified efficiency of 80%, which is the specified baseline efficiency in the IN TRM v2.2.

The remaining HVAC measures consisted of steam trap leak fix/replacement, smart thermostat installation, VFD on HVAC fans, and HVAC equipment installation, none of which had any modifications made to *ex ante* savings claimed.

### KITCHEN

A single kitchen measure was sampled and adjusted to align with the IN TRM v2.2 deemed savings, resulting in an electric realization rate of 104%.

### MOTORS AND WATER HEAT

Both sampled motors measures received near 100% electric realization rates. The single sampled water heat measure received a 100% therms realization rate.

### PROCESS

Two large process measures were handpicked due to their size and impact. One was adjusted due to a loading factor incorrectly being applied twice in the *ex ante* calculations. When applied just once, the resulting electric realization rate was 127%.

### REFRIGERATION

Four refrigeration measures were sampled from two unique customer projects. One project was adjusted very slightly to reflect a standardized savings factor resulting in electric realization rates for the measures of 100% and 96%. The other project was adjusted with a fan count reflective of the provided project documentation, resulting in measure electric realization rates of 70% and 100%.

### VFD AND VENTILATION

Two VFD measures were sampled and adjusted for more project specific building space types, related to HOU, loading and coincidence demand, resulting in electric realization rates of 75% and 89%. Three ventilation measures were sampled; all measures had slight deviations due to an evaluator calculator being used in place of vendor calculations provided with the project documentation. The resulting therms realization rates were 102%, 79% and 106%.

Table 213 shows the *ex ante* savings and the measure-specific realization rates from the sampled non-lighting measures in the 2022 C&I programs, by fuel type. The evaluation team only applied the measure-specific realization rates from the handpicked sampled measures to those specific measures. The table shows the realization rates determined for randomly sampled measures; however, the team did not extrapolate those realization rates to the rest of a given population. The evaluation team aggregated non-lighting measure types to create realization rates for each program as a full measure category and then extrapolated the rates to the complete non-lighting population for each program. The extrapolated non-lighting realization rates for all programs combined were 97% for electric savings, 97% for demand savings, and 93% for natural gas therm savings. The complete set of extrapolated realization rates are shown in Table 213.

TABLE 213. 2022 C&I PROGRAMS *EX ANTE* SAVINGS & REALIZATION RATES FOR SAMPLED NON-LIGHTING MEASURES

| PROGRAM | | SAMPLED *EX ANTE* | | | REALIZATION RATES (KWH) | | REALIZATION RATES (KW) | | REALIZATION RATES (THERMS) | |
|---|---|---|---|---|---|---|---|---|---|---|
| | | KWH | KW | THERMS | HAND PICKED | RAND | HAND PICKED | RAND | HAND PICKED | RANDOM |
| Building Redesign | Prescriptive | | | | | | | | | |
| | Custom | | | | | | | | | |
| | New Construction | | | | | | | | | |
| | SBDI | | | | | | | | | |
| Compressed Air | Prescriptive | | | | | | | | | |
| | Custom | 1,110,710.00 | - | - | 100% | 96% | N/A | N/A | N/A | N/A |
| | New Construction | 118,125.00 | - | - | | 90% | | N/A | | N/A |
| | SBDI | | | | | | | | | |
| Controls | Prescriptive | | | | | | | | | |
| | Custom | 1,586,784.85 | 15.600 | 6,247.50 | 87% | 96% | 138% | N/A | N/A | 98% |
| | New Construction | | | | | | | | | |
| | SBDI | | | | | | | | | |
| HVAC | Prescriptive | 29,536.25 | 9.473 | 4,145.50 | 100% | N/A | 100% | N/A | N/A | 103% |
| | Custom | - | - | 210,634.00 | N/A | N/A | N/A | N/A | 102% | 98% |
| | New Construction | 290,260.00 | 22.200 | 337,755.46 | 100% | 90% | N/A | 153% | 104% | 87% |
| | SBDI | 2,955.66 | 0.522 | 43,795.80 | N/A | 100% | N/A | 135% | 100% | 100% |
| Kitchen | Prescriptive | 36,864.00 | 5.930 | - | | 82% | | 69% | | N/A |
| | Custom | | | | | | | | | |
| | New Construction | | | | | | | | | |
| | SBDI | | | | | | | | | |
| Motors | Prescriptive | | | | | | | | | |
| | Custom | 45,361.00 | - | - | | 96% | | N/A | | N/A |
| | New Construction | 52,696.00 | - | - | | 90% | | N/A | | N/A |
| | SBDI | | | | | | | | | |
| Process | Prescriptive | | | | | | | | | |
| | Custom | 478,544.16 | 30.728 | - | 100% | | 100% | | N/A | |
| | New Construction | 1,670,410.00 | - | - | 127% | | N/A | | N/A | |
| | SBDI | | | | | | | | | |
| Refrigeration | Prescriptive | 199,290.00 | 18.804 | - | | 82% | | 69% | | N/A |
| | Custom | 61,378.00 | - | - | | 96% | | N/A | | N/A |
| | New Construction | 21,344.00 | - | - | | 90% | | N/A | | N/A |
| | SBDI | | | | | | | | | |
| Ventilation | Prescriptive | | | | | | | | | |
| | Custom | - | - | 43,396.00 | | N/A | | N/A | | 98% |
| | New Construction | | | | | | | | | |
| | SBDI | | | | | | | | | |
| VFD | Prescriptive | 126,224.00 | 13.411 | - | | 82% | | 69% | | N/A |
| | Custom | | | | | | | | | |
| | New Construction | | | | | | | | | |
| | SBDI | | | | | | | | | |
| Water Heat | Prescriptive | - | - | 620.00 | | N/A | | N/A | | 103% |
| | Custom | | | | | | | | | |
| | New Construction | | | | | | | | | |
| | SBDI | | | | | | | | | |

Figure 82 and Figure 83 illustrate the distribution of realization rates for the individually sampled projects, by program and by fuel source. Most of the smaller impact measures realized close to 100% of savings (kWh and therms). The largest impact kWh measure (process measure) realized 127% savings. The second largest kWh measure (controls measure) had a slightly lower realization rate of 87%. Most of the largest kWh measures fell into the process, refrigeration, controls, and compressed air measure categories. There were small deviations in therms realization rates, with most projects clustered at the 100% realization mark. There were a few larger deviations in smaller projects, ranging from 58% - 104% realization rates. There was a larger deviation in the therms savings realization rates, however the largest impact measures received at or near 100% realization.

FIGURE 82. 2022 C&I PROGRAMS SAMPLED NON-LIGHTING ELECTRIC MEASURES

*EX ANTE* IMPACT AND REALIZATION RATES

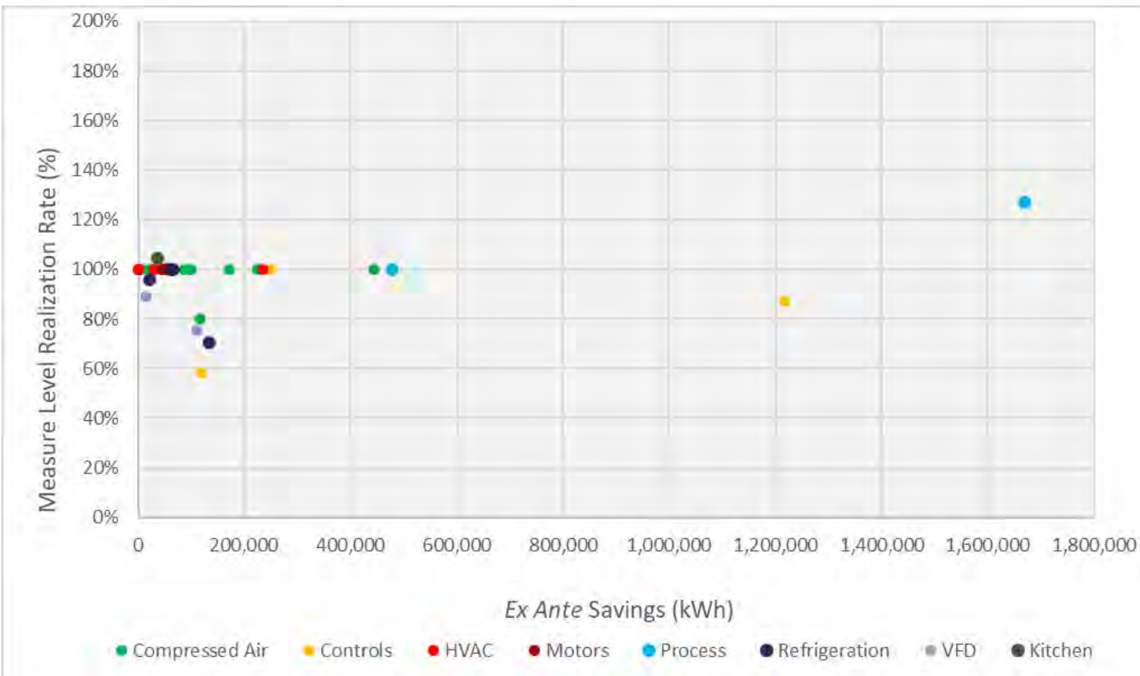


FIGURE 83. 2022 C&I PROGRAMS SAMPLED NON-LIGHTING GAS MEASURES *EX ANTE* IMPACT AND REALIZATION RATES

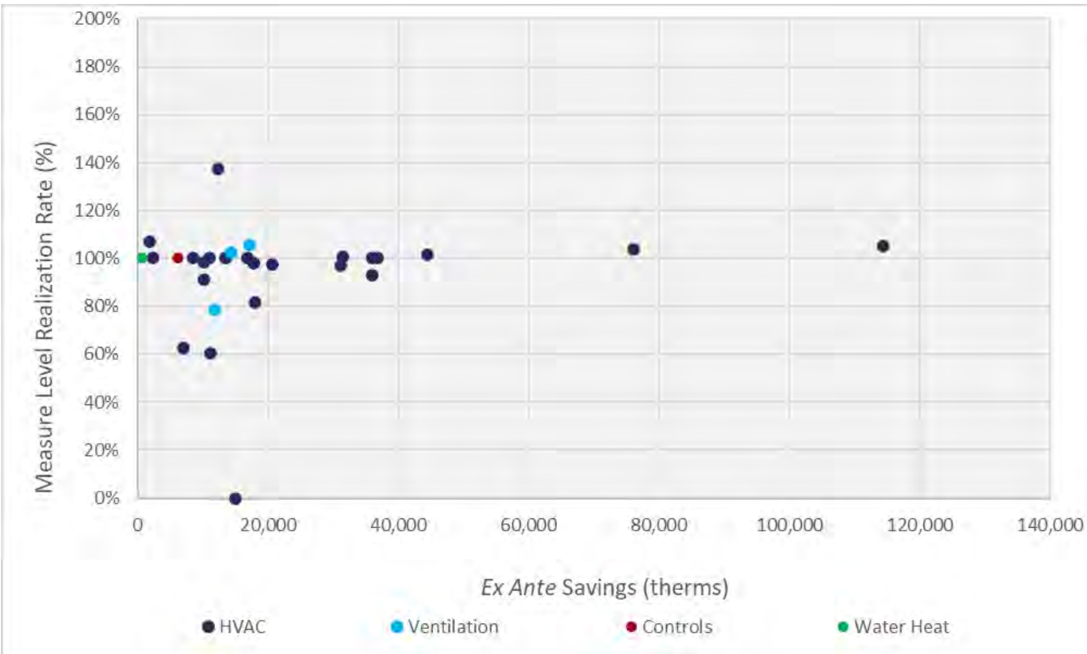



Table 214 summarizes notable differences between *ex ante* and *ex post* gross estimates from the measures sampled.

TABLE 214. 2022 C&I PROGRAMS NOTABLE DIFFERENCES BETWEEN *EX ANTE* & *EX POST* GROSS

| MEASURE CATEGORY | *EX ANTE* SOURCES AND ASSUMPTIONS | *EX POST* GROSS SOURCES AND ASSUMPTIONS | PRIMARY REASONS FOR DIFFERENCES |
|---|---|---|---|
| Building Redesign | Did not sample, did not include | | |
| Compressed Air | *Ex ante* savings were determined through deemed values from the IL TRM v10.0 | IL TRM v10.0. All inputs were verified through project documentation, virtual site visits or interviews. | Modifications based on customer attained data to the load profile, hours of use, and pressure to custom projects only. |
| Controls | *Ex ante* savings were determined custom calculations | Custom calculations. All inputs were verified through project documentation, virtual site visits or interviews. | Equipment capacity did not match reported capacity. Customer collected data demonstrated programming modifications to implemented measures. Modifications based on customer interview and trend data to the measure inputs. |
| HVAC | *Ex ante* savings were determined by the IL TRM v10.0 or IN v2.2 TRM, depending on measure type, calculated through the application excel tool. | IL TRM v10.0 or IN TRM v2.2 depending on measure type, calculated through the application excel tool. All inputs were verified through project documentation, virtual site visits or interviews. | Installed equipment efficiencies for energy and demand savings calculations. Missing calculations were recreated with evaluator created furnace savings calculation spreadsheets resulting in minor differences in claimed savings. |
| Kitchen | *Ex ante* savings were determined through engineering calculations derived from IL TRM v10.0. | MI Energy Measures Database, IN TRM v2.2. All inputs were verified through project documentation, virtual site visits or interviews. | Differing input assumptions from IN TRM v2.0 measure. |
| Motor | *Ex ante* savings were determined through custom calculations | Custom calculations. All inputs were verified through project documentation, | Modifications based on customer interview and trend data to the measure inputs. |

| MEASURE CATEGORY | *EX ANTE* SOURCES AND ASSUMPTIONS | *EX POST* GROSS SOURCES AND ASSUMPTIONS | PRIMARY REASONS FOR DIFFERENCES |
|---|---|---|---|
| | | virtual site visits or interviews. Customer data was requested to supplement inputs. | |
| Process | *Ex ante* savings were determined through custom engineering calculations | Custom calculations. All inputs were verified through project documentation, virtual site visits or interviews. | Modifications based on customer interview and trend data to the measure inputs. |
| Refrigeratio n | *Ex ante* savings were determined by the Indiana IL TRM v10.0, Michigan EMD, or through engineering calculations. | IL TRM v10.0. All inputs were verified through project documentation, virtual site visits or interviews. | Modifications to quantities based on project plans provided. |
| Ventilation | *Ex ante* savings were determined through engineering calculations. | Calculated through the application excel tool. All inputs were verified through project documentation, virtual site visits or interviews. | Installed equipment efficiencies for energy and demand savings calculations. Missing calculations were recreated with evaluator created savings calculation spreadsheets resulting in minor differences in claimed savings. |
| VFD | *Ex ante* savings were determined by the Indiana TRM v2.2, Michigan EMD, or through engineering calculations. | Indiana TRM v2.2. All inputs were verified through project documentation, virtual site visits or interviews. | Modifications to baseline case volumes, quantities, capacities composed most adjustments. Deviation from the IN TRM v2.2 prescriptive calculations. |

### ADJUSTMENT SUMMARY – ALL C&I MEASURES

Table 215 provides the realization rates for lighting and non-lighting projects by each C&I program and overall. The evaluation team determined cumulative realization rates by extrapolating the random sample realization rates to the full population. The handpicked realization rate had a greater effect on the cumulative realization rate when those projects are larger and constitute a greater portion of savings. For example, high performance of the handpicked sampled measures had a mitigating effect on the random sample realization rate, influencing the cumulative realization rates upward as a result.

TABLE 215. 2022 C&I PROGRAMS SAMPLE REALIZATION RATES

| MEASURE CATEGORY | HANDPICKED SAMPLE REALIZATION RATE | | | RANDOM SAMPLE REALIZATION RATE | | | CUMULATIVE REALIZATION RATE | | |
|---|---|---|---|---|---|---|---|---|---|
| | KWH | KW | THERMS | KWH | KW | THERMS | KWH | KW | THERMS |
| Prescriptive Program | | | | | | | | | |
| Lighting | 100% | 100% | N/A | 99% | 101% | 100% | 99% | 101% | N/A |
| Non-Lighting | 100% | 100% | N/A | 82% | 69% | 103% | 82% | 70% | 103% |
| Custom Program | | | | | | | | | |
| Lighting | 96% | 110% | N/A | 100% | 97% | 100% | 99% | 99% | N/A |
| Non-Lighting | 93% | 113% | 102% | 96% | 100% | 98% | 95% | 103% | 99% |
| New Construction Program | | | | | | | | | |
| Lighting | 100% | 100% | N/A | 103% | 109% | 100% | 101% | 100% | N/A |
| Non-Lighting | 124% | N/A | 104% | 90% | 153% | 87% | 113% | 153% | 90% |
| SBDI Program | | | | | | | | | |
| Lighting | 100% | 100% | N/A | 97% | 99% | 100% | 98% | 100% | N/A |
| Non-Lighting | N/A | N/A | 100% | 100% | 135% | 100% | 100% | 135% | 100% |

Note: SEM projects were not part of the lighting sample. Custom lighting realization rates were applied to SEM lighting projects.

## SUMMARY C&I PROGRAM REALIZATION RATES AND *EX POST* GROSS SAVINGS

The next three tables (Table 216 through Table 218) show the C&I program's collective *ex ante* reported savings, verified savings, and *ex post* gross savings. The lighting measure group achieved a high electric realization rate of 99%. Realization rates were generally very consistent across the non-lighting measure group, with an average rate of 97%. There was some variability in the VFD, Kitchen and Refrigeration measure groups, which resulted in realization rates of 82%, 82% and 83%, respectively. The realization rates for the collective measure categories were more consistently clustered around 100% in PY 2022 than in the PY 2021 evaluation. The overall realization rate for electric savings across-programs in PY 2022 is 99%.

TABLE 216. 2022 C&I PROGRAMS *EX ANTE* AND *EX POST* GROSS ELECTRIC ENERGY SAVINGS

| MEASURE GROUP | *EX ANTE* [a] ELECTRIC ENERGY SAVINGS (KWH/YR.) | AUDITED GROSS ELECTRIC ENERGY SAVINGS (KWH/YR.) | VERIFIED GROSS ELECTRIC ENERGY SAVINGS (KWH/YR.) | *EX POST* GROSS ELECTRIC ENERGY SAVINGS (KWH/YR.) | REALIZATION RATE |
|---|---|---|---|---|---|
| **Lighting** | **44,492,790.11** | **44,492,826.20** | **44,393,113.54** | **44,215,854.50** | **99%** |
| **Non-Lighting** | **15,593,372.58** | **15,593,371.14** | **15,777,265.62** | **15,185,203.19** | **97%** |
| Building Redesign | 976.00 | 976.00 | 976.00 | 878.96 | 90% |
| Compressed Air | 7,136,767.98 | 7,136,767.98 | 7,136,767.98 | 6,830,779.24 | 96% |
| Controls | 2,403,144.15 | 2,403,144.06 | 2,172,373.57 | 2,194,600.71 | 91% |
| HVAC | 1,331,788.53 | 1,331,788.53 | 1,331,788.53 | 1,240,397.86 | 93% |
| Kitchen | 64,272.00 | 64,272.00 | 65,913.84 | 52,437.86 | 82% |
| Motors | 840,768.16 | 840,768.64 | 840,768.56 | 790,479.81 | 94% |
| Other | - | - | - | - | N/A |
| Process | 2,857,314.16 | 2,857,312.33 | 3,309,920.53 | 3,279,389.81 | 115% |
| Refrigeration | 778,440.58 | 778,440.58 | 738,855.58 | 649,462.35 | 83% |
| Ventilation | - | - | - | - | N/A |
| VFD | 179,901.02 | 179,901.02 | 179,901.02 | 146,776.59 | 82% |
| Water Heat | - | - | - | - | N/A |
| Total | 60,086,162.69 | 60,086,197.33 | 60,170,379.17 | 59,401,057.69 | 99% |

Note: Totals may not sum properly due to rounding.

[a] Values presented at a measure-level represent audited values since the scorecard provides only savings totals.

The C&I portfolio achieved a 100% demand realization rate, primarily driven by the lighting measure group results. The lighting measure group had a realization rate of 100%. The non-lighting demand realization rates varied by sampled measures, with most measure groups achieving high realization rates. Project variability in controls, kitchen, motors, refrigeration, and VFD measures drove the realization rates away from 100% in those measure groups. However, cumulatively across the non-lighting categories, the realization rate was 97%, and the overall realization rate across all programs and measure categories was 100%.

TABLE 217. 2022 C&I PROGRAMS *EX ANTE* & *EX POST* GROSS PEAK DEMAND REDUCTION

| MEASURE GROUP | *EX ANTE* [a] PEAK DEMAND REDUCTION (KW/YR.) | AUDITED GROSS PEAK DEMAND REDUCTION (KW/YR.) | VERIFIED GROSS PEAK DEMAND REDUCTION (KW/YR.) | *EX POST* GROSS PEAK DEMAND REDUCTION (KW/YR.) | REALIZATION RATE |
|---|---|---|---|---|---|
| **Lighting** | **7,903.857** | **7,903.856** | **7,861.436** | **7,914.017** | **100%** |
| **Non-Lighting** | **576.416** | **574.743** | **582.119** | **557.634** | **97%** |
| Building Redesign | - | - | - | - | N/A |
| Compressed Air | 18.962 | 18.962 | 18.962 | 19.199 | 101% |
| Controls | 15.600 | 15.600 | 15.600 | 21.578 | 138% |
| HVAC | 272.470 | 270.797 | 280.454 | 273.760 | 100% |
| Kitchen | 9.433 | 9.433 | 10.888 | 6.527 | 69% |
| Motors | 26.948 | 26.948 | 26.948 | 41.221 | 153% |
| Other | - | - | - | - | N/A |
| Process | 110.754 | 110.754 | 110.754 | 110.754 | 100% |
| Refrigeration | 95.978 | 95.978 | 92.243 | 66.415 | 69% |
| Ventilation | - | - | - | - | N/A |
| VFD | 26.271 | 26.271 | 26.271 | 18.179 | 69% |
| Water Heat | - | - | - | - | N/A |
| Total | 8,480.273 | 8,478.599 | 8,443.555 | 8,471.651 | 100% |

Note: Totals may not sum properly due to rounding.
[a] Values presented at a measure-level represent audited values since the scorecard provides only savings totals.

Realization rates were very consistent across all measure groups in the gas fuel type. The C&I Portfolio gas realization rate of 93% is driven primarily by the HVAC measure group, which contains 89% of the *ex ante* therm savings for the C&I portfolio.

TABLE 218. 2022 C&I PROGRAMS *EX ANTE* & *EX POST* GROSS GAS ENERGY SAVINGS

| MEASURE GROUP | *EX ANTE* [a] NATURAL GAS ENERGY SAVINGS (THERMS/YR.) | AUDITED GROSS NATURAL GAS ENERGY (THERMS/YR.) | VERIFIED GROSS NATURAL GAS ENERGY SAVINGS (THERMS/YR.) | *EX POST* GROSS NATURAL GAS ENERGY SAVINGS (THERMS/YR.) | REALIZATION RATE |
|---|---|---|---|---|---|
| **Lighting** | **-** | **-** | **-** | **-** | **N/A** |
| **Non-Lighting** | **1,445,285.57** | **1,443,079.52** | **1,445,652.77** | **1,351,322.34** | **93%** |
| Building Redesign | - | - | - | - | N/A |
| Compressed Air | - | - | - | - | N/A |
| Controls | 10,748.50 | 10,748.50 | 10,748.50 | 10,312.59 | 96% |
| HVAC | 1,279,235.07 | 1,277,029.02 | 1,282,045.76 | 1,191,254.28 | 93% |
| Kitchen | - | - | - | - | N/A |
| Motors | - | - | - | - | N/A |
| Other | - | - | - | - | N/A |
| Process | 15,291.00 | 15,291.00 | 15,291.00 | 13,268.63 | 87% |
| Refrigeration | - | - | - | - | N/A |
| Ventilation | 129,252.00 | 129,252.00 | 126,808.51 | 126,113.56 | 98% |
| VFD | - | - | - | - | N/A |
| Water Heat | 10,759.00 | 10,759.00 | 10,759.00 | 10,373.29 | 96% |
| Total | 1,445,285.57 | 1,443,079.52 | 1,445,652.77 | 1,351,322.34 | 93% |

Note: Totals may not sum properly due to rounding.

[a] Values presented at a measure-level represent audited values since the scorecard provides only savings totals.

Table 219 shows the realization rates and *ex post* gross savings values for each program and the overall C&I portfolio. The lighting measure group represented a high proportion of electric savings for Prescriptive, New Construction, SBDI, and SEM programs. As such, the high electric realization rate for lighting drove the overall electric realization rate for those programs. In contrast, a higher proportion of Custom program electric savings are from non-lighting measures; therefore, the realization rate skews slightly lower for that program, aligning with lower non-lighting measure realization rates.

TABLE 219. 2022 C&I PROGRAMS *EX POST* GROSS SAVINGS AND REALIZATION RATES

| PROGRAM/ MEASURE CATEGORY | KWH | | | KW | | | THERMS | | |
|---|---|---|---|---|---|---|---|---|---|
| | *EX ANTE* | *EX POST* GROSS | REALIZATION RATE | *EX ANTE* | *EX POST* GROSS | REALIZATION RATE | *EX ANTE* | *EX POST* GROSS | REALIZATION RATE |
| Prescriptive Total | 26,137,346.44 | 25,724,089.20 | 98% | 4,970.984 | 4,918.554 | 99% | 30,722.81 | 31,519.00 | 103% |
| Lighting | 25,009,837.57 | 24,798,745.48 | 99.2% | 4,703.982 | 4,730.876 | 100.6% | - | - | N/A |
| Non-Lighting | 1,127,508.87 | 925,343.73 | 82.1% | 267.002 | 187.678 | 70.3% | 30,722.81 | 31,519.00 | 102.6% |
| Custom Total | 19,386,560.67 | 18,735,182.01 | 97% | 1,298.454 | 1,288.479 | 99% | 493,592.50 | 487,175.97 | 99% |
| Lighting | 7,756,836.66 | 7,671,877.16 | 98.9% | 1,092.232 | 1,076.279 | 98.5% | - | - | N/A |
| Non-Lighting | 11,629,724.01 | 11,063,304.84 | 95.1% | 206.222 | 212.200 | 102.9% | 493,592.50 | 487,175.97 | 98.7% |
| New Construction Total | 13,029,948.12 | 13,444,792.21 | 103% | 2,042.457 | 2,097.238 | 103% | 877,174.46 | 788,831.56 | 90% |
| Lighting | 10,196,764.08 | 10,251,193.25 | 100.5% | 1,939.787 | 1,940.188 | 100.0% | - | - | N/A |
| Non-Lighting | 2,833,184.04 | 3,193,598.96 | 112.7% | 102.670 | 157.050 | 153.0% | 877,174.46 | 788,831.56 | 89.9% |
| SBDI Total | 1,470,494.50 | 1,435,471.64 | 98% | 153.092 | 152.530 | 100% | 43,795.80 | 43,795.80 | 100% |
| Lighting | 1,467,538.84 | 1,432,515.98 | 97.6% | 152.570 | 151.824 | 99.5% | - | - | N/A |
| Non-Lighting | 2,955.66 | 2,955.66 | 100.0% | 0.522 | 0.706 | 135.2% | 43,795.80 | 43,795.80 | 100.0% |
| SEM Total | 61,812.96 | 61,522.63 | 100% | 15.286 | 14.849 | 97% | - | - | N/A |
| Lighting | 61,812.96 | 61,522.63 | 99.5% | 15.286 | 14.849 | 97.1% | - | - | N/A |
| Non-Lighting | - | - | N/A | - | - | N/A | - | - | N/A |
| Total C&I | 60,086,162.69 | 59,401,057.69 | 99% | 8,480.273 | 8,471.651 | 100% | 1,445,285.57 | 1,351,322.34 | 93% |

## *EX POST* NET SAVINGS

The evaluation team used 2021 C&I program evaluation results for the NTG ratios for all five programs in 2022 due to no participant survey activity occurring as part of the 2022 evaluation. Table 220 shows the freeridership, spillover and NTG ratios for the C&I programs in 2022. The SEM program did not exist in 2021 and the evaluation team applied the 2021 Custom program NTG ratio.

TABLE 220. 2022 C&I PROGRAMS NTG RATIOS BY PROGRAM

| PROGRAM | FREERIDERSHIP | PARTICIPANT SPILLOVER | NTG |
|---|---|---|---|
| Prescriptive | 15% | 0% | 85% |
| Custom | 10% | 0% | 90% |
| New Construction | 46% | 0% | 54% |
| SBDI | 6% | 0% | 94% |
| SEM | 10% | 0% | 90% |

Note: Custom NTG ratios were applied to SEM projects.

## RESULTING NET SAVINGS

Table 221 through Table 225 present the resulting C&I programs net electric savings, demand reduction, and natural gas savings by program.

### TABLE 221. 2022 C&I PRESCRIPTIVE *EX POST* NET SAVINGS

| MEASURE | *EX POST* GROSS SAVINGS | | | NTG | *EX POST* NET SAVINGS | | |
|---|---|---|---|---|---|---|---|
| | KWH | KW | THERMS | | KWH | KW | THERMS |
| HVAC | 191,043.93 | 96.557 | 30,723.92 | 85% | 162,387.34 | 82.073 | 26,115.33 |
| Kitchen | 52,437.86 | 6.527 | - | 85% | 44,572.18 | 5.548 | - |
| Lighting | 24,798,745.48 | 4,730.876 | - | 85% | 21,078,933.65 | 4,021.244 | - |
| Refrigeration | 535,085.35 | 66.415 | - | 85% | 454,822.54 | 56.453 | - |
| VFD | 146,776.59 | 18.179 | - | 85% | 124,760.10 | 15.452 | - |
| Water Heat | | | 795.08 | 85% | - | - | 675.82 |
| Total Savings | 25,724,089.20 | 4,918.554 | 31,519.00 | 85% | 21,865,475.82 | 4,180.771 | 26,791.15 |

### TABLE 222. 2022 C&I CUSTOM *EX POST* NET SAVINGS

| MEASURE | *EX POST* GROSS SAVINGS | | | NTG | *EX POST* NET SAVINGS | | |
|---|---|---|---|---|---|---|---|
| | KWH | KW | THERMS | | KWH | KW | THERMS |
| Compressed Air | 6,549,988.01 | 18.514 | - | 90% | 5,894,989.21 | 16.663 | - |
| Controls | 2,194,600.71 | 21.578 | 8,906.85 | 90% | 1,975,140.64 | 19.420 | 8,016.16 |
| HVAC | 529,099.89 | 61.354 | 343,890.25 | 90% | 476,189.90 | 55.219 | 309,501.23 |
| Lighting | 7,671,877.16 | 1,076.279 | - | 90% | 6,904,689.45 | 968.651 | - |
| Motors | 565,820.53 | - | - | 90% | 509,238.47 | - | - |
| Process | 1,156,371.61 | 110.754 | - | 90% | 1,040,734.45 | 99.679 | - |
| Refrigeration | 67,424.09 | - | - | 90% | 60,681.68 | - | - |
| Ventilation | - | - | 126,113.56 | 90% | - | - | 113,502.21 |
| Water Heat | - | - | 8,265.31 | 90% | - | - | 7,438.78 |
| Total Savings | 18,735,182.01 | 1,288.479 | 487,175.97 | 90% | 16,861,663.80 | 1,159.632 | 438,458.38 |

### TABLE 223. 2022 C&I NEW CONSTRUCTION *EX POST* NET SAVINGS

| MEASURE | *EX POST* GROSS SAVINGS | | | NTG | *EX POST* NET SAVINGS | | |
|---|---|---|---|---|---|---|---|
| | KWH | KW | THERMS | | KWH | KW | THERMS |
| Building Redesign | 878.96 | - | - | 54% | 474.64 | - | - |
| Compressed Air | 280,791.23 | 0.685 | - | 54% | 151,627.26 | 0.370 | - |
| Controls | - | - | 1,405.74 | 54% | - | - | 759.10 |
| HVAC | 517,298.38 | 115.143 | 772,844.30 | 54% | 279,341.13 | 62.177 | 417,335.92 |
| Lighting | 10,251,193.25 | 1,940.188 | - | 54% | 5,535,644.35 | 1,047.701 | - |
| Motors | 224,659.28 | 41.221 | - | 54% | 121,316.01 | 22.259 | - |
| Process | 2,123,018.20 | - | 13,268.63 | 54% | 1,146,429.83 | - | 7,165.06 |
| Refrigeration | 46,952.91 | - | - | 54% | 25,354.57 | - | - |
| Water Heat | - | - | 1,312.89 | 54% | - | - | 708.96 |
| Total Savings | 13,444,792.21 | 2,097.238 | 788,831.56 | 54% | 7,260,187.79 | 1,132.508 | 425,969.04 |

TABLE 224. 2022 C&I SBDI *EX POST* NET SAVINGS

| MEASURE | *EX POST* GROSS SAVINGS | | | NTG | *EX POST* NET SAVINGS | | |
|---|---|---|---|---|---|---|---|
| | KWH | KW | THERMS | | KWH | KW | THERMS |
| HVAC | 2,955.66 | 0.706 | 43,795.80 | 94% | 2,778.32 | 0.664 | 41,168.05 |
| Lighting | 1,432,515.98 | 151.824 | - | 94% | 1,346,565.03 | 142.715 | - |
| Total Savings | 1,435,471.64 | 152.530 | 43,795.80 | 94% | 1,349,343.35 | 143.379 | 41,168.05 |

TABLE 225. 2022 C&I SEM *EX POST* NET SAVINGS

| MEASURE | *EX POST* GROSS SAVINGS | | | NTG | *EX POST* NET SAVINGS | | |
|---|---|---|---|---|---|---|---|
| | KWH | KW | THERMS | | KWH | KW | THERMS |
| Lighting | 61,522.63 | 14.849 | - | 90% | 55,370.36 | 13.364 | - |
| Total Savings | 61,522.63 | 14.849 | - | 90% | 55,370.36 | 13.364 | - |

Custom NTG ratios were applied to SEM projects.

# PROCESS EVALUATION

In 2022, the evaluation team completed a process evaluation of three C&I programs: Prescriptive, Custom and SBDI. Evaluation of these programs included in-depth interviews with contractors, who were active in the programs in 2022, and a review of program materials. The team sought answers to the following process-related research questions:

- What type of C&I customers do contractors work with through the program?
- What are customer attitudes and priorities toward efficiency and equipment purchasing?
- What messages about efficiency upgrades are most persuasive with C&I customers?
- How can the program better help contractors promote the program?
- What are the program's benefits to customers and contractors?
- What economic benefits have contractors experienced from participating in NIPSCO's programs?
- Are contractors satisfied with the program and components?
- Are their customers satisfied with the program and its components?
- What opportunities exist to improve contractors' and their customers' experience with the program?
- What are the barriers or challenges for contractors working with the program?
- Have contractors participated in and benefitted from program training?
- How well are program and utility staff engaging contractors?
- Are contractors confident in program offers and processes?

The Commercial New Construction program was not included in the research this year, as these tend to be very different contractors (builders), and this program continues to exceed goals.

## PROCESS SAMPLING STRATEGY

The evaluation team took a census of all contractors who had participated in 2022 and for whom contact information was available to recruit for interviews. The sampling frame included a total of 98 Prescriptive, Custom and SBDI program participants from 2022, drawn from the data provided by TRC.

Participants were asked about each program they participated in, and many contractors participated in multiple programs. Because of the small number of SBDI participants in 2022, the team also asked all interviewees about working with the SBDI program and if there were any specific reasons for their lack of involvement. The team interviewed all contractors who agreed to participate.

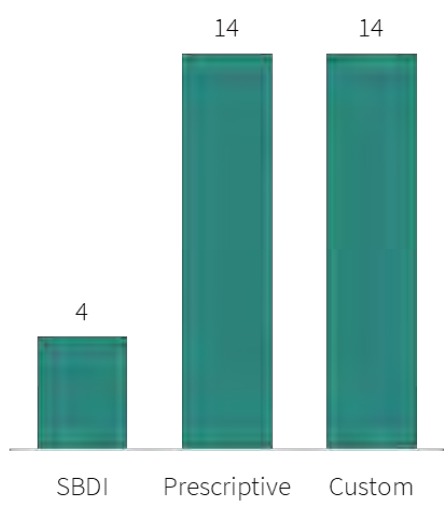
Although 19% (19 out of 98) of the participants were interviewed, it should be noted that all analyses in this section are considered qualitative. The interviews were designed to be qualitative, loosely structured, and exploratory in nature. As such, results are presented as relative quantities or as counts (as opposed to percentages) for most analyses. The intent of these interviews was to better understand TA experiences working with the program, their successes, challenges, and any impressions they might have of customer priorities and market behavior. Additionally, the evaluation used these interviews as an opportunity to gather any insights or suggestions TAs have for improving TA and customer satisfaction with the program.

## CONTRACTOR FEEDBACK

The evaluation team interviewed 19 TAs who were active in at least one of the three studied programs in 2022. As noted above, many of these contractors work across two or more programs. Therefore, most of this analysis is presented at an overarching level, with specific detail provided by the program where appropriate. Additionally, at the end of this section we provide more detailed information about the SBDI program specifically.

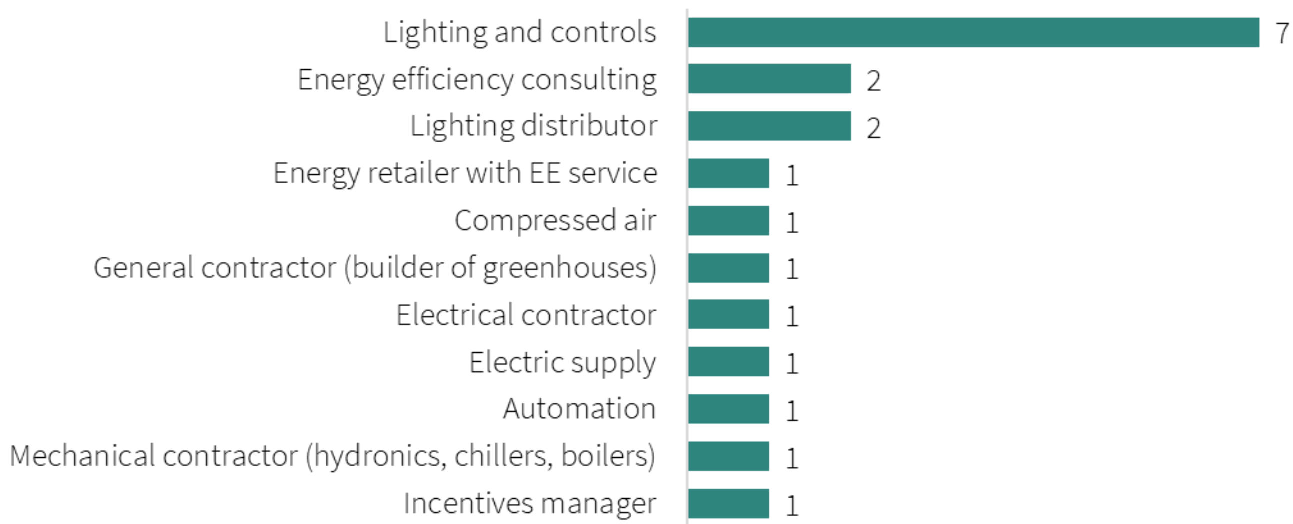
The number of interviewees active in each program is listed in Figure 84 below:

FIGURE 84: INTERVIEWEES PROGRAM PARTICIPATION




The interviewed contractors represented many different business types. Their self-described types are listed in Figure 85.

FIGURE 85: COUNT OF CONTRACTOR BUSINESS TYPE




The interviewed contractors reported serving virtually every type of non-residential customer including small retail, offices, restaurants, and large industrial facilities. Most TAs worked strictly in the commercial and industrial sector, but a few (n=3) also worked with residential customers. Their business size ranged from one-person businesses to companies with over 10,000 employees. Many worked in multiple utility service territories, and some have customers throughout North America and Europe.

The following sections describe the results related to, insights on customers, engagement and economic impacts, barriers and opportunities, contractor, and customer satisfaction, and SBDI participation.

## INSIGHTS ON CUSTOMERS

When asked what customers' overall attitudes towards energy efficiency were**,** some of the most common answers were that energy efficiency was:

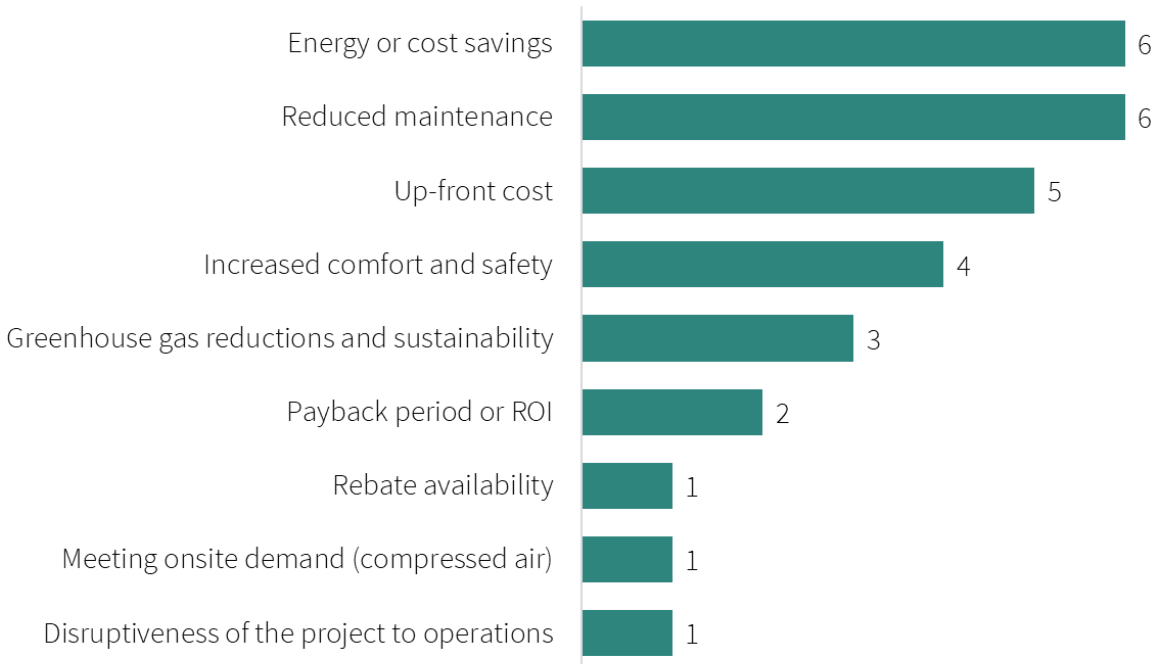
- Of growing interest due to utility rate increases (n=6),
- Of ongoing interest due to corporate mandates (n=5),
- Part of an overall focus on cost savings (n=4), and
- The way of the future (n=2).

Some other insights individual TAs shared on customer perspectives on energy efficiency included:

- Customers are already sold on LED technology and just want to know who can do it at a good price.
- Some are skeptics about efficiency as a worthy pursuit but do it because of corporate goals.
- Some corporations place importance on their customers' perception of them as environmental stewards.
- Some customers are pushing for more energy efficiency every year (i.e., ongoing improvement).
- Insufficient service workforce may be a barrier to adoption of new high efficiency equipment.

The team asked TAs what customers' most important considerations were when scoping efficiency projects and selecting equipment. Figure 86 below shows the responses and frequencies. The three most common considerations were energy or cost savings, reduced maintenance, and up-front costs (of equipment).

FIGURE 86. CUSTOMERS' MOST IMPORTANT CONSIDERATIONS WHEN SCOPING EFFICIENCY PROJECTS




n=19, Multiple responses allowed.

One TA noted that the customer area of interest depends on the role of the person they talk to within an organization, and can be focused on maintenance, financial factors, or durability. That TA prefers to get all interested parties in the room and deal with these issues comprehensively. Another TA who serves national chain stores said the most important motivations for that group is first that their stores be fully functional and look identical, and then that they meet corporate efficiency and "*going green*" standards.

When we asked if customers were aware of available rebates, most contractors felt that at least some portion of their customers know there will be rebates and expect them, but that they may not know the details of how they work or who offers them. The quotes below highlight these themes.

*"I'm surprised if we encounter a customer of NIPSCO's that is not aware of the program. They at least know it exists, but they really rely on us to explain it and execute it."*

*"Everyone knows and expects that there are rebate programs through utilities."*

Conversely, one TA said, "*I tell them (about rebate programs) 9 out of 10 times*." One noted that incentive options can sometimes get lost with larger companies, and that whether they pursue incentives tends to be dependent on the company having "*competent management*."

Of the contractors who were asked whether they bring up NIPSCO program incentives to customers (n=15), most said that they mention these incentives either for every qualifying project or "*as much as possible*" (n=9) and others said they did so most of the time (n=4). The quotes below highlight how contractors feel that rebates are a motivating factor for customers.

> *"[We discuss it] every time, that's going to help us close the sale."*
>
> *"It's one of the big motivating factors to get people interested in moving forward."*

The team asked TAs if there were ever instances when customers complete rebate-eligible projects but do not participate in the programs. Most who answered this question said either they cannot think of an instance of this occurring (n=4), or it would only happen if the customer was unaware of the incentive program (n=2). Some noted that big companies may not think it is worth applying for the rebate and they have budget allocated for the project, so they sometimes choose not to apply (n=2). Finally, one noted that customers might be short-staffed and decide they just do not want to deal with the paperwork. They added: "*That's where I come in*."

The most common message TAs use that resonates with customers is the availability of utility rebates or "*free money*" to help pay for upgrades (n=12). Some other things they use to spur decisions include telling customers about the other benefits of lighting upgrades, such as improved light quality and reduced maintenance (n=3), that it is for a limited time (n=1), and that the customers have already been paying into this program (n=1).

TAs noted that they have seen an increasing interest among their clients in efficiency programs. They see this change as driven primarily by rising utility rates (n=3). Some other contributors they see are expanding corporate mandates and a growing environmental consciousness among businesses (n=3).

Customers still see all the usual benefits from investing in improved energy efficiency, such as cost savings, progress toward corporate goals, and reduced equipment maintenance. The only downsides for customers that TAs mentioned are the upfront cost of making these changes (n=4) and any disruption of production that might occur during the upgrade (n=2).

## EFFICIENCY MARKET

The evaluation team asked TAs about how they would describe the current market, trends they have seen in the market in the last few years, and where they think the market is going.

In describing the current market, TAs were focused on lighting, and most felt there were still lots of customers who could use upgrades. One TA said they felt the lighting stock was about 30-40% converted to LEDs and that they could still find "*as many leads as we can handle*." Another said, "*We are not running out of people to talk to, or customers to go after*." Several noted, however, that there were fewer opportunities than before, and they must "*dig*" a little more to find them. One noted that "*the low hanging fruit is all gone.*"

Over the last two years, TAs said that higher utility rates are driving people to rebates (n=3) and there is a growing focus on sustainability and climate change (n=3). Other individuals observed more focus on technologies like controls, real-time energy management and EV charging stations. Some other trends or changes in the marketplace TAs observed include:

- Maturing LED market moving from lamps to fixtures,
- Improving supply chain issues,
- More interest in controls,
- Interest in real time energy management, and
- Growth in demand for EV charging stations.

The evaluation team also asked if TAs have needed to make large changes in recent years in response to customer demand and most TAs (n=9) said no. One noted that due to technology advancements they are now able to offer some lighting products with high field adjustability (i.e., ability to change voltage, lumens and color temperature using DIP switches on the fixtures). This greatly reduces the variety of models they need to stock, as seen in the quote below.

> *"We now have one product with 9 variations that can be adjusted out in the field. We can stock just one pallet instead of a whole row of pallets."*

Some TAs also reported that they experienced difficulties with recent market conditions including challenges with supply chain (n=7) and workforce shortages (n=2) but felt these specific issues were getting better. Some said they have had minimal challenges (n=5) and others have made other adjustments such as narrowing their focus to more profitable projects, focusing on larger clients, or increasing prices.

## ENGAGEMENT AND ECONOMIC IMPACTS

### CONTRACTOR WORK WITH THE PROGRAMS

The evaluation team asked contractors their reasons for working with the NIPSCO commercial efficiency programs. The most frequently given reasons were:

- It is a good sales tool and helps improve the project financials for customers (n=6).
- Their business model or company policy is to always work with incentive programs when available (n=5).
- They were initially urged by prospective customers to work with the program to improve a project they had proposed (n=4).
- It is useful or even necessary to be competitive (n=3).

In addition, they said: incentives have gotten better, they have a good relationship with the implementer (TRC), and the program does not require preapproval for projects with incentives under $10,000.

We asked the contractors if they were registered as participating trade allies with TRC for NIPSCO programs. Fifteen said they were or thought they probably were, two said they were not, and two did not know.

For those contractors registered as trade allies with the programs, we asked what the benefits of being registered were for them. About half said it was good for business and gave them credibility (n=8). Two trade allies did not think they received any real benefit from being a registered trade ally in NIPSCO's network.

Most of the contractors who were asked whether working with the NIPSCO commercial programs has benefitted their business said yes (n=4); one said "*no*." Some replies included:

> *“Efficient lighting is a no-brainer to begin with and when it is incentivized there’s a heck of a sales pitch.”*
>
> *“Yes, definitely. We are doing more retrofitting to LED because of the program. …I can't think of any jobs that I've done recently that if the program wasn't around, they would be (likely) to even think about doing the job.”*
>
> *“Our revenue has increased because of utility programs, and NIPSCO is part of that.”*

One contractor who was relatively new to the NIPSCO programs said they could not yet say what effect NIPSCO’s program has on their operation specifically, but that in general:

> *“Rebates help us sell things. It takes the edge off (and) creates a bit of a sense of urgency for the customer.”*

## PROGRAM COMMUNICATIONS

Contractors said they receive information on program updates most often from emails (n=12). Some rely on meetings including program kickoffs and virtual meetings (n=4). Others mentioned talking on the phone on a regular basis with their local rep or TRC (n=4). A few others said they check the website when they have a prospective job (n=3). Three contractors said they were not getting program updates (one of these is not currently a registered trade ally and one relies on the program website for updates).

When asked about their preferences for receiving updates, the most preferred option was by email (n=10), followed by contact from a program representative (n=7). A few contractors mentioned liking this personal touch and being able to ask questions that are unique to their business. The quotes below highlight these sentiments.

> *“I'm in contact with people at TRC all the time. If I have a question, they answer it. And if it touches on something that is going to be changing, they give me a heads up.”*
>
> *“I like the little bit of hand holding, when you’re dealing with utilities from coast to coast and everyone is sending out emails every week or every quarter, it gets a bit overwhelming.”*

The team also asked contractors if they felt well-informed about the programs and were able to easily communicate program details to customers. All who were asked said yes (n=11). Because many of them handle program interactions for their customers, not much explanation is needed. Some also mentioned the program website, representatives, and the application forms as sources of useful information.

## BARRIERS AND OPPORTUNITIES

Contractors saw minimal barriers for customers to participate in NIPSCO's commercial programs. Three mentioned that filling out the application takes a lot of time, and one mentioned awareness of the program could be a barrier. For the interviewed contractors, their customers' experiences with the programs consisted of either getting an upfront discount on equipment or services or getting a rebate check after purchase. The "downsides" to efficiency improvement projects mentioned above, such as initial cost or potential loss of production during installation, could conceivably be barriers to some.

The evaluation team also asked contractors if they, themselves, experienced any barriers or challenges in working with the programs. Most contractors (n=5 out of 8 asked) saw no barriers to working with the programs. Two mentioned that the Excel file used in the application process was difficult to work with. One who worked with the Custom program said the administrative burden was a challenge. Estimating a rebate before the proposal and before the project has been sold is difficult. They noted:

> *"(It would be) nice to get an estimate reviewed (by the program) without it requiring me to submit a W9 and paperwork."*

Contractors did have some suggestions of things NIPSCO could consider in the next few years to improve contractors' experience with the program. These were:

- Simplify the application and rebate process,
- Offer higher incentives,
- Keep incentivizing lighting upgrades (because there are still opportunities),
- Require DLC listing for lighting (to "*cut out the [junk] that is being sold that doesn't last*"), and
- Put more focus on advanced controls.

In addition, one contractor expressed dissatisfaction with using online portals in general, while another said they should get the portal up and running and add the application process to it so they can track the status of applications.

Some other suggestions that would help contractors to promote and expand their program participation are:

- Track customers' facilities history with the programs and notify contractors when those facilities are ready for a new upgrade,
- Provide more information geared towards customers on how the rebates work and where the money comes from,
- Add a midstream program,
- Get rid of the $10,000 incentive cap (for pre-approval) in the Prescriptive program, and
- Continue to work with large suppliers and suppliers of industrial equipment.

Some contractors had suggestions for equipment they would like NIPSCO to incentivize. These included: EV charging, advanced rooftop unit controls, more refrigeration options, and troffer retrofit kits. One suggested NIPSCO continue looking for options to include measures that currently need to apply through the Custom program in the Prescriptive and SBDI programs, because those programs pay better.

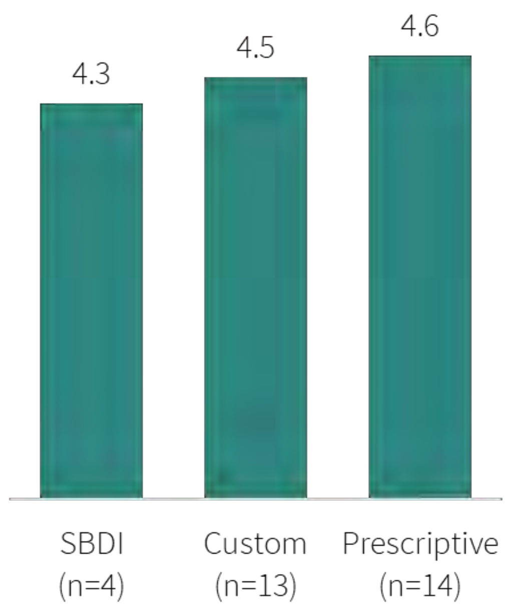
## CONTRACTOR AND CUSTOMER SATISFACTION

Interviewed contractors reported that because they handle all interactions with the programs for their customers, they generally did not receive any customer feedback or questions on the programs unless something went wrong (n=14). On occasion, they received expressions of gratitude about the rebate amounts.

> *"Once we showed them the set of financials that had something like $85,000 in that line item, I think their ears wiggled and eyes dilated, and they said, 'does that go to you or me?'"*

The evaluation team asked interviewees to provide satisfaction ratings for each program they work with using a scale of 1 to 5 where 1 is "very dissatisfied" and 5 is "very satisfied". Their average scores are shown in Figure 87 below.

FIGURE 87. CONTRACTOR AVERAGE SATISFACTION SCORES FOR EACH PROGRAM




The most common score given for each program was 5, very satisfied. One contractor who rated their satisfaction with the programs at 5 said this regarding Custom and Prescriptive:

> *"…our involvement (with the programs) has been positive, and it just helps us do our jobs. …I would go higher if I could."*

The following is some additional detail on the lower satisfaction scores for each program.

**Custom**. The person who rated their satisfaction a 3 said "*It is just difficult. It's not easy to fill out the applications*." (In comparison, this same person rated their satisfaction a 5 for the Prescriptive program.) One who rated their satisfaction with Custom at 4 said the rating was because it requires preapproval for everything. They suggested the program set a project minimum incentive level, below which pre-approval is not required.

Two who gave Custom a 4 said incentive values could be higher. Two contractors who rated their satisfaction with Custom and Prescriptive at 4 said "*there is always room to improve*" and "*I don't give out 5s a lot*." One who said their satisfaction was 4.5 suggested more money for advanced controls and "*make it weighted to actual savings*." They added "*If we can somehow get NIPSCO to be less theoretical, and more actuarial in their approach, that would be a good thing*."

**Prescriptive**. Two contractors who rated Prescriptive at 4 said NIPSCO should offer higher rebates and include other measures. "*Do market research around the country and look at other utility offerings*." Another who rated it 4 for satisfaction said the rating is because they would like to see added measures or clarity on efficiency improvements like de-lamping, upgrading from older fluorescents (in particular, T12 and high output T8 and T5), and upgrades that lower wattage.

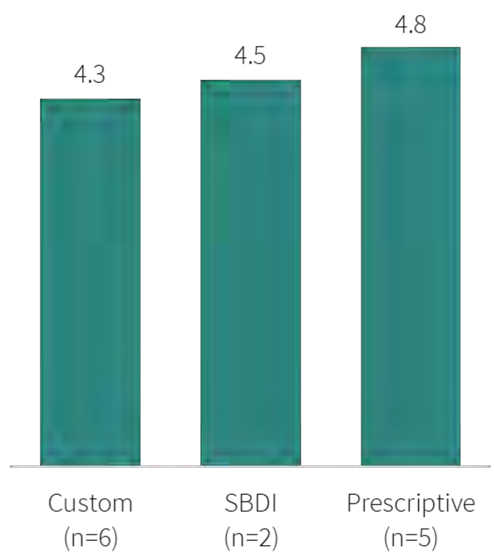
**SBDI**. The one who rated SBDI satisfaction at 2.5-3 said it was because of what the program offers. "*It has shrunk in offerings over the last few years*" and is "*pretty limited*." They would like to see better offerings for smaller businesses, who tend to have eight-foot fluorescents and four-by-four-foot fluorescent fixtures.

> *"If they could offer like an extra $0.50 or something on the fluorescent bulb conversions, I think that would be helpful."*

The contractor who rated their satisfaction at 4 said "*I'm an always-room-for-improvement kind of guy*."

Some of the contractors (n=8) were also asked about their satisfaction with the application process. Their average satisfaction scores are shown in Figure 88 below.

FIGURE 88. AVERAGE CONTRACTOR SATISFACTION SCORE FOR APPLICATION PROCESS




Most rated their satisfaction with the application process for Custom and Prescriptive at 5 (n=5) and one of the two who provided ratings for SBDI gave that process a 5. Another contractor who worked with the Custom program said the application process was "*pretty simple*", but then did not provide a score.

Contractors also provided some additional feedback. One who rated their satisfaction at a 3 for the Custom program said it was not difficult but was "*certainly time consuming.*" One contractor who participated in all three programs gave the application process a rating of 4 overall (for all 3 programs) because it was sometimes difficult to get all the information needed from the customer. Finally, one rated both Prescriptive and SBDI application processes at 5, then noted that NIPSCO "*constantly changes*" the applications, which is inconvenient for them. They suggested NIPSCO try to change it less often.

When the team asked contractors how satisfied they were with the support received from program representatives at TRC, they were overwhelmingly positive, with the vast majority rating satisfaction at 5 (n=14). Only a few rated their satisfaction at 4 (n=4). Some comments included "*They are phenomenal, (I have) never not gotten an answer*" and that those who work at TRC are "*very good people*." Comments on the 4 ratings were also positive, but one contractor suggested "*it would be beneficial to have a specific contact*" person for them.

When asked about satisfaction with support from NIPSCO account managers and other staff, most said they did not have contact (n=9). For those who did, most rated their satisfaction at 5 (n=6 out of 7), with one noting that they are "*good at giving me results*."

### TRAINING

Most interviewed contractors (n=11) did not receive, or did not recall receiving, training through the program in 2022. Those that did rated their satisfaction at 5, except for one contractor who rated it at 3. That person said that as someone who has been working with the program for a long time, they need more detail on the programs themselves, rather than the high-level treatment the trainings currently present.

When contractors were asked if they are interested in any technology-specific training, most said no (n=11). Those who were interested in trainings suggested:

- Controls (n=2),
- EV chargers (n=2),
- Steam trap repair (n=1),
- HVAC (n=1),
- Compressed air and compressor maintenance (n=1),
- Networked lighting (n=1),
- Process cooling (n=1), and
- Solar (n=1).

## SBDI PARTICIPATION

SBDI program participation was lower than expected in 2022. Because we were only able to recruit a small number of contractors who participated in the SBDI program in 2022 for interviews, we asked all contractors we interviewed about why they do or do not submit rebates through the SBDI program. Those who were already active in SBDI said things like "*it is a little easier and most projects don't require preapproval.*" Others noted that it was a "*good*" program and had higher incentives for smaller firms, so it gives "*that extra little punch for the smaller guys.*" One interviewee said they "*used it whenever the customer qualified for it*." Another contractor suggested "*I would love to see more products added to SBDI to accommodate smaller customers*."

Those allies not active in SBDI in 2022 were asked why. Some of their most common reasons included that they:

- Have projects that do not typically fit into SBDI (e.g., industrial automation, controls, refrigeration) (n=5),
- Focus on working with larger businesses (n=4), and
- Are not familiar with SBDI (n=4).

Some other reasons given by individual respondents were:

- They avoid SBDI programs because contractors they work with had bad experiences with programs (in other states) in which jobs were "*stolen*" from them when the utility opened the bid up for competition.
- They use a tool/app for determining which programs a proposed project qualifies for and it never shows SBDI as an option.
- They are a union shop and could not compete with the others on small project bids.
- Small business programs have productivity requirements that do not fit their business model and territory.

Many of those that did not participate in SBDI did not feel negatively toward the program. Some things they said include:

> *"(The fact that we are not working with SBDI now) doesn't mean we won't in the future."*
>
> *"Once our team gets large enough to where we can place that focus, if that is a segment (i.e., small business) we can get into and really build, then that is where we might go."*
>
> *"Actually, I think we just signed up for that recently, and we've partnered with a couple contractors. We just did one (project) at the end of the year, and I'm not as familiar with it and I'm trying to become more familiar."*

# CONCLUSIONS AND RECOMMENDATIONS

### CONCLUSION 1: THE COMMERCIAL AND INDUSTRIAL PROGRAMS FELL SHORT OF THEIR ENERGY SAVINGS GOALS OVERALL.

Cumulatively, the C&I portfolio achieved 68% of its electric savings goal and 93% of its gas savings goal. To gain a better understanding of where to target incentives and marketing, the evaluation team compared participation in the 2022 C&I programs to the 2021, 2020, and 2019 programs. Specifically, the team reviewed customer participation, electric savings impact, gas saving impact, and total MMBTU savings impact and concluded the following:

- The Prescriptive program grew electric savings by 7%, and demand and gas savings by 32% from PY 2021. The electric savings goal for the program remained similar to the PY 2021 goal value. The Prescriptive program fell short of the PY 2022 goal, achieving 61% of electric savings, despite an increase in electric savings from PY 2021 to PY 2022. The gas savings goal was increased by nearly 3x from PY2021, and despite the growth in gas savings, was unable to achieve the goal in PY 2022. The participant count decreased but measure count increased in PY 2022 as compared to PY 2021.

- The Custom program maintained very similar electric savings in PY 2022 as in PY 2021. Gas savings decreased by 22% from PY 2021. The electric and gas savings goals for the program were both lowered from PY 2021 levels, but PY 2022 savings achieved still fell short of the PY 2022 goals set. The participant count decreased but measure count increased in PY 2022 as compared to PY 2021.
- The New Construction (NC) program experienced significant growth in 2021 over 2020 and was able to sustain and slightly increase the level of savings achieved in 2022. The electric savings goal for the program has been decreased year over year, and while unable to achieve the goal in PY 2021 (88% of goal), the goal was overshot dramatically in 2022 (292%). Demand savings goals and gas goals followed a similar pattern (425% achieved and 320% achieved, respectively). NC participant count and measure count increased by approximately 20% in PY 2022 over PY 2021.
- The SBDI program experienced a 30% decrease in electric savings, but a 10-fold increase in gas savings from PY 2021. Participant and measure count decreased by approximately half in PY 2022 as compared to PY 2021.
- The SEM program was a new commercial offering in PY 2022. The participation in this program was very limited this year and occurred only in the last quarter of the program year. None of the PY 2022 goals for the program were met.
- Across all five programs, the measure count and participant count remained very similar in PY 2022 as in PY 2021. Electric savings, demand savings and gas savings all increased by approximately 20% in PY 2022 as compared to PY 2021. Goals for all three metrics were decreased by approximately 20% in PY 2022 as compared to PY 2022. Despite the savings growth and goal threshold lowered, the cumulative C&I program did not meet any of the three, goal metrics.

It is likely that COVID-19 and the economic climate of uncertainty affected participation, which is largely out of NIPSCO's ability to control. The data obtained from the 2021 customer survey indicated that customers are still feeling the effects of the pandemic (63%, n=64), which could be affecting customer willingness and ability to support business capital investments.

Recommendations:

- For Prescriptive, Custom, and SBDI programs, closely monitor participation trends throughout 2023 to determine if the decreased participation trend will persist and identify whether program strategies, such as bonus incentives to contractors, could help boost participation throughout the year.
- Conduct evaluation research with nonparticipating businesses to understand major barriers and needs across business segments (planned for summer 2023).

### CONCLUSION 2: WASTE HEAT FACTORS WERE NOT APPLIED CONSISTENTLY ACROSS THE PORTFOLIO.

Currently, C&I programs do not capture WHF therm penalties in the tracking data. The IL TRM v10.0, IN TRM v2.2 along with most other state TRMs, include WHFs to capture interactive effects that lighting upgrades have on the building HVAC systems. These waste heating effects have real effects on the energy consumption of buildings and should be included in the application calculation tool so that they can be included for cost-effectiveness. Going forward, both NIPSCO and the evaluation team plan to address WHF therm penalties within program cost-effectiveness on the electric side. There was some inconsistency found in the PY 2022 sampled measures in how waste heat factors were applied. Five evaluated measures that should have had waste heat factors applied to the electric impacts based on the selected building type and HVAC type noted in the application did not incorporate the impact in the *ex ante* savings values. Waste heat factors were applied to the electric impact in the *ex post* savings values, resulting in a discrepancy.

Recommendations:

- To be consistent across the portfolio, NIPSCO should calculate WHFs for all C&I programs going forward in the project tracking data, so these factors can be included in cost-effectiveness and future planning, even if they are not counted in reported savings. To do this, NIPSCO should take the following steps:
    1. Utilize the inputs in the applicable section of the application tool to determine how each area is heated or cooled. There is a "space conditioning type" variable in the "Project Information" tab of the application, but some areas may be conditioned differently (i.e., warehouses with an attached office area).
    2. Add functionality to the application to look up the electricity, demand, and natural gas WHFs based on the project site location and the method of heating and cooling.
    3. Modify kWh, kW, and therm calculation methodologies in the application Excel tool to include these WHFs. Note that some lighting projects accounted for kWh and kW WHFs, but not uniformly across all sampled projects, where lighting was installed within conditioned space.
    4. Track fuel type by customer to accurately capture applicable WHFs for electric-only versus dual fuel customers.

### CONCLUSION 3: MOST CONTRACTORS FEEL CUSTOMER INTEREST IN EFFICIENCY IS GROWING OR HOLDING STEADY LARGELY DUE TO UTILITY RATE INCREASES, CORPORATE MANDATES, AND THE DESIRE TO REDUCE OPERATING COSTS.

Utility rate increases and corporate directives were the top two motivators pushing customers to participate, followed closely by financial or cost reduction.

### CONCLUSION 4: WHEN CUSTOMERS ARE SCOPING EFFICIENCY PROJECTS AND SELECTING EQUIPMENT THEIR MOST IMPORTANT CONSIDERATIONS ARE ABOUT ENERGY OR COST SAVINGS AND REDUCED MAINTENANCE.

These considerations were followed closely by up-front cost, increased comfort and safety and greenhouse gas reductions and sustainability.

### CONCLUSION 5: MOST CONTRACTORS SAW NO BARRIERS TO WORKING WITH THE PROGRAM FOR THEM, BUT STILL HAD SUGGESTIONS FOR CHANGES AND NEW TECHNOLOGIES TO INCENTIVIZE.

Some suggestions included lowering the administrative burden of the Custom program, simplifying the application and rebate processes, and adding incentives for EV charging, advanced rooftop controls, and more refrigeration options.

Recommendations:

- Explore options to reduce the administrative burden of Custom program applications and simplify the processes in general.
- Research options for adding incentives or other support for EV charging, advanced rooftop controls, and refrigeration options.

### CONCLUSION 6: CONTRACTORS CURRENTLY WORKING WITH THE NIPSCO EFFICIENCY PROGRAMS ARE GENERALLY SATISFIED WITH THEM.

Some contractors suggested adding more eligible measures to SBDI and moving some common Custom projects into the Prescriptive program so they can get higher incentives. Some said they would consider working with the SBDI program should the opportunity arise. Program implementers and NIPSCO staff received very high ratings with the only suggestion being that they would like to have a single point of contact.

Recommendations:

- Continually look for opportunities to add eligible measures to the SBDI offering and to make some of the more common Custom measures prescriptive so that customers can receive higher incentives.

### CONCLUSION 7: CONTRACTORS SEE WORKING WITH NIPSCO PROGRAMS AS BENEFICIAL OR EVEN NECESSARY TO HELP THEM CLOSE SALES AND BE COMPETITIVE.

Some said their business models are designed to work with utility programs and being able to bring incentives to the table helps them to close sales that probably would not happen without them. About half the contractors felt that being registered trade allies was generally good for business and helped give them credibility.

### CONCLUSION 8: SEVERAL CONTRACTORS SAID THEY BELIEVE THERE ARE STILL MANY OPPORTUNITIES FOR SAVINGS WITH LIGHTING UPGRADES.

Contractors felt that while LEDs are now considered a known and accepted technology, there are still a large percentage of facilities that need to be converted. They said they have no shortage of projects they can do, and some wished the program would incentivize more types of lighting retrofits.

Recommendations:

- Continue to provide incentives for customers and contractors to upgrade existing inefficient EISA-exempt lamps and fixtures. Consider ways to “leapfrog” adoption and encourage related measures, such as lighting controls, with these projects where possible.

### CONCLUSION 9: INCREMENTAL COST IS TRACKED INCONSISTENTLY ACROSS C&I PROGRAMS.

For the C&I programs specifically, incremental cost information is tracked either in the Captures tracking data, or in the measure assumptions documentation. However, this information is not consistent by measure or program and data often contains errors. This information is critical to the cost-effectiveness analysis performed by the evaluation team, and the inconsistency and incompleteness of data requires significant effort to reconcile after the fact and increases the chance for errors or inaccuracies in cost-effectiveness analysis.

Recommendations:

- TRC should track incremental cost data, and any other cost or incentive data, clearly and accurately within Captures for all measures, including prescriptive measures, in the C&I datasets. This will limit introduced errors and allow the evaluation team to more accurately QA/QC these data during the cost-effectiveness analysis process.
- If possible, TRC should track these data consistently on the residential side as well. Although all residential measures are prescriptive in nature and incremental costs are tracked in the measure assumptions documentation, tracking incremental costs directly in Captures would again limit the introduction of error and allow the evaluation team to more easily QA/QC these values by measure and program.

# 15. COMMERCIAL AND INDUSTRIAL (C&I) ONLINE MARKETPLACE PROGRAM

## PROGRAM DESIGN AND DELIVERY

The Commercial and Industrial (C&I) Online Marketplace program is in its second year as an offering within NIPSCO's portfolio. The offering was launched in late December of 2020, with a full ramp up in 2021. This program provides instant discounts on energy-saving kits and other products ordered through an online store. The intent of the program is to help remove the financial barrier associated with the initial cost of these energy-efficient alternatives. This program is implemented by TRC, who partners with TechniArt to implement the Online Marketplace. TechniArt is responsible for building, hosting, and maintaining the C&I Online Marketplace website, verifying customer accounts, handling customer orders, shipping products to customers and answering customer questions and concerns.

In 2022, NIPSCO offered kits to C&I customers at no cost. They also offered packs that included multiples of the same bulb and products at a discounted cost. To participate, customers visit the online store website, add the kits and products they would like to receive to their shopping cart, and provide their account information at checkout. TechniArt then ships the products directly to the customer's business address within five to eight days, and customers may return products up to 30 days after receipt. Participants must be active NIPSCO commercial and industrial customers within designated rate schedules, and who receive the corresponding electric or natural gas service for the product they are selecting. Products purchased through the C&I Online Marketplace are not eligible for rebates through other NIPSCO programs.

Table 226 lists the measures offered through the C&I Online Marketplace. A single customer account can order up to five kits (any combination) in a calendar year. The Restaurant, Office and Retail kits were initially released in January 2021, the Lighting Add-On packs were added to the C&I Online Marketplace in late December 2021. Other packs and individual products were offered beginning in early 2022.

TABLE 226. 2022 C&I ONLINE MARKETPLACE KIT CONTENTS AND SUMMARY METRICS

| PRODUCTS | QTY | INCENTIVE VALUE | EUL | *EX ANTE* KWH SAVINGS | *EX ANTE* KW SAVINGS | *EX ANTE* THERMS SAVINGS *(DUAL FUEL ONLY)* |
|---|---|---|---|---|---|---|
| Restaurant Kit (650000 & 650003) | | | | | | |
| LED Filament A19 Bulb<br>Model FA19D6027EC | 12 | $17.40 | 3 | 1,790.27 | 0.381 | - |
| LED Filament Candle E12 Bulb<br>Model FB11D4027EE12C | 6 | $10.44 | 3 | 537.08 | 0.114 | - |
| LED Exit Sign Retrofit<br>Model 20715 | 2 | $30.00 | 5 | 46.86 | 0.005 | - |
| Power Pre-Rinse Spray Valve<br>Model N2180 1.1 GPM | 1 | $25.00 | 5 | 42.01 | - | 6.23 |
| Bathroom Aerator<br>Model N3115P 1.0 GPM | 2 | $4.00 | 10 | 31.09 | 0.003 | 5.15 |

| PRODUCTS | QTY | INCENTIVE VALUE | EUL | *EX ANTE* KWH SAVINGS | *EX ANTE* KW SAVINGS | *EX ANTE* THERMS SAVINGS *(DUAL FUEL ONLY)* |
|---|---|---|---|---|---|---|
| Kitchen Aerator<br>Model N3115P 1.5 GPM | 1 | $3.00 | 10 | 35.62 | 0.004 | 6.23 |
| Retail Kit (650001 & 650004) | | | | | | |
| LED A19 (60W) Bulb<br>Model L60A19D1527KUT | 6 | $8.70 | 5 | 553.24 | 0.154 | - |
| LED Filament BR30 Bulb<br>Model LED9BR30D50K Daylight | 12 | $42.36 | 9 | 1,806.15 | 0.503 | - |
| LED Exit Sign Retrofit<br>Model 20715 | 2 | $30.00 | 5 | 48.60 | 0.005 | - |
| Tier 1 Advanced Power Strip<br>Model TS1104 | 1 | $5.00 | 7 | 42.76 | - | - |
| Bathroom Aerator<br>Model N3210B-PC 1.0 GPM | 2 | $4.00 | 10 | 8.95 | 0.001 | 1.48 |
| Office Kit (650002 & 650005) | | | | | | |
| LED A19 (60W) Bulb<br>Model L60A19D1527KUT | 6 | $8.70 | 5 | 571.68 | 0.110 | - |
| LED Filament BR30 Bulb<br>Model LED9BR30D50K Daylight | 10 | $35.30 | 8 | 1,555.31 | 0.300 | - |
| LED Exit Sign Retrofit<br>Model 20715 | 2 | $30.00 | 5 | 47.73 | 0.003 | - |
| LED Desk Lamp<br>Model 31710 | 1 | $1.45 | 12 | 61.09 | 0.012 | - |
| Tier 1 Advanced Power Strip<br>Model TS1104 | 1 | $5.00 | 7 | 44.82 | - | - |
| Bathroom Aerator<br>Model N3210B-PC 1.0 GPM | 2 | $4.00 | 10 | 6.13 | 0.002 | 1.02 |
| Kitchen Aerator<br>Model N3115P 1.5 GPM | 1 | $3.00 | 10 | 7.03 | 0.002 | 1.23 |
| Restaurant Kit Revision 1 (650006 & 650007) | | | | | | |
| LED Filament A19 Bulb<br>Model LA19727DCFIL9 | 12 | $17.40 | 3 | 1,841.42 | 0.392 | - |
| LED Filament Candle E12 Bulb<br>Model FB11D4027EE12C | 6 | $10.44 | 3 | 537.08 | 0.114 | - |
| LED Exit Sign Retrofit<br>Model 20715 | 2 | $30.00 | 5 | 46.86 | 0.005 | - |
| Power Pre-Rinse Spray Valve<br>Model N2180 1.1 GPM | 1 | $25.00 | 5 | 42.01 | - | 6.23 |
| Bathroom Aerator<br>Model N3115P 1.0 GPM | 2 | $4.00 | 10 | 31.09 | 0.003 | 5.15 |
| Kitchen Aerator<br>Model N3115P 1.5 GPM | 1 | $3.00 | 10 | 35.62 | 0.004 | 6.23 |
| Packs (Multiples of same bulb) | | | | | | |
| LED T8 linear<br>Model LT814840G9 | 25 | $122.50 | 15 | 918.26 | 0.219 | - |

| PRODUCTS | QTY | INCENTIVE VALUE | EUL | *EX ANTE* KWH SAVINGS | *EX ANTE* KW SAVINGS | *EX ANTE* THERMS SAVINGS *(DUAL FUEL ONLY)* |
|---|---|---|---|---|---|---|
| Measure 650008 | | | | | | |
| LED Filament A19 Bulb<br>Model L60A19D1527KUT<br>Measure 650009 | 24 | $34.80 | 5 | 2,286.73 | 0.221 | - |
| 4-Pack 14W LED T8 Type A Tube 4000k AL+PC<br>Measure 650010 | 4 | $20.00 | 15 | 172.25 | 0.041 | - |
| BR30. 650-1419 lumens. 9W (65W Equivalent)<br>Measure 650030 | 6 | $21.00 | 7 | 180.22 | 0.040 | - |
| 330 Lumen. LED Candle. 4W (40W Equivalent)<br>Measure 650042 | 6 | $10.20 | 4 | 115.86 | 0.026 | - |
| 800 Lumen. Omni (7W) (60W Equivalent)<br>Measure 650048 | 6 | $8.70 | 4 | 170.57 | 0.038 | - |
| Globe. 350-499 lumens. 5W (40W Equivalent)<br>Measure 650036 | 6 | $10.20 | 7 | 112.64 | 0.025 | - |
| 750-1049 lumens. Omnidirectional. 11W (75W Equivalent)<br>Measure 650041 | 6 | $8.70 | 4 | 205.97 | 0.046 | - |
| 1050-1489 lumens. Omnidirectional (15W)<br>Measure 650039 | 6 | $8.70 | 4 | 276.77 | 0.062 | - |
| Individual Products (Quantity 1x) | | | | | | |
| LED Corn Bulb (54W) Replace 175W MH<br>Measure 650017 | 1 | $65.00 | 12 | 579.24 | - | - |
| Smart Thermostat - Electric Cooling and Heating<br>Measure 650033 | 1 | $65.00 | 11 | 1,477.83 | 0.353 | - |
| Smart Thermostat - Electric Cooling Only<br>Measure 650025 | 1 | $65.00 | 11 | 472.41 | 0.353 | - |
| Smart Thermostat - Electric Cooling and Gas Heating<br>Measure 650026 | 1 | $65.00 | 11 | 667.35 | 0.353 | 86.40 |
| LED Exit Sign Retrofit Model 20715<br>Measure 650019 | 1 | $15.00 | 5 | 51.01 | 0.007 | - |
| Smart Thermostat - Gas Heating<br>Measure 650018 | 1 | $55.00 | 11 | - | - | 86.40 |
| Wall Pack 55W (120W Equivalent)<br>Measure 650016 | 1 | $65.00 | 13 | 606.82 | - | - |

Note: Restaurant Kit Revision 1 differs from the Restaurant Kit only in that a different model of A19 LED filament bulb was offered.

# PROGRAM PERFORMANCE

The C&I Online Marketplace program fell short of its goals, achieving 61% of electric energy savings, 65% of peak demand savings, and 9% of natural gas therms savings. While the program did not meet its goals, many programs do experience a ramp up period in their first several years, while awareness and engagement builds. The COVID-19 pandemic and subsequent economic conditions did also continue to impact businesses in 2022, which may have also affected participation.

Table 227 summarizes savings for the full year of program performance, including program savings goals.

TABLE 227. 2022 C&I ONLINE MARKETPLACE PROGRAM SAVING SUMMARY

| METRIC | GROSS SAVINGS GOAL | *EX ANTE* | AUDITED | VERIFIED | *EX POST* GROSS | *EX POST* NET | GROSS GOAL ACHIEVEMENT |
|---|---|---|---|---|---|---|---|
| Electric Energy Savings (kWh/yr.) | 4,252,379.00 | 3,121,262.01 | 3,130,871.55 | 2,646,369.35 | 2,615,038.79 | 2,552,728.79 | 61% |
| Peak Demand Reduction (kW) | 880.781 | 673.756 | 682.481 | 567.852 | 568.577 | 556.833 | 65% |
| Natural Gas Energy Savings (therms/yr.) | 90,773.03 | 6,228.18 | 6,302.58 | 7,935.41 | 8,673.54 | 8,539.46 | 9% |

Table 228 outlines the *ex post* gross and net-to-gross (NTG) adjustment factors. The evaluation team developed these values by analyzing survey data collected from the 2022 C&I Online Marketplace customer population, as described in the *Ex Post* Gross Savings section.

TABLE 228. 2022 C&I ONLINE MARKETPLACE PROGRAM ADJUSTMENT FACTORS

| METRIC | REALIZATION RATE[a] | FREERIDERSHIP | SPILLOVER | NTG[b] |
|---|---|---|---|---|
| Electric Energy Savings (kWh/yr.) | 84% | 7% | 5% | 98% |
| Peak Demand Reduction (kW) | 84% | 7% | 5% | 98% |
| Natural Gas Energy Savings (therms/yr.) | 136% | 6% | 5% | 98% |

[a] Realization rate is defined as *ex post* gross savings divided by *ex ante* savings.
[b] NTG is defined as *ex post* net savings divided by *ex post* gross savings.

NIPSCO spent 46% of the electric program budget and 12% of the natural gas program budget. The proportion of spending aligns closely to the achievement of electric savings goals (46% of budget spent, 61% of goal savings achieved) and gas savings goals (12% of budget spent, 9% of savings goals achieved). Compared to 2021, while the budgets increased, the program expenditures for electric remained similar, but the gas expenditures doubled from 2021 to 2022. Table 229 lists the 2022 C&I Online Marketplace program budget and expenditures by fuel type.

TABLE 229. 2022 C&I ONLINE MARKETPLACE PROGRAM EXPENDITURES

| FUEL | PROGRAM BUDGET | PROGRAM EXPENDITURES | BUDGET SPENT |
|---|---|---|---|
| Electric | $518,705.14 | $238,408.40 | 46% |
| Natural Gas | $98,346.63 | $11,595.84 | 12% |

# EVALUATION METHODOLOGY

To inform the impact and process evaluation of the 2022 C&I Online Marketplace program, the evaluation team completed the following research activities:

- **Program staff interviews and discussions**, to understand program design and delivery.
- **Documentation and materials review**, to provide context on program design and implementation.
- **Tracking data analysis**, to audit and verify the accuracy of program participation data.
- **Engineering analysis**, to audit the calculation methodology and assumptions that form the measure savings for each C&I Online Marketplace kit component, which also informs the realization rates for the kit components.
- **Participant survey**, to provide feedback on areas for program improvement and data on freeridership, in-service rate (ISR), spillover, NTG, awareness, motivations, perceptions, experience, and satisfaction with the program.

# IMPACT EVALUATION

The evaluation team completed the impact evaluation to answer the following research questions:

- What assumptions were used to develop deemed savings estimates? Are there any updates that should be made? Do claimed savings algorithms align with the 2015 Indiana Technical Reference Manual (TRM) version 2.2 (v2.2) or the Illinois Technical Reference Manual version 10.0 (v10.0), NIPSCO's measure savings database, or other more appropriate secondary sources?[61] Are there any updates that should be made?
- What are *ex post* program savings? Do these suggest any needed updates to program design, delivery, or savings assumptions?
- What are installation rates for kit measures? Are there certain measures that are installed most often? Least often?
- How effective was the program in influencing customer decision making (net savings)?
- Is the program on track to meet its participation and savings goals?

For all measure types, the evaluation team compared its engineering calculations to NIPSCO's *ex ante* savings, basing its savings methodologies and inputs for each measure on several sources: standard engineering practices, the 2015 Indiana TRM (v2.2), IL TRM v10.0 (2021), NIPSCO's measure savings database, and other secondary TRM sources.[62]

## AUDITED AND VERIFIED SAVINGS

To develop an audited measure quantity and savings, the evaluation team first checked the program tracking data for duplicates or other data quality issues. To audit program savings, the evaluation team performed the following reviews to verify alignment with the program's scorecard:

[61] Cadmus. July 28, 2015. *Indiana Technical Reference Manual Version 2.2 (v2.2).*

[62] September 24, 2021. *Illinois Statewide Technical Reference Manual for Energy Efficiency Version 10.0*

- **Audited kits quantity.** Reviewed program tracking data provided by the implementer and audited the number of kits distributed.
- **Confirmed measure-level savings calculations.** Reviewed per-measure and per-kit savings calculations in the documentation provided by NIPSCO.
- **Reviewed savings estimates.** Confirmed program-level total savings reported in the scorecard.

## AUDITED QUANTITY OF KITS

Table 230 shows the number of reported and audited kits, packs and products distributed through the C&I Online Marketplace program in 2022. The evaluation team checked reported scorecard values against the program tracking data and found that kit quantities aligned. The program rebated a total of 1,410 kits, packs, or products of varying types.

TABLE 230. 2022 C&I ONLINE MARKETPLACE AUDITED KIT QUANTITY

| KIT TYPE | MEASURE ID | SCORECARD | TRACKING DATA |
|---|---|---|---|
| Dual Fuel Kit – Restaurant | 650000 | 56 | 56 |
| Dual Fuel Kit – Retail | 650001 | 290 | 290 |
| Dual Fuel Kit – Office | 650002 | 491 | 491 |
| Electric Only Kit – Restaurant | 650003 | 27 | 27 |
| Electric Only Kit – Retail | 650004 | 86 | 86 |
| Electric Only Kit – Office | 650005 | 165 | 165 |
| Dual Fuel Kit - Restaurant Rev 1 | 650006 | 98 | 98 |
| Electric Only Kit - Restaurant Rev 1 | 650007 | 31 | 31 |
| LED Tube - Add-On Pack - Electric Only | 650008 | 78 | 78 |
| A19 Add-On Pack - Electric Only | 650009 | 25 | 25 |
| LED Corn Bulb (54W) Replace 175W MH | 650017 | 4 | 4 |
| 4-Pack 14W LED T8 Type A Tube 4000k AL+PC | 650010 | 5 | 5 |
| Smart Thermostat - Electric Cooling and Heating | 650033 | 3 | 3 |
| Smart Thermostat - Electric Cooling Only | 650025 | 6 | 6 |
| Smart Thermostat - Electric Cooling and Gas Heating | 650026 | 21 | 21 |
| LED Exit Sign Retrofit | 650019 | 3 | 3 |
| BR30. 650-1419 lumens. 9W (65W Equivalent) | 650030 | 2 | 2 |
| 330 Lumen. LED Candle. 4W (40W Equivalent) | 650042 | 3 | 3 |
| Smart Thermostat - Gas Heating | 650018 | 2 | 2 |
| 800 Lumen. Omni (7W) (60W Equivalent) | 650048 | 5 | 5 |
| Globe. 350-499 lumens. 5W (40W Equivalent) | 650036 | 2 | 2 |
| 750-1049 lumens. Omnidirectional. 11W (75W Equivalent) | 650041 | 1 | 1 |
| 1050-1489 lumens. Omnidirectional (15W) | 650039 | 1 | 1 |
| Wall Pack 55W (120W Equivalent) | 650016 | 5 | 5 |
| Total | | 1,410 | 1,410 |

## MEASURE AND KIT SAVINGS REVIEW

The evaluation team reviewed the measure and kit savings documentation (file titled: NIPSCO Commercial Product and Kit Quote w Calcs 04.01.2022), which contained measure-level and kit-level savings.[63] Importantly, NIPSCO included ISR values from other programs' past EM&V efforts in their *ex ante* assumptions for the C&I Marketplace measures. The program documentation included rates to adjust savings for both in-service rates and water heater fuel saturation.

Upon review of this document, the evaluation team found that measure-level savings values in the tracking data mostly aligned with NIPSCO's kit savings documentation and reported kWh savings aligned with calculated values. However, the team identified a few calculation or rounding errors, described below:

- **Demand savings for the A19 Add-On Pack** were incorrectly reported as 0.221 kW demand savings. This value was incorrectly hardcoded in the provided calculations, but actively calculated to 0.441 kW demand savings. This error was present in 2021 ex ante as well.
- **Several lighting packs** incorrectly report *ex ante* savings from a single bulb rather than the pack quantity (in all instances quantity is 6x). The original calculation file is accurate, but it appears the quantity was not factored into the final *ex ante* programmed value. As a result, there are six lighting packs where the audited savings are 6x the reported *ex ante* savings on a per pack basis. There were very few of these products distributed, so the impact of these modifications is minor relative to the entire population.
- **Wall Pack 55 watt** incorrectly reports *ex ante* savings as 606.82 kWh, differing from the original calculation file demonstrating 259.84 kWh. There is a single bulb in this product offering, so the discrepancy cause is not clear. Verified savings agree with the original calculation file of 259.84 kWh. There were very few of these products distributed, so the impact of this modification is minor relative to the entire population.
- **Like other kit programs,** program tracking data savings were **reported at the kit-level** with a rounded total kit value, and savings in NIPSCO's Measure Calculation file were reported at the measure level with unrounded per-measure values. This difference resulted in a rounding discrepancy, meaning that the sum of total measure savings was slightly off from the tracking data savings at the kit-level. The difference in kW demand reduction is within a hundredth of a decimal place (0.10 kW). The difference in kWh savings is 1.03 kWh. The difference in therms savings is slightly greater, at 2.71 therms. These rounding discrepancies are noted, where applicable, in the table notes in the remainder of this report.

Table 231 shows the comparison between reported *ex ante* savings values in the program tracking data compared against provided savings calculations. The savings impact for each individual measure was calculated and compared to *ex ante*. These values make up the audited savings reported. The values below are for a single kit, pack, or product by measure ID, and do not represent the entire Online Marketplace population.

[63] TRC Companies. April 2022. *NIPSCO Commercial Product and Kit Quote w Calcs_04.01.2022*

TABLE 231. 2022 C&I ONLINE MARKETPLACE PROGRAM AUDITED PER-KIT AND PER-MEASURE SAVINGS

| KIT TYPE | *EX ANTE* SAVINGS | | | AUDITED SAVINGS | | |
|---|---|---|---|---|---|---|
| | KWH | KW | THERMS | KWH | KW | THERMS |
| Dual Fuel Kit – Restaurant | 2,482.93 | 0.508 | 17.61 | 2,482.93 | 0.508 | 18.03 |
| Dual Fuel Kit – Retail | 2,459.70 | 0.663 | 1.48 | 2,459.70 | 0.663 | 1.48 |
| Dual Fuel Kit – Office | 2,293.79 | 0.429 | 2.24 | 2,293.79 | 0.430 | 2.26 |
| Electric Only Kit – Restaurant | 2,482.93 | 0.508 | - | 2,482.93 | 0.508 | - |
| Electric Only Kit – Retail | 2,459.70 | 0.663 | - | 2,459.70 | 0.663 | - |
| Electric Only Kit – Office | 2,293.79 | 0.429 | - | 2,293.79 | 0.430 | - |
| Dual Fuel Kit - Restaurant Rev 1 | 2,534.08 | 0.519 | 17.61 | 2,534.08 | 0.519 | 18.03 |
| Electric Only Kit - Restaurant Rev 1 | 2,534.08 | 0.519 | - | 2,534.08 | 0.519 | - |
| LED Tube - Add-On Pack - Electric Only | 918.26 | 0.219 | - | 918.26 | 0.219 | - |
| Add-On Pack - Electric Only | 2,286.73 | 0.221 | - | 2,286.73 | 0.441 | - |
| LED Corn Bulb (54W) Replace 175W MH | 579.24 | - | - | 579.24 | - | - |
| 4-Pack 14W LED T8 Type A Tube 4000k AL+PC | 172.25 | 0.041 | - | 172.25 | 0.041 | - |
| Smart Thermostat - Electric Cooling and Heating | 1,477.83 | 0.353 | - | 1,477.83 | 0.353 | - |
| Smart Thermostat - Electric Cooling Only | 472.41 | 0.353 | - | 472.41 | 0.353 | - |
| Smart Thermostat - Electric Cooling and Gas Heating | 667.35 | 0.353 | 86.40 | 667.35 | 0.353 | 86.40 |
| LED Exit Sign Retrofit | 51.01 | 0.007 | - | 51.01 | 0.007 | - |
| BR30. 650-1419 lumens. 9W (65W Equivalent) | 180.22 | 0.040 | - | 1,081.35 | 0.241 | - |
| 330 Lumen. LED Candle. 4W (40W Equivalent) | 115.86 | 0.026 | - | 695.15 | 0.155 | - |
| Smart Thermostat - Gas Heating | - | - | 86.40 | - | - | 86.40 |
| 800 Lumen. Omni (7W) (60W Equivalent) | 170.57 | 0.038 | - | 1,023.42 | 0.229 | - |
| Globe. 350-499 lumens. 5W (40W Equivalent) | 112.64 | 0.025 | - | 675.84 | 0.151 | - |
| 750-1049 lumens. Omnidirectional. 11W | 205.97 | 0.046 | - | 1,235.82 | 0.276 | - |
| 1050-1489 lumens. Omnidirectional (15W) | 276.77 | 0.062 | - | 1,660.64 | 0.371 | - |
| Wall Pack 55W (120W Equivalent) | 606.82 | - | - | 259.84 | - | - |

## VERIFIED IN-SERVICE RATE

The evaluation team calculated verified savings using in-service rate (ISR) values obtained by surveying the C&I Online Marketplace customer base. The evaluation team surveyed all customers that received a kit between January 1, 2022, and December 31, 2022, and received complete ISR related responses from 87 customers. To determine ISR, the customers were asked how many units of each measure they installed from the kits they specifically received. Aside from ISR modifications, all other savings calculation methodologies were held constant between *ex ante* and verified savings calculations.

The kits (Retail, Office, Restaurant and Restaurant Rev 1) made up nearly 90% of the Online Marketplace products distributed, thus the customers receiving kits were targeted for survey response. The customer survey did not include any customers or questions regarding the non-kit products (individual products or lighting packs). Therefore, the ISRs the evaluation team used to calculate verified savings for packs and individual products were unaltered from the *ex ante* ISRs, as these appeared to be reasonable assumptions.

Across measures, verified ISRs varied relatively widely when compared to *ex ante* assumptions. For some measures, like A19 LEDs, BR30 LEDs, pre rinse spray valves and kitchen aerators included in the kits, ISRs measured in evaluation surveys were relatively close to the *ex ante* assumptions. The evaluation team found somewhat lower ISRs for filament bulbs, candelabra bulbs, desk lamps and LED Exit signs. The evaluation team found somewhat higher ISRs for bathroom aerators and power strips. Table 232 lists the *ex ante* and verified ISRs and resulting verified savings for measures included in each kit.

TABLE 232. 2022 C&I ONLINE MARKETPLACE PROGRAM IN-SERVICE RATE BY MEASURE

| KIT MEASURES | QUANTITY PER KIT | *EX ANTE* ISR | VERIFIED ISR | VERIFIED SAVINGS PER KIT KWH | KW | THERMS *(DUAL FUEL ONLY)* |
|---|---|---|---|---|---|---|
| Restaurant Kit (650000 & 650003) | | | | | | |
| LED Filament A19 Bulb | 12 | 83% | 57% | 1,232.57 | 0.262 | - |
| LED Filament Candle E12 Bulb | 6 | 83% | 50% | 325.50 | 0.069 | - |
| LED Exit Sign Retrofit | 2 | 83% | 52% | 29.54 | 0.003 | - |
| Power Pre-Rinse Spray Valve | 1 | 30% | 25% | 44.71 | - | 5.74 |
| Bathroom Aerator | 2 | 25% | 52% | 81.92 | 0.009 | 10.47 |
| Kitchen Aerator | 1 | 29% | 35% | 54.15 | 0.006 | 5. 81 |
| Retail Kit (650001 & 650004) | | | | | | |
| LED A19 (60W) Bulb | 6 | 83% | 73% | 491.92 | 0.137 | - |
| LED Filament BR30 Bulb | 12 | 83% | 68% | 1,496.68 | 0.417 | - |
| LED Exit Sign Retrofit | 2 | 83% | 52% | 30.64 | 0.004 | - |
| Tier 1 Advanced Power Strip | 1 | 40% | 78% | 83.18 | - | - |
| Bathroom Aerator | 2 | 25% | 52% | 23.59 | 0.003 | 3.01 |
| Office Kit (650002 & 650005) | | | | | | |
| LED A19 (60W) Bulb | 6 | 83% | 73% | 508.32 | 0.098 | - |
| LED Filament BR30 Bulb | 10 | 83% | 68% | 1,288.82 | 0.249 | - |
| LED Exit Sign Retrofit | 2 | 83% | 52% | 30.09 | 0.004 | - |
| LED Desk Lamp | 1 | 83% | 66% | 48.92 | 0.009 | - |
| Tier 1 Advanced Power Strip | 1 | 40% | 78% | 87.19 | - | - |
| Bathroom Aerator | 2 | 25% | 52% | 16.16 | 0.004 | 2.06 |
| Kitchen Aerator | 1 | 29% | 35% | 10.68 | 0.003 | 1.36 |
| Restaurant Revision 1 Kit (650006 & 650007) | | | | | | |
| LED Filament A19 Bulb | 12 | 83% | 57% | 1,267.79 | 0.270 | - |
| LED Filament Candle E12 Bulb | 6 | 83% | 50% | 325.50 | 0.069 | - |
| LED Exit Sign Retrofit | 2 | 83% | 52% | 29.54 | 0.003 | - |
| Power Pre-Rinse Spray Valve | 1 | 30% | 25% | 44.71 | - | 5.74 |
| Bathroom Aerator | 2 | 25% | 52% | 81.92 | 0.009 | 10.47 |
| Kitchen Aerator | 1 | 29% | 35% | 54.15 | 0.006 | 5.81 |
| Packs (Multiples of same bulb) | | | | | | |
| LED T8 linear<br>Measure 650008 | 25 | 83% | 83% | 918.26 | 0.219 | - |
| LED Filament A19 Bulb<br>Measure 650009 | 24 | 83% | 83% | 2,033.29 | 0.392 | - |
| 4-Pack 14W LED T8 Type A Tube<br>Measure 650010 | 4 | 83% | 83% | 172.25 | 0.041 | - |
| BR30. 650-1419 lumens.  9W<br>Measure 650030 | 6 | 83% | 83% | 1,081.35 | 0.241 | - |
| 330 Lumen.  LED Candle. 4W<br>Measure 650042 | 6 | 83% | 83% | 695.15 | 0.155 | - |

| KIT MEASURES | QUANTITY PER KIT | *EX ANTE* ISR | VERIFIED ISR | VERIFIED SAVINGS PER KIT KWH | KW | THERMS *(DUAL FUEL ONLY)* |
|---|---|---|---|---|---|---|
| 800 Lumen. Omni (7W) Measure 650048 | 6 | 83% | 83% | 1,023.42 | 0.229 | - |
| Globe. 350-499 lumens. 5W Measure 650036 | 6 | 83% | 83% | 675.84 | 0.151 | - |
| 750-1049 lumens. Omni. 11W Measure 650041 | 6 | 83% | 83% | 1,235.82 | 0.276 | - |
| 1050-1489 lumens. Omni (15W) Measure 650039 | 6 | 83% | 83% | 1,660.64 | 0.371 | - |
| Individual Products (Quantity 1x) | | | | | | |
| LED Corn Bulb (54W) Replace 175W MH Measure 650017 | 1 | 93% | 93% | 579.24 | - | - |
| Smart Thermostat - Electric Cooling and Heating Measure 650033 | 1 | 100% | 100% | 1,477.83 | 0.353 | - |
| Smart Thermostat - Electric Cooling Only Measure 650025 | 1 | 100% | 100% | 472.41 | 0.353 | - |
| Smart Thermostat - Electric Cooling and Gas Heating Measure 650026 | 1 | 100% | 100% | 667.35 | 0.353 | 86.40 |
| LED Exit Sign Retrofit Model 20715 Measure 650019 | 1 | 93% | 93% | 51.01 | 0.007 | - |
| Smart Thermostat - Gas Heating Measure 650018 | 1 | 100% | 100% | - | - | 86.40 |
| Wall Pack 55W (120W Equivalent) Measure 650016 | 1 | 93% | 93% | 259.84 | - | - |

Table 233 shows the comparison between the *ex ante* and verified savings. The values reported are for a single kit or measure and do not represent the entire Online Marketplace population.

TABLE 233. 2022 C&I ONLINE MARKETPLACE PROGRAM VERIFIED PER-KIT OR PER-MEASURE SAVINGS

| KIT TYPE | *EX ANTE* SAVINGS | | | VERIFIED SAVINGS | | |
|---|---|---|---|---|---|---|
| | KWH | KW | THERMS | KWH | KW | THERMS |
| Dual Fuel Kit – Restaurant | 2,482.93 | 0.508 | 17.61 | 1,768.40 | 0.350 | 22.02 |
| Dual Fuel Kit – Retail | 2,459.70 | 0.663 | 1.48 | 2,126.01 | 0.561 | 3.01 |
| Dual Fuel Kit – Office | 2,293.79 | 0.429 | 2.24 | 1,990.19 | 0.367 | 3.43 |
| Electric Only Kit – Restaurant | 2,482.93 | 0.508 | - | 1,768.40 | 0.350 | - |
| Electric Only Kit – Retail | 2,459.70 | 0.663 | - | 2,126.01 | 0.561 | - |
| Electric Only Kit – Office | 2,293.79 | 0.429 | - | 1,990.19 | 0.367 | - |
| Dual Fuel Kit - Restaurant Rev 1 | 2,534.08 | 0.519 | 17.61 | 1,803.61 | 0.357 | 22.02 |
| Electric Only Kit - Restaurant Rev 1 | 2,534.08 | 0.519 | - | 1,803.61 | 0.357 | - |
| LED Tube - Add-On Pack - Electric Only | 918.26 | 0.219 | - | 918.26 | 0.219 | - |
| Add-On Pack - Electric Only | 2,286.73 | 0.221 | - | 2,033.29 | 0.392 | - |
| LED Corn Bulb (54W) Replace 175W MH | 579.24 | - | - | 579.24 | - | - |
| 4-Pack 14W LED T8 Type A Tube 4000k AL+PC | 172.25 | 0.041 | - | 172.25 | 0.041 | - |
| Smart Thermostat - Electric Cooling and Heating | 1,477.83 | 0.353 | - | 1,477.83 | 0.353 | - |
| Smart Thermostat - Electric Cooling Only | 472.41 | 0.353 | - | 472.41 | 0.353 | - |
| Smart Thermostat - Electric Cooling and Gas Heating | 667.35 | 0.353 | 86.40 | 667.35 | 0.353 | 86.40 |
| LED Exit Sign Retrofit | 51.01 | 0.007 | - | 51.01 | 0.007 | - |
| BR30. 650-1419 lumens. 9W (65W Equivalent) | 180.22 | 0.040 | - | 1,081.35 | 0.241 | - |
| 330 Lumen. LED Candle. 4W (40W Equivalent) | 115.86 | 0.026 | - | 695.15 | 0.155 | - |
| Smart Thermostat - Gas Heating | - | - | 86.40 | - | - | 86.40 |
| 800 Lumen. Omni (7W) (60W Equivalent) | 170.57 | 0.038 | - | 1,023.42 | 0.229 | - |
| Globe. 350-499 lumens. 5W (40W Equivalent) | 112.64 | 0.025 | - | 675.84 | 0.151 | - |
| 750-1049 lumens. Omnidirectional. 11W | 205.97 | 0.046 | - | 1,235.82 | 0.276 | - |
| 1050-1489 lumens. Omnidirectional (15W) | 276.77 | 0.062 | - | 1,660.64 | 0.371 | - |
| Wall Pack 55W (120W Equivalent) | 606.82 | - | - | 259.84 | - | - |

## *EX POST* GROSS SAVINGS

The evaluation team referred to the Illinois TRM (v10.0) and 2015 Indiana TRM (v2.2) to calculate *ex post* gross electric energy savings, demand reduction, and natural gas savings. Through the engineering review, the team found differences between *ex ante* and *ex post* gross savings. These differences were primarily driven by the following overarching factors:

- As this program is relatively new, *ex ante* assumptions relied on residential EM&V results ISR values (although programs/years referenced for these values are not noted in *ex ante* savings documentation). The evaluation team was able to update ISRs for most measures using more tailored information from C&I Online Marketplace participant survey responses. As discussed in the previous section, the team applied ISR values to verified and *ex post* gross savings for all kits, except add-on kits.
- Like ISR assumptions, *ex ante* assumptions relied on residential EM&V results for water heater and heating source fuel saturation values (although programs/years referenced for these values are not noted in *ex ante* savings documentation). The evaluation team updated these values for all measures using more tailored information from C&I Online Marketplace population data. This modification is discussed below.
- The evaluation team did not assign a waste heat factor (WHF) therm penalty to the LED measures, consistent with the approach for all C&I programs. The team incorporated WHFs into calculations for *ex post* gross kWh energy and kW demand savings but is only reporting these values for cost-effectiveness purposes (in alignment with all lighting EM&V). This modification is discussed below.

- For all kit measures, the *ex ante* calculations predominately relied on the Illinois TRM v10.0 inputs. Since the Illinois TRM (v10.0) has measures more specific to a commercial kit application, the evaluation team used similar methodology for most *ex post* calculations inputs. Some deviations existed where the *ex ante* values were built on IL TRM v9.0 metrics:
    - For some coincidence factor (CF) inputs for exit lighting measures, the evaluation team modified the value to 1.0 to reflect 24/7 hours of operation.
    - IL TRM v10.0 updated several faucet aerator measure metrics including the ground water supply temperature to 50.7 degrees F (from 54.1), resulting in deviation in the EPG Elec and EPG Gas values calculated in *ex ante* and *ex post*.

The following sections summarize the team's findings and recommendations based on the engineering review.

## FUEL SATURATION

During 2022, C&I Online Marketplace kit recipients were required to provide data on their water heater fuel source and their space heating fuel source when ordering the kits online. The evaluation team used these data to calculate saturation rates for space heating and for water heating used in the *ex post* gross savings results. For 2022, *ex ante* calculations relied on residential EM&V results to determine the fuel saturation ratios by measure. Results demonstrate a slight discrepancy between *ex ante* and *ex post* gross electric and natural gas fuel sources for water heating equipment and space heating equipment, as shown in Table 234.

TABLE 234. 2022 C&I ONLINE MARKETPLACE PROGRAM WATER HEATER FUEL SATURATION

| SAVINGS TYPE | ELECTRIC WATER HEATING SATURATION RATE | NATURAL GAS WATER HEATING SATURATION RATE | ELECTRIC SPACE HEATING SATURATION RATE | NATURAL GAS SPACE HEATING SATURATION RATE |
|---|---|---|---|---|
| *Ex Ante* | 22% | 78% | 22% | 78% |
| *Ex Post* Gross | 28% | 72% | 13% | 87% |

## WASTE HEAT FACTORS

The C&I Online Marketplace program did not report electric or therm WHFs in *ex ante* calculations. In discussions with NIPSCO, the evaluation team did not include negative therm WHFs in *ex post* therm calculations. Electric (kWh and kW demand) WHF penalties are minor in comparison with therm waste heat factor penalties and were reported within *ex post* savings. To calculate WHFs, the team used values from the IL TRM v10.0, matching the space type to the space types used for HOU and CF, and weighted the WHF by the space heating saturation rate (e.g., 87% WHF impact for gas heating and AC, 13% WHF impact for electric HP).

Table 235 shows the therm waste heat penalties by applicable measure and kit for the total 2022 population for inclusion in cost-effectiveness calculations. There was a 26,345.30 therm penalty for the entire C&I Online Marketplace program in 2022.

TABLE 235. 2022 C&I ONLINE MARKETPLACE PROGRAM WASTE HEAT FACTOR PENALTIES

| APPLICABLE KIT MEASURES | WHF PENALTY BY INDIVIDUAL MEASURE (THERMS) | 2022 POPULATION OF KITS COUNT | WHF PENALTY TOTAL 2022 POPULATION |
|---|---|---|---|
| Restaurant Kit (650000 only) | (20.92) | | |
| LED Filament A19 Bulb | (15.78) | 56 | (883.42) |
| LED Filament Candle E12 Bulb | (4.73) | 56 | (265.03) |
| LED Exit Sign Retrofit | (0.41) | 56 | (23.12) |
| Retail Kit (650001 only) | (43.19) | | |
| LED A19 (60W) Bulb | (9.92) | 290 | (2,877.97) |
| LED Filament BR30 Bulb | (32.40) | 290 | (9,395.73) |
| LED Exit Sign Retrofit | (0.87) | 290 | (252.81) |
| Office Kit (650002 only) | (21.49) | | |
| LED A19 (60W) Bulb | (5.50) | 491 | (2,698.27) |
| LED Filament BR30 Bulb | (14.95) | 491 | (7,340.88) |
| LED Exit Sign Retrofit | (0.46) | 491 | (225.28) |
| LED Desk Lamp | (0.59) | 491 | (288.34) |
| Restaurant Kit Rev 1 (650006) | (21.37) | | |
| LED Filament A19 Bulb | (16.23) | 98 | (1,590.16) |
| LED Filament Candle E12 Bulb | (4.73) | 98 | (463.80) |
| LED Exit Sign Retrofit | (0.41) | 98 | (40.47) |
| Total | | | (26,345.30) |

## MEASURE SAVINGS INPUT MODIFICATIONS

For all kit measures, the *ex ante* and *ex post* calculations predominately relied on inputs from the Illinois TRM (v10.0). Since this TRM has measures more specific to a kit application, the team followed a similar methodology for most inputs to calculate *ex post* savings. There were very slight modifications to a couple CF metrics due to the HOU of how the fixture operated. Table 236 shows the deviations between *ex ante* and *ex post* HOU and CF inputs for applicable measures.

TABLE 236. 2022 C&I ONLINE MARKETPLACE PROGRAM *EX POST* MEASURE INPUT MODIFICATIONS

| KIT MEASURES | *EX ANTE* CF | *EX ANTE* GROUND WATER SUPPLY TEMPERATURE | *EX POST* CF | *EX POST* GROUND WATER SUPPLY TEMPERATURE | SOURCE REFERENCE |
|---|---|---|---|---|---|
| Restaurant Kits (650000, 650003, 650006, 650007) | | | | | |
| Bath, and Kitchen Aerators | | 54.1 | | 50.7 | IL TRM v10, Low-flow Faucet Aerators |
| Pre-Rinse Spray Valve | | 54.1 | | 50.7 | IL TRM v10, Low-flow Faucet Aerators |
| Retail Kit (650001 & 650004) | | | | | |
| LED Exit Sign Retrofit | 0.71 | | 1.0 | | Given 24/7 operation, CF should be 1.0 |
| Bath, and Kitchen Aerators | | 54.1 | | 50.7 | IL TRM v10, Low-flow Faucet Aerators |
| Office Kit (650002 & 650005) | | | | | |
| LED Exit Sign Retrofit | 0.52 | | 1.0 | | Given 24/7 operation, CF should be 1.0 |
| Bath, and Kitchen Aerators | | 54.1 | | 50.7 | IL TRM v10, Low-flow Faucet Aerators |

## *EX POST* GROSS SAVINGS

Table 237 shows the *ex ante* deemed savings and *ex post* gross per-measure savings for 2022 C&I Online Marketplace program measures. The reasons for differences between *ex ante* and *ex post* gross values are outlined in the section below.

TABLE 237. 2022 C&I ONLINE MARKETPLACE PROGRAM *EX ANTE* AND *EX POST* GROSS PER-MEASURE SAVINGS

| KIT MEASURES | QUANTITY IN KIT | *EX ANTE* SAVINGS KWH | *EX ANTE* SAVINGS KW | *EX ANTE* SAVINGS THERMS | *EX POST* SAVINGS KWH | *EX POST* SAVINGS KW | *EX POST* SAVINGS THERMS |
|---|---|---|---|---|---|---|---|
| Restaurant Kit (650000 & 650003) | | | | | | | |
| LED Filament A19 Bulb | 12 | 1,790.27 | 0.381 | - | 1,219.46 | 0.262 | - |
| LED Filament Candle E12 Bulb | 6 | 537.08 | 0.114 | - | 322.04 | 0.069 | - |
| LED Exit Sign Retrofit | 2 | 46.86 | 0.005 | - | 29.23 | 0.003 | - |
| Power Pre-Rinse Spray Valve | 1 | 42.01 | - | 6.23 | 46.88 | - | 6.02 |
| Bathroom Aerator | 2 | 31.09 | 0.003 | 5.15 | 90.66 | 0.010 | 11.58 |
| Kitchen Aerator | 1 | 35.62 | 0.004 | 6.23 | 58.88 | 0.006 | 7.52 |
| Retail Kit (650001 & 650004) | | | | | | | |
| LED A19 (60W) Bulb | 6 | 553.24 | 0.154 | - | 480.71 | 0.137 | - |
| LED Filament BR30 Bulb | 12 | 1,806.15 | 0.503 | - | 1,462.57 | 0.417 | - |
| LED Exit Sign Retrofit | 2 | 48.60 | 0.005 | - | 29.94 | 0.004 | - |
| Tier 1 Advanced Power Strip | 1 | 42.76 | - | - | 83.18 | - | - |
| Bathroom Aerator | 2 | 8.95 | 0.001 | 1.48 | 26.11 | 0.003 | 3.34 |
| Office Kit (650002 & 650005) | | | | | | | |
| LED A19 (60W) Bulb | 6 | 571.68 | 0.110 | - | 502.42 | 0.098 | - |
| LED Filament BR30 Bulb | 10 | 1,555.31 | 0.300 | - | 1,273.87 | 0.249 | - |
| LED Exit Sign Retrofit | 2 | 47.73 | 0.003 | - | 29.74 | 0.004 | - |
| LED Desk Lamp | 1 | 61.09 | 0.012 | - | 48.36 | 0.009 | - |
| Tier 1 Advanced Power Strip | 1 | 44.82 | - | - | 87.19 | - | - |
| Bathroom Aerator | 2 | 6.13 | 0.002 | 1.02 | 17.88 | 0.005 | 2.28 |
| Kitchen Aerator | 1 | 7.03 | 0.002 | 1.23 | 11.61 | 0.003 | 1.48 |
| Restaurant Kit Revision 1 (650006 & 650007) | | | | | | | |
| LED Filament A19 Bulb | 12 | 1,841.42 | 0.392 | - | 1,254.50 | 0.270 | - |
| LED Filament Candle E12 Bulb | 6 | 537.08 | 0.114 | - | 322.04 | 0.069 | - |
| LED Exit Sign Retrofit | 2 | 46.86 | 0.005 | - | 29.23 | 0.003 | - |
| Power Pre-Rinse Spray Valve | 1 | 42.01 | - | 6.23 | 46.88 | - | 6.02 |
| Bathroom Aerator | 2 | 31.09 | 0.003 | 5.15 | 90.66 | 0.010 | 11.58 |
| Kitchen Aerator | 1 | 35.62 | 0.004 | 6.23 | 58.88 | 0.006 | 7.52 |

| KIT MEASURES | QUANTITY IN KIT | *EX ANTE* SAVINGS KWH | KW | THERMS | *EX POST* SAVINGS KWH | KW | THERMS |
|---|---|---|---|---|---|---|---|
| Packs (Multiples of same bulb) | | | | | | | |
| LED T8 linear Measure 650008 | 25 | 918.26 | 0.219 | - | 901.98 | 0.219 | - |
| LED Filament A19 Bulb Measure 650009 | 24 | 2,286.73 | 0.221 | - | 2,009.70 | 0.392 | - |
| 4-Pack 14W LED T8 Type A Measure 650010 | 4 | 172.25 | 0.041 | - | 169.20 | 0.041 | - |
| BR30. 650-1419 lumens. 9W Measure 650030 | 6 | 180.22 | 0.040 | - | 1,062.18 | 0.241 | - |
| 330 Lumen. LED Candle. 4W Measure 650042 | 6 | 115.86 | 0.026 | - | 682.83 | 0.155 | - |
| 800 Lumen. Omni. 7WMeasure 650048 | 6 | 170.57 | 0.038 | - | 1,005.27 | 0.229 | - |
| Globe. 350-499 lumens. 5W Measure 650036 | 6 | 112.64 | 0.025 | - | 663.86 | 0.151 | - |
| 750-1049 lumens. Omni 11W Measure 650041 | 6 | 205.97 | 0.046 | - | 1,213.92 | 0.276 | - |
| 1050-1489 lumens. Omni 15W Measure 650039 | 6 | 276.77 | 0.062 | - | 1,631.20 | 0.371 | - |
| Individual Products (Quantity 1x) | | | | | | | |
| LED Corn Bulb (54W) Measure 650017 | 1 | 579.24 | - | - | 579.24 | - | - |
| Smart Thermostat - Electric Cooling and Heating. Measure 650033 | 1 | 1,477.83 | 0.353 | - | 1,477.83 | 0.353 | - |
| Smart Thermostat - Electric Cooling Only Measure 650025 | 1 | 472.41 | 0.353 | - | 472.41 | 0.353 | - |
| Smart Thermostat - Electric Cooling and Gas Heating. Measure 650026 | 1 | 667.35 | 0.353 | 86.40 | 667.35 | 0.353 | 86.40 |
| LED Exit Sign Retrofit Measure 650019 | 1 | 51.01 | 0.007 | - | 50.11 | 0.007 | - |
| Smart Thermostat - Gas Heating. Measure 650018 | 1 | - | - | 86.40 | - | - | 86.40 |
| Wall Pack 55W Measure 650016 | 1 | 606.82 | - | - | 259.84 | - | - |

Table 238 shows the comparison between the *ex ante* and *ex post* gross savings. The values reported are for a single kit or measure and do not represent the entire C&I Online Marketplace population.

TABLE 238. 2022 C&I ONLINE MARKETPLACE PROGRAM *EX POST* GROSS PER-KIT OR PER-MEASURE SAVINGS

| KIT TYPE | *EX ANTE* SAVINGS | | | *EX POST* GROSS SAVINGS | | |
|---|---|---|---|---|---|---|
| | KWH | KW | THERMS | KWH | KW | THERMS |
| Dual Fuel Kit – Restaurant | 2,482.93 | 0.508 | 17.61 | 1,767.15 | 0.351 | 25.12 |
| Dual Fuel Kit – Retail | 2,459.70 | 0.663 | 1.48 | 2,082.50 | 0.561 | 3.34 |
| Dual Fuel Kit – Office | 2,293.79 | 0.429 | 2.24 | 1,971.07 | 0.368 | 3.77 |
| Electric Only Kit – Restaurant | 2,482.93 | 0.508 | - | 1,767.15 | 0.351 | - |
| Electric Only Kit – Retail | 2,459.70 | 0.663 | - | 2,082.50 | 0.561 | - |
| Electric Only Kit – Office | 2,293.79 | 0.429 | - | 1,971.07 | 0.368 | - |
| Dual Fuel Kit - Restaurant Rev 1 | 2,534.08 | 0.519 | 17.61 | 1,801.99 | 0.359 | 25.12 |
| Electric Only Kit - Restaurant Rev 1 | 2,534.08 | 0.519 | - | 1,801.99 | 0.359 | - |
| LED Tube - Add-On Pack - Electric Only | 918.26 | 0.219 | - | 901.98 | 0.219 | - |
| Add-On Pack - Electric Only | 2,286.73 | 0.221 | - | 2,009.70 | 0.392 | - |
| LED Corn Bulb (54W) Replace 175W MH | 579.24 | - | - | 579.24 | - | - |
| 4-Pack 14W LED T8 Type A Tube 4000k AL+PC | 172.25 | 0.041 | - | 169.20 | 0.041 | - |
| Smart Thermostat - Electric Cooling and Heating | 1,477.83 | 0.353 | - | 1,477.83 | 0.353 | - |
| Smart Thermostat - Electric Cooling Only | 472.41 | 0.353 | - | 472.41 | 0.353 | - |
| Smart Thermostat - Electric Cooling and Gas Heating | 667.35 | 0.353 | 86.40 | 667.35 | 0.353 | 86.40 |
| LED Exit Sign Retrofit | 51.01 | 0.007 | - | 50.11 | 0.007 | - |
| BR30. 650-1419 lumens. 9W (65W Equivalent) | 180.22 | 0.040 | - | 1,062.18 | 0.241 | - |
| 330 Lumen. LED Candle. 4W (40W Equivalent) | 115.86 | 0.026 | - | 682.83 | 0.155 | - |
| Smart Thermostat - Gas Heating | - | - | 86.40 | - | - | 86.40 |
| 800 Lumen. Omni (7W) (60W Equivalent) | 170.57 | 0.038 | - | 1,005.27 | 0.229 | - |
| Globe. 350-499 lumens. 5W (40W Equivalent) | 112.64 | 0.025 | - | 663.86 | 0.151 | - |
| 750-1049 lumens. Omnidirectional. 11W | 205.97 | 0.046 | - | 1,213.92 | 0.276 | - |
| 1050-1489 lumens. Omnidirectional (15W) | 276.77 | 0.062 | - | 1,631.20 | 0.371 | - |
| Wall Pack 55W (120W Equivalent) | 606.82 | - | - | 259.84 | - | - |

Table 239 highlights notable differences between *ex ante* and *ex post* gross savings estimates by measure type.

TABLE 239. 2022 C&I ONLINE MARKETPLACE NOTABLE DIFFERENCES BETWEEN *EX ANTE* AND *EX POST GROSS*

| MEASURE TYPE | *EX ANTE* SOURCES AND ASSUMPTIONS | *EX POST* GROSS SOURCES AND ASSUMPTIONS | PRIMARY REASONS FOR DIFFERENCES |
|---|---|---|---|
| LED Lighting | *Ex ante* savings based on the Illinois TRM (v9.0), and specification data from products within the kits. ISR from Illinois TRM (v9.0) | Illinois TRM (v10.0), and customer survey data to inform ISR and fuel source saturation. | WHF penalties for kW and KWH, fuel saturation ratio applied to WHF penalties exist in the ex post calculations only. ISR differences. |
| Occupancy Sensor Power Strip | *Ex ante* savings from the Illinois TRM (v9.0), and specification data from products within the kits. Unknown ISR source | Illinois TRM (v10.0), and customer survey data to inform ISR | Differences in ISRs |
| Low-flow Aerators | *Ex ante* savings from the Illinois TRM (v9.0), and specification data from product within kit. ISR and fuel saturation ratio from 2019 Residential EM&V values | Illinois TRM (v10.0), and customer survey data to inform ISR and fuel source saturation. | Differences in ISR and fuel saturation values |
| Low-flow Spray Rinse Valves | *Ex ante* savings from the Illinois TRM (v9.0), and specification data from product within kit. ISR and | Illinois TRM (v10.0), and customer survey data to inform ISR and fuel source saturation. | Differences in ISR and fuel saturation values |

| MEASURE TYPE | *EX ANTE* SOURCES AND ASSUMPTIONS | *EX POST* GROSS SOURCES AND ASSUMPTIONS | PRIMARY REASONS FOR DIFFERENCES |
|---|---|---|---|
| | fuel saturation ratio from 2019 Residential EM&V values | | |
| Smart Thermostats | *Ex ante* savings from the Illinois TRM (v10.0) | Illinois TRM (v10.0) | none |

## REALIZATION RATES

The next three tables (Table 240 through Table 242) show *ex ante*, audited gross, verified gross, and *ex post* gross electric and therm savings for the total population of the C&I Online Marketplace program.

TABLE 240. 2022 C&I ONLINE MARKETPLACE PROGRAM *EX ANTE* AND *EX POST* GROSS ELECTRIC ENERGY SAVINGS

| MEASURE | *EX ANTE*[A] ELECTRIC ENERGY SAVINGS (KWH/YR.) | AUDITED GROSS ELECTRIC ENERGY SAVINGS (KWH/YR.) | VERIFIED GROSS ELECTRIC ENERGY SAVINGS (KWH/YR.) | *EX POST* GROSS ELECTRIC ENERGY SAVINGS (KWH/YR.) | REALIZATION RATE[B] |
|---|---|---|---|---|---|
| Restaurant Kit (650000 & 650003) | | | | | |
| LED Filament A19 Bulb | 148,592.28 | 148,592.28 | 102,303.54 | 101,215.38 | 68% |
| LED Filament Candle E12 Bulb | 44,577.69 | 44,577.69 | 27,016.78 | 26,729.41 | 60% |
| LED Exit Sign Retrofit | 3,889.63 | 3,889.63 | 2,451.95 | 2,425.87 | 62% |
| Power Pre-Rinse Spray Valve | 3,487.15 | 3,487.15 | 3,710.52 | 3,890.75 | 112% |
| Bathroom Aerator | 2,580.19 | 2,580.19 | 6,799.73 | 7,524.47 | 292% |
| Kitchen Aerator | 2,956.18 | 2,956.42 | 4,494.43 | 4,887.26 | 165% |
| Retail Kit (650001 & 650004) | | | | | |
| LED A19 (60W) Bulb | 208,016.65 | 208,016.65 | 184,962.32 | 180,746.56 | 87% |
| LED Filament BR30 Bulb | 679,113.17 | 679,113.17 | 562,753.02 | 549,926.45 | 81% |
| LED Exit Sign Retrofit | 18,273.11 | 18,273.11 | 11,519.02 | 11,256.47 | 62% |
| Tier 1 Advanced Power Strip | 16,077.19 | 16,077.19 | 31,275.74 | 31,275.74 | 195% |
| Bathroom Aerator | 3,366.07 | 3,366.07 | 8,870.81 | 9,816.29 | 292% |
| Office Kit (650002 & 650005) | | | | | |
| LED A19 (60W) Bulb | 375,023.02 | 375,023.02 | 333,459.51 | 329,590.23 | 88% |
| LED Filament BR30 Bulb | 1,020,283.23 | 1,020,283.23 | 845,466.55 | 835,656.21 | 82% |
| LED Exit Sign Retrofit | 31,311.45 | 31,311.45 | 19,738.14 | 19,509.11 | 62% |
| LED Desk Lamp | 40,075.99 | 40,075.99 | 32,094.68 | 31,722.27 | 79% |
| Tier 1 Advanced Power Strip | 29,401.76 | 29,401.76 | 57,196.68 | 57,196.68 | 195% |
| Bathroom Aerator | 4,022.42 | 4,022.42 | 10,600.50 | 11,730.34 | 292% |
| Kitchen Aerator | 4,608.56 | 4,608.94 | 7,006.64 | 7619.05 | 165% |
| Restaurant Kit Revision 1 (650006 & 650007) | | | | | |
| LED Filament A19 Bulb | 237,543.05 | 237,543.05 | 163,544.79 | 161,805.25 | 68% |
| LED Filament Candle E12 Bulb | 69,283.39 | 69,283.39 | 41,989.93 | 41,543.31 | 60% |
| LED Exit Sign Retrofit | 6,045.33 | 6,045.33 | 3,810.86 | 3,770.33 | 62% |
| Power Pre-Rinse Spray Valve | 5,419.78 | 5,419.78 | 5,766.96 | 6,047.07 | 112% |
| Bathroom Aerator | 4,010.18 | 4,010.18 | 10,568.25 | 11,694.65 | 292% |
| Kitchen Aerator | 4,594.54 | 4,594.92 | 6,985.33 | 7,595.87 | 165% |
| Packs (Multiples of same bulb) | | | | | |
| LED T8 linear. Measure 650008 | 71,624.28 | 71,624.29 | 71,624.29 | 70,354.57 | 98% |
| LED Filament A19 Bulb Measure 650009 | 57,168.14 | 57,168.14 | 50,832.24 | 50,242.41 | 88% |
| 4-Pack 14W LED T8 Type A Tube Measure 650010 | 861.25 | 861.25 | 861.25 | 845.99 | 98% |
| BR30. 650-1419 lumens. 9W Measure 650030 | 360.44 | 2,162.69 | 2,162.69 | 2,124.35 | 98% |

| MEASURE | *EX ANTE*[A] ELECTRIC ENERGY SAVINGS (KWH/YR.) | AUDITED GROSS ELECTRIC ENERGY SAVINGS (KWH/YR.) | VERIFIED GROSS ELECTRIC ENERGY SAVINGS (KWH/YR.) | *EX POST* GROSS ELECTRIC ENERGY SAVINGS (KWH/YR.) | REALIZATION RATE[B] |
|---|---|---|---|---|---|
| 330 Lumen. LED Candle. 4W Measure 650042 | 347.58 | 2,085.45 | 2,085.45 | 2,048.48 | 98% |
| 800 Lumen. Omni. 7W Measure 650048 | 852.85 | 5,117.08 | 5,117.08 | 5,026.37 | 98% |
| Globe. 350-499 lumens. 5W Measure 650036 | 225.28 | 1,351.68 | 1,351.68 | 1,327.72 | 98% |
| 750-1049 lumens. Omnidirectional 11W Measure 650041 | 205.97 | 1,235.82 | 1,235.82 | 1,213.92 | 98% |
| 1050-1489 lumens. Omnidirectional 15W Measure 650039 | 276.77 | 1,660.64 | 1,660.64 | 1,631.20 | 98% |
| Individual Products (Quantity 1x) | | | | | |
| LED Corn Bulb (54W) Replace 175W MH Measure 650017 | 2,316.94 | 2,316.94 | 2,316.94 | 2,316.94 | 100% |
| Smart Thermostat - Electric Cooling and Heating. Measure 6500337 | 4,433.49 | 4,433.49 | 4,433.49 | 4,433.49 | 100% |
| Smart Thermostat - Electric Cooling Only Measure 650025 | 2,834.46 | 2,834.46 | 2,834.46 | 2,834.46 | 100% |
| Smart Thermostat - Electric Cooling and Gas Heating. Measure 650026 | 14,014.35 | 14,014.35 | 14,014.35 | 14,014.35 | 100% |
| LED Exit Sign Retrofit Model 20715 Measure 650019 | 153.03 | 153.03 | 153.03 | 150.32 | 98% |
| Smart Thermostat - Gas Heating. Measure 650018 | - | - | - | - | N/A |
| Wall Pack 55W (120W Equivalent) Measure 650016 | 3,034.10 | 1,299.18 | 1,299.18 | 1,299.18 | 100% |
| Total Savings | 3,121,262.01 | 3,130,871.55 | 2,646,369.35 | 2,615,038.79 | |
| Total Program Realization Rate | | | | | 84% |

Note: Totals may not sum properly due to rounding of measure level savings.

[a] Program tracking data is summed at the kit-level (not measure level). Therefore, *ex ante* savings are only reported at the summary level, due to rounding errors.

[b] Measure level realization rates compare to the audited value as the tracking data does not report measure level savings.

TABLE 241. 2022 C&I ONLINE MARKETPLACE PROGRAM *EX ANTE* & *EX POST* GROSS PEAK DEMAND REDUCTION

| MEASURE | *EX ANTE*[A] PEAK DEMAND REDUCTION (KW/YR.) | AUDITED GROSS PEAK DEMAND REDUCTION (KW/YR.) | VERIFIED GROSS PEAK DEMAND REDUCTION (KW/YR.) | *EX POST* GROSS PEAK DEMAND REDUCTION (KW/YR.) | REALIZATION RATE[B] |
|---|---|---|---|---|---|
| Restaurant Kit (650000 & 650003) | | | | | |
| LED Filament A19 Bulb | 31.635 | 31.635 | 21.781 | 21.781 | 69% |
| LED Filament Candle E12 Bulb | 9.491 | 9.491 | 5.752 | 5.752 | 61% |
| LED Exit Sign Retrofit | 0.452 | 0.452 | 0.285 | 0.285 | 63% |
| Power Pre-Rinse Spray Valve | - | - | - | - | N/A |
| Bathroom Aerator | 0.281 | 0.281 | 0.741 | 0.820 | 292% |
| Kitchen Aerator | 0.322 | 0.322 | 0.490 | 0.532 | 165% |
| Retail Kit (650001 & 650004) | | | | | |
| LED A19 (60W) Bulb | 57.959 | 57.959 | 51.535 | 51.535 | 89% |
| LED Filament BR30 Bulb | 189.219 | 189.219 | 156.798 | 156.798 | 83% |
| LED Exit Sign Retrofit | 1.705 | 1.705 | 1.514 | 1.514 | 89% |
| Tier 1 Advanced Power Strip | - | - | - | - | N/A |
| Bathroom Aerator | 0.402 | 0.402 | 1.060 | 1.173 | 292% |
| Office Kit (650002 & 650005) | | | | | |

| MEASURE | *EX ANTE*[A] PEAK DEMAND REDUCTION (KW/YR.) | AUDITED GROSS PEAK DEMAND REDUCTION (KW/YR.) | VERIFIED GROSS PEAK DEMAND REDUCTION (KW/YR.) | *EX POST* GROSS PEAK DEMAND REDUCTION (KW/YR.) | REALIZATION RATE[B] |
|---|---|---|---|---|---|
| LED A19 (60W) Bulb | 72.337 | 72.337 | 64.320 | 64.320 | 89% |
| LED Filament BR30 Bulb | 196.800 | 196.800 | 163.080 | 163.080 | 83% |
| LED Exit Sign Retrofit | 2.128 | 2.905 | 2.579 | 2.579 | 89% |
| LED Desk Lamp | 7.730 | 7.730 | 6.191 | 6.191 | 80% |
| Tier 1 Advanced Power Strip | - | - | - | - | N/A |
| Bathroom Aerator | 1.073 | 1.073 | 2.827 | 3.128 | 292% |
| Kitchen Aerator | 1.229 | 1.229 | 2.032 | 2.032 | 165% |
| Restaurant Kit Rev 1 (650006 & 650007) | | | | | |
| LED Filament A19 Bulb | 50.573 | 50.573 | 34.819 | 34.819 | 69% |
| LED Filament Candle E12 Bulb | 14.751 | 14.751 | 8.940 | 8.940 | 61% |
| LED Exit Sign Retrofit | 0.702 | 0.702 | 0.443 | 0.443 | 63% |
| Power Pre-Rinse Spray Valve | - | - | - | - | N/A |
| Bathroom Aerator | 0.437 | 0.437 | 1.151 | 1.274 | 292% |
| Kitchen Aerator | 0.501 | 0.501 | 0.761 | 0.828 | 165% |
| Packs (Multiple of same bulb) | | | | | |
| LED T8 linear Measure 650008 | 17.082 | 17.095 | 17.095 | 17.095 | 100% |
| LED Filament A19 Bulb Measure 650009 | 5.525 | 11.027 | 9.805 | 9.805 | 89% |
| 4-Pack 14W LED T8 Type A Tube Measure 65001 | 0.205 | 0.206 | 0.206 | 0.206 | 100% |
| BR30. 650-1419 lumens. 9W Measure 650030 | 0.080 | 0.483 | 0.483 | 0.483 | 100% |
| 330 Lumen. LED Candle. 4W Measure 650042 | 0.078 | 0.466 | 0.466 | 0.466 | 100% |
| 800 Lumen. Omni. 7W Measure 650048 | 0.190 | 1.143 | 1.143 | 1.143 | 100% |
| Globe. 350-499 lumens. 5W Measure 650036 | 0.050 | 0.302 | 0.302 | 0.302 | 100% |
| 750-1049 lumens. Omnidirectional 11W Measure 650041 | 0.046 | 0.276 | 0.276 | 0.276 | 100% |
| 1050-1489 lumens. Omnidirectional 15W Measure 650039 | 0.062 | 0.371 | 0.371 | 0.371 | 100% |
| Individual Products (Quantity 1x) | | | | | |
| LED Corn Bulb (54W) Replace 175W MH Measure 650017 | | - | - | - | N/A |
| Smart Thermostat - Electric Cooling and Heating. 6500337 | 1.059 | 1.059 | 1.059 | 1.059 | 100% |
| Smart Thermostat - Electric Cooling Only Measure 650025 | 2.118 | 2.118 | 2.118 | 2.118 | 100% |
| Smart Thermostat - Electric Cooling and Gas Heat. 650026 | 7.413 | 7.413 | 7.413 | 7.413 | 100% |
| LED Exit Sign Retrofit Measure 650025 | 0.021 | 0.021 | 0.021 | 0.021 | 100% |
| Smart Thermostat - Gas Heating. Measure 650019 | | - | - | - | N/A |
| Wall Pack 55W (120W Equivalent) Measure 650016 | | - | - | - | N/A |
| Total Savings | 673.756 | 682.481 | 567.852 | 568.577 | |
| Total Program Realization Rate | | | | | 83% |

Note: Totals may not sum properly due to rounding of measure level savings.

[a] Program tracking data is summed at the kit-level (not measure level). Therefore, *ex ante* savings are only reported at the summary level, due to rounding errors.

[b] Measure level realization rates compare to the audited value as the tracking data does not report measure level savings.

TABLE 242. 2022 C&I ONLINE MARKETPLACE PROGRAM *EX ANTE* & *EX POST* GROSS NATURAL GAS ENERGY SAVINGS

| MEASURE | *EX ANTE*[A] NATURAL GAS ENERGY SAVINGS (THERMS/YR.) | AUDITED GROSS NATURAL GAS ENERGY (THERMS/YR.) | VERIFIED GROSS NATURAL GAS ENERGY SAVINGS (THERMS/YR.) | *EX POST* GROSS NATURAL GAS ENERGY SAVINGS (THERMS/YR.) | REALIZATION RATE[B] |
|---|---|---|---|---|---|
| Restaurant Kit (650000 & 650003) | | | | | |
| LED Filament A19 Bulb | - | - | - | - | N/A |
| LED Filament Candle E12 Bulb | - | - | - | - | N/A |
| LED Exit Sign Retrofit | - | - | - | - | N/A |
| Power Pre-Rinse Spray Valve | 348.66 | 348.66 | 321.43 | 337.04 | 97% |
| Bathroom Aerator | 288.57 | 308.03 | 586.11 | 648.57 | 225% |
| Kitchen Aerator | 348.68 | 352.95 | 325.38 | 421.26 | 121% |
| Retail Kit (650001 & 650004) | | | | | |
| LED A19 (60W) Bulb | - | - | - | - | N/A |
| LED Filament BR30 Bulb | - | - | - | - | N/A |
| LED Exit Sign Retrofit | - | - | - | - | N/A |
| Tier 1 Advanced Power Strip | - | - | - | - | N/A |
| Bathroom Aerator | 430.35 | 429.93 | 874.07 | 967.23 | 225% |
| Office Kit (650002 & 650005) | | | | | |
| LED A19 (60W) Bulb | - | - | - | - | N/A |
| LED Filament BR30 Bulb | - | - | - | - | N/A |
| LED Exit Sign Retrofit | - | - | - | - | N/A |
| LED Desk Lamp | - | - | - | - | N/A |
| Tier 1 Advanced Power Strip | - | - | - | - | N/A |
| Bathroom Aerator | 499.06 | 498.57 | 1,013.63 | 1,121.66 | 225% |
| Kitchen Aerator | 603.02 | 610.40 | 669.98 | 728.54 | 121% |
| Restaurant Kit Revision 1 (650006 & 650007) | | | | | |
| LED Filament A19 Bulb | - | - | - | - | N/A |
| LED Filament Candle E12 Bulb | - | - | - | - | N/A |
| LED Exit Sign Retrofit | - | - | - | - | N/A |
| Power Pre-Rinse Spray Valve | 610.15 | 610.15 | 562.50 | 589.82 | 97% |
| Bathroom Aerator | 505.00 | 539.05 | 1,025.68 | 1,135.00 | 225% |
| Kitchen Aerator | 610.19 | 617.66 | 569.42 | 737.20 | 121% |
| Packs (Multiple of same bulb) | | | | | |
| LED T8 linear Measure 650008 | - | - | - | - | N/A |
| LED Filament A19 Bulb Measure 650009 | - | - | - | - | N/A |
| 4-Pack 14W LED T8 Type A Tube Measure 650010 | - | - | - | - | N/A |
| BR30. 650-1419 lumens. 9W Measure 650030 | - | - | - | - | N/A |
| 330 Lumen. LED Candle. 4W Measure 650042 | - | - | - | - | N/A |
| 800 Lumen. Omni. 7W Measure 650048 | - | - | - | - | N/A |
| Globe. 350-499 lumens. 5W Measure 650036 | - | - | - | - | N/A |
| 750-1049 lumens. Omnidirectional 11W Measure 650041 | - | - | - | - | N/A |
| 1050-1489 lumens. Omnidirectional 15W Measure 650039 | - | - | - | - | N/A |
| Individual Products (Quantity 1x) | | | | | |
| LED Corn Bulb (54W) Replace 175W MH Measure 650017 | - | - | - | - | N/A |

| MEASURE | *EX ANTE*[A] NATURAL GAS ENERGY SAVINGS (THERMS/YR.) | AUDITED GROSS NATURAL GAS ENERGY (THERMS/YR.) | VERIFIED GROSS NATURAL GAS ENERGY SAVINGS (THERMS/YR.) | *EX POST* GROSS NATURAL GAS ENERGY SAVINGS (THERMS/YR.) | REALIZATION RATE[B] |
|---|---|---|---|---|---|
| Smart Thermostat - Electric Cooling and Heating. Measure 650033 | - | - | - | - | N/A |
| Smart Thermostat - Electric Cooling Only Measure 650025 | - | - | - | - | N/A |
| Smart Thermostat - Electric Cooling and Gas Heating. Measure 650026 | 1,814.40 | 1,814.40 | 1,814.40 | 1,814.40 | 100% |
| LED Exit Sign Retrofit Measure 650019 | - | - | - | - | N/A |
| Smart Thermostat - Gas Heating. Measure 650018 | 172.80 | 172.80 | 172.80 | 172.80 | 100% |
| Wall Pack 55W (120W Equivalent) Measure 650016 | - | - | - | - | N/A |
| Total Savings | 6,228.18 | 6,302.58 | 7,935.41 | 8,673.54 | |
| Total Program Realization Rate | | | | | 138% |

Note: Totals may not sum properly due to rounding of measure level savings.

[a] Program tracking data is summed at the kit-level (not measure level). Therefore, *ex ante* savings are only reported at the summary level, due to rounding errors.

[b] Measure level realization rates compare to the audited value as the tracking data does not report measure level savings.

## *EX POST* NET SAVINGS

The evaluation team calculated freeridership and participant spillover using survey data collected from the 2022 C&I Online Marketplace participant survey, which was fielded in early 2023. Due to the relative impact of the C&I Marketplace products in the population, the survey focused exclusively on questions related to the primary kit offerings (Retail, Restaurant, Restaurant Rev 1, and Office) which made up 95% of the *ex ante* kWh savings, rather than on the add on lighting packs (4%) or the individual products (1%). Table 243 shows the NTG ratios by measure, which are relatively high across measures, indicating most customers would not have purchased this equipment on their own if they had not received the kits for free.

TABLE 243. 2022 C&I ONLINE MARKETPLACE PROGRAM-LEVEL NTG RATIOS BY MEASURE

| MEASURE | RESPONSES (n) | FREERIDERSHIP [a] | PARTICIPANT SPILLOVER | NTG |
|---|---|---|---|---|
| Standard A-Lamp LEDs | 64 | 9% | 5% | 96% |
| BR30 Spotlight LEDs | 56 | 6% | 5% | 99% |
| Candelabra LEDs | 13 | 4% | 5% | 101% |
| LED Exit Signs | 39 | 16% | 5% | 89% |
| LED Desk Lamps | 45 | 8% | 5% | 97% |
| Occupancy Sensor Power Strips | 63 | 14% | 5% | 91% |
| Bathroom Faucet Aerator | 46 | 6% | 5% | 99% |
| Kitchen Faucet Aerators | 30 | 5% | 5% | 100% |
| Pre-Rinse Spray Valve | 8 | 11% | 5% | 94% |

[a] This score is an average weighted by verified quantity of measure installed.

## FREERIDERSHIP

### INTENTION FREERIDERSHIP

The evaluation team calculated measure-level *intention* freeridership values for each participant using the following survey questions:

- **FR1**. If you had not received the free kits(s) through the NIPSCO Online Marketplace, would you have purchased any of the following energy efficient items somewhere else?
- **FR2.** When would you have purchased the following energy efficient items for your business if the NIPSCO Online Marketplace and instant discount had not been available?

Respondents who responded *no* to FR1 were assigned an *intention* freeridership score of 0%. Those who responded *no, I already have them installed in all available locations* were assigned an *intention* freeridership score of 100%. Those who said *yes* to FR1 were asked FR2 and assigned an *intention* freeridership score based on the timing of their decision (Table 244).

TABLE 244. 2022 C&I ONLINE MARKETPLACE PROGRAM INTENTION FREERIDERSHIP ASSIGNMENT

| FR2. RESPONSE OPTION | ASSIGNED INTENTION FREERIDERSHIP VALUE |
|---|---|
| Around the same time you purchased the products through the NIPSCO Online Marketplace | 100% |
| Later but within one year | 50% |
| Later but more than one year | 0% |
| Not sure | 25% |

Table 245 shows *intention* freeridership score for each surveyed measure.

TABLE 245. 2022 C&I ONLINE MARKETPLACE PROGRAM INTENTION FREERIDERSHIP BY MEASURE

| MEASURE | INTENTION FREERIDERSHIP SCORE |
|---|---|
| Standard A-Lamp LEDs (n=64) | 9% |
| BR30 Spotlight LEDs (n=56) | 8% |
| Candelabra LEDs (n=13) | 5% |
| LED Exit Signs (n=39) | 30% |
| LED Desk Lamps (n=45) | 7% |
| Occupancy Sensor Power Strips (n=63) | 22% |
| Bathroom Faucet Aerator (n=46) | 8% |
| Kitchen Faucet Aerators (n=30) | 6% |
| Pre-Rinse Spray Valve (n=8) | 22% |

### INFLUENCE FREERIDERSHIP

The evaluation team assessed *influence* freeridership by asking participants how important the following program elements were in their purchasing decision-making process:

- The NIPSCO instant discount
- Information about energy efficiency that NIPSCO provided
- Previous participation in a NIPSCO energy efficiency program.

The evaluation team determined each respondent's *influence* freeridership score using the maximum rating provided for any program element, as shown in Table 246.

TABLE 246. 2022 C&I ONLINE MARKETPLACE PROGRAM INTENTION FREERIDERSHIP BY MEASURE

| MAXIMUM RATING | INFLUENCE FREERIDERSHIP SCORE (%) |
|---|---|
| 1 - Not at all important | 100% |
| 2 - Not too important | 75% |
| 3 - Somewhat important | 25% |
| 4 - Very important | 0% |
| Don't know | 50% |
| Not applicable | 50% |

Table 247 shows *influence* freeridership score for each surveyed measure.

TABLE 247. 2022 C&I ONLINE MARKETPLACE PROGRAM INFLUENCE FREERIDERSHIP BY MEASURE

| MEASURE | INFLUENCE FREERIDERSHIP SCORE |
|---|---|
| Standard A-Lamp LEDs (n=64) | 9% |
| BR30 Spotlight LEDs (n=56) | 4% |
| Candelabra LEDs (n=13) | 2% |
| LED Exit Signs (n=39) | 2% |
| LED Desk Lamps (n=45) | 8% |
| Occupancy Sensor Power Strips (n=63) | 5% |
| Bathroom Faucet Aerator (n=46) | 3% |
| Kitchen Faucet Aerators (n=30) | 3% |
| Pre-Rinse Spray Valve (n=8) | 0% |

## FINAL FREERIDERSHIP

The evaluation team calculated the mean of *intention* and the *influence* of freeridership components to estimate final freeridership for each surveyed measure. A higher freeridership score translates to more savings that were deducted from the gross savings estimates. Table 248 lists the *intention*, *influence*, and final freeridership scores for the 2022 C&I Online Marketplace program.

TABLE 248. 2022 C&I ONLINE MARKETPLACE PROGRAM FREERIDERSHIP SCORE BY MEASURE

| MEASURE | INTENTION SCORE | INFLUENCE SCORE | FINAL SCORE |
|---|---|---|---|
| Standard A-Lamp LEDs (n=64) | 9% | 9% | 9% |
| BR30 Spotlight LEDs (n=56) | 8% | 4% | 6% |
| Candelabra LEDs (n=13) | 5% | 2% | 4% |
| LED Exit Signs (n=39) | 30% | 2% | 16% |
| LED Desk Lamps (n=45) | 7% | 8% | 8% |
| Occupancy Sensor Power Strips (n=63) | 22% | 5% | 14% |
| Bathroom Faucet Aerator (n=46) | 8% | 3% | 6% |
| Kitchen Faucet Aerators (n=30) | 6% | 3% | 5% |
| Pre-Rinse Spray Valve (n=8) | 22% | 0% | 11% |

## PARTICIPANT SPILLOVER

The evaluation team estimated participant spillover measure savings using specific information about participants collected through surveys and using the Illinois TRM v10.0 as a baseline reference. The team estimated the percentage of program participant spillover by dividing the sum of additional spillover savings (as reported by survey respondents) by the total gross savings achieved by all survey respondents.[64] The participant spillover estimate for the C&I Online Marketplace program is 5%, rounded to the nearest whole percent, shown in Table 249.

[64] The spillover measures attributed to the program are LEDs, lighting controls, a high-efficiency refrigeration, a VSD for a range hood and smart thermostat HVAC system controls that did not receive a program rebate.

TABLE 249. 2022 C&I ONLINE MARKETPLACE PROGRAM PARTICIPANT SPILLOVER RESULTS

| MEASURE | SPILLOVER SAVINGS (MMBtu) | PARTICIPANT PROGRAM SAVINGS (MMBtu) | PARTICIPANT SPILLOVER |
|---|---|---|---|
| Total Program | 75.2 | 1,494.8 | 5% |

## RESULTING NET SAVINGS

Table 250 shows the resulting net electric savings, demand reduction, and natural gas savings.

TABLE 250. 2022 C&I ONLINE MARKETPLACE PROGRAM *EX POST* NET SAVINGS BY MEASURE TYPE

| MEASURE | *EX POST* GROSS SAVINGS/REDUCTION | | | NTG | *EX POST* NET SAVINGS/REDUCTION | | |
|---|---|---|---|---|---|---|---|
| | KWH | KW | THERMS | | KWH | KW | THERMS |
| Standard A-Lamp LEDs | 824,813.75 | 182.536 | - | 96% | 791,821.20 | 175.234 | - |
| BR30 Spotlight LEDs | 1,387,707.01 | 320.360 | - | 99% | 1,373,829.94 | 317.157 | - |
| Candelabra LEDs | 68,272.72 | 14.692 | - | 101% | 68,955.45 | 14.839 | - |
| LED Exit Sign | 37,112.11 | 4.841 | - | 89% | 33,029.77 | 4.309 | - |
| LED Desk Lamp | 31,722.27 | 6.191 | - | 97% | 30,770.60 | 6.005 | - |
| Tier 1 Advanced Power Strip | 88,472.42 | - | - | 91% | 80,509.90 | - | - |
| Bathroom Faucet Aerator | 40,765.75 | 6.394 | 3,872.48 | 99% | 40,358.09 | 6.330 | 3,833.75 |
| Kitchen Faucet Aerators | 20,102.18 | 3.392 | 1,887.00 | 100% | 20,102.18 | 3.392 | 1,887.00 |
| Pre-Rinse Spray Valve | 9,937.82 | - | 926.86 | 94% | 9,341.55 | - | 871.25 |
| Linear LED | 71,200.56 | 17.300 | - | 98% [a] | 69,776.54 | 16.954 | - |
| LED Corn Bulb (54W) | 2,316.94 | - | - | 98% [a] | 2,270.60 | - | - |
| Smart Thermostat | 21,282.30 | 10.590 | 1,987.20 | 98% [a] | 20,856.65 | 10.378 | 1,947.46 |
| 330 Lumen. LED Candle. 4W | 2,048.48 | 0.466 | - | 98% [a] | 2,007.51 | 0.456 | - |
| 800 Lumen. Omni 7W | 5,026.37 | 1.143 | - | 98% [a] | 4,925.84 | 1.120 | - |
| Globe. 350-499 lumens. 5W | 1,327.72 | 0.302 | - | 98% [a] | 1,301.17 | 0.296 | - |
| 1050-1489 lumens. Omni 15W | 1,631.20 | 0.371 | - | 98% [a] | 1,598.58 | 0.363 | - |
| Wall Pack 55W | 1,299.18 | - | - | 98% [a] | 1,273.20 | - | - |
| Total Savings | 2,615,038.79 | 568.577 | 8,673.54 | 98% | 2,552,728.79 | 556.833 | 8,539.46 |

[a] The average electric energy savings program NTG value was applied to this measure category. Due to the relative impact of the C&I Marketplace products in the population, the survey focused exclusively on questions related to the primary pack offerings (Retail, Restaurant, Restaurant Rev 1, and Office) which made up 95% of the ex ante kWh savings, rather than on the add on lighting packs (4%) or the individual products (1%).

Table 251 shows the net-to-gross ratio for each fuel.

TABLE 251. 2022 C&I ONLINE MARKETPLACE NET-TO-GROSS RESULTS BY FUEL TYPE

| SAVINGS TYPE | *EX ANTE* GROSS SAVINGS | *EX POST* GROSS SAVINGS | NTG RATIO (%) | *EX POST* NET SAVINGS |
|---|---|---|---|---|
| Electric Energy Savings (kWh/yr.) | 3,121,262.01 | 2,615,038.79 | 98% | 2,552,728.79 |
| Peak Demand Reduction (kW) | 673.756 | 568.577 | 98% | 556.833 |
| Natural Gas Energy Savings (therms/yr.) | 6,228.18 | 8,673.54 | 98% | 8,539.46 |

# PROCESS EVALUATION

As part of the process evaluation, the evaluation team reviewed the program data and materials, and surveyed program participants who received kits. The team also interviewed NIPSCO's program implementation staff to gain a better understanding of the program design and delivery process and any associated changes or challenges experienced in 2022. The evaluation team sought to answer the following process-related research questions:

- How do participants learn about the program? How is the program promoted?
- What are the barriers and challenges to energy efficiency and program participation?
- What type of C&I customers is the program reaching?
- Are there any suggestions for future improvements to the Online Marketplace itself or the measure offerings?

## PARTICIPANT SURVEY

The evaluation team surveyed 89 customers who ordered a kit between January 31, 2022, and December 31, 2022. Two-thirds of survey respondents (66%) ordered an office kit, while one quarter ordered the restaurant kit (24%) (Table 252). About half of respondents (45%) ordered more than one kit, with nine customers (10%) receiving five or more kits.[65] The following sections describe the findings related to sources of awareness, reasons for participation, satisfaction with the program, and program impacts on customers.

TABLE 252. TYPES AND COUNT OF KITS RECEIVED BY SURVEY PARTICIPANTS

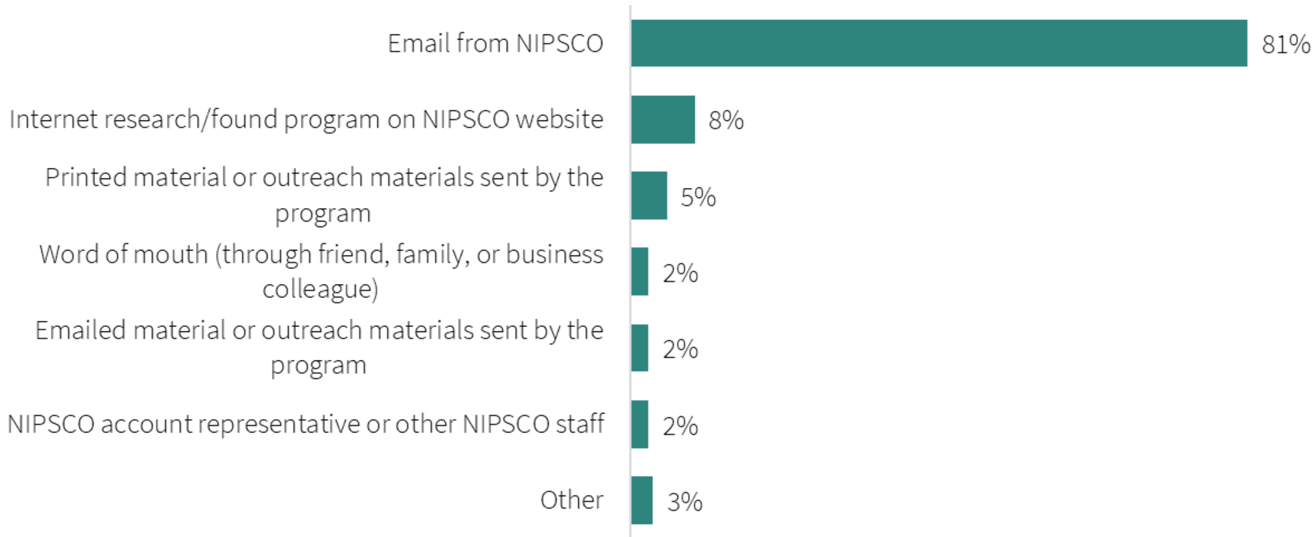
| KIT TYPE | NUMBER | CUSTOMERS RECEIVED |
|---|---|---|
| Office Kit | 95 | 66% |
| Retail Kit | 71 | 37% |
| Restaurant Kit | 28 | 24% |

### ENERGY EFFICIENCY AWARENESS AND MARKETING

The implementer delivered monthly email campaigns to different waves of customers and monthly social media campaigns. Each order from the C&I marketplace was shipped with cross promotional marketing material that highlighted other NIPSCO Business and Residential energy efficiency programs. Most respondents had heard about the program through an email from NIPSCO (81%), followed by internet search or the NIPSCO website (8%), printed material or outreach materials sent by the program (5%), word of mouth (2%), and email material or outreach materials about the program from another source (2%) (Figure 89).

[65] Three respondents received more than five kits; those are participants who ordered kits for more than one account.

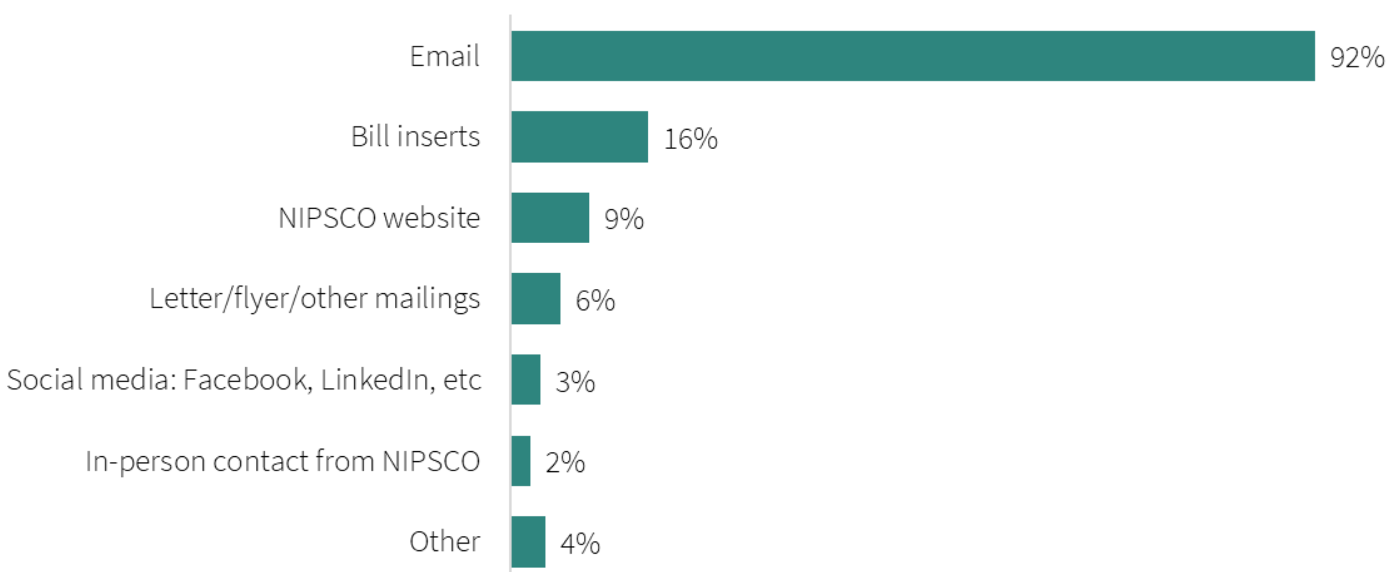
FIGURE 89. HOW PARTICIPANTS LEARNED ABOUT THE ONLINE MARKETPLACE




Source: Survey Question B1: "How did you learn about NIPSCO's Online Marketplace? (Please select all that apply)" n=89, Multiple responses allowed.

As seen below in Figure 90, most of these respondents preferred to hear about opportunities to save energy through email (92%), bill inserts (16%), and the NIPSCO website (9%). Compared to 2021, the number of respondents that preferred to receive information about energy efficiency through a letter/flyer or other mailings dropped from 25% to 6%, and preference for the NIPSCO website dropped from 20% to 9%.

FIGURE 90. PREFERRED ENERGY EFFICIENCY COMMUNICATION CHANNEL



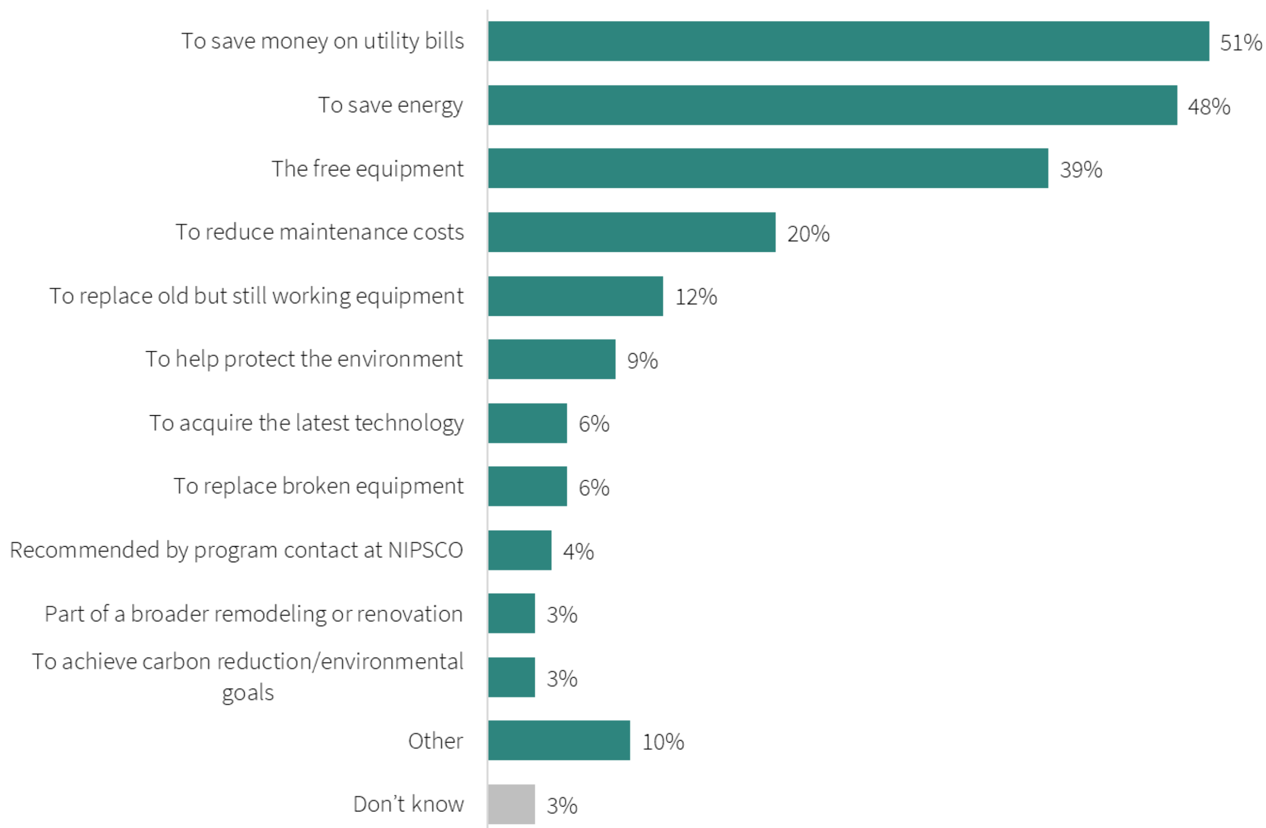

Source: Survey Question B5: "In your opinion, what is the best way for NIPSCO to keep organizations like yours informed about opportunities to save energy? (Please select all that apply)", n=89 Multiple responses allowed.

Almost two thirds (66%) of respondents were aware of other commercial energy efficiency offerings from NIPSCO, an increase from 53% in 2021. Of the Online Marketplace respondents that reported they were aware of other offerings (n=59), most were aware of incentives for lighting measures (66%), followed by HVAC (31%), thermostats (22%), and appliances (15%).

## PARTICIPATION DRIVERS AND BARRIERS

The most common reasons respondents ordered a kit from the marketplace were to save money on utility bills (51%), to save energy (48%), and because the kit was free (39%). The 2021 program year participants reported similar motivations, except their third most common reason was to save on maintenance costs instead of the fact that the kit was free. Figure 91 below shows the 2022 program year motivations for ordering the kits.

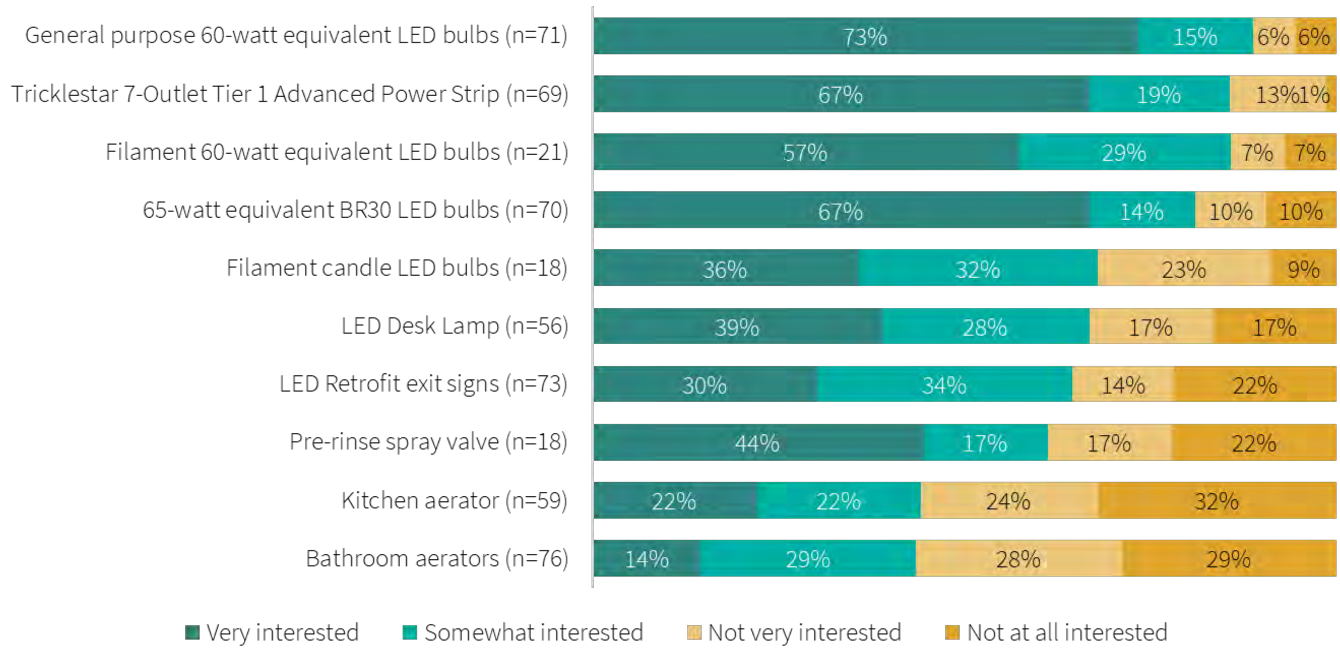
FIGURE 91. PRIMARY MOTIVATION FOR ORDERING THE KIT




Source: Survey Question G1: "What factors were the most important in your decision to order a kit from the NIPSCO Online Marketplace?", n=89 Multiple responses allowed.

We asked survey respondents which items in the kit they were most interested in receiving. Overall, respondents were most interested in receiving the general purpose 60-watt equivalent LED bulbs, the TrickleStar 7 outlet Tier 1 advanced power strip, and the filament 60-watt and 65-watt equivalent LED bulbs. Respondents were least interested in receiving the bathroom and kitchen aerators, and the pre-rinse spray valve. These were also the top four items last year, when the evaluation team asked respondents which items were the most significant in their decision to order a kit. Figure 92 below shows how 2022 program year respondents rated their interest in each kit item. Similarly, the aerators and the pre-rinse spray valve were also the least important kit items to 2021 program year respondents.

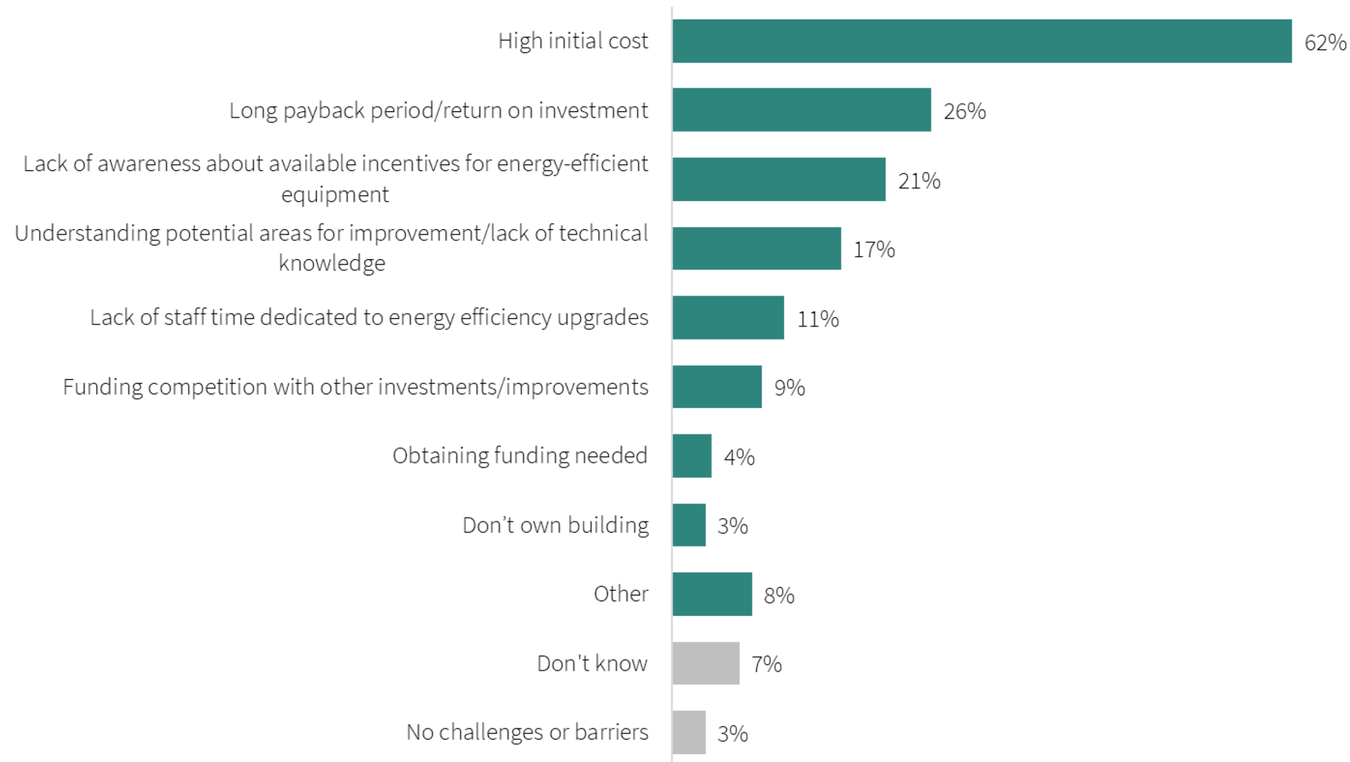
FIGURE 92. INTEREST IN EACH KIT ITEM BEFORE RECEIVING KIT




Source: Survey Question G2.1-G2.10: "How interested were you in each of the following items from the NIPSCO Marketplace kit(s)? Single response.

The evaluation team also asked respondents what challenges their organizations face when it comes to making energy-efficient improvements. A higher percentage of respondents (62%) were challenged by high initial costs in 2022 than in 2021 (52%) but it was by far the most frequently cited challenge both years (Figure 93). This growing percentage challenged by high costs is consistent with the current inflationary economy. The long payback/return on investment was the second most frequently mentioned challenge in 2022 (26%) and had been the fifth most frequently mentioned in 2021, but was a challenge for the same percentage of respondents each year. Far fewer respondents mentioned the lack of awareness about the available incentives for energy-efficient equipment this year (21%) compared to 2021 (46%), a possible sign outreach efforts may be succeeding in improving awareness. Just 3% of respondents said that they did not face any concerns or challenges regarding energy efficiency.

FIGURE 93. CHALLENGES TO ENERGY EFFICIENCY

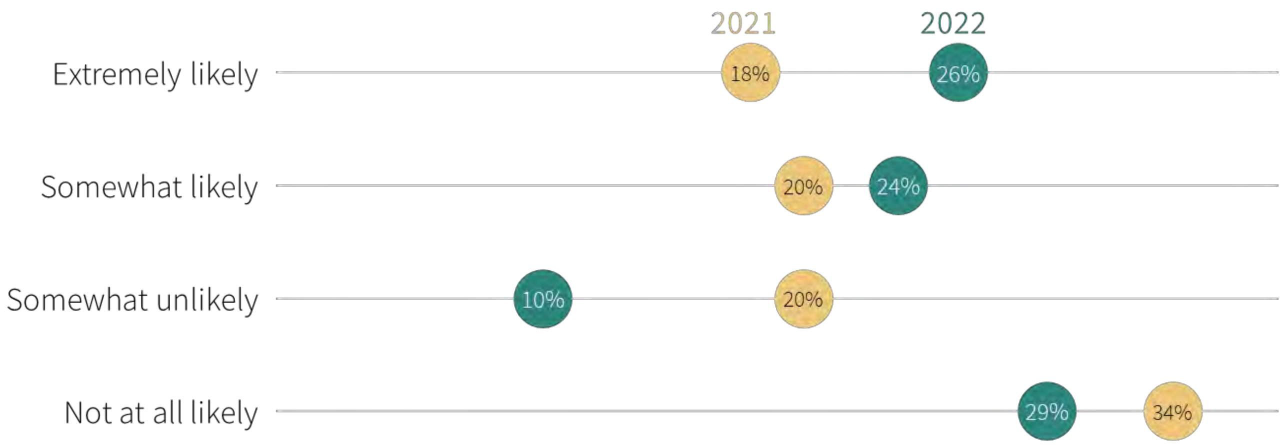



Source: Survey Question C1: "When considering improvements to increase commercial and industrial energy efficiency, what are the most significant challenges that organizations face?", n=89, Multiple responses allowed.

To understand what the demand for energy-efficient HVAC equipment is, the evaluation team asked respondents how likely they were to replace their HVAC equipment in the next five years. Nearly one third (29%) of respondents were "not at all likely" and 10% were "somewhat unlikely" to replace their HVAC equipment in the next five years (Figure 94). Those that were "not at all likely" to replace (n=26) said this was because their equipment was either new (42%) or still operational (35%).

However, one quarter (26%) of respondents said they were "extremely likely" to replace or update HVAC equipment in the next five years, an increase from last year's evaluation, where just 18% said they were "extremely likely." The evaluation team asked this group what rebate amount would be needed for them to choose high-efficiency HVAC equipment. If a high-efficiency HVAC unit costs $5,000, about half of respondents (50%) said that a value of $2000 would be needed to make the equipment more accessible. Thirty percent said that a value of $1000 or less would be needed.

FIGURE 94. LIKELIHOOD TO REPLACE OR UPDATE HVAC EQUIPMENT IN THE NEXT FIVE YEARS (2022 VS 2021)




Source: Survey Question C3: "Thinking now specifically about your facility's HVAC equipment, how likely is your company to invest in replacing or upgrading any of that equipment in the next 5 years?", n=89, Single response.

The 2021 evaluation included specific questions about the lingering effects of COVID-19. In this year's survey, the evaluation team asked respondents about challenges that their businesses experienced over the past year more broadly. The most common challenges participants experienced were increased costs due to inflation (72%) and supply chain disruption/difficulty finding products (54%). In addition, nearly half of respondents reported general concerns about the economy (46%) and difficulty hiring employees (45%). In contrast, the top COVID-19-related challenges respondents reported for the 2021 program year were: decrease in business, sales, production, or operating hours (76%); difficulties finding products (61%); trouble hiring staff (39%); and staff illness or death (36%). These responses are seen below in Figure 95.

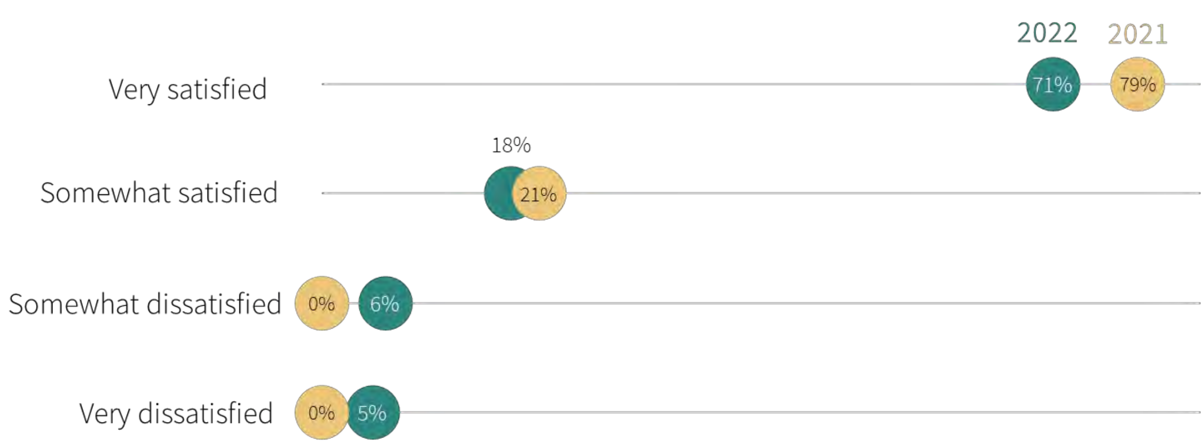
FIGURE 95. CHALLENGES IN THE PAST YEAR THAT BUSINESSES EXPERIENCED


Source: Survey Question C6: "Has your business faced any of the following challenges this year?", n=89, Multiple response.

## SATISFACTION WITH PROGRAM

Respondents expressed high levels of satisfaction with the program, however this overall satisfaction was lower compared to 2021 (i.e., satisfaction levels were lower and dissatisfaction levels were higher), as seen below in Figure 96. A small percentage of respondents were either "very" (5%) or "somewhat" (6%) dissatisfied.

FIGURE 96. OVERALL SATISFACTION (2022 VS 2021)



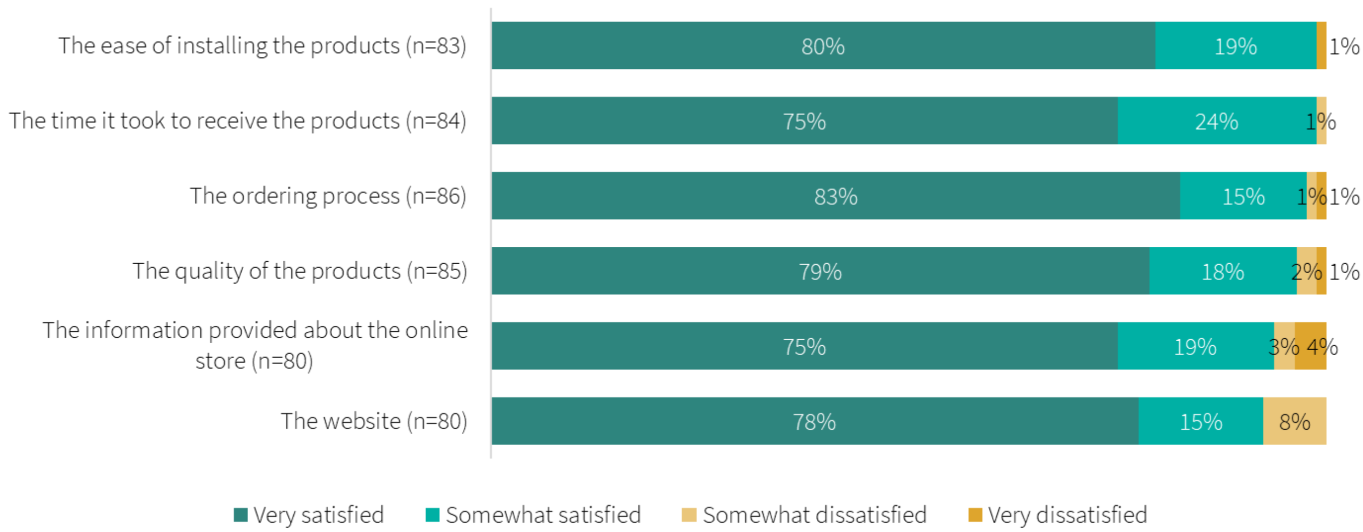

Source: Survey Question G4: "How satisfied are you with NIPSCO's Online Marketplace overall?", n=89, Single response. Note: 2021 ratings were based on n=39 responses.

Comparisons between the two years should be made with care given the small sample size in 2021 (n=39). In addition, two of the 2022 program respondents who gave "very dissatisfied" ratings to the program overall apparently did not understand the rating because their comments were "*It was a very easy process and a great program*" and "*I would like to see more! I did it twice for my home.*" Assuming these two meant to give favorable ratings, about 8% expressed some level of dissatisfaction with the overall program. The reasons given for that dissatisfaction included:

- The kit or certain items were not received.
- The program is not geared towards smaller businesses.
- It should "*be more competitive price-wise.*"
- The description of kit items was not detailed enough so several items were not usable for them.
- The "*products don't fulfill all my needs*."

Respondents were generally satisfied with all components of the program, with 75% or more of respondents saying they were "very satisfied" with each component. Respondents rated the ease of installing products and the time it took to receive the products the highest, with only 1% saying they were somewhat or very dissatisfied with those components of the program. Less than 10% of respondents reported any level of dissatisfaction with any individual program component. The ratings given to each component are shown in Figure 97.

FIGURE 97. SATISFACTION WITH THE VARIOUS COMPONENTS OF THE PROGRAM




Source: Survey Question G3.1 – G3.6: "Please rate your level of satisfaction with each of these components"
Single response.

Most respondents did not experience any challenges with the program (95%, n=85). For the 5% (n=4) who reported facing challenges, they included:

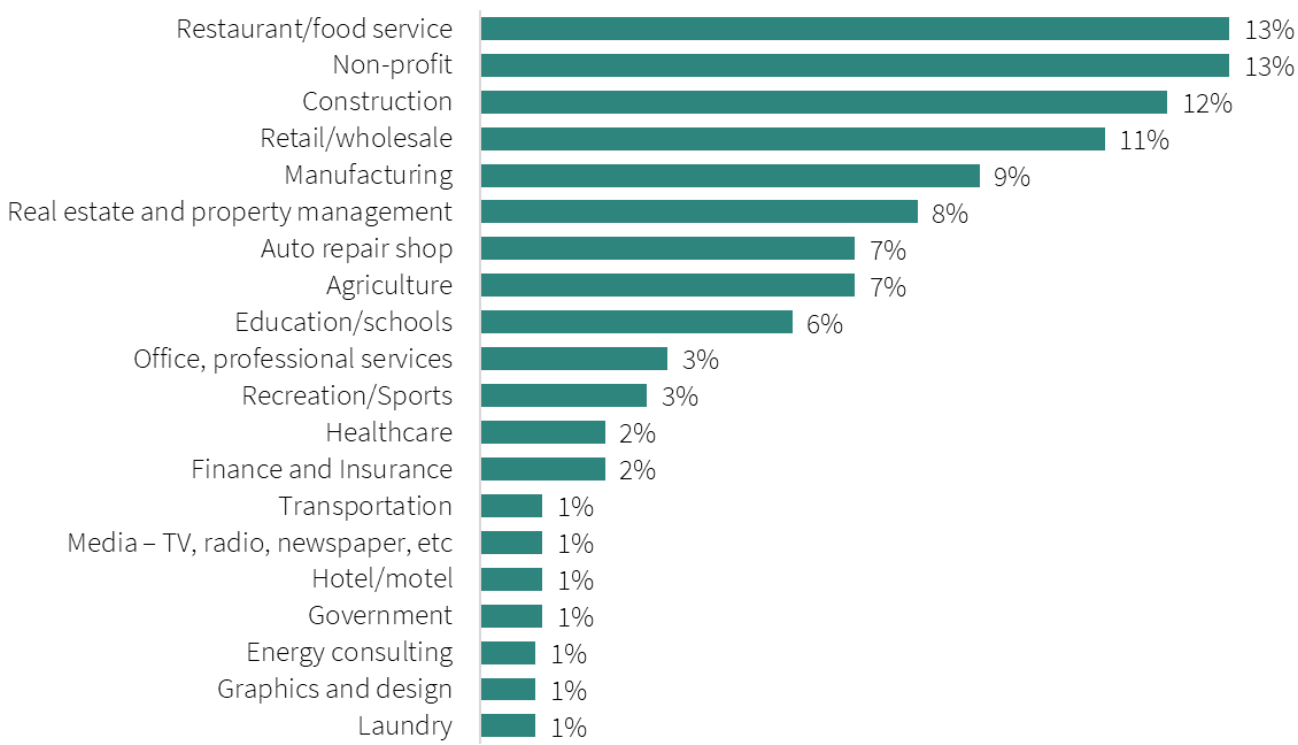
- The online ordering process (n=3),
- Confusion on who to contact for information or navigating the Marketplace (n=1), and
- Difficulty knowing how many kits they could order because they have several properties (n=1).

When the team asked these four participants what NIPSCO could have done to help their organization overcome the challenges, all four suggested improving the online ordering process (which also received one of the highest satisfaction ratings for components with 98% saying they were very satisfied or somewhat satisfied). This suggests that there may be an opportunity to provide guidance to a small number of customers and improve satisfaction.

## PARTICIPANT SURVEY FIRMOGRAPHICS

NIPSCO's C&I Online Marketplace program reached a wide variety of business types (Figure 98). The most common were restaurant or food services (13%), non-profit (13%), construction (12%), retail/wholesale (11%) and manufacturing (9%).

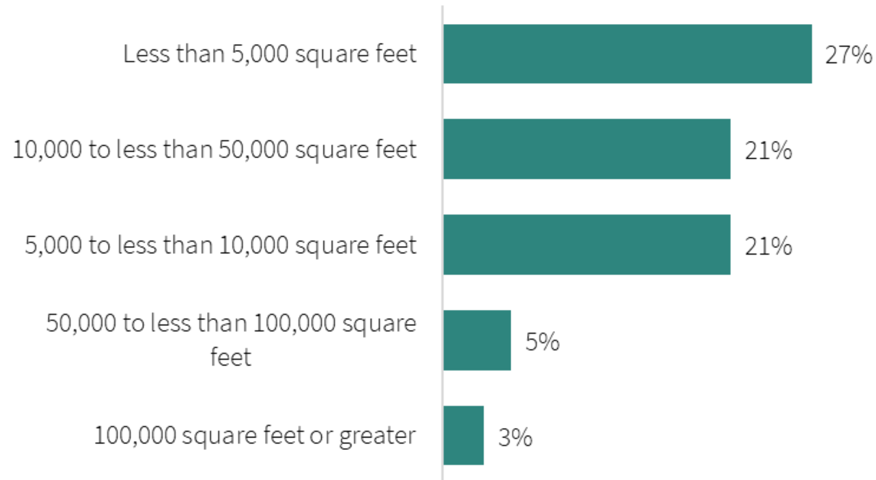
FIGURE 98. BUSINESS INDUSTRY REPRESENTATION OF SURVEY RESPONDENTS




Source: Survey Question H1: "What industry is your organization in?", n=89, Multiple responses allowed.

Almost three quarters of respondents (70%) reported installing the equipment in smaller facilities, with 27% installing in facilities less than 5,000 square feet, 21% in facilities 5,000 to less than 10,000 square feet, and 21% in facilities 10,000 to less than 50,000 square feet. Some respondents reported installing the kit items in large facilities: 5% (n=4) in facilities 50,000 to less than 100,000 square feet, and 3% (n=3) in facilities 100,000 square feet or larger. Figure 99 below shows the facility sizes reported by respondents. About two thirds of respondents owned their facility (n=62) and about one third leased (n=27).

FIGURE 99: SIZE OF FACILITY WHERE KIT EQUIPMENT WAS INSTALLED




Source: Survey Question H2: "What is the approximate square footage of space in the facility where you installed the items from the kit?" n=89.

About two thirds of respondents owned their facility (n=62) and about one third leased (n=27).

# CONCLUSIONS AND RECOMMENDATIONS

**CONCLUSION 1: THE PROGRAM DID NOT ACHIEVE THE PARTICIPATION OR SAVINGS GOALS IN ITS SECOND YEAR.**

The program fell short of its goals for a variety of reasons. This is the second year of the program, and programs often experience a ramp-up period when building awareness and engagement with the customer base. Additionally, most participants reported that they are continuing to experience challenges driven by the COVID-19 pandemic and economic conditions, including inflation, hiring and supply chain issues, and general economic uncertainty. These conditions appear to be affecting businesses more broadly and program participation overall. The electric and demand savings goals, *ex ante* electric and demand savings achieved and percent achievement to electric and demand goals maintained very similar metrics from PY 2021 to PY 2022, achieving 62% of gross electric savings and 65% of gross demand savings in PY 2022. The therms savings goal increased three-fold from PY 2021 to PY 2022. Gas *ex ante* savings increased two-fold from PY 2021 to PY 2022. The program fell far short of the therms savings goal again in PY 2022, at 9% of gross savings achievement to goal.

Recommendations:

- Continue and expand upon established outreach methods and strategies that seem to be increasing awareness and are a good match to customer preferences.
- Use evaluation findings on the most influential messages to inform future outreach. Respondents mentioned influential kit items (e.g., LEDs and power strip), customer motivations and attitudes toward efficiency (e.g., reducing utility bills and energy use, getting free equipment), and economic challenges faced by businesses (e.g., inflation and high up-front costs) the most.

### CONCLUSION 2: THE PROGRAM CONTINUES TO GET HIGH SATISFACTION RATINGS IN ITS SECOND YEAR.

Participants reported slightly lower satisfaction with the program in 2022 than in its first year, but the ratings overall remain high. It is unclear whether the decrease is meaningful given the small sample size upon which the 2021 rating was based and the apparent erroneous rating of “very dissatisfied” by two 2022 respondents. The vast majority of 2022 respondents (95%) reported having no challenges with the program.

### CONCLUSION 3: OUTREACH AND COMMUNICATION METHODS AND MEDIA APPEAR TO BE EFFECTIVE AND TO ALIGN WITH CUSTOMER PREFERENCES.

Respondents reported email as their most common source of finding out about the program, and the vast majority prefer it that way. Bill inserts or other printed materials and the program website were also in the top three for informing them and in their preferred methods of getting information on the program. As a possible indication that current advertising and outreach methods are effective, a declining proportion of respondents (dropping from nearly half to about one fifth) reported that finding information on program incentives was a challenge to taking efficiency improvement actions.

Recommendations:

- Continue using emails, bill inserts or other printed material, and the company website to inform customers of incentive offerings because they are effective and popular.

### CONCLUSION 4: A WIDE VARIETY OF BUSINESS TYPES AND FACILITY SIZES PARTICIPATED IN 2022.

Respondents worked in facilities that were occupied by 21 different industry types. The most common were restaurant/food service, non-profit, construction, and retail/wholesale. About half of the facilities were 10,000 square feet or less. Almost two thirds of the respondents owned their facility.

### CONCLUSION 5: INFLATION AND HIGH UP-FRONT COSTS WERE THE FOREMOST CHALLENGES TO BUSINESSES OVERALL AND TO MAKING EFFICIENCY IMPROVEMENTS.

Respondents reported inflation most often as a general challenge to their businesses in 2022 and stated initial costs as the biggest barrier to making energy efficiency improvements.

### CONCLUSION 6: REDUCING UTILITY BILLS WAS THE MOST COMMON REASON FOR BUSINESSES TO ORDER A KIT.

The biggest motivation for businesses to order a kit through the program was to reduce their energy bills, followed by reducing energy use and getting free equipment. Several trade allies, during in-depth interviews for the other C&I programs, also said higher bills due to recent increases in utility rates played a big role in their customers looking for options to improve efficiency.

Recommendations:

- Continue to expand upon marketing efforts that promote the program as an easy way for customers to act to improve efficiency with free equipment from energy saving kits that can lower energy bills and fight the effects of inflation.

### CONCLUSION 7: LEDS AND POWER STRIPS WERE THE KIT PRODUCTS THAT MOST MOTIVATED CUSTOMERS.

When ordering energy saving kits, respondents were most interested in receiving the LED bulb products and the advanced power strip, and they were least interested in both types of aerators and the pre-rinse spray valve. While LEDs are popular measures, most screw-base bulbs will be impacted by the upcoming EISA backstop in mid-2023. Like residential kits, the C&I Marketplace program will need to reconsider the measure mix of kits with this in mind.

Recommendations:

- Continue to monitor available self-install products that can motivate customers to order kits and products, particularly products that have a high impact on energy and water savings, given the upcoming EISA backstop.
- Continue to include advanced power strips in kit contents.

# APPENDIX

# APPENDIX 1: ENERGY EFFICIENCY REBATES PROGRAM

## ALGORITHMS AND DETAILED RESULTS FROM ENGINEERING REVIEW

### FURNACES

The program tracking data contained 4,587 natural gas furnaces. However, during the evaluation, AHRI model number look ups revealed that 2 of the reported natural gas furnace measures were boilers, one of which was a legacy measure. The evaluation team did not apply furnace evaluated savings, but instead moved these two measures to boilers and applied evaluated boiler savings. Therefore, the total evaluated furnace count was 4,586 units. Per the Illinois TRM (v10) the evaluation team used the following natural gas savings algorithm for furnaces:

$$\Delta therms = (1 - ER) \times \left( \frac{CAP \times EFLH_H}{(1 - Derating_{EE})} \times \left( \frac{AFUE_{EE} \times (1 - Derating_{EE})}{AFUE_{BASE} \times (1 - Derating_{BASE})} - 1 \right) \right) \times 0.00001 + ER \times \left( \frac{CAP \times EFLH_H}{(1 - Derating_{EE})} \times \left( \frac{AFUE_{EE} \times (1 - Derating_{EE})}{AFUE_{EXIST} \times (1 - Derating_{BASE})} - 1 \right) \right) \times 0.00001$$

Where:

| | | |
|---|---|---|
| CAP | = | Capacity of the furnace in Btu/h |
| $EFLH_H$ | = | Equivalent full-load heating hours |
| $AFUE_{EE}$ | = | Efficiency of the installed furnace |
| $AFUE_{BASE}$ | = | Efficiency of the baseline furnace |
| $AFUE_{EXIST}$ | = | Efficiency of the existing furnace |
| $Derating_{EE}$ | = | Efficient furnace AFUE derating |
| $Derating_{BASE}$ | = | Base furnace AFUE derating |
| ER | = | Early Replacement rate |
| 0.00001 | = | Factor to convert from Btu/h to therms |

In addition to natural gas therm savings, the Illinois TRM (v10) also identifies cooling, heating, and circulation kWh savings for furnaces associated with the code ECM installed with the furnace, however, these savings are only eligible for early replacement measures. The evaluation team applied these savings combined with the furnace early replacement rate to furnaces that were not installed alongside an AC installed through the program in 2021 and 2022.

These deemed savings are based on the existing cooling system and furnace size. In cases where the reported household has no central cooling system or the cooling system is unknown, the Illinois TRM (v10) suggests multiplying the kWh saved value by 2 tons for furnaces <70 kBTU, by 3 tons for furnaces 70 kBTU – 90 kBTU and by four tons for furnaces 90+ kBTU. The evaluation team used the average kWh savings based on the reported cooling system where able and a furnace multiplier based on the installed furnace capacity. If a central cooling system was reported the evaluation team used a program average cooling capacity. Following from the Indiana TRM (v2.2) the evaluation team applied no demand savings or fossil FUEL impacts associated with the ECM. The Illinois TRM (v10) algorithm is outlined below:

$$\Delta kWh = ER \times CAP_{ECM} \times kWhSavingsPerTon$$

Where:

$CAP_{ECM}$ = Average cooling capacity or Furnace capacity multiplier

ER = Early Replacement rate

kWhSavingsPerTon = Blower fan kWh savings per ton of cooling

The evaluation team obtained CAP and $AFUE_{EE}$ for each unit from the *ex ante* data, $EFLH_H$ from 2020 billing analysis results based on location, and assigned an $AFUE_{BASE}$ and $AFUE_{EXIST}$ of 80% and 64.4% based on the Illinois TRM (v10). The 2022 participant survey, based on 80 responses, determined that 13.75% of participants replaced broken units. Based on this early replacement rate and following the Illinois TRM (v10) practices for time of sale and early replacement furnaces, the evaluation team produced weighted savings that blends savings from replacing an existing stock AFUE furnace and a broken code AFUE furnace. Table 253 shows the mean values for 2022.

TABLE 253. 2022 FURNACE MEAN VALUES

| INDEPENDENT VARIABLES | 2022 MEAN VALUE | SOURCE |
|---|---|---|
| Capacity (Furnace) | 74,098.41 | Actual from program tracking data |
| Capacity (Cooling) | 34,043.90 | 2022 Program Average Air Conditioner Capacity |
| EFLH | 909.32 | 2020 Billing Analysis, values vary based on nearest city to project location |
| AFUE ee | 0.959 | Actual from program tracking data |
| AFUE Base [a] | 0.80 | Illinois TRM (v10) |
| AFUE Exist [a] | 0.644 | Illinois TRM (v10) |
| Derating [a] | 0.064 | For all derating factors |
| ER | 13.75% | 2022 EE Rebates Participant Survey |
| kWhSavingsPerTon | 220.77 | Illinois TRM (v10) |

[a] Constants

Evaluated unit therm savings range from 69.36 to 347.66 therms, with an average value of 172.27 therms. The *ex ante* data assigned deemed savings of 119.44 therms. The overall natural gas realization rate for this measure category is 144%. This difference is largely due to the additional early replacement savings, plus small differences due to using actual instead of assumed AFUE (96% average) and capacity (74,098.41 Btuh average) resulted in *ex post* savings that deviated from *ex ante*. In addition to natural gas savings, the Illinois TRM assigns kWh cooling savings associated with the Furnace ECM installed alongside existing ACs, to furnaces. Aligning with previous EM&V findings *ex ante* did not apply these savings to furnaces resulting in deemed *ex ante* savings of 0 kWh compared with average *ex post* gross savings of 67.88 kWh. Table 254 highlights these results.

Table 254. DETAILED RESULTS FROM FURNACES

| AUDITED COUNT | *EX ANTE* DEEMED SAVINGS PER MEASURE | *EX POST* GROSS AVERAGE SAVINGS PER MEASURE | REALIZATION RATE |
|---|---|---|---|
| 4,586 | 119.44 therms | 172.27 therms | 144% |

## FURNACES – 2021 LEGACY MEASURE

In the 2022 tracking data, there were 616 Furnace deemed Legacy 2021 Measures for which the evaluation team assigned a deemed savings value of 129.89 therms. These deemed savings are the *ex post* gross per measure savings from the 2021 evaluation. Reference the 2021 NIPSCO EE Rebates evaluation Appendix for details on how this measure was calculated.

*Ex ante* used a deemed therm savings value of 187.29 therms compared with evaluated therm savings of 129.89 resulting in a therm savings realization rate of 69% for the Furnaces - Legacy 2021 Measure.

## AIR CONDITIONERS

In the 2022 tracking data, there were 511 air conditioners. The evaluation team used the following equation from the Illinois TRM (v10) to calculate energy savings from the SEER upgrade for air conditioners:

$$\begin{aligned}\Delta kWh = {} & (1-ER)\times\frac{CAP}{1{,}000}\times EFLH_C \\ & \times\left(\frac{1}{\left(SEER_{BASE}\times(1-DeratingCool_{BASE})\right)}-\frac{1}{\left(SEER_{EE}\times SEER_{adj}\times(1-DeratingCool_{EE})\right)}\right) \\ & + ER\times\frac{CAP}{1{,}000}\times EFLH_C \\ & \times\left(\frac{1}{\left(SEER_{EXIST}\times(1-DeratingCool_{BASE})\right)}-\frac{1}{\left(SEER_{EE}\times SEER_{adj}\times(1-DeratingCool_{EE})\right)}\right)\end{aligned}$$

Where:

| | | |
|---|---|---|
| CAP | = | Total cooling capacity in Btu/h |
| $EFLH_C$ | = | Equivalent full-load cooling hours from TRM (2.2) |
| $SEER_{BASE}$ | = | Baseline SEER value for time-of-sale replacements |
| $SEER_{EXIST}$ | = | Baseline SEER value for early replacements |
| $SEER_{EE}$ | = | Installed SEER value |
| $SEER_{adj}$ | = | Adjustment percentage to account for in-situ performance |

| | | |
|---|---|---|
| $DeratingCool_{EE}$ | = | Efficient AC SEER derating |
| $DeratinCoolg_{BASE}$ | = | Base AC SEER derating |
| ER | = | Early Replacement rate |

The evaluation team obtained CAP and $SEER_{EE}$ from the *ex ante* data, and $EFLH_C$ from the Indiana TRM (v2.2) based on project location. The 2022 participant survey, based on 89 responses, determined that 18% of AC installations were early replacements. Based on these percentages and following the Illinois TRM (v10) practices for time of sale and early replacement air conditioners, the evaluation team produced a weighted baseline SEER that blends federal code ($SEER_{BASE}$ = 13.0) for broken unit replacements and building stock findings ($SEER_{EXIST}$ = 11.15) from the Indiana TRM (v2.2) for working replacements.

Per the Indiana TRM (v2.2), the evaluation team used the following algorithm to calculate demand reduction for sites that received an air conditioner:

$$\Delta kW = \left( (1-ER) \times \frac{CAP}{1{,}000} \times \left( \frac{1}{(EER_{BASE} \times (1 - DeratingCool_{BASE}))} - \frac{1}{(EER_{EE} \times (1 - DeratingCool_{EE}))} \right) + ER \times \frac{CAP}{1{,}000} \times \left( \frac{1}{(EER_{EXIST} \times (1 - DeratingCool_{BASE}))} - \frac{1}{(EER_{EE} \times (1 - DeratingCool_{EE}))} \right) \right) \times CF$$

Where:

| | | |
|---|---|---|
| $EER_{BASE}$ | = | Baseline EER value for time-of-sale replacements |
| $EER_{EXIST}$ | = | Baseline EER value for early replacements |
| $EER_{EE}$ | = | Installed efficiency |
| CF | = | Coincidence factor |

To account for a lack of efficient EER in the tracking data, the evaluation team assumed an efficient EER according to average EER/SEER conversion ratios in the AHRI database to calculate demand reduction. This produced an average efficient EER of approximately 13.05, resulting in a demand reduction realization rate of 79%. Table 255 shows the mean values for 2022.

TABLE 255. 2022 AIR CONDITIONER MEAN VALUES

| INDEPENDENT VARIABLES | 2022 MEAN VALUE | SOURCE |
|---|---|---|
| Capacity | 34,432.90 | Actual from program tracking data |
| EFLHc | 427.48 | Indiana TRM (v2.2), values assigned based on nearest TRM city to project location |
| SEERbase[a] | 13.00 | Illinois TRM (v10) |
| SEERexist[a] | 11.15 | Indiana TRM (v2.2) |
| SEERadj | 1.01 | Illinois TRM (v10) |
| SEERee | 16.42 | Actual from program tracking data |
| EERbase[a] | 10.50 | Illinois TRM (v10) |
| EERstockexist[a] | 10.04 | 0.9*$SEER_{exist}$; Indiana TRM (v2.2) |
| EERee | 13.05 | Average EER/SEER Conversion in the AHRI Database*SEERee |

| | | |
|---|---|---|
| CF[a] | 0.88 | Indiana TRM (v2.2) |

[a]Constants

Cooling savings range from 150.58 kWh to 740.09 kWh, averaging 304.94 kWh. The *ex ante* deemed savings range from 683.54 to 754.89 kWh averaging 709.06 kWh; compared to the average *ex post* unit energy savings of 304.94 kWh, resulting in an energy savings realization rate of 43%. Small differences due to using actual instead of assumed SEER, EER, and capacity, differences between assumed EERee (0.9 x SEERee) and approximate actual EERee (varies from 0.82-0.74 x SEER) with conversions based on AHRI data, and additional early replacement savings all contributed to ex post deviating from ex ante. However, the largest driver is due to differences in approach between the Indiana TRM (v2.2) and Illinois TRM (v10), specifically in the exclusion of additional circulation and heating fan energy savings that come from the installation of an ECM with new AC's. Updated standards have resulted in new SEER values already accounting for the added efficiency of the ECM. The Illinois TRM (v10) instead provides cooling and circulation electric energy savings for furnaces. Table 256 highlights these results.

TABLE 256. DETAILED RESULTS FROM AIR CONDITIONERS

| AUDITED COUNT | *EX ANTE* DEEMED SAVINGS PER MEASURE | *EX POST* GROSS AVERAGE SAVINGS PER MEASURE | REALIZATION RATE |
|---|---|---|---|
| 511 | 709.06 kWh | 304.94 kWh | 43% |
| | 0.827 kW | 0.650 kW | 79% |

## AIR CONDITIONER – LEGACY 2021 MEASURE

In the 2022 tracking data, there were 482 Air Conditioner Legacy 2021 measures. This measure is a Legacy 2021 Measure for which the evaluation team assigned a deemed savings value of 681.32 kWh and 0.802 kW. These deemed savings are the *ex post* gross per measure savings from the 2021 evaluation. Reference the 2021 NIPSCO EE Rebates evaluation Appendix for details on how this measure was calculated.

*Ex ante* used a deemed kWh savings value of 639.78 kWh and 0.669 kW compared with evaluated kWh and kW savings of 681.32 kWh and 0.802 kW, resulting in an electric energy savings and demand reduction realization rate of 106% and 120%, respectively for the Air Conditioner - Legacy 2021 Measures.

## AIR CONDITIONER TUNE-UP

In the 2022 tracking data, there were 64 air conditioner tune-ups. Per the Illinois TRM (v10) the evaluation team used the following savings algorithm for air conditioner tune-ups:

$$\Delta kWh_{CAC} = EFLH_{COOL} \times \frac{Btuh_{COOL}}{1{,}000} \times \frac{1}{SEER_{CAC}} \times MF_E$$

Where:

$EFLH_{COOL}$ = Equivalent full-load cooling hours from Indiana TRM (2.2)

| | | |
|---|---|---|
| $Btuh_{COOL}$ | = | Cooling capacity of equipment in Btuh |
| $SEER_{CAC}$ | = | SEER efficiency of existing central air conditioning unit receiving maintenance |
| 1,000 | = | Conversion from Btuh to kBtuh |
| $MF_E$ | = | Maintenance energy savings factor |

The evaluation team obtained $EFLH_C$ from the Indiana TRM (v2.2) based on project location. Of the 64 units for this measure, 46 listed $Btuh_{COOL}$ in number of tons. For measures where the tons of cooling were provided, the evaluation team assumed average capacities from the air conditioner replacement tracking data for each unique reported tons of cooling with an overall average of 32,738.18 Btuh. Only two units listed SEER and therefore the evaluation team assumed an average SEER from the air conditioner replacement tracking data for each unique reported tons of cooling for an overall average SEER of 15.71. For capacity and SEER values where the tons of cooling weren't provided, the evaluation team assumed the program average air conditioner capacity and SEER of 34,068.49 Btuh and 15.8, respectively.

Per the Illinois TRM (v10) the evaluation team used the following algorithm to calculate demand reduction for sites that received an air conditioner tune up:

$$\Delta kW = Btuh_{COOL} \times \frac{1}{EER_{EE} \times 1{,}000} \times MF_D \times CF$$

Where:

| | | |
|---|---|---|
| $MF_E$ | = | Maintenance demand reduction factor |
| CF | = | Summer peak coincidence factor |
| EER | = | EER efficiency of existing unit receiving maintenance |

To account for a lack of efficient EER in the tracking data the evaluation team used the same method of finding a program average EER from the air conditioner replacement evaluation for each unique tons of cooling reported. This resulted in an overall average EER of 12.7. Table 257 shows the mean values for 2022.

TABLE 257. 2022 AC TUNE UP MEAN VALUES

| INDEPENDENT VARIABLES | 2022 MEAN VALUE | SOURCE |
|---|---|---|
| Btuhcool | 32,738.18 | Actual and averages from program tracking data |
| EFLHcool | 430.1 | Indiana TRM (v2.2), values assigned based on nearest TRM city to project location |
| SEERcac | 15.71 | Actual from program tracking data |
| MFe[a] | 0.05 | Illinois TRM (v10) |
| EER | 12.70 | Assumed 0.9*SEER |
| MFd[a] | 0.02 | Illinois TRM (v10) |
| CF[a] | 0.88 | Indiana TRM (v2.2) |

[a]Constants

Evaluated savings range from 32.92 kWh to 81.81 kWh, averaging 44.79 kWh—roughly equal to the reported savings of 43.28 kWh, which match the average evaluated savings from 2020, for a realization rate of 103% for this measure category. Differences in the assumed maintenance demand reduction factor between the IN TRM (v2.2) of 0.05 and IL TRM (v10) 0.02 resulted in significantly less demand reduction and a higher average cooling capacity drove slightly higher energy savings than reported in 2022. Table 258 highlights these results.

TABLE 258. DETAILED RESULTS FROM AC TUNE UPS

| AUDITED COUNT | *EX ANTE* DEEMED SAVINGS PER MEASURE | *EX POST* GROSS AVERAGE SAVINGS PER MEASURE | REALIZATION RATE |
|---|---|---|---|
| 64 | 43.28 kWh | 44.79 kWh | 103% |
| | 0.122 kW | 0.045 kW | 37% |

## AIR CONDITIONER TUNE UP– LEGACY 2021 MEASURE

In the 2022 tracking data, there was 1 Air Conditioner Tune Up Legacy 2021 measure. This measure is a Legacy 2021 Measure for which the evaluation team assigned a deemed savings value of 44.39 kWh and 0.101 kW. These deemed savings are the *ex post* gross per measure savings from the 2021 evaluation. Reference the 2021 NIPSCO EE Rebates evaluation Appendix for details on how this measure was calculated.

*Ex ante* used a deemed kWh savings value of 51.11 kWh and 0.116 kW compared with evaluated kWh and kW savings of 44.39 kWh and 0.101 kW, resulting in an electric energy savings and demand reduction realization rate of 87% and 87%, respectively for the Air Conditioner Tune Up- Legacy 2021 Measures.

## BOILERS

There were 60 boiler measures reported as part of the program in 2022. However, during the evaluation, AHRI model number look ups revealed that 2 of the reported natural gas furnace measures were boilers, one of which was deemed a Legacy 2021 Measure. The evaluation team did not apply furnace evaluated savings, but instead moved these two measures to boilers and applied evaluated boiler savings. Therefore, the total evaluated boiler count was 61 units. Per the Illinois TRM (v10) the evaluation team used the following savings algorithm for boilers:

$$\Delta therms = (1 - ER) \times \frac{\left(EFLH_H \times CAP_{input} \times \left(\frac{AFUE_{EE}}{AFUE_{BASE}} - 1\right)\right)}{100{,}000} + ER \times \frac{\left(EFLH_H \times CAP_{input} \times \left(\frac{AFUE_{EE}}{AFUE_{BASE}} - 1\right)\right)}{100{,}000}$$

Where:

| | | |
|---|---|---|
| $EFLH_H$ | = | Equivalent full-load heating hours from 2020 billing analysis |
| $CAP_{input}$ | = | Input capacity of equipment in Btuh |
| $AFUE_{ee}$ | = | AFUE efficiency of efficient boiler |
| $AFUE_{base}$ | = | AFUE efficiency of federal baseline boiler |
| $AFUE_{exist}$ | = | AFUE efficiency of existing boiler |
| 100,000 | = | Conversion from Btuh to therms |
| ER | = | Early replacement rate |

*Ex ante* savings were calculated using the Indiana TRM (v2.2) and assumed base AFUE while assuming an average capacity and an average AFUE of 95% for 92% AFUE measures based on 2020 boiler data, and South Bend EFLH from the 2020 billing analysis. Evaluated savings used the reported model number to look up all 2022 boiler heating capacity and AFUE in the AHRI database. Table 259 shows the mean values for 2022.

TABLE 259. 2022 BOILER MEAN VALUES

| INDEPENDENT VARIABLES | 2022 MEAN VALUE - 92% AFUE | SOURCE |
|---|---|---|
| Capacity | 129,326.23 | Actual from program tracking data |
| EFLH | 913 | 2020 Billing Analysis, values vary based on nearest city to project location |
| AFUE ee | 0.95 | Actual from program tracking data |
| AFUE Base[a] | 0.84 | Illinois TRM (v10) |
| AFUE Exist [a] | 0.616 | Illinois TRM (v10) |

[a]Constants

Evaluated savings range from 111.99 therms to 497.50 therms, averaging 255.04 therms while *ex ante* deemed savings were 215.74 therms. These savings resulted in a realization rate of 118% for this measure, largely because the evaluation team used each unit's specific reported AFUE and capacities to calculate savings. Table 260 highlights these results.

TABLE 260. DETAILED RESULTS FROM BOILERS

| AUDITED COUNT | *EX ANTE* DEEMED SAVINGS PER MEASURE | *EX POST* GROSS AVERAGE SAVINGS PER MEASURE | REALIZATION RATE |
|---|---|---|---|
| 61 | 215.74 therms | 255.04 therms | 118% |

## BOILER – LEGACY 2021 MEASURE

In the 2022 tracking data, there was a 13 Boiler Legacy 2021 measure. This measure is a Legacy 2021 Measure for which the evaluation team assigned a deemed savings value of 208.15 therms. These deemed savings are the *ex post* gross per measure savings from the 2021 evaluation. Reference the 2021 NIPSCO EE Rebates evaluation Appendix for details on how this measure was calculated.

*Ex ante* used a deemed therm savings value of 294.17 therms compared with evaluated therm savings of 208.15 therms, resulting in a therm savings realization rate of 71% for the Boiler - Legacy 2021 Measures.

## AIR SOURCE HEAT PUMPS

In the 2022 tracking data, there were 10 air source heat pumps. The evaluation team used the following algorithm from the Illinois TRM (v10) to calculate the total electric energy savings:

$$\Delta kWh = (1 - ER) \times \left( \frac{\left( EFLH_C \times CAP_C \times \left( \frac{1}{SEER_{BASE} \times (1 - DeratingCool_{BASE})} - \frac{1}{SEER_{EE} \times SEER_{adj} \times (1 - DeratingCool_{EE})} \right) \right)}{1{,}000} + \frac{\left( Heatload \times \left( \frac{1}{HSPF_{BASE} \times (1 - DeratingHeat_{BASE})} - \frac{1}{HSPF_{EE} \times HSPF_{adj} \times (1 - DeratingHeat_{EE})} \right) \right)}{1{,}000} \right)$$

And the addition of early replacement savings

$$\Delta kWh_{ER} = ER \times \left( \frac{\left( EFLH_C \times CAP_C \times \left( \frac{1}{SEER_{EXIST} \times (1 - DeratingCool_{BASE})} - \frac{1}{SEER_{EE} \times SEER_{adj} \times (1 - DeratingCool_{EE})} \right) \right)}{1,000} + \frac{\left( Heatload \times \left( \frac{1}{HSPF_{EXIST} \times (1 - DeratingHeat_{BASE})} - \frac{1}{HSPF_{EE} \times HSPF_{adj} \times (1 - DeratingHeat_{EE})} \right) \right)}{1,000} \right)$$

Where:

| | | |
|---|---|---|
| $CAP_C$ | = | Total cooling capacity |
| $EFLH_C$ | = | Effective full-load cooling hours from Indiana TRM (2.2) |
| $SEER_{BASE}$ | = | Baseline SEER |
| $SEER_{EE}$ | = | Efficient SEER |
| $SEER_{EXIST}$ | = | Existing SEER |
| $SEER_{adj}$ | = | Adjustment % to account for in-situ performance |
| DeratingCool | = | Efficient and base ASHP cooling derating |
| Heatload | = | Total heating capacity × $EFLH_H$ |
| $EFLH_H$ | = | Effective full-load heating hours derived via 2020 billing analysis |
| $HSPF_{BASE}$ | = | Baseline heating seasonal performance factor |
| $HSPF_{EE}$ | = | Efficient heating seasonal performance factor |
| $HSPF_{EXIST}$ | = | Existing heating seasonal performance factor |
| $HSPF_{adj}$ | = | Adjustment % to account for in-situ performance |
| ER | = | Early Replacement rate |

The evaluation team used $CAP_C$ and $CAP_H$ values from model lookups in the AHRI equipment database. The evaluation team also found $SEER_{EE}$ and $HSPF_{EE}$ in the AHRI database and used $EFLH_C$ values from the Indiana TRM (v2.2) and $EFLH_H$ from the 2020 billing analysis, based on project location. The evaluation team assumed $SEER_{BASE}$ and $HSPF_{BASE}$ to be 14.0 and 8.2, respectively.

The evaluation team used the following algorithm to calculate demand reduction:

$$\Delta kW = \frac{CAP_C}{1,000} \times \left( \frac{(1 - ER)}{(EER_{BASE} \times (1 - DeratingCool_{BASE}))} + \frac{ER}{(EER_{EXIST} \times (1 - DeratingCool_{BASE}))} - \frac{1}{(EER_{EE} \times (1 - DeratingCool_{EE}))} \right) \times CF$$

The evaluation team assumed an $EER_{BASE}$ of 11.0 according to the Illinois TRM (v10) while CF was 0.88 assumed from the Indiana TRM (v2.2) and the evaluation team found $EER_{EE}$ in the AHRI database. Table 261 shows the mean values for 2022.

TABLE 261. 2022 ASHP MEAN VALUES

| INDEPENDENT VARIABLES | 2022 MEAN VALUE | SOURCE |
|---|---|---|
| CAPc | 34,740.00 | Actual from AHRI equipment database |
| EFLHc | 419.4 | Indiana TRM (v2.2); values vary based on nearest city to project location |
| SEERbase[a] | 14.00 | Illinois TRM (v10) |
| SEERee | 17.65 | Actual from AHRI equipment database |
| SEERexist[a] | 9.3 | Illinois TRM (v10) |
| SEERadj | 0.91 | Illinois TRM (v10); calculated from AHRI equipment data base |
| CAPh | 33,370.00 | Actual from AHRI equipment database |
| $EFLH_H$ | 904.8 | 2020 Billing Analysis, values vary based on nearest city to project location |
| HSPFbase[a] | 8.2 | Illinois TRM (v10) |
| HSPFee | 9.61 | Actual from AHRI equipment database |
| HSPFexist[a] | 5.54 | Illinois TRM (v10) |
| HSPFadj | 1.01 | Illinois TRM (v10); calculated from AHRI equipment data base |
| Derating Factors | 0.1 | Illinois TRM (v10) |
| CF[a] | 0.88 | Indiana TRM (v2.2) |

[a]Constants

Evaluated savings varied from 612.46 kWh to 2,603.83 kWh, averaging 1,270.87 kWh. The evaluation team used EFLH values from the TRM and AHRI-verified capacities and efficiencies for this analysis. Using the AHRI-verified capacity, additional early replacement savings, and differences in assumed algorithms made *ex post* vary widely from *ex ante*. Evaluated demand reduction ranged from 0.152 kW to 1.035 kW, averaging 0.542 kW. The *ex ante* savings used an average deemed savings value of 1,218.34 kWh, and the realization rate for electric energy savings was 104%. *Ex ante* demand savings were an average deemed value of 0.755 kW, and the peak demand realization rate for this measure category was 72%. Table 262 highlights these results.

TABLE 262. DETAILED RESULTS FROM AIR SOURCE HEAT PUMPS

| AUDITED COUNT | *EX ANTE* DEEMED SAVINGS PER MEASURE | *EX POST* GROSS AVERAGE SAVINGS PER MEASURE | REALIZATION RATE |
|---|---|---|---|
| 10 | 1,218.34 kWh | 1,270.87 kWh | 104% |
| | 0.755 kW | 0.542 kW | 72% |

## AIR SOURCE HEAT PUMP – LEGACY 2021 MEASURE

In the 2022 tracking data, there were 2 Legacy 2021 Measures for which the evaluation team assigned a deemed savings value of 757.47 kWh and 0.696 kW. These deemed savings are the *ex post* gross per measure savings from the 2021 evaluation. Reference the 2021 NIPSCO EE Rebates evaluation Appendix for details on how this measure was calculated.

*Ex ante* used a deemed kWh savings value of 1046.06 kWh and 0.365 kW compared with evaluated kWh and kW savings of 757.47 kWh and 0.696 kW, resulting in an electric energy savings and demand reduction realization rate of 72% and 191%, respectively for the Air Source Heat Pump - Legacy 2021 Measures.

## SMART WI-FI THERMOSTATS

There were 1,872 smart Wi-Fi thermostats installed through the program in 2022. Several evaluated savings cases exist within this measure category, and each was established within the measure name, with delivered unit population splits shown in Table 263.

TABLE 263. HVAC CONFIGURATIONS FOR THERMOSTAT MEASURES AND *EX ANTE* SAVINGS

| MEASURE NAME-DEFINED CONFIGURATION | COUNT OF UNITS [a] | *EX ANTE* UNIT SAVINGS | | |
|---|---|---|---|---|
| | | KWH | KW | THERMS |
| Natural gas heat with no air conditioner | 863 | 0.00 | 0.000 | 22.00 |
| Natural gas heat with air conditioner | 986 | 109.26 | 0.124 | 22.00 |
| Electric resistance heating with air conditioner | 1 | 754.11 | 0.124 | 0.00 |
| Heat pump | 8 | 304.07 | 0.117 | 0.00 |
| Air conditioner only | 14 | 109.26 | 0.124 | 0.00 |

[a] These quantities reflect physical unit counts, and therefore may not match the scorecard, which counted both fuel types for dual-fuel measures.

The thermostat 2020 billing analysis examined all 2018 and 2019 participants, revealing net gas savings of 35 therms (5.4%) for 2019 participants receiving one thermostat. The analysis also revealed net cooling electric energy savings of 8.3%—the savings for sites receiving one thermostat in either 2018 or 2019. More detail on these options can be seen in the billing analysis section of the 2020 EE Rebates evaluation report. The 5.4% gas savings factor was applied for all sites with gas heat. Next year, the evaluation team recommends conducting a 2023 billing analysis formed around the Illinois TRM algorithm or the newest Indiana TRM algorithm. Table 264 shows the mean values for 2022.

TABLE 264. 2022 THERMOSTAT MEAN VALUES

| INDEPENDENT VARIABLES | 2022 MEAN VALUE - GAS HEATING ONLY | 2022 MEAN VALUE - ELECTRIC COOLING AND GAS HEATING | 2022 MEAN VALUE - ELECTRIC COOLING AND HEATING | 2022 MEAN VALUE - ELECTRIC COOLING ONLY | 2022 MEAN VALUE - HEAT PUMP | SOURCE |
|---|---|---|---|---|---|---|
| $CAP_C$ | - | 34,043.90 | 34,043.90 | 34,043.90 | 33,215.83 | Actual from the program tracking data when possible or average of program ACs or heat pumps |
| SEER[a] | 11.15 | 11.15 | 11.15 | 11.15 | 11.15 | Indiana TRM (v2.2) |
| $EFLH_C$ | 402.75 | 429.77 | 431.00 | 422.71 | 423.75 | Indiana TRM (v2.2), values vary based on nearest city to project location |
| $ESF_C$[a] | 0.083 | 0.083 | 0.083 | 0.083 | 0.083 | 2020 Billing Analysis |
| $CAP_H$ | 74,186.37 | 74,186.37 | 74,186.37 | - | 22,568.75 | Actual from the program tracking data, when possible, otherwise program average furnaces or heat pump capacities |

| INDEPENDENT VARIABLES | 2022 MEAN VALUE - GAS HEATING ONLY | 2022 MEAN VALUE - ELECTRIC COOLING AND GAS HEATING | 2022 MEAN VALUE - ELECTRIC COOLING AND HEATING | 2022 MEAN VALUE - ELECTRIC COOLING ONLY | 2022 MEAN VALUE - HEAT PUMP | SOURCE |
|---|---|---|---|---|---|---|
| COP | - | - | 1.00 | - | 2.26 | Indiana TRM (v2.2) or engineering assumption |
| $EFLH_H$ | 919.78 | 898.80 | 897.00 | 902.57 | 901.88 | 2020 Billing Analysis, values vary based on nearest city to project location |
| $ESF_H$[a] | 0.054 | 0.054 | 0.054 | 0.054 | 0.054 | 2020 Billing Analysis |

[a]Constants

To determine energy savings for air conditioning and electric heat sites, the evaluation team used the following equations. For natural gas heating with air conditioning, and for air conditioning alone:

$$\Delta kWh = \frac{CAP_C}{SEER \times 1{,}000} \times EFLH_C \times ESF_C$$

For heat pump systems:

$$\Delta kWh = \left(\frac{CAP_C}{SEER \times 1{,}000} \times EFLH_C \times ESF_C\right) + \left(\frac{CAP_H}{COP \times 3{,}412} \times EFLH_H \times ESF_H\right)$$

Where:

| | | |
|---|---|---|
| $CAP_C$ | = | System cooling capacity |
| SEER | = | System SEER |
| $EFLH_C$ | = | Effective full-load cooling hours from Indiana TRM (2.2) |
| $ESF_C$ | = | Savings factor for cooling derived via 2020 billing analysis, 8.3% |
| $CAP_H$ | = | System heating capacity |
| COP | = | Heating system coefficient of performance |
| 3,412 | = | Conversion from Btu to kWh (3,412 Btu = 1 kWh) |
| $EFLH_H$ | = | Effective full-load heating hours |
| $ESF_H$ | = | Savings factor for heating derived via 2020 billing analysis, 5.4% |

For thermostats serving natural gas heating systems without air conditioning, no electric energy savings are produced from the Indiana TRM (v2.2) calculations.

The Indiana TRM (v2.2) does not provide guidance on claiming demand reduction for these thermostat measures. Currently, savings for thermostats in most TRMs and evaluations are derived via analysis of billing data, which generally cannot produce values for demand reduction. However, it is likely that some demand reduction for smart Wi-Fi thermostats does exist, and this reduction is accommodated in the Illinois TRM (v9.0).[66] This TRM calculates savings using standard methods for deriving baseline peak load, then applies a smart Wi-Fi thermostat ESF and half the CF normally used for cooling. The evaluation team used that same approach. Here, the standard cooling CF of 0.88 is used, but divided by 2:

[66] Illinois Energy Efficiency Stakeholder Advisory Group (SAG). *2021 Illinois Statewide Technical Reference Manual for Energy Efficiency Version 9.0.* September 25,2020.

$$\Delta kW = \frac{CAP_C}{EER \times 1{,}000} \times \frac{CF}{2} \times ESF_C$$

In this evaluation 1,872 program thermostats were delivered to 1,749 sites; with 123 thermostats (6.6%) being the second thermostat delivered to a given site. The evaluation team investigated the behavior of customers who received more than one thermostat for NIPSCO's 2019 program year. In the 2019 evaluation, the evaluation team obtained survey responses for 58 participants who received two thermostats and found that all of them were using both thermostats to control their homes' HVAC systems. However, the billing analysis did not show that sites receiving more than one thermostat saw savings that were statistically different from those receiving only one.[67] However, because NIPSCO thermostats were not found to be given away to adjacent sites, second thermostats are granted no savings.

The overall kWh realization rate for this measure category is 91%, the overall kW realization rate is 91%, and the overall natural gas realization rate is 155%. Table 265 highlights these results.

TABLE 265. DETAILED RESULTS FROM THERMOSTATS

| AUDITED COUNT | *EX ANTE* DEEMED SAVINGS PER MEASURE | *EX POST* GROSS AVERAGE SAVINGS PER MEASURE | REALIZATION RATE |
|---|---|---|---|
| 1,872 | 60.07 kWh | 54.50 kWh | 91% |
| | 0.067 kW | 0.061 kW | 91% |
| | 21.73 therms | 33.62 therms | 155% |

### WI-FI THERMOSTATS – LEGACY 2021 MEASURE

In the 2022 tracking data, there were 269 Wi-Fi Thermostat Legacy 2021 Measures for which the evaluation team assigned deemed *post* gross per measure savings from the 2021 evaluation. The average deemed ex post gross savings were 54.60 kWh, 0.061 kW, and 29.92 therms. Reference the 2021 NIPSCO EE Rebates evaluation Appendix for details on how this measure was calculated.

*Ex ante* used an average deemed kWh savings value of 103.73 kWh, 0.111 kW, and 105.57 therms, resulting in an electric energy savings, demand reduction, and therm savings realization rates of 53%, 56%, and 28%, respectively for the Wi-Fi Thermostat - Legacy 2021 Measures.

### NATURAL GAS CONDENSING WATER HEATER – LEGACY 2021 MEASURE

In the 2022 tracking data, there were 2 *Natural Gas Condensing Water Heaters (≥0.70 UEF).* This measure is a Legacy 2021 Measure for which the evaluation team assigned a deemed savings value of 23.88 therms. These deemed savings are the *ex post* gross per measure savings from the 2021 evaluation. Reference the 2021 NIPSCO EE Rebates evaluation Appendix for details on how this measure was calculated.

*Ex ante* used a deemed therms savings value of 15.06 therms compared to evaluated therms savings of 23.88 therms resulting in a gas savings realization rate of 159% for the Natural Gas Condensing Water Heater – Legacy 2021 Measure.

### NATURAL GAS TANKLESS WATER HEATER – LEGACY 2021 MEASURE

In the 2022 tracking data, there were 5 *Natural Gas Tankless Water Heaters (≥0.94 UEF).* This measure is a Legacy 2021 Measure for which the evaluation team assigned a deemed savings value of 33.30 therms. These deemed savings are the *ex post* gross per measure savings from the 2021 evaluation. Reference the 2021 NIPSCO EE Rebates evaluation Appendix for details on how this measure was calculated.

[67] Cadmus. *2019 Evaluation, Measurement, and Verification Final Report*. Prepared for: Dayton Power and Light. May 6, 2020. PDF page 218, Cadmus report page 56. http://dis.puc.state.oh.us/DocumentRecord.aspx?DocID=762b0518-9da9-459b-9ef1-d8026bcc147f

*Ex ante* used a deemed therms savings value of 59.76 therms, compared to evaluated therms savings of 33.30 therms, resulting in a gas savings realization rate of 56% for the Natural Gas Tankless Water Heater – Legacy 2021 Measure.

HEAT PUMP WATER HEATER

In the 2022 tracking data, there were ten heat pump water heaters. The evaluation team used the following algorithm to calculate savings for water heaters:

$$\Delta kWh = \left( \frac{\left(\frac{1}{UEF_{BASE}} - \frac{1}{UEF_{EE}}\right) \times GPD \times Household \times 365.25 \times \gamma Water \times (T_{out} - T_{in}) \times 1.0}{3412} \right) + kWh_{cooling} - kWh_{heating} + Deh_{reduction}$$

Where:

| | | |
|---|---|---|
| GPD | = | Gallons per day per person |
| Household | = | Average number of people per household |
| 365.25 | = | Days per year |
| γWater | = | Specific weight of water; 8.33 lb per gallon |
| $T_{in}$ | = | Supply temperature |
| $T_{out}$ | = | Water heater setpoint |
| $UEF_{BASE}$ | = | Baseline uniform energy factor |
| $UEF_{EE}$ | = | Efficient uniform energy factor |
| 3412 | = | Conversion from Btu to kWh |
| $kWh_{cooling}$ | = | Cooling savings from heat in home to water heat |
| $kWh_{heating}$ | = | heating cost from conversion of heat in home to water heat |
| $Deh_{Reduction}$ | = | savings resulting from reduced dehumidification |

Following the Indiana TRM (v2.2), the evaluation team assumed 2.47 people per household—the prescribed value for sites unknown to be single-family or multifamily. The evaluation team applied this to a linear fit for gallons per day per person based on the "Hot Water Use by Family Size" table in the Indiana TRM (v2.2) to produce a GPD per household value of 53.2 or 21.55 GPD per person. The evaluation team applied groundwater temperature based on the nearest city and assumed a water temperature setpoint of 125°F. $kWh_{cooling}$, $kWh_{heating}$, and $Deh_{Reduction}$ were calculated on a per measure basis using algorithms and assumptions from the Illinois TRM (v10).

The current standard for residential water heater efficiency is uniform energy factor (UEF).[68] The UEF required by code is a function of tank volume, heater type (instant or storage), and draw pattern (very small, low, medium, high). These parameters were looked up in the AHRI database for units delivered for this measure category.

[68] UEF became the standard on July 13, 2015.
https://www.energy.gov/sites/prod/files/2015/03/f20/water_heater_conversionfactor_nopr.pdf

The team also used its actual rated efficient UEF determined from the AHRI database for that model to calculate savings. The evaluation team used the following algorithm from the Illinois TRM (v10) to calculate demand reduction:

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

Where:

| | | |
|---|---|---|
| DkWh | = | kWh savings |
| Hours | = | Full load hours of water heater |
| CF | = | Coincidence factor |

Table 266 shows the mean values for 2022.

TABLE 266. 2022 WATER HEATER MEAN VALUES

| INDEPENDENT VARIABLES | 2022 HEAT PUMP WATER HEATER MEAN VALUES | SOURCES |
|---|---|---|
| UEFbase | 0.92 | Applied based on equipment tank volume, heater type, and draw patterns found in the AHRI equipment database and in accordance with DOE standards |
| UEFee | 3.67 | Actual from AHRI equipment database |
| Tin | 57.4 | Indiana TRM (v2.2), values vary based on nearest city to project location |
| GPD[a] | 21.55 | linear fit for gallons per day per person based on the "Hot Water Use by Family Size" table in the Indiana TRM (v2.2) |
| Hours[a] | 2,533 | Illinois TRM (v10) |
| kWh heating | 5.71 | Varies based on UEF values; Input assumptions from the Illinois TRM (v10) |
| kWh cooling | 65.82 | Varies based on UEF values; Input assumptions from the Illinois TRM (v10) |
| Deh reduction[a] | 72 | Illinois TRM (v10) |
| LF[a] | 0.22 | Illinois TRM (v10) |
| ηHeat[a] | 0.7 | Illinois TRM (v10) |
| %NaturalGas[a] | 72% | 2020 RECs Data for East North Central Region |

[a]Constants

The resulting average evaluated unit electric energy and demand reduction savings were 2,736.26 kWh and 0.374 kW, respectively, compared to average *ex ante* values of 1,900.85 kWh and 0.090 kW, for a kWh realization rate of 144% and kW realization rate of 415% for this measure category. Table 267 highlights these results.

TABLE 267. DETAILED RESULTS FROM WATER HEATERS

| AUDITED COUNT | *EX ANTE* DEEMED SAVINGS PER MEASURE | *EX POST* GROSS AVERAGE SAVINGS PER MEASURE | REALIZATION RATE |
|---|---|---|---|
| 10 | 1900.85 kWh | 2,736.26 kWh | 144% |
| | 0.090 kW | 0.374 | 415% |

DUCTLESS MINI-SPLIT HEAT PUMP

In the 2022 tracking data, there were 52 ductless mini-split heat pumps. The evaluation team used the following algorithm from the Illinois TRM (v10) to calculate savings for ductless mini-split heat pump:

$$\Delta kWh = Capacity_{cool} * EFLH_{cool} * \frac{\left(\frac{(1-ER)}{SEER_{Base}} + \frac{ER}{SEER_{Exist}} - \frac{1}{SEER_{ee}}\right)}{1000} + Capacity_{heat*} * EFLH_{heat} * \frac{\left(\frac{(1-ER)}{HSPF_{Base}} + \frac{ER}{HSPF_{Exist}} - \frac{1}{HSPF_{ee}}\right)}{1000}$$

Where:

| | | |
|---|---|---|
| $Capacity_{cool}$ | = | Total cooling capacity |
| $EFLH_{cool}$ | = | Effective full-load cooling hours from TRM (2.2) |
| $SEER_{Base}$ | = | Baseline SEER |
| $SEER_{ee}$ | = | Efficient SEER |
| $SEER_{exist}$ | = | Existing SEER |
| $Capacity_{heat}$ | = | Total heating capacity |
| $EFLH_{heat}$ | = | Effective full-load heating hours derived via 2020 billing analysis for furnaces |
| $HSPF_{Base}$ | = | Baseline heating seasonal performance factor |
| $HSPF_{ee}$ | = | Efficient heating seasonal performance factor |
| $HSPF_{exist}$ | = | Existing heating seasonal performance factor |
| ER | = | Early replacement rate |

The evaluation team used EFLH values from the 2020 billing analysis and AHRI-verified capacities and efficiencies for this analysis. Existing efficiency assumptions were from the Illinois TRM (v10). Using the AHRI-verified capacities and additional early replacement savings made *ex post* vary widely from the *ex ante*. Specifically, the variance between *ex ante* and *ex post* savings is likely caused by the evaluation team's use of actual values for CAP, $SEER_{EE}$, and $HSPF_{EE}$ and savings associated with early replacement.

The evaluation team used the following algorithm from the Illinois TRM (v10) to calculate demand reduction:

$$\Delta kW = Capacity_{cool} * \left(\frac{(1-ER)}{EER_{base}} + \frac{ER}{EER_{Exist}} - \frac{1}{EER_{ee}}\right) / 1000 * CF$$

When calculating time of sale coincident peak demand savings relative to the baseline, 4 units had AHRI-verified EER values that were less than the assumed baseline EER of 11 and were given demand savings of 0 kW, otherwise they would yield a negative result. The EER baseline used for the ductless mini-split heat pumps is consistent with the air source heat pump measure and pulled from the Illinois TRM (v10). Table 268 shows the mean values for 2022.

TABLE 268. 2022 DUCTLESS MINI-SPLIT MEAN VALUES

| INDEPENDENT VARIABLES | 2022 MEAN VALUE | SOURCE |
|---|---|---|
| CAPc | 18,494.23 | Actual from AHRI equipment database |
| EFLHcool | 427.65 | Indiana TRM (v2.2), values vary based on nearest city to project location |
| SEERbase[a] | 14.00 | Illinois TRM (v10) |
| SEERee | 22.95 | Actual from AHRI equipment database |
| CAPh | 19,736.54 | Actual from the program tracking data[b] |
| EFLHh | 899.25 | Actual from AHRI equipment database |
| HSPFbase[a] | 8.2 | Illinois TRM (v10) |
| HSPFee | 11.37 | Actual from AHRI equipment database |
| EERbase[a] | 11.00 | Illinois TRM (v10) |
| EERee | 13.06 | Actual from AHRI equipment database |
| CF[a] | 0.88 | Indiana TRM (v2.2) |
| ER | 0.21 | 2022 Participant Survey |

[a]Constants
[b]Checked against AHRI equipment database, matched for all cases.

Evaluated savings varied from 325.29 kWh to 1994.63 kWh, averaging 1020.83 kWh. The *ex ante* savings used a deemed value of 701.92 kWh, and the realization rate for electric energy savings was 145%. Evaluated coincident peak demand savings ranged from 0.071 kW to 0.816 kW, averaging 0.0.294 kW. *Ex ante* demand savings were a deemed value of 0.100 kW, and the peak demand realization rate for this measure category was 294%. Table 269 highlights these results.

TABLE 269. DETAILED RESULTS FROM DUCTLESS MINI-SPLIT HEAT PUMPS

| AUDITED COUNT | *EX ANTE* DEEMED SAVINGS PER MEASURE | *EX POST* GROSS AVERAGE SAVINGS PER MEASURE | REALIZATION RATE |
|---|---|---|---|
| 52 | 701.92 kWh | 1020.83 kWh | 145% |
| | 0.100 kW | 0.294 kW | 294% |

## POOL PUMP

In the 2022 tracking data, there were 16 pool pumps. The evaluation team applied the savings approach outlined in the Illinois TRM (v10), where savings are dependent on the installed Weighted Energy Factor, orientation, and Tier:

$$\Delta kWh = (Gallons \times Turnovers \times (\frac{1}{WEF_{base}} - \frac{1}{WEF_{ESTAR}}) \times \frac{Days}{1{,}000}$$

Where:

$WEF_{BASE}$ = Weighted Energy Factor of baseline pump (gal/Wh)

$WEF_{ESTAR}$ = Weighted Energy Factor of efficient pump (gal/Wh)

Gallons = Capacity of the pool

Turnovers = Desired number of pool water turnovers per day

Days = Number of days per year that the swimming pool is operational

1,000 = Conversion from WH to kWh

The team determined each model's configuration and tier from the ENERGY STAR qualified products list (QPL) and assigned savings according to the savings shown above. For models that could not be find through look ups the reported configuration and tier were assumed. The *ex ante* values were also calculated using the Illinois TRM (v10). Differences between *ex ante* and *ex post* come from different than reported model configurations and tiers confirmed during look ups. Where configurations and tiers were the same between *ex ante* and *ex post,* savings were the same.

The evaluation team used the following algorithm to calculate demand reduction:

$$\Delta kW = \left( \frac{\left(\frac{kWh}{Day}\right)_{BASE}}{\left(\frac{Hrs}{Day}\right)_{BASE}} - \frac{\left(\frac{kWh}{Day}\right)_{ESTAR}}{\left(\frac{Hrs}{Day}\right)_{ESTAR}} \right) \times CF$$

Where:

kWh/Day = Daily energy consumption of pool pump

Hrs/Day = Daily Run Hours of pool pump

= Gallons × Turnovers / GPM

CF = Summer peak coincidence factor

Table 270 shows the mean values for 2022.

TABLE 270. 2022 POOL PUMP MEAN VALUES

| INDEPENDENT VARIABLES | 2022 MEAN VALUE-ESTAR IN-GROUND | 2022 MEAN VALUE-CEE TIER 1 ABOVE GROUND | SOURCE |
|---|---|---|---|
| WEFestar | 6.09 | 4.43 | Configuration and Tier according to ENERGY STAR QPL Look up; Values from Illinois TRM (v10) table |
| WEFbase[a] | 4.6 | 2.6 | Illinois TRM (v10) |
| Gallons[a] | 22,000 | 7,540 | Illinois TRM (v10) |
| Turnovers[a] | 2 | 2 | Illinois TRM (v10) |
| Days[a] | 122 | 122 | Illinois TRM (v10) |
| GPMbase[a] | 43.6 | 44.7 | Illinois TRM (v10) |
| GPMestar[a] | 32.20 | 27.3 | Illinois TRM (v10) |
| CF[a] | 0.831 | 0.831 | Illinois TRM (v10) |

[a]Constants

The resulting average evaluated unit kWh savings were 290.78 kWh, compared to an average *ex ante* value of 349.18 kWh, for a realization rate of 83%. The resulting average evaluated unit kW savings were 0.265 kW compared to an average *ex ante* value of 0.308 kW which led to a realization rate of 86%. Table 271 highlights these results.

TABLE 271. DETAILED RESULTS FROM POOL PUMPS

| AUDITED COUNT | *EX ANTE* DEEMED SAVINGS PER MEASURE | *EX POST* GROSS AVERAGE SAVINGS PER MEASURE | REALIZATION RATE |
|---|---|---|---|
| 16 | 349.18 kWh | 290.78 kWh | 83% |
| | 0.308 kW | 0.265 kW | 86% |

## AIR PURIFIERS

In the 2022 tracking data, there were 53 air purifiers. The evaluation team applied the savings approach outlined in the Illinois TRM (v10), where savings are dependent on the installed model's smoke free clean air delivery rate (CADR) and partially on mode power consumption:

$$\Delta kWh = kWh_{BASE} - kWh_{eff}$$

Where

$$kWh_{BASE} = hours \times \left(\frac{SmokeCADR_{BASE}}{SmokeCADRperWatt_{BASE} \times 1{,}000}\right) + (8{,}760 - hours) \times \frac{PartialOnModePower_{BASE}}{1{,}000}$$

$$kWh_{eff} = hours \times \left(\frac{SmokeCADR_{eff}}{SmokeCADRperWatt_{eff} \times 1{,}000}\right) + (8{,}760 - hours) \times \frac{PartialOnModePower_{eff}}{1{,}000}$$

And

| | | |
|---|---|---|
| $kWh_{BASE}$ | = | Annual electrical usage for baseline unit (kWh) |
| $kWh_{eff}$ | = | Annual electrical usage for efficient unit (kWh) |
| hours | = | Annual active operating hours |
| $SmokeCADR_{Base}$ | = | Smoke CADR for baseline units |
| $SmokeCADRperWatt_{BASE}$ | = | Smoke CADR delivery rate per watt for baseline units |
| $PartialOnModePower_{BASE}$ | = | Partial on mode power for baseline units (Watts) |
| 1000 | = | Conversion factor from watts to kilowatts |
| $SmokeCADR_{eff}$ | = | Smoke CADR for efficient units |
| $SmokeCADRperWatt_{eff}$ | = | Smoke CADR delivery rate per watt for efficient units |
| $PartialOnModePower_{eff}$ | = | Partial on mode power for efficient units (Watts) |

The evaluation team used the following algorithm to calculate demand reduction:

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

Where:

Hours = Average hours of use per year

CF = Summer peak coincidence factor

The team determined each model's smoke free CADR from the ENERGY STAR qualified products list (QPL) and assigned savings according to the savings shown above. The *ex ante* values were calculated using the Illinois TRM (v10). Differences between *ex ante* and *ex post* come from different CADR than reported found during look ups. Table 272 documents the mean values for 2022.

TABLE 272. 2022 AIR PURIFIER MEAN VALUES

| INDEPENDENT VARIABLES | 2022 MEAN VALUE-CADR 30-99 | 2022 MEAN VALUE-CADR 101-149 | 2022 MEAN VALUE-CADR 150-199 | 2022 MEAN VALUE-CADR ≥200 | SOURCE |
|---|---|---|---|---|---|
| SmokeCADRbase | 83.30 | 127.60 | 159.33 | 292.90 | Efficient CADR from ENERGY STAR QPL Look up; Base look up from Illinois TRM (v10) |
| SmokeCADRperWattbase | 1.64 | 1.83 | 1.90 | 1.89 | Efficient CADR from ENERGY STAR QPL Look up; Base look up from Illinois TRM (v10) |
| PartialOnModePowerbase | 2.00 | 2.00 | 2.00 | 2.00 | Efficient CADR from ENERGY STAR QPL Look up; Base look up from Illinois TRM (v10) |
| SmokeCADReff | 84.44 | 129.22 | 155.33 | 273.29 | ENERGY STAR QPL Look up |
| SmokeCADRperWattEff | 2.7 | 4.04 | 3.78 | 4.28 | ENERGY STAR QPL Look up |
| PartialOnModePowerEff | 0.59 | 0.27 | 0.26 | 0.62 | ENERGY STAR QPL Look up |
| Hours[a] | 5840 | | | | |
| CF[a] | 0.667 | | | | |

[a]Constants

The resulting average evaluated unit kWh savings were 377.11 kWh, compared to an average *ex ante* value of 414.53 kWh, for a realization rate of 91%. The resulting average evaluated unit kW savings were 0.043 kW compared to an average *ex ante* value of 0.047 kW which led to a realization rate of 91%. Table 273 highlights these results.

TABLE 273. DETAILED RESULTS FROM AIR PURIFIERS

| AUDITED COUNT | *EX ANTE* DEEMED SAVINGS PER MEASURE | *EX POST* GROSS AVERAGE SAVINGS PER MEASURE | REALIZATION RATE |
|---|---|---|---|
| 53 | 414.53 kWh | 377.11 kWh | 91% |
| | 0.047 kW | 0.043 kW | 91% |

## AIR PURIFIER – LEGACY 2021 MEASURE

In the 2022 tracking data, there was one *ENERGY STAR Air Purifier/Cleaner CADR 201-250 and one ENERGY STAR Air Purifier/Cleaner CADR Over 250* measure. These measures are Legacy 2021 Measures for which the evaluation team assigned a deemed savings value of 328 kWh and 0.037 kW. These deemed savings are the *ex post* gross per measure savings from the 2021 evaluation. Reference the 2021 NIPSCO EE Rebates evaluation Appendix for details on how this measure was calculated.

*Ex ante* used an average deemed kWh savings value of 1,023 kWh and 0.365 kW compared with evaluated kWh and kW savings of 757.47 kWh and 0.117 kW, resulting in an electric energy savings and demand reduction realization rate of 32% and 32%, respectively for the Air Purifier - Legacy 2021 Measures.

## CLOTHES DRYERS

In the 2022 tracking data, there were 16 clothes dryers. The evaluation team used the following algorithm from the Illinois TRM (v10) to calculate savings for clothes dryers:

$$\Delta kWh = \left(\frac{Load}{CEF_{base}} - \frac{Load}{CEF_{eff}}\right) * N_{cycles} * \%Electric$$

Where:

Load = The average total weight (lbs) of clothes per drying cycle

$CEF_{base}$ = Combined energy factor (lbs/kWh) of the baseline unit

$CEF_{EE}$ = Combined energy factor (lbs/ kWh) of the ENERGYSTAR unit

$N_{cycles}$ = Number of dryer cycles per year

%Electric = The percent of overall savings coming from electricity

The evaluation team used the following algorithm to calculate demand reduction:

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

Where:

Hours = Annual run hours of clothes dryer

CF = Summer peak coincidence factor

Clothes dryer energy type and installed CEF were determined from model number look ups in the ENERGY STAR QPL. *Ex ante* assumed an electric energy type for all installed clothes dryers, a deemed energy savings value of 160.44 kWh, and demand savings of 0.022 kW. Table 274 shows the mean values for 2022.

TABLE 274. 2022 CLOTHES DRYERS MEAN VALUES

| INDEPENDENT VARIABLES | 2022 MEAN VALUE | SOURCE |
|---|---|---|
| Load[a] | 8.45 | Illinois TRM (v10) |
| CEFbase[a] | 3.11 | Illinois TRM (v10) |
| CEFEE | 3.85 | Actual from ENERGY STAR QPL Look up |
| Ncycles[a] | 283.00 | Illinois TRM (v10) |
| %electric[a] | 100% | Illinois TRM (v10) |

[a]Constants

The evaluated savings varied from 81.75 kWh to 161.98 kWh, averaging 146.58 kWh while *ex ante* assumed a deemed energy savings value of 160.44 kWh resulting in an average kWh realization rate of 91%.

Evaluated demand savings averaged 0.020 kW while *ex ante* used deemed demand savings of 0.022 kW resulting in an average kW realization rate of 89%. Table 275 highlights these results.

TABLE 275. DETAILED RESULTS FROM CLOTHES DRYERS

| TRACKING DATA | *EX ANTE* DEEMED SAVINGS PER MEASURE | *EX POST* GROSS AVERAGE SAVINGS PER MEASURE | REALIZATION RATE |
|---|---|---|---|
| 16 | 160.44 | 146.58 kWh | 91% |
| | 0.022 kW | 0.020 kW | 89% |

## DEHUMIDIFIERS

In the 2022 tracking data, there were 63 dehumidifiers. The evaluation team used the following algorithm from the Illinois TRM (v10) to calculate savings for dehumidifiers:

$$\Delta kWh = \left(\frac{Avg\ Capacity * .0473}{24} * Hours\right) * \left(\frac{1}{L/kWh\_Base} - \frac{1}{L/kWh\_Eff}\right)$$

Where:

Avg Capacity = Average capacity of the unit (pints/day)
.0473 = Conversion for pints to liters
24 = Conversion for Liters/day to Liters/hour
Hours = Run hours per year
L/kWh = Liters of water per kWh consumed

The unit specific average capacity and water removal per kWh values were determined by looking up reported model numbers in the ENERGY STAR QPL.

The evaluation team used the following algorithm to calculate demand reduction:

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

Where:

Hours = Annual operating hours
CF = Summer peak coincidence factor

Table 276 shows the mean values for 2022.

TABLE 276. 2022 DEHUMIDIFIERS MEAN VALUES

| INDEPENDENT VARIABLES | 2022 MEAN VALUE - (CAPACITY ≤ 25 PINTS/DAY) (≥ 1.57 L/KWH) | 2022 MEAN VALUE - (CAPACITY 26 - 50 PINTS/DAY) (≥ 1.80 L/KWH) | 2022 MEAN VALUE - PORTABLE (CAPACITY > 50 AND <155 PINTS/DAY) (≥ 3.30 L/KWH) | SOURCE |
|---|---|---|---|---|
| Average Capacity | 21.84 | 45.33 | 85.00 | Actual from ENERGY STAR QPL Look up |

| | | | | |
|---|---|---|---|---|
| Federal Standard L/kWh | 1.30 | 1.59 | 2.80 | Illinois TRM (v10) |
| L/kWh | 1.68 | 1.85 | 2.35 | Actual from ENERGY STAR QPL Look up |
| Pints to Liters[a] | 0.473 | 0.473 | 0.473 | Illinois TRM (v10) |
| Run Hours/year[a] | 2,200 | 2,200 | 2,200 | Illinois TRM (v10) |
| Hours/day[a] | 24.00 | 24.00 | 24.00 | Illinois TRM (v10) |

[a]Constants

*Ex ante* savings varied from 113 kWh to 240 kWh based on their capacity and L/kWh values, averaging 115.21 kWh. Evaluated savings varied from 105.02 kWh to 241.00 kWh, averaging 165.50 kWh, which resulted in an average kWh realization rate of 144%. *Ex ante* demand savings varied from 0.026 kW to 0.055 kW, averaging 0.026 kW; while evaluated demand savings varied from 0.024 kW to 0.055 kW, averaging 0.038 kW and resulting in an average kW realization rate of 142%. Table 277 highlights these results.

TABLE 277. DETAILED RESULTS FROM DEHUMIDIFIERS

| TRACKING DATA | *EX ANTE* DEEMED SAVINGS PER MEASURE | *EX POST* GROSS AVERAGE SAVINGS PER MEASURE | REALIZATION RATE |
|---|---|---|---|
| 63 | 115.21 kWh | 165.50 kWh | 144% |
| | 0.026 kW | 0.038 kW | 142% |

### DEHUMIDIFIER – LEGACY 2021 MEASURE

In the 2022 tracking data, there were 4 Dehumidifier Legacy 2021 Measures for which the evaluation team assigned deemed *ex post* gross per measure savings from the 2021 evaluation. Reference the 2021 NIPSCO EE Rebates evaluation Appendix for details on how this measure was calculated.

*Ex ante* used an average deemed kWh savings value of 95.44 kWh and 0.022 kW compared with evaluated kWh and kW savings of 124.14 kwh and 0.027 kW, resulting in an electric energy savings and demand reduction realization rate of 130% and 123%, respectively for the Dehumidifier - Legacy 2021 Measures.

# APPENDIX 2: RESIDENTIAL LIGHTING PROGRAM

For the PY2022 evaluation, the evaluation team referenced the IN TRM (ver 2.2) for savings algorithms.

## LEDS

The evaluation team used the following equations to calculate electric energy and peak demand savings for LEDs:

$$kWh\ savings\ per\ lamp = \frac{(W_{base} - W_{LED}) * (HOURS) * (1 + WHF_e)}{1{,}000} * ISR$$

$$kW\ reduction\ per\ lamp = \frac{(W_{base} - W_{LED}) * Coincidence\ Factor * (1 + WHF_d)}{1{,}000} * ISR$$

Where:

$W_{base}$ = Wattage of the bulb being replaced, W

$W_{LED}$ = Wattage of the LED bulb, W

HOURS = Average annual hours of use, hr

$WHF_e$ = Waste heat factor for energy to account for HVAC interactions with lighting (depends on location)

$WHF_d$ = Waste heat factor for demand to account for HVAC interactions with lighting (depends on location)

Coincidence Factor = Summer peak coincidence factor

1,000 = Constant to convert watts to kilowatts

ISR = In-service rate

Table 278 lists the input assumptions and source of each assumption for the LED measure savings calculations.

TABLE 278. *EX POST* VARIABLE ASSUMPTIONS FOR LEDS

| INPUT | VALUE | SOURCE |
|---|---|---|
| $W_{base}$ | Varies | ENERGY STAR lumens bins |
| $W_{LED}$ | Varies | Actual wattage from 2020 tracking data |
| HOURS | 902 | Indiana TRM (v2.2) |
| $WHF_e$ | -0.07 | Indiana TRM (v2.2), South Bend values |
| $WHF_d$ | 0.038 | Indiana TRM (v2.2), averaged across participant location |
| Coincidence Factor | 0.11 | Indiana TRM (v2.2) |
| ISR | Varies | 2015 Opinion Dynamics Market Effects Study |

### BASELINE WATTAGE FOR PAR AND MR LAMP TYPES

For highly focused directional lamps, the evaluation team used the Center Beam Candle Power (CBCP) and beam angle measurements to accurately estimate the equivalent baseline wattage. The formula below is based on the ENERGY STAR Center Beam Candle Power tool.[69] If CBCP and beam angle information were not available, or if the equation below returned a negative value (or undefined), the team used the manufacturer's recommended baseline wattage equivalent.[70] The baseline wattage algorithm below is for reference.

$$Wbase = 375.1 - 4.355(D) - \sqrt{227800 - 937.9(D) - 0.9903(D2) - 1479(BA) - 12.02(D * BA)} + 14.69(BA2) - 16720 * ln(CBCP)\ 84$$

Where:

| | | |
|---|---|---|
| D | = | Bulb diameter (e.g., for PAR20 D = 20) |
| BA | = | Beam angle |
| CBCP | = | Center beam candle power |

The evaluation team rounded down the result of the ENERGY STAR calculator, or equation above, to the nearest wattage established by ENERGY STAR, as shown in Table 279.

TABLE 279. BASELINE WATTAGES FOR PAR AND MR LED LAMPS

| LAMP DIAMETER | PERMITTED WATTAGES |
|---|---|
| 16 | 20, 35, 40, 45, 50, 60, 75 |
| 20 | 50 |
| 30S | 40, 45, 50, 60, 75 |
| 30L | 50, 75 |
| 38 | 40, 45, 50, 55, 60, 65, 75, 85, 90, 100, 120, 150, 250 |

### BASELINE WATTAGE FOR NON-PAR AND MR LAMP TYPES

Table 280 shows the distribution of baseline wattages applied using the lumen equivalence method. This approach is specified in the UMP and uses the ENERGY STAR online database to calculate final baseline wattages for all program LEDs except certain PAR and MR lamp types (depending on their stated output).

[69] ENERGY STAR.gov. Accessed March 7, 2022. "ENERGY STAR Lamps v1.1. Center Beam Intensity Benchmark Tool." http://www.energystar.gov/ia/products/lighting/iledl/IntLampCenterBeamTool.zip

[70] The ENERGY STAR CBCP tool does not accurately model baseline wattages for lamps with certain bulb characteristic combinations, specifically for lamps with very high CBCP.

TABLE 280. BASELINE WATTAGES FOR LED LAMPS BY LUMENS AND SHAPE

| LAMP SHAPE | LUMEN RANGE LOWER | LUMEN RANGE UPPER | 2017–2020 $WATTS_{BASE}$ |
|---|---|---|---|
| Omnidirectional, Medium Screw-Base Lamps (A, BT, P, PS, S or T) See exceptions in gray rows below | 250 | 309 | 25 |
| | 310 | 749 | 29 |
| | 750 | 1,049 | 43 |
| | 1,050 | 1,489 | 53 |
| | 1,490 | 2,600 | 72 |
| | 2,601 | 3,300 | 150 |
| | 3,301 | 3,999 | 200 |
| | 4,000 | 6,000 | 300 |
| S Shape ≤749 lumens and T Shape ≤749 lumens or T Shape >10-inches long | 250 | 309 | 25 |
| | 310 | 749 | 40 |
| Decorative, Medium Screw-Base Lamps (G) See exceptions in gray rows below | 250 | 309 | 25 |
| | 310 | 749 | 29 |
| | 750 | 1,049 | 43 |
| | 1,050 | 1,300 | 53 |
| G16-1/2, G25, and G30 ≤499 lumens | 250 | 309 | 25 |
| | 310 | 349 | 25 |
| | 350 | 499 | 40 |
| G Shape with diameter ≥5 inches | 250 | 349 | 25 |
| | 350 | 499 | 40 |
| | 500 | 574 | 60 |
| | 575 | 649 | 75 |
| | 650 | 1,099 | 100 |
| | 1,100 | 1,300 | 150 |
| Decorative, Medium Screw-Base Lamps (B, BA, C, CA, DC, F, and ST) See exceptions in gray rows below | 70 | 89 | 10 |
| | 90 | 149 | 15 |
| | 150 | 299 | 25 |
| | 300 | 309 | 40 |
| | 310 | 499 | 29 |
| | 500 | 699 | 29 |
| B, BA, CA, and F ≤499 lumens | 70 | 89 | 10 |
| | 90 | 149 | 15 |
| | 150 | 299 | 25 |
| | 300 | 309 | 40 |
| | 310 | 499 | 40 |
| Omnidirectional, Intermediate Screw-Base Lamps (A, BT, P, PS, S or T) See exceptions in gray rows below | 250 | 309 | 25 |
| | 310 | 749 | 40 |
| S Shape with a first number ≤12.5 and T Shape with a first number ≤8 and nominal overall length <12 inches | 250 | 309 | 25 |
| | 310 | 749 | 40 |
| Decorative, Intermediate Screw-Base Lamps (G) See exceptions in gray rows below | 250 | 309 | 25 |
| | 310 | 349 | 25 |
| | 350 | 499 | 40 |
| G Shape with a first number ≤12.5 or diameter ≥5 inches | 250 | 349 | 25 |
| | 350 | 499 | 40 |
| Decorative, Intermediate Screw-Base Lamps (B, BA, C, CA, DC, F, and ST) | 70 | 89 | 10 |
| | 90 | 149 | 15 |
| | 150 | 299 | 25 |
| | 300 | 309 | 40 |
| | 310 | 499 | 40 |
| Omnidirectional, Candelabra Screw-Base Lamps (A, BT, P, PS, S, and T) See exceptions in gray rows below | 250 | 309 | 25 |
| | 310 | 749 | 40 |
| | 750 | 1,049 | 60 |
| | 250 | 309 | 25 |

| LAMP SHAPE | LUMEN RANGE LOWER | UPPER | 2017–2020 $WATTS_{BASE}$ |
|---|---|---|---|
| S Shape with a first number ≤12.5 and T Shape with a first number ≤8 and nominal overall length <12 inches | 310 | 749 | 40 |
| | 750 | 1,049 | 60 |
| Decorative, Candelabra Screw-Base Lamps (G) See exceptions in gray rows below | 250 | 309 | 25 |
| | 310 | 349 | 25 |
| | 350 | 499 | 40 |
| | 500 | 574 | 60 |
| G Shape with a first number ≤12.5 or diameter ≥5 inches | 250 | 349 | 25 |
| | 350 | 499 | 40 |
| | 500 | 574 | 60 |
| Decorative, Candelabra Screw-Base Lamps (B, BA, C, CA, DC, F, and ST) | 70 | 89 | 10 |
| | 90 | 149 | 15 |
| | 150 | 299 | 25 |
| | 300 | 309 | 40 |
| | 310 | 499 | 40 |
| | 500 | 699 | 60 |
| Directional, Medium Screw-Base Lamps with Diameter ≤2.25 Inches | 400 | 449 | 40 |
| | 450 | 499 | 45 |
| | 500 | 649 | 50 |
| | 650 | 1,199 | 65 |
| Directional, Medium Screw-Base Lamps (R, ER, BR, BPAR, and similar bulb shapes with diameter >2.5 inches) See exceptions in gray rows below | 640 | 739 | 40 |
| | 740 | 849 | 45 |
| | 850 | 1,179 | 50 |
| | 1,180 | 1,419 | 65 |
| | 1,420 | 1,789 | 75 |
| | 1,790 | 2,049 | 90 |
| | 2,050 | 2,579 | 100 |
| | 2,580 | 3,300 | 120 |
| | 3,301 | 3,429 | 120 |
| | 3,430 | 4,270 | 150 |
| Directional, Medium Screw-Base Lamps (R, ER, BR, BPAR, and similar bulb shapes with medium screw bases and diameter >2.26 inches and ≤2.5 inches) See exceptions in gray rows below | 540 | 629 | 40 |
| | 630 | 719 | 45 |
| | 720 | 999 | 50 |
| | 1,000 | 1,199 | 65 |
| | 1,200 | 1,519 | 75 |
| | 1,520 | 1,729 | 90 |
| | 1,730 | 2,189 | 100 |
| | 2,190 | 2,899 | 120 |
| | 2,900 | 3,300 | 120 |
| | 3,301 | 3,850 | 150 |
| ER30, BR30, BR40, or ER40 | 400 | 449 | 40 |
| | 450 | 499 | 45 |
| | 500 | 649 to 1,179 | 50 |
| BR30, BR40, or ER40 | 650 | 1419 | 65 |
| R20 | 400 | 449 | 40 |
| | 450 | 719 | 45 |
| All reflector lamps below lumen ranges specified above | 200 | 299 | 20 |
| | 300 | 399 to 639 | 30 |

| LAMP SHAPE | LUMEN RANGE | | |
|---|---|---|---|
| | LOWER | UPPER | 2017–2020 $WATTS_{BASE}$ |
| Rough Service, Shatter Resistant, Three-Way Incandescent, and Vibration | 250 | 309 | 25 |
| | 310 | 749 | 40 |
| | 750 | 1,049 | 60 |
| | 1,050 | 1,489 | 75 |
| | 1,490 | 2,600 | 100 |
| | 2,601 | 3,300 | 150 |
| | 3,301 | 3,999 | 200 |
| | 4,000 | 6,000 | 300 |

# APPENDIX 3: HOME ENERGY ASSESSMENT (HEA) PROGRAM

## ALGORITHMS AND ASSUMPTIONS

This appendix contains the assumptions used in electric savings, demand reduction, and gas savings algorithms for the measures within the Home Energy Assessment program. The team examined each assumption behind the algorithms to capture savings and compared it against the Illinois TRM v10.0, the Indiana TRM (v2.2), the Pennsylvania TRM 2016, the Uniform Methods Project, and CHA data from the 2019 NIPSCO program. Detailed information on the analysis and supporting assumptions for the following Home Energy Assessment program measures are included within this appendix:

- LEDs
- Kitchen faucet aerators
- Bathroom faucet aerators
- Low-flow showerheads
- Shower Start
- Attic Insulation
- Duct sealing
- Pipe Wrap

Table 281 lists the assumptions of the *ex post* per-measure savings.

TABLE 281. HOME ENERGY ASSESSMENTS PROGRAM MEASURES

| MEASURE | REVIEWED ASSUMPTIONS |
|---|---|
| LEDs | New and baseline wattages, house of use, waste heat factors, coincidence factors |
| Kitchen Faucet Aerator | New and baseline flow rates, people per house, minutes of use per day, faucets per home, water temperatures, water heater fuel type and efficiency |
| Bathroom Faucet Aerator | New and baseline flow rates, people per house, minutes of use per day, faucets per home, water temperatures, water heater fuel type and efficiency |
| Low-Flow Showerhead | New and baseline flow rates, people per house, minutes of use per day, showerheads per home, water temperatures, water heater fuel type and efficiency |
| Shower Start | New and baseline flow rates, people per house, showerheads per home, minutes of use per day, water temperatures, water heater fuel type and efficiency, and wasted seconds per shower |
| Pipe Wrap | New and baseline R-values, pipe diameter, water heater recovery efficiency |
| Duct Sealing | New and baseline distribution efficiencies, full load heating and cooling hours, capacities, and efficiencies of heating and cooling equipment |
| Attic Insulation | Void space and compression factor, pre-install and post-install R-values, square footage of installed insulation |

The algorithms and assumptions the evaluation team used to calculate *ex post* savings for each of these measures follow.

### LEDS

The team used the following equations to calculate electric energy and peak demand savings, as well as natural gas energy penalties, for LEDs:

$$kWh\ savings\ per\ lamp = \frac{(W_{base} - W_{LED}) * (Daily\ hours\ of\ use * 365) * (1 + WHF_e)}{1{,}000}$$

$$kW\ reduction\ per\ lamp = \frac{(W_{base} - W_{LED}) * Coincidence\ Factor * (1 + WHF_d)}{1{,}000}$$

$$therm\ savings\ per\ lamp = \frac{(W_{base} - W_{LED}) * (Daily\ hours\ of\ use * 365) * WHF_g}{1{,}000}$$

Where:

| | | |
|---|---|---|
| $W_{base}$ | = | Wattage of the bulb being replaced, W |
| $W_{LED}$ | = | Wattage of the LED bulb, W |
| Daily hours of use | = | Average hours of use per day, hr |
| $WHF_e$ | = | Waste heat factor for energy to account for HVAC interactions with lighting (depends on location) |
| $WHF_d$ | = | Waste heat factor for demand to account for HVAC interactions with lighting (depends on location) |
| $WHF_g$ | = | Waste heat factor for gas to account for HVAC interactions with lighting (depends on location) |
| Coincidence Factor | = | Summer peak coincidence factor |
| 365 | = | Number of days per year, days/yr |
| 1,000 | = | Constant to convert watts to kW |

Table 282 lists the input assumptions and source of each assumption for the LED measure savings calculations.

TABLE 282. *EX POST* VARIABLE ASSUMPTIONS FOR LEDS

| INPUT | VALUE | SOURCE |
|---|---|---|
| $W_{base}$ (Candelabra, Globe) | 40 | ENERGY STAR Qualified Products List (QPL) for lumens, UMP for baseline equivalent |
| $W_{base}$ (A-Line) | 43 | ENERGY STAR QPL for lumens, UMP for baseline equivalent |
| $W_{base}$ (PAR38) | 120 | ENERGY STAR QPL for lumens, UMP for baseline equivalent |
| $W_{LED}$ (Candelabra) | 5 | Actual installed wattage |
| $W_{LED}$ (Globe) | 6 | Actual installed wattage |
| $W_{LED}$ (A-Line) | 9 | Actual installed wattage |
| $W_{LED}$ (PAR38) | 15 | Actual installed wattage |
| Daily hours of use x 365 | 902 | Indiana TRM (v2.2) |
| $WHF_e$ | -0.07 | Indiana TRM (v2.2), values assigned based on nearest TRM city. Value shown is the program average, not the value used to calculate savings for each participant |
| $WHF_d$ | 0.038 | Indiana TRM (v2.2), values assigned based on nearest TRM city. Value shown is the program average, not the value used to calculate savings for each participant |
| $WHF_g$ | -0.0019 | Indiana TRM (v2.2), values assigned based on nearest TRM city. Value shown is the program average, not the value used to calculate savings for each participant |

| INPUT | VALUE | SOURCE |
|---|---|---|
| Coincidence Factor | 0.11 | Indiana TRM (v2.2) |
| Conversion Factor | 1000 | Convert watts to kW |
| Conversion Factor | 365 | Convert years to days |

## KITCHEN AND BATHROOM FAUCET AERATORS

The evaluation team used the following equations to calculate electric energy, peak demand, and natural gas energy savings for Kitchen and Bathroom Faucet Aerators:

$$kWh\ savings = \left(GPM_{base} - GPM_{low\ flow}\right) * MPD * \frac{PH}{FH} * DR * 8.33 * (T_{mix} - T_{inlet}) * \frac{365}{RE * 3412}$$

$$kW\ savings = \left(GPM_{base} - GPM_{low\ flow}\right) * 60 * DR * 8.33 * \frac{T_{mix} - T_{inlet}}{RE * 3412} * CF$$

$$therm\ savings = \left(GPM_{base} - GPM_{low\ flow}\right) * MPD * \frac{PH}{FH} * DR * 8.33 * (T_{mix} - T_{inlet}) * \frac{365}{RG * 100{,}000}$$

Where:

| | | |
|---|---|---|
| $GPM_{base}$ | = | Gallons per minute of baseline faucet aerator |
| $GPM_{low\text{-}flow}$ | = | Gallons per minute of low-flow faucet aerator |
| ISR | = | In-service rate, or fraction of units that get installed |
| MPD | = | Average minutes of faucet use per person per day |
| PH | = | Average number of people per household |
| FH | = | Average number of faucets per household |
| DR | = | Percentage of water flowing down the drain |
| $T_{mix}$ | = | Mixed water temperature exiting faucet, °F |
| $T_{inlet}$ | = | Cold water temperature entering the DWH system, °F (depends on location) |
| RE | = | Recovery efficiency of electric hot water heater |
| RG | = | Recovery efficiency of natural gas hot water heater |
| CF | = | Summer peak coincidence factor |
| 60 | = | Minutes per Hour |
| 8.3 | = | Specific weight of water in pounds per gallon |
| 3,412 | = | Constant to convert Btu to kWh |
| 365 | = | Days of faucet use per year |
| 100,000 | = | Constant to convert Btu to therms |

Table 283 lists the assumptions and source of each assumption for kitchen and bathroom faucet aerator measure savings calculations.

TABLE 283. *EX POST* VARIABLE ASSUMPTION FOR KITCHEN AND BATHROOM FAUCET AERATORS

| INPUT | VALUE | SOURCE |
|---|---|---|
| $GPM_{base}$ (Kitchen) | 1.63 | Illinois TRM (v10) |
| $GPM_{base}$ (Bathroom) | 1.53 | Illinois TRM (v10) |
| $GPM_{low\text{-}flow}$ (Kitchen) | 0.94 | Illinois TRM (v10) |
| $GPM_{low\text{-}flow}$ (Bathroom) | 0.94 | Illinois TRM (v10) |
| MPD (Kitchen) | 4.5 | Illinois TRM (v10) |
| MPD (Bathroom) | 1.6 | Illinois TRM (v10) |
| PH | 2.64 | Indiana TRM (v2.2) |
| FH (Kitchen) | 1.0 | Illinois TRM (v10) |
| FH (Bathroom) | 2.83 | Illinois TRM (v10) |
| DR (Kitchen) | 0.75 | Illinois TRM (v10) |
| DR (Bathroom) | 0.9 | Illinois TRM (v10) |
| $T_{mix}$ (Kitchen) | 93.00 | Indiana TRM (v2.2) |
| $T_{mix}$ (Bathroom) | 86.00 | Indiana TRM (v2.2) |
| $T_{inlet}$ | 57.19 | Indiana TRM (v2.2), values assigned based on nearest TRM city. Value shown is the program average, not the value used to calculate savings for each participant |
| RE | 0.98 | Illinois TRM (v10) |
| RG | 0.78 | Illinois TRM (v10) |
| CF (Kitchen) | 0.0033 | Illinois TRM (v10) |
| CF (Bathroom) | 0.0012 | Illinois TRM (v10) |
| Conversion Factor | 60 | Minutes per hour |
| Conversion Factor | 8.33 | Specific weight of water in pounds per gallon |
| Conversion Factor | 3,412 | Constant to convert Btu to kWh |
| Conversion Factor | 365.25 | Days of faucet use per year |
| Conversion Factor | 100,000 | Constant to convert Btu to therms |

## LOW-FLOW SHOWERHEADS

The evaluation team used the following equations to calculate electric energy, peak demand, and natural gas energy savings for Low-Flow Showerheads:

$$kWh\ savings = \left(GPM_{base} - GPM_{low\ flow}\right) * MS * \frac{SPH}{SH} * 8.33 * (T_{mix} - T_{inlet}) * \frac{365.25}{RE * 3412}$$

$$kW\ savings = \left(GPM_{base} - GPM_{low\ flow}\right) * 60 * 8.33 * \frac{T_{mix} - T_{inlet}}{RE * 3412} * CF$$

$$therm\ savings = ISR * \left(GPM_{base} - GPM_{low\ flow}\right) * MS * \frac{SPH}{SH} * 8.33 * (T_{mix} - T_{inlet}) * \frac{365.25}{RG * 100{,}000}$$

Where:

| | | |
|---|---|---|
| $GPM_{base}$ | = | Gallons per minute of baseline showerhead |
| $GPM_{low\text{-}flow}$ | = | Gallons per minute of low-flow showerhead |
| ISR | = | In-service rate, or fraction of units that get installed |
| MS | = | Average number of minutes per shower event |
| SPH | = | Average number of shower events per day |
| SH | = | Average number of showerheads per household |
| $T_{mix}$ | = | Mixed water temperature exiting faucet, °F |
| $T_{inlet}$ | = | Cold water temperature entering the DWH system, °F (depends on location) |
| RE | = | Recovery efficiency of electric hot water heater |
| RG | = | Recovery efficiency of natural gas hot water heater |
| CF | = | Summer peak coincidence factor |
| 60 | = | Minutes per Hour |
| 8.3 | = | Specific weight of water in pounds per gallon |
| 3,412 | = | Constant to convert Btu to kWh |
| 365 | = | Days of faucet use per year |
| 100,000 | = | Constant to convert Btu to therms |

Table 284 lists the assumptions and source of each assumption for low-flow showerhead measure savings calculations.

TABLE 284. *EX POST* VARIABLE ASSUMPTIONS FOR LOW-FLOW SHOWERHEADS

| INPUT | VALUE | SOURCE |
|---|---|---|
| $GPM_{base}$ | 2.24 | Illinois TRM (v10) |
| $GPM_{low\text{-}flow}$ | 1.5 | Actual |
| MS | 7.8 | Illinois TRM (v10) |
| SPH | 1.065 | NIPSCO 2022 Survey Results |
| SH | 1.79 | Illinois TRM (v10) |
| $T_{mix}$ | 101 | Illinois TRM (v10) |
| $T_{inlet}$ | 57.19 | Indiana TRM (v2.2), values assigned based on nearest TRM city. Value shown is the program average, not the value used to calculate savings for each participant |
| RE | 0.98 | Illinois TRM (v10) |
| RG | 0.78 | Illinois TRM (v10) |
| CF | 0.0023 | Indiana TRM (v2.2) |
| Conversion Factor | 60 | Minutes per hour |
| Conversion Factor | 8.33 | Specific weight of water in pounds per gallon |
| Conversion Factor | 3,412 | Constant to convert Btu to kWh |
| Conversion Factor | 365 | Days of faucet use per year |

## SHOWER START

The evaluation team used the following equations to calculate electric energy, peak demand, and natural gas energy savings for shower start attachments:

$$kWh\ savings = \ GPM * \frac{8.33}{3412} * (T_{out} - T_{in}) * \frac{SPH}{SH} * \frac{WS}{RE} * 365.25$$

$$kW\ savings = kWh\ savings * CF$$

$$therm\ savings = GPM * \frac{8.33}{100{,}000} * (T_{out} - T_{in}) * \frac{SPH}{SH} * \frac{WS}{RG} * 365.25$$

Where:

| | | |
|---|---|---|
| GPM | = | Flow rate (in gallons per minute) of the showerhead equipped with a Shower Start attachment. Varies depending on whether the attachment was installed on an existing showerhead or installed along with a new low-flow showerhead. |
| ISR | = | In-service rate, or fraction of units that get installed |
| SPH | = | Average number of shower events per day |
| SH | = | Average number of showerheads per household |
| WS | = | Number of shower minutes saved by Shower Start attachment |
| $T_{out}$ | = | Mixed water temperature exiting faucet, °F |
| $T_{in}$ | = | Cold water temperature entering the DWH system, °F (depends on location) |
| RE | = | Recovery efficiency of electric hot water heater |
| RG | = | Recovery efficiency of natural gas hot water heater |
| CF | = | Summer peak coincidence and energy-to-demand factor |
| 8.3 | = | Specific weight of water in pounds per gallon |
| 3,412 | = | Constant to convert Btu to kWh |
| 365 | = | Days of faucet use per year |
| 100,000 | = | Constant to convert Btu to therms |

Table 285 lists the assumptions and source of each assumption for shower start measure savings calculations.

TABLE 285. *EX POST* VARIABLE ASSUMPTIONS FOR SHOWER START

| INPUT | VALUE | SOURCE |
|---|---|---|
| $GPM_{base}$ | 2.44 | Illinois TRM (v10) |
| $GPM_{low\text{-}flow}$ | 1.5 | Actual: Used for projects where a shower start was installed along with a new low-flow showerhead. |
| SPH | 1.065 | NIPSCO 2022 Survey Results |
| SH | 1.79 | Illinois TRM (v10) |
| WS | 0.89 | PA TRM 2016 |
| $T_{mix}$ | 101 | Illinois TRM (v10) |
| $T_{inlet}$ | 57.33 | Indiana TRM (v2.2), values assigned based on nearest TRM city. Value shown is the program average, not the value used to calculate savings for each participant |
| RE | 0.98 | Illinois TRM (v10) |
| RG | 0.78 | Illinois TRM (v10) |
| CF | 0.0022 | Illinois TRM (v10) |
| Conversion Factor | 8.33 | Product of the specific weight of water (pounds per gallon) and the specific heat capacity of water (Btu per pound per °F) |
| Conversion Factor | 3,412 | Constant to convert Btu to kWh |
| Conversion Factor | 365.25 | Days of faucet use per year |

## PIPE WRAP

The evaluation team used the following equations to calculate electric energy, peak demand, and natural gas energy savings for Pipe Wrap:

$$kWh\ savings = \left(\frac{1}{R_{Exist}} - \frac{1}{R_{New}}\right) * \frac{L * C * \Delta T * 8{,}760}{\eta_{DHWE} * 3{,}412}$$

$$kW\ savings = \frac{kWh\ savings}{8{,}760}$$

$$therm\ savings = \left(\frac{1}{R_{Exist}} - \frac{1}{R_{New}}\right) * \frac{L * C * \Delta T * 8{,}760}{\eta_{DHWG} * 100{,}000}$$

Where:

$R_{Exist}$ = Pipe heat loss coefficient (R-value) of uninsulated pipe existing

$R_{New}$ = Pipe heat loss coefficient (R-value) of insulated pipe

L = Feet of pipe from water heating source covered by pipe wrap

C = Circumference of pipe in feet

$\Delta T$ = Average temperature difference between supplied water and ambient air temperature

$\eta_{DHWE}$ = Recovery efficiency of electric water heater

$\eta_{DHWG}$ = Recovery efficiency of gas water heater

8,760 = Hours per year

| | | |
|---|---|---|
| 3,412 | = | Constant to convert Btu to kWh |
| 100,000 | = | Constant to convert Btu to therms |

Table 286 lists the assumptions and source of each assumption for pipe wrap savings calculations.

TABLE 286. *EX POST* VARIABLE ASSUMPTIONS FOR PIPE WRAP

| INPUT | VALUE | SOURCE |
|---|---|---|
| $R_{Exist}$ | 0.22 | Illinois TRM (v10) |
| $R_{New}$ | 3.12 | Actual: Based on insulation R-value of 2.9 and bare-pipe R-value of 0.22 (per Illinois TRM (v10)). |
| L | 8.42 | Value shown is the program average, not the value used to calculate savings for each participant. |
| C | 0.21 | Actual: Based on assumed pipe diameter of 0.75 inches |
| ΔT | 60 | Illinois TRM (v10) |
| $\eta_{DHWE}$ | .98 | Illinois TRM (v10) |
| $\eta_{DHWG}$ | .78 | Illinois TRM (v10) |
| Conversion Factor | 3,412 | Constant to convert Btu to kWh |
| Conversion Factor | 100,000 | Constant to convert Btu to therms |

## ATTIC INSULATION

The evaluation team used the following equations to calculate electric energy, peak demand, and natural gas energy savings for attic insulation:

$$kWh\ savings = \left(\frac{SF}{1000}\right) * \left(\frac{\Delta kWh}{kSF}\right)$$

$$kW\ savings = \left(\frac{SF}{1000}\right) * \left(\frac{\Delta kW}{kSF}\right) * CF$$

$$therm\ savings = \left(\frac{SF}{1000}\right) * \left(\frac{\Delta MMBtu}{kSF}\right) * 10$$

Where:

| | | |
|---|---|---|
| SF | = | Total area of wall insulation in square feet |
| ΔkWh/kSF | = | Energy savings expected for every 1,000 square feet of insulation installed with respect to pre-R and post-R values from data tracking information |
| ΔkW/kSF | = | Demand savings expected for every 1,000 square feet of insulation installed with respect to pre-R and post-R values from data tracking information |
| ΔMMBtu/kSF | = | Natural gas savings expected for every 1,000 square feet of insulation installed with respect to pre-R and post-R values from data tracking information |
| CF | = | Coincidence factor |

Electric energy, peak demand, and natural gas energy savings are dependent upon pre-R and post-R measure insulation values, calculated using the following steps:

- **Step 1.** Determine variables for insulation compression, $R_{ratio}$, and void factors
- **Step 2.** Calculate adjusted R-values, $R_{adj}$
- **Step 3.** Interpolate with Indiana TRM (v2.2) tables to obtain savings per 1,000 square feet of insulation to obtain values for ΔkWh/kSF, ΔkW/kSF, ΔMMBtu/kSF

**Step 1.** Determine variables for insulation compression, $R_{ratio}$, and void factors:

Adjusted pre-installation and post-installation R-values are calculated using the following formula:

$$R_{adj} = R_{nominal} * F_{compression} * F_{void}$$

Where:

| | | |
|---|---|---|
| $R_{nominal}$ | = | Total installed R-value per manufacturers specifications. This value varies across participants and was calculated on an individual level to account for individual savings between pre and post measure. |
| $F_{compression}$ | = | Insulation compression factor, assumed to be 1 for 0% compression (as shown in TRM v2.2), because actual information is unknown. |
| $F_{void}$ | = | Void factor, dependent on insulation grade level and percent coverage, assumed to be at the 2% grade per the Indiana TRM (v2.2), because the actual information is unknown. |

The void factor, $F_{void}$, varies based on the ration between the full assembly R-value and he nominal R-value, $R_{nominal}$, including compression effects. Pre and post insulation values are determined next, using the following equation:

$$R_{ratio} = \frac{R_{nominal} * F_{compression}}{R_{nominal} + R_{framing\&airspace}}$$

Where:

| | | |
|---|---|---|
| $R_{nominal}$ | = | Total installed R-value per manufacturers specifications. This value varies across participants and was calculated on an individual level to account for individual savings between pre and post measure. |
| $F_{compression}$ | = | Insulation compression factor, assumed to be 1 for 0% compression (as shown in TRM v2.2), because actual information is unknown. |
| $R_{framing\&airspace}$ | = | R-value for materials, framing, and airspace for the area in which the insulation is installed. Assumed to be R-5, per Indiana TRM (v2.2). |

Values for void factors, based on the $R_{ratio}$ calculation are shown in Table 287. The evaluation team assumed a void factor at 2% in accordance with the Indiana TRM (v2.2).

TABLE 287. INSULATION VOID FACTORS

| $R_{RATIO}$ | $F_{VOID}$, 2% |
|---|---|
| 0.50 | 0.96 |
| 0.55 | 0.96 |
| 0.60 | 0.95 |
| 0.65 | 0.94 |
| 0.70 | 0.94 |
| 0.75 | 0.94 |
| 0.80 | 0.91 |
| 0.85 | 0.88 |
| 0.90 | 0.83 |
| 0.95 | 0.71 |
| 0.99 | 0.33 |

**Step 2.** Calculate $R_{adj}$

Pre-R and post-R values, $R_{adj}$, are calculated at the participant level using $R_{nominal}$ and $R_{ratio}$

**Step 3.** Determine ΔkWh/kSF, ΔkW/kSF, ΔMMBtu/kSF

Electric energy, peak demand, and natural gas savings per thousand square feet values were obtained by interpolating within the Indiana TRM (v2.2) tables and averaging across participant location.

Table 288 lists the assumptions and source for R-values of insulation in the attic insulation measure.

TABLE 288. *EX POST* VARIABLE ASSUMPTIONS FOR ATTIC INSULATION

| INPUT | VALUE | SOURCE |
|---|---|---|
| $R_{nominal\text{-}pre}$ (Not adjusted for voids / compression) | 6.02 | Value assigned based on Comprehensive Home Assessments (CHA) report data. Value shown is a program average which was used for the analysis. |
| $R_{nominal\text{-}post}$ (Not adjusted for voids / compression) | 40.06 | Value assigned based on Comprehensive Home Assessments (CHA) report data. Value shown is a program average which was used for the analysis. |
| $R_{framing\&airspace}$ | 5.0 | R-value for materials, framing, and airspace for the area in which the insulation is installed. Assumed to be R-5, per Indiana TRM (v2.2). |
| $F_{compression}$ | 1.00 | Insulation compression factor, assumed to be 1.0 for 0% compression (as shown in TRM v2.2), because actual information is unknown. |
| R-ratio$_{pre}$ | 0.55 | Calculated using $R_{nominal\text{-}pre}$, $F_{compression}$, and $R_{framing\&airspace}$ |
| R-ratio$_{post}$ | 0.89 | Calculated using $R_{nominal\text{-}post}$, $F_{compression}$, and $R_{framing\&airspace}$ |
| $F_{void\text{-}pre}$ | 0.96 | Interpolated from insulation void factors from the Indiana TRM (v2.2) based on the ratio of $R_{nominal\text{-}pre}$ to $R_{nominal\text{-}post}$. |
| $F_{void\text{-}post}$ | 0.84 | Interpolated from insulation void factors from the Indiana TRM (v2.2) based on the ratio of $R_{nominal\text{-}pre}$ to $R_{nominal\text{-}post}$. |
| $R_{adj\text{-}pre}$ (Adjusted for voids / compression) | 5.78 | Calculated using $R_{nominal\text{-}pre}$, $F_{compression}$, and $F_{void\text{-}pre}$ |
| $R_{adj\text{-}post}$ (Adjusted for voids / compression) | 33.69 | Calculated using $R_{nominal\text{-}post}$, $F_{compression}$, and $F_{void\text{-}post}$ |

Table 289 lists the program-average kWh savings per thousand square feet for the attic insulation measure.

TABLE 289. *EX POST* KWH SAVINGS PER THOUSAND SQUARE FEET OF ATTIC INSULATION

| TRM REFERENCE CITY | HVAC SYSTEM TYPE | SAVINGS VALUES |
|---|---|---|
| Ft. Wayne | Gas Heating Only | 100.16 |
| South Bend | Electric Cooling and Gas Heating | 236.05 |
| South Bend | Gas Heating Only | 102.23 |

Table 290 lists the program-average KW savings per thousand square feet for the attic insulation measure.

TABLE 290. *EX POST* KW SAVINGS PER THOUSAND SQUARE FEET OF ATTIC INSULATION

| TRM REFERENCE CITY | HVAC SYSTEM TYPE | SAVINGS VALUES |
|---|---|---|
| Ft. Wayne | Gas Heating Only | 0.000 |
| South Bend | Electric Cooling and Gas Heating | 0.116 |
| South Bend | Gas Heating Only | 0.000 |

Table 291 lists the program-average MMBtu savings per thousand square feet for the attic insulation measure.

TABLE 291. *EX POST* MMBTU SAVINGS PER THOUSAND PER THOUSAND SQUARE FEET OF ATTIC INSULATION

| TRM REFERENCE CITY | HVAC SYSTEM TYPE | SAVINGS VALUES |
|---|---|---|
| Ft. Wayne | Gas Heating Only | 21.71 |
| South Bend | Electric Cooling and Gas Heating | 20.68 |
| South Bend | Gas Heating Only | 20.99 |

## DUCT SEALING

The evaluation team used the following equations to calculate electric and natural gas energy savings for duct sealing.

$$kWh\ savings_{cool} = \frac{DE_{coolafter} - DE_{coolbefore}}{DE_{coolafter}} * \frac{EFLH_{cool} * Btuh_{cool}}{SEER * 1{,}000}$$

$$kWh\ savings_{heat} = \frac{DE_{heatafter} - DE_{heatbefore}}{DE_{heatafter}} * \frac{EFLH_{heat} * Btuh_{heat}}{3{,}412 * N_{heating}}$$

$$kW\ savings = \left(\frac{DE_{pkafter} - DE_{pkbefore}}{DE_{pkafter}}\right) * \left(\frac{Btuh_{cool}}{EER * 1{,}000} * CF\right)$$

$$therm\ savings = 56.4$$

Where:

$DE_{coolafter}$ = Distribution efficiency after duct sealing

$DE_{coolbefore}$ = Distribution efficiency before duct sealing

$DE_{heatafter}$ = Distribution efficiency after duct sealing

$DE_{heatbefore}$ = Distribution efficiency before duct sealing

$DE_{pkafter}$ = Distribution efficiency under peak summer conditions after duct sealing

$DE_{pkbefore}$ = Distribution efficiency under peak summer conditions before duct sealing

$EFLH_{cool}$ = Full load cooling hours

$EFLH_{heat}$ = Full load heating hours

$BtuH_{cool}$ = Cooling capacity of cooling equipment (Btu per hour)

$BtuH_{heat}$ = Heating capacity of heating equipment (Btu per hour)

$N_{heat}$ = Efficiency in COP of heating equipment

SEER = Seasonal average efficiency of air conditioning equipment

EER = Peak efficiency of air conditioning equipment

56.4 = Gas duct sealing savings evaluated through billing analysis in the 2018 program evaluation

CF = Coincidence factor

Table 292 lists the assumptions and source of each assumption for the duct sealing savings calculations.

TABLE 292. *EX POST* VARIABLE ASSUMPTIONS FOR DUCT SEALING

| INPUT | VALUE | SOURCE |
|---|---|---|
| $DE_{coolafter}$ (attic) | 0.70 | Value assigned based on 2019 program average. |
| $DE_{coolafter}$ (basement) | 0.89 | Value assigned based on 2019 program average. |
| $DE_{coolbefore}$ (attic) | 0.62 | Value assigned based on 2019 program average. |
| $DE_{coolbefore}$ (basement) | 0.83 | Value assigned based on 2019 program average. |
| $DE_{heatafter}$ (attic) | 0.71 | Value assigned based on 2019 program average. |
| $DE_{heatafter}$ (basement) | 0.76 | Value assigned based on 2019 program average. |
| $DE_{heatbefore}$ (attic) | 0.65 | Value assigned based on 2019 program average. |
| $DE_{heatbefore}$ (basement) | 0.71 | Value assigned based on 2019 program average. |
| $DE_{pkafter}$ (attic) | 0.58 | Value assigned based on 2019 program average. |
| $DE_{pkafter}$ (basement) | 0.87 | Value assigned based on 2019 program average. |
| $DE_{pkbefore}$ (attic) | 0.47 | Value assigned based on 2019 program average. |
| $DE_{pkbefore}$ (basement) | 0.81 | Value assigned based on 2019 program average. |
| $EFLH_{heat}$ | 1,415 | Indiana TRM (v2.2). values assigned based on nearest TRM city. Value shown is the program average, not the value used to calculate savings for each participant |
| $EFLH_{cool}$ | 425 | Indiana TRM (v2.2). values assigned based on nearest TRM city. Value shown is the program average, not the value used to calculate savings for each participant |

| INPUT | VALUE | SOURCE |
| --- | --- | --- |
| SEER | 11.41 | Value assigned based on 2019 program average. |
| EER | 10.10 | Value assigned based on 2019 program average. |
| $N_{heating}$ | 1 | Indiana TRM (v2.2) |
| $BtuH_{cool}$ | 31,763 | Value assigned based on 2019 program average. |
| $BtuH_{heat}$ | 80,000 | Value assigned based on 2019 program average. |
| 56.43 | 56.4 | Gas duct sealing savings evaluated through billing analysis in the 2018 program evaluation |
| CF | 0.88 | Indiana TRM (v2.2) |

# APPENDIX 4: INCOME-QUALIFIED WEATHERIZATION (IQW) PROGRAM

## ALGORITHMS AND ASSUMPTIONS

This appendix contains the assumptions used in electric savings, demand reduction, and gas savings algorithms for the measures within the HEA program. The team examined each assumption behind the algorithms to capture savings and compared it against the Indiana TRM (v2.2), as well as other state and industry approaches. Detailed information on the analysis and supporting assumptions for the following Home Energy Assessment program measures are included within this appendix:

- LEDs (A-Line, Candelabra, and Globe)
- Kitchen Faucet Aerators
- Bathroom faucet Aerators
- Low-flow showerheads
- Shower Start
- Pipe wrap
- Programmable Thermostats
- Refrigerator Replacement
- Duct Sealing
- Attic Insulation
- Air Sealing

Table 293 below contains the reviewed assumptions for each measure.

TABLE 293. IQW PROGRAM MEASURES

| MEASURE | REVIEWED ASSUMPTIONS |
|---|---|
| LEDs | New and baseline wattages, hours of use, waste heat factors, coincidence factors |
| Kitchen Faucet Aerator | New and baseline flow rates, people per house, minutes of use per day, faucets per home, water temperatures, water heater fuel type and efficiency |
| Bathroom Faucet Aerator | New and baseline flow rates, people per house, minutes of use per day, faucets per home, water temperatures, water heater fuel type and efficiency |
| Low-flow Showerhead | New and baseline flow rates, people per house, minutes of use per day, showerheads per home, water temperatures, water heater fuel type and efficiency |
| Shower Start | New and baseline flow rates, people per house, minutes of use per day, showerheads per home, water temperatures, water heater fuel type and efficiency |
| Pipe Wrap | New and baseline R-values, pipe diameter, water heater recovery efficiency |
| Duct Sealing | New and baseline distribution efficiencies, full load heating and cooling hours, capacities, and efficiencies of heating and cooling equipment |
| Refrigerator replacement | New and baseline energy use |
| Programmable thermostat | Heating and cooling BtuHs, ESFs, efficiencies, and full load hours |

The algorithms and assumptions the evaluation team used to calculate *ex post* savings for each of these measures follow.

LEDs:

The team used the following equations to calculate electric energy and peak demand savings, as well as natural gas energy penalties, for LEDs:

$$kWh\ savings\ per\ lamp = \frac{(W_{base} - W_{LED}) * (Daily\ hours\ of\ use * 365) * (1 + WHF_e)}{1{,}000}$$

$$kW\ reduction\ per\ lamp = \frac{(W_{base} - W_{LED}) * Coincidence\ Factor * (1 + WHF_d)}{1{,}000}$$

$$therm\ savings\ per\ lamp = \frac{(W_{base} - W_{LED}) * (Daily\ hours\ of\ use * 365) * WHF_g}{1{,}000}$$

Where:

| | | |
|---|---|---|
| $W_{base}$ | = | Wattage of the bulb being replaced, W |
| $W_{LED}$ | = | Wattage of the LED bulb, W |
| Daily hours of use | = | Average hours of use per day, hr |
| $WHF_e$ | = | Waste heat factor for energy to account for HVAC interactions with lighting (depends on location) |
| $WHF_d$ | = | Waste heat factor for demand to account for HVAC interactions with lighting (depends on location) |
| $WHF_g$ | = | Waste heat factor for gas to account for HVAC interactions with lighting (depends on location) |
| Coincidence Factor | = | Summer peak coincidence factor |
| 365 | = | Number of days per year, days/yr |
| 1,000 | = | Constant to convert watts to kW |

Table 294 lists the input assumptions and source of each assumption for the LED measure savings calculations.

TABLE 294. *EX POST* VARIABLE ASSUMPTIONS FOR LEDS

| INPUT | VALUE | SOURCE |
|---|---|---|
| $W_{base}$ (Candelabra, Globe) | 40 | ENERGY STAR Qualified Products List (QPL) for lumens, UMP for baseline equivalent |
| $W_{base}$ (A-Line) | 43 | ENERGY STAR QPL for lumens, UMP for baseline equivalent |
| $W_{base}$ (PAR38) | 120 | ENERGY STAR QPL for lumens, UMP for baseline equivalent |
| $W_{LED}$ (Candelabra) | 5 | Actual installed wattage |
| $W_{LED}$ (Globe) | 6 | Actual installed wattage |
| $W_{LED}$ (A-Line) | 9 | Actual installed wattage |
| $W_{LED}$ (PAR38) | 15 | Actual installed wattage |
| Daily hours of use x 365 | 902 | Indiana TRM (v2.2) |
| $WHF_e$ | -0.07 | Indiana TRM (v2.2), values assigned based on nearest TRM city. Value shown is the program average, not the value used to calculate savings for each participant |

| INPUT | VALUE | SOURCE |
| --- | --- | --- |
| $WHF_d$ | 0.038 | Indiana TRM (v2.2), values assigned based on nearest TRM city. Value shown is the program average, not the value used to calculate savings for each participant |
| $WHF_g$ | -0.0019 | Indiana TRM (v2.2), values assigned based on nearest TRM city. Value shown is the program average, not the value used to calculate savings for each participant |
| Coincidence Factor | 0.11 | Indiana TRM (v2.2) |
| Conversion Factor | 1000 | Convert watts to kW |
| Conversion Factor | 365 | Convert years to days |

## KITCHEN AND BATHROOM FAUCET AERATORS

The evaluation team used the following equations to calculate electric energy, peak demand, and natural gas energy savings for Low-Flow Kitchen and Bathroom Faucet Aerators:

$$kWh\ savings = \left(GPM_{base} - GPM_{low\ flow}\right) * MPD * \frac{PH}{FH} * DR * 8.33 * (T_{mix} - T_{inlet}) * \frac{365}{RE * 3412}$$

$$kW\ savings = \left(GPM_{base} - GPM_{low\ flow}\right) * 60 * DR * 8.33 * \frac{T_{mix} - T_{inlet}}{RE * 3412} * CF$$

$$therm\ savings = \left(GPM_{base} - GPM_{low\ flow}\right) * MPD * \frac{PH}{FH} * DR * 8.33 * (T_{mix} - T_{inlet}) * \frac{365}{RG * 100{,}000}$$

Where:

| | | |
| --- | --- | --- |
| $GPM_{base}$ | = | Gallons per minute of baseline faucet aerator |
| $GPM_{low\text{-}flow}$ | = | Gallons per minute of low-flow faucet aerator |
| ISR | = | In-service rate, or fraction of units that get installed |
| MPD | = | Average minutes of faucet use per person per day |
| PH | = | Average number of people per household |
| FH | = | Average number of faucets per household |
| DR | = | Percentage of water flowing down the drain |
| $T_{mix}$ | = | Mixed water temperature exiting faucet, °F |
| $T_{inlet}$ | = | Cold water temperature entering the DWH system, °F (depends on location) |
| RE | = | Recovery efficiency of electric hot water heater |
| RG | = | Recovery efficiency of natural gas hot water heater |
| CF | = | Summer peak coincidence factor |
| 60 | = | Minutes per Hour |
| 8.3 | = | Specific weight of water in pounds per gallon |
| 3,412 | = | Constant to convert Btu to kWh |
| 365 | = | Days of faucet use per year |
| 100,000 | = | Constant to convert Btu to therms |

Table 295 lists the assumptions and source of each assumption for kitchen and bathroom faucet aerator measure savings calculations.

TABLE 295. *EX POST* VARIABLE ASSUMPTION FOR KITCHEN AND BATHROOM FAUCET AERATORS

| INPUT | VALUE | SOURCE |
|---|---|---|
| $GPM_{base}$ (Kitchen) | 1.63 | Illinois TRM (v10) |
| $GPM_{base}$ (Bathroom) | 1.53 | Illinois TRM (v10) |
| $GPM_{low\text{-}flow}$ (Kitchen) | 0.94 | Illinois TRM (v10) |
| $GPM_{low\text{-}flow}$ (Bathroom) | 0.94 | Illinois TRM (v10) |
| MPD (Kitchen) | 4.5 | Illinois TRM (v10) |
| MPD (Bathroom) | 1.6 | Illinois TRM (v10) |
| PH | 2.64 | Indiana TRM (v2.2) |
| FH (Kitchen) | 1.0 | Illinois TRM (v10) |
| FH (Bathroom) | 2.83 | Illinois TRM (v10) |
| DR (Kitchen) | 0.75 | Illinois TRM (v10) |
| DR (Bathroom) | 0.9 | Illinois TRM (v10) |
| $T_{mix}$ (Kitchen) | 93.00 | Indiana TRM (v2.2) |
| $T_{mix}$ (Bathroom) | 86.00 | Indiana TRM (v2.2) |
| $T_{inlet}$ | 57.19 | Indiana TRM (v2.2), values assigned based on nearest TRM city. Value shown is the program average, not the value used to calculate savings for each participant |
| RE | 0.98 | Illinois TRM (v10) |
| RG | 0.78 | Illinois TRM (v10) |
| CF (Kitchen) | 0.0033 | Illinois TRM (v10) |
| CF (Bathroom) | 0.0012 | Illinois TRM (v10) |
| Conversion Factor | 60 | Minutes per hour |
| Conversion Factor | 8.33 | Specific weight of water in pounds per gallon |
| Conversion Factor | 3,412 | Constant to convert Btu to kWh |
| Conversion Factor | 365.25 | Days of faucet use per year |
| Conversion Factor | 100,000 | Constant to convert Btu to therms |

## LOW-FLOW SHOWERHEADS

The evaluation team used the following equations to calculate electric energy, peak demand, and natural gas energy savings for Low-Flow Showerheads:

$$kWh\ savings = \left(GPM_{base} - GPM_{low\ flow}\right) * MS * \frac{SPH}{SH} * 8.33 * (T_{mix} - T_{inlet}) * \frac{365.25}{RE * 3412}$$

$$kW\ savings = \left(GPM_{base} - GPM_{low\ flow}\right) * 60 * 8.33 * \frac{T_{mix} - T_{inlet}}{RE * 3412} * CF$$

$$therm\ savings = ISR * \left(GPM_{base} - GPM_{low\ flow}\right) * MS * \frac{SPH}{SH} * 8.33 * (T_{mix} - T_{inlet}) * \frac{365.25}{RG * 100{,}000}$$

Where:

| | | |
|---|---|---|
| $GPM_{base}$ | = | Gallons per minute of baseline showerhead |
| $GPM_{low\text{-}flow}$ | = | Gallons per minute of low-flow showerhead |
| ISR | = | In-service rate, or fraction of units that get installed |
| MS | = | Average number of minutes per shower event |
| SPH | = | Average number of shower events per day |
| SH | = | Average number of showerheads per household |
| $T_{mix}$ | = | Mixed water temperature exiting faucet, °F |
| $T_{inlet}$ | = | Cold water temperature entering the DWH system, °F (depends on location) |
| RE | = | Recovery efficiency of electric hot water heater |
| RG | = | Recovery efficiency of natural gas hot water heater |
| CF | = | Summer peak coincidence factor |
| 60 | = | Minutes per Hour |
| 8.3 | = | Specific weight of water in pounds per gallon |
| 3,412 | = | Constant to convert Btu to kWh |
| 365 | = | Days of faucet use per year |
| 100,000 | = | Constant to convert Btu to therms |

Table 296 lists the assumptions and source of each assumption for low-flow showerhead measure savings calculations.

TABLE 296. *EX POST* VARIABLE ASSUMPTIONS FOR LOW-FLOW SHOWERHEADS

| INPUT | VALUE | SOURCE |
|---|---|---|
| $GPM_{base}$ | 2.24 | Illinois TRM (v10) |
| $GPM_{low\text{-}flow}$ | 1.5 | Actual |
| MS | 7.8 | Illinois TRM (v10) |
| SPH | 1.065 | NIPSCO 2022 Survey Results |
| SH | 1.79 | Illinois TRM (v10) |
| $T_{mix}$ | 101 | Illinois TRM (v10) |
| $T_{inlet}$ | 57.19 | Indiana TRM (v2.2), values assigned based on nearest TRM city. Value shown is the program average, not the value used to calculate savings for each participant |
| RE | 0.98 | Illinois TRM (v10) |
| RG | 0.78 | Illinois TRM (v10) |
| CF | 0.0023 | Indiana TRM (v2.2) |
| Conversion Factor | 60 | Minutes per hour |
| Conversion Factor | 8.33 | Specific weight of water in pounds per gallon |
| Conversion Factor | 3,412 | Constant to convert Btu to kWh |
| Conversion Factor | 365 | Days of faucet use per year |

## SHOWER START

The evaluation team used the following equations to calculate electric energy, peak demand, and natural gas energy savings for shower start attachments:

$$kWh\ savings = GPM * \frac{8.33}{3412} * (T_{out} - T_{in}) * \frac{SPH}{SH} * \frac{WS}{RE} * 365.25$$

$$kW\ savings = kWh\ savings * CF$$

$$therm\ savings = GPM * \frac{8.33}{100{,}000} * (T_{out} - T_{in}) * \frac{SPH}{SH} * \frac{WS}{RG} * 365.25$$

Where:

| | | |
|---|---|---|
| GPM | = | Flow rate (in gallons per minute) of the showerhead equipped with a Shower Start attachment. Varies depending on whether the attachment was installed on an existing showerhead or installed along with a new low-flow showerhead. |
| ISR | = | In-service rate, or fraction of units that get installed |
| SPH | = | Average number of shower events per day |
| SH | = | Average number of showerheads per household |
| WS | = | Number of shower minutes saved by Shower Start attachment |
| $T_{out}$ | = | Mixed water temperature exiting faucet, °F |
| $T_{in}$ | = | Cold water temperature entering the DWH system, °F (depends on location) |
| RE | = | Recovery efficiency of electric hot water heater |
| RG | = | Recovery efficiency of natural gas hot water heater |
| CF | = | Summer peak coincidence and energy-to-demand factor |
| 8.3 | = | Specific weight of water in pounds per gallon |
| 3,412 | = | Constant to convert Btu to kWh |
| 365 | = | Days of faucet use per year |
| 100,000 | = | Constant to convert Btu to therms |

Table 297 lists the assumptions and source of each assumption for shower start measure savings calculations.

TABLE 297. *EX POST* VARIABLE ASSUMPTIONS FOR SHOWER START

| INPUT | VALUE | SOURCE |
|---|---|---|
| $GPM_{base}$ | 2.44 | Illinois TRM (v10) |
| $GPM_{low\text{-}flow}$ | 1.5 | Actual: Used for projects where a shower start was installed along with a new low-flow showerhead. |
| SPH | 1.065 | NIPSCO 2022 Survey Results |
| SH | 1.79 | Illinois TRM (v10) |
| WS | 0.89 | PA TRM 2016 |
| $T_{mix}$ | 101 | Illinois TRM (v10) |
| $T_{inlet}$ | 57.33 | Indiana TRM (v2.2), values assigned based on nearest TRM city. Value shown is the program average, not the value used to calculate savings for each participant |

| INPUT | VALUE | SOURCE |
|---|---|---|
| RE | 0.98 | Illinois TRM (v10) |
| RG | 0.78 | Illinois TRM (v10) |
| CF | 0.0022 | Illinois TRM (v10) |
| Conversion Factor | 8.33 | Product of the specific weight of water (pounds per gallon) and the specific heat capacity of water (Btu per pound per °F) |
| Conversion Factor | 3,412 | Constant to convert Btu to kWh |
| Conversion Factor | 365.25 | Days of faucet use per year |

## PIPE WRAP

The evaluation team used the following equations to calculate electric energy, peak demand, and natural gas energy savings for Pipe Wrap:

$$kWh\ savings = \left(\frac{1}{R_{Exist}} - \frac{1}{R_{New}}\right) * \frac{L * C * \Delta T * 8{,}760}{\eta_{DHWE} * 3{,}412}$$

$$kW\ savings = \frac{kWh\ savings}{8{,}760}$$

$$therm\ savings = \left(\frac{1}{R_{Exist}} - \frac{1}{R_{New}}\right) * \frac{L * C * \Delta T * 8{,}760}{\eta_{DHWG} * 100{,}000}$$

Where:

| | | |
|---|---|---|
| $R_{Exist}$ | = | Pipe heat loss coefficient (R-value) of uninsulated pipe existing |
| $R_{New}$ | = | Pipe heat loss coefficient (R-value) of insulated pipe |
| L | = | Feet of pipe from water heating source covered by pipe wrap |
| C | = | Circumference of pipe in feet |
| ΔT | = | Average temperature difference between supplied water and ambient air temperature |
| $\eta_{DHWE}$ | = | Recovery efficiency of electric water heater |
| $\eta_{DHWG}$ | = | Recovery efficiency of gas water heater |
| 8,760 | = | Hours per year |
| 3,412 | = | Constant to convert Btu to kWh |
| 100,000 | = | Constant to convert Btu to therms |

Table 298 lists the assumptions and source of each assumption for pipe wrap savings calculations.

TABLE 298. *EX POST* VARIABLE ASSUMPTIONS FOR PIPE WRAP

| INPUT | VALUE | SOURCE |
|---|---|---|
| $R_{Exist}$ | 0.22 | Illinois TRM (v10) |
| $R_{New}$ | 3.12 | Actual: Based on insulation R-value of 2.9 and bare-pipe R-value of 0.22 (per Illinois TRM (v10)). |
| L | 8.42 | Value shown is the program average, not the value used to calculate savings for each participant. |
| C | 0.21 | Actual: Based on assumed pipe diameter of 0.75 inches |
| ΔT | 60 | Illinois TRM (v10) |
| $\eta_{DHWE}$ | .98 | Illinois TRM (v10) |
| $\eta_{DHWG}$ | .78 | Illinois TRM (v10) |
| Conversion Factor | 3,412 | Constant to convert Btu to kWh |
| Conversion Factor | 100,000 | Constant to convert Btu to therms |

## PROGRAMMABLE THERMOSTAT

The evaluation team used the following equations to calculate electric and natural gas energy savings for programmable thermostats. There are no summer peak coincidence demand savings associated with this measure.

$$kWh\ savings\_cool = \frac{1}{SEER} * EFLH_{cool} * \frac{Btuh_{cool}}{1{,}000} * ESF_{cool}$$

$$kWh\ savings\_heat = EFLH_{heat} * \frac{BtuH_{heat}}{N_{heat} * 3412} * ESF_{heat}$$

$$therm\ savings = EFLH_{heat} \frac{BtuH_{FF} * ESF_{heat}}{100{,}000}$$

Where:

| | | |
|---|---|---|
| SEER | = | Seasonal average efficiency ratio |
| $EFLH_{cool}$ | = | Full load cooling hours |
| $BtuH_{cool}$ | = | Cooling system capacity in Btu per hour |
| $ESF_{cool}$ | = | Cooling energy savings fraction |
| $EFLH_{heat}$ | = | Full load heating hours |
| $BtuH_{heat}$ | = | Heating system capacity in Btu per hour |
| $N_{heat}$ | = | Efficiency in COP of heating equipment |
| $BtuH_{FF}$ | = | Heating capacity of gas equipment |

Table 299 lists the assumptions and source of each assumption for the smart thermostat measure savings calculations.

TABLE 299. *EX POST* VARIABLE ASSUMPTIONS FOR PROGRAMMABLE THERMOSTATS

| INPUT | VALUE | SOURCE |
|---|---|---|
| SEER | 11.15 | Illinois TRM (v10) |
| EFLHcool | 431 | Illinois TRM (v10) |
| Btuhcool | 34,426 | Illinois TRM (v10) |
| ESFcool | 0.083 | Illinois TRM (v10) |
| EFLHheat | 897 | Illinois TRM (v10) |
| Btuhheat | 22,900 | Illinois TRM (v10) |
| COPheat | 2.26 | Illinois TRM (v10) |
| ESFhg | 0.054 | Indiana TRM (v2.2) |
| BTUhff | 71,694 | |
| ESFhe | 0.068 | |
| Conversion Factor | 3,412 | Conversion from kW to BTU |
| Conversion Factor | 100,000 | Conversion from therms to BTU |
| Conversion Factor | 1,000 | Conversion from kW to W |

## DUCT SEALING

The evaluation team used the following equations to calculate electric and natural gas energy savings for duct sealing.

$$kWh\ savings_{cool} = \frac{DE_{coolafter} - DE_{coolbefore}}{DE_{coolafter}} * \frac{EFLH_{cool} * Btuh_{cool}}{SEER * 1{,}000}$$

$$kWh\ savings_{heat} = \frac{DE_{heatafter} - DE_{heatbefore}}{DE_{heatafter}} * \frac{EFLH_{heat} * Btuh_{heat}}{3{,}412 * N_{heating}}$$

$$kW\ savings = \left(\frac{DE_{pkafter} - DE_{pkbefore}}{DE_{pkafter}}\right) * \left(\frac{Btuh_{cool}}{EER * 1{,}000} * CF\right)$$

$$therm\ savings = 56.4$$

Where:

$DE_{coolafter}$ = Distribution efficiency after duct sealing

$DE_{coolbefore}$ = Distribution efficiency before duct sealing

$DE_{heatafter}$ = Distribution efficiency after duct sealing

$DE_{heatbefore}$ = Distribution efficiency before duct sealing

$DE_{pkafter}$ = Distribution efficiency under peak summer conditions after duct sealing

$DE_{pkbefore}$ = Distribution efficiency under peak summer conditions before duct sealing

$EFLH_{cool}$ = Full load cooling hours

$EFLH_{heat}$ = Full load heating hours

$BtuH_{cool}$ = Cooling capacity of cooling equipment (Btu per hour)

$BtuH_{heat}$ = Heating capacity of heating equipment (Btu per hour)

$N_{heat}$ = Efficiency in COP of heating equipment

SEER = Seasonal average efficiency of air conditioning equipment

EER = Peak efficiency of air conditioning equipment

56.4 = Gas duct sealing savings evaluated through billing analysis in the 2018 program evaluation

CF = Coincidence factor

Table 300 lists the assumptions and source of each assumption for the smart duct sealing savings calculations.

TABLE 300. *EX POST* VARIABLE ASSUMPTIONS FOR DUCT SEALING

| INPUT | VALUE | SOURCE |
|---|---|---|
| $DE_{coolafter}$ (attic) | 0.70 | Value assigned based on 2019 program average. |
| $DE_{coolafter}$ (basement) | 0.89 | Value assigned based on 2019 program average. |
| $DE_{coolbefore}$ (attic) | 0.62 | Value assigned based on 2019 program average. |
| $DE_{coolbefore}$ (basement) | 0.83 | Value assigned based on 2019 program average. |
| $DE_{heatafter}$ (attic) | 0.71 | Value assigned based on 2019 program average. |
| $DE_{heatafter}$ (basement) | 0.76 | Value assigned based on 2019 program average. |
| $DE_{heatbefore}$ (attic) | 0.65 | Value assigned based on 2019 program average. |
| $DE_{heatbefore}$ (basement) | 0.71 | Value assigned based on 2019 program average. |
| $DE_{pkafter}$ (attic) | 0.58 | Value assigned based on 2019 program average. |
| $DE_{pkafter}$ (basement) | 0.87 | Value assigned based on 2019 program average. |
| $DE_{pkbefore}$ (attic) | 0.47 | Value assigned based on 2019 program average. |
| $DE_{pkbefore}$ (basement) | 0.81 | Value assigned based on 2019 program average. |
| $EFLH_{heat}$ | 1,417 | Indiana TRM (v2.2). values assigned based on nearest TRM city. Value shown is the program average, not the value used to calculate savings for each participant |
| $EFLH_{cool}$ | 427 | Indiana TRM (v2.2). values assigned based on nearest TRM city. Value shown is the program average, not the value used to calculate savings for each participant |
| SEER | 11.41 | Value assigned based on 2019 program average. |
| EER | 10.10 | Value assigned based on 2019 program average. |
| $N_{heating}$ | 1 | Indiana TRM (v2.2) |
| $BtuH_{cool}$ | 31,763 | Value assigned based on 2019 program average. |
| $BtuH_{heat}$ | 80,000 | Value assigned based on 2019 program average. |
| 56.43 | 56.4 | Gas duct sealing savings evaluated through billing analysis in the 2018 program evaluation |
| CF | 0.88 | Indiana TRM (v2.2) |

## REFRIGERATOR REPLACEMENT

The evaluation team used the following equations to calculate electric energy savings for refrigerator replacement. There are no natural gas savings associated with this measure. The IL TRM v10.0 does not have an income-qualified carve-out for refrigerator replacements. However, it is unreasonable to assume that a low-income population would, in the absence of the program, purchase a brand-new standard efficiency fridge as opposed to an inefficient model on the secondary market, as is the assumption for the Low Income A/C replacement. Therefore, the evaluation team calculated a $UEC_{existing}$, rather than using the $UEC_{base}$ prescribed in the IL TRM v10.0.

$$kWh = UEC_{existing} - UEC_{efficient}$$

$$kW = \frac{kWh}{8760} * TAF * LSAF$$

Where:

| | | |
|---|---|---|
| $UEC_{existing}$ | = | Unit energy consumption of existing refrigerator in kWh |
| $UEC_{efficient}$ | = | Unit energy consumption of efficient refrigerator in kWh |
| TAF | = | Temperature adjustment factor |
| LSAF | = | Load shape adjustment factor for existing unit |
| 8760 | = | Annual hours of use |

Table 301 lists the assumptions and source of each assumption for the refrigerator replacement measure savings calculations.

TABLE 301. *EX POST* VARIABLE ASSUMPTIONS FOR REFRIGERATOR REPLACEMENT

| INPUT | VALUE | SOURCE |
|---|---|---|
| $UEC_{existing}$ | 828.5 | Illinois TRM (v10). Value shown is the program average, not the value used to calculate savings for each participant. |
| $UEC_{efficient}$ | 370.8 | Actual model specification. Value shown is the program average, not the value used to calculate savings for each participant |
| TAF | 1.25 | Illinois TRM (v10) |
| LSAF | 1.06 | Illinois TRM (v10) |
| 8760 | 8760 | Hours per year |

## ATTIC INSULATION

The evaluation team used the following equations to calculate electric energy, peak demand, and natural gas energy savings for attic insulation:

$$kWh\ savings = \left(\frac{SF}{1000}\right) * \left(\frac{\Delta kWh}{kSF}\right)$$

$$kW\ savings = \left(\frac{SF}{1000}\right) * \left(\frac{\Delta kW}{kSF}\right) * CF$$

$$therm\ savings = \left(\frac{SF}{1000}\right) * \left(\frac{\Delta MMBtu}{kSF}\right) * 10$$

Where:

SF = Total area of wall insulation in square feet

ΔkWh/kSF = Energy savings expected for every 1,000 square feet of insulation installed with respect to pre-R and post-R values from data tracking information

ΔkW/kSF = Demand savings expected for every 1,000 square feet of insulation installed with respect to pre-R and post-R values from data tracking information

ΔMMBtu/kSF = Natural gas savings expected for every 1,000 square feet of insulation installed with respect to pre-R and post-R values from data tracking information

CF = Coincidence factor

Electric energy, peak demand, and natural gas energy savings are dependent upon pre-R and post-R measure insulation values, calculated using the following steps:

- **Step 1.** Determine variables for insulation compression, $R_{ratio}$, and void factors
- **Step 2.** Calculate adjusted R-values, $R_{adj}$
- **Step 3.** Interpolate with Indiana TRM (v2.2) tables to obtain savings per 1,000 square feet of insulation to obtain values for ΔkWh/kSF, ΔkW/kSF, ΔMMBtu/kSF

**Step 1.** Determine variables for insulation compression, $R_{ratio}$, and void factors:

Adjusted pre-installation and post-installation R-values are calculated using the following formula:

$$R_{adj} = R_{nominal} * F_{compression} * F_{void}$$

Where:

$R_{nominal}$ = Total installed R-value per manufacturers specifications. This value varies across participants and was calculated on an individual level to account for individual savings between pre and post measure.

$F_{compression}$ = Insulation compression factor, assumed to be 1 for 0% compression (as shown in TRM v2.2), because actual information is unknown.

$F_{void}$ = Void factor, dependent on insulation grade level and percent coverage, assumed to be at the 2% grade per the Indiana TRM (v2.2), because the actual information is unknown.

The void factor, $F_{void}$, varies based on the ration between the full assembly R-value and he nominal R-value, $R_{nominal}$, including compression effects. Pre and post insulation values are determined next, using the following equation:

$$R_{ratio} = \frac{R_{nominal} * F_{compression}}{R_{nominal} + R_{framing\&airspace}}$$

Where:

$R_{nominal}$ = Total installed R-value per manufacturers specifications. This value varies across participants and was calculated on an individual level to account for individual savings between pre and post measure.

$F_{compression}$ = Insulation compression factor, assumed to be 1 for 0% compression (as shown in TRM v2.2), because actual information is unknown.

$R_{framing\&airspace}$ = R-value for materials, framing, and airspace for the area in which the insulation is installed. Assumed to be R-5, per Indiana TRM (v2.2).

Values for void factors, based on the $R_{ratio}$ calculation are shown in Table 302. The evaluation team assumed a void factor at 2% in accordance with the Indiana TRM (v2.2).

TABLE 302. INSULATION VOID FACTORS

| $R_{RATIO}$ | $F_{VOID}$, 2% |
|---|---|
| 0.50 | 0.96 |
| 0.55 | 0.96 |
| 0.60 | 0.95 |
| 0.65 | 0.94 |
| 0.70 | 0.94 |
| 0.75 | 0.94 |
| 0.80 | 0.91 |
| 0.85 | 0.88 |
| 0.90 | 0.83 |
| 0.95 | 0.71 |
| 0.99 | 0.33 |

**Step 2.** Calculate $R_{adj}$

Pre-R and post-R values, $R_{adj}$, are calculated at the participant level using $R_{nominal}$ and $R_{ratio}$

**Step 3.** Determine ΔkWh/kSF, ΔkW/kSF, ΔMMBtu/kSF

Electric energy, peak demand, and natural gas savings per thousand square feet values were obtained by interpolating within the Indiana TRM (v2.2) tables and averaging across participant location.

Table 303 lists the assumptions and source for R-values of insulation in the attic insulation measure.

TABLE 303. *EX POST* VARIABLE ASSUMPTIONS FOR ATTIC INSULATION

| INPUT | VALUE | SOURCE |
|---|---|---|
| $R_{nominal-pre}$ (Not adjusted for voids / compression) | 6.02 | Value assigned based on Comprehensive Home Assessments (CHA) report data. Value shown is a program average which was used for the analysis. |
| $R_{nominal-post}$ (Not adjusted for voids / compression) | 40.06 | Value assigned based on Comprehensive Home Assessments (CHA) report data. Value shown is a program average which was used for the analysis. |
| $R_{framing\&airspace}$ | 5.0 | R-value for materials, framing, and airspace for the area in which the insulation is installed. Assumed to be R-5, per Indiana TRM (v2.2). |
| $F_{compression}$ | 1.00 | Insulation compression factor, assumed to be 1.0 for 0% compression (as shown in TRM v2.2), because actual information is unknown. |
| R-ratio$_{pre}$ | 0.55 | Calculated using $R_{nominal-pre}$, $F_{compression}$, and $R_{framing\&airspace}$ |
| R-ratio$_{post}$ | 0.89 | Calculated using $R_{nominal-post}$, $F_{compression}$, and $R_{framing\&airspace}$ |

| INPUT | VALUE | SOURCE |
|---|---|---|
| $F_{void\text{-}pre}$ | 0.96 | Interpolated from insulation void factors from the Indiana TRM (v2.2) based on the ratio of $R_{nominal\text{-}pre}$ to $R_{nominal\text{-}post}$. |
| $F_{void\text{-}post}$ | 0.84 | Interpolated from insulation void factors from the Indiana TRM (v2.2) based on the ratio of $R_{nominal\text{-}pre}$ to $R_{nominal\text{-}post}$. |
| $R_{adj\text{-}pre}$ (Adjusted for voids / compression) | 5.78 | Calculated using $R_{nominal\text{-}pre}$, $F_{compression}$, and $F_{void\text{-}pre}$ |
| $R_{adj\text{-}post}$ (Adjusted for voids / compression) | 33.69 | Calculated using $R_{nominal\text{-}post}$, $F_{compression}$, and $F_{void\text{-}post}$ |

Table 304 lists the program-average kWh savings per thousand square feet for the attic insulation measure.

TABLE 304. *EX POST* kWh SAVINGS PER THOUSAND SQUARE FEET OF ATTIC INSULATION

| TRM REFERENCE CITY | HVAC SYSTEM TYPE | SAVINGS VALUES |
|---|---|---|
| Ft. Wayne | Gas Heating Only | 100.2 |
| South Bend | Electric Cooling and Gas Heating | 236.0 |
| South Bend | Gas Heating Only | 102.2 |

Table 305 lists the program-average KW savings per thousand square feet for the attic insulation measure.

TABLE 305. *EX POST* KW SAVINGS PER THOUSAND SQUARE FEET OF ATTIC INSULATION

| TRM REFERENCE CITY | HVAC SYSTEM TYPE | SAVINGS VALUES |
|---|---|---|
| Ft. Wayne | Gas Heating Only | 0.000 |
| South Bend | Electric Cooling and Gas Heating | 0.116 |
| South Bend | Gas Heating Only | 0.000 |

Table 306 lists the program-average MMBtu savings per thousand square feet for the attic insulation measure.

TABLE 306. *EX POST* MMBtu SAVINGS PER THOUSAND PER THOUSAND SQUARE FEET OF ATTIC INSULATION

| TRM REFERENCE CITY | HVAC SYSTEM TYPE | SAVINGS VALUES |
|---|---|---|
| Ft. Wayne | Gas Heating Only | 21.7 |
| South Bend | Electric Cooling and Gas Heating | 20.7 |
| South Bend | Gas Heating Only | 21.0 |

## AIR SEALING

The evaluation team used the following equations to calculate electric energy, peak demand, and natural gas energy savings for air sealing:

$$kWh\ savings = \frac{\Delta CFM50}{Nfactor} * \frac{\Delta kWh}{CFM}$$

$$kW\ savings = \frac{\Delta CFM50}{Nfactor} * \frac{\Delta kW}{CFM} * CF$$

$$therm\ savings = \frac{\Delta CFM50}{Nfactor} * \frac{\Delta MMBtu}{CFM} * 10$$

Where:

ΔCFM50 = Change in infiltration at 50 Pascal pressure differential in cubic feet per minute

Nfactor = Conversion from 50 Pascal air flow to natural air flow

ΔkWh/CFM = kWh impacts per CFM of infiltration rate reduction

ΔkW/CFM = kW impacts per CFM of infiltration rate reduction

ΔMMBtu/CFM= MMBtu impacts per CFM of infiltration rate reduction

CF = Coincidence factor

Table 307 lists the assumptions and source of each assumption for the air sealing measure.

TABLE 307. *EX POST* VARIABLE ASSUMPTIONS FOR AIR SEALING

| INPUT | VALUE | SOURCE |
|---|---|---|
| ΔCFM50 | 838.1 | Value assigned based on Comprehensive Home Assessments (CHA) report data. Value shown is a program average which was used for the analysis. |
| Nfactor | 16.3 | IN TRM (v2.2) |
| ΔkWh/CFM | 2.44 | Value assigned from IN TRM (v2.2). Value shown is the program average, not the value used to calculate savings for each participant. |
| ΔkW/CFM | 0.0008 | Value assigned from IN TRM (v2.2). Value shown is the program average, not the value used to calculate savings for each participant. |
| ΔMMBtu/CFM | 0.197 | Value assigned from IN TRM (v2.2). Value shown is the program average, not the value used to calculate savings for each participant. |
| CF | 0.88 | IN TRM (v2.2) |
| 10 | 10 | Therms/MMBtu |

# APPENDIX 5: MULTIFAMILY DIRECT INSTALL (MFDI) PROGRAM

## ALGORITHMS AND ASSUMPTIONS

This appendix contains the assumptions for electric energy savings, peak demand reduction, and natural gas energy savings algorithms for the measures within the MFDI program. The evaluation team examined each assumption used by the algorithms to capture savings and compared them with the Indiana TRM (v2.2) and Illinois TRM (v10), as well as other state and industry approaches.

Detailed information on the analysis and supporting assumptions for the following MFDI program measures are included within this appendix:

- LED light bulbs
- Bathroom faucet aerators (1.0 gpm)
- Kitchen aerators (1.5 gpm)
- Low-flow showerheads (1.5 gpm)
- Programmable Thermostat

Table 308 lists our assumptions for the *ex post* per measure savings.

TABLE 308. MFDI PROGRAM MEASURES

| MEASURE | REVIEWED ASSUMPTIONS |
|---|---|
| LEDs | New and baseline wattages, hours of use, waste heat factors, coincidence factors |
| Kitchen Faucet Aerator | New and baseline flow rates, occupants per dwelling, minutes of use per day, faucets per home, water temperatures, water heater fuel type and efficiency |
| Bathroom Faucet Aerator | New and baseline flow rates, occupants per dwelling, minutes of use per day, faucets per home, water temperatures, water heater fuel type and efficiency |
| Low-flow Showerhead | New and baseline flow rates, occupants per dwelling, minutes of use per day, showerheads per home, water temperatures, water heater fuel type and efficiency |
| Programmable Thermostat | Seasonal average energy efficiency ratios, equivalent full load heating and cooling hours, HVAC system capacities, and energy savings fractions for heating and cooling |

### DETAILS BY MEASURE

The algorithms and assumptions the evaluation team used to calculate *ex post* savings for each of these measures follow.

#### LEDS

The following equations are used to calculate electric, demand, and therm penalties for LEDs:

$$kWh\ savings\ per\ lamp = \frac{(W_{base} - W_{LED}) * Hours * (1 + WHF_e)}{1,000}$$

$$kW\ reduction\ per\ lamp = \frac{(W_{base} - W_{LED}) * Coincidence\ Factor * (1 + WHF_d)}{1{,}000}$$

$$Therm\ savings\ per\ lamp = \frac{(W_{base} - W_{LED}) * Hours * WHF_g}{1{,}000} \times 10$$

Where:

| | | |
|---|---|---|
| $W_{base}$ | = | Wattage of the bulb being replaced, W |
| $W_{LED}$ | = | Wattage of the LED bulb, W |
| Hours | = | Average hours of use per year, hr |
| $WHF_e$ | = | Waste heat factor for energy (depends on location) |
| $WHF_d$ | = | Waste heat factor for demand (depends on location) |
| $WHF_g$ | = | Waste heat factor for natural gas (depends on location) |
| Coincidence Factor | = | Summer peak coincidence factor |
| 1,000 | = | Constant to convert watts to kW |
| 10 | = | Constant to convert MMBtu to Therm |

Table 309 lists the input assumptions and source of each assumption for the LED measure savings calculations.

TABLE 309. *EX POST* VARIABLE ASSUMPTIONS FOR LEDS

| INPUT | VALUE | SOURCE |
|---|---|---|
| $Watts_{Base}$ (9 W LEDs) | 43 | Indiana TRM V2.2; NREL Residential Lighting Protocol Post-EISA and post-EISA exempt baseline wattages based on a 2020 ENERGY STAR QPL analysis |
| $Watts_{Base}$ (Globe LEDs) | 40 | |
| $Watts_{Base}$ (Candelabras) | 40 | |
| $Watts_{Eff}$ (9 W LEDs) | 9 | Actual installed wattage; Verified during model number look ups |
| $Watts_{Eff}$ (Globe LEDs) | 6 | |
| $Watts_{Eff}$ (Candelabras) | 4.5 | |
| Hours | 902 | Indiana TRM V2.2 |
| Coincidence Factor | 0.11 | Indiana TRM V2.2 |
| Energy Waste Heat Factor ($WHF_E$) | -0.07 | Indiana TRM V2.2, location specific. Assumed South Bend. |
| Demand Waste Heat Factor ($WHF_D$) | 0.038 | |
| Gas Waste Heat Factor ($WHF_G$) | -0.0019 | |
| Conversion Factor | 1000 | Convert watts to kW |
| Conversion Factor | 10 | Convert MMBtu to Therm |

### KITCHEN AND BATHROOM FAUCET AERATORS

The evaluation team used the following equations to calculate natural gas energy savings for low-flow kitchen and bathroom faucet aerators:

$$therm\ savings = (GPM_{base} * L_{base} - GPM_{low} * L_{low}) * Household * 365.25 * \frac{DF}{FH} * 8.33 * 1.0 * \frac{(T_{water} - T_{supply})}{(RG * 100{,}000)}$$

Where:

| | | |
|---|---|---|
| $GPM_{base}$ | = | Gallons per minute of baseline faucet aerator |
| $GPM_{low}$ | = | Gallons per minute of low-flow faucet aerator |

$L_{base}$ = Average baseline minutes of faucet use per person per day

$L_{low}$ = Average retrofit minutes of faucet use per person per day

Household = Average number of people per household

DF = Drain factor

FH = Average number of faucets per household

$T_{water}$ = Mixed water temperature exiting faucet, °F

$T_{supply}$ = Cold water temperature entering the domestic hot water (DHW) system, °F

RG = Recovery efficiency of gas hot water heater

1.0 = Heat capacity of water

8.33 = Specific weight of water in pounds per gallon, then multiplied by specific water temperature (1.0 Btu/lb-°F)

365.25 = Days per year, day/yr

100,000 = Constant to convert Btu to therm

Table 310 lists the input assumptions and source of each assumption for the kitchen and bathroom faucet aerator measure savings calculations.

TABLE 310. VARIABLE ASSUMPTIONS FOR FAUCET AERATORS

| INPUT | KITCHEN VALUE | BATHROOM VALUE | SOURCE |
|---|---|---|---|
| $GPM_{base}$ | 1.63 | 1.53 | Illinois TRM (v10) |
| $GPM_{low}$ | 0.94 | 0.94 | Illinois TRM (v10) |
| $L_{base}$ | 4.5 | 1.6 | Illinois TRM (v10) |
| $L_{low}$ | 4.5 | 1.6 | Illinois TRM (v10) |
| Household | 1.83 | 1.83 | Illinois TRM (v10) for multifamily housing |
| DF | 0.75 | 0.9 | Illinois TRM (v10) |
| FH | 1 | 1.5 | Indiana TRM (v2.2) for multifamily housing |
| $T_{water}$ | 93 | 86 | Indiana TRM (v2.2) |
| $T_{supply}$ | 57.4˚F | 57.4˚F | Indiana TRM V2.2, assumed South Bend. |
| RG | 0.67 | 0.67 | Indiana TRM (v2.2) |

## LOW-FLOW SHOWERHEADS

The evaluation team used the following equations to calculate natural gas energy savings for low-flow showerheads:

$$therm\ savings = ISR * (GPM_{base} * L_{base} - GPM_{low} * L_{low}) * Household * SPCD * \frac{365.25}{SH} * 8.33 * 1.0 * \frac{(T_{shower} - T_{supply})}{(RG * 100{,}000)}$$

Where:

$GPM_{base}$ = Gallons per minute of baseline showerhead

$GPM_{low}$ = Gallons per minute of low-flow showerhead

$L_{base}$ = Shower length in minutes with baseline showerhead

$L_{low}$ = Shower length in minutes with retrofit showerhead

ISR = In-service rate, or fraction of units that get installed

| | | |
|---|---|---|
| Household | = | Average number of people per household |
| SPCD | = | Average number of shower events per person per day |
| SH | = | Average number of showerheads per household |
| $T_{shower}$ | = | Mixed water temperature exiting faucet, °F |
| $T_{supply}$ | = | Cold water temperature entering the DWH system, °F (depends on location) |
| RG | = | Recovery efficiency of natural gas hot water heater |
| 8.33 | = | Specific weight of water in pounds per gallon |
| 1.0 | = | Heat capacity of water |
| 365.25 | = | Days of faucet use per year |
| 100,000 | = | Constant to convert Btu to Therm |

Table 311 lists the input assumptions and source of each assumption for the low-flow showerhead measure savings calculations.

TABLE 311. *EX POST* VARIABLE ASSUMPTIONS FOR LOW-FLOW SHOWERHEADS

| INPUT | VALUE | SOURCE |
|---|---|---|
| $GPM_{base}$ | 2.24 | Illinois TRM (v10) |
| $GPM_{low}$ | 1.5 | Actual |
| $L_{base}$ | 7.8 | Illinois TRM (v10) |
| $L_{low}$ | 7.8 | Illinois TRM (v10) |
| SPCD | 0.60 | Illinois TRM (v10) |
| Household | 1.83 | Indiana TRM (v2.2) for multifamily housing |
| SH | 1.3 | Illinois TRM (v10) |
| $T_{shower}$ | 101 | Illinois TRM (v10) |
| $T_{supply}$ | 57.4 | Indiana TRM (v2.2), values assigned based on nearest TRM city. Assumed South Bend for calculation |
| RG | 0.67 | Illinois TRM (v10) |
| Conversion Factor | 8.3 | Specific weight of water in pounds per gallon |
| Conversion Factor | 1.0 | Heat capacity of water |
| Conversion Factor | 100,000 | Constant to convert Btu to Therm |
| Conversion Factor | 365.25 | Days of faucet use per year |

### THERMOSTATIC RESTRICTOR VALVE

The evaluation team used the following equations to calculate natural gas energy savings for thermostatic restrictor valves:

$$therm\ savings = ISR * (GPM_{base} * L_{shower\ device}) * Household * SPCD * \frac{365.25}{SH} * 8.33 * 1.0 * \frac{(T_{shower} - T_{supply})}{(RG * 100{,}000)}$$

Where:

| | | |
|---|---|---|
| $GPM_{base}$ | = | Gallons per minute of baseline showerhead |
| $L_{shower\ device}$ | = | Hot water waste time avoided due to thermostatic restrictor valve |
| ISR | = | In-service rate, or fraction of units that get installed |
| Household | = | Average number of people per household |
| SPCD | = | Average number of shower events per person per day |

| | | |
|---|---|---|
| SH | = | Average number of showerheads per household |
| $T_{shower}$ | = | Mixed water temperature exiting faucet, °F |
| $T_{supply}$ | = | Cold water temperature entering the DWH system, °F (depends on location) |
| RG | = | Recovery efficiency of natural gas hot water heater |
| 8.33 | = | Specific weight of water in pounds per gallon |
| 1.0 | = | Heat capacity of water |
| 365.25 | = | Days of faucet use per year |
| 100,000 | = | Constant to convert Btu to Therm |

Table 312 lists the input assumptions and source of each assumption for the low-flow showerhead measure savings calculations.

TABLE 312. *EX POST* VARIABLE ASSUMPTIONS FOR THERMOSTATIC RESTRICTOR VALVES

| INPUT | VALUE | SOURCE |
|---|---|---|
| $GPM_{base}$ | 2.24 or 1.5 | Illinois TRM (v10); assumes the flow rate of the showerhead installed. If installed with a low-flow showerhead, the low-flow rate is assumed |
| $L_{shower\ device}$ | 0.89 | Illinois TRM (v10) |
| SPCD | 0.60 | Illinois TRM (v10) |
| Household | 1.83 | Indiana TRM (v2.2) for multifamily housing |
| SH | 1.3 | Illinois TRM (v10) |
| $T_{shower}$ | 101 | Illinois TRM (v10) |
| $T_{supply}$ | 57.4 | Indiana TRM (v2.2), values assigned based on nearest TRM city. Assumed South Bend for calculation |
| RG | 0.67 | Illinois TRM (v10) |
| Conversion Factor | 8.3 | Specific weight of water in pounds per gallon |
| Conversion Factor | 1.0 | Heat capacity of water |
| Conversion Factor | 100,000 | Constant to convert Btu to Therm |
| Conversion Factor | 365.25 | Days of faucet use per year |

### PROGRAMMABLE THERMOSTATS

A few evaluated savings cases exist within this measure category, and each was established within the measure name. In 2022, this was either electric cooling only savings or electric cooling and gas heating savings. The algorithm used was from the Indiana TRM (v2.2) with inputs based on results from a 2020 smart thermostat billing analysis and 2021 HVAC program data.

The smart thermostat 2020 billing analysis examined all 2018 and 2019 participants, revealing net gas savings of 35 therms (5.4%) for 2019 participants receiving one thermostat. The analysis also revealed net cooling electric energy savings of 8.3%—the savings for sites receiving one thermostat in either 2018 or 2019. More detail on these options can be seen in the billing analysis section of the 2020 HVAC evaluation report. The 5.4% heating savings factor was applied for all sites with gas heat. The reduced heating savings factor reflects the increase in work from home participants due to the COVID-19 pandemic and is still applicable in 2022. Based on a review of the Illinois TRM (v10), Indiana TRM (v2.2), and the 2013-2014 Vectren/CenterPoint programmable and smart thermostat program evaluation results, it was determined that the 2020 smart thermostat billing analysis results are comparable and applicable to programmable thermostats in this year's evaluation. In addition to inputs used from program data and the billing analysis, to adjust savings to reflect reduced cooling and heating demand in MF units, a MF multiplier from the 2022 Vectren MFDI Evaluation was applied.

To determine energy savings for air conditioning and electric heat sites, the evaluation team used the following equations. For natural gas heating with air conditioning, and for air conditioning alone:

$$kWh\ savings = \frac{BTUh_c}{SEER \times 1{,}000} * EFLH_C * ESF_C * MF_{cool}$$

$$therm\ savings = \frac{BTUh_{ff}}{100{,}000} * ESF_h * MF_{gas}$$

Where:

| | | |
|---|---|---|
| $BTUh_c$ | = | System cooling capacity |
| SEER | = | System SEER |
| $EFLH_C$ | = | Effective full-load cooling hours from Indiana TRM (2.2) |
| $ESF_C$ | = | Savings factor for cooling derived via 2020 billing analysis, 8.3% |
| $BTUh_{ff}$ | = | System heating capacity |
| COP | = | Heating system coefficient of performance |
| 3,412 | = | Conversion from Btu to kWh (3,412 Btu = 1 kWh) |
| $EFLH_H$ | = | Effective full-load heating hours |
| $ESF_H$ | = | Savings factor for heating derived via 2020 billing analysis, 5.4% |

For thermostats serving natural gas heating systems without air conditioning, no electric energy savings are produced from the Indiana TRM (v2.2) calculations.

The Indiana TRM (v2.2) does not provide guidance on claiming demand reduction for these thermostat measures. Currently, savings for thermostats in most TRMs and evaluations are derived via analysis of billing data, which generally cannot produce values for demand reduction. However, it is likely that some demand reduction for smart Wi-Fi thermostats does exist, and this reduction is accommodated in the Illinois TRM (v9.0).[71] This TRM calculates savings using standard methods for deriving baseline peak load, then applies a smart Wi-Fi thermostat ESF and half the CF normally used for cooling. The evaluation team used that same approach. Here, the standard cooling CF of 0.88 is used, but divided by 2:

$$kW\ savings = \frac{BTUh_C}{EER \times 1{,}000} * \frac{CF}{2} * ESF_C * MF_{cool}$$

Table 313 lists the input assumptions and sources of each assumption for the programmable thermostat savings calculation.

[71] Illinois Energy Efficiency Stakeholder Advisory Group (SAG). *2021 Illinois Statewide Technical Reference Manual for Energy Efficiency Version 9.0.* September 25,2020.

TABLE 313. *EX POST* VARIABLE ASSUMPTIONS FOR PROGRAMMABLE THERMOSTATS

| INPUT | ELECTRIC COOLING AND GAS HEATING VALUES | ELECTRIC COOLING ONLY VALUES | SOURCE |
|---|---|---|---|
| $BTUh_c$ | 34,426 | 34,426 | 2021 program average AC capacity |
| SEER | 11.15 | 11.15 | Indiana TRM (v2.2) |
| $EFLH_C$ | 431 | 431 | Indiana TRM (v2.2), values assigned based on nearest TRM city. Assumed South Bend for calculation |
| $ESF_C$ | 0.083 | 0.083 | 2020 Billing Analysis |
| $BTUh_{ff}$ | 71,694 | 71,694 | 2021 program average furnace capacity |
| COP | 2.26 | 2.26 | Indiana TRM (v2.2) or engineering assumption |
| $EFLH_H$ | 897 | 897 | 2020 Billing Analysis, values assigned based on nearest TRM city. Assumed South Bend for calculation |
| $ESF_H$ | 0.054 | 0.054 | 2020 Billing Analysis |
| $MF_{gas}$ | 0.45 | - | 2022 Vectren MFDI Program Evaluation |
| $MF_{cool}$ | 0.60 | 0.60 | 2022 Vectren MFDI Program Evaluation |

# APPENDIX 6: APPLIANCE RECYCLING PROGRAM

## ALGORITHMS AND ASSUMPTIONS

This appendix contains the assumptions used in electric savings and demand reduction algorithms for the measures within the Appliance Recycling program. For the 2022 program year, the evaluation team estimated per-unit energy and demand savings estimates for recycled refrigerators and freezers using algorithms and variable assumptions from the Illinois TRM (v10.0). The Illinois TRM (v10.0) and Indiana TRM (v2.2) were used to estimate recycled room AC energy and demand savings. The Pennsylvania TRM (2021) was used to estimate savings for dehumidifier recycling. The section below details information on the analysis and supporting assumptions for the Appliance Recycling measures in this appendix.

### REFRIGERATORS AND FREEZERS

The evaluation team used the regression model recommended in the Illinois TRM (v10.0) to estimate savings resulting from the Appliance Recycling program. Table 314 lists the Illinois TRM (v10.0) model specification used to estimate the annual unit energy consumption (UEC) of refrigerators recycled in 2022, along with the model's estimated coefficients.

TABLE 314. 2022 APPLIANCE RECYCLING REFRIGERATOR UNIT ENERGY CONSUMPTION REGRESSION MODEL ESTIMATES

| INDEPENDENT VARIABLES | COEFFICIENT |
|---|---|
| Intercept | 83.324 |
| Age (years) | 3.678 |
| Dummy: Manufactured Pre-1990 | 485.037 |
| Size (cubic feet) | 27.149 |
| Dummy: Side-by-Side | 406.779 |
| Dummy: Primary | 161.857 |
| Interaction: Unconditioned Space * HDDs[a] /365.25 | -11.067 |
| Interaction: Unconditioned Space * CDDs[a] /365.25 | 15.366 |

[a.] The evaluation team derived HDDs and CDDs from the weighted average from TMY3 data for weather stations mapped to participating appliance zip codes. TMY3 uses median daily values for a variety of weather data collected from 1991 through 2005.

The coefficient value indicates the marginal impact on per-unit energy consumption of a one-point increase in the independent variable. For example, as shown in Table 314, an increase of one cubic foot in refrigerator size resulted in an increase of 27.149 kWh in annual consumption. In the case of dummy variables, the coefficient value represented the difference in consumption if the given condition proved true. For example, the evaluation team's refrigerator model used a coefficient of 161.857 for the variable indicating whether a refrigerator was a primary unit; thus, with all else equal, a primary refrigerator consumed 161.857 kWh per year more than a secondary unit.

Table 315 lists the regression model recommended in the Illinois TRM (v10.0) used to estimate the annual UEC of freezers recycled in 2022, along with the model's estimated coefficients.

TABLE 315. 2022 APPLIANCE RECYCLING PROGRAM FREEZER UNIT ENERGY CONSUMPTION REGRESSION MODEL ESTIMATES

| INDEPENDENT VARIABLES | COEFFICIENT |
|---|---|
| Intercept | 132.122 |
| Age (years) | 12.130 |
| Dummy: Manufactured Pre-1990 | 156.181 |
| Size (cubic feet) | 31.839 |
| Dummy: Chest Freezer | -19.709 |
| Interaction: Unconditioned Space * HDDs | -12.755 |
| Interaction: Unconditioned Space * CDDs | 9.778 |

Table 316 lists the mean values derived from 2022 data used to estimate the annual UEC of refrigerators recycled in 2022, along with the model's estimated coefficients. It also includes our model coefficients and means derived from 2022 data for recycled freezers.

TABLE 316. 2022 APPLIANCE RECYCLING PROGRAM PARTICIPANT MEAN VARIABLES AND MODEL COEFFICIENTS

| | INDEPENDENT VARIABLES | 2022 MEAN VALUE | 2022 MODEL COEFFICIENT |
|---|---|---|---|
| Refrigerator | Intercept | 1.00 | 83.324 |
| | Age (years) | 20.161 | 3.678 |
| | Dummy: Manufactured Pre-1990 | 0.106 | 485.037 |
| | Size (cubic feet) | 19.900 | 27.149 |
| | Dummy: Side-by-Side | 0.047 | 406.779 |
| | Dummy: Primary | 0.331 | 161.857 |
| | Interaction: Unconditioned Space * HDDs[a] | 0.846 | -11.067 |
| | Interaction: Unconditioned Space * CDDs[a] | 4.659 | 15.366 |
| Freezer | Intercept | 1.00 | 132.122 |
| | Age (years) | 24.546 | 12.130 |
| | Dummy: Manufactured Pre-1990 | 0.246 | 156.181 |
| | Size (cubic feet) | 16.065 | 31.839 |
| | Dummy: Chest Freezer | 0.365 | -19.709 |
| | Interaction: Unconditioned Space * HDDs | 7.479 | -12.755 |
| | Interaction: Unconditioned Space * CDDs | 1.357 | 9.778 |

a. Cooling degree days (CDDs) and heating degree days (HDDs) are weighted averages, based on TMY3 data from weather stations mapped to participating appliance zip codes.

## PER-UNIT ENERGY CONSUMPTION

The following regression model shows how the Illinois TRM (v10.0)-defined model was used. For the refrigerator UEC calculation, this included average appliance characteristics:

$$UEC_{Ref} = [0.83.324 + (3.678 * (20.161\ years\ old)) + \big(485.037 * (10.6\%\ units\ manufactured\ before\ 1990)\big) + (27.149 *\ 19.900\ unit\ size\ ft.^3\ ) +\ (406.779 * 33.1\%\ side - by - side\ units) + (161.857 *\ 58\%\ primary\ usage) +\ (-11.067 * 4.659\ unconditioned\ HDDs) +\ (15.366 * 0.846\ Unconditioned\ CDDs)] = 939\ kWh \text{ year}$$

The following regression model shows how the UMP-defined model was used. For the freezer UEC calculation, this included average appliance characteristics:

$$UEC_{Frz} = [132.122 + (12.130 * (26.546\ years\ old)) + \big(156.181 * (24.6\%\ units\ manufactured\ before\ 1990)\big) + (31.839 *\ 16.065\ unit\ size\ ft.^3\ ) + (-19.709 * 36.5\%\ units\ that\ are\ chest\ freezers) + (-12.755 * 7.479\ unconditioned\ HDDs) +\ (9.778 * 1.357\ Unconditioned\ CDDs)] = 890\ kWh \text{ year}$$

Using the values from Table 317, the evaluation team estimated the *ex post* annual UEC for an average program refrigerator and freezer.

TABLE 317. 2022 APPLIANCE RECYCLING PROGRAM AVERAGE UNIT ENERGY CONSUMPTION BY APPLIANCE TYPE

| MEASURE | AVERAGE PER-UNIT ENERGY CONSUMPTION (KWH/YEAR) |
|---|---|
| Refrigerators | 939 |
| Freezers | 890 |

## DEMAND IMPACTS

To calculate demand reduction, the team used the coincident factors shown in Table 318, drawn from the Illinois TRM (v10.0), to calculate per-measure demand reduction for refrigerators and freezers. The evaluation team used the following equation to calculate demand reduction separately for refrigerator and freezer appliance measures.

$$kW\ reduction = \frac{Average\ PerUnit\ Energy\ Consumption\ kWh/Year}{8{,}766} * CF$$

Where:

CF = Coincident factor defined as summer kW/average kW
= 1.081 for Refrigerators
= 1.028 for Freezers

TABLE 318. 2022 APPLIANCE RECYCLING DEMAND REDUCTION ASSUMPTIONS FOR APPLIANCE RECYCLING PROGRAM–RECYCLED REFRIGERATORS AND FREEZERS

| VARIABLE | RECYCLED APPLIANCE VALUE |
|---|---|
| CF – Coincident Factor – Refrigerators | 1.081 |
| CF – Coincident Factor – Freezers | 1.028 |

Using the values from Table 319 the evaluation team estimated the *ex post* annual gross peak demand reduction for an average program refrigerator and freezer.

TABLE 319. 2022 APPLIANCE RECYCLING PROGRAM AVERAGE UNIT ENERGY DEMAND REDUCTION BY APPLIANCE TYPE

| APPLIANCE | AVERAGE PER-UNIT GROSS PEAK DEMAND REDUCTION (KW/YEAR) |
|---|---|
| Refrigerators | 0.116 |
| Freezers | 0.104 |

### PART-USE FACTOR

Applying the part-use factors calculated from the 2020 survey to the modeled annual consumption and demand reduction from Table 318 and Table 319 yielded average gross, per-unit energy savings and demand reductions. Table 320 shows average per-unit gross annual energy savings and demand reduction values, part-use factors and the part-use adjusted per-unit gross energy savings and peak demand reduction values used as final *ex post* gross per-unit values for the 2022 evaluation.

TABLE 320. 2022 APPLIANCE RECYCLING PROGRAM *EX POST* PER-UNIT ENERGY SAVINGS AND DEMAND REDUCTION

| SAVINGS TYPE | AVERAGE PER-UNIT ANNUAL ENERGY SAVINGS (KWH/YEAR) | AVERAGE PER-UNIT ANNUAL PEAK DEMAND REDUCTION (KW/YEAR) | PART-USE FACTOR | *EX POST* PER-UNIT GROSS ENERGY SAVINGS (KWH/YEAR) | *EX POST* PER-UNIT PEAK DEMAND REDUCTION (KWH/YEAR) |
|---|---|---|---|---|---|
| Refrigerators | 939 | 0.116 | 0.89 | 836.00 | 0.103 |
| Freezers | 890 | 0.104 | 0.90 | 801.00 | 0.094 |

### DEHUMIDIFIERS

Dehumidifier recycling is not included in the Indiana TRM (v2.2) or the Illinois TRM (v10.0); therefore, the evaluation team used the default values from the Pennsylvania TRM (2021) to calculate *ex post* per-measure energy savings and demand reduction for recycled dehumidifiers. The energy savings and demand reduction values in the Pennsylvania TRM (2021) for dehumidifier recycling were established using actual metered residential dehumidifier usage data. The metered data was best fit with a polynomial which is second order in temperature humidity index and first order in capacity. The evaluation team applied the default, average usage and savings values provided in Pennsylvania TRM (2021) for the most similar climate region identified (Scranton, PA) because the evaluation team could not confirm the pints of water per day capacity of the units in the program tracking data.

Table 321 shows a summary of the recycled dehumidifier savings assumptions and assumption source.

TABLE 321. 2022 APPLIANCE RECYCLING PROGRAM VARIABLE ASSUMPTIONS FOR RECYCLED DEHUMIDIFIER

| CLIMATE REGION | REFERENCE CITY | DEFAULT ANNUAL SAVINGS | SOURCE |
|---|---|---|---|
| B | Scranton | 711 kWh | Pennsylvania TRM (2021) |
| Statewide | Statewide | 0.1731 kW | |

Table 322 shows resulting *ex post* per-unit savings for recycled dehumidifiers.

TABLE 322. 2022 APPLIANCE RECYCLING PROGRAM DEHUMIDIFIERS *EX POST* PER-UNIT SAVINGS

| MEASURE | *EX POST* PER-MEASURE SAVINGS | |
|---|---|---|
| | KWH | KW |
| Dehumidifier | 711.00 | 0.1731 |

## ROOM AIR CONDITIONERS

The evaluation team used the following equations from the Illinois TRM (v10.0) to calculate *ex post* per-measure energy savings and demand reduction for recycled room air conditioners:

- $$kWh\ savings = \left(\frac{FLH_{RoomAC} * \text{Btu/H}}{1{,}000}\right) * \left(\frac{\frac{1}{EER_{exist}}}{1000}\right)$$
- $$kW\ reduction = \left(\frac{Btu/H * CF}{1{,}000}\right) * \left(\frac{\frac{1}{EER_{exist}}}{1000}\right) * \text{CF}$$

Where:

| | | |
|---|---|---|
| $FLH_{RoomAC}$ | = | Full-load cooling hours for participants (average across all participants) |
| Btu/h | = | Actual size of the recycled AC in Btu/H units (where 1 ton=12,000 Btu/H) |
| $EER_{exist}$ | = | Energy efficiency rating of the recycled AC |
| CF | = | Coincidence factor, a number between 0 and 1 indicating how many ACs are expected to be in use and saving energy during the peak summer demand period |

Table 323 shows a summary of the recycled room air conditioner savings assumptions and assumption source. The evaluation team mapped room air conditioner recycling participants service address zip code to the closest reference city specific full-load cooling hours default values from the Indiana TRM (V2.0) to develop a weighted average $FLH_{RoomAC}$ value of 294.

TABLE 323. 2022 APPLIANCE RECYCLING PROGRAM VARIABLE ASSUMPTIONS FOR RECYCLED ROOM AIR CONDITIONERS

| VARIABLE | ROOM AIR CONDITIONER VALUE | SOURCE |
|---|---|---|
| Full-Load Cooling Hours ($FLH_{RoomAC}$) | 294 | Indiana TRM (v2.2) |
| Size of retired unit (Btu/H) | 8,500 | Illinois TRM (v10.0) |
| Energy Efficiency Rating – Existing ($EER_{exist}$) | 9.8 | |
| Coincidence Factor (CF) | 0.30 | |

Table 324 shows resulting *ex post* per-unit savings for recycled room air conditioners.

TABLE 324. 2022 APPLIANCE RECYCLING PROGRAM ROOM AIR CONDITIONER *EX POST* PER-UNIT SAVINGS

| MEASURE | *EX POST* PER-UNIT SAVINGS | |
|---|---|---|
| | KWH | KW |
| Room Air Conditioner | 254.71 | 0.260 |

# APPENDIX 7: BEHAVIORAL PROGRAM

## REGRESSION ANALYSIS AND CROSS-PROGRAM PARTICIPATION ANALYSIS

### REGRESSION ANALYSIS

The evaluation team conducted a regression analysis to determine energy savings for treatment and control respondents using two models: PPR and LFER. Both approaches produced unbiased estimates of program savings. The evaluation team reported the PPR results and used the LFER results as a robustness check. Although structurally different, assuming the RCT is well-balanced with respect to the drivers of energy use, the two models should produce similar program savings estimates. Based on our experience analyzing the impacts of similar programs, the savings estimates produced by the PPR approach tend to be more precisely estimated (smaller standard errors) than those produced from the LFER model. This increase in precision occurs because the PPR accounts for groupwide pre-post consumption differences with a continuous term (ADClag) instead of a categorical term (post). Detailed descriptions of both model types are provided below.

### POST-PERIOD REGRESSION

The PPR model controls for anomalous differences in energy usage between treatment and control group respondents by using lagged energy use as an explanatory variable. In other words, the model frames energy use in each calendar month of the post-program period as a function of both the treatment variable and energy use in the same calendar month of the pre-program year. The underlying logic is that any small systematic differences between the control and treatment respondents that remain, despite the randomization, will be reflected in differences in their past energy use, which is highly correlated with their current energy use. Including the lagged energy use in the model serves as a control for any such differences. The version the evaluation team estimated includes monthly fixed effects interacted with the pre-program energy use variable. These interaction terms allow pre-program usage to have a different effect on post-program usage in each calendar month.

**Equation 1. Post-Period Regression**

$$ADC_{kt} = \beta_0 + \beta_1 ADClag_{kt} + \beta_2 Treatment_k + \sum_j \beta_{3j} Month_{jt} + \sum_j \beta_{4j} Month_{jt} * ADClag_{kt} + \varepsilon_{kt}$$

Where:

$ADC_{kt}$ = The average daily usage in kilowatt-hours or therms for respondent *k* during billing cycle *t*. This is the dependent variable in the model.

$ADClag_{kt}$ = Respondent *k*’s energy use in the same calendar month of the pre-treatment year as calendar month *t.*

$Treatment_k$ = A binary variable indicating whether respondent *k* is in the participant group (taking a value of 1) or the control group (taking a value of 0).

$Month_{jt}$ = A binary variable taking a value of 1 when *j*=*t* and 0 otherwise.[72]

$\varepsilon_{kt}$ = The cluster-robust error term for respondent *k* during billing cycle *t* that accounts for heteroscedasticity and autocorrelation at the respondent level.

In this model, $\beta_2$ is the estimate of average daily energy savings due to the program. Program savings are the product of the average daily savings estimate and the total number of participant-days in the analysis.

## LINEAR FIXED EFFECTS REGRESSION

As with the PPR model, the LFER model combines cross-sectional and time series data. Unlike the PPR model, however, the LFER models the full set of pre- and post-program usage data. The regression essentially compares the pre- and post-program energy usage of participants to those in the control group to identify the effect of the program. The purpose of the respondent-specific fixed effect is to capture all systematic cross-respondent variation in electric energy usage that is not captured by the model. Like the lagged usage variable in the PPR model, the fixed effect represents an attempt to control for any small systematic differences between the treatment and control respondents that might occur in the data despite the randomization.

**Equation 2. Linear Fixed Effects Regression**

$$ADC_{kt} = \beta_{0kt} + \beta_1 Post_t + \beta_2 Treatment_k Post_t + \varepsilon_{kt}$$

Where:

$ADC_{kt}$ = The average daily usage in kilowatt-hours or therms for respondent *k* during billing cycle *t*. This is the dependent variable in the model.

$\beta_{0kt}$ = The respondent-specific fixed effect at month-year *t*.

$\beta_1$ = The effect of being in the post-period on energy use to account for non-program effects that impact both the treatment and control groups.

$Post_t$ = A binary variable indicating whether bill cycle *t* is in the post-program period (taking a value of 1) or in the pre-program period (taking a value of 0).

$\beta_2$ = The estimate of treatment effects: the average daily energy savings per household due to behavioral program treatment.

72 If there are post-program months, the model has monthly dummy variables, with the dummy variable "month" being the only one to take a value of 1 at time *t*. These are, in other words, monthly fixed effects.

$Treatment_k$ = A binary variable indicating whether respondent *k* is in the participant group (taking a value of 1) or in the control group (taking a value of 0).

$\varepsilon_{kt}$ = The cluster-robust error term for respondent *k* during billing cycle *t*. Cluster-robust errors account for heteroscedasticity and autocorrelation at the respondent level.

## CROSS-PROGRAM PARTICIPATION ANALYSIS

The HERs sent to treatment respondents included energy saving tips and marketing modules, some of which encouraged respondents to participate in other NIPSCO energy efficiency programs. To assess the interactions between these programs, the evaluation team analyzed both the HER program and the Behavioral program data for participation overlap to address two factors:

- **Participation lift:** Does the Behavioral program treatment influence participation in other energy efficiency programs?
- **Savings lift and adjustment:** What portion of savings from the Behavioral program was obtained through NIPSCO's other energy efficiency efforts?

As with the energy savings calculations, the control group acts as the counterfactual, for both participation and savings from other programs, to address the above questions and provide unbiased estimates through the RCT model.

First, the evaluation team assessed whether the Behavioral program increased participation in NIPSCO's other energy efficiency programs by comparing participation rates between control and treatment groups. If participation rates in other residential energy efficiency programs were the same across HER treatment and control groups, the savings estimates for HERs from the regression analysis were already net of savings from the other programs and indicates that the Behavioral program had no effect on participation in other energy efficiency programs.

However, if the Behavioral program channeled participants into other energy efficiency programs, then savings detected in the HER billing analysis would include savings that are also counted by those other energy efficiency programs. For instance, if the Behavioral program increased participation in the HEA program, the increase in savings could be allocated to either the HER program or to HEAs provided through the Behavioral program (or some portion to each), but it could not be fully allocated to both programs simultaneously.

The evaluation team then calculated participant lift and savings lift and adjustment:

- **Participant lift:** Using participation flags, the evaluation team calculated a participation rate based on the number of accounts (either by individual or by household) that initiated participation in other tracked energy efficiency programs after the first report date. The difference in treatment and control participation in the post-treatment period is participation lift.
- **Savings lift and adjustment:** The evaluation team estimated the energy savings associated with participation lift in other NIPSCO energy efficiency programs:
    - First the evaluation team calculated annual savings for all measures installed in the post-period.

- Then the evaluation team adjusted annual savings for each measure installation by the number of days per year in the post-period in which the measure was installed while the account was active; this step is necessary to most accurately estimate the savings that would be captured by the billing analysis.

- Next the evaluation team determined the average household net savings per participant day (the number of days a household was active in each period) from other programs in the post-period for both the treatment and control groups.

- Last, the evaluation team multiplied the average savings per participant day by the number of treatment group participant days in the post-period to identify the incremental savings attributable to other energy efficiency programs.

# APPENDIX 8: RESIDENTIAL NEW CONSTRUCTION PROGRAM

## APPENDIX A. PROGRAM SAVINGS METHODOLOGY

The evaluation team's impact evaluation of the Residential New Construction program included homes with attributable electric savings and gas savings, including the following:

- Silver Star Homes (gas and electric)
- Gold Star Homes (gas and electric)
- Platinum Star Homes (gas and electric)

### ESTIMATING 2022 PROGRAM IMPACTS

The evaluation team evaluated gross savings for Residential New Construction program homes by drawing a random sample of 65 builder applications and one handpicked platinum (gas and electric) application from PY 2022 participants and recording critical home data, such as square footage, insulation levels, and HVAC efficiencies from HERS certificates. Two platinum projects were originally selected primarily to observe in more detail what characteristics of the home contributed to achieve platinum electric rating, and to include platinum electric projects in the 2022 sample. However, one of the platinum projects contained what the evaluation team deemed to be erroneous or outlying square footage (7,490 sf for a two-bedroom home) in the HERS data and was excluded from the sample. Cadmus modeled program home savings for this sample using the REM/Rate data, then applied the sample's realization rate to the overall deemed program savings to estimate *ex post* program per-unit and program-level savings.

Cadmus developed energy models using REM/Rate V16.3.2 to evaluate the electric and gas savings of the homes built under program requirements and found that electric energy savings were much higher and electric demand savings were lower than the *ex ante* savings. Meanwhile, gas savings were slightly higher than *ex ante* assumed savings.

Cadmus reviewed 66 REM/Rate and Ekotrope-generated HERS reports (none of these reports were for electric only homes, and all 66 were for gas homes). Based on these reports, Cadmus compiled the homes' characteristics, such as insulation levels and square footage, into a database for energy modeling. Table 325 shows the sample of the PY 2022 homes.

TABLE 325. 2022 HERS CERTIFICATE SAMPLE[73]

| NIPSCO FUEL | SAMPLE | PY 2022 PARTICIPATING HOMES |
|---|---|---|
| Electric | 0 | 1 |
| Gas | 66 | 829 |
| Gas & Electric | 5 | 21 |

Table 326 shows the number of homes that participated in the 2022 program year as well as the sample homes that were used for the evaluation in each category.

TABLE 326. 2022 PROGRAM YEAR PARTICIPANTS

| MEASURE | PARTICIPANTS | SAMPLE |
|---|---|---|
| Silver Star Electric (HERS 62-59) | 11 | 2 |
| Silver Star Gas (HERS 62-59) | 606 | 41 |
| Gold Star Electric (HERS 58-57) | 9 | 2 |
| Gold Star Gas (HERS 58-57) | 138 | 11 |
| Platinum Star Electric (HERS <=56) | 2 | 1 |
| Platinum Star Gas (HERS <=56) | 106 | 9 |

Table 327 presents the average home characteristics from the PY 2022 sample homes as found in the HERS certificates the evaluator received. The table shows that electric and gas homes had similar characteristics. All homes in the sample had gas furnaces, although all 12 homes that had electric water heaters were gas homes. No electric homes had tankless water heaters or electric heat pump water heaters. Most of the gas homes had tank water heaters. HERS certificates generated with the Ekotrope modeling software do not provide information about the percentage of efficient lighting in rated homes. Since 65 of the 66 HERS certificates were generated using Ekotrope, the evaluation team did not have sufficient data to estimate the percentage of efficient lightbulbs for the energy models. Instead, the models were updated with the assumption that interior, garage, and exterior lightbulbs in homes built through the program were 100% efficient (100% LED interior, 99% LED/1% fluorescent exterior and garage).

[73] All sampled homes that received electric incentives also received gas incentives. There were a total of 22 electric homes, and 850 gas homes in the 2022 program year. Cadmus calculates precision estimates based on each year's population and sample size, assuming standard variability. Cadmus expected most metrics to be estimated at 90% confidence. Note that we did not calculate confidence and precision for individual metrics.

TABLE 327. 2022 RESIDENTIAL NEW CONSTRUCTION PROGRAM HOME CHARACTERISTICS

| HOME CHARACTERISTIC | ELECTRIC HOMES | GAS HOMES |
|---|---|---|
| Sample Size | 6 | 66 |
| Participants | 22 | 850 |
| Precision at 90% Confidence[2] | 29% | 10% |
| Home Size | 2,790 | 2,845 |
| Ceiling R Value | 45 | 43 |
| Walls R Value | 16 | 16 |
| Basement Wall R Value | 11.4 | 12.5 |
| Windows U Factor[3] | 0.288 | 0.291 |
| Home Tightness ACH50[3] | 3.00 | 3.21 |
| Duct Tightness CFM25/100 sq. ft.[3] | 1.41 | 1.87 |
| Furnace AFUE | 96.4 | 94.9 |
| Air Conditioner SEER | 15.3 | 13.8 |
| Percentage High-Efficiency Lighting | 100% | 100% |
| Gas Water Heat Energy Factor | 0.736 | 0.745 |
| Electric Water Heat Energy Factor | None in Sample | 0.923 |

[1] All values rounded.

[2] Cadmus calculated precision estimates based on each year's population and sample size, assuming standard variability. Cadmus expected most metrics to be estimated at 90% confidence. Note that Cadmus did not calculate confidence and precision for individual metrics.

[3] Lower value represents higher efficiency.

To evaluate electric and gas savings for the participating homes, the evaluation team developed prototype energy models, using the characteristics of the homes documented in the HERS certificates. The models represented typical characteristics of the sampled participant home as they varied by water heater type, foundation type, and nearest weather station. Some assumptions were made about the prototype energy models where the HERS certificates lacked the information necessary to complete the model in REM/Rate. For each prototype these are some of the assumptions made; homes had 2 stories above grade, were single-family detached, had un-insulated slabs for basements, had R-10 sub slab insulation for slab-on-grade homes, had 2x6 16" on center wall framing, and the heating and cooling setpoints assumed at 68 and 78, respectively. These assumptions have an impact on the overall energy consumption of the home but reflect typical construction methods in the industry.

The evaluation team developed eleven prototypes for gas homes and two prototypes for electric homes, reflecting the characteristics of gas home participants and electric home participants. The number of prototypes developed were based on differences in foundation type, water heater fuel, water heater type, and weather station information for both gas and electric homes. The team then developed average weighted therms, kWh, and kW savings based on the number of sampled homes that fit into each prototype. The team then based the program-wide realization rate on this savings estimate versus the weighted ex-ante savings value for the modeled homes.

Table 328 shows the gas prototypes, as well as the modeled savings using the Indiana Statewide Residential Energy Code for baseline home characteristics.

TABLE 328. 2022 RESIDENTIAL NEW CONSTRUCTION PROGRAM GAS PROTOTYPE MODELS

| FOUNDATION TYPE | WATER HEATER FUEL | WATER HEATER TYPE | NEAREST WEATHER STATION | NUMBER OF HOMES | MODELED THERMS SAVINGS |
|---|---|---|---|---|---|
| Conditioned Basement | Electric | Tank | South Bend | 1 | 249 |
| Conditioned Basement | Gas | Tank | South Bend | 23 | 354 |
| Conditioned Basement | Gas | Tankless | South Bend | 9 | 372 |
| Slab on Grade | Electric | Tank | South Bend | 2 | 96 |
| Slab on Grade | Gas | Tank | South Bend | 4 | 91 |
| Conditioned Basement | Electric | Tank | Fort Wayne | 2 | 315 |
| Conditioned Basement | Gas | Tank | Fort Wayne | 5 | 369 |
| Conditioned Basement | Gas | Tankless | Fort Wayne | 1 | 355 |
| Slab on Grade | Electric | Tank | Fort Wayne | 7 | 54 |
| Slab on Grade | Gas | Tank | Fort Wayne | 11 | 129 |
| Slab on Grade | Gas | Tankless | Fort Wayne | 2 | 67 |

Table 329 shows the electric prototypes and modeled savings. As with gas homes, the evaluation team weighted the prototype home savings by the number of homes in the sample and then created a program wide realization rate based on the weighted *ex ante* savings.

TABLE 329. 2022 RESIDENTIAL NEW CONSTRUCTION PROGRAM ELECTRIC PROTOTYPE MODELS

| FOUNDATION TYPE | WATER HEATER FUEL | WATER HEATER TYPE | NEAREST WEATHER STATION | NUMBER OF HOMES | MODELED KWH SAVINGS | MODELED KW SAVINGS |
|---|---|---|---|---|---|---|
| Conditioned Basement | Gas | Tank | South Bend | 4 | 574 | 0.3 |
| Conditioned Basement | Gas | Tankless | South Bend | 1 | 522 | 0.2 |

Table 330 shows the realization rates for therms, kWh, and kW. These realization rates are based on the average weighted evaluated savings, based on the as-built prototype models compared to the weighted *ex ante* savings for those homes. As illustrated in the *ex ante* savings, underestimated therms savings and demand reduction, while overestimating energy savings, compared to modeled results.

TABLE 330. 2022 RESIDENTIAL NEW CONSTRUCTION PROGRAM REALIZATION RATES

| METRIC | SAMPLE SIZE | AVERAGE WEIGHTED EVALUATED SAVINGS OF SAMPLE | AVERAGE WEIGHTED REPORTED (*EX ANTE*) SAVINGS OF SAMPLE | REALIZATION RATE |
|---|---|---|---|---|
| Therms | 66 | 248.30 | 241.20 | 103% |
| kWh | 5 | 563.60 | 191.64 | 294% |
| kW | 5 | 0.280 | 0.444 | 63% |

# APPENDIX B. SECONDARY LITERATURE REVIEW FINDINGS

After reviewing several residential new construction programs across the Midwest and other regions, the evaluation team included eight programs in the benchmarking research, in addition to NIPSCO.

Table 331 lists the eight programs and key metrics for comparison.

TABLE 331. RESIDENTIAL NEW CONSTRUCTION PROGRAMS

| ENTITY | STATE | PROGRAM NAME | PROGRAM YEAR | ENERGY SAVINGS METHODOLOGY | PROGRAM COST | ANNUAL SAVINGS[A] | # HOMES | STACKED INCENTIVES[E] | NTG RATIO |
|---|---|---|---|---|---|---|---|---|---|
| **Midwest** | | | | | | | | | |
| NIPSCO | Indiana | Residential New Construction | 2021 | HERS | Electric: $1,754<br>Gas: $439,210 | 4.00 MWh<br>0.01 MW<br>204,090 therms | Electric: 22<br>Gas: 850 | No | 54% (2021) |
| Focus on Energy | Wisconsin | Residential New Construction offering | 2021 | Counter-factual Home | $1,742,908[b] | 4,300.76 MWh<br>0.96 MW<br>486,326 therms | 2,488 | Yes | 4% |
| CenterPoint[c] | Indiana | Residential New Construction | 2021 | HERS[d] | Electric: $76,348<br>Gas: $559,725 | 144.30 MWh<br>0.06 MW<br>357,931 therms | Electric: 256<br>Gas: 1,660 | No | 57% |
| Consumers Energy | Michigan | New Home Construction | 2021 | HERS/ENERGY STAR | Electric: $651,139<br>Gas: $759,265 | 1,080.00 MWh<br>0.54 MW<br>541,554 therms | ENERGY STAR-certified: 373<br>HERS standard: 897 | Yes | 90%[f] |
| DTE | Michigan | New Home Construction | 2021 | HERS/ENERGY STAR | Electric: $1,100,000<br>Gas: $1,300,000 | 2,431.00 MWh<br>1.44 MW<br>763,364 therms | 1,845 | Yes | 92%[f] |
| Nicor Gas | Illinois | Residential New Construction | 2021 | Prescriptive | $1,035,138 | 645,334 therms | 2,003 | No | 82% |
| Xcel Energy | Minnesota | MN Efficient New Home Construction Product | 2018 | HERS | Total Savings (Gas and Electric): $977,175 | 2,936.733 MWh<br>1.15 MW<br>347,484 Therms | 2,861 | Yes | 79% |
| **Other** | | | | | | | | | |
| PPL Electric Utilities | Pennsylvania | New Homes | 2020-2021 | HERS/ENERGY STAR | N/A | 4,282 MWh<br>0.84 MW | 1,491 | Yes | 16% |
| Xcel Energy | Colorado | ENERGY STAR New Homes | 2020 | HERS/ENERGY STAR | Electric: $935,434<br>Gas: $2,193,149 | 4,350.33 MWh<br>818,920 therms | Electric: 2,397<br>Gas: 4,398 | Yes | 63% |

[a] *Ex post* gross savings.
[b] Incentive spending, not total cost.
[c] The 2020 Indiana Residential Code increased the efficiency of the baseline for the Residential New Construction program, resulting in lower program energy savings. As a result of the lower potential for savings, the program was discontinued at the end of 2021.
[d] CenterPoint Energy provided three incentive tiers: one for Gold Star homes (rating 61 to 62), one for Platinum Star homes (rating 60 or less), and one for Platinum Star Plus homes (rating 60 or less, including installation of a natural gas tankless water heater).
[e] Stacked incentives indicates there are a variety of ways projects can be incentivized and incentives can be combined, or "stacked," to increase the value.
[f] The NTG ratios for Michigan utilities is stipulated for the entire portfolio. These values are not specific to the residential new construction program.

## PROGRAM DESIGN

There are many residential new construction program designs, all with their own specific nuances and rules. Most of the programs we reviewed use some mix of the Home Energy Rating System (HERS) and ENERGY STAR appliance standards to determine energy savings and rebate levels. Important to note is that these programs can use both systems at the same time and sometimes interchangeably. A third method of measuring savings is using the counterfactual home as a baseline. Finally, some programs simply rebate high-efficiency equipment on a prescriptive basis for their new home programs. Table 332 describes each of these methods of measuring savings.

TABLE 332. METHODS FOR MEASURING RESIDENTIAL NEW CONSTRUCTION SAVINGS

| RATING/BENCHMARKING METHODOLOGY | DESCRIPTION |
|---|---|
| HERS | Residential Energy Services Network, or RESNET, developed the HERS Index to gauge how energy-efficient a new home is. A HERS score of 100 represents the national median energy use for a home. The HERS Index applies specifically to new construction or down-to-the-foundation renovations of an existing home. Builders use the HERS Index score to specify the minimum efficiency of new home construction before a Certificate of Occupancy is issued. A HERS rater must test the house and perform and document inspections. These inspections during the construction process ensure the house is built as designed and assess things such as building envelop air leaks, leakage from HVAC distribution ducts, effectiveness of the insulation, the home's orientation and the number and kind of windows. A home with a lower HERS Index score will save energy and money over a standard new home.[74] |
| ENERGY STAR | ENERGY STAR certification for a new home means not only that it is more efficient, but that it is designed and built to standards well above most other homes and apartments on the market and that it has undergone a process of inspections, testing, and verification to meet strict requirements set by Environmental Protection Agency.[75] All programs in this benchmark report are in states required to meet the National Version 3.1 as of January 1, 2023.[76] |
| Counter-Factual Home | Rather than using a residential building code as the driver for the baseline construction, a counterfactual home can be used as a baseline. The counterfactual home is determined by conducting interviews with a group of contractors to determine what their baseline for building would be if not for the program standards. The counterfactual baseline can more accurately reflect actual market conditions. |
| Prescriptive | Rebates are offered for the installation of high-efficiency equipment on a prescriptive, per-unit basis. |

[74]Realtor.com. December 13, 2022. "What Is a HERS Index? Putting a Number on Energy Efficiency. https://www.realtor.com/advice/buy/what-is-a-hers-index/.

[75] ENERGY STAR.gov. Accessed February 19, 2023. "ENERGY STAR Certifications." ENERGY STAR Certifications | ENERGY STAR.

[76] ENERGY STAR.gov. Accessed February 19, 2023. "ENERGY STAR Single-Family New Homes National Program Requirements, Version 3.1 (Rev. 12)." ENERGY STAR Single-Family New Homes National Program Requirements, Version 3.1 (Rev. 12).

Incentives may vary depending on the organization, and most of the raters are trained in both HERS and ENERGY STAR. A home may have certain rebates offered due to the HERS rating and then gain additional rebates for an ENERGY STAR-certified home or the prescriptive addition of ENERGY STAR appliances. NIPSCO's Residential New Construction program exclusively offers a rebate per HERS rating tier. Trained inspectors perform HERS assessments to evaluate different aspects of the building, such as light fixtures, HVAC systems, and home insulation, to determine the home's efficiency rating.

Table 333 provides a comparison of several utilities' incentives and rebate structures for the current 2023 program year.

TABLE 333. 2023 RESIDENTIAL NEW CONSTRUCTION INCENTIVES

| ENTITY | STATE | PROGRAM NAME | CURRENT PROGRAM YEAR INCENTIVES | |
|---|---|---|---|---|
| NIPSCO [a] | Indiana | Residential New Construction | Platinum Star (HERS ≤ 56) | \$510 – Electric & Gas Service<br>\$60 – Electric Service Only<br>\$450 – Gas Service Only |
| | | | Gold Star (HERS 57-58) | \$450 – Electric & Gas Service<br>\$50 – Electric Service Only<br>\$400 – Gas Service Only |
| | | | Silver Star (HERS 59-62) | \$390 – Electric & Gas Service<br>\$40 – Electric Service Only<br>\$350 – Gas Service Only |
| Focus on Energy [b] | Wisconsin | Residential New Construction offering | Core 30% Savings Over Code | \$45/MMBtu |
| | | | ENERGY STAR | \$50/MMBtu |
| | | | Zero Energy Ready | \$60/MMBtu |
| CenterPoint | Indiana | Residential New Construction | N/A – Program Discontinued | |
| Consumers Energy [c] | Michigan | New Home Construction | ENERGY STAR and HERS ≤ 40 | \$4,000 – Electric Service Only w/HP or Geothermal<br>\$3,500 – Electric & Gas Service w/AC<br>\$2,800 – Gas Service Only |
| | | | ENERGY STAR and HERS 40-45 | \$3,000 – Electric Service Only w/HP/Geothermal<br>\$2,750 – Electric & Gas Service w/AC<br>\$2,100 – Gas Service Only |
| | | | ENERGY STAR and HERS ≤ 56 | \$2,000 – Electric Service Only w/HP/Geothermal<br>\$2,000 – Electric & Gas Service w/AC<br>\$1,400 – Gas Service Only<br>\$600 – Electric Service Only<br>\$1,400 – Electric & Gas Service without AC |

| ENTITY | STATE | PROGRAM NAME | CURRENT PROGRAM YEAR INCENTIVES | | | |
|---|---|---|---|---|---|---|
| | | | HERS ≤ 56 | $1,000 – Electric Service Only w/HP/Geothermal<br>$1,000 – Electric & Gas Service w/AC<br>$700 – Gas Service Only<br>$300 – Electric Service Only<br>$700 – Electric & Gas Service without AC | | |
| | | | ENERGY STAR and HERS ≤ 56 | $1,000 – Electric & Gas Service w/AC<br>$700 – Gas Service Only<br>$300 – Electric Service Only<br>$700 – Electric & Gas Service without AC | | |
| PPL Electric Utilities [d] | Pennsylvania | New Homes | 15% above code* | $0.30 per kWh | | |
| | | | 15% above code* + ENERGY STAR home | $0.35 per kWh | | |
| | | | *Homes must be at least 15% more energy efficient than current codes and federal standards (2015 IECC) require, as documented by a HERS rating using REM/Rate software; builders can earn up to $4,500 per home. | | | |
| DTE [e] | Michigan | New Home Construction | HERS ≤ 60*[Δ†] | $1,500 – Electric Service Only<br>$2,100 – Electric & Gas Service<br>$1,300 – Gas Service Only | | |
| | | | HERS ≤ 45 and ccHP as primary heating/cooling equipment* [Δ†] | $3,500 – Electric Service Only<br>$3,500 – Electric & Gas Service | | |
| | | | *ENERGY STAR Bonus | $350 – Energy & Gas Service<br>$300 – Electric Service Only | | |
| | | | [Δ] Performance Incentive | $10/MCF natural gas saved<br>$0.25/kWh of electricity saved | | |
| | | | [†]Supplementary Incentives | | Silver | Gold | Platinum |
| | | | | Furnace | $200 | $250 | |
| | | | | ASHP | | $750 | $850 |
| | | | | GSHP | | $800 | $900 |
| | | | | Infiltration | $125 | $200 | $275 |
| | | | | Gas WH | $75 | $100 | |
| | | | | HPWH | | $750 | $850 |

| ENTITY | STATE | PROGRAM NAME | CURRENT PROGRAM YEAR INCENTIVES | | | |
|---|---|---|---|---|---|---|
| | | | | Windows | $6.70/SF | $10/SF |
| | | | | Ceiling Insulation | $500 | $600 |
| | | | | Wall Insulation | | $700 |
| | | | | Slab Insulation | | $700 |
| | | | | Lighting | | $100 |
| Nicor Gas [f] | Illinois | Residential New Construction | Prescriptive Measure Package | $115 – Advanced thermostat, 95+ AFUE furnace or boiler | | |
| | | | Base Measure Package | $115 – Duct sealing (2 CFM per 100 SF), Air sealing (3.0 ACH50), 92+ AFUE furnace or boiler | | |
| | | | High-efficiency Measure Package | $145 – Duct sealing (2 CFM per 100 SF), Air sealing (3.0 ACH50), 95+ AFUE furnace or boiler | | |
| | | | Thermostat add-on (base and high-efficiency only) | $25 – Advanced thermostat | | |
| | | | Verifier fee | $75 – collect required data from the builder and upload to program implementer's online portal | | |

[a] Residential New Construction Program - NIPSCO, retrieved March 8, 2023.
[b] Builders | Focus on Energy, retrieved March 8, 2023. Incentive information available to Participating Builders.
[c] 34410_CE_NHC_Rebate_Chart_v07.pdf (consumersenergytradeally.com), retrieved March 8, 2023. Table 3 shows Single-family Home builder incentives. Consumers Energy also offers New Construction incentives for townhomes/duplexes, PV/EV Ready, installed EV chargers, and ACH50.
[d] Builder Incentives – PPL New Homes Program (pplelectricnewhomes.com), retrieved March 8, 2023.
[e] 37937_dte_nh_rebate_incentive_chart_v2_web_release_0.pdf (michiganrebates.com), retrieved March 8, 2023. Refer to link for details on Supplementary Incentive efficiency requirements.
[f] Contractor Circle for Builders | Nicor Gas, retrieved March 8, 2023. Table 3 shows Single-family Home builder incentives. Nicor Gas has different ACH50 and CFM requirements for townhomes.

## PROGRAM IMPLEMENTATION PRACTICES

In Pennsylvania, PPL Electric Utilities offered the New Homes program to educate customers and the construction industry on energy-saving building solutions. They did this by offering up to $2,500 in incentives to builders with homes that saved at least 15% above the residential building code (2009 IECC). PPL Electric Utilities offered an additional $0.05 per kilowatt-hour saved over code if the home also had an ENERGY STAR-rated appliance. The base incentive for HERS and the additional rebates for ENERGY STAR appliances can be obtained at the same time.

Consumers Energy's New Home Construction program in Michigan tries to encourage participation from builders who do not regularly participate in energy efficiency programs. The program offers incentive tiers to reduce the upfront costs of construction and to provide educational material to builders and homeowners. Consumers Energy's 2022-2025 Energy and Waste Reduction Plan proposes incentives for both HERS ratings and ENERGY STAR that go up from $25 to $4,000. These incentives can be stacked with additional incentives if ENERGY STAR appliances are installed in the homes. Respondents to a 2021 participating homeowner survey provided higher average satisfaction ratings for ENERGY STAR homes than for HERS homes regarding the overall home, energy costs, and level of comfort. Consumers Energy also offers add-on incentives to build homes that are photovoltaic-ready and electric vehicle charger-ready or installed.

Neighboring Michigan utility, DTE, requires a HERS score of 60 or lower to be eligible for its New Home Construction program. After meeting the HERS prerequisite (incentives up to $1,500 for a DTE electric account and $1,300 for a DTE gas account, $2,100 combined), builders are eligible for performance-based and tiered incentives for specific prescriptive measures, including furnaces, water heaters, and air sealing techniques. Builders that construct ENERGY STAR-rated homes are eligible for an additional bonus incentive of $300 to $350. In 2021, the program also added increased incentives for homes built with a HERS score of 45 or less and that use a cold climate heat pump as the primary heating and cooling equipment. Additionally, DTE added welcome kits for the new homeowners, consisting of information highlighting the energy efficiency of their new home, maintenance tips, information about DTE's Insight app, as well as an advanced power strip and LED night light to help save additional energy.

The tiered incentive system has proven beneficial for most of the utility companies running energy efficiency programs. Xcel Energy, which runs programs in Colorado and Minnesota, reported that over half of the participants chose to provide improvements that were above the minimum tier to get higher incentives. Many also reported that their main motivation was to achieve an ENERGY STAR certification by using properly rated appliances.

Rather than using Wisconsin's residential building code as the driver for the baseline construction, Focus on Energy instead uses a counterfactual home as a baseline. The counterfactual home is determined by conducting interviews with a group of contractors to determine what their baseline for building would be if not for the Focus on Energy standards. According to the 2021 Focus on Energy Evaluation report (Cadmus, May 2022), the counter-factual baseline is derived from a market characterization study, accurately reflecting actual market conditions.[77] Focus on Energy's fixed incentives range from $150, for a home that is 30% more efficient than code, to $1,000 for a home that is 100% more efficient than code. They also offer bonus incentives for things such as 98% efficient furnaces, heat pump water heaters, and continuous exterior insulation. Prescriptive HVAC rebates are given independent of HERS scores. Focus on Energy has a higher incentive for electric heating and cooling than gas heating. The average rebate exceeded $700 per home.

[77] According to this report, Focus on Energy expected the market characterization study to be updated to provide new baseline characteristics in 2022.

## BARRIERS TO PARTICIPATION

Research found several market barriers to increased new construction program participation. In most cases, barriers were common from program to program. Three themes emerged as leading barriers to participation: increased cost of efficiency, lack of training, and program administrative burdens. Table 334 highlights program barriers identified in several utilities' evaluation reports.

TABLE 334. BARRIERS TO PARTICIPATION

| PROGRAM | BARRIER | BARRIER DESCRIPTION |
|---|---|---|
| Xcel, CO | Cost | Participating builders and HERS raters indicated that costs remain a barrier to energy-efficient building practices, specifically to including electrification technologies in the new home. Both participating builders and HERS raters recommended including more prescriptive measures and pointed to client cost concerns as the primary barrier to achieving above-code savings. |
| | Administrative Burden | HERS raters struggled with product administrative requirements, citing data entry frustrations and time-consuming edits with the implementer's online platform, and indicating the incentive is insufficient to cover administrative tasks. |
| | Training | Homeowners indicated their desire for improved training from their builders on their energy-efficient homes. Homeowners felt as though builders were not knowledgeable enough about energy efficiency topics such as energy efficient equipment and materials, how to properly maintain their new equipment, and how to properly use the equipment to maximize savings. |
| Focus on Energy, WI | Scarcity of Inspectors | Scheduling with a home inspector/rater can be difficult because they are in short supply. There are many home inspectors, but very few can certify homes. The program administrator also said that many inspectors are nearing retirement age. |
| Xcel, MN | Training | Homeowners reported they would like more training on their energy-efficient equipment and builders reported they would appreciate additional support from the utility to train homeowners.<br>Some builders were confused about the incentive structures; some did not understand how to reach higher rebate tiers and some were not aware of the existence of prescriptive rebates. |
| Consumers Energy | Cost | Higher upfront costs of construction and a lack of confidence among consumers that the higher initial investment will be recouped from lower energy costs. |
| | Awareness | Lack of awareness among homeowners of the benefits of energy-efficient homes.<br>Lack of awareness among builders and homeowners regarding energy-efficient technologies and building practices. |

## ENERGY SAVING OPPORTUNITIES

Recommendations from various program evaluations, as well as insights from filed future plans, identify several opportunities to drive savings out of residential new construction programs going forward.

According to the Consumers Energy 2021 Residential New Construction program evaluation, the renovations and additions market is expected to continue growing. High demand and cost for new housing will cause homeowners to stay in their homes longer and thus pursue renovation or additional projects. All home addition projects offer opportunities for energy savings by installing efficient building shell measures like insulation and windows, as well as targeting upgrades to HVAC, water heating, and appliances. Contractors involved in the renovations and additions market are often different from those serving new homes. Intentionally targeting these market actors with a program and incentives that yield larger, longer-lasting savings than typical rebate programs could provide additional savings opportunities.

Another Consumers Energy insight is around manufactured homes. Manufactured homes are subject to federal standards. Manufactured homes tend to have higher energy-use intensity and residents of non-ENERGY STAR–certified manufactured homes are more likely to experience weaker energy performance, such as inefficient appliances and HVAC systems, and greater air leakage. Because manufactured homes are less efficient and not subject to local codes, there may be a large savings opportunity for efficient manufactured homes. Manufactured home program administrators typically offer homeowner rebates when the homeowner applies after purchase. In addition, these programs often require certifications of compliance and occupancy after the manufactured home is installed and inspected. Some programs offer an additional $1,000 incentive to encourage homeowners to recycle an older mobile home. Ensuring that retailers offer ENERGY STAR models is an important element of an ENERGY STAR manufactured home program. This can be facilitated by providing retailer incentives when they sell an ENERGY STAR manufactured home.

Stacking incentives is a common theme among many of the benchmarked utilities. Programs that offered stacked incentives to builders and customers saw higher electric savings on a per-home basis than NIPSCO's program. Offering prescriptive incentives for high-efficiency HVAC, water heating, and appliance choices, over and above a HERS incentive or an ENERGY STAR incentive, provides increased opportunity to capture savings and gives builders alternatives and variety in how they participate in the program. Consumers Energy and PPL Electric Utilities both proposed plans with increasing savings and increasing incentives, retaining their multitiered program designs.

### CONCLUSION 1: THERE ARE SEVERAL WAYS TO DESIGN ELIGIBILITY AND MEASURE SAVINGS FOR RESIDENTIAL NEW CONSTRUCTION PROGRAMS, WITH STACKED INCENTIVES AND PRESCRIPTIVE MEASURES DRIVING HIGHER SAVINGS.

Programs that offered stacked incentives to builders and customers saw higher electric savings on a per-home basis than NIPSCO's program. Additionally, offering several tiers of rebates and including a prescriptive option provides multiple ways for builders and homeowners to engage in the program.

## CONCLUSION 2: RESIDENTIAL NEW CONSTRUCTION PROGRAM ADD-ONS CAN DRIVE ADDITIONAL UTILITY PROGRAM INITIATIVES.

In addition to capturing savings associated with the construction of new homes, utilities can leverage their residential new construction program to increase the number and type of rebates offered and enhance customer satisfaction initiatives and ways to engage with the utility. Providing incentives for building homes with electric vehicle chargers or photovoltaic-ready roofs, or offering bonus incentives for cold climate heat pumps, can add value and additional ways for the customer to engage with the utility. Including welcome kits for new homeowners, consisting of information highlighting the energy efficiency of their new home, maintenance tips, information about other utility programs, as well as energy-efficient products like advanced power strips, will enhance utility program attribution and keep energy efficiency top of mind for customers.

## CONCLUSION 3: TRAINING OF ALL MARKET ACTORS IS CRITICAL TO A RESIDENTIAL NEW CONSTRUCTION PROGRAM'S SUCCESS.

Residential new construction programs are complex to understand. Training builders to understand the benefits of energy-efficient new construction, as well as how to speak to the customer about it, is paramount to overcoming barriers like higher initial costs. Administrative burdens should be minimized for raters, training should be provided to get new raters certified, and they should be compensated commensurate with the effort to participate in the program. Homeowners need to understand their new home's efficient equipment and how to operate and maintain it to optimize performance over the long run.

## CONCLUSION 4: NEW SAVINGS OPPORTUNITIES MAY EXIST BY EXPANDING RESIDENTIAL NEW CONSTRUCTION PROGRAMS TO INCLUDE RENOVATIONS, ADDITIONS, AND MANUFACTURED HOMES.

High demand and cost for new housing will cause homeowners to stay in their homes longer and thus pursue renovation or home additions, offering utilities the opportunity to capture savings associated with building shell measures, HVAC, water heating, and appliances. Rebating ENERGY STAR–certified manufactured homes is a way to increase the market share of efficient manufactured homes and engage both retailers and homeowners in the utility program.

# LITERATURE REVIEW REFERENCES


Cadmus. June 1, 2022. New Home Construction Program Annual Evaluation Report: 2021 Program Year. Prepared for Consumers Energy. https://mi-psc.force.com/sfc/servlet.shepherd/version/download/0688y0000042thDAAQ

Cadmus. May 20, 2022. Focus on Energy Calendar Year 2021 Evaluation Report. WI Focus on Energy CY 2021 Volume II (s3.us-east-1.amazonaws.com)

Cadmus. April 8, 2022. 2021 CenterPoint Energy Demand-Side Management Portfolio Electric Evaluation Key Findings, Conclusions, and Recommendations Memo. https://builder.vectren.com/assets/downloads/planning/irp/IRP-2021-vectren-electric-dsm-evaluation.pdf

Cadmus. April 8, 2022. 2021 CenterPoint Energy Demand-Side Management Portfolio Natural Gas Evaluation Key Findings, Conclusions, and Recommendations Memo. https://builder.vectren.com/assets/downloads/planning/irp/IRP-2021-vectren-electric-dsm-evaluation.pdf

Cadmus. November 15, 2021. PPL Electric Utilities Annual Report to the Pennsylvania Public Utility Commission. https://www.pplelectric.com/-/media/PPLElectric/Save-Energy-and-Money/Docs/Act129_Phase3/PPLPY12AnnualReport20211115FINAL.ashx

Consumers Energy. August 2, 2021. Consumers Energy 2022-2025 Energy Waste Reduction Plan. https://mi-psc.force.com/sfc/servlet.shepherd/version/download/068t000000RUvuRAAT

DTE. 2023 New Home Construction Builder Program Participation Application and Terms and Conditions. 37937_dte_nh_builder_part_agree_v4_web_release_fillable.pdf (michiganrebates.com).

DTE Electric and Gas. July 1, 2022. 2021 Annual Report. https://insights.esource.com/documents/DTE%20Electric%20and%20Gas%20-%207.1.2022%20-%202021%20Annual%20Report%20-%20U-21206.pdf#page=72)

EMI Consulting. February 21, 2020. MN Efficient New Home Construction Product Impact and Process Evaluation. https://dsmevaluations.esource.com/system/files/evaluations/2020-efficient-new-home-construction-evaluation.pdf

Guidehouse. May 10, 2022. Residential New Construction Program Impact Evaluation Report. Prepared for Nicor Gas. https://www.ilsag.info/wp-content/uploads/Nicor-Gas-RNC-2021-Impact-Evaluation-Report-2022-05-10-Final.pdf

Nicor Gas. February 2, 2022. 2021 Quarterly Report, Fourth Quarter. https://insights.esource.com/documents/Nicor%20Gas%20-%202.22.2022%20-%202021%20Q4%20Report%20-%2017-0310.pdf#page=26)

PPL Electric Utilities Corporation. Revised May 24, 2021. Energy Efficiency and Conservation Plan Act 129 Phase IV. Docket No. M-2020-3020824. https://www.puc.pa.gov/pcdocs/1705055.pdf

TRC. January 28, 2022. Colorado ENERGY STAR New Homes Product Impact & Process Evaluation. Prepared for Xcel Energy. https://dsmevaluations.esource.com/content/2021-colorado-energy-star-new-homes-product-impact-process-evaluation

# APPENDIX 9: SCHOOL EDUCATION PROGRAM

## ALGORITHMS AND ASSUMPTIONS

This appendix contains the assumptions used in electric savings, demand reduction, and gas savings algorithms for the measures within the School Education program. The team examined each assumption behind the algorithms to capture savings and compared it against the Illinois TRM (v10.0) and the Indiana TRM (v2.2), as well as other state and industry approaches. Detailed information on the analysis and supporting assumptions for the following School Education program measures are included within this appendix:

- LED candelabras
- Kitchen faucet aerators
- Bathroom faucet aerators
- Low-flow showerheads
- LED Nightlights
- Advanced Power Strips
- Light Switch Gaskets
- Power Outlet Gaskets

Table 335 lists the assumptions of the *ex post* per-measure savings.

TABLE 335. 2022 SCHOOL EDUCATION PROGRAM MEASURES

| MEASURE | REVIEWED ASSUMPTIONS |
|---|---|
| LED Candelabra | New and baseline wattages, hours of use, waste heat factors, coincidence factor |
| Kitchen Faucet Aerator | New and baseline flow rates, people per house, minutes of use per day, faucets per home, drain factor, water temperatures, water heater fuel type and efficiency, coincidence factor |
| Bathroom Faucet Aerator | New and baseline flow rates, people per house, minutes of use per day, faucets per home, drain factor, water temperatures, water heater fuel type and efficiency, coincidence factor |
| Low-Flow Showerhead | New and baseline flow rates, people per house, minutes of use per day, showerheads per home, water temperatures, water heater fuel type and efficiency, coincidence factor |
| LED Nightlights | New and baseline wattages, hours of use |
| Advanced Power Strips | Deemed savings, hours of use, coincidence factor |
| Light Switch Gaskets | Deemed savings, leakage reduction, heating system fuel type and efficiency, coincidence factor |
| Power Outlet Gaskets | Deemed savings, leakage reduction, heating system fuel type and efficiency, coincidence factor |

The algorithms and assumptions the evaluation team used to calculate *ex post* savings for these measures follow.

## LED CANDELABRAS

The team used the following equations to calculate electric energy and peak demand savings, as well as natural gas energy penalties, for LEDs.

$$kWh\ savings\ per\ lamp = \frac{(WattsBase - WattsEE) * Hours * (1 + WHFe)}{1{,}000} * ISR$$

$$kW\ reduction\ per\ lamp = \frac{(WattsBase - WattsEE) * CF * (1 + WHFd)}{1{,}000} * ISR$$

$$therm\ savings\ per\ lamp = \frac{(WattsBase - WattsEE) * Hours * WHFg * 10}{1{,}000} * ISR$$

Where:

| | | |
|---|---|---|
| WattsBase | = | Wattage of the bulb being replaced, W |
| WattsEE | = | Wattage of the LED bulb, W |
| Hours | = | Average annual hours of use, hours |
| WHFe | = | Waste heat factor for energy to account for HVAC interactions with lighting |
| WHFd | = | Waste heat factor for demand to account for HVAC interactions with lighting |
| WHFg | = | Heating factor, or percentage of lighting savings that must be replaced by heating system. |
| CF | = | Summer peak coincidence factor |
| 1,000 | = | Constant to convert W to kW |
| 10 | = | Constant to convert MMBtuh to Therms |
| ISR | = | In-service rate |

Table 336 lists the input assumptions and source of each assumption for the LED candelabra measure savings calculations.

TABLE 336. *EX POST* VARIABLE ASSUMPTIONS FOR LED CANDELABRAS

| INPUT | VALUE | SOURCE |
|---|---|---|
| WattsBase | 29 | NIPSCO 2022 HomeLife survey |
| WattsEE | 5 | Program data |
| Hours | 763 | Illinois TRM (v10.0) |
| WHFe | -0.070 | Indiana TRM (v2.2), South Bend value |
| WHFd | 0.038 | Indiana TRM (v2.2), South Bend value |
| WHFg | -0.0019 | Indiana TRM (v2.2), South Bend value |
| CF | 0.11 | Indiana TRM (v2.2) |
| ISR | 61% | NIPSCO 2022 HomeLife Calculator survey |

Table 337 provides the survey findings used to calculate the LED candelabra measure.

TABLE 337. *EX POST* BASELINE WATTAGE ASSUMPTIONS FOR LED CANDELABRAS*

| BULB TYPE | BASELINE WATTAGE | FREQUENCY | PERCENT |
|---|---|---|---|
| Incandescent | 40 | 61 | 69% |
| Halogen** | 30 | 0 | 0% |
| CFL | 7 | 8 | 9% |
| LED | 5 | 19 | 22% |
| Total | - | 88 | 100% |
| Weighted Baseline | 29 | | |

* Source: 2022 HomeLife Calculator participant survey
**HomeLife Calculator survey results indicated six instances of LED candelabras replacing halogen candelabras. Halogen candelabras are rarely used in the residential sectors, so the evaluation team assigned these responses as incandescent bulbs when calculating the weighted baseline.

## KITCHEN AND BATHROOM FAUCET AERATORS

The team used the following equations to calculate electric energy and peak demand savings, as well as natural gas energy savings, for kitchen and bathroom aerators:

$$kWh\ savings = \%ElectricDHW * (\mathrm{GPM_{base}} * \mathrm{L_{base}} - \mathrm{GPM_{low}} * \mathrm{L_{low}}) * \mathrm{Household} * 365.25 * \frac{\mathrm{DF}}{\mathrm{FPH}} * \mathrm{EPG\_electric} * \mathrm{ISR}$$

$$EPG_{electric} = 8.33 * 1.0 * \frac{\mathrm{WaterTemp} - \mathrm{SupplyTemp}}{\mathrm{RE_{electric}} * 3412}$$

$$kW\ reduction = \frac{\Delta kWh}{Hours} * CF$$

$$Hours = GPM_{base} * L_{base} * \frac{Household}{FPH} * 365.25 * DF * \frac{\%HotWater}{GPH}$$

$$therm\ savings = \%GasDHW * (\mathrm{GPM_{base}} * \mathrm{L_{base}} - \mathrm{GPM_{low}} * \mathrm{L_{low}}) * \mathrm{Household} * 365.25 * \frac{\mathrm{DF}}{\mathrm{FPH}} * \mathrm{EPG\_gas} * \mathrm{ISR}$$

$$EPG_{gas} = 8.33 * 1.0 * \frac{\mathrm{WaterTemp} - \mathrm{SupplyTemp}}{\mathrm{RE_{gas}} * 100{,}000}$$

Where:

GPM_base = Gallons per minute of baseline faucet aerator, gpm

GPM_low = Gallons per minute of low-flow faucet aerator, gpm
L_base = Average minutes of baseline faucet use per person per day, minutes
L_low = Average minutes of low-flow faucet use per person per day, minutes
Household = Average number of people per household
DF = Percentage of water flowing down the drain
FPH = Average number of faucets per household
WaterTemp = Assumed temperature of mixed water, °F
SupplyTemp = Assumed temperature of water entering the house, °F
RE_electric = Recovery efficiency of electric water heater
RE_gas = Recovery efficiency of gas water heater
CF = Summer peak coincidence factor
8.33 = Specific weight of water, lb./gallon
1.0 = Heat capacity of water, Btu/lb.-°F
3,412 = Constant to convert Btu to kWh
365.25 = Days per year
100,000 = Constant to convert Btu to therms
ISR = In-service rate
%ElectricDHW = Percentage of electric water heaters
%GasDHW = Percentage of gas water heaters

TABLE 338 lists the input assumptions and source of each assumption for the kitchen and bathroom faucet aerator measure savings calculations.

TABLE 338. *EX POST* VARIABLE ASSUMPTIONS FOR KITCHEN AND BATHROOM FAUCET AERATORS

| INPUT | KITCHEN VALUE | BATHROOM VALUE | SOURCE |
|---|---|---|---|
| GPM_base | 1.63 | 1.53 | Illinois TRM (v10.0) |
| GPM_low | 0.94 | 0.94 | Illinois TRM (v10.0) |
| L_base | 4.5 | 1.6 | Illinois TRM (v10.0) |
| L_low | 4.5 | 1.6 | Illinois TRM (v10.0) |
| Household | 4.88 | 4.88 | NIPSCO 2022 HEW |
| DF | 0.75 | 0.9 | Illinois TRM (v10.0) |
| FPH | 1 | 2.5 | NIPSCO 2022 HEW |
| WaterTemp | 93 | 86 | Illinois TRM (v10.0) |
| SupplyTemp | 57.4 | 57.4 | Indiana TRM (v2.2), South Bend value |
| RE_electric | 0.98 | 0.98 | Illinois TRM (v10.0) |
| RE_gas | 0.78 | 0.78 | Illinois TRM (v10.0) |
| CF | 0.0033 | 0.0012 | Indiana TRM (v2.2) |
| ISR | 35% | 28% | NIPSCO 2021 School Education evaluation |
| %ElectricDHW | 20% | 20% | NIPSCO 2022 HEW |
| %GasDHW | 65% | 65% | NIPSCO 2022 HEW |

## LOW-FLOW SHOWERHEADS

The team used the following equations to calculate electric energy and peak demand savings, as well as natural gas energy savings, for low-flow showerheads:

$$kWh\ savings = \%ElectricDHW * (\mathrm{GPM_{base}} * \mathrm{L_{base}} - \mathrm{GPM_{low}} * \mathrm{L_{low}}) * 365.25 * \mathrm{SPCD} * \frac{\mathrm{Household}}{\mathrm{SPH}} * \mathrm{EPG\_electric} * \mathrm{ISR}$$

$$EPG_{electric} = 8.33 * 1.0 * \frac{\mathrm{ShowerTemp} - \mathrm{SupplyTemp}}{\mathrm{RE_{electric}} * 3412}$$

$$kW\ reduction = \frac{\Delta kWh}{Hours} * CF$$

$$Hours = GPM_{base} * L_{base} * Household * SPCD * 365.25 * \frac{\%HotWater}{GPH}$$

$$therm\ savings = \%GasDHW * (\mathrm{GPM_{base}} * \mathrm{L_{base}} - \mathrm{GPM_{low}} * \mathrm{L_{low}}) * 365.25 * \mathrm{SPCD} * \frac{\mathrm{Household}}{\mathrm{SPH}} * \mathrm{EPG\_gas} * \mathrm{ISR}$$

$$EPG_{gas} = 8.33 * 1.0 * \frac{\mathrm{ShowerTemp} - \mathrm{SupplyTemp}}{\mathrm{RE_{gas}} * 100{,}000}$$

Where:

| | |
|---|---|
| GPM_base | = Gallons per minute of baseline showerhead, gpm |
| GPM_low | = Gallons per minute of low-flow showerhead, gpm |
| L_base | = Average shower duration with baseline showerhead, minutes |
| L_low | = Average shower duration with low-flow showerhead, minutes |
| Household | = Average number of people per household |
| SPCD | = Showers per person per day |
| SPH | = Average number of showerheads per household |
| ShowerTemp | = Assumed temperature of mixed water, °F |
| SupplyTemp | = Assumed temperature of water entering the house, °F |
| RE_electric | = Recovery efficiency of electric water heater |
| RE_gas | = Recovery efficiency of gas water heater |
| CF | = Summer peak coincidence factor |
| 8.33 | = Specific weight of water, lb./gallon |
| 1.0 | = Heat capacity of water, Btu/lb.-°F |
| 3,412 | = Constant to convert Btu to kWh |

| | |
|---|---|
| 365.25 | = Days per year |
| 100,000 | = Constant to convert Btu to therms |
| ISR | = In-service rate |
| %ElectricDHW | = Percentage of electric water heaters |
| %GasDHW | = Percentage of gas water heaters |

TABLE 339 lists the input assumptions and source of each assumption for the low-flow showerhead measure savings calculations.

TABLE 339. *EX POST* VARIABLE ASSUMPTIONS FOR LOW-FLOW SHOWERHEADS

| INPUT | VALUE | SOURCE |
|---|---|---|
| GPM_base | 2.35 | Illinois TRM (v10.0) |
| GPM_low | 1.5 | Program Data |
| L_base | 7.8 | Illinois TRM (v10.0) |
| L_low | 7.8 | Illinois TRM (v10.0) |
| Household | 4.88 | NIPSCO 2022 HEW |
| SPCD | 0.6 | Illinois TRM (v10.0) |
| SPH | 1.99 | NIPSCO 2022 HEW |
| ShowerTemp | 101 | Illinois TRM (v10.0) |
| SupplyTemp | 57.4 | Indiana TRM (v2.2), South Bend value |
| RE_electric | 0.98 | Illinois TRM (v10.0) |
| RE_gas | 0.78 | Illinois TRM (v10.0) |
| CF | 0.0023 | Indiana TRM (v2.2) |
| ISR | 30% | NIPSCO 2021 School Education evaluation |
| %ElectricDHW | 20% | NIPSCO 2022 HEW |
| %GasDHW | 65% | NIPSCO 2022 HEW |

## NIGHTLIGHTS

The team used the following equation to calculate electric energy savings for LED nightlights:

$$kWh\ savings = \frac{(WattsBase - \mathrm{WattsEE}) * IRF * \ Hours * ISR}{1{,}000}$$

Where:

| | | |
|---|---|---|
| WattsBase | = | Wattage of the bulb being replaced, W |
| WattsEE | = | Wattage of the LED bulb, W |
| Hours | = | Average annual hours of use, hours |
| ISR | = | In-service rate |
| 1,000 | = | Constant to convert W to kW |
| IRF | = | Incandescent replacement factor representing the percentage of LED nightlights that replaced incandescent and halogen nightlights. |

TABLE 340 lists the input assumptions and source of each assumption for the nightlights measure savings calculations.

TABLE 340. *EX POST* VARIABLE ASSUMPTIONS FOR LED NIGHTLIGHTS

| INPUT | VALUE | SOURCE |
|---|---|---|
| WattsBase | 7 | Illinois TRM (v10.0) |
| WattsEE | 0.33 | Program data |
| Hours | 4,380 | Illinois TRM (v10.0) |
| IRF | 9% | NIPSCO 2022 HEW |
| ISR | 70% | NIPSCO 2021 School Program evaluation |

## ADVANCED POWER STRIPS

The team used the following equation to calculate electric energy savings for advanced power strips:

$$kWh\ savings = \text{kWh} * \text{ISR}$$

$$kW\ reduction = \frac{\text{kWh savings}}{Hours} * \text{CF}$$

Where:

kWh = Deemed savings for a tier 1, 7-plug unit
ISR = In-service rate
Hours = Annual hours controlled standby loads are turned off by the advanced power strip
CF = Summer peak coincidence factor

Table 341 lists the input assumptions and source of each assumption for the advanced power strips measure savings calculations.

TABLE 341. *EX POST* VARIABLE ASSUMPTIONS FOR ADVANCED POWER STRIPS

| INPUT | VALUE | SOURCE |
|---|---|---|
| kWh | 103 | Illinois TRM (v10.0) |
| ISR | 81% | NIPSCO 2022 HomeLife Calculator survey |
| Hours | 7,129 | Illinois TRM (v10.0) |
| CF | 50% | Indiana TRM (v2.2) |

## OUTLET AND SWITCH GASKETS

The team used the following equation to calculate electric energy savings for advanced power strips:

$$kWh\ savings = (\%\text{Electric} * \text{kWh}_{\text{heating}} * \text{FLH}_{\text{HeatRatio}} + \%\text{Cool} * \text{kWh}_{\text{cooling}} * \text{FLH}_{\text{CoolRatio}}) * \text{ISR}$$

$$kW\ reduction = \frac{\%Cool * \mathrm{kWh_{cooling}} * FLH_{CoolRatio}}{FLH_{cooling}} * \mathrm{CF} * \mathrm{ISR}$$

$$therm\ savings = \%\mathrm{Gas} * \mathrm{Therms_{heating}} * \mathrm{FLH_{HeatRatio}} * \mathrm{ISR}$$

Where:

| | |
|---|---|
| %Electric | = Percentage of electrically heated homes |
| kWh_heating | = Deemed electric heating savings from installation of gasket |
| FLH_HeatRatio | = Ratio of South Bend, IN to Rockford, IL full load heating hours |
| %Cool | = Percentage of homes with central cooling |
| kWh_cooling | = Deemed cooling savings from installation of gasket |
| FLH_CoolRatio | = Ratio of South Bend, IN to Rockford, IL full load cooling hours |
| ISR | = In-service rate |
| FLH_cooling | = full load hours of air conditioning |
| CF | = Summer peak coincidence factor |
| %Gas | = Percentage of gas heated homes |
| Therms_heating | = Deemed gas heating savings from installation of gasket |

Table 342 lists the input assumptions and source of each assumption for the advanced power strips measure savings calculations.

TABLE 342. *EX POST* VARIABLE ASSUMPTIONS FOR OUTLET AND SWITCH GASKETS

| INPUT | VALUE | SOURCE |
|---|---|---|
| %Electric | 24% | NIPSCO 2022 HEW |
| kWh_heating | 7.7 | Illinois TRM (v10.0) weighted average of Rockford heat pump and electric resistance values |
| FLH_HeatRatio | 72% | Illinois TRM (v10.0) Rockford value and Indiana TRM (v2.2) South Bend value |
| %Cool | 81% | Indiana TRM (v2.2) |
| kWh_cooling | 0.93 | Illinois TRM (v10.0) |
| FLH_CoolRatio | 84% | Illinois TRM (v10.0) Rockford value and Indiana TRM (v2.2) South Bend value |
| ISR (Light Switch Gaskets) | 17% | NIPSCO 2022 HomeLife Calculator survey |
| ISR (Power Outlet Gaskets) | 15% | NIPSCO 2022 HomeLife Calculator survey |
| FLH_cooling | 431 | Indiana TRM (v2.2) South Bend value |
| CF | 0.88 | Indiana TRM (v2.2) |
| %Gas | 70% | NIPSCO 2022 HEW |
| Therms_heating | 0.39 | Illinois TRM (v10.0) Rockford value |

# APPENDIX 10: HOMELIFE CALCULATOR PROGRAM

## APPENDIX A. ALGORITHMS AND ASSUMPTIONS

This appendix contains the assumptions used in electric savings, demand reduction, and gas savings algorithms for the measures within the Homelife Calculator program. The team examined each assumption behind the algorithms to capture savings and compared it against the Illinois TRM (v10.0) and the Indiana TRM (v2.2), as well as other state and industry approaches. Detailed information on the analysis and supporting assumptions for the following Residential Homelife Calculator program measures are included within this appendix:

- LED candelabras
- Nightlights
- Kitchen faucet aerators
- Bathroom faucet aerators
- Low-flow showerheads
- Nightlights
- Advanced Power Strips
- Light Switch Gaskets
- Power Outlet Gaskets

Table 343 lists the assumptions of the *ex post* per-measure savings.

TABLE 343. 2022 HOMELIFE CALCULATOR PROGRAM MEASURES

| MEASURE | REVIEWED ASSUMPTIONS |
|---|---|
| LED candelabra | New and baseline wattages, hours of use, waste heat factors, coincidence factor |
| Kitchen Faucet Aerator | New and baseline flow rates, people per house, minutes of use per day, faucets per home, drain factor, water temperatures, water heater fuel type and efficiency, coincidence factor |
| Bathroom Faucet Aerator | New and baseline flow rates, people per house, minutes of use per day, faucets per home, drain factor, water temperatures, water heater fuel type and efficiency, coincidence factor |
| Low-Flow Showerhead | New and baseline flow rates, people per house, minutes of use per day, showerheads per home, water temperatures, water heater fuel type and efficiency, coincidence factor |
| LED Nightlights | New and baseline wattages, hours of use |
| Advanced Power Strips | Deemed savings, hours of use, coincidence factor |
| Light Switch Gaskets | Deemed savings, leakage reduction, heating system fuel type and efficiency, coincidence factor |
| Power Outlet Gaskets | Deemed savings, leakage reduction, heating system fuel type and efficiency, coincidence factor |

The algorithms and assumptions the evaluation team used to calculate *ex post* savings these measures follow.

## LED CANDELABRAS

The team used the following equations to calculate electric energy and peak demand savings, as well as natural gas energy penalties, for LEDs.

$$kWh\ savings\ per\ lamp = \frac{(WattsBase - WattsEE) * Hours * (1 + WHFe)}{1{,}000} * ISR$$

$$kW\ reduction\ per\ lamp = \frac{(WattsBase - WattsEE) * CF * (1 + WHFd)}{1{,}000} * ISR$$

$$therm\ savings\ per\ lamp = \frac{(WattsBase - WattsEE) * Hours * WHFg * 10}{1{,}000} * ISR$$

Where:

| | | |
|---|---|---|
| WattsBase | = | Wattage of the bulb being replaced, W |
| WattsEE | = | Wattage of the LED bulb, W |
| Hours | = | Average annual hours of use, hours |
| WHFe | = | Waste heat factor for energy to account for HVAC interactions with lighting |
| WHFd | = | Waste heat factor for demand to account for HVAC interactions with lighting |
| WHFg | = | Heating factor, or percentage of lighting savings that must be replaced by heating system. |
| CF | = | Summer peak coincidence factor |
| 1,000 | = | Constant to convert W to kW |
| 10 | = | Constant to convert MMBtuh to Therms |
| ISR | = | In-service rate |

Table 344 lists the input assumptions and source of each assumption for the LED candelabra measure savings calculations.

TABLE 344. *EX POST* VARIABLE ASSUMPTIONS FOR LED CANDELABRAS

| INPUT | VALUE | SOURCE |
|---|---|---|
| WattsBase | 29 | NIPSCO 2022 HomeLife survey |
| WattsEE | 5 | Program data |
| Hours | 763 | Illinois TRM (v10.0) |
| WHFe | -0.070 | Indiana TRM (v2.2), South Bend value |
| WHFd | 0.038 | Indiana TRM (v2.2), South Bend value |
| WHFg | -0.0019 | Indiana TRM (v2.2), South Bend value |
| CF | 0.11 | Indiana TRM (v2.2) |
| ISR | 61% | NIPSCO 2022 HomeLife survey |

Table 345 provides the survey findings used to calculate the LED candelabra measure.

TABLE 345. *EX POST* BASELINE WATTAGE ASSUMPTIONS FOR LED CANDELABRAS

| BULB TYPE | BASELINE WATTAGE | FREQUENCY | PERCENT |
|---|---|---|---|
| Incandescent | 40 | 61 | 69% |
| Halogen* | 30 | 0 | 0% |
| CFL | 7 | 8 | 9% |
| LED | 5 | 19 | 22% |
| Total | - | 88 | 100% |
| Weighted Baseline | 29 | | |

*HomeLife Calculator participant survey results indicated six instances of LED candelabras replacing halogen candelabras. Halogen candelabras are rarely used in the residential sectors, so the evaluation team assigned these responses as incandescent bulbs.

## KITCHEN AND BATHROOM FAUCET AERATORS

The team used the following equations to calculate electric energy and peak demand savings, as well as natural gas energy savings, for kitchen and bathroom aerators:

$$kWh\ savings = \%ElectricDHW * (\mathrm{GPM_{base}} * \mathrm{L_{base}} - \mathrm{GPM_{low}} * \mathrm{L_{low}}) * \mathrm{Household} * 365.25 * \frac{\mathrm{DF}}{\mathrm{FPH}} * \mathrm{EPG\_electric} * \mathrm{ISR}$$

$$EPG_{electric} = 8.33 * 1.0 * \frac{\mathrm{WaterTemp} - \mathrm{SupplyTemp}}{\mathrm{RE_{electric}} * 3412}$$

$$kW\ reduction = \frac{\Delta kWh}{Hours} * CF$$

$$Hours = GPM_{base} * L_{base} * \frac{Household}{FPH} * 365.25 * DF * \frac{\%HotWater}{GPH}$$

$$therm\ savings = \%GasHW * (\mathrm{GPM_{base}} * \mathrm{L_{base}} - \mathrm{GPM_{low}} * \mathrm{L_{low}}) * \mathrm{Household} * 365.25 * \frac{\mathrm{DF}}{\mathrm{FPH}} * \mathrm{EPG\_gas} * \mathrm{ISR}$$

$$EPG_{gas} = 8.33 * 1.0 * \frac{\mathrm{WaterTemp} - \mathrm{SupplyTemp}}{\mathrm{RE_{gas}} * 100{,}000}$$

Where:

| | |
|---|---|
| GPM_base | = Gallons per minute of baseline faucet aerator, gpm |
| GPM_low | = Gallons per minute of low-flow faucet aerator, gpm |
| L_base | = Average minutes of baseline faucet use per person per day, minutes |
| L_low | = Average minutes of low-flow faucet use per person per day, minutes |

| | |
|---|---|
| Household | = Average number of people per household |
| DF | = Percentage of water flowing down the drain |
| FPH | = Average number of faucets per household |
| WaterTemp | = Assumed temperature of mixed water, °F |
| SupplyTemp | = Assumed temperature of water entering the house, °F |
| RE_electric | = Recovery efficiency of electric water heater |
| RE_gas | = Recovery efficiency of gas water heater |
| CF | = Summer peak coincidence factor |
| 8.33 | = Specific weight of water, lb/gallon |
| 1.0 | = Heat capacity of water, Btu/lb-°F |
| 3,412 | = Constant to convert Btu to kWh |
| 365.25 | = Days per year |
| 100,000 | = Constant to convert Btu to therms |
| ISR | = In-service rate |
| %ElectricDHW | = Percentage of electric water heaters |
| %GasDHW | = Percentage of gas water heaters |

TABLE 346 lists the input assumptions and source of each assumption for the kitchen and bathroom faucet aerator measure savings calculations.

TABLE 346. *EX POST* VARIABLE ASSUMPTIONS FOR KITCHEN AND BATHROOM FAUCET AERATORS

| INPUT | KITCHEN VALUE | BATHROOM VALUE | SOURCE |
|---|---|---|---|
| GPM_base | 1.63 | 1.53 | Illinois TRM (v10.0) |
| GPM_low | 0.94 | 0.94 | Illinois TRM (v10.0) |
| L_base | 4.5 | 1.6 | Illinois TRM (v10.0) |
| L_low | 4.5 | 1.6 | Illinois TRM (v10.0) |
| Household | 2.64 | 2.64 | Indiana TRM (v2.2) |
| DF | 0.75 | 0.9 | Illinois TRM (v10.0) |
| FPH | 1 | 2.19 | NIPSCO 2022 HomeLife survey |
| WaterTemp | 93 | 86 | Illinois TRM (v10.0) |
| SupplyTemp | 57.4 | 57.4 | Indiana TRM (v2.2), South Bend value |
| RE_electric | 0.98 | 0.98 | Illinois TRM (v10.0) |
| RE_gas | 0.78 | 0.78 | Illinois TRM (v10.0) |
| CF | 0.0033 | 0.0012 | Indiana TRM (v2.2) |
| ISR | 42% | 46% | 2 NIPSCO 2022 HomeLife survey |
| %ElectricDHW (Combo/Electric Kit) | 14% | 14% | NIPSCO 2022 HomeLife survey |
| %ElectricDHW (gas only kit) | 17% | 17% | NIPSCO 2022 HomeLife survey |
| %GasDHW (Combo/Electric Kit) | 86% | 86% | NIPSCO 2022 HomeLife survey |
| %GasDHW (gas only kit) | 83% | 83% | NIPSCO 2022 HomeLife survey |

## LOW-FLOW SHOWERHEADS

The team used the following equations to calculate electric energy and peak demand savings, as well as natural gas energy savings, for low-flow showerheads:

$$kWh\ savings = \%ElectricDHW * (\mathrm{GPM_{base}} * \mathrm{L_{base}} - \mathrm{GPM_{low}} * \mathrm{L_{low}}) * 365.25 * \mathrm{SPCD} * \frac{\mathrm{Household}}{\mathrm{SPH}} * \mathrm{EPG\_electric} * \mathrm{ISR}$$

$$EPG_{electric} = 8.33 * 1.0 * \frac{\mathrm{ShowerTemp} - \mathrm{SupplyTemp}}{\mathrm{RE_{electric}} * 3412}$$

$$kW\ reduction = \frac{\Delta kWh}{Hours} * CF$$

$$Hours = GPM_{base} * L_{base} * Household * SPCD * 365.25 * \frac{\%HotWater}{GPH}$$

$$therm\ savings = \%GasDHW * (\mathrm{GPM_{base}} * \mathrm{L_{base}} - \mathrm{GPM_{low}} * \mathrm{L_{low}}) * 365.25 * \mathrm{SPCD} * \frac{\mathrm{Household}}{\mathrm{SPH}} * \mathrm{EPG\_gas} * \mathrm{ISR}$$

$$EPG_{gas} = 8.33 * 1.0 * \frac{\mathrm{ShowerTemp} - \mathrm{SupplyTemp}}{\mathrm{RE_{gas}} * 100{,}000}$$

Where:

| | |
|---|---|
| GPM_base | = Gallons per minute of baseline showerhead, gpm |
| GPM_low | = Gallons per minute of low-flow showerhead, gpm |
| L_base | = Average shower duration with baseline showerhead, minutes |
| L_low | = Average shower duration with low-flow showerhead, minutes |
| Household | = Average number of people per household |
| SPCD | = Showers per person per day |
| SPH | = Average number of showerheads per household |
| ShowerTemp | = Assumed temperature of mixed water, °F |
| SupplyTemp | = Assumed temperature of water entering the house, °F |
| RE_electric | = Recovery efficiency of electric water heater |
| RE_gas | = Recovery efficiency of gas water heater |
| CF | = Summer peak coincidence factor |
| 8.33 | = Specific weight of water, lb/gallon |
| 1.0 | = Heat capacity of water, Btu/lb-°F |
| 3,412 | = Constant to convert Btu to kWh |
| 365.25 | = Days per year |
| 100,000 | = Constant to convert Btu to therms |

| | | |
|---|---|---|
| ISR | = | In-service rate |
| %ElectricDHW | = | Percentage of electric water heaters |
| %GasDHW | = | Percentage of gas water heaters |

TABLE 347 lists the input assumptions and source of each assumption for the low-flow showerhead measure savings calculations.

TABLE 347. *EX POST* VARIABLE ASSUMPTIONS FOR LOW-FLOW SHOWERHEADS

| INPUT | VALUE | SOURCE |
|---|---|---|
| GPM_base | 2.35 | Illinois TRM (v10.0) |
| GPM_low | 1.5 | Program Data |
| L_base | 7.8 | Illinois TRM (v10.0) |
| L_low | 7.8 | Illinois TRM (v10.0) |
| Household | 2.64 | Indiana TRM (v2.2) |
| SPCD | 0.6 | Illinois TRM (v10.0) |
| SPH | 1.73 | NIPSCO 2022 HomeLife survey |
| ShowerTemp | 101 | Illinois TRM (v10.0) |
| SupplyTemp | 57.4 | Indiana TRM (v2.2), South Bend value |
| RE_electric | 0.98 | Illinois TRM (v10.0) |
| RE_gas | 0.78 | Illinois TRM (v10.0) |
| CF | 0.0023 | Indiana TRM (v2.2) |
| ISR | 38% | NIPSCO 2022 HomeLife survey |
| %ElectricDHW (Combo/Electric Kit) | 14% | NIPSCO 2022 HomeLife survey |
| %ElectricDHW (gas only kit) | 17% | NIPSCO 2022 HomeLife survey |
| %GasDHW (Combo/Electric Kit) | 86% | NIPSCO 2022 HomeLife survey |
| %GasDHW (gas only kit) | 83% | NIPSCO 2022 HomeLife survey |

## NIGHTLIGHTS

The team used the following equation to calculate electric energy savings for LED nightlights:

$$kWh\ savings = \frac{(WattsBase - \text{WattsEE}) * IRF * \ \ Hours * ISR}{1{,}000}$$

Where:

| | | |
|---|---|---|
| WattsBase | = | Wattage of the bulb being replaced, W |
| WattsEE | = | Wattage of the LED bulb, W |
| Hours | = | Average annual hours of use, hours |
| IRF | = | Incandescent replacement factor representing the percentage of LED nightlights that replaced incandescent and halogen nightlights. |
| ISR | = | In-service rate |
| 1,000 | = | Constant to convert W to kW |

TABLE 348 lists the input assumptions and source of each assumption for the nightlights measure savings calculations.

TABLE 348. *EX POST* VARIABLE ASSUMPTIONS FOR LED NIGHTLIGHTS

| INPUT | VALUE | SOURCE |
|---|---|---|
| WattsBase | 7 | Illinois TRM (v10.0) |
| WattsEE | 0.33 | Program data |
| Hours | 4,380 | Illinois TRM (v10.0) |
| IRF | 24% | NIPSCO 2022 HomeLife survey |
| ISR | 77% | NIPSCO 2022 HomeLife survey |

## ADVANCED POWER STRIPS

The team used the following equation to calculate electric energy savings for advanced power strips:

$$kWh\ savings = \text{kWh} * \text{ISR}$$

$$kW\ reduction = \frac{\text{kWh savings}}{Hours} * \text{CF}$$

Where:

kWh = Deemed savings for a tier 1, 7-plug unit

ISR = In-service rate

Hours = Annual hours controlled standby loads are turned off by the advanced power strip

CF = Summer peak coincidence factor

Table 349 lists the input assumptions and source of each assumption for the advanced power strips measure savings calculations.

TABLE 349. *EX POST* VARIABLE ASSUMPTIONS FOR ADVANCED POWER STRIPS

| INPUT | VALUE | SOURCE |
|---|---|---|
| kWh | 103 | Illinois TRM (v10.0) |
| ISR | 81% | NIPSCO 2022 HomeLife survey |
| Hours | 7,129 | Illinois TRM (v10.0) |
| CF | 50% | Indiana TRM (v2.2) |

## OUTLET AND SWITCH GASKETS

The team used the following equation to calculate electric energy savings for advanced power strips:

$$kWh\ savings = (\%\mathrm{Electric} * \mathrm{kWh_{heating}} * \mathrm{FLH_{HeatRatio}} + \%\mathrm{Cool} * \mathrm{kWh_{cooling}} * \mathrm{FLH_{CoolRatio}}) * \mathrm{ISR}$$

$$kW\ reduction = \frac{\%\mathrm{Cool} * \mathrm{kWh_{cooling}} * FLH_{CoolRatio}}{FLH_{cooling}} * \mathrm{CF} * \mathrm{ISR}$$

$$therm\ savings = \%\mathrm{Gas} * \mathrm{Therms_{heating}} * \mathrm{FLH_{HeatRatio}} * \mathrm{ISR}$$

Where:

| | |
|---|---|
| %Electric | = Percentage of electrically heated homes |
| kWh_heating | = Deemed electric heating savings from installation of gasket |
| FLH_HeatRatio | = Ratio of South Bend, IN to Rockford, IL full load heating hours |
| %Cool | = Percentage of homes with central cooling |
| kWh_cooling | = Deemed cooling savings from installation of gasket |
| FLH_CoolRatio | = Ratio of South Bend, IN to Rockford, IL full load cooling hours |
| ISR | = In-service rate |
| FLH_cooling | = Full load hours of air conditioning |
| CF | = Summer peak coincidence factor |
| %Gas | = Percentage of gas heated homes |
| Therms_heating | = Deemed gas heating savings from installation of gasket |

Table 350 below contains the sources for each input.

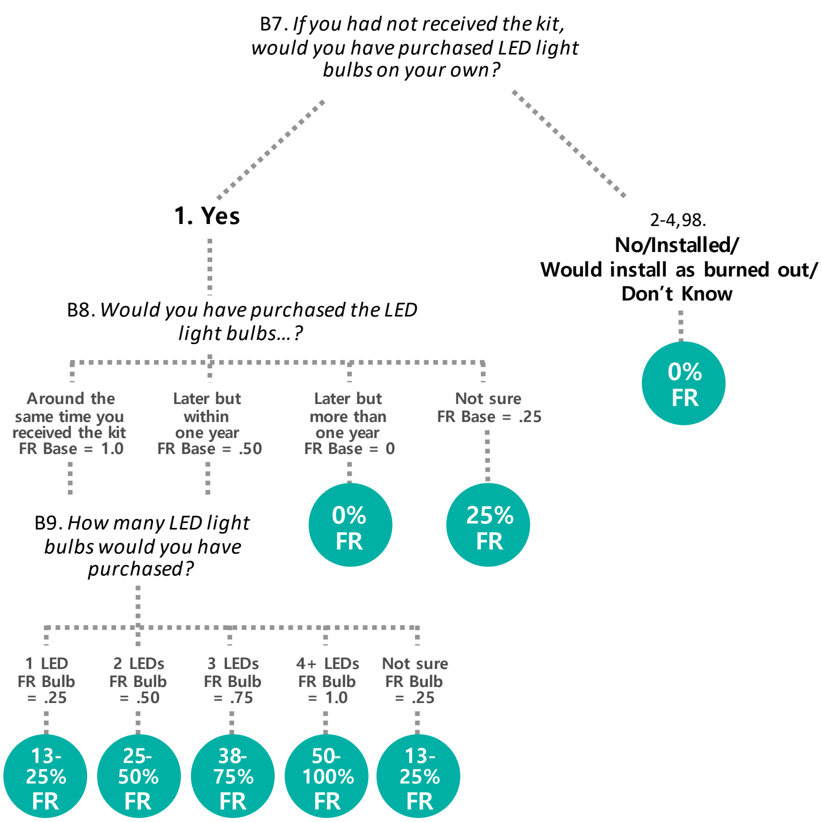
TABLE 350. *EX POST* VARIABLE ASSUMPTIONS FOR OUTLET AND SWITCH GASKETS

| INPUT | VALUE | SOURCE |
|---|---|---|
| %Electric (Combo/Electric Kit) | 13% | NIPSCO 2022 HomeLife survey |
| kWh_heating | 7.7 | Illinois TRM (v10.0) weighted average of Rockford heat pump and electric resistance values |
| FLH_HeatRatio | 72% | Illinois TRM (v10.0) Rockford value and Indiana TRM (v2.2) South Bend value |
| %Cool | 91% | NIPSCO 2022 HomeLife survey |
| kWh_cooling | 0.93 | Illinois TRM (v10. |
| FLH_CoolRatio | 84% | Illinois TRM (v10.0) Rockford value and Indiana TRM (v2.2) South Bend value |
| ISR (Light Switch Gaskets) | 17% | NIPSCO 2022 HomeLife survey |
| ISR (Power Outlet Gaskets) | 15% | NIPSCO 2022 HomeLife survey |
| FLH_cooling | 431 | Indiana TRM (v2.2) South Bend value |
| CF | 0.88 | Indiana TRM (v2.2) |
| %Gas (Combo/Electric Kit) | 87% | NIPSCO 2022 HomeLife survey |
| %Gas (gas only kit) | 90% | NIPSCO 2022 HomeLife survey |
| Therms_heating | 0.39 | Illinois TRM (v10.0) Rockford value |

## APPENDIX B. FREERIDERSHIP (LEDS)

Below in Figure 100 is a flow chart detailing the evaluation approach to assessing freeridership for LEDs.

FIGURE 100. FREERIDERSHIP APPROACH



# APPENDIX C. PARTICIPANT DEMOGRAPHICS AND HOME CHARACTERISTICS

Most respondents (89%) live in a single-family home and 85% are owners. Natural gas was the primary heating source for most homes (84%).[78,79]

Most respondents (89%) have one or two showers in their home.[80] Two thirds of respondents (66%) have one- or two-bathroom faucets and almost all have one kitchen sink (86%) in their home.[81]

The following is a snapshot of self-reported home characteristics:

- Heating equipment: 84% heat their homes with a furnace.[82]
- Cooling equipment: 87% have central air conditioning and 7% use room or window air conditioners.

Table 351 contains additional detail on home characteristics of surveyed participants.

TABLE 351. HOME CHARACTERISTICS OF SURVEYED 2022 HOMELIFE CALCULATOR PROGRAM PARTICIPANTS

| HOME CHARACTERISTICS | COUNT | PERCENT |
|---|---|---|
| **Type of residence** | | |
| Single-family detached home | 125 | 89% |
| Multifamily apartment or condo building (with 4 or more units) | 11 | 8% |
| Attached house (townhouse, row house, or twin) | 3 | 2% |
| Mobile or manufactured home | 1 | <1% |
| Other ("Multi unit apartments") | 1 | <1% |
| **Total** | **141** | **100.0%** |
| **Ownership of residence** | | |
| Own | 120 | 85% |
| Rent | 21 | 15% |
| **Total** | **141** | **100.0%** |
| **Primary fuel source for heating** | | |
| Electricity | 16 | 11% |
| Natural gas | 118 | 84% |
| Not sure/other | 6 | 4% |
| **Total** | **140** | **100.0%** |
| **Year home was built** | | |
| 1900 to 1939 | 17 | 14% |
| 1940 to 1959 | 26 | 21% |
| 1960 to 1979 | 28 | 23% |

78 The overall N for these questions was 141.
79 The overall N for this question was 140.
80 The overall N for this question was 140.
81 The overall N for this question was 140.
82 The overall N for this question was 140.

| HOME CHARACTERISTICS | COUNT | PERCENT |
|---|---|---|
| 1980 to 1989 | 12 | 10% |
| 1990 to 1999 | 22 | 18% |
| 2000 to 2004 | 7 | 6% |
| 2005 or later | 12 | 10% |
| **Total** | **124** | **100.0%** |
| Number of kitchen sinks | | |
| 1 | 121 | 85% |
| 2 | 16 | 11% |
| 3 | 2 | 1% |
| 4 | 2 | 1% |
| Prefer not to answer | 1 | <1% |
| **Total** | **142** | **100.0%** |
| Number of bathroom faucets | | |
| 1 | 40 | 29% |
| 2 | 53 | 38% |
| 3 | 35 | 25% |
| 4 | 9 | 6% |
| 5 | 2 | 1% |
| 10 | 1 | <1% |
| **Total** | **140** | **100.0%** |
| Number of showers | | |
| 1 | 53 | 38% |
| 2 | 71 | 50% |
| 3 | 14 | 10% |
| 4 | 1 | <1% |
| Prefer not to answer | 2 | 1% |
| **Total** | **141** | **100.0%** |

Demographic characteristics were varied among surveyed participants. More than two-thirds of respondents (69%) reported having lived in their home for six years or more (n=137). More than a third (36%) had at least a 4-year college degree (n=132). Most frequently, family households were made up of one or two people (68%). Table 352 contains more detail on the demographics of surveyed HomeLife participants.

TABLE 352. DEMOGRAPHICS OF SURVEYED 2022 HOMELIFE CALCULATOR PROGRAM PARTICIPANTS

| PARTICIPANT DEMOGRAPHICS | COUNT | PERCENT |
|---|---|---|
| Number of people living in home | | |
| 1-2 | 97 | 68% |
| 3-4 | 29 | 20% |
| 5-6 | 10 | 7% |
| Prefer not to answer | 6 | 4% |
| **Total** | **142** | **100.0%** |

| PARTICIPANT DEMOGRAPHICS | COUNT | PERCENT |
|---|---|---|
| **Number of years living in home** | | |
| One year or less | 9 | 6% |
| 2-3 years | 16 | 11% |
| 4-5 years | 17 | 12% |
| 6-10 years | 29 | 20% |
| More than 10 | 66 | 46% |
| Prefer not to answer | 5 | 4% |
| **Total** | **142** | **100.0%** |
| **Year born** | | |
| 1900 to 1939 | 1 | <1% |
| 1940 to 1959 | 60 | 42% |
| 1960 to 1979 | 37 | 26% |
| 1980 to 1989 | 17 | 12% |
| 1990 to 1999 | 10 | 7% |
| Prefer not to answer | 17 | 12% |
| **Total** | **142** | **100.0%** |
| **Highest level of education completed** | | |
| High school or less | 1 | <1% |
| High school graduate or equivalent | 31 | 22% |
| Some college, no degree | 28 | 20% |
| Technical college degree or certificate | 12 | 9% |
| Two-year college degree | 13 | 9% |
| Four-year college degree | 29 | 20% |
| Graduate or professional degree | 18 | 13% |
| Prefer not to answer | 10 | 7% |
| **Total** | **142** | **100.0%** |
| **Income** | | |
| Under $25,000 | 18 | 12.5% |
| $25,000 to under $35,000 | 11 | 8% |
| $35,000 to under $50,000 | 12 | 9% |
| $50,000 to under $75,000 | 28 | 20% |
| $75,000 to under $100,000 | 10 | 7% |
| $100,000 to under $150,000 | 15 | 11% |
| Over $150,000 | 8 | 6% |
| Prefer not to answer | 38 | 27% |
| **Total** | **140** | **100.0%** |

# APPENDIX 11: RESIDENTIAL ONLINE MARKETPLACE (OLM) PROGRAM

## ALGORITHMS AND ASSUMPTIONS

This appendix contains the assumptions used in electric savings, demand reduction, and gas savings algorithms for the measures within the Residential Online Marketplace program. The team examined each assumption behind the algorithms to capture savings and compared it against the Illinois TRM v10.0 or the Indiana TRM (v2.2), as well as other state and industry approaches. Detailed information on the analysis and supporting assumptions for the Residential Online Marketplace program measures are included within this appendix:

- Advanced Power Strip Tier 1
- Advanced Power Strip Tier 2
- Air Purifier
- Bathroom Aerator
- Kitchen Aerator
- LED Reflector
- LED Specialty
- LED String
- Smart LED
- Low-Flow Showerhead
- Low-Flow Showerhead with ShowerStart
- ShowerStart
- Smart Plug
- Wi-Fi Thermostat
- Home Office/Back to School Kit – Smart LEDs (2)
- Home Office/Back to School Kit – Advanced Power Strip Tier 1
- Home Office/Back to School Kit – Desk Lamp
- Home Office/Back to School Kit – LED Nightlight
- Home Office/Back to School Kit Add-On – LED Reflector
- Home Office/Back to School Kit Add-On – LED Candelabra

### ADVANCED POWER STRIP TIER 1

The evaluation team used the following equations from Illinois TRM v10.0 p. 63 to calculate electric energy and peak demand savings for advanced power strips (tier 1):

$$\Delta kWh = kWh * ISR$$

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

Where:

kWh = Assumed annual kWh savings per unit
ISR = In-service rate
Hours = Annual number of hours during which the controlled standby loads are turned off by the Tier 1 Advanced Power Strip
CF = Summer Peak Coincidence Factor for measure

Table 353 lists the assumptions and source of each assumption for advanced power strip tier 1 measure savings calculations.

TABLE 353. *EX POST* VARIABLE ASSUMPTION FOR ADVANCED POWER STRIP TIER 1

| INPUT | VALUE | SOURCE |
|---|---|---|
| kWh (7-unit plug) – time of sale | 73.10 | Illinois TRM v10.0 |
| kWh (7-unit plug) – single-family energy efficiency kit | 56.70 | Illinois TRM v10.0 |
| ISR | 78% | 2022 NIPSCO Residential OLM survey |
| Hours | 7,129 | Illinois TRM v10.0 |
| CF | 0.80 | Illinois TRM v10.0 |

### ADVANCED POWER STRIP TIER 2

The evaluation team used the following equations from Illinois TRM v10.0 p. 67 to calculate electric energy and peak demand savings for advanced power strips (tier 2):

$$\Delta kWh = ERP * BaselineEnergy_{AV} * ISR$$

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

Where:

ERP = Energy Reduction Percentage of qualifying Tier 2 AV APS product range as provided
Baseline Energy AV = 466 kWh
ISR = In-service rate
Hours = Average number of hours during which the APS provides savings

CF = Summer Peak Coincidence Factor for measure

Table 354 lists the assumptions and source of each assumption for advanced power strip tier 2 measure savings calculations.

TABLE 354. *EX POST* VARIABLE ASSUMPTION FOR ADVANCED POWER STRIP TIER 2

| INPUT | VALUE | SOURCE |
|---|---|---|
| ERP | 40%<br>25% | Illinois TRM v10.0, infrared only<br>Illinois TRM v10.0, infrared, and occupancy sensor |
| $BaselineEnergy_{AV}$ | 466 | Illinois TRM v10.0 |
| ISR | 78% | 2022 NIPSCO Residential OLM survey |
| Hours | 4,380 | Illinois TRM v10.0 |
| CF | 0.80 | Illinois TRM v10.0 |

AIR PURIFIER

The team used the following equation from Illinois TRM v10.0 p. 6 to calculate electric energy savings and peak demand savings for air purifiers:

$$\Delta kWh = kWh\_base - kWh\_eff$$

$$kWh\_base = hours * SmokeCADR_{base}/(SmokeCADR_{per_{watt_{base}}} * 1000)) + (8760 - hours) * PartialOnModePower\_base/1000)$$

$$kWh\_eff = hours * SmokeCADR_{Eff}/(SmokeCADR_{per_{watt_{Eff}}} * 1000)) + (8760 - hours) * PartialOnModePower\_eff/1000)$$

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

Where:

| | | |
|---|---|---|
| kWh_base | = | Annual Electrical usage for baseline unit (kWh) |
| kWh_eff | = | Annual electrical usage for efficient unit (kWh) |
| Hours | = | Annual active operating hours |
| SmokeCADR_base | = | Smoke CADR for baseline unit |
| SmokeCADR_per_watt_base | = | Smoke CADR delivery rate per watt for baseline unit |
| PartialOnModePower_base | = | Partial On Model Power for baseline units by category |
| SmokeCADR_eff | = | Smoke CADR for efficient unit |
| SmokeCADR_per_watt_eff | = | Smoke CADR delivery rate per watt for efficient unit |
| PartialOnModePower_eff | = | Partial On Model Power for efficient units by category |

| | | |
|---|---|---|
| CF | = | Summer Peak Coincidence Factor for measure |

Table 355 lists the input assumptions and source of each assumption for the air purifier measure savings calculations.

TABLE 355. *EX POST* VARIABLE ASSUMPTIONS FOR AIR PURIFIERS

| INPUT | VALUE | SOURCE |
|---|---|---|
| SmokeCADR_base | 175.2 | Illinois TRM v10.0 for CADR range between 150 - 200 |
| SmokeCADR_eff | 154 | Actual |
| SmokeCADR_per_watt_base | 1.94 | Illinois TRM v10.0 for CADR range between 150 - 200 |
| SmokeCADR_per_watt_eff | 3.1 | Actual |
| PartialOnModePower_base | 2.0 | Illinois TRM v10.0 for CADR range between 150 - 200 |
| PartialOnModePower_eff | 0.048 | Actual |
| Hours | 5840 | Illinois TRM v10.0 |
| CF | 0.667 | Illinois TRM v10.0 |

## KITCHEN AND BATHROOM FAUCET AERATORS

The evaluation team used the following equations from Illinois TRM v10.0 p.222 to calculate electric energy, peak demand, and natural gas energy savings for Low-flow Kitchen and Bathroom Faucet Aerators:

$$kWh\ savings = \%ElectricDHW * ((\mathrm{GPM_{base}} * \mathrm{L_{base}} - \mathrm{GPM_{low}} * \mathrm{L_{low}}) * \mathrm{Household} * 365.25 * \frac{\mathrm{DF}}{\mathrm{FPH}}) * \mathrm{EPG\_electric} * \mathrm{ISR}$$

$$EPG_{electric} = 8.33 * 1.0 * \frac{\mathrm{WaterTemp} - \mathrm{SupplyTemp}}{\mathrm{RE_{electric}} * 3412}$$

$$kW\ reduction = \frac{\Delta kWh}{Hours} * CF$$

$$Hours = GPM_{base} * L_{base} * \frac{Household}{FPH} * 365.25 * DF * \frac{\%HotWater}{GPH}$$

$$therm\ savings = \%FossilDHW * ((\mathrm{GPM_{base}} * \mathrm{L_{base}} - \mathrm{GPM_{low}} * \mathrm{L_{low}}) * \mathrm{Household} * 365.25 * \frac{\mathrm{DF}}{\mathrm{FPH}}) * \mathrm{EPG\_gas} * \mathrm{ISR}$$

$$EPG_{gas} = 8.33 * 1.0 * \frac{\mathrm{WaterTemp} - \mathrm{SupplyTemp}}{\mathrm{RE_{gas}} * 100{,}000}$$

Where:

GPM_base = Gallons per minute of baseline faucet aerator, gpm

GPM_low = Gallons per minute of low-flow faucet aerator, gpm

L_base = Average minutes of baseline faucet use per person per day, minutes

L_low = Average minutes of low-flow faucet use per person per day, minutes

Household = Average number of people per household

DF = Percentage of water flowing down the drain

FPH = Average number of faucets per household

WaterTemp = Assumed temperature of mixed water, °F

SupplyTemp = Assumed temperature of water entering the house, °F

RE_electric = Recovery efficiency of electric water heater

| | |
|---|---|
| RE_gas | = Recovery efficiency of gas water heater |
| Hours | = Annual electric DHW recovery hours for faucet use per faucet |
| CF | = Summer peak coincidence factor |
| 8.33 | = Specific weight of water, lb/gallon |
| 1.0 | = Heat capacity of water, Btu/lb-°F |
| 3,412 | = Constant to convert Btu to kWh |
| 365.25 | = Days per year |
| 100,000 | = Constant to convert Btu to therms |
| ISR | = In-service rate |
| %ElectricDHW | = Percentage of electric water heaters |
| %GasDHW | = Percentage of gas water heaters |

TABLE 356 lists the input assumptions and source of each assumption for the kitchen and bathroom faucet aerator measure savings calculations.

TABLE 356. *EX POST* VARIABLE ASSUMPTIONS FOR KITCHEN AND BATHROOM FAUCET AERATORS

| INPUT | KITCHEN VALUE | BATHROOM VALUE | SOURCE |
|---|---|---|---|
| GPM_base | 1.63 | 1.53 | Illinois TRM (v10.0) |
| GPM_low | 0.94 | 0.94 | Illinois TRM (v10.0) |
| L_base | 4.5 | 1.6 | Illinois TRM (v10.0) |
| L_low | 4.5 | 1.6 | Illinois TRM (v10.0) |
| Household | 2.42 | 2.42 | Illinois TRM (v10.0) |
| DF | 0.75 | 0.9 | Illinois TRM (v10.0) |
| FPH | 1 | 2.42 | Illinois TRM (v10.0) |
| WaterTemp | 93 | 86 | Illinois TRM (v10.0) |
| SupplyTemp | 57.4 | 57.4 | Indiana TRM (v2.2), values assigned based on nearest TRM city. Value shown is the program average, not the value used to calculate savings for each participant |
| RE_electric | 0.98 | 0.98 | Illinois TRM (v10.0) |
| RE_gas | 0.78 | 0.78 | Illinois TRM (v10.0) |
| Hours | 102 | 20 | Illinois TRM (v10.0) |
| CF | 0.0033 | 0.0012 | Indiana TRM (v2.2) |
| ISR | 92.16% | 92.59% | 2022 HEA participant survey |
| %ElectricDHW | 100% | 100% | Actual, electric WH only |
| %GasDHW | 100% | 100% | Actual, gas WH only |

## LOW-FLOW SHOWERHEAD

The evaluation team used the following equations from Illinois TRM v10.0 p.232 to calculate electric energy, peak demand, and natural gas energy savings for low-flow showerheads:

$$kWh\ savings = \%ElectricDHW * \left( (\mathrm{GPM_{base}} * \mathrm{L_{base}} - \mathrm{GPM_{low}} * \mathrm{L_{low}}) * \mathrm{Household} * \mathrm{SPCD} * \frac{365.25}{\mathrm{SPH}} \right) * \mathrm{EPG\_electric} * \mathrm{ISR}$$

$$EPG_{electric} = \frac{(8.33 * 1.0 * (\mathrm{ShowerTemp} - \mathrm{SupplyTemp}))}{\mathrm{RE_{electric}} * 3412}$$

$$kW\ reduction = \frac{\Delta kWh}{Hours} * CF$$

$$Hours = ((GPM_{base} * L_{base}) * Household * SPCD * 365.25) * 0.726/GPH$$

$$therm\ savings = \%FossilDHW * ((\mathrm{GPM_{base}} * \mathrm{L_{base}} - \mathrm{GPM_{low}} * \mathrm{L_{low}}) * \mathrm{Household} * \mathrm{SPCD} * 365.25/\mathrm{SPH}) * \mathrm{EPG\_gas} * \mathrm{ISR}$$

$$EPG_{gas} = \frac{(8.33 * 1.0 * (\mathrm{WaterTemp} - \mathrm{SupplyTemp}))}{\mathrm{RE_{gas}} * 100{,}000}$$

Where:

| | |
|---|---|
| GPM_base | = Gallons per minute of baseline showerhead, gpm |
| GPM_low | = Gallons per minute of low-flow showerhead, gpm |
| L_base | = Average minutes of baseline showerhead use per person per day, minutes |
| L_low | = Average minutes of low-flow showerhead use per person per day, minutes |
| Household*SPCD | = Average number of showers per household |
| SPH | = Showerheads per household |
| ShowerTemp | = Assumed temperature of mixed water, °F |
| SupplyTemp | = Assumed temperature of water entering the house, °F |
| RE_electric | = Recovery efficiency of electric water heater |
| RE_gas | = Recovery efficiency of gas water heater |
| GPH | = Gallons per hour recovery |
| Hours | = Annual electric DHW recovery hours for showerhead use |
| CF | = Summer peak coincidence factor |
| 8.33 | = Specific weight of water, lb/gallon |
| 1.0 | = Heat capacity of water, Btu/lb-°F |
| 3,412 | = Constant to convert Btu to kWh |
| 365.25 | = Days per year |
| 100,000 | = Constant to convert Btu to therms |
| ISR | = In-service rate |
| %ElectricDHW | = Percentage of electric water heaters |
| %GasDHW | = Percentage of gas water heaters |

TABLE 357 lists the input assumptions and source of each assumption for the low-flow showerhead savings calculations.

TABLE 357. *EX POST* VARIABLE ASSUMPTIONS FOR LOW-FLOW SHOWERHEADS

| INPUT | VALUE | SOURCE |
|---|---|---|
| GPM_base | 2.35 | Illinois TRM (v10.0) |
| GPM_low | 1.5 | Illinois TRM (v10.0) |
| L_base | 7.8 | Illinois TRM (v10.0) |
| L_low | 7.8 | Illinois TRM (v10.0) |
| Household*SPCD | 1.065 | 2022 HEA participant survey |
| SPH | 1.64 | Illinois TRM (v10.0) |
| GPH | 26.1 | Illinois TRM (v10.0) |
| Hours | 198 | Illinois TRM (v10.0) |
| ShowerTemp | 101 | Illinois TRM (v10.0) |
| SupplyTemp | 57.4 | Indiana TRM (v2.2), values assigned based on nearest TRM city. Value shown is the program average, not the value used to calculate savings for each participant |
| RE_electric | 0.98 | Illinois TRM (v10.0) |
| RE_gas | 0.78 | Illinois TRM (v10.0) |
| CF | 0.0023 | Indiana TRM (v2.2) |
| ISR | 86.2% | 2022 HEA participant survey |
| %ElectricDHW | 100% | Actual, electric WH only |
| %GasDHW | 0% | Actual, electric WH only |

## SHOWERSTART

The evaluation team used the following equations from Illinois TRM v10.0 p.247 to calculate electric energy, peak demand, and natural gas energy savings for ShowerStarts:

$$kWh\ savings = \%ElectricDHW * \left( (\mathrm{GPM\_showerhead} * \mathrm{L\_showerdevice}) * \mathrm{Household} * \mathrm{SPCD} * \frac{365.25}{\mathrm{SPH}} \right) * \mathrm{EPG\_electric} * \mathrm{ISR}$$

$$EPG_{electric} = \frac{(8.33 * 1.0 * (\mathrm{ShowerTemp} - \mathrm{SupplyTemp}))}{\mathrm{RE_{electric}} * 3412}$$

$$kW\ reduction = \frac{\Delta kWh}{Hours} * CF$$

$$Hours = ((GPM_{base} * L_{base}) * Household * SPCD * 365.25) * 0.726/GPH$$

$$therm\ savings = \%FossilDHW * \left(\mathrm{GPM_{showerhead}} * \mathrm{L_{showerdevice}}\right) * \mathrm{Household} * \mathrm{SPCD} * 365.25/\mathrm{SPH}) * \mathrm{EPG\_gas} * \mathrm{ISR}$$

$$EPG_{gas} = \frac{(8.33 * 1.0 * (\text{WaterTemp} - \text{SupplyTemp}))}{\text{RE}_{\text{gas}} * 100{,}000}$$

Where:

| | |
|---|---|
| GPM_showerhead | = flowrate of showerhead, gpm |
| L_showerdevice | = Hot water time avoided due to ShowerStart, minutes |
| Household*SPCD | = Average number of showers per household |
| SPH | = Showerheads per household |
| ShowerTemp | = Assumed temperature of mixed water, °F |
| SupplyTemp | = Assumed temperature of water entering the house, °F |
| RE_electric | = Recovery efficiency of electric water heater |
| RE_gas | = Recovery efficiency of gas water heater |
| GPH | = Gallons per hour recovery |
| Hours | = Annual electric DHW recovery hours for wasted showerhead use prevented by device |
| CF | = Summer peak coincidence factor |
| 8.33 | = Specific weight of water, lb/gallon |
| 1.0 | = Heat capacity of water, Btu/lb-°F |
| 3,412 | = Constant to convert Btu to kWh |
| 365.25 | = Days per year |
| 100,000 | = Constant to convert Btu to therms |
| ISR | = In-service rate |
| %ElectricDHW | = Percentage of electric water heaters |
| %GasDHW | = Percentage of gas water heaters |

Table 358 lists the input assumptions and source of each assumption for the ShowerStart savings calculations.

TABLE 358. *EX POST* VARIABLE ASSUMPTIONS FOR SHOWERSTART

| INPUT | VALUE | SOURCE |
|---|---|---|
| GPM_showerhead | 2.35 | Illinois TRM (v10.0) or actual |
| L_showerdevice | 0.89 | Illinois TRM (v10.0) |
| Household*SPCD | 1.065 | 2022 HEA participant survey |
| SPH | 1.64 | Illinois TRM (v10.0) |
| GPH | 26.1 | Illinois TRM (v10.0) |
| Hours | 22.63 | Illinois TRM (v10.0) |
| ShowerTemp | 101 | Illinois TRM (v10.0) |
| SupplyTemp | 57.4 | Indiana TRM (v2.2), values assigned based on nearest TRM city. Value shown is the program average, not the value used to calculate savings for each participant |
| RE_electric | 0.98 | Illinois TRM (v10.0) |
| RE_gas | 0.78 | Illinois TRM (v10.0) |

| INPUT | VALUE | SOURCE |
|---|---|---|
| CF | 0.0023 | Indiana TRM (v2.2) |
| ISR | 86.2% | 2022 HEA participant survey |
| %ElectricDHW | 100% | Actual, electric WH only |
| %GasDHW | 0% | Actual, electric WH only |

### LEDS, SMART LEDS, AND STRING LEDS

The evaluation team used the following equations from Indiana TRM (v2.2) p. 130 to calculate electric energy and peak demand savings, as well as natural gas energy penalties, for LEDs, Smart LEDs, and String LEDs:

$$\Delta kWh = \frac{(W_{base} - W_{LED})}{1{,}000} * (ISR * Hours) * (1 + WHF_e)$$

$$\Delta kW = \frac{(W_{base} - W_{LED})}{1{,}000} * Coincidence\ Factor * ISR * (1 + WHF_d)$$

$$\Delta MMBtu_{WH} = \frac{(W_{base} - W_{LED})}{1{,}000} * (ISR * Hours) * \left(WHF_g\right)$$

Where:

$W_{base}$ = Wattage of the bulb being replaced, W

$W_{LED}$ = Wattage of the LED bulb, W

Hours = Average hours of use per year, hr.

$WHF_e$ = Waste heat factor for energy to account for HVAC interactions with lighting (depends on location)

$WHF_d$ = Waste heat factor for demand to account for HVAC interactions with lighting (depends on location)

$WHF_g$ = Waste heat factor for gas to account for HVAC interactions with lighting (depends on location)

Coincidence Factor = Summer peak coincidence factor, 0.11

ISR = In-service rate, or fraction of units that get installed

365 = Number of days per year, days/yr.

1,000 = Constant to convert watts to kW

Table 359 lists the input assumptions and source of each assumption for the LED measure savings calculations.

TABLE 359. *EX POST* VARIABLE ASSUMPTIONS FOR LEDS

| INPUT | VALUE | SOURCE |
|---|---|---|
| $W_{base}$ for 4-watt (Candelabra LED, Kit Add-on) | 28.69 | 2022 NIPSCO Residential OLM survey, in-situ |
| $W_{base}$ for 9.5-watt (Reflector LED, Kit Add-on) | 39.88 | 2022 NIPSCO Residential OLM survey, in-situ |
| $W_{base}$ for 4-watt (Decorative/ Mini LED) | 40 | Ch. 6 Residential Lighting Evaluation Protocol, UMP |
| $W_{base}$ for 5-watt (Decorative/ Mini LED) | 40 | Ch. 6 Residential Lighting Evaluation Protocol, UMP |
| $W_{base}$ for 4-watt (Filament LED) | 40 | Ch. 6 Residential Lighting Evaluation Protocol, UMP |

| INPUT | VALUE | SOURCE |
|---|---|---|
| $W_{base}$ for 6.5-watt (Decorative/Mini LED) | 50 | Ch. 6 Residential Lighting Evaluation Protocol, UMP |
| $W_{base}$ for 9-watt (MR/Par) | 75 | Ch. 6 Residential Lighting Evaluation Protocol, UMP |
| $W_{base}$ for 17-watt (MR/Par) | 120 | Ch. 6 Residential Lighting Evaluation Protocol, UMP |
| $W_{base}$ for 9.5-watt (BR/Par) | 65 | Ch. 6 Residential Lighting Evaluation Protocol, UMP |
| $W_{base}$ for 10-watt (BR/Par) | 90 | Ch. 6 Residential Lighting Evaluation Protocol, UMP |
| $W_{base}$ for 9-watt (Smart LED, kit) | 32.99 | 2022 NIPSCO Residential OLM survey, in-situ |
| $W_{base}$ for 9-watt (Smart LED) | 43 | Ch. 6 Residential Lighting Evaluation Protocol, UMP |
| $W_{base}$ for 8-watt (Smart LED) | 65 | Ch. 6 Residential Lighting Evaluation Protocol, UMP |
| $W_{base}$ for C7 LED String | 125 | Illinois TRM v10 |
| $W_{base}$ for C9 LED String | 175 | Illinois TRM v10 |
| $W_{LED}$ for 4-watt (Candelabra LED, Kit Add-on) | 5.5 | Actual installed wattage |
| $W_{LED}$ for 9.5-watt (Reflector LED, Kit Add-on) | 9.5 | Actual installed wattage |
| $W_{LED}$ for 4-watt (Decorative/ Mini LED) | 4 | Actual installed wattage |
| $W_{LED}$ for 5-watt (Decorative/ Mini LED) | 5 | Actual installed wattage |
| $W_{LED}$ for 4-watt (Filament LED) | 4 | Actual installed wattage |
| $W_{LED}$ for 6.5-watt (Decorative/ Mini LED) | 6.5 | Actual installed wattage |
| $W_{LED}$ for 9-watt (MR/Par) | 9 | Actual installed wattage |
| $W_{LED}$ for 17-watt (MR/Par) | 17 | Actual installed wattage |
| $W_{LED}$ for 9.5-watt (BR/Par) | 9.5 | Actual installed wattage |
| $W_{LED}$ for 10-watt (BR/Par) | 10 | Actual installed wattage |
| $W_{LED}$ for 9-watt (Smart LED) | 9 | Actual installed wattage |
| $W_{LED}$ for 8-watt (Smart LED) | 8 | Actual installed wattage |
| $W_{LED}$ for C7 LED String | 2.4 | Actual installed wattage |
| $W_{LED}$ for C9 LED String | 2.4 | Actual installed wattage |
| Hours | 902 | Indiana TRM (v2.2) |
| $WHF_e$ | -0.070 | Indiana TRM (v2.2), averaged across participant location |
| $WHF_d$ | 0.038 | Indiana TRM (v2.2), averaged across participant location |
| $WHF_g$ | -0.0019 | Indiana TRM (v2.2), averaged across participant location |
| Coincidence Factor | 0.11 | Indiana TRM (v2.2) |
| ISR (Kit, Smart LED)<br>ISR (Kit Add-on, LED reflector)<br>ISR (Kit Add-on, LED candelabra)<br>ISR (Standalone) | 72%<br>60%<br>69%<br>86% | 2022 NIPSCO Residential OLM survey<br>2022 NIPSCO Residential OLM survey<br>2022 NIPSCO Residential OLM survey<br>Blended ISR from 2022 Residential Lighting evaluation |

### LED NIGHTLIGHT

The evaluation team used the following equation from the Illinois TRM v10.0 p.310 to calculate electric energy savings for LED nightlights:

$$kWh\ savings = \frac{((WattsBase - \mathrm{WattsEE})}{1{,}000} * IRF * \ Hours * ISR$$

Where:

| | | |
|---|---|---|
| WattsBase | = | Wattage of the bulb being replaced, W |
| WattsEE | = | Wattage of the LED bulb, W |
| Hours | = | Average annual hours of use, hours |
| ISR | = | In-service rate |
| 1,000 | = | Constant to convert W to kW |
| IRF | = | Incandescent replacement factor representing the percentage of LED nightlights that replaced incandescent and halogen nightlights. |

Table 360 lists the input assumptions and source of each assumption for the nightlights measure savings calculations.

TABLE 360. *EX POST* VARIABLE ASSUMPTIONS FOR LED NIGHTLIGHTS

| INPUT | VALUE | SOURCE |
|---|---|---|
| WattsBase | 7 | Illinois TRM (v10.0) |
| WattsEE | 0.30 | Program data |
| Hours | 4,380 | Illinois TRM (v10.0) |
| IRF | 26% | 2022 NIPSCO Residential OLM survey |
| ISR | 84% | 2022 NIPSCO Residential OLM survey |

### LED DESK LAMP

The evaluation team used the following equations from Indiana TRM (v2.2) p. 130 to calculate electric energy and peak demand savings, as well as natural gas energy penalties, for Desk Lamps:

$$\Delta kWh = \frac{(W_{base} - W_{LED})}{1{,}000} * (ISR * Hours) * (1 + WHF_e)$$

$$\Delta kW = \frac{(W_{base} - W_{LED})}{1{,}000} * Coincidence\ Factor * ISR * (1 + WHF_d)$$

$$\Delta MMBtu_{WH} = \frac{(W_{base} - W_{LED})}{1{,}000} * (ISR * Hours) * \left(WHF_g\right)$$

Where:

| | | |
|---|---|---|
| $W_{base}$ | = | Wattage of the bulb being replaced, W |
| $W_{LED}$ | = | Wattage of the LED bulb, W |
| Hours | = | Average hours of use per year, hr. |
| $WHF_e$ | = | Waste heat factor for energy to account for HVAC interactions with lighting (depends on location) |
| $WHF_d$ | = | Waste heat factor for demand to account for HVAC interactions with lighting (depends on location) |

| | | |
|---|---|---|
| $WHF_g$ | = | Waste heat factor for gas to account for HVAC interactions with lighting (depends on location) |
| Coincidence Factor | = | Summer peak coincidence factor, 0.11 |
| ISR | = | In-service rate, or fraction of units that get installed |
| 365 | = | Number of days per year, days/yr. |
| 1,000 | = | Constant to convert watts to kW |

Table 361 lists the input assumptions and source of each assumption for the desk lamp measure savings calculations.

TABLE 361. *EX POST* VARIABLE ASSUMPTIONS FOR DESK LAMPS

| INPUT | VALUE | SOURCE |
|---|---|---|
| $W_{base}$ | 38 | LED Application Series, DOE |
| $W_{LED}$ | 3.2 | Actual Installed wattage |
| Hours | 300 | Residential Lighting End-Use Consumption Study, DOE |
| $WHF_e$ | -0.070 | Indiana TRM (v2.2), averaged across participant location |
| $WHF_d$ | 0.038 | Indiana TRM (v2.2), averaged across participant location |
| $WHF_g$ | -.002 | Indiana TRM (v2.2), averaged across participant location |
| Coincidence Factor | 0.11 | Indiana TRM (v2.2) |
| ISR | 82% | 2022 NIPSCO Residential OLM survey |

### SMART PLUG

The evaluation team determined that because this measure was not included in the Illinois TRM v10.0 or the IN TRM v2.2, *ex post* savings would not be granted.

### WI-FI THERMOSTAT

The evaluation team referenced recent research to inform the 2022 analysis of Wi-fi thermostats. The variables taken from the 2020 NIPSCO EM&V report include cooling system capacity and heating system capacity, averaged across all HVAC units (by type). The inputs used from the 2020 billing analysis include cooling energy savings fraction and heating energy savings fraction, which the billing analysis determined were lower than the same values used in *ex ante*, totaling 8.3% and 5.4%, respectively. For gas savings, the evaluation team applied a deemed value of 35 therms from the billing analysis.

The evaluation team used the following equations from Indiana TRM (v2.2) and Illinois TRM v9.0 (for demand) to calculate electric energy savings for Wi-fi thermostats. The thermostat 2020 billing analysis examined all 2018 and 2019 participants, revealing net gas savings of 35 therms (5.4%) for 2019 participants receiving one thermostat.

$$\Delta kWh = ISR\left(\left(\frac{1}{SEER} * EFLH_{cool} * \frac{Btuh_{cool}}{1{,}000} * ESF_{cool}\right) + \left(EFLH_{heat} * \frac{Btuh_{heat}}{N_{heat} * 3412} * ESF_{heat}\right)\right)$$

The Indiana TRM (v2.2) does not provide guidance on claiming demand reduction for these thermostat measures. Currently savings for thermostats in most TRMs and evaluations are derived via analysis of billing data, which generally cannot produce values for demand reduction. However, it is likely that some demand reduction for smart

Wi-Fi thermostats does exist, and this reduction is accommodated in the Illinois TRM v9.0.[83] This TRM calculates savings using standard methods for deriving baseline peak load, then applies a smart Wi-Fi thermostat ESF and half the coincidence factor normally used for cooling. The evaluation team used that same approach. The evaluation team did not update the demand algorithm to the IL TRM v10.0 because the 2020 billing analysis has inputs specific to the v9.0 algorithm. Here, the standard cooling coincidence factor of 0.88 is used, but divided by 2:

$$\Delta kW = \frac{CAP_C}{SEER \times 1{,}000} \times \frac{Coincidence\ Factor}{2} \times ESF_C$$

Where:

- $SEER$ = Seasonal average efficiency ratio
- $EFLH_{cool}$ = Full load cooling hours
- $BtuH_{cool}$ = Cooling system capacity in Btu per hour
- $ESF_{cool}$ = Cooling energy savings fraction
- $EFLH_{heat}$ = Full load heating hours
- $BtuH_{heat}$ = Heating system capacity in Btu per hour
- $N_{heat}$ = Efficiency in COP of heating equipment
- $ESF_{heat}$ = Heating energy savings fraction
- $ISR$ = In-service rate, or fraction of units that get installed
- $CAP_C$ = System cooling capacity ($Btuh_{cool}$)
- $ESF_C$ = Savings factor for cooling derived via 2020 billing analysis, 8.3%
- Coincidence Factor = Standard cooling coincidence factor, 0.88

Table 362 lists the assumptions and source of each assumption for the Wi-Fi thermostat measure savings calculations.

TABLE 362. *EX POST* VARIABLE ASSUMPTIONS FOR WI-FI THERMOSTATS

| INPUT | VALUE | SOURCE |
|---|---|---|
| SEER | 11.15 | Indiana TRM (v2.2) |
| $EFLH_{cool}$ | 429 | Indiana TRM (v2.2), values assigned based on nearest TRM city. Value shown is the program average, not the value used to calculate savings for each participant |
| $Btuh_{cool}$ | 34,426 | AC, average of 2021 program data |
| | 32,925 | HP, average of 2021 program data |
| $ESF_{cool}$ | 0.083 | 2020 billing analysis |
| $EFLH_{heat}$ | 899 | 2020 billing analysis, values assigned based on nearest TRM city. Value shown is the program average, not the value used to calculate savings for each participant |
| $Btuh_{heat}$ | 71,731 | ERH, average of 2021 program data |
| | 22,900 | HP, average of 2021 program data |
| $ESF_{heat}$ | 0.054 | 2020 billing analysis |
| ISR | 91% | 2022 NIPSCO Residential OLM survey |
| $N_{heat}$ | 100% | Assumed electric resistance heat for electric heating customers |

[83] Illinois Energy Efficiency Stakeholder Advisory Group (SAG). *2021 Illinois Statewide Technical Reference Manual for Energy Efficiency Version 9.0.* September 25,2020.

# APPENDIX 12: COMMERCIAL AND INDUSTRIAL (C&I) PROGRAM

## IMPACT EVALUATION NON-LIGHTING DETAILS

### COMPRESSED AIR

The C&I Prescriptive, Custom, and New Construction programs installed compressed air measures in 2022. Table 363 shows the number of measures, savings, and sample sizes by program. The team evaluated nine compressed air measures across the C&I programs. One compressed air measure was handpicked, the rest were randomly selected.

TABLE 363. 2022 C&I PROGRAMS SAMPLED COMPRESSED AIR MEASURES

| PROGRAM | NUMBER OF MEASURES | | | | PROPORTION OF PROGRAM SAVINGS EVALUATED | | |
|---|---|---|---|---|---|---|---|
| | TOTAL | SAMPLED TOTAL | HANDPICKED | RANDOM | KWH | KW | THERMS |
| Prescriptive | - | | | | - | - | - |
| Custom | 223 | 8 | 1 | 7 | 16% | 0% | N/A |
| New Construction | 7 | 1 | - | 1 | 38% | 0% | N/A |
| SBDI | - | | - | - | - | - | - |
| Total | 230 | 9 | 1 | 8 | 17% | 0% | N/A |

Most compressed air sampled measures in PY 2022 related to compressed air leak repairs, all eight of these measures received a 100% realization rate. One compressed air replacement measure was adjusted with customer provided loading data confirming slightly reduced hours of use and demand on the equipment than projected in *ex ante* electric savings calculations (80%).

Table 364 shows the *ex ante* savings and the measure-specific realization rates from the sampled compressed air measures in the 2022 C&I programs. The table shows the actual realization rates the evaluation team estimated for randomly sampled projects; however, the team did not extrapolate those realization rates to the rest of the compressed air measure group population. The team aggregated non-lighting measure types to create realization rates for each program as a full measure category and then extrapolated the non-lighting realization rates to the complete non-lighting population for each program.

TABLE 364. 2022 C&I PROGRAMS *EX ANTE* SAVINGS AND REALIZATION RATES FOR SAMPLED COMPRESSED AIR MEASURES

| PROGRAM | SAMPLED *EX ANTE* | | | REALIZATION RATES (KWH) | | REALIZATION RATES (KW) | |
|---|---|---|---|---|---|---|---|
| | KWH | KW | THERMS | HAND PICKED | RANDOM | HAND PICKED | RANDOM |
| Prescriptive | - | - | - | - | - | - | - |
| Custom | 1,110,710.00 | - | - | 100% | 96% | - | - |
| New Construction | 118,125.00 | | | - | 90% | | - |
| SBDI | - | | | - | | | - |
| Total | 1,228,835.00 | - | - | 100% | 97% | - | - |

Figure 101 illustrates the distribution of realization rates for the individually sampled projects by program. As illustrated, most projects met a 100% realization rate, with the single sampled New Construction measure at 80% realization.

FIGURE 101. 2022 C&I PROGRAMS SAMPLED COMPRESSED AIR MEASURES *EX ANTE* IMPACT AND REALIZATION RATE

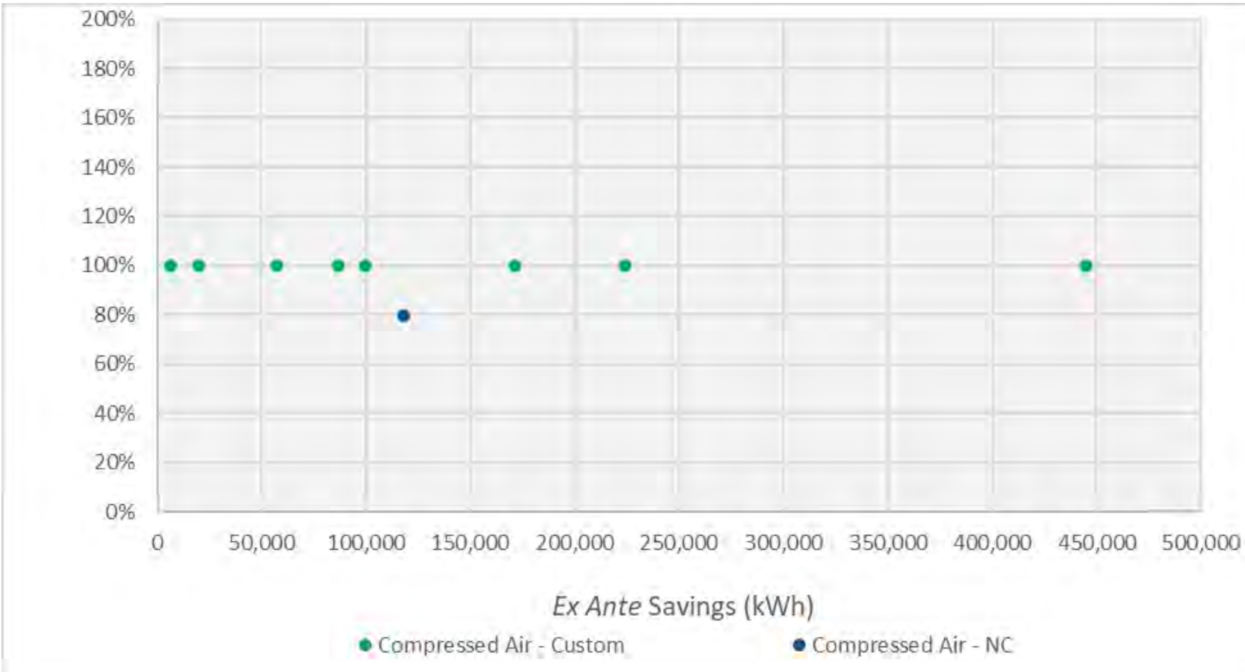



Table 365 summarizes notable differences between *ex ante* and *ex post* gross estimates from the measures sampled.

TABLE 365. 2022 C&I PROGRAMS NOTABLE DIFFERENCES BETWEEN *EX ANTE* & *EX POST* GROSS COMPRESSED AIR MEASURES

| MEASURE CATEGORY | *EX ANTE* SOURCES AND ASSUMPTIONS | *EX POST* GROSS SOURCES AND ASSUMPTIONS | PRIMARY REASONS FOR DIFFERENCES |
|---|---|---|---|
| Compressed Air | *Ex ante* savings were determined through deemed values from the IL TRM v10.0 | IL TRM v10.0. All inputs were verified through project documentation, virtual site visits or interviews. | Modifications based on customer attained data to the load profile, hours of use, and pressure to custom projects only. |

## CONTROLS

The C&I Custom program installed controls measures in 2022. Table 366 details the number of measures, savings, and sample size. The team evaluated four controls measures from the Custom program.

TABLE 366. 2022 C&I PROGRAMS SAMPLED CONTROLS MEASURES

| PROGRAM | NUMBER OF MEASURES | | | | PROPORTION OF PROGRAM SAVINGS EVALUATED | | |
|---|---|---|---|---|---|---|---|
| | TOTAL | SAMPLED TOTAL | HAND PICKED | RANDOM | KWH | KW | THERMS |
| Prescriptive | - | - | | | | | |
| Custom | 19 | 4 | 1 | 3 | 66% | 100% | 68% |
| New Construction | - | - | | | | | |
| SBDI | - | - | | | | | |
| Total | 20 | 4 | 1 | 3 | 66% | 100% | 58% |

Four controls measures were sampled in the PY 2022 population, all of which related to building automation system upgrades. Two measures were unadjusted (one electric, one gas). One large measure was adjusted by incorporating normalized metered data from the equipment being controlled, demonstrating an electric realization rate of 87% and a demand savings realization rate of 138%. The final measure was adjusted to reflect effective full load hours (EFLH), which is a standardized metric in the IL and IN TRMs for climate areas. *Ex ante* calculations utilized operational hours, which do not consider partial loading for weather dependent HVAC equipment. The modification resulted in an electric realization rate of 58%.

Table 367 shows the *ex ante* savings and the measure-specific realization rates from the sampled controls measures in the 2022 C&I programs. The evaluation team applied the measure-specific realization rates from the handpicked sampled projects to only those specific projects. The table shows actual realization rates that the team estimated for randomly sampled projects; however, the team did not extrapolate those realization rates to the rest of the population. The team aggregated non-lighting measure types to create realization rates for each program as a full measure category and then extrapolated the non-lighting realization rates to the complete non-lighting population for each program.

TABLE 367. 2022 C&I PROGRAMS *EX ANTE* SAVINGS & REALIZATION RATES FOR SAMPLED CONTROLS MEASURES

| PROGRAM | SAMPLED *EX ANTE* | | | REALIZATION RATES (KWH) | | REALIZATION RATES (KW) | | REALIZATION RATES (THERMS) | |
|---|---|---|---|---|---|---|---|---|---|
| | KWH | KW | THERMS | HAND PICKED | RANDOM | HAND PICKED | RANDOM | HAND PICKED | RANDOM |
| Prescriptive | - | - | - | - | - | - | - | - | - |
| Custom | 1,586,784.85 | 15.600 | 6,247.50 | 87% | 96% | 138% | - | - | 98% |
| New Construction | - | - | - | - | - | - | - | - | - |
| SBDI | - | - | - | - | - | - | - | - | - |
| Total | 1,586,784.85 | 15.600 | 6,247.50 | 87% | 87% | 138% | - | - | 100% |

Figure 102 and Figure 103 illustrate the distribution of realization rates for the individually sampled projects by program. The larger impact electric measure had a realization rate of 84%. The single sampled therms measure had a realization rate of 100%.

FIGURE 102. 2022 C&I PROGRAMS SAMPLED CONTROLS MEASURES
KWH *EX ANTE* IMPACT AND REALIZATION RATES

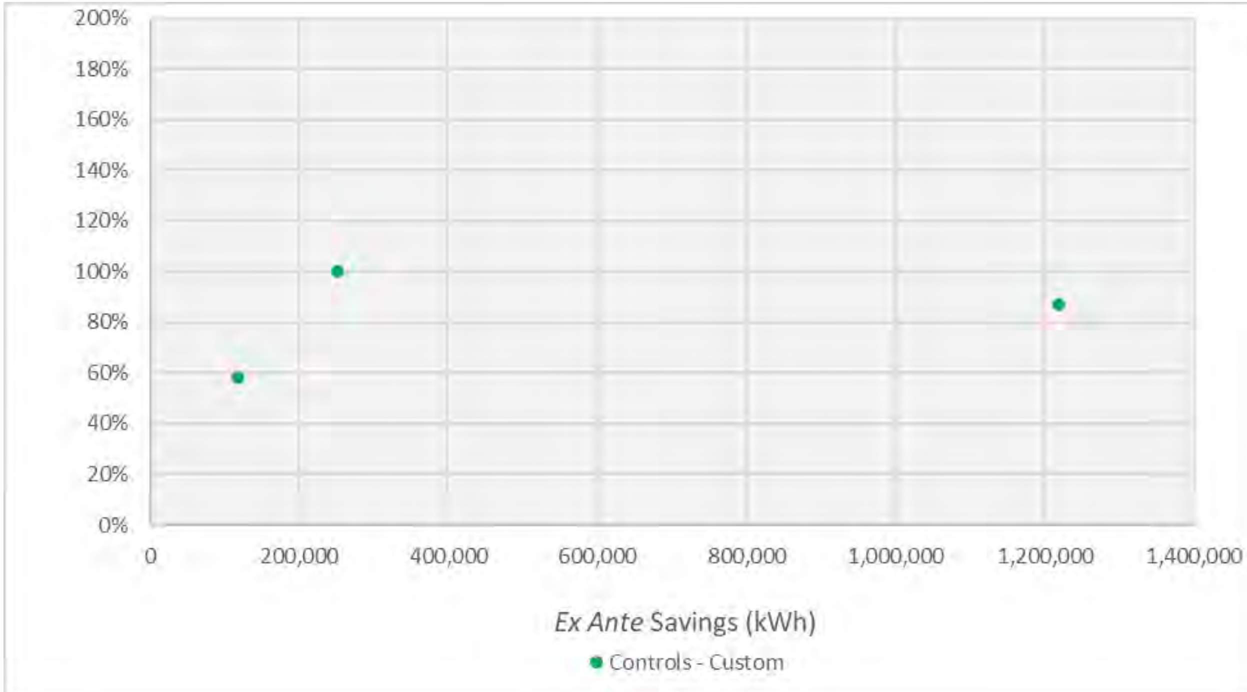



FIGURE 103. 2022 C&I PROGRAMS SAMPLED CONTROL MEASURES
THERM *EX ANTE* IMPACT AND REALIZATION RATES

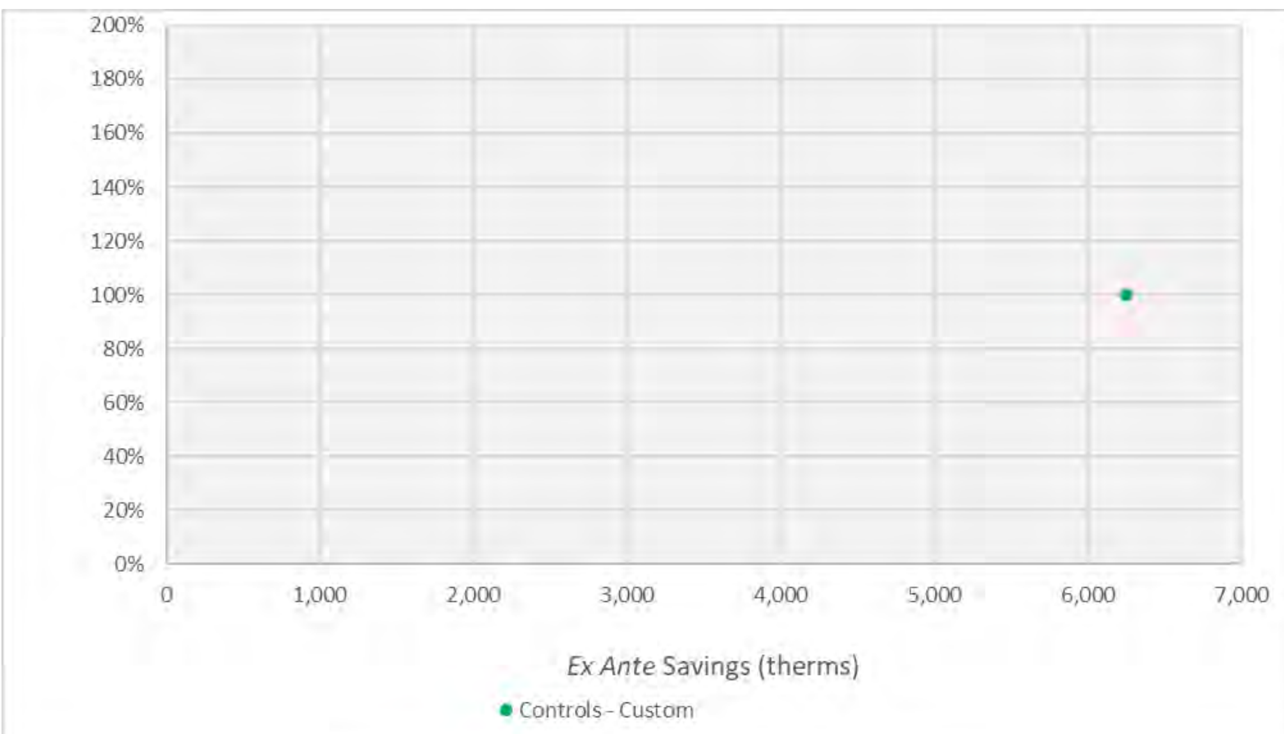


Table 368 summarizes notable differences between *ex ante* and *ex post* gross estimates from the measures sampled.

TABLE 368. 2022 C&I PROGRAMS NOTABLE DIFFERENCES BETWEEN *EX ANTE* & *EX POST* GROSS WATER HEAT MEASURES

| MEASURE CATEGORY | *EX ANTE* SOURCES AND ASSUMPTIONS | *EX POST* GROSS SOURCES AND ASSUMPTIONS | PRIMARY REASONS FOR DIFFERENCES |
|---|---|---|---|
| Controls | *Ex ante* savings were determined custom calculations | Custom calculations. All inputs were verified through project documentation, virtual site visits or interviews. | Equipment capacity did not match reported capacity. Customer collected data demonstrated programming modifications to implemented measures. Modifications based on customer interview and trend data to the measure inputs. |

## HEATING VENTILATION AND AIR CONDITIONING (HVAC)

All four C&I programs offered HVAC measures in 2022. Table 369 shows the number of measures, savings, and sample sizes. The evaluation team evaluated 29 HVAC measures across the C&I programs, which represented 47% of the gas savings for the measure group.

TABLE 369. 2022 C&I PROGRAMS SAMPLED HVAC MEASURES

| PROGRAM | NUMBER OF MEASURES | | | | PROPORTION OF PROGRAM SAVINGS EVALUATED | | |
|---|---|---|---|---|---|---|---|
| | TOTAL | SAMPLED TOTAL | HAND PICKED | RANDOM | KWH | KW | THERMS |
| Prescriptive | 128 | 3 | 1 | 2 | 13% | 7% | 14% |
| Custom | 61 | 8 | 2 | 6 | 0% | 0% | 61% |
| New Construction | 135 | 13 | 3 | 10 | 53% | 29% | 39% |
| SBDI | 9 | 5 | 1 | 4 | 100% | 100% | 100% |
| Total | 333 | 29 | 7 | 22 | 24% | 12% | 47% |

Furnace installations made up 13 of the sampled measures, and nearly all measures had slight deviations due to an evaluator calculator being used in place of implementor model outputs provided with the project documentation. Most evaluations resulted in minor deviations from *ex ante* therms savings (82% - 105%) due to minor deviations in system efficiency values or infiltration values. There were a couple minor errors in translation of savings output values from the *ex ante* calculation (CCF) to the *ex ante* reported values (therms). Two of the furnace projects had larger deviations due to the *ex ante* calculations not accounting for setback savings (137%), and a correction made to total building square footage served (63%).

There were seven boiler replacement measures evaluated, of which two realized 100% *ex ante* therms savings. One measure was adjusted slightly due to a different specified efficiency of equipment (91%), while another was evaluated against normalized utility bill analysis and demonstrated slightly less savings than projected in the *ex ante* therms calculations (93%). Three boiler measures were adjusted to reflect the prescriptive deemed savings found in the IN TRM v2.2. One of these measures resulted in 60% therms realization, another in 107% therms realization, and another resulted in 0% therms realization rate due to the performance boiler having a specified efficiency of 80%, which is the specified baseline efficiency in the IN TRM v2.2.

The remaining HVAC measures consisted of steam trap leak fix/replacement, smart thermostat installation, VSD on HVAC fans, and HVAC equipment installation, none of which had any modifications made to *ex ante* savings claimed.

TABLE 370shows the *ex ante* savings and the measure-specific realization rates from the sampled HVAC measures in the 2022 C&I programs by fuel type. The team applied the measure-specific realization rates from the handpicked sampled projects to only those specific projects. The table shows actual realization rates the team estimated for randomly sampled projects; however, the team did not extrapolate those realization rates to the rest of the HVAC population. The team aggregated the non-lighting measure types to create realization rates for each program as a full measure category and then extrapolated the non-lighting realization rates to the complete non-lighting population for each program.

TABLE 370. 2022 C&I PROGRAMS *EX ANTE* SAVINGS VALUES FOR HVAC MEASURES AND REALIZATION RATES FOR SAMPLED HVAC MEASURES

| PROGRAM | SAMPLED *EX ANTE* | | | REALIZATION RATES (KWH) | | REALIZATION RATES (KW) | | REALIZATION RATES (THERMS) | |
|---|---|---|---|---|---|---|---|---|---|
| | KWH | KW | THERMS | HAND PICKED | RANDOM | HAND PICKED | RANDOM | HAND PICKED | RANDOM |
| Prescriptive | 29,536.25 | 9.473 | 4,145.50 | 100% | - | 100% | - | - | 103% |
| Custom | - | - | 210,634.00 | - | - | - | - | 102% | 98% |
| New Construction | 290,260.00 | 22.200 | 337,755.46 | 100% | 90% | - | 153% | 104% | 87% |
| SBDI | 2,955.66 | 0.522 | 43,795.80 | - | 100% | - | 135% | 100% | 100% |
| Total | 322,751.91 | 32.195 | 596,330.76 | 100% | 100% | 135% | 100% | 92% | 103% |

Figure 104 and Figure 105 illustrate the distribution of realization rates for the individually sampled projects by program and by fuel source. As illustrated, projects with kWh savings met a 100% realization rate. There were more therms projects in this category, most with very near 100% realization rates, with larger deviation in the smaller impact HVAC measures.

FIGURE 104. 2022 C&I PROGRAMS SAMPLED HVAC MEASURES
KWH *EX ANTE* IMPACT AND REALIZATION RATES

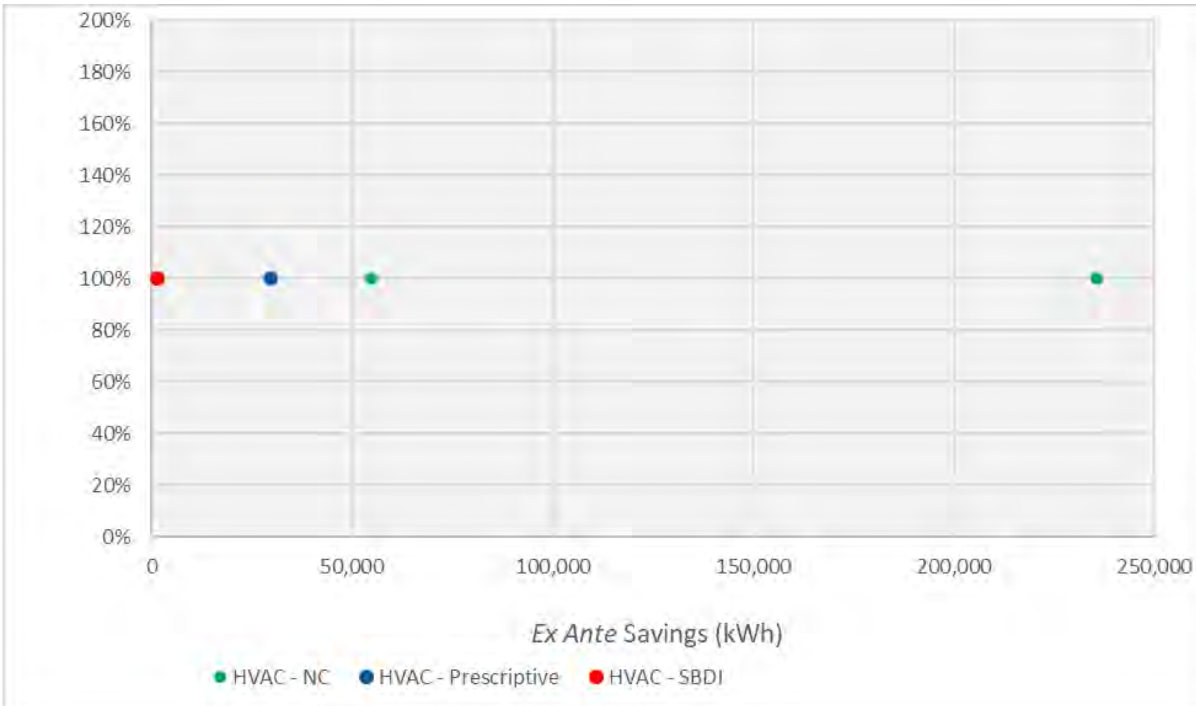



FIGURE 105. C&I PROGRAMS SAMPLED HVAC MEASURES
THERM *EX ANTE* IMPACT AND REALIZATION RATES

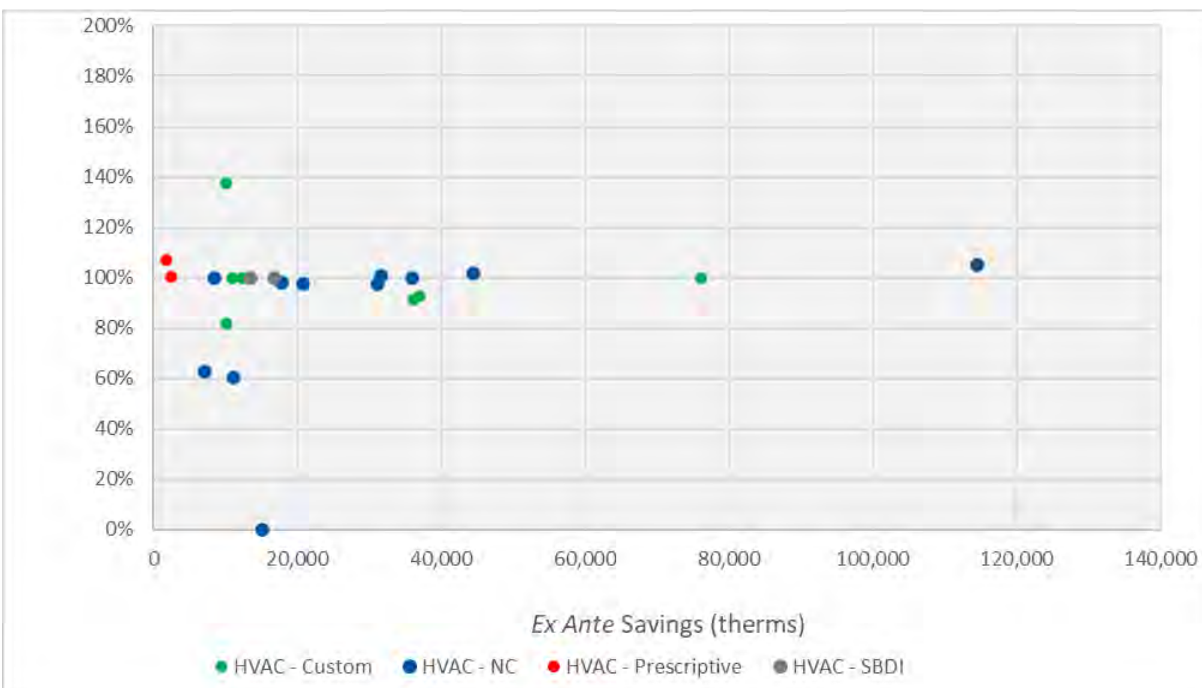


Table 371 summarizes notable differences between *ex ante* and *ex post* gross estimates from the measures sampled.

TABLE 371. 2022 C&I PROGRAMS NOTABLE DIFFERENCES BETWEEN *EX ANTE* & *EX POST* GROSS HVAC MEASURES

| MEASURE CATEGORY | *EX ANTE* SOURCES AND ASSUMPTIONS | *EX POST* GROSS SOURCES AND ASSUMPTIONS | PRIMARY REASONS FOR DIFFERENCES |
|---|---|---|---|
| HVAC | *Ex ante* savings were determined by the IL TRM v10.0, calculated through the application excel tool. | IL TRM v10.0, calculated through the application excel tool. All inputs were verified through project documentation, virtual site visits or interviews. | Installed equipment efficiencies for energy and demand savings calculations. Missing calculations were recreated with evaluator created furnace savings calculation spreadsheets resulting in minor differences in claimed savings. |

## MOTORS

The Custom and New Construction programs reported savings from motor measures in 2022. Table 372 details the number of measures, savings, and sample sizes. The team evaluated 25 motor measures, capturing 12% of the energy savings for the motor measure group.

TABLE 372. 2022 C&I PROGRAMS SAMPLED MOTOR MEASURES

| PROGRAM | NUMBER OF MEASURES | | | | PROPORTION OF PROGRAM SAVINGS EVALUATED | | |
|---|---|---|---|---|---|---|---|
| | TOTAL | SAMPLED TOTAL | HAND PICKED | RANDOM | KWH | KW | THERMS |
| Prescriptive | - | - | | | | | |
| Custom | 11 | 1 | - | 1 | 8% | N/A | N/A |
| New Construction | 14 | 1 | - | 1 | 21% | 0% | N/A |
| SBDI | - | - | | | | | |
| Total | 25 | 2 | - | 2 | 12% | 0% | N/A |

Both sampled motors measures received 100% electric realization rates. No deviations were found.

Table 373 shows the *ex ante* savings and the measure-specific realization rates from the sampled motor measures in the 2022 Custom and New Construction programs. The evaluation team applied measure-specific realization rates from the handpicked sampled projects to only those specific projects. The table shows actual realization rates the team estimated for randomly sampled projects; however, the team did not extrapolate those realization rates to the rest of the motors population. The team aggregated the non-lighting measure types to create realization rates for each program as a full measure category and then extrapolated the non-lighting realization rates to the complete non-lighting population for each program.

TABLE 373. 2022 C&I PROGRAMS *EX ANTE* SAVINGS AND REALIZATION RATES FOR SAMPLED MOTOR MEASURES

| PROGRAM | SAMPLED *EX ANTE* | | | REALIZATION RATES (KWH) | | REALIZATION RATES (KW) | |
|---|---|---|---|---|---|---|---|
| | KWH | KW | THERMS | HAND PICKED | RANDOM | HAND PICKED | RANDOM |
| Prescriptive | - | - | - | - | - | - | - |
| Custom | 45,361.00 | - | - | - | 100% | - | - |
| New Construction | 52,696.00 | - | - | - | 100% | - | - |
| SBDI | - | - | - | - | - | - | - |
| Total | 98,057.00 | | | - | 100% | - | - |

Figure 106 illustrates the distribution of realization rates for the individually sampled projects by program. Both sampled motors measures received 100% electric realization rates.

FIGURE 106. C&I PROGRAMS SAMPLED MOTOR MEASURES *EX ANTE* IMPACT AND REALIZATION RATES

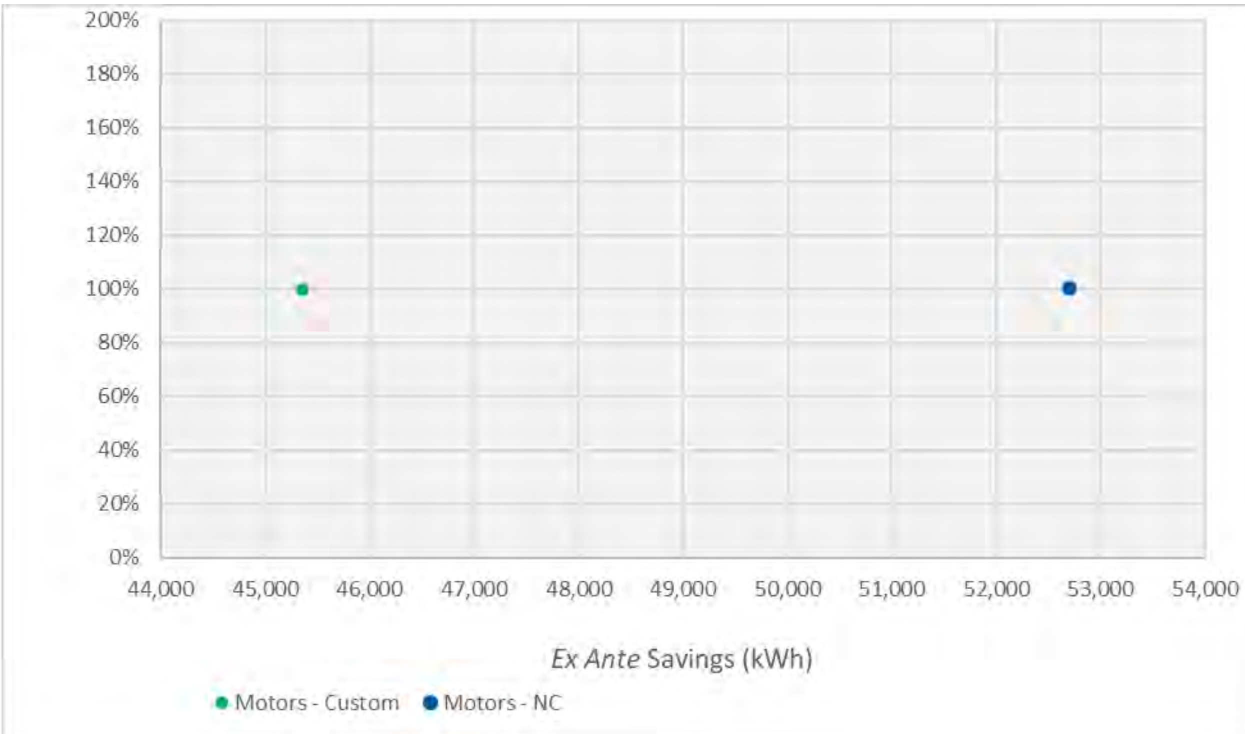



Table 374 summarizes notable differences between *ex ante* and *ex post* gross estimates from the measure sampled.

TABLE 374. 2022 C&I PROGRAMS NOTABLE DIFFERENCES BETWEEN *EX ANTE* AND *Ex Post* Gross MOTOR MEASURES

| MEASURE CATEGORY | *EX ANTE* SOURCES AND ASSUMPTIONS | *EX POST* GROSS SOURCES AND ASSUMPTIONS | PRIMARY REASONS FOR DIFFERENCES |
|---|---|---|---|
| Motors | *Ex ante* savings were determined through custom calculations | Custom calculations. All inputs were verified through project documentation, virtual site visits or interviews. Customer data was requested to supplement inputs. | Modifications based on customer interview and trend data to the measure inputs. |

## PROCESS

The C&I Custom program installed process measures in 2022. Table 375 details the number of measures, savings, and sample size. The team evaluated 11 process measures from the Custom and New Construction program.

TABLE 375. 2022 C&I PROGRAMS SAMPLED PROCESS MEASURES

| PROGRAM | NUMBER OF MEASURES | | | | PROPORTION OF PROGRAM SAVINGS EVALUATED | | |
|---|---|---|---|---|---|---|---|
| | TOTAL | SAMPLED TOTAL | HAND PICKED | RANDOM | KWH | KW | THERMS |
| Prescriptive | - | - | | | | | |
| Custom | 5 | 1 | 1 | - | 40% | 28% | N/A |
| New Construction | 6 | 1 | 1 | - | 100% | N/A | 0% |
| SBDI | - | - | | | | | |
| Total | 11 | 2 | 2 | - | 75% | 28% | 0% |

Two large process measures were handpicked due to their size and impact. One was adjusted due to a loading factor incorrectly being applied twice in the ex ante calculations. When applied just once, the resulting electric realization rate was 127%. The other process measure received a 100% electric realization rate.

Table 376 shows the *ex ante* savings and the measure-specific realization rates from the sampled process measures in the 2022 Custom program. The evaluation team applied the measure-specific realization rates from the handpicked sampled projects to only those specific projects. The table shows actual realization rates the team estimated for randomly sampled projects; however, the team did not extrapolate those realization rates to the rest of the process population. The team aggregated the non-lighting measure types to create realization rates for each program as a full measure category and then extrapolated the non-lighting realization rates to the complete non-lighting population for the program.

TABLE 376. 2022 C&I PROGRAMS *EX ANTE* SAVINGS AND REALIZATION RATES FOR SAMPLED PROCESS MEASURES

| PROGRAM | SAMPLED *EX ANTE* | | | REALIZATION RATES (KWH) | | REALIZATION RATES (KW) | | REALIZATION RATES (THERMS) | |
|---|---|---|---|---|---|---|---|---|---|
| | KWH | KW | THERMS | HAND PICKED | RANDOM | HAND PICKED | RANDOM | HAND PICKED | RANDOM |
| Prescriptive | - | - | - | | | | | | |
| Custom | 478,544.16 | 30.728 | - | 100% | - | 100% | - | - | - |
| New Construction | 1,670,410.00 | - | - | 127% | - | - | - | - | - |
| SBDI | - | - | - | | | | | | |
| Total | 2,148,954.16 | 30.728 | - | 121% | - | 100% | - | - | - |

Figure 107 illustrates the distribution of realization rates for the individually sampled projects by program. Most projects in this category had small impact, most with realization rates near 100%. One larger impact new construction project had a realization rate of 127%.

FIGURE 107. 2022 C&I PROGRAMS SAMPLED PROCESS MEASURES *EX ANTE* IMPACT AND REALIZATION RATES

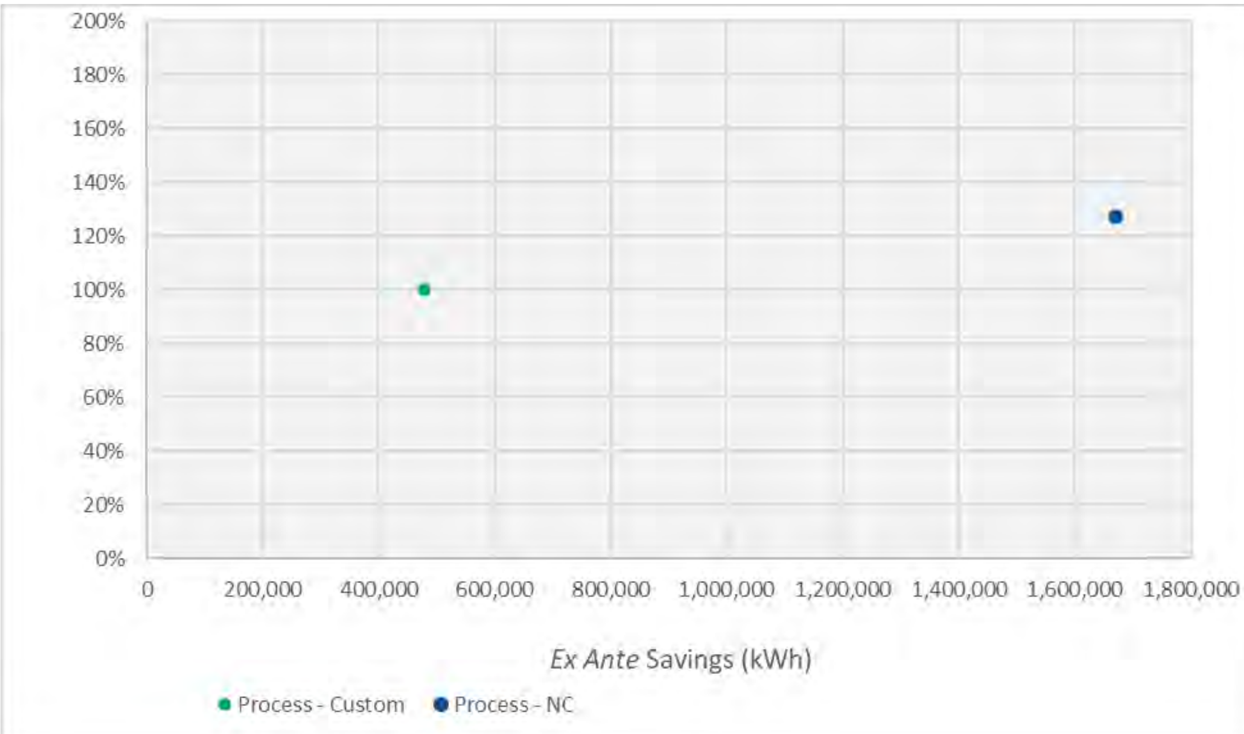



Table 377 summarizes notable differences between *ex ante* and *ex post* gross estimates from the measures sampled.

TABLE 377. 2022 C&I PROGRAMS NOTABLE DIFFERENCES BETWEEN *EX ANTE* AND *EX POST* GROSS PROCESS MEASURES

| MEASURE CATEGORY | *EX ANTE* SOURCES AND ASSUMPTIONS | *EX POST* GROSS SOURCES AND ASSUMPTIONS | PRIMARY REASONS FOR DIFFERENCES |
|---|---|---|---|
| Process | *Ex ante* savings were determined through custom engineering calculations | Custom calculations. All inputs were verified through project documentation, virtual site visits or interviews. | Modifications based on customer interview and trend data to the measure inputs. |

## REFRIGERATION

The Prescriptive, Custom and New Construction C&I programs reported savings for refrigeration measures in 2022. Table 378 details the number of measures, savings, and sample sizes for refrigeration measures. The team evaluated four refrigeration measures across the C&I programs.

TABLE 378. 2022 C&I PROGRAMS SAMPLED REFRIGERATION MEASURES

| PROGRAM | NUMBER OF MEASURES | | | | PROPORTION OF PROGRAM SAVINGS EVALUATED | | |
|---|---|---|---|---|---|---|---|
| | TOTAL | SAMPLED TOTAL | HAND PICKED | RANDOM | KWH | KW | THERMS |
| Prescriptive | 42 | 2 | - | 2 | 87% | N/A | N/A |
| Custom | 5 | 1 | - | 1 | 30% | 20% | N/A |
| New Construction | 6 | 1 | - | 1 | 41% | N/A | N/A |
| SBDI | - | - | - | - | - | - | - |
| Total | 53 | 4 | - | 4 | 36% | 20% | N/A |

Four refrigeration measures were sampled from two unique customer projects. The two measures in one project were adjusted very slightly to reflect a standardized savings factor resulting in electric realization rates for the measures of 100% and 96%. The two measures in the other project were adjusted with a fan count reflective of the provided project documentation, resulting in measure electric realization rates of 70% and 100%.

Table 379 shows the *ex ante* savings and the measure-specific realization rates from the sampled refrigeration measures in the 2022 C&I programs. The evaluation team applied the measure-specific realization rates from the handpicked sampled projects to only those specific projects. The table shows actual realization rates the team estimated for randomly sampled projects; however, the team did not extrapolate those realization rates to the rest of the refrigeration population. The team aggregated the non-lighting measure types to create realization rates for each program as a full measure category and then extrapolated the non-lighting realization rates to the complete non-lighting population for each program.

TABLE 379. 2022 C&I PROGRAMS *EX ANTE* SAVINGS AND REALIZATION RATES FOR SAMPLED REFRIGERATION MEASURES

| PROGRAM | SAMPLED *EX ANTE* | | | REALIZATION RATES (KWH) | | REALIZATION RATES (KW) | |
|---|---|---|---|---|---|---|---|
| | KWH | KW | THERMS | HANDPICKED | RANDOM | HANDPICKED | RANDOM |
| Prescriptive | 199,290.00 | 18.804 | - | - | 82% | - | 87% |
| Custom | 61,378.00 | - | - | - | 100% | - | - |
| New Construction | 21,344.00 | - | - | - | 96% | - | - |
| SBDI | - | - | - | | - | - | - |
| Total | 282,012.00 | 18.804 | - | - | 86% | - | 87% |

Figure 108 illustrates the distribution of realization rates for the individually sampled projects by program. Most projects in this category had small impact, most with realization rates near 100%.  One larger impact prescriptive project had a realization rate of 70%.

FIGURE 108. 2022 C&I PROGRAMS SAMPLED REFRIGERATION MEASURES *EX ANTE* IMPACT AND REALIZATION RATES

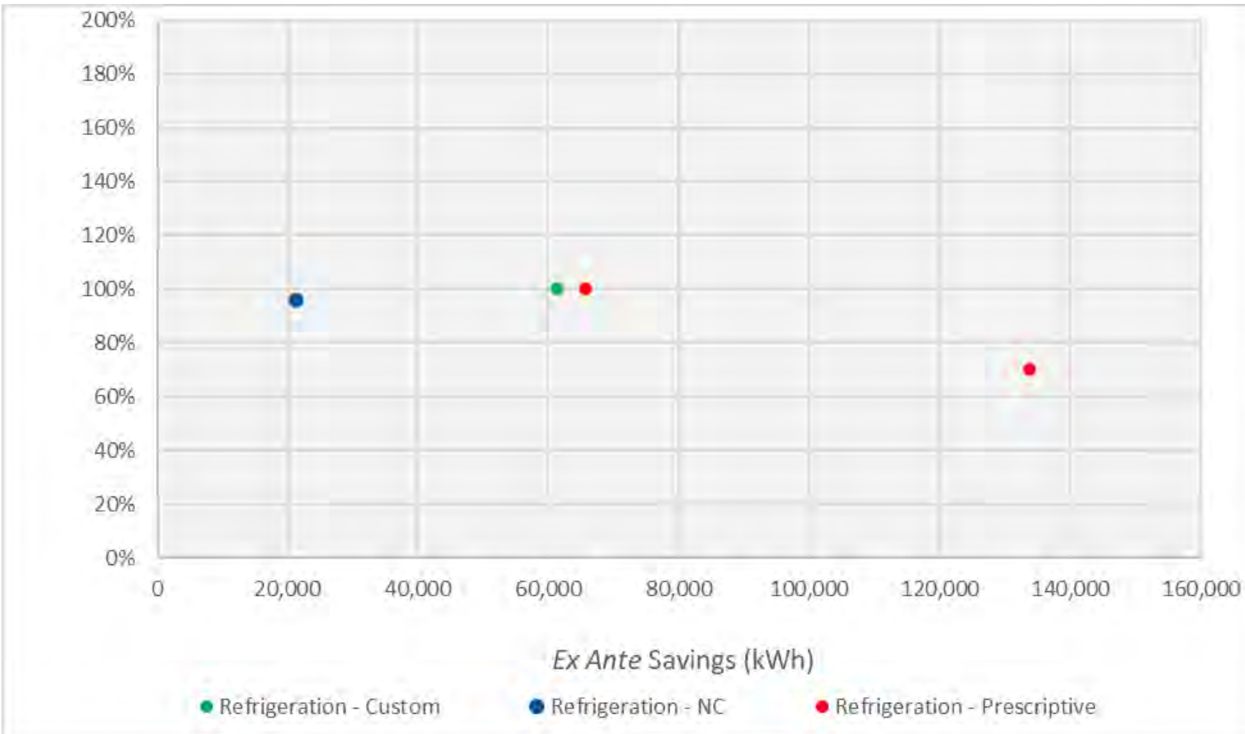



Table 380 summarizes notable differences between *ex ante* and *ex post* gross estimates from the measures sampled.

TABLE 380. 2022 C&I PROGRAMS NOTABLE DIFFERENCES BETWEEN *EX ANTE* & *EX POST* GROSS REFRIGERATION MEASURES

| MEASURE CATEGORY | *EX ANTE* SOURCES AND ASSUMPTIONS | *EX POST* GROSS SOURCES AND ASSUMPTIONS | PRIMARY REASONS FOR DIFFERENCES |
|---|---|---|---|
| Refrigeration | *Ex ante* savings were determined by the Indiana IL TRM v10.0, Michigan EMD, or through engineering calculations. | IL TRM v10.0. All inputs were verified through project documentation, virtual site visits or interviews. | Modifications to quantities based on project plans provided. |

## VARIABLE FREQUENCY DRIVES (VFD)

Only the Prescriptive program rebated VFD measures in 2022. Table 381 documents the number of measures, savings, and sample size for the measures. The evaluation team sampled two VFD measures.

TABLE 381. 2022 C&I PROGRAMS SAMPLED VFD MEASURES

| PROGRAM | NUMBER OF MEASURES | | | | PROPORTION OF PROGRAM SAVINGS EVALUATED | | |
|---|---|---|---|---|---|---|---|
| | TOTAL | SAMPLED TOTAL | HAND PICKED | RANDOM | KWH | KW | THERMS |
| Prescriptive | 12 | 2 | - | 2 | 70% | 51% | N/A |
| Custom | - | - | | | | | |
| New Construction | - | - | | | | | |
| SBDI | - | - | | | | | |
| Total | 12 | 2 | - | 2 | 70% | 51% | N/A |

Two VFD measures were sampled and adjusted for more project specific building space types, related to HOU, loading and coincidence demand, resulting in electric realization rates of 75% and 89%.

Table 382 shows the *ex ante* savings and the measure-specific realization rates from the sampled VFD measures in the Prescriptive program. The evaluation team applied the measure-specific realization rates from the handpicked sampled projects to only those specific projects. The table shows actual realization rates the team estimated for randomly sampled projects; however, the team did not extrapolate those realization rates to the rest of the VFD population. The team aggregated the non-lighting measure types to create realization rates for the program as a full measure category and then extrapolated the non-lighting realization rates to the complete non-lighting population for the program.

TABLE 382. 2022 C&I PROGRAMS *EX ANTE* SAVINGS & REALIZATION RATES FOR SAMPLED VFD MEASURES

| PROGRAM | SAMPLED *EX ANTE* | | | REALIZATION RATES (KWH) | | REALIZATION RATES (KW) | |
|---|---|---|---|---|---|---|---|
| | KWH | KW | THERMS | HAND PICKED | RANDOM | HAND PICKED | RANDOM |
| Prescriptive | 126,224.00 | 13.411 | N/A | - | 82% | - | 69% |
| Custom | - | - | - | | | | |
| New Construction | - | - | - | | | | |
| SBDI | - | - | - | | | | |
| Total | 126,224.00 | 13.411 | N/A | - | 77% | - | 20% |

Figure 109 illustrates the distribution of the realization rates for the individually sampled projects by program. The sampled Prescriptive VFD projects had realization rates below 100%.

FIGURE 109. 2022 C&I PROGRAMS SAMPLED VFD MEASURES *EX ANTE* IMPACT AND REALIZATION RATES

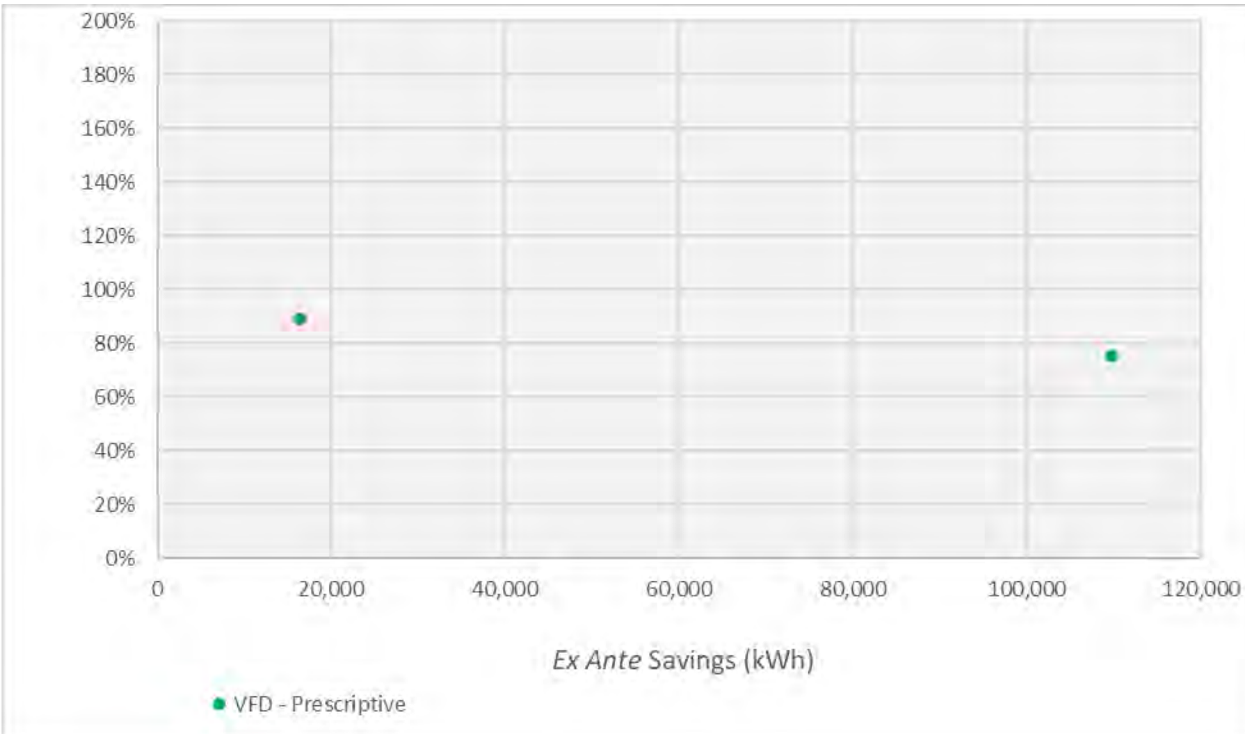



Table 383 summarizes notable differences between *ex ante* and *ex post* gross estimates from the measures sampled.

TABLE 383. 2022 C&I PROGRAMS NOTABLE DIFFERENCES BETWEEN *EX ANTE* AND *EX POST* GROSS VFD MEASURES

| MEASURE CATEGORY | *EX ANTE* SOURCES AND ASSUMPTIONS | *EX POST* GROSS SOURCES AND ASSUMPTIONS | PRIMARY REASONS FOR DIFFERENCES |
|---|---|---|---|
| VFD | *Ex ante* savings were determined by the Indiana TRM v2.2, Michigan EMD, or through engineering calculations. | Indiana TRM v2.2. All inputs were verified through project documentation, virtual site visits or interviews. | Modifications to baseline case volumes, quantities, capacities composed most adjustments. Deviation from the IN TRM v2.2 prescriptive calculations. |

## OTHER CATEGORY

The evaluation team grouped measures that had low participation and low savings impact into the *Other* category. These measures include Other, Building Redesign, Kitchen, Ventilation, and Water Heat. Table 384 details the number of measures, savings, and sampling sizes for measures within the *Other* category. No measures from the other measure group existed in the population this year. And no measures from the building redesign measure group were sampled in the 2022 evaluation given their relatively small impact to the New Construction program.

TABLE 384. 2022 C&I PROGRAMS SAMPLED OTHER CATEGORY MEASURES

| PROGRAM | NUMBER OF MEASURES | | | | PROPORTION OF PROGRAM SAVINGS EVALUATED | | |
|---|---|---|---|---|---|---|---|
| | TOTAL | SAMPLED TOTAL | HAND PICKED | RANDOM | KWH | KW | THERMS |
| **Building Redesign Measures** | | | | | | | |
| Prescriptive | - | - | | | | | |
| Custom | - | - | | | | | |
| New Construction | 2 | - | - | - | - | - | - |
| SBDI | - | - | | | | | |
| **Kitchen Measures** | | | | | | | |
| Prescriptive | 3 | 1 | - | 1 | 57% | 63%% | N/A |
| Custom | - | - | | | | | |
| New Construction | - | - | | | | | |
| SBDI | - | - | | | | | |
| **Other Measures** | | | | | | | |
| Prescriptive | - | - | | | | | |
| Custom | - | - | | | | | |
| New Construction | - | - | | | | | |
| SBDI | - | - | | | | | |
| **Ventilation Measures** | | | | | | | |
| Prescriptive | - | - | | | | | |
| Custom | 12 | 3 | - | 3 | - | - | 34% |
| New Construction | - | - | | | | | |
| SBDI | - | - | | | | | |
| **Water Heat Measures** | | | | | | | |
| Prescriptive | 3 | 1 | - | 1 | N/A | N/A | 80% |
| Custom | 1 | - | | | | | |
| New Construction | 3 | - | | | | | |
| SBDI | - | - | | | | | |

**Kitchen.** The team evaluated one (of one) kitchen measure from the Prescriptive program. A single kitchen measure was sampled and adjusted to align with the IN TRM v2.2 deemed savings, resulting in an electric realization rate of 104%.

**Other.** No other measure category measures appeared in the population this year.

**Ventilation:** Three ventilation measures were sampled from the Custom program, all measures had slight deviations due to an evaluator calculator being used in place of vendor calculations provided with the project documentation, resulting in therms realization rates of 102%, 79% and 106%.

**Water Heat.** The team evaluated one (of 7) water heat measures from the Prescriptive program. The single sampled water heat measure received a 100% therms realization rate.

Table 385 shows the *ex ante* savings and the measure specific realization rates from the sampled Other measures in the 2022 C&I programs. The evaluation team applied the measure-specific realization rates from the handpicked sampled projects to only those specific projects. The table shows actual realization rates the team estimated for randomly sampled projects; however, the team did not extrapolate those realization rates to the rest of the *Other* population. The team aggregated the non-lighting measure types to create realization rates for each program as a full measure category and then extrapolated the non-lighting realization rates to the complete non-lighting population for each program.

TABLE 385. 2022 C&I PROGRAMS *EX ANTE* SAVINGS AND REALIZATION RATES FOR SAMPLED OTHER MEASURES

| PROGRAM | SAMPLED *EX ANTE* | | | REALIZATION RATES (KWH) | | REALIZATION RATES (KW) | | REALIZATION RATES (THERMS) | |
|---|---|---|---|---|---|---|---|---|---|
| | KWH | KW | THERMS | HAND PICKED | RANDOM | HAND PICKED | RANDOM | HAND PICKED | RANDOM |
| **Building Redesign Measures** | | | | | | | | | |
| Prescriptive | - | - | - | | | | | | |
| Custom | - | - | - | | | | | | |
| New Construction | - | - | - | | | | | | |
| SBDI | - | - | - | | | | | | |
| **Kitchen Measure** | | | | | | | | | |
| Prescriptive | 5,278.00 | 0.806 | - | | 100% | | 100% | | - |
| Custom | - | - | - | | | | | | |
| New Construction | - | - | - | | | | | | |
| SBDI | - | - | - | | | | | | |
| **Other Measures** | | | | | | | | | |
| Prescriptive | - | - | - | | | | | | |
| Custom | - | - | 31,450.00 | - | | - | | 86% | |
| New Construction | - | - | - | | | | | | |
| SBDI | - | - | - | | | | | | |
| **Ventilation Measures** | | | | | | | | | |
| Prescriptive | - | - | - | | | | | | |
| Custom | - | - | - | | | | | | |
| New Construction | - | - | - | | | | | | |
| SBDI | - | - | - | | | | | | |
| **Water Heat Measures** | | | | | | | | | |
| Prescriptive | - | - | 208.00 | | - | | - | | 100% |
| Custom | - | - | - | | | | | | |
| New Construction | - | - | 114.00 | | - | | - | | 100% |
| SBDI | - | - | - | | | | | | |
| **Total** | 5,278.00 | 0.806 | 31,772.00 | | | | | | |

Figure 110 illustrates the distribution of realization rates for the individually sampled electric savings projects by program, and Figure 111 illustrates the distribution of realization rates distribution for the individually sampled gas savings projects by program. The single kWh saving kitchen project had a realization rate just above 100%. There was some deviation in therms savings realization rates, with one of the larger impact projects achieving a realization rate of 79%, but the other two largest measures slightly above 100% realization.

FIGURE 110. 2022 C&I PROGRAMS SAMPLED OTHER MEASURES
KWH *EX ANTE* IMPACT AND REALIZATION RATES

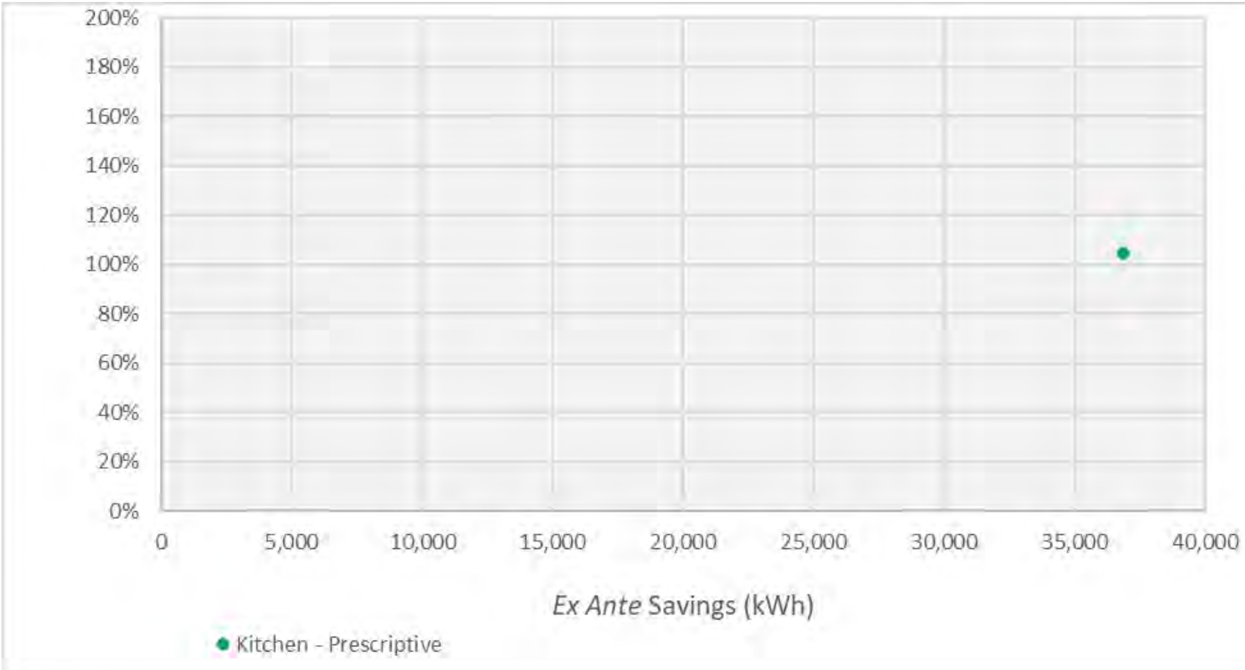



FIGURE 111. 2022 C&I PROGRAMS SAMPLED OTHER MEASURES
THERM *EX ANTE* IMPACT AND REALIZATION RATES

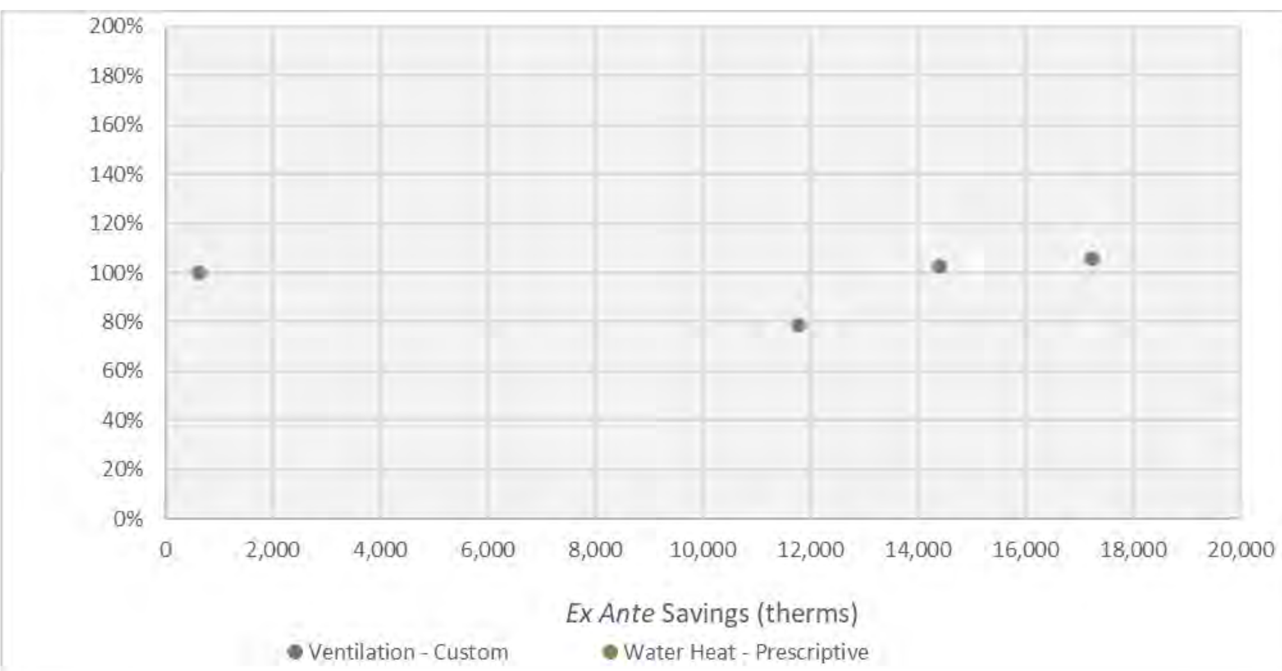


Table 386 summarizes notable differences between *ex ante* and *ex post* gross estimates from the measures sampled.

TABLE 386. 2022 C&I PROGRAMS NOTABLE DIFFERENCES BETWEEN *EX ANTE* & *EX POST* GROSS OTHER MEASURES

| MEASURE CATEGORY | *EX ANTE* SOURCES AND ASSUMPTIONS | *EX POST* GROSS SOURCES AND ASSUMPTIONS | PRIMARY REASONS FOR DIFFERENCES |
|---|---|---|---|
| Kitchen | *Ex ante* savings were determined through engineering calculations derived from the MI Energy Measures Database. | 2015 Indiana TRM (v2.2), Michigan Energy Measures Database. All inputs were verified through project documentation, virtual site visits or interviews. | No deviations found. |
| Other | *Ex ante* savings were determined through engineering calculations. | 2015 Indiana TRM (v2.2). All inputs were verified through project documentation, virtual site visits or interviews. | Customer collected data demonstrated RCx programming modifications to implemented measures |
| Water Heat | *Ex ante* savings were determined by the 2015 Indiana TRM (v2.2). | 2015 Indiana TRM (v2.2). All inputs were verified through project documentation, virtual site visits or interviews. | No deviations found. |

## NON-LIGHTING ADJUSTMENT SUMMARY

Table 387 shows the *ex ante* savings and the measure-specific realization rates from the sampled non-lighting measures in the 2022 C&I programs by fuel type. The evaluation team only applied the measure-specific realization rates from the handpicked sampled measures to those specific measures. The table shows the realization rates determined for randomly sampled measures; however, the team did not extrapolate those realization rates to the rest of a given population. The evaluation team aggregated non-lighting measure types to create realization rates for each program as a full measure category and then extrapolated the rates to the complete non-lighting population for each program. The extrapolated non-lighting realization rates for all programs combined were 97% for electric savings, 97% for demand savings, and 93% for natural gas therm savings. The complete set of extrapolated realization rates are shown in Table 387.

## TABLE 387. 2022 C&I PROGRAMS *EX ANTE* SAVINGS AND REALIZATION RATES FOR SAMPLED NON-LIGHTING MEASURES

| PROGRAM | | SAMPLED *EX ANTE* | | | REALIZATION RATES (KWH) | | REALIZATION RATES (KW) | | REALIZATION RATES (THERMS) | |
|---|---|---|---|---|---|---|---|---|---|---|
| | | KWH | KW | THERMS | HAND PICKED | RANDOM | HAND PICKED | RANDOM | HAND PICKED | RANDOM |
| Building Redesign | Prescriptive | | | | | | | | | |
| | Custom | | | | | | | | | |
| | New Construction | | | | | | | | | |
| | SBDI | | | | | | | | | |
| Compressed Air | Prescriptive | | | | | | | | | |
| | Custom | 1,110,710.00 | - | - | 100% | 96% | N/A | N/A | N/A | N/A |
| | New Construction | 118,125.00 | - | - | | 90% | | N/A | | N/A |
| | SBDI | | | | | | | | | |
| Controls | Prescriptive | | | | | | | | | |
| | Custom | 1,586,784.85 | 15.600 | 6,247.50 | 87% | 96% | 138% | N/A | N/A | 98% |
| | New Construction | | | | | | | | | |
| | SBDI | | | | | | | | | |
| HVAC | Prescriptive | 29,536.25 | 9.473 | 4,145.50 | 100% | N/A | 100% | N/A | N/A | 103% |
| | Custom | - | - | 210,634.00 | N/A | N/A | N/A | N/A | 102% | 98% |
| | New Construction | 290,260.00 | 22.200 | 337,755.46 | 100% | 90% | N/A | 153% | 104% | 87% |
| | SBDI | 2,955.66 | 0.522 | 43,795.80 | N/A | 100% | N/A | 135% | 100% | 100% |
| Kitchen | Prescriptive | 36,864.00 | 5.930 | - | | 82% | | 69% | | N/A |
| | Custom | | | | | | | | | |
| | New Construction | | | | | | | | | |
| | SBDI | | | | | | | | | |
| Motors | Prescriptive | | | | | | | | | |
| | Custom | 45,361.00 | - | - | | 96% | | N/A | | N/A |
| | New Construction | 52,696.00 | - | - | | 90% | | N/A | | N/A |
| | SBDI | | | | | | | | | |
| Process | Prescriptive | | | | | | | | | |
| | Custom | 478,544.16 | 30.728 | - | 100% | | 100% | | N/A | |
| | New Construction | 1,670,410.00 | - | - | 127% | | N/A | | N/A | |
| | SBDI | | | | | | | | | |
| Refrigeration | Prescriptive | 199,290.00 | 18.804 | - | | 82% | | 69% | | N/A |
| | Custom | 61,378.00 | - | - | | 96% | | N/A | | N/A |
| | New Construction | 21,344.00 | - | - | | 90% | | N/A | | N/A |
| | SBDI | | | | | | | | | |
| Ventilation | Prescriptive | | | | | | | | | |
| | Custom | - | - | 43,396.00 | | N/A | | N/A | | 98% |
| | New Construction | | | | | | | | | |
| | SBDI | | | | | | | | | |
| VFD | Prescriptive | 126,224.00 | 13.411 | - | | 82% | | 69% | | N/A |
| | Custom | | | | | | | | | |
| | New Construction | | | | | | | | | |
| | SBDI | | | | | | | | | |
| Water Heat | Prescriptive | - | - | 620.00 | | N/A | | N/A | | 103% |
| | Custom | | | | | | | | | |
| | New Construction | | | | | | | | | |
| | SBDI | | | | | | | | | |

Figure 112 and Figure 113 illustrate the distribution of realization rates for the individually sampled projects by program and by fuel source. Most of the smaller impact measures realized close to 100% of savings (kWh and therms). The largest impact kWh measure (process measure) realized 127% savings. The second largest kWh measure (controls measure) had a slightly lower realization rate of 87%. Most of the largest kWh measures fell into the process, refrigeration, controls, and compressed air measure categories. There were small deviations in therms realization rates, with most projects clustered at the 100% realization mark. There were a few larger deviations in smaller projects ranging from 58% - 104% realization rates. There was larger deviation in the therms savings realization rates, however the largest impact measures received at or near 100% realization.

FIGURE 112. 2022 C&I PROGRAMS SAMPLED NON-LIGHTING ELECTRIC MEASURES *EX ANTE* IMPACT AND REALIZATION RATES

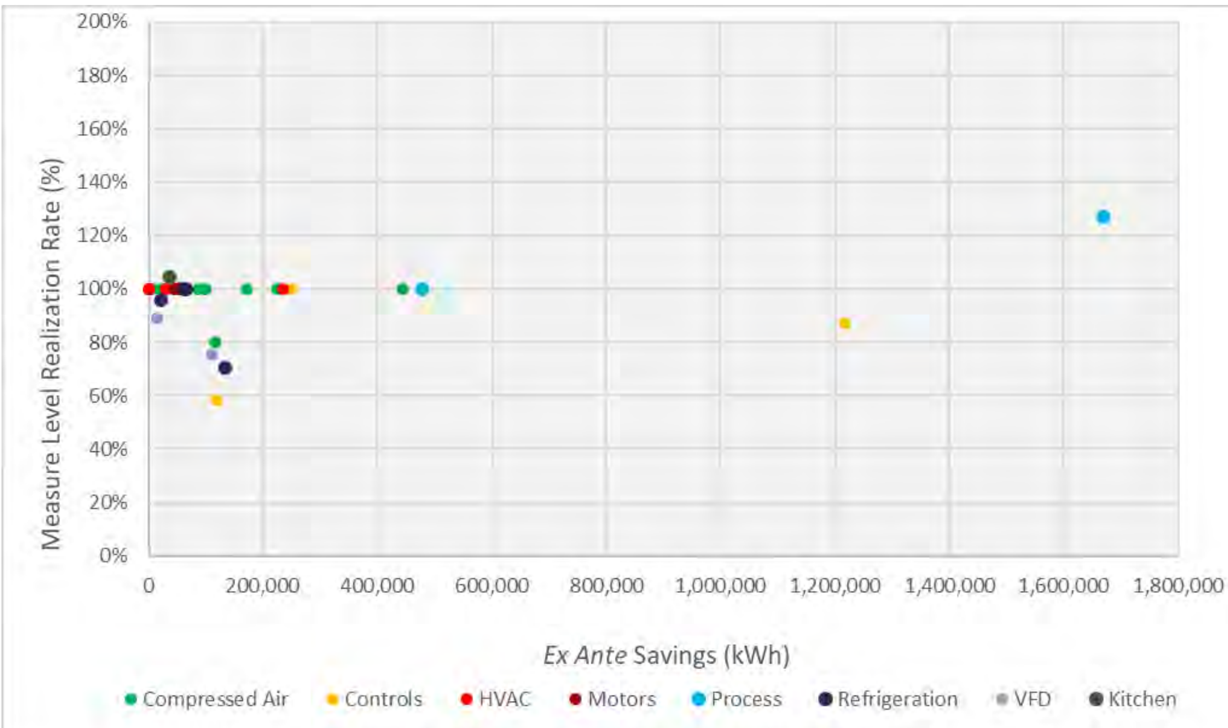
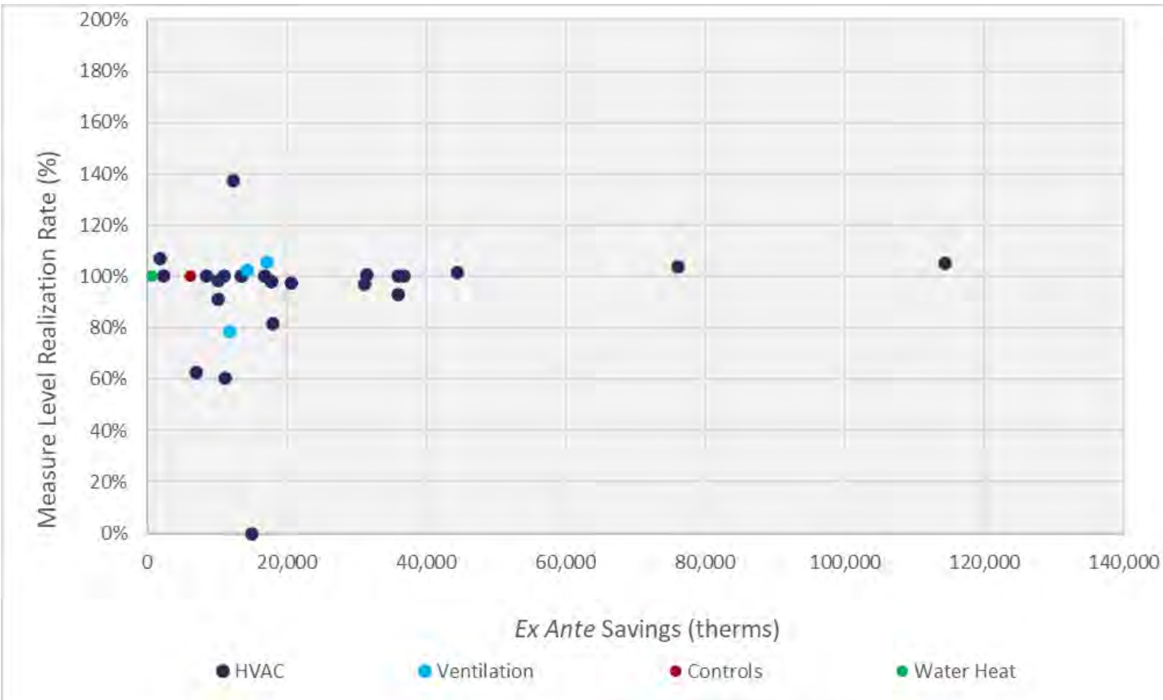


FIGURE 113. 2022 C&I PROGRAMS SAMPLED NON-LIGHTING GAS MEASURES *EX ANTE* IMPACT AND REALIZATION RATES




## ALL MEASURES AND ADJUSTMENT SUMMARY

Table 388 provides the realization rates for lighting and non-lighting projects by each C&I program and overall. The evaluation team determined cumulative realization rates by extrapolating the random sample realization rates to the full population. The handpicked realization rate had a greater effect on the cumulative realization rate when those projects are larger and constitute a greater portion of savings. For example, high performance of the handpicked sampled measures had a mitigating effect on the random sample realization rate, influencing the cumulative realization rates upward as a result.

TABLE 388. 2022 C&I PROGRAMS SAMPLE REALIZATION RATES

| MEASURE CATEGORY | HAND PICKED SAMPLE REALIZATION RATE | | | RANDOM SAMPLE REALIZATION RATE | | | CUMULATIVE REALIZATION RATE | | |
|---|---|---|---|---|---|---|---|---|---|
| | KWH | KW | THERMS | KWH | KW | THERMS | KWH | KW | THERMS |
| Prescriptive Program | | | | | | | | | |
| Lighting | 100% | 100% | N/A | 99% | 101% | 100% | 99% | 101% | N/A |
| Non-Lighting | 100% | 100% | N/A | 82% | 69% | 103% | 82% | 70% | 103% |
| Custom Program | | | | | | | | | |
| Lighting | 96% | 110% | N/A | 100% | 97% | 100% | 99% | 99% | N/A |
| Non-Lighting | 93% | 113% | 102% | 96% | 100% | 98% | 95% | 103% | 99% |
| New Construction Program | | | | | | | | | |
| Lighting | 100% | 100% | N/A | 103% | 109% | 100% | 101% | 100% | N/A |
| Non-Lighting | 124% | N/A | 104% | 90% | 153% | 87% | 113% | 153% | 90% |
| SBDI Program | | | | | | | | | |
| Lighting | 100% | 100% | N/A | 97% | 99% | 100% | 98% | 100% | N/A |
| Non-Lighting | N/A | N/A | 100% | 100% | 135% | 100% | 100% | 135% | 100% |

# C&I MEASURE ALGORITHMS AND ASSUMPTIONS

This appendix contains the assumptions used in electric savings, demand reduction, and gas savings algorithms for the measures within the C&I programs. The team examined each assumption behind the algorithms to capture savings and compared it against the Indiana TRM v2.2, as well as other state and industry approaches. Detailed information on the *ex post* savings analysis and supporting assumptions for the following C&I program measures are included within this appendix. Table 389 lists the assumptions of the *ex post* per-measure savings.

TABLE 389. C&I MEASURES

| MEASURE | REVIEWED ASSUMPTIONS |
|---|---|
| Lighting Replacement | New and baseline wattages, hours of use, waste heat factors, coincidence factors |
| Lighting Power Density Reduction | Square footage, baseline allowed watts, installed watts, operating hours, waste heating factors |
| Lighting Controls | New and baseline wattages, hours of use, waste heat factors, coincidence factors |
| Refrigeration LED Case Lighting | New and baseline wattages, number of doors, hours of use, waste heat factors, coincidence factors |
| HVAC – Package Unit Replacement | Full load heating and cooling hours, equipment capacities, equipment efficiencies |
| HVAC – Hydronic Unit Replacement | Full load heating and cooling hours, equipment capacities, equipment efficiencies |
| HVAC – VFDs Pumps and Fans | Motor size, motor efficiency, average equipment speed, operating hours, power consumption under baseline and VFD control |
| HVAC – Programmable Thermostats | Equipment heating and cooling capacities, equipment heating and cooling efficiencies, equivalent full load hours |
| HVAC Furnaces | Methodology for calculating shell heat loss, infiltration heat loss, stratification rates, setback controls, equipment efficiencies. |
| HVAC – Pipe Insulation | New and baseline R-values, pipe diameter, water heater recovery efficiency |
| HVAC – Steam Traps | Steam pressure, trap orifice diameter |
| VFD Air Compressors | Equipment capacity, equipment performance, average CFM load, operating hours |
| Kitchen Equipment | Pounds of food cooked per day, equipment efficiency, idle energy rate, production capacity, preheat time, preheat energy |
| Water Heating | Gallons per day of plant, equipment efficiency, equipment hot water temperature setpoint |

## LIGHTING – REPLACEMENT

The team used the following equations to calculate electric energy and peak demand savings for interior and exterior lighting replacement measures, as well as natural gas energy penalties:

$$kWh\ savings = \frac{(W_{base} - W_{EE}) * (Hours) * (1 + WHF_e)}{1{,}000}$$

$$kW\ reduction = \frac{(W_{base} - W_{LED}) * Coincidence\ Factor * (1 + WHF_d)}{1{,}000}$$

$$therm\ savings = (kWh\ savings) * \left(1 + WHF_g\right) * 10\ therms/MMBtu$$

Where:

$W_{base}$ = Total wattage of the baseline lighting system, W

$W_{EE}$ = Total wattage of the installed lighting system, W

Hours = Annual operating hours of system from TRM or posted site schedules, hrs./yr.

$WHF_e$ = Waste heat factor for energy to account for HVAC interactions with lighting (depends on location, building type, and HVAC system type)

$WHF_d$ = Waste heat factor for demand to account for HVAC interactions with lighting (depends on location, building type, and HVAC system type)

$WHF_g$ = Waste heat factor for gas to account for HVAC interactions with lighting (depends on location, building type, and HVAC system type)

Coincidence Factor = Summer peak coincidence factor from TRM based on building type

1,000 = Constant to convert watts to kW

10 = Constant to convert MMBtu to therm

Table 390 lists the input assumptions and source of each assumption for the lighting replacement measure savings calculations.

TABLE 390. *EX POST* VARIABLE ASSUMPTIONS FOR LIGHTING REPLACEMENTS

| INPUT | VALUE | SOURCE |
|---|---|---|
| $W_{base}$ | Varies | Based on existing number of fixtures and fixture type |
| $W_{EE}$ | Varies | Based on installed number of fixtures and fixture type |
| Hours | Varies | IL TRM v10.0 or posted operating hours of business |
| $WHF_e$ | Varies | IL TRM v10.0, dependent on building type, location, and HVAC system type |
| $WHF_d$ | Varies | IL TRM v10.0 dependent on building type, location, and HVAC system type |
| $WHF_g$ | Varies | IL TRM v10.0, dependent on building type, location, and HVAC system type |
| Coincidence Factor | Varies | IL TRM v10.0, dependent on building type |

## LIGHTING POWER DENSITY REDUCTION

The team used the following equations to calculate electric energy and peak demand savings, as well as natural gas energy penalties, for interior and exterior lighting power density reduction measures:

$$kWh\ savings = \frac{(LPD_{base} - LPD_{EE}) * (AREA) * (HOURS) * (1 + WHF_e)}{1{,}000}$$

$$kW\ reduction = \frac{(LPD_{base} - LPD_{EE}) * (AREA) * (CF) * (1 + WHF_d)}{1{,}000}$$

$$therm\ savings\ per\ lamp = (kWh\ savings) * \ (WHF_g)$$

Where:

$LPD_{base}$ = Allowed lighting power density (watts per square foot) based on energy code requirements for building or space type, from ASHRAE 90.1-2007 Table 9.5.1 or Table 9.6.1

$LPD_{EE}$ = Installed lighting wattage per square foot of the efficient lighting system for building type as determined by site-surveys or design diagrams

1000 = Conversion factor from watts to kilowatts

AREA = Square footage of building, determined from site-specific information

HOURS = Annual operating hours of lighting system, from TRM or actual building schedules

$WHF_e$ = Waste heat factor for energy to account for HVAC interactions with lighting (depends on location, building type, and HVAC system type)

CF = Summer peak coincidence factor, dependent on building type from TRM

$WHF_d$ = Waste heat factor for demand to account for HVAC interactions with lighting (depends on location, building type, and HVAC system type)

$WHF_g$ = Waste heat factor for gas to account for HVAC interactions with lighting (depends on location, building type, and HVAC system type)

Table 391 lists the input assumptions and source of each assumption for the lighting power density reduction measure savings calculations.

TABLE 391. *EX POST* VARIABLE ASSUMPTIONS FOR LIGHTING POWER DENSITY REDUCTION

| INPUT | VALUE | SOURCE |
|---|---|---|
| $LPD_{base}$ | Varies | ASHRAE 90.1-2007 Table 9.5.1 or Table 9.6.1 |
| $LPD_{EE}$ | Varies | Actual installed wattage |
| AREA | Varies | Actual building square footage |
| HOURS | Varies | IL TRM v10.0 or actual operating hours of building |
| $WHF_e$ | Varies | IL TRM v10.0, based on location, building type, and HVAC system type |
| $WHF_d$ | Varies | IL TRM v10.0 based on location, building type, and HVAC system type |
| $WHF_g$ | Varies | IL TRM v10.0, based on location, building type, and HVAC system type |
| CF | Varies | IL TRM v10.0 based on building type |

## LIGHTING CONTROLS – OCCUPANCY SENSORS

The team used the following equations to calculate electric energy and peak demand savings for occupancy sensor measures, as well as natural gas energy penalties:

$$kWh\ savings = kW_{controlled} * Hours * (1 + WHF_e) * ESF$$

$$kW\ reduction = kW_{controlled} * (1 + WHF_d) * CF$$

$$therm\ savings = (kWh\ savings) * \left(1 + WHF_g\right) * 10\ therms/MMBtu$$

Where:

$kW_{controlled}$ = Total wattage controlled per sensor, kW

Hours = Annual operating hours of system from TRM or posted site schedules, hrs./yr.

$WHF_e$ = Waste heat factor for energy to account for HVAC interactions with lighting (depends on location, building type, and HVAC system type)

ESF = Energy savings factor, dependent on the percentage of operating hours reduced due to installing occupancy lighting controls or time clocks, or the percentage of wattage reduction multiplied by the hours of dimming for dimming lighting controls and multilevel switching, from TRM

$WHF_d$ = Waste heat factor for demand to account for HVAC interactions with lighting (depends on location, building type, and HVAC system type)

$WHF_g$ = Waste heat factor for gas to account for HVAC interactions with lighting (depends on location, building type, and HVAC system type)

CF = Summer peak coincidence factor from TRM based on building type

10 = Constant to convert MMBtu to therm

Table 392 lists the input assumptions and source of each assumption for the lighting occupancy sensor measure savings calculations.

TABLE 392. *EX POST* VARIABLE ASSUMPTIONS FOR LIGHTING OCCUPANCY SENSOR MEASURES

| INPUT | VALUE | SOURCE |
|---|---|---|
| $kW_{controlled}$ | Varies | Based on actual wattage controlled per sensor |
| Hours | Varies | IL TRM v10.0 or posted operating hours of business |
| ESF | Varies | IL TRM v10.0, dependent on control type |
| $WHF_e$ | Varies | IL TRM v10.0, dependent on building type, location, and HVAC system type |
| $WHF_d$ | Varies | IL TRM v10.0, dependent on building type, location, and HVAC system type |
| $WHF_g$ | Varies | IL TRM v10.0, dependent on building type, location, and HVAC system type |
| CF | Varies | IL TRM v10.0, dependent on building type |

## LIGHTING – REFRIGERATION LED CASE LIGHTING

The team used the following equations to calculate electric energy and peak demand savings for refrigeration case lighting replacement measures. There are no natural gas energy penalties for this measure:

$$kWh\ savings = \frac{(W_{base} - W_{EE}) * (Hours) * (N+1) * (1 + WHF_e) * ESF_{MC}}{1{,}000}$$

$$kW\ reduction = \frac{(W_{base} - W_{EE}) * (N+1) * CF * \ (1 + WHF_d) * DSF_{MC}}{1{,}000}$$

Where:

$W_{base}$ = Wattage per door of the baseline lighting system, W

$W_{EE}$ = Wattage per door of the installed lighting system, W

Hours = Annual operating hours of system from TRM or posted site schedules, hrs./yr.

N = Number of doors (= l; note: N+1 accounts for the additional fixture that is present in a row of case lighting doors)

$ESF_{MC}$ = Energy savings factor; additional savings percentage achieved with a motion sensor (= 1.0 if no motion sensor is installed; = 1.43 if motion sensor installed)

$WHF_e$ = Waste heat factor for energy to account for cooling savings from efficient lighting (= 0.41 for refrigerated space; = 0.52 for freezer space)

$WHF_d$ = Waste heat factor for energy to account for cooling savings from efficient lighting (= 0.41 for prescriptive refrigerated lighting measures; = 0.52 for freezer space)

| | | |
|---|---|---|
| $DSF_{MC}$ | = | Demand savings factor; additional savings percentage achieved with a motion sensor (= 1.0 if no motion sensor is installed; = 1.43 if motion sensor installed) |
| CF | = | Summer peak coincidence factor (= 0.92) |
| 1,000 | = | Constant to convert watts to kW |

Table 393 lists the input assumptions and source of each assumption for the LED case lighting measure savings calculations.

TABLE 393. *EX POST* VARIABLE ASSUMPTIONS FOR LED CASE LIGHTING MEASURES

| INPUT | VALUE | SOURCE |
|---|---|---|
| $W_{base}$ | Varies | Based on baseline number of lamps and lamp wattage |
| $W_{EE}$ | Varies | Based on installed number of lamps and lamp wattage |
| Hours | Varies | Indiana TRM v2.2 or posted operating hours of business |
| $WHF_e$ | Varies | Indiana TRM v2.2, = 0.41 for refrigerated space; = 0.52 for freezer space |
| $WHF_d$ | Varies | Indiana TRM v2.2, dependent on building type, location, and HVAC system type, = 0.41 for refrigerated space; = 0.52 for freezer space |
| $ESF_{MC}$ | Varies | Indiana TRM v2.2, = 1.0 if no motion sensor is installed; = 1.43 if motion sensor installed |
| $DSF_{MC}$ | Varies | Indiana TRM v2.2, = 1.0 if no motion sensor is installed; = 1.43 if motion sensor installed |
| CF | 0.92 | Indiana TRM v2.2 |

## HVAC – PACKAGE UNITS REPLACEMENT

The evaluation team used the following equations to calculate electric and natural gas energy savings for HVAC package units.

$$kWh\ savings_{cool} = Btuh_{cool} * (\frac{1}{SEER_{base}} - \frac{1}{SEER_{EE}}) * \frac{EFLH_{cool}}{1{,}000}$$

$$kW\ reduction = Btuh_{cool} * (\frac{1}{EER_{base}} - \frac{1}{EER_{EE}}) * \frac{CF}{1{,}000}$$

$$therm\ savings = Btuh_{heat} * (\frac{1}{EFF_{base}} - \frac{1}{EFF_{EE}}) * \frac{EFLH_{heat}}{100{,}000}$$

Where:

| | | |
|---|---|---|
| $Btuh_{cool}$ | = | actual capacity of the cooling equipment installed, Btu/hr |
| $SEER_{base}$ | = | seasonal energy efficiency ratio of the baseline equipment, from TRM or ASHRAE 90.1 2007, Btu/W-hr |
| $SEER_{EE}$ | = | actual seasonal energy efficiency ratio of installed equipment, Btu/W-hr |
| $EFLH_{cool}$ | = | equivalent full load hours for cooling, from TRM based on building type and location, hrs./yr. |
| 1000 | = | conversion from watts to kilowatts |
| $EER_{base}$ | = | full load energy efficiency ratio of the baseline equipment, from TRM or ASHRAE 90.1 2007, Btu/W-hr |
| $EER_{EE}$ | = | actual energy efficiency ratio of installed equipment, Btu/W-hr |
| CF | = | summer coincidence factor, from TRM |

$Btuh_{heat}$ = actual capacity of the natural gas heating equipment installed, Btu/hr

$EFF_{base}$ = baseline heating efficiency, 80%

$EFF_{EE}$ = actual heating efficiency of installed equipment

$EFLH_{heat}$ = equivalent full load hours for heating, from TRM based on building type and location, hrs./yr.

100,000 = conversion factor from Btu to therm

Table 394 lists the assumptions and source of each assumption for the HVAC package unit measure savings calculations.

TABLE 394. *EX POST* VARIABLE ASSUMPTIONS FOR HVAC PACKAGE UNITS

| INPUT | VALUE | SOURCE |
|---|---|---|
| $Btuh_{cool}$ | Varies | Equipment specifications |
| $SEER_{base}$ | Varies | Indiana TRM (v2.2), ASHRAE 90.1 2007 |
| $SEER_{EE}$ | Varies | Equipment specifications |
| $EFLH_{cool}$ | Varies | Indiana TRM (v2.2) |
| $EER_{base}$ | Varies | Indiana TRM (v2.2), ASHRAE 90.1 2007 |
| $EER_{EE}$ | Varies | Equipment specifications |
| CF | Varies | Indiana TRM (v2.2) |
| $Btuh_{heat}$ | Varies | Equipment specifications |
| $EFF_{base}$ | 80% | ASHRAE 90.1 2007 |
| $EFF_{EE}$ | Varies | Equipment specifications |
| $EFLH_{heat}$ | Varies | Indiana TRM (v2.2) |

## HVAC – HYDRONIC UNIT REPLACEMENT

The evaluation team used the following equations to calculate electric and natural gas energy savings for HVAC hydronic units.

$$kWh\ savings_{cool} = TONS * (\frac{3.516}{IPLV_{base}} - \frac{3.516}{IPLV_{EE}}) * EFLH_{cool}$$

$$kW\ reduction = TONS * (\frac{3.516}{COP_{base}} - \frac{3.516}{COP_{EE}}) * CF$$

$$therm\ savings = Btuh_{heat} * (\frac{1}{EFF_{base}} - \frac{1}{EFF_{EE}}) * \frac{EFLH_{heat}}{100{,}000}$$

Where:

TONS = Actual cooling capacity of chiller, tons

$IPLV_{base}$ = Integrated part load value efficiency of the baseline equipment, from TRM or ASHRAE 90.1 2007, COP

$IPLV_{EE}$ = Integrated part load value efficiency of actual installed equipment, COP

$EFLH_{cool}$ = Equivalent full load hours for cooling, from TRM based on building type and location, hrs./yr.

$COP_{base}$ = Coefficient of performance of the baseline equipment, from TRM or ASHRAE 90.1 2007, unitless

$COP_{EE}$ = Actual coefficient of performance of installed equipment, unitless

CF = Summer coincidence factor, from TRM

$Btuh_{heat}$ = Actual capacity of the boiler installed, Btu/hr

$EFF_{base}$ = Baseline heating efficiency, 80%

$EFF_{EE}$ = Actual heating efficiency of installed equipment

$EFLH_{heat}$ = Equivalent full load hours for heating, from TRM based on building type and location, hrs./yr.

100,000 = Conversion factor from Btu to therm

Table 395 lists the assumptions and source of each assumption for the HVAC hydronic unit measure savings calculations.

TABLE 395. *EX POST* VARIABLE ASSUMPTIONS FOR HVAC HYDRONIC UNITS

| INPUT | VALUE | SOURCE |
|---|---|---|
| TONS | Varies | Equipment specifications |
| $IPLV_{base}$ | Varies | Indiana TRM (v2.2), ASHRAE 90.1 2007 |
| $IPLV_{EE}$ | Varies | Equipment specifications |
| $EFLH_{cool}$ | Varies | Indiana TRM (v2.2) |
| $COP_{base}$ | Varies | Indiana TRM (v2.2), ASHRAE 90.1 2007 |
| $COP_{EE}$ | Varies | Equipment specifications |
| CF | Varies | Indiana TRM (v2.2) |
| $Btuh_{heat}$ | Varies | Equipment specifications |
| $EFF_{base}$ | 80% | ASHRAE 90.1 2007 |
| $EFF_{EE}$ | Varies | Equipment specifications |
| $EFLH_{heat}$ | Varies | Indiana TRM (v2.2) |

## HVAC – VFD PUMPS AND FANS

The evaluation team used the following equations to calculate electrical energy savings and summer coincidence peak demand savings associated with this measure. There are no natural gas savings associated with this measure.

$$kWh\ savings = HP * \left(\frac{CLF_{base} - CLF_{VFD}}{EFF_m}\right) * HOURS * 0.746$$

$$kW\ reduction = HP * \left(\frac{CLF_{base} - CLF_{VFD}}{EFF_m}\right) * CF * 0.746$$

Where:

HP = Motor horsepower of installed equipment, hp

$CLF_{base}$ = Controlled load factor of baseline equipment at average flow conditions, adapted from the Bonneville Power Administration ASD Calculator curves, %

$CLF_{VFD}$ = Controlled load factor of VFD controlled equipment at average flow conditions, adapted from the Bonneville Power Administration ASD Calculator curves, %

$EFF_M$ = Motor efficiency, actual or from NEMA guidelines, %

HOURS = Operating hours of equipment, from facility interviews or logged data, hrs./yr.

0.746 = Conversion from hp to kW

CF = Summer peak coincidence factor, varies depending on operating schedule and loading of pump or fan during the utility peak period

Table 396 lists the assumptions and source of each assumption for the VFD pumps and fans measure savings calculations.

TABLE 396. *EX POST* VARIABLE ASSUMPTIONS FOR VFD PUMPS AND FANS

| INPUT | VALUE | SOURCE |
|---|---|---|
| HP | Varies | Equipment specifications |
| $CLF_{base}$ | Varies | Adapted from the Bonneville Power Administration ASD Calculator curves at average flow conditions, varies depending on baseline control method |
| $CLF_{VFD}$ | Varies | Adapted from the Bonneville Power Administration ASD Calculator curves at average flow conditions |
| $EFF_M$ | Varies | Equipment specifications, typical NEMA values at equipment horsepower |
| HOURS | Varies | Facility staff interviews, logged run time |
| CF | Varies | Facility staff interviews, logged run time and loading of equipment during utility peak period |

## HVAC – PROGRAMMABLE THERMOSTATS

The evaluation team would have used the following equations to calculate energy savings for programmable thermostat replacements if enough information was available in the project documentation. There are no peak coincident demand savings for this measure.

$$kWh\ savings = \frac{Btuh_{cool} * EFLH_{cool} * ESF_{cool}}{SEER * \ 1{,}000}$$

$$therm\ savings = \frac{Btuh_{ff} * EFLH_{heat} * ESF_{heat}}{SEER * \ 100{,}000}$$

Where:

$Btuh_{cool}$ = Cooling system capacity, actual, Btu/hr

$EFLH_{cool}$ = Equivalent full load cooling hours, from TRM dependent on location, hrs./yr.

$ESF_{cool}$ = Cooling energy savings fraction, 0.09 from TRM

SEER = Seasonal average energy efficiency ratio, actual or from TRM, Btu/W-hr

1,000 = Constant to convert W to kW

$Btuh_{ff}$ = Heating system capacity, actual, Btu/hr

$EFLH_{heat}$ = equivalent full load heating hours, from TRM dependent on location, hrs./yr.

$ESF_{heat}$ = Heating energy savings fraction, 0.068 from TRM

100,000 = Constant to convert Btu to therm

Table 397 lists the assumptions and source of each assumption for the programmable thermostat measure savings calculations.

TABLE 397. *EX POST* VARIABLE ASSUMPTIONS FOR PROGRAMMABLE THERMOSTATS

| INPUT | VALUE | SOURCE |
|---|---|---|
| $Btuh_{cool}$ | Varies | Project application, invoices, spec sheets |
| $EFLH_{cool}$ | Varies | Indiana TRM v2.2, dependent on location |
| $ESF_{cool}$ | 0.09 | Indiana TRM v2.2 |
| SEER | Varies | Actual or Indiana TRM v2.) |
| $Btuh_{ff}$ | Varies | Project application, invoices, spec sheets |
| $EFLH_{heat}$ | Varies | Indiana TRM v2.2, dependent on location |
| $ESF_{heat}$ | 0.068 | Indiana TRM v2.2 |

## HVAC – FURNACES

The evaluation team reviewed Trane TRACE 700 model output files provided by the implementer to determine the energy savings for furnace measures in large warehouses and manufacturing facilities.

Table 398 lists the assumptions and source of each assumption for the HVAC furnace measure savings calculations.

TABLE 398. *EX POST* VARIABLE ASSUMPTIONS FOR HVAC FURNACES

| INPUT | VALUE | SOURCE |
|---|---|---|
| $T_{SET}$ | Varies | Temperature setpoint during occupied and setback operation from equipment control screens |
| Schedule | Varies | Operating hours for occupied and setback operation from equipment control screens |
| Baseline Stratification Factor | 0.8 $^{o}$F/ft | Approved value for this type of measure |
| Infiltration air shift | 0.9 ACH new construction, 0.20 existing construction | Approved values for these type of measures |
| Efficiency | Varies | 80% for baseline efficiency, actual equipment efficiency for installed unit |

## HVAC – PIPE INSULATION

The evaluation team used the following equations to calculate natural gas energy savings for hot water and steam pipe insulation. There are no electrical energy or summer peak coincident demand savings associated with this measure.

$$therm\ savings = \frac{(Btu_{base} - Btu_{ee}) * Hours * LF}{EFF * \ 100{,}000}$$

Where:

| | | |
|---|---|---|
| $Btu_{base}$ | = | Energy loss per linear foot from uninsulated pipe, calculated using 3E Plus, Btu/hr-ft |
| $Btu_{ee}$ | = | Energy loss per linear foot from insulated pipe, calculated using 3E plus, Btu/hr-ft |
| Hours | = | Annual operating hours of steam or hot water system, actual, hrs./yr. |
| LF | = | Linear feet of piping, actual, ft |
| EFF | = | Efficiency of hot water or steam boilers, actual or assumed 80% |
| 100,000 | = | constant to Btu to therm |

Table 399 lists the assumptions and source of each assumption for the HVAC pipe insulation savings calculations.

TABLE 399. *EX POST* VARIABLE ASSUMPTIONS FOR HVAC PIPE INSULATION

| INPUT | VALUE | SOURCE |
|---|---|---|
| $Btu_{base}$ | Varies | 3E Plus. Calculated based on process fluid temperature, pipe diameter, insulation material, and insulation thickness |
| $Btu_{EE}$ | Varies | 3E Plus. Calculated based on process fluid temperature, pipe diameter, insulation material, and insulation thickness |
| LF | Varies | Project application, invoices, spec sheets |
| Hours | Varies | Dependent on operating hours of heating system |
| EFF | Varies | Assumed 80% unless information on the actual heating efficiency of the boiler system is available |

## HVAC – STEAM TRAP REPLACEMENT

The evaluation team used the following equations to calculate natural gas energy savings for steam trap replacements. There are no electrical energy or summer peak coincident demand savings associated with this measure.

$$therm\ savings = \frac{24.24\ * P_{Abs} * D^2 * h_{fg} * HOU * DF}{EFF *\ 100{,}000}$$

Where:

PAbs = System absolute pressure in pounds per square inch (= steam gauge pressure at trap inlet + atmospheric pressure of 14.7 psi)
D = Steam trap orifice diameter in inches
hfg = Latent heat of vaporization for water at PAbs, Btu/lb
DF = Derating factor to account for the average percentage open a trap fails vs. theoretical energy loss, assumed 32%
EFF = Efficiency of heating system, assumed 80% if specifications of heating system were not available
100,000= Constant to convert Btu to therm

Table 400 lists the assumptions and source of each assumption for the steam trap replacement measure savings calculations.

TABLE 400. *EX POST* VARIABLE ASSUMPTIONS FOR STEAM TRAP REPLACEMENTS

| INPUT | VALUE | SOURCE |
|---|---|---|
| $P_{Abs}$ | Varies | From project specific operating pressure |
| D | Varies | From steam trap specifications |
| $h_{fg}$ | Varies | From steam tables, dependent on $P_{Abs}$ |
| DF | 32% | From 2019 Wisconsin Focus on Energy Technical Reference Manual |
| EFF | Varies | Assumed 80% unless information on the actual heating efficiency of the boiler system is available |

## KITCHEN EQUIPMENT

The evaluation team used the following equations to calculate electric energy savings for kitchen equipment measures.

$$kWh\ savings =\ kWh_{base} -\ kWh_{EE}$$

$$kWh_{base} = \left(\frac{LB *\ E_{FOOD}}{EFF_{base}} + IE_{base} * \left(H - \frac{LB}{PC_{base}} - \frac{T_P}{60}\right) + E_{p,base}\right) * DAYS$$

$$kkWh_{EE} = \left(\frac{LB *\ E_{FOOD}}{EFF_{EE}} + IE_{EE} * \left(H - \frac{LB}{PC_{EE}} - \frac{T_P}{60}\right) + E_{p,EE}\right) * DAYS$$

$$kW\ reduction =\ kWh\ Savings * \frac{CF}{HOURS}$$

Where:

| | | |
|---|---|---|
| LB | = | Pounds of food cooked per day, actual or assumed 100 lbs./day |
| $E_{FOOD}$ | = | Amount of energy absorbed by the food during cooking, 0.139 kWh/lb. |
| $EFF_{BASE}$ | = | Cooking efficiency of baseline equipment |
| $EFF_{EE}$ | = | Cooking efficiency of installed equipment |
| $IE_{BASE}$ | = | Idle energy rate of baseline equipment |
| $IE_{EE}$ | = | Idle energy rate of installed equipment |
| H | = | Daily operating hours, actual or assumed 12 hrs./day |
| $PC_{BASE}$ | = | Production capacity of baseline equipment, lbs./hr. |
| $PC_{EE}$ | = | Production capacity of installed equipment, lbs./hr. |
| $T_P$ | = | Preheat time for equipment to reach operating temperature, actual or assumed 15 min/day |
| $E_{P,BASE}$ | = | Preheat energy per day for baseline equipment, kWh/day |
| $E_{P,EE}$ | = | Preheat energy per day for installed equipment, kWh/day |
| DAYS | = | Operating days per year |
| CF | = | Summer peak coincidence factor, 0.84 |
| HOURS | = | Annual operating hours of kitchen, actual or 4,380 hrs./yr. |

Table 401 lists the assumptions and source of each assumption for the kitchen equipment measure savings calculations.

TABLE 401. *EX POST* VARIABLE ASSUMPTIONS FOR KITCHEN EQUIPMENT

| INPUT | VALUE | SOURCE |
|---|---|---|
| LB | Varies | Actual or from Indiana TRM v2.2 |
| EFOOD | 0.139 | Indiana TRM v2.2 |
| EFFBASE | 0.6 | Indiana TRM v2.2 |
| EFFEE | Varies | Actual or from Indiana TRM v2.2 |
| IEBASE | 2.4 | Indiana TRM v2.2 |
| IEEE | Varies | Actual or from Indiana TRM v2.2 |
| H | Varies | Actual or from Indiana TRM v2.2 |
| PCBASE | 35 | Indiana TRM v2.2 |
| PCEE | Varies | Actual or from Indiana TRM v2.2 |
| TP | Varies | Actual or from Indiana TRM v2.2 |
| EP,BASE | 4 | Indiana TRM v2.2 |
| EP,EE | Varies | Actual or from Indiana TRM v2.2 |
| DAYS | Varies | Actual or from Indiana TRM v2.2 |
| CF | 0.84 | Indiana TRM v2.2 |
| HOURS | Varies | Actual or from Indiana TRM v2.2 |

## VFD AIR COMPRESSORS

VFD air compressor projects should be calculated using the methodologies outlined in the National Renewable Energy Laboratory's Chapter 22: Compressed Air Evaluation Protocol document.[84]

[84] From: https://www.nrel.gov/docs/fy17osti/68577.pdf

## DOMESTIC HOT WATER HEATERS

The evaluation team used the following equations to calculate natural gas energy savings for water heater measures. There are no electrical energy savings or summer peak coincidence demand savings associated with this measure.

$$therm\ savings = GPD * 365 * 8.3 * \left(\frac{1}{EFF_{base}} - \frac{1}{EFF_{EE}}\right) * \frac{TD}{100{,}000}$$

Where:

| | | |
|---|---|---|
| GPD | = | Average daily hot water consumption, gallons per day |
| 365 | = | Days per year |
| 8.3 | = | Constant, Btu/gal-°F |
| $EFF_{base}$ | = | Baseline heating efficiency, 80% |
| $EFF_{EE}$ | = | Actual heating efficiency of installed equipment |
| TD | = | Temperature differential between the hot water setpoint and average groundwater temperature for the region, °F |
| 100,000 | = | Conversion factor from Btu to therms |

Table 402 lists the assumptions and source of each assumption for the water heater measure savings calculations.

TABLE 402. *EX POST* VARIABLE ASSUMPTIONS FOR WATER HEATERS

| INPUT | VALUE | SOURCE |
|---|---|---|
| GPD | Varies | From TRM or based on actual usage of site |
| $EFF_{base}$ | 80% | ASHRAE 90.1 2007 |
| $EFF_{EE}$ | Varies | Equipment specifications |
| TD | Varies | Hot water setpoint is actual temperature the water heater operates at. The groundwater temperature is from Indiana TRM v2.2 based on the region the site is located. |

# APPENDIX 13: COMMERCIAL AND INDUSTRIAL (C&I) ONLINE MARKETPLACE PROGRAM

## ALGORITHMS AND ASSUMPTIONS

This appendix contains the assumptions used in electric savings, demand reduction, and gas savings algorithms for the measures within the C&I Online Marketplace program. The evaluation team examined each assumption behind the algorithms to capture savings and compared it against the Illinois v10.0 TRM, as well as other state and industry approaches.[85] Detailed information on the analysis and supporting assumptions for the C&I Online Marketplace program measures are included within this appendix:

- Advanced Power Strip Tier 1
- Bathroom Aerator
- Kitchen Aerator
- Pre-Rinse Spray Valve
- LED Bulbs
- LED Exit Sign
- LED Desk Lamp
- Smart Thermostat

### ADVANCED POWER STRIP TIER 1

The evaluation team used the following equations from the Illinois TRM (v10.0) p. 743 to calculate electric energy and peak demand savings for advanced power strips (tier 1):

$$\Delta kWh = ((\text{kWwkday} * (\text{hrswkday} - \text{hrswkdayopen})) + (\text{kWwkend} * (\text{hrswkend} - \text{hrswkendopen}))) * \text{weeks/year} * \text{ISR}$$

Where:

- kWwkday = standby power consumption of connected electronics on weekdays off-hours. If unknown, assume 0.0315 kW.
- kWwkend = standby power consumption of connected electronics on weekend off-hours. If unknown, assume 0.00617 kW.
- hrswkday = total hours during the work week (Monday 7:30 AM to Friday 5:30 PM) = 106.
- hrswkend = total hours during the weekend (Friday 5:30 PM to Monday 7:30 AM) = 62.
- hrswkdayopen = hours the office is open during the work week. If unknown, assume 50 hours.
- hrswkendopen = hours the office is open during the weekend. If unknown, assume 0 hours.

[85] Illinois Energy Efficiency Stakeholder Advisory Group. *2022 Illinois Statewide Technical Reference Manual for Energy Efficiency Version 10.0. Volume 2: Commercial and Industrial Measures.* September 24, 2021.

- weeks/year = number of weeks per year = 52.2.
- ISR = in-service rate. The Illinois TRM (v10.0) specifies 0.969 for commercial direct install application; however, 0.4 was used in the *ex ante* calculation with no reference as to the source.

Table 403 lists the assumptions and source of each assumption for advanced power strip tier 1 measure savings calculations.

TABLE 403. *EX POST* VARIABLE ASSUMPTION FOR ADVANCED POWER STRIP TIER 1

| INPUT | VALUE | SOURCE |
|---|---|---|
| kWwkday | 0.0315 | Illinois TRM (v10.0) pg. 744 |
| kWwkend | 0.00617 | Illinois TRM (v10.0) pg. 744 |
| hrswkday | 106 | Illinois TRM (v10.0) pg. 744 |
| hrswkend | 62 | Illinois TRM (v10.0) pg. 744 |
| hrswkdayopen | 50 | Illinois TRM (v10.0) pg. 744 |
| hrswkendopen | 0 | Illinois TRM (v10.0) pg. 744 |
| weeks/year | 52.2 | Illinois TRM (v10.0) pg. 744 |
| ISR | 78% | 2022 NIPSCO C&I Online Marketplace Customer Survey |

## KITCHEN AND BATHROOM FAUCET AERATORS, AND KITCHEN PRE-RINSE SPRAY VALVE

The evaluation team used the following equations from Illinois TRM (v10.0) p. 166 to calculate electric energy, peak demand, and natural gas energy savings for low-flow kitchen and bathroom faucet aerators:

$$\Delta kWh = ISR * \%ElectricDHW * -GPM_{base} - \frac{GPM_{low\ flow}}{GPM_{base}} * Usage * EPG\ electric$$

$$\Delta kW = (kWh/Hours) * CF$$

$$\Delta therms = ISR * \%GasDHW * \left(GPM_{base} - \frac{GPM_{low\ flow}}{GPM_{base}}\right) * Usage * EPG\ gas$$

Where:

- ISR = in-service rate.
- % ElectricDHW = specified as 100% for electric DHW heaters and 0% for gas DHW heaters in the TRM; however, it was used as the fuel saturation ratio in *ex ante* and *ex post* calculation. *Ex ante* utilized 22% electric and 78% gas. *Ex post* utilized 29% electric and 71% gas.
- % Gas DHW = specified as 100% for electric DHW heaters and 0% for gas DHW heaters in the TRM; however, it was used as fuel saturation ratio in *ex ante* and *ex post* calculation. *Ex ante* utilized 22% electric and 78% gas. *Ex post* utilized 29% electric and 71% gas.
- $GPM_{base}$ = gallons per minute of baseline faucet aerator. As used or 1.39.
- $GPM_{low\text{-}flow}$ = gallons per minute of low-flow faucet aerator. As used (1.0 provided in kit).
- Usage = default usage of annual gallons mixed water per faucet.

- EPG Electric = energy per gallon of mixed water used by faucet, incorporates specific weight of water, heat capacity of water, water inlet temperature, water outlet temperature, and thermal recovery efficiency of electric water heater.
- EPG Gas = energy per gallon of mixed water used by faucet, incorporates specific weight of water, heat capacity of water, water inlet temperature, water outlet temperature, and thermal recovery efficiency of gas water heater.
- Hours = annual DHW recovery hours for faucet use, dependent on space type.
- CF = Coincidence factor.

Table 404 lists the assumptions and source of each assumption for kitchen and bathroom faucet aerator measure savings calculations.

TABLE 404. *EX POST* VARIABLE ASSUMPTION FOR KITCHEN AND BATHROOM FAUCET AERATORS

| INPUT | VALUE | SOURCE |
|---|---:|---|
| $GPM_{base}$ (Kitchen) | 2.75 | Illinois TRM (v9.0) pg. 131 |
| $GPM_{base}$ (Bathroom) | 1.39 | Illinois TRM (v9.0) pg. 131 |
| $GPM_{low\text{-}flow}$ (Kitchen) | 1.5 | Actual |
| $GPM_{low\text{-}flow}$ (Bathroom) | 1.0 | Actual |
| ISR (Bathroom) | 52% | 2022 NIPSCO C&I Online Marketplace survey |
| ISR (Kitchen) | 35% | 2022 NIPSCO C&I Online Marketplace survey |
| ISR (Pre-Rinse Spray) | 25% | 2022 NIPSCO C&I Online Marketplace survey |
| % Electric DHW | 29% | 2022 NIPSCO C&I Online Marketplace survey |
| % Gas DHW | 71% | 2022 NIPSCO C&I Online Marketplace survey |
| Usage (Office) | 2,500 | Illinois TRM (v10.0) pg. 168. |
| Usage (Retail) | 3,650 | Illinois TRM (v10.0) pg. 168. |
| Usage (Restaurant) | 12,674.5 | Illinois TRM (v10.0) pg. 168. Average of fast food (9,581 gallons) and sit-down restaurant (15,768 gallons) |
| EPG Electric (Bathroom) | 0.08794 | Illinois TRM (v10.0). Assumes specific weight of water 8.33, water temp supply 50.7 degrees F, water temp out 86 degrees F, and RE Electric 98% recovery efficiency of electric water heater |
| EPG Electric (Kitchen) | 0.10538 | Illinois TRM (v10.0). Assumes specific weight of water 8.33, water temp supply 50.7 degrees F, water temp out 93 degrees F, and RE Electric 98% recovery efficiency of electric water heater |
| EPG Electric (Pre-Rinse) | 0.183 | Illinois TRM (v10.0) Assumes specific weight of water 8.33, water temp supply 50.7 degrees F, water temp out 124.1 degrees F, and RE Electric 98% recovery efficiency of electric water heater |
| EPG Gas (Bathroom) | 0.00439 | Illinois TRM (v10.0. Assumes specific weight of water 8.33, water temp supply 50.7 degrees F, water temp out 86 degrees F, and RE Gas 67% recovery efficiency of gas water heater |
| EPG Gas (Kitchen) | 0.00526 | Illinois TRM (v10.0). Assumes specific weight of water 8.33, water temp supply 50.7 degrees F, water temp out 93 degrees F, and RE Gas 67% recovery efficiency of gas water heater |
| EPG Gas (Pre-Rinse) | 0.00913 | Illinois TRM (v10.0). Assumes specific weight of water 8.33, water temp supply 50.7 degrees F, water temp out 124.1 degrees F, and RE Gas 67% recovery efficiency of gas water heater |

| INPUT | VALUE | SOURCE |
| --- | --- | --- |
| Hours (Office) | 24 | Illinois TRM (v10.0) |
| Hours (Retail) | 36 | Illinois TRM (v10.0) |
| Hours (Restaurant) | 123 | Illinois TRM (v10.0) Average of fast food (93 hrs.) and sit-down restaurant (153 hrs.) |
| CF (office) | 0.0064 | Illinois TRM (v10.0) pg. 171 |
| CF (Retail) | 0.0043 | Illinois TRM (v10.0) pg. 171 |
| CF (Restaurant) | 0.0134 | Illinois TRM (v10.0) pg. 171. Average of fast food (0.0084) and sit-down restaurant (0.0184) |

## LED BULBS, LED EXIT SIGN, AND LED DESK LAMP

The team used the following equations from the 2015 Indiana TRM (v2.2) p. 492 and 509 to calculate electric energy and peak demand savings, as well as natural gas energy penalties, for all LED bulbs, including the A19 shape, BR30, candelabra base, exit signs, and linear tubes. The following equation also applies to the LED desk lamp.

$$\Delta kWh = (FS_{Gas} * kWh_{Gas}) + ((1 - FS_{Gas}) * kWh_{Elec})$$

$$\Delta kWh_{Gas} = \frac{(W_{base} - W_{LED}) * (ISR * Hours) * (1 + WHF_{eGasHeat})}{1{,}000}$$

$$\Delta kWh_{Elec} = FS_{Gas} * \frac{(W_{base} - W_{LED}) * (ISR * Hours) * (1 + WHF_{eElecHeat})}{1{,}000}$$

$$\Delta kW = (FS_{Gas} * kW_{Gas}) + ((1 - FS_{Gas}) * kW_{Elec})$$

$$\Delta kW_{Gas} = \frac{(W_{base} - W_{LED}) * Coincidence\ Factor * ISR * (1 + WHF_{dGasHeat})}{1{,}000}$$

$$\Delta kW_{Elec} = \frac{(W_{base} - W_{LED}) * Coincidence\ Factor * ISR * (1 + WHF_{dElecHeat})}{1{,}000}$$

$$\Delta therms = FS_{Gas} * \frac{(W_{base} - W_{LED}) * (ISR * Hours) * \left(WHF_{g}\right)}{1{,}000}$$

Where:

- FSgas = Fuel saturation of gas/electric ratio.
- $W_{base}$ = Wattage of the bulb being replaced, W
- $W_{LED}$ = Wattage of the LED bulb, W
- Hours = Average hours of use per year
- $WHF_{e\ GAS\ HEAT}$= Waste heat factor for energy to account for HVAC interactions with lighting
- $WHF_{e\ ELEC\ HEAT}$= Waste heat factor for energy to account for HVAC interactions with lighting
- $WHF_{d\ GAS\ HEAT}$ = Waste heat factor for demand to account for HVAC interactions with lighting
- $WHF_{d\ ELEC\ HEAT}$ = Waste heat factor for demand to account for HVAC interactions with lighting
- $WHF_{g}$ = Waste heat factor for gas to account for HVAC interactions with lighting
- Coincidence Factor = Summer peak coincidence factor
- ISR = In-service rate, or fraction of units that get installed
- 365 = Number of days per year, days/yr.

- 1,000 = Constant to convert watts to kW

Table 405 lists the input assumptions and source of each assumption for the LED measure savings calculations.

TABLE 405. *EX POST* VARIABLE ASSUMPTIONS FOR LEDS

| INPUT | VALUE | SOURCE |
|---|---|---|
| $FS_{Gas}$ | 87% | 2022 NIPSCO C&I Online Marketplace customer survey. 87% gas heating source versus 13% electric heating source |
| $W_{base}$ for A19 60-watt equivalent (Globe LED, kit) | 43 | Illinois TRM (v10.0) |
| $W_{base}$ for Filament 60-watt equivalent (Filament LED, kit) | 43 | Illinois TRM (v10.0). |
| $W_{base}$ for Filament Candle E12 base (Decorative/ Mini LED) | 25 | Illinois TRM (v10.0) |
| $W_{base}$ for R30 day light (BR/Par LED, kit) | 65 | Illinois TRM (v10.0) |
| $W_{base}$ for exit sign (Specialty LED, kit) | 7 | Illinois TRM (v10.0) |
| $W_{base}$ for Linear tube LED (Linear LED) | 28.2 | Illinois TRM (v10.0) |
| $W_{base}$ for 55 watt wall pack (120 W Equivalent) | 120 | Illinois TRM (v10.0) |
| $W_{base}$ for 750 – 1049 lumens omni 11 watt | 75 | Illinois TRM (v10.0) |
| $W_{base}$ for 1050 – 1489 lumens omni 11 watt | 100 | Illinois TRM (v10.0) |
| $W_{base}$ for Globe 350 – 499 lumens 5 watt | 40 | Illinois TRM (v10.0) |
| $W_{base}$ for 330 lumen LED candle 4 watt | 40 | Illinois TRM (v10.0) |
| $W_{base}$ for LED Corn Bulb 54 watt | 198.9 | Illinois TRM (v10.0) |
| $W_{base}$ for 800 lumen Omni 7 watt | 60 | Illinois TRM (v10.0) |
| $W_{base}$ for LED Desk Lamp (Specialty LED, kit) | 25 | Ch. 6 Residential Lighting Evaluation Protocol, UMP |
| $W_{LED}$ for A19 60-watt equivalent (Globe LED, kit) | 9 | Actual installed wattage |
| $W_{LED}$ for Filament 60-watt equivalent (Filament LED, kit) | 8 | Actual installed wattage |
| $W_{LED}$ for Filament Candle E12 base (Decorative/ Mini LED) | 4 | Actual installed wattage |
| $W_{LED}$ for R30 day light (BR/Par LED, kit) | 9.5 | Actual installed wattage |
| $W_{LED}$ for exit sign (Specialty LED, kit) | 4 | Actual installed wattage |
| $W_{LED}$ for Linear tube LED (Linear LED) | 16 | Actual installed wattage |
| $W_{LED}$ for LED Desk Lamp (Specialty LED, kit) | 3.2 | Actual installed wattage |
| $W_{LED}$ for 55 watt wall pack (120 W Equivalent) | 55 | Actual installed wattage |
| $W_{LED}$ for 750 – 1049 lumens omni 11 watt | 11 | Actual installed wattage |
| $W_{LED}$ for 1050 – 1489 lumens omni 11 watt | 11 | Actual installed wattage |
| $W_{LED}$ for Globe 350 – 499 lumens 5 watt | 5 | Actual installed wattage |
| $W_{LED}$ for 330 lumen LED candle 4 watt | 4 | Actual installed wattage |
| $W_{LED}$ for LED Corn Bulb 54 watt | 54 | Actual installed wattage |
| $W_{LED}$ for 800 lumen Omni 7 watt | 7 | Actual installed wattage |
| Hours (Office) | 3088 | Illinois TRM (v10.0) |
| Hours (Retail) | 2935 | Illinois TRM (v10.0) |
| Hours (Restaurant) | 4784 | Illinois TRM (v10.0) |
| $WHF_{e\ Electric\ AC}$ | 1.1 | Illinois TRM (v10.0) |

| INPUT | VALUE | SOURCE |
|---|---|---|
| | 1.12<br>1.1<br>1.08 | Sequentially Office, Retail, Restaurant, unknown |
| $WHF_{d\ demand\ AC}$ | 1.26<br>1.29<br>1.1<br>1.3 | Illinois TRM (v10.0)<br>Sequentially Office, Retail, Restaurant, unknown |
| $WHF_{e\ Electric\ Heat}$ | 1<br>0.92<br>0.99<br>0.93 | Illinois TRM (v10.0)<br>Sequentially Office, Retail, Restaurant, unknown |
| $WHF_{g\ Gas\ Heat}$ | -0.01<br>-0.019<br>-0.009<br>-0.015 | Illinois TRM (v10.0)<br>Sequentially Office, Retail, Restaurant, unknown |
| Coincidence Factor (Office) | 0.52 | Illinois TRM (v10.0) |
| Coincidence Factor (Retail) | 0.71 | Illinois TRM (v10.0) |
| Coincidence Factor (Restaurant) | 1.0 | Illinois TRM (v10.0) |
| Coincidence Factor (Exit Signs) | 1.0 | Illinois TRM (v10.0) |
| ISR (A19 globe) | 73% | 2022 NIPSCO C&I Online Marketplace customer survey |
| ISR (A19 Filament) | 57% | 2022 NIPSCO C&I Online Marketplace customer survey |
| ISR (Filament candelabra E12 base) | 50% | 2022 NIPSCO C&I Online Marketplace customer survey |
| ISR (BR30) | 68% | 2022 NIPSCO C&I Online Marketplace customer survey |
| ISR (Linear LED), and all pack LEDs | 82.5% | Illinois TRM (v10.0). 2022 NIPSCO C&I Online Marketplace customer survey did not include questions about this lamp type and did not get distributed to these customers to determine an ISR |
| ISR all individually sold LEDs | 92.9% | Illinois TRM (v10.0). 2022 NIPSCO C&I Online Marketplace customer survey did not include questions about this lamp type and did not get distributed to these customers to determine an ISR |
| ISR (Exit Sign) | 52% | 2022 NIPSCO C&I Online Marketplace customer survey |
| ISR (Desk Lamp) | 66% | 2022 NIPSCO C&I Online Marketplace customer survey |

## SMART THERMOSTAT

The evaluation team used the following equations from Illinois TRM (v10.0) pg. 476, Small Commercial Thermostats.

$$\Delta kWh = \Delta kWh_{Heating} + \Delta kWh_{Cooling}$$

$$\Delta kWh_{Heating} = \left(\%ElecHeat * \frac{kBtu}{hr_{Heat}} * \frac{1}{HSPF} * EFLH_{Heat} * Heating_{Reduction} * BAF\right) + ((1 - \%ElecHeat) * \Delta Therms * F_e * 29.3$$

$$\Delta kWh_{Cooling} = \frac{kBtu}{hr_{Cool}} * \frac{1}{SEER} * EFLH_{Cool} * Cooling_{Reduction} * BAF$$

Where:

- %ElecHeat = Percentage of heating savings assumed to be electric

- $kBTU/Hr_{Heat}$ = Capacity of heating equipment
- $HSPF_{Base}$ = Heating Seasonal Performance Factor Baseline Equipment
- $EFLH_{Heat}$ = Heating mode equivalent full load hours
- Heating Reduction = Assumed percentage reduction in total building heating energy consumption
- Delta Therms = Therms savings if natural gas heating system
- $F_e$ = Furnace fan energy consumption as percentage of annual fuel consumption
- 29.3 = KWh per therm, IL TRM v10.0 Pg. 478
- $Kbtu/Hr_{cool}$ = Capacity of the cooling equipment installed in kBtu/hr
- SEER = Seasonal Energy Efficiency Ratio of the cooling equipment
- $EFLH_{Cool}$ = Equivalent full load hours for cooling
- Cooling_Reduction = Average percentage reduction in total building cooling energy consumption due to thermostat installation
- BAF = Baseline adjustment factor

Table 406 lists the input assumptions and source of each assumption for the smart thermostat measure savings calculations.

TABLE 406. *EX POST* VARIABLE ASSUMPTIONS FOR SMART THERMOSTATS

| INPUT | VALUE | SOURCE |
|---|---|---|
| $\%Elec_{Heat}$ | 0 or 1 | Illinois TRM (v10.0) pg. 476. 0 for gas heating, 1 for electric heating system |
| $kBTU/Hr_{Heat}$ | 0 or 87 | 0 for gas heating, 87 for electric heating system, defined by WI TRM 2020 Pg. 250 |
| $HSPF_{Base}$ | 7.7 | IN TRM 2015 Pg. 230, <65,000 Btuh |
| $EFLH_{Heat}$ | 1264 | IN TRM 2015 Pg. 231, SB Location, Other |
| Heating Reduction | 8.8% | IL TRM v10.0 Pg. 478 |
| $F_e$ | 7.7% | IL TRM v10.0 Pg. 478 |
| $Kbtu/Hr_{cool}$ | 61 or 0 | IL TRM v10.0 Pg. 478 for AC, 0 for no AC installed or gas only customer |
| SEER | 13 | WI TRM 2020 Pg. 247 |
| $EFLH_{Cool}$ | 711 | IN TRM 2015 Pg. 230, SB Location, Other |
| Cooling_Reduction | 17.7% | IL TRM v10.0 Pg. 478 |
| BAF | 0.8 | IL TRM v10.0 Pg. 478 |