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NV5

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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
SEM	Strategic Energy Management
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 six commercial and industrial (C&I) programs that serve its customer base. This executive summary includes key findings from the evaluation team's[1] 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 109,389,721 kWh *ex post* gross electric energy savings, 14,543 kW *ex post* gross peak demand reduction, and 4,676,763 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 2023 but did not meet its electric energy goal. The C&I portfolio did not meet its electric energy or peak demand reduction goals and fell just short of its natural gas energy goals.

Portfolio Performance and Insights

Thousands of residential and C&I customers participated in NIPSCO's DSM programs in 2023. NIPSCO's portfolio included the same programs as offered in 2022.

To evaluate program impacts and performance, the evaluation team held discussions with 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 evaluation team includes ILLUME Advising (lead firm), Cadmus, and NV5.

RESIDENTIAL SECTOR

- The residential portfolio exceeded its savings goals for demand reduction and natural gas, but fell short of its electric savings goals.
- Overall, electric program performance was driven by the Behavioral and Lighting programs. Gas program performance was driven by the Behavioral and Home Rebates programs.
- Realization rates varied across programs, mainly due to differences in the source of savings calculations used by the implementation and evaluation teams.

	Electric Savings (kWh)	Peak Demand Reduction (kW)	Natural Gas Savings (Therms)
Goal	39,143,178	3,914	2,688,825
Ex Ante	37,635,642	2,719	3,118,061
Audited	37,635,634	2,720	3,118,029
Verified	37,946,665	5,482	2,998,689
Ex Post Gross	35,087,832	5,208	3,136,724
Ex Post Net	32,063,626	4,626	2,641,594

Ex Post Gross Achieved to Gross Goal

Electric	Peak Demand	Natural Gas
90%	133%	117%

Realization Rate

Electric	Peak Demand	Natural Gas
93%	192%	101%

Budget

Electric and Peak Demand

Budget	9,018,796
Expenditures	7,588,284

Spent 84%

Natural Gas

Budget	5,186,039
Expenditures	4,307,416

Spent 83%

COMMERCIAL & INDUSTRIAL SECTOR

- The C&I portfolio fell short of its savings goals across all fuel types, though it came very close to its natural gas savings goal.
- Overall, electric program performance was driven by the New Construction, Custom and Prescriptive programs. Gas program performance was almost solely driven by the New Construction and Custom programs.
- Realization rates were close to 100% across most programs, indicating alignment between the implementation and evaluation teams in estimating savings.

	Electric Savings (kWh)	Peak Demand Reduction (kW)	Natural Gas Savings (Therms)
Goal	93,761,000	14,181	1,567,895
Ex Ante	76,272,414	9,498	1,546,018
Audited	76,288,843	9,499	1,546,011
Verified	75,696,142	9,391	1,540,701
Ex Post Gross	74,301,890	9,336	1,540,038
Ex Post Net	50,746,133	6,233	970,315

Ex Post Gross Achieved to Gross Goal

79% 66% 98%

Realization Rate

97% 98% 100%

Budget

Electric and Peak Demand

Budget	13,722,788
Expenditures	11,470,666

Spent 84%

Natural Gas

Budget	2,160,186
Expenditures	2,070,938

Spent 96%

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 2023 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 2023 goals, program performance varied widely across individual programs. On the residential side, the New Construction program had the lowest electric (8%) and natural gas (35%) goal achievement, and the Appliance Recycling program had the lowest peak demand goal achievement (18%). The C&I New Construction and Schools SEM programs exceeded their savings goals, while the other C&I programs continued to achieve lower-than-expected savings.

Table 1. 2023 Portfolio Electric Goal Achievement

	ELECTRICITY			DEMAND		
PROGRAM	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						
Home Rebates	2,175,513	888,210	41%	1,781	501	28%
Lighting	5,382,619	4,172,016	78%	729	524	72%
Home Energy Analysis	687,706	759,449	110%	151	397	262%
Appliance Recycling	2,346,435	654,206	28%	525	96	18%
School Education	1,486,610	2,136,224	144%	106	178	168%
Multifamily Direct Install	1,561,851	929,771	60%	177	85	48%
Behavioral	23,443,500	24,136,791	103%	0	2,755	n/a
New Construction	256,093	23,727	9%	28	10	33%

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 (%)
Home Life Calculator	114,003	287,576	252%	10	36	381%
IQW	1,247,606	579,744	46%	275	397	144%
Online Marketplace	441,244	520,119	118%	131	228	173%
Total Residential	**39,143,178**	**35,087,832**	**90%**	**3,914**	**5,208**	**133%**
Commercial & Industrial Programs						
Prescriptive	43,946,641	20,605,024	47%	8,077	4,079	51%
Custom	37,480,553	23,302,902	62%	4,417	567	13%
New Construction	4,688,050	25,997,163	555%	502	4,108	818%
Small Business Direct Install	2,832,574	2,530,178	89%	330	311	94%
Online Marketplace	4,344,377	1,294,522	30%	761	128	17%
Schools SEM	468,805	572,099	122%	93	142	154%
Total Commercial & Industrial	**93,761,000**	**74,301,890**	**79%**	**14,181**	**9,336**	**66%**
Total 2023 Portfolio	**132,904,178**	**109,389,721**	**82%**	**18,095**	**14,543**	**80%**

Table 2. 2023 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			
Home Rebates	544,615	940,677	173%
Lighting	n/a	n/a	n/a
Home Energy Analysis	49,431	96,427	195%
Appliance Recycling	n/a	n/a	n/a

PROGRAM	GROSS NATURAL GAS SAVINGS GOAL (THERMS)	*EX POST* NATURAL GAS SAVINGS (THERMS)	SHARE OF NATURAL GAS GOAL ACHIEVED (%)
School Education	160,875	104,063	65%
Multi Family Direct Install	108,823	37,851	35%
Behavioral	1,134,873	1,669,912	147%
New Construction	397,446	139,335	35%
Home Life Calculator	12,234	27,682	226%
IQW	280,527	120,777	43%
Online Marketplace	n/a	n/a	n/a
Total Residential	**2,688,825**	**3,136,724**	**117%**
Commercial & Industrial Programs			
Prescriptive	367,168	112,669	31%
Custom	600,875	560,490	93%
New Construction	251,232	853,983	340%
Small Business Direct Install	248,151	0	0%
Online Marketplace	92,629	12,896	14%
Schools SEM	7,839	0	0%
Total Commercial & Industrial	**1,567,895**	**1,540,038**	**98%**
Total 2023 Portfolio	**4,256,720**	**4,676,763**	**110%**

Table 3 through Table 5 show the electric energy, peak demand reduction, and natural gas energy savings achieved by each program in the 2023 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 96% of electric energy, 119% of demand, and 100% of therms savings. Program-level realization rates varied for reasons described in the individual chapters.

Table 3. 2023 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							
Home Rebates	870,584	870,584	870,584	888,210	102%	64%	565,193
Lighting	7,274,360	7,274,360	7,103,697	4,172,016	57%	51%	2,132,849
Home Energy Analysis	696,740	696,740	687,501	759,449	109%	71%	536,030
Appliance Recycling	716,634	716,634	716,634	654,206	91%	62%	405,543
School Education	1,486,610	1,486,606	2,095,040	2,136,224	144%	95%	2,025,830
Multi Family Direct Install	1,333,236	1,333,236	1,160,051	929,771	70%	97%	906,252
Behavioral	23,976,172	23,976,172	24,136,791	24,136,791	101%	100%	24,136,791
New Construction	21,984	21,984	21,984	23,727	108%	36%	8,522
Home Life Calculator	173,787	173,791	232,957	287,576	165%	96%	274,949
IQW	502,037	502,037	486,537	579,744	115%	100%	579,744
Online Marketplace	583,498	583,491	434,889	520,119	89%	95%	491,923
Total Residential	**37,635,642**	**37,635,634**	**37,946,665**	**35,087,832**	**93%**	**n/a**	**32,063,626**
Commercial & Industrial Programs							
Prescriptive	20,670,500	20,670,500	20,670,500	20,605,024	100%	79%	16,277,969
Custom	24,332,558	24,332,558	24,332,558	23,302,902	96%	76%	17,710,206
New Construction	26,813,891	26,813,891	26,259,011	25,997,163	97%	52%	13,518,525
Small Business Direct Install	2,531,192	2,531,192	2,531,192	2,530,178	100%	61%	1,543,409
Online Marketplace	1,343,157	1,359,586	1,330,782	1,294,522	96%	87%	1,123,925
Schools SEM	581,117	581,117	572,099	572,099	98%	100%	572,099
Total Commercial & Industrial	**76,272,414**	**76,288,843**	**75,696,142**	**74,301,890**	**97%**	**n/a**	**50,746,133**
Total 2023 Portfolio	**113,908,056**	**113,924,478**	**113,642,807**	**109,389,721**	**96%**	**n/a**	**82,809,759**

Table 4. 2023 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							
Home Rebates	827	827	827	501	61%	69%	345
Lighting	974	974	952	524	54%	47%	249
Home Energy Analysis	251	251	249	397	158%	81%	322
Appliance Recycling	116	116	116	96	83%	62%	60
School Education	106	108	173	178	168%	91%	162
Multi Family Direct Install	117	117	104	85	73%	96%	82
Behavioral	-	-	2,755	2,755	n/a	100%	2,755
New Construction	9	9	9	10	104%	21%	2
Home Life Calculator	14	15	22	36	250%	93%	34
IQW	157	157	155	397	253%	100%	397
Online Marketplace	147	146	119	228	155%	96%	218
Total Residential	**2,719**	**2,720**	**5,482**	**5,208**	**192%**	**n/a**	**4,626**
Commercial & Industrial Programs							
Prescriptive	4,090	4,090	4,090	4,079	100%	79%	3,223
Custom	605	605	605	567	94%	76%	431
New Construction	4,205	4,205	4,108	4,108	98%	52%	2,136
Small Business Direct Install	318	318	318	311	98%	61%	190
Online Marketplace	130	131	127	128	99%	87%	112
Schools SEM	150	150	142	142	95%	100%	142
Total Commercial & Industrial	**9,498**	**9,499**	**9,391**	**9,336**	**98%**	**n/a**	**6,233**
Total 2023 Portfolio	**12,217**	**12,219**	**14,873**	**14,543**	**119%**	**n/a**	**10,860**

Table 5. 2023 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							
Home Rebates	625,928	625,928	625,928	940,677	150%	60%	568,599
Lighting	n/a	n/a	n/a	n/a	n/a	n/a	n/a
Home Energy Analysis	100,136	100,136	98,188	96,427	96%	86%	82,546
Appliance Recycling	n/a	n/a	n/a	n/a	n/a	n/a	n/a
School Education	161,139	161,109	147,116	104,063	65%	102%	106,017
Multifamily Direct Install	59,668	59,668	50,061	37,851	63%	98%	36,987
Behavioral	1,770,973	1,770,973	1,669,912	1,669,912	94%	100%	1,669,912
New Construction	213,019	213,019	213,019	139,335	65%	21%	29,260
Home Life Calculator	29,269	29,266	42,333	27,682	95%	99%	27,497
IQW	157,930	157,930	152,133	120,777	76%	100%	120,777
Online Marketplace	n/a	n/a	n/a	n/a	n/a	n/a	n/a
Total Residential	**3,118,061**	**3,118,029**	**2,998,689**	**3,136,724**	**101%**	**n/a**	**2,641,594**
Commercial & Industrial Programs							
Prescriptive	109,777	109,777	109,777	112,669	103%	79%	89,008
Custom	552,741	552,741	552,741	560,490	101%	76%	425,972
New Construction	865,298	865,298	865,298	853,983	99%	52%	444,071
SBDI	n/a	n/a	n/a	n/a	n/a	n/a	n/a
Online Marketplace	18,202	18,195	12,885	12,896	71%	87%	11,263

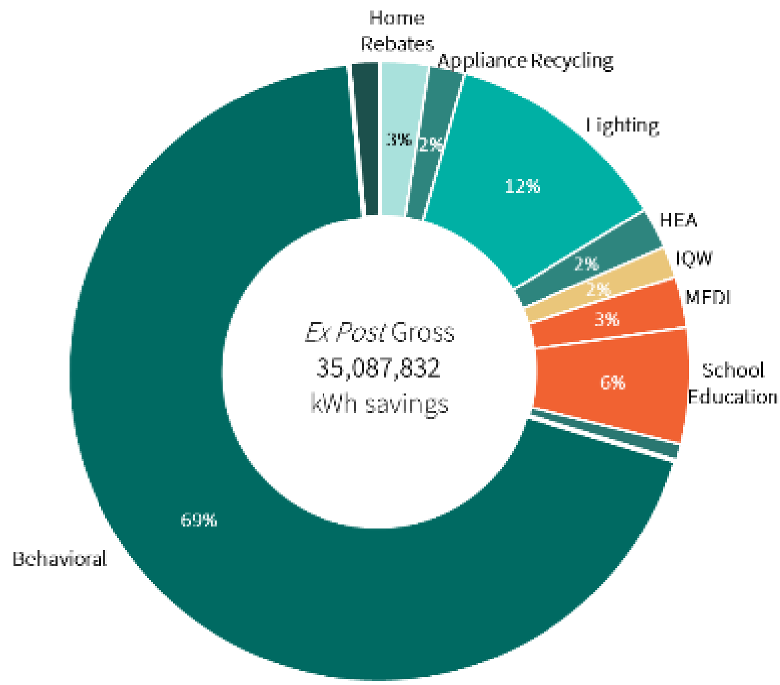
PROGRAM	REPORTED NATURAL GAS SAVINGS (THERMS)			EVALUATED NATURAL GAS SAVINGS (THERMS)			
	EX ANTE	AUDITED	VERIFIED	*EX POST* GROSS	REALIZATION RATE (%)	NTG RATIO (%)	*EX POST* NET
Schools SEM	n/a	n/a	n/a	n/a	n/a	n/a	n/a
Total Commercial & Industrial	**1,546,018**	**1,546,011**	**1,540,701**	**1,540,038**	**100%**	**n/a**	**970,315**
Total 2023 Portfolio	**4,664,079**	**4,664,039**	**4,539,390**	**4,676,763**	**100%**	**n/a**	**3,611,910**

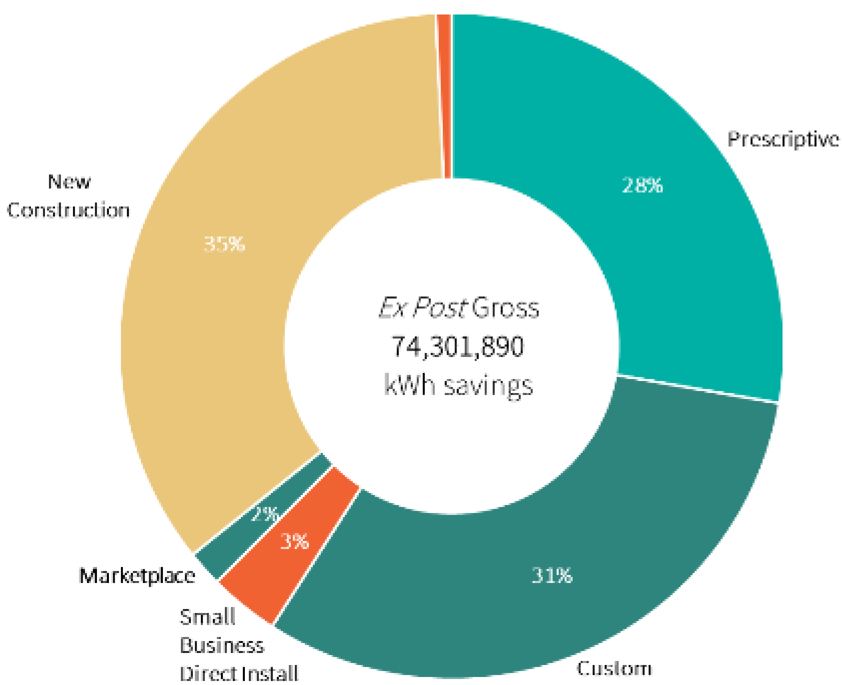
Program Contribution to Portfolio Savings

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 69% of total electric energy (kilowatt-hour) savings. The Lighting program accounted for the next largest share (12%). The Behavioral program also accounted for the largest share of peak demand reduction (kilowatts) for the Residential portfolio, contributing 53% of total peak demand reduction, followed by the Lighting and Home Rebates programs at 10% each.

In the C&I sector, the New Construction program contributed the largest share of electric energy savings, with 35% of the total C&I portfolio electric energy (kilowatt-hour) savings, with the Custom program contributing 31% and the Prescriptive program contributing 28%. The Prescriptive and New Construction programs contributed the largest share of peak demand reduction (kilowatts) to the C&I portfolio, accounting for 44% of peak demand reduction, each.

Figure 1. Program Contributions to Portfolio Electric Savings (kWh) by *Ex Post* Gross [a,b]

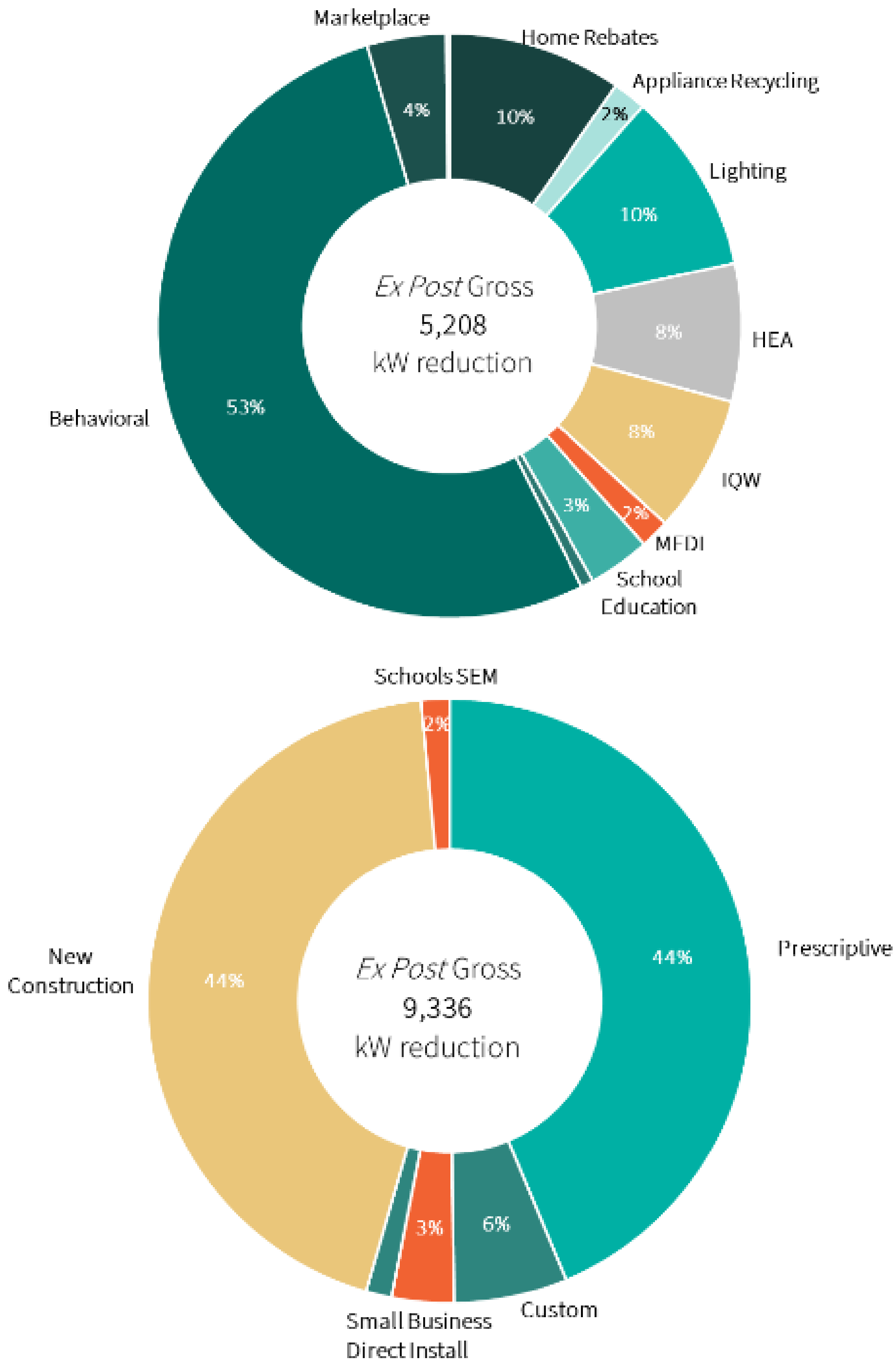




[a] Three residential programs are not labeled due to savings of 1% or less of the total portfolio in 2023. This includes the HomeLife Calculator, New Construction and Online Marketplace programs.

[b] One C&I program, Schools SEM, is not labeled due to savings of less than 1% of the total portfolio in 2023.

Figure 2. Program Contribution to Portfolio Peak Demand Reduction (KW) by *Ex Post* Gross [a,b]

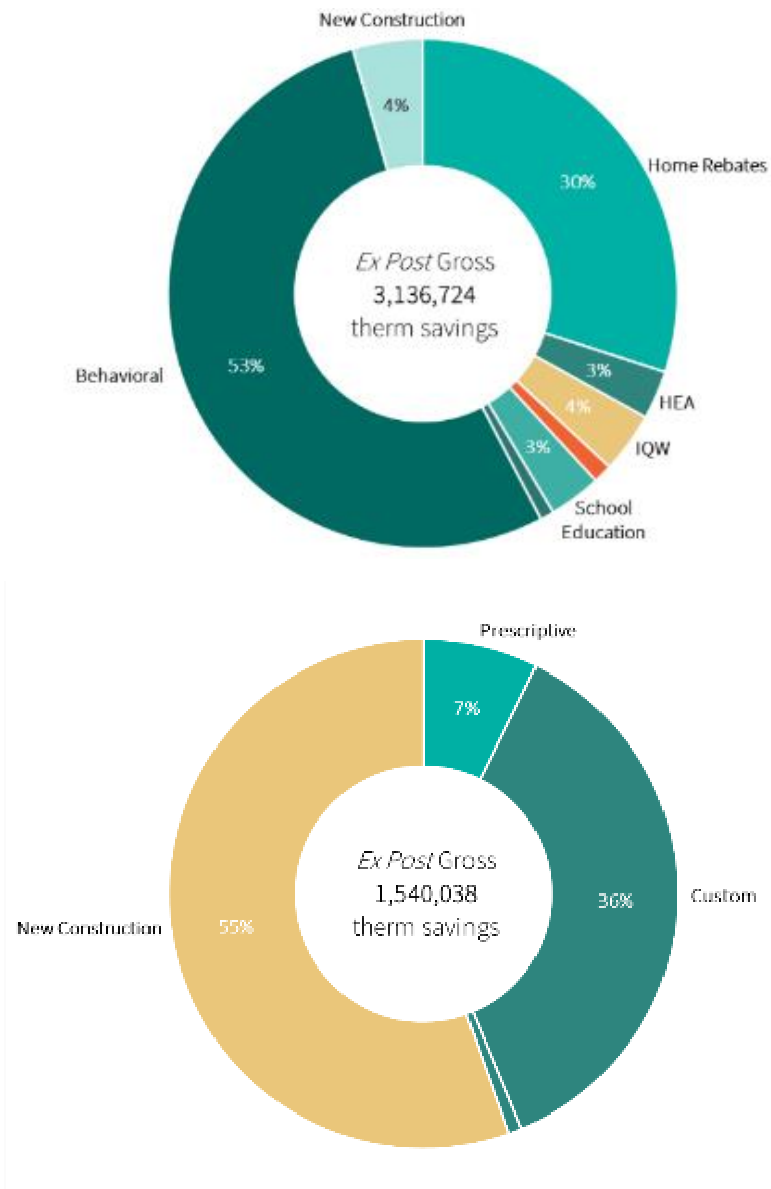


[a] Two residential programs are not labeled due to savings of less than 1% of the total portfolio in 2023. This includes the Hom elife Calculator and New Construction programs.

[b] One C&I program, the Online Marketplace, is not labeled due to savings of less than 1% of the total portfolio in 2023.

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 53% of the Residential portfolio savings. The Home Rebates program was the second largest contributor to the Residential program's natural gas savings total (30%). The New Construction program contributed 55% 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] Two residential programs are not labeled due to savings of 1% or less of the total portfolio in 2023. This includes the MFDI and Homelife programs.

[b] Three C&I programs are not labeled due to savings of less than 1% of the total portfolio in 2023. This includes the Small Business Direct Install, Online Marketplace and Schools SEM programs.

Budget

As shown in Table 6 and Table 7, NIPSCO spent 84% of its electric budget and 87% of its natural gas budget for the 2023 portfolio.

Table 6. 2023 Electric Portfolio Budget and Spending

PROGRAM	BUDGET ($)	ACTUAL SPEND ($)	BUDGET SPENT (%)	SHARE OF ELECTRIC GOAL ACHIEVED (%)	SHARE OF PEAK DEMAND GOAL ACHIEVED (%)
Residential Programs					
Home Rebates	890,331.17	393,673.05	44%	41%	28%
Lighting	2,425,365.80	2,353,983.12	97%	78%	72%
Home Energy Analysis	510,521.95	585,691.80	115%	110%	262%
Appliance Recycling	488,058.30	158,863.60	33%	28%	18%
School Education	895,181.82	863,781.99	96%	144%	168%
Multi Family Direct Install	575,107.44	509,475.09	89%	60%	48%
Behavioral	1,767,417.76	1,705,312.98	96%	103%	n/a
New Construction	85,077.59	8,379.81	10%	9%	33%
Home Life Calculator	71,349.71	104,949.73	147%	252%	381%
IQW	1,101,490.76	538,297.11	49%	46%	144%
Online Marketplace	208,893.93	365,875.83	175%	118%	173%
Total Residential	**9,018,796.23**	**7,588,284.11**	**84%**	**90%**	**133%**
Commercial & Industrial Programs					
Prescriptive	6,420,167.24	2,966,824.01	46%	47%	51%
Custom	5,589,776.20	3,983,210.69	71%	62%	13%
New Construction	680,934.56	3,513,755.68	516%	555%	818%
Small Business Direct Install	383,665.92	489,495.33	128%	89%	94%
Online Marketplace	579,137.93	434,205.41	75%	30%	17%
Schools SEM	69,106.34	83,175.19	120%	122%	154%
Total Commercial & Industrial	**13,722,788.19**	**11,470,666.31**	**84%**	**79%**	**66%**
Total 2023 Portfolio	**22,741,584.42**	**19,058,950.42**	**84%**	**82%**	**80%**

Source: 2023 DSM Scorecard.

Note: Totals may not properly sum due to rounding

Table 7. 2023 Natural Gas Portfolio Budget and Spending

PROGRAM	BUDGET ($)	ACTUAL SPEND ($)	BUDGET SPENT (%)	SHARE OF NATURAL GAS GOAL ACHIEVED (%)
Residential Programs				
Home Rebates	1,350,786.80	1,494,370.77	111%	173%
Lighting	-	-	n/a	n/a
Home Energy Analysis	156,666.91	351,032.01	224%	195%
Appliance Recycling	-	-	n/a	n/a
School Education	353,510.16	340,596.20	96%	65%
Multi Family Direct Install	308,443.66	128,970.20	42%	35%
Behavioral	455,487.30	437,870.90	96%	147%
New Construction	812,410.75	431,355.71	53%	35%
Home Life Calculator	29,491.32	77,929.56	264%	226%
IQW	1,719,242.17	1,045,290.94	61%	43%
Online Marketplace	-	-	n/a	n/a
Total Residential	**5,186,039.07**	**4,307,416.31**	**83%**	**117%**
Commercial & Industrial Programs				
Prescriptive	413,509.57	147,342.55	36%	31%
Custom	885,492.69	758,337.03	86%	93%
New Construction	370,234.00	1,127,771.11	305%	340%
Small Business Direct Install	370,478.10	14,683.41	4%	0%
Online Marketplace	109,343.98	22,362.83	20%	14%
Schools SEM	11,127.78	441.03	4%	0%
Total Commercial & Industrial	**2,160,186.12**	**2,070,937.96**	**96%**	**98%**
Total 2023 Portfolio	**7,346,225.19**	**6,378,354.27**	**87%**	**110%**

Source: 2023 DSM Scorecard.

Note: Totals may not properly sum due to rounding

Summary of Recommendations

Based on the 2023 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.

Home Rebates Program

- Update inputs for measures that use heating effective full load hour (EFLH) inputs to use the results from the 2023 billing analysis to reflect a more accurate representation of usage.
- Use the new Indiana Technical Reference Manual Workbook v1.0 value for measures that use cooling EFLH inputs in program planning. Use Indiana location-specific input assumptions for EFLH, which the Indiana TRM Workbook v1.0 maps to climate comparable Illinois TRM cities.
- Use the 2023 billing analysis gas savings and electric energy savings factors for smart thermostats in future program years. Therms savings are estimated to be 43 therms per site. The cooling savings factor should be updated to 9.6%.
- Monitor the proportion of participants receiving more than one thermostat; if this negatively affects overall program cost-effectiveness, consider limiting participation to one thermostat.
- Assess in-service (ISR) rates for smaller measures (air purifiers, dehumidifiers, pool pumps, and thermostats) in 2024. While the evaluation team deemed these ISRs at 100% this year, they are likely below 100% for smaller measures and should be evaluated in the future, which may reduce savings.

Residential Lighting Program

- Promote the benefits of using air purifiers, particularly those with high CADR per watt, and the incentives NIPSCO provides.
- Provide incentives for a variety of air purifier sizes and models. The current ENERGY STAR qualified products list is long, but there is an opportunity to further expand the list of program eligible models to include those that maximize savings potential, like those with high CADR per watt.
- Determine the calculated savings of various air purifier models using the ENERGY STAR qualified products list to determine which additional models will bring the most savings to the program.
- Update the baseline wattage assumptions to account for fixture brightness and represent the fixtures they were designed to replace, e.g., LED under cabinet fixtures replace fixtures using T5 fluorescent tubes.
- Work with the evaluation team in 2024 to perform a mid-year audit of lighting tracking data and baseline assumptions used.
- Conduct NTG research on upstream utility programs with similar measure offerings in 2024.

Home Energy Assessment Program

- Update *ex ante* savings approaches to the Illinois TRM v12.0, as instructed by the new Indiana Technical Reference Manual Workbook v1.0. Where applicable, use Indiana location specific input assumptions from Indiana TRM v1.0, which map to climate comparable Illinois TRM cities. Update measures that are passing through old program averages (like duct insulation) instead of calculating them.
- Supply project documentation in the form of photographs of inefficient *in situ* lighting prior to it being replaced.
- Prioritize the installation of smart thermostats in the program to increase electric savings. Unlike the programmable thermostats offered in 2023, which can only claim heating savings according to the Illinois TRM v11.0, smart thermostats have the potential to increase heating savings as well as reintroduce cooling savings.

Income-Qualified Weatherization Program

- Prioritize the installation of smart thermostats in the program. Unlike the programmable thermostats offered in 2023, which can only claim heating savings according to the Illinois TRM v11.0, smart thermostats have the potential to increase heating savings as well as reintroduce cooling savings.
- Update *ex ante* savings approaches to the Illinois TRM v12.0, as instructed by the new Indiana Technical Reference Manual Workbook v1.0. Where applicable, use Indiana location specific input assumptions from Indiana TRM v1.0. Update measures that are simply passing through old program averages (like duct insulation) instead of calculating them.
- Conduct a market segmentation study to identify populations and geographies that would benefit from IQW. Use the study results to guide targeted outreach efforts in terms of where outreach is being done and the channels being used.
- Leverage local, community-based organizations for outreach to supplement existing marketing channels.
- Foster a relationship with Indiana WAP providers, CAAs, and/or CAP agencies to enhance the reach of IQW marketing.
- Supply project documentation in the form of photographs of the inefficient *in situ* lighting prior to it being replaced.

Multifamily Direct Install Program

- As previously recommended, consider one-stop-shop participation models, which streamline the process and emphasize both in-unit (MFDI) and common area (SBDI) improvements as part of the same participation experience.
- Prioritize the installation of smart thermostats in the program. Unlike the programmable thermostats offered in 2023, which can only claim heating savings according to the Illinois TRM v11.0, smart thermostats have the potential to increase heating savings as well as reintroduce cooling savings.

- Update *ex ante* savings approaches to the Illinois TRM v12.0, as instructed by the new Indiana Technical Reference Manual Workbook v1.0. Where applicable, use Indiana location specific input assumptions from Indiana TRM Workbook v1.0 and programmable thermostat heating consumptions, which map to climate comparable Illinois TRM cities.
- Continue in-person direct outreach strategies to recruit MFDI participants.
- Foster word-of-mouth marketing or sharing among property manager peer groups by developing case studies of successful products and engaging local real estate industry trade organizations.
- Investigate ways to ensure that energy assessment reports are being delivered to property managers in a format that is readable and simple to understand. Though the assessment summary is emailed to the property manager/owner before work commences, the program could consider making the document more memorable with a clearer call to action to ensure that property managers/owners are thoroughly reviewing it. Ensure that MFDI participants are also connected with SBDI program offerings and clarify next steps to drive deeper savings per property.
- Supply project documentation in the form of photographs of the *in situ* inefficient lighting prior to it being replaced.

Appliance Recycling Program

- Update the program *ex ante* savings estimates as well as evaluation metrics such as part-use factor and ISR to reflect the most recent evaluated results.
- Continue to use the NIPSCO website and bill inserts to increase customer awareness of the program.
- Consider offering a referral program, where customers are incentivized to refer friends and family to the program, building upon the already strong word of mouth referrals the program benefits from.
- Ensure that all marketing materials align with program rules, such as the requirement that the recycled unit is a secondary appliance and is not being replaced with a new one.

Behavioral Program

- Continue to plan for consistent electric savings as a major source of overall portfolio savings in 2024.
- Consider increasing the gas program goal to help plan for total portfolio gas savings throughout the program year.
- Provide updated customer emails to Oracle to bolster their email distribution list. Reaching these additional customers and promoting additional programs and energy savings tips through eHERs can increase program savings.
- Conduct a brief or in-depth customer survey to better understand customer interest in energy savings tips and communication preferences. A brief survey can be a quick take on 1) participant preferences for mail, email, or both types of communication; and 2) relative interest in energy savings tips, the customer portal, or information in other NIPSCO programs. Or consider an in-depth customer survey, which the evaluation team conducted last in 2018. A more extensive survey can ask customers about preferences for email frequency, messaging, and other resources needed to inform Oracle's tip library and potentially drive program cross-participation.

- Consider ways to reorganize the HER reports so that program information is more eye-catching to the customer. One potential solution is moving channel messaging higher up or closer to the customer's energy use breakdown in HER reports.
- Enhance seasonal channel messaging to help customers understand how the recommended program can help address seasonal concerns. NIPSCO currently sends Summer and Winter HER reports with relevant tips for the season. Since customers are often concerned about seasonal energy usage, these reports are a great opportunity to point them towards NIPSCO resources that help them save energy. Use channel messaging to show how NIPSCO programming can help with energy cost concerns in these seasonal report editions. For example, the current winter edition contains information on how to get a Home Energy Assessment. Since many customers are concerned about heating bills in the winter, use a headline that explains how the program can help with energy savings that can motivate them to look further.
- Consider moving control customers into treatment groups to maximize savings and minimize the number of total control customers across the program as overall numbers decline. The evaluation team could conduct a study to determine how the NIPSCO team can maximize savings while decreasing control group sizes and maintaining the ability to calculate statistical significance for savings differences. This could help inform the strategy for adding participants to the program to drive savings in future years.
- Using move-out, zip code, and/or renter data at the customer level from NIPSCO, Oracle, or from the census for the whole NIPSCO service territory, investigate any fundamental differences between the waves and the service territory to take into consideration when rebalancing customers in future waves.
- Develop new strategies to increase engagement with the online portal. With increased portal engagement, NIPSCO can better market other program offerings to program participants.
- Monitor the time customers spend on the portal in 2024. If it continues to decline, consider surveying customers to determine what changes can be made to increase portal engagement.
- Continue to monitor these new waves in 2024, as savings can take a few years to build up. If differences continue, consider further exploring the customers in the two waves to pinpoint what is contributing to the different behavior. If these waves were selected based on common characteristics, such as square footage of home, home age, energy usage, cooling types, or other factors, looking at savings differences by characteristic may help explain differences in customer behavior. Additionally, some customers share information with NIPSCO by updating their Home Profiles. Home Profile data can help the evaluation team further explore what drives saving decisions.
- If these newer waves were selected based on common characteristics, conduct a statistical analysis study to determine which factors used in the wave selection or entered in the Home Profile have the greatest impact on savings. For any new waves in 2024 or 2025, use the results of this study to strategize new types of waves that target customers that may have different savings behavior. For example, targeting customers for cooling or heating consumption may help NIPSCO maximize savings and reach any gas or electric specific savings goals.

- Consider a customer behavior study to understand why behavioral savings increase over time. The study can examine savings data from the lifespan of the program, as well as demographic and educational messaging data to find drivers of long-term savings. The study can attempt to understand how much customer knowledge about energy savings comes from this program, while helping understand the persistence of savings for the program going forward.
- Conduct a message testing study with a sample of customers from waves that demonstrate high savings to evaluate the effectiveness of using targeted channeling efforts that highlight other NIPSCO programs. For example, the team could test using more targeted channeling messaging with participants who are in the oldest waves and have the highest behavioral savings. If the test results demonstrate that targeted channeling leads to higher cross-participation and additional energy savings, this could be a new model to drive more savings from the highest savings participants in the largest program in NIPSCO's residential portfolio.
- Conduct research to better understand underlying reasons for persistent negative savings to inform decisions about whether to retire a wave with persistent negative savings. This research could include investigating baseline usage for waves with negative savings and attempting to collect different home data from Oracle or NIPSCO, such as square footage, home vintage, or cooling system types to understand differences between waves with positive and negative savings.

Residential New Construction Program

- Consider normalizing gas and electric savings for each project on a per-square foot basis to reduce the impact of home size variations.
- Consider using the following values (most conservative between 2022 and 2023 evaluations) as a starting point.
    - kWh (from 2023): 0.25 kWh/sf
    - kW (from 2022): 0.000100 kW/sf
    - Gas (from 2023): 0.081 therms/sf (Silver)
      0.085 therms/sf (Gold)
      0.089 therms/sf (Platinum)
- Consider increasing the minimum cooling efficiency standard for electric participation to 16.0 SEER to offset the federal minimum efficiency increase.
- Consider increasing the electric rebate value to encourage more builders to move to above code minimum equipment, offsetting the upfront cost of higher efficiency and potentially reducing freeridership.
- Consider offering "bonus" or "a la carte" rebates on top of the Home Energy Rating System (HERS) rating rebates for high efficiency HVAC and domestic hot water equipment, energy recovery ventilation (ERV), above code envelope insulation and air sealing, high efficiency appliances, and ENERGY STAR certification, through the Residential New Construction program. While program participants could stack these rebates with builder natural gas and/or electric HERS tier rebates, there would not be additional prescriptive savings associated with these rebates. Modeled savings would theoretically increase with the higher efficiency average home characteristics driven by the builders making more efficient choices. One Michigan utility found higher average satisfaction ratings for

ENERGY STAR homes than for HERS homes, regarding the overall home, energy costs and level of comfort.[2]

- Work with the evaluation team to determine the best approach for estimating manufactured home savings. Consider choosing between a modeled savings approach or a TRM based approach (whole home or prescriptive measures).
    - Establish a consensus for default values for modeling parameters (for example, indoor heating/cooling design temperature, skirting R-value) or TRM default variables, where not explicitly mentioned in ENERGY STAR documentation.
    - Update savings projections using ENERGY STAR Manufactured Homes Cost Savings Summary Version 3 when available.[3]
- Consider collecting ENERGY STAR Single-Family New Homes National HVAC Design Report documents or similar documentation (in lieu of the HERS certificate used for single-family homes) from program participants to inform energy models or TRM-based calculations for manufactured homes. This document should include the following information:
    - HVAC equipment capacity/efficiency/AHRI number.
    - Envelope insulation levels (ceiling, walls, floor, windows, doors, etc.) and measured air tightness.
    - Duct insulation and measured leakage.
    - Home Dimensions (length, width, height).
    - Window and door areas.
- Conduct ENERGY STAR manufactured homes builder interviews as part of the 2024 evaluation.
- Conduct benchmarking research on other utility programs that incentivize ENERGY STAR manufactured homes.

School Education Program

- Include behavior tips in the kit marketing collateral to encourage easy-to-adopt energy efficiency habits.
- Consider enhancing educational materials and activities to include additional energy topics, including renewable energy and how energy production is changing.
- Explore opportunities to highlight and emphasize gasket placement on exterior walls, including additional educational materials and visual aids.
- Consider adding a question to the Home Energy Worksheet, to gather data on how many installed gaskets were installed on exterior walls. Include a diagram illustrating an “exterior wall” and information reminding participants that gasket energy savings occur when gaskets are installed on exterior walls.

[2] 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

[3] Version 3 Cost Savings & Estimates document for manufactured homes publication expected in May 2024.

- Assess whether it is cost-effective to continue offering bathroom aerators and low-flow showerheads in the kits.
- Send follow-up fliers or emails to parents of School Education program participants reminding them of NIPSCO's other programs. Explore opportunities for and channels to educate participants about other NIPSCO programs through the School Education program, such as the program website and other program materials including the kit insert.
- Improve the visibility of NIPSCO's programs on the kit insert and identify ways to highlight savings opportunities by participating in other NIPSCO programs.
- Update *ex ante* ISRs to reflect the recent evaluation available each year.
- Adjust the *ex ante* assumptions for gaskets to reflect the distribution of heating system fuel type and the presence of central air conditioning.

HomeLife Calculator Program

- Build upon satisfaction with the HomeLife Calculator program to generate interest in other programs. Send follow-up emails to participating customers, including links and information about other NIPSCO programs, as well as links for coupons for the Residential Online Marketplace.
- Expand on the uplift analysis in a future evaluation to look at cross-program participation in more detail, including the average time between participating in the HomeLife Calculator program and other programs, participation in multiple programs, and trends in overall program participation pathways.
- Continue offering popular kit measures, such as advanced power strips, nightlights, and connected LEDs to generate interest in the kits.
- Update the *ex ante* ISR assumptions to reflect 2023 evaluation results.
- Continue to offer light switches and power outlet gaskets as these provide measurable savings to the program.
- Investigate ways to clarify the distinction between exterior and interior wall installation to the participants and highlight that energy savings only occur when gaskets are installed on exterior walls.
- Include multiple languages in marketing materials to expand customer reach and engagement. Expand this approach to other NIPSCO programs if successful.
- Update *ex ante* ISRs to reflect the most recent evaluation available each year.
- Adjust the *ex ante* assumptions for gaskets to assign energy and natural gas savings consistent with the distribution of heating system fuel type. Include cooling energy savings and demand reduction aligning with the percentage of participants with central air conditioning.

Residential Online Marketplace

- Connected LEDS and desk lamps/task lighting can continue to be offered in 2024, but most varieties of residential LEDs lighting will be EISA-impacted and therefore ineligible for claimed savings.

- Apply inputs and deemed savings values from the 2023 billing analysis to all Wi-Fi thermostats, and do not apply an ISR to the *ex ante* savings, as this is already accounted for in the billing analysis results.
- Consider prioritizing a re-evaluation of the thermostat billing analysis within the EE Rebates program in the next 3-year cycle, to update savings inputs.
- NIPSCO should exercise caution in widespread distribution of smart plugs unless documented savings can be substantiated.
- Identify customers as electric, gas, or combo customers in the tracking data for the Online Marketplace (OLM) and all other NIPSCO programs, so savings can be accurately assigned. This will allow the evaluation team to confirm ex ante savings and assign accurate savings to customers.
- Include water heating fuel and home heating fuel, which are both required inputs during the OLM check-out process, for every measure in the tracking data.
- Include therm penalties in the tracking data and consistently apply these for all lighting measures installed in natural gas heated homes.
- Determine the calculated savings of various air purifier models using the ENERGY STAR qualified products list, to determine the models that will bring the most savings to the program, and then offer those specific model numbers on the OLM.
- Continue to promote the Online Marketplace through customer email, as it is the strongest channel for Marketplace participation. Emphasize how prices on the Online Marketplace may be lower than other retailers, as this continues to be a primary participation driver.
- Consider sending re-engagement emails to customers who have already bought Online Marketplace products, reminding them of limited time offers.
- Consider increasing the marketing presence of the Online Marketplace on other common sources of information, like bill inserts or the NIPSCO website.
- Consider more opportunities to cross-channel customers of the Online Marketplace to other EE programs, or vice versa. For example, remind customers who complete a Home Energy Assessment that they can buy products from the Online Marketplace for their specific needs at a typically lower price.
- Include instructional materials on these measures in the kits. The evaluation team recommends 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.
- Emphasize in the instructional materials for smart LEDs that customers should use the app to achieve greater energy savings than if they do not use the app.
- Offer more types of kits that are more customizable to the customer. For example, offer a limited time offer with “smart” products and an LTO with traditional products.

Commercial and Industrial Programs

- Use existing savings calculation methodologies, paying close attention to TRM revisions and code changes that could impact claimed savings.

- Continue to consult with the evaluation team on the front end of complex Custom projects that require engineering assumptions or modeled savings to ensure accuracy of *ex ante* savings.
- Continue to incorporate findings from incremental evaluation waves throughout the program year into reported savings calculations for all C&I programs.
- Provide and market incentives at a high enough level so that customers feel the incentive makes it possible to implement the project.
- Target customers who have already participated in other C&I programs with additional recommendations and offers for ongoing program participation.
- Consider trade ally incentives to widely promote the NIPSCO rebate programs to potential customers.
- Ensure the SBDI program delivery matches the program abstract process narrative which states that the trade ally will identify potential measures that could benefit the customer and then install those measures.
- Conduct targeted outreach for the SBDI program to those who have not yet participated in the program.
- Change the baseline for calculating lighting power density savings from ASHRAE 90.1-2007 to IECC 2018, which is the Indiana assumption called out in the new Indiana Technical Reference Manual Workbook v1.0.
- Find ways to motivate participating customers to seek out additional savings not already considered. For example, providing additional technical support services, with the intent of driving scope expansion, could encourage greater adoption of measures.
- Consider a tiered incentive approach or higher minimum savings requirements to encourage participants to achieve higher savings, and to provide an incentive commensurate with savings. For example, if a measure produces high savings but has a low incremental cost to the customer, the incentive might be lower than it would be if it were based on savings alone. In this way, customers that may need greater assistance to implement a measure would be prioritized.
- Adopt payback criteria such as projects must have >1 year simple payback before the incentive is applied to qualify for an incentive.

Commercial and Industrial Online Marketplace

- Use evaluation findings on the most important items in the kit and influential messages to inform future outreach. Respondents mentioned that they purchased kits for the advanced power strip, desk lamp, and pipe insulation. Additionally, respondents cited motivations and attitudes toward efficiency (specifically reducing utility bills and energy use, getting equipment at no cost), and economic challenges faced by businesses (specifically inflation and high up-front costs) most frequently as reasons for participating.
- Maintain the same measure level calculation and referenced sources for products that appear both within kits and are available for individual sale. The evaluation team recommends using the IL TRM v11.0 as the primary reference, when the measure exists. ISRs should be adjusted to reflect the likely installation of the product based on the distribution.

- Update ISR values used for *ex ante* savings to those provided in this evaluation report which are based on the most recent survey data available.
- Use lower estimated ISRs in the first year of offering any new products as new products will carry risks to ISR shifts in *ex post* savings.
- Consider discontinuing products with ISRs less than 20%.
- Continue to invest in program marketing as businesses invest in themselves. If challenges related to the economy continue to decrease, businesses may have increased interest in energy efficiency programs like the C&I Online Marketplace.
- Consider offering industry-specific kits again, or developing industry-specific messaging for existing kits, especially if there is a target industry for future iterations of the C&I Online Marketplace and monitor effects on uptake with targeted customer segments.
- Investigate the root cause of C&I customer dissatisfaction with NIPSCO through surveys and/or conversations with NIPSCO key account managers and program implementers.
- Continue using programs like the C&I Online Marketplace to build rapport.

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. The 2023 program year marked the second year of a two-year program cycle. A brief description of each program's offering follows:

- The **Home 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. In 2023, the program began offering discounts on non-lighting products, including advanced power strips and air purifiers.
- 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. In 2023, NIPSCO continued incentivizing HERS measures and began incentivizing qualified manufactured new homes.
- The **Homelife 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 smart LEDs, LED nightlights, 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 Energy Savers Starter Packs, 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 Strategic Energy Management (SEM) program** 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. It also offers a variety of energy efficient products, such as LED fixtures, smart thermostats, advanced power strips, air purifiers, pre-rinse spray valves, door sweeps and pipe insulation, at a discounted cost.

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 v11.0, 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 2023 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 held discussions 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 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. 2023 Impact Evaluation Activities

PROGRAM	DATABASE REVIEW	ENGINEERING ANALYSIS	VERIFICATION/ SITE VISITS	NTG ESTIMATION/ UPDATES	GATHER IMPACT INPUTS VIA PARTICIPANT SURVEYS
Home Rebates	✓	✓			
Lighting	✓	✓			
HEA	✓	✓			
Appliance Recycling	✓	✓		✓	✓
School Education	✓	✓		✓	✓
MFDI	✓	✓			
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. 2023 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 v11.0, 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 v11.0, 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 2023 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 2023, a second time in Fall 2023, and a third time in early 2024, to identify high-saving projects and draw these projects into a sample for recruitment. Virtual verifications were completed between Spring 2023 and February 2024.

Table 10. 2023 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	31	6	16%	25%
C&I Custom	33	19	12%	44%
C&I New Construction	24	13	31%	54%
C&I SBDI	20	-	14%	n/a
C&I Schools SEM	10	7	82%	n/a
C&I Total Programs	**118**	**45**	**21%**	**48%**

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 attended meetings with NIPSCO implementation staff to understand how the programs were designed and delivered. The meetings 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 surveys. 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					
Appliance Recycling	Participants	Surveys	738	Census	97
HomeLife Calculator	Participants	Surveys	2,152 (as of Oct 2023 at time of survey)	120	120
School Education	Parents	Surveys	831 (parents who agreed to be surveyed)	70	70
Residential Online Marketplace	Participants	Surveys	3,341	210	210
C&I					
Prescriptive/Custom/SBDI/ New Construction	Participants	Surveys	719	Census	83
C&I Online Marketplace	Participants	Surveys	192	Census	57

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 2023, 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 v11.0 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 Appliance Recycling 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

For several programs, where the evaluation team did not do primary research or 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 2023 evaluation year.

3. HOME REBATES PROGRAM

Program Design and Delivery

NIPSCO offers the Home 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 2023 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 thermostats

Program rebates range from $8 for certain air purifiers to $750 for a heat pump water heater. Rebate levels vary by equipment efficiency level and measure type.

Like previous years, customers can install measures through a contractor of their choice or install the measure themselves. A licensed HVAC contractor must complete air conditioner and air-source heat pump tune-ups. Customers or contractors can complete the application through an online portal or a form that they email, mail or fax to NIPSCO.

For customers who are looking for a contractor, NIPSCO provides a link on their website to program-participating contractors, also known as trade allies. Customers can navigate to the "Trade Ally Search" page on the NIPSCO website to find the contact information for contractors in their area. Contractors have the option to provide an instant discount on equipment or services to their customers and submit the rebate application on their behalf. Otherwise, if contractors do not pursue the instant discount option, participants must fill out and submit the rebate forms themselves. Customers or contractors must submit rebate applications within 60 days of installation. TRC, the implementation contractor, randomly inspects 10% of all installations each year as a means of quality control.

Based on program documentation, NIPSCO advertised the program through direct contractor outreach, bill inserts, email, direct mail, community outreach events, public relations, social media, cross-selling, and their website.

Changes from the 2022 Design

In 2023, NIPSCO added a midstream program component to the program. Distributors offer these measures with an instant discount at the time of purchase. Distributors confirm that purchasers are NIPSCO customers via a Midstream portal and then submit a project for the customer through the portal. Three measures are eligible through the midstream program:

- Air conditioners
- Air source heat pumps
- Heat pump water heaters.

Additionally, the rebate amounts for several measures were updated in 2023 and the changes are outlined in Table 12 below.

Table 12. Home Rebates Program 2022 and 2023 Measure Rebate Amounts

2022 MEASURE	2022 REBATE	2023 MEASURE	2023 REBATE
Air conditioner 15 SEER	$200	Air conditioner 15 SEER	$105
Air conditioner 16 SEER	$250	Air conditioner 16 SEER	$220
ENERGY STAR dehumidifier (portable)	$25	ENERGY STAR dehumidifier (portable)	$10
ENERGY STAR heat pump water heater 2.0+ UEF	$350	ENERGY STAR heat pump water heater 2.0+ UEF	$750
ENERGY STAR room air purifier	$50	ENERGY STAR room air purifier CADR 30-99	$8
		ENERGY STAR room air purifier CADR 100-149	$22
		ENERGY STAR room air purifier CADR 150-199	$50
		ENERGY STAR room air purifier CADR > 200	$44

Program Performance

The Home Rebates program fell short of its energy savings and peak demand reduction goals and exceeded its natural gas energy savings goal. Compared to last year, the program's reported *ex ante* savings were 94% of 2022 electric, 89% of 2022 peak demand, and 84% of 2022 natural gas savings. Table 13 summarizes savings for the full year of program performance, including program savings goals.

Table 13. 2023 Home Rebates Program Saving Summary

METRIC	GROSS SAVINGS GOAL	*EX ANTE*	AUDITED	VERIFIED	*EX POST* GROSS	*EX POST* NET	*EX POST* GROSS GOAL ACHIEVE-MENT
Electric Energy Savings (kWh/yr.)	2,175,512.70	870,583.94	870,583.94	870,583.94	888,209.76	565,193.10	41%

METRIC	GROSS SAVINGS GOAL	*EX ANTE*	AUDITED	VERIFIED	*EX POST* GROSS	*EX POST* NET	*EX POST* GROSS GOAL ACHIEVE-MENT
Peak Demand Reduction (kW)	1,780.746	826.968	826.968	826.968	501.496	345.053	28%
Natural Gas Energy Savings (therms/yr.)	544,615.44	625,927.60	625,927.60	625,927.60	940,677.33	568,598.69	173%

The evaluation team calculated *ex post* gross savings that exceeded *ex ante* for electric energy and natural gas energy savings but was much lower for peak demand reduction. As in past evaluations, the evaluation team found that using actual measure characteristics changed the savings substantially. Also, differences between the approaches outlined in the Illinois TRM v11.0, which the evaluation team used to calculate *ex post* savings, and Indiana TRM (v2.2) which the implementation team used to calculate *ex ante* savings, especially the inclusion of early replacement savings in the Illinois TRM v 11.0 and the use of 2023 billing analysis results, contributed to the differences observed between *ex ante* and *ex post* gross savings. Table 14 outlines the *ex post* and NTG adjustment factors.

Table 14. 2023 Home Rebates Program Adjustment Factors

METRIC	REALIZATION RATE (%)[a]	FREERIDERSHIP	SPILLOVER	NTG (%)[b]
Electric Energy Savings (kWh/yr.)	102%	37%	1%	64%
Peak Demand Reduction (kW)	61%	32%	1%	69%
Natural Gas Energy Savings (therms/yr.)	150%	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 44% of the electric budget and 111% of the natural gas budget, which aligns with goal achievement. Table 15 lists the 2023 Home Rebates program budget and expenditures by fuel type.

Table 15. 2023 Home Rebates Program Expenditures

FUEL	PROGRAM BUDGET	PROGRAM EXPENDITURES	BUDGET SPENT (%)
Electric	$890,331.17	$393,673.05	44%
Natural Gas	$1,350,786.80	$1,494,370.77	111%

Evaluation Methodology

To inform the 2023 Home Rebates 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.
- **Billing analysis,** to develop updated equivalent full-load hour (EFLH) values for heating and cooling equipment and to determine participant base consumption and updated smart thermostat savings.

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? Which measures generate the most savings or have the greatest participation? How has participation in these measures compared with previous years? 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: the Illinois TRM v11.0, the Pennsylvania TRM (2021), and the 2015 Indiana TRM (v2.2).[4,5,6]

[4] Cadmus. Indiana Technical Reference Manual Version 2.2. July 28, 2015.
[5] Illinois Energy Efficiency Stakeholder Group. 2023 Illinois Statewide Technical Reference Manual for Energy Efficiency Versio n 11.0. Volume 3: Residential Measures. September 22, 2022.
[6] Pennsylvania Public Utility Commission. Technical Reference Manual Volume 2: Residential Measures. February 2021.

For the 2023 program year, the evaluation team conducted two billing analyses that examined furnace and air conditioner equivalent full-load hour (EFLH) and electric and gas savings for smart thermostat installations. The EFLH analysis examined over a year of post-install monthly usage data for a robust sample of furnace and air conditioner customers to produce updated EFLH values. The smart thermostat analysis examined a year of pre-install and a year of post-install usage data for 2020, 2021, and 2022 program year thermostat customers to produce updated thermostat savings values.

Audited and Verified Savings

The Home Rebates program rebated 7,815 measures in 2023. 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. The evaluation team found that no measures were duplicative and all followed program guidelines and proper deemed savings amounts; the evaluation team did not remove any measures in the tracking data audit.

However, the evaluation team found that some measures used savings values from 2022. These measures include air conditioners, air source heat pumps, ductless mini-split heat pumps, heat pump water heaters, boilers, furnaces, and Wi-Fi thermostats. In the program tracking data, these measures had a per-unit savings value which aligned with the 2022 program year, an installation date in 2022, and an end date in 2023. We include these measures as separate line items with “Legacy 2022 Measure” added to the end of the measure name in the tables throughout this report.

Air conditioners and furnaces comprised the bulk of audited program savings. Air conditioners made up 66% of the program audited electric energy savings and 77% of the program audited demand savings. Furnaces made up 93% of program audited gas savings. Table 16 summarizes audited savings for each measure type.

Table 16. 2023 Home Rebates Program Savings Shares by Measure Type

MEASURE	AUDITED ELECTRIC ENERGY SAVINGS		AUDITED PEAK DEMAND REDUCTION		AUDITED NATURAL GAS ENERGY SAVINGS	
	kWh/YR.	SHARE	kW	SHARE	THERMS/YR.	SHARE
Air conditioners	522,734.88	60%	579.948	70%	0.00	0%
Air conditioners - Legacy 2022 Measure	51,666.95	6%	58.506	7%	0.00	0%
Air conditioner tune-ups	3,015.12	0%	6.868	1%	0.00	0%
Air purifiers	24,493.00	3%	2.792	0%	0.00	0%
Air-source heat pumps	15,050.65	2%	24.274	3%	0.00	0%
Air-source heat pumps - Legacy 2022 Measure	1,184.21	0%	0.678	0%	0.00	0%

MEASURE	AUDITED ELECTRIC ENERGY SAVINGS		AUDITED PEAK DEMAND REDUCTION		AUDITED NATURAL GAS ENERGY SAVINGS	
	kWh/YR.	SHARE	kW	SHARE	THERMS/YR.	SHARE
Air-source heat pump tune-ups	399.14	0%	0.126	0%	0.00	0%
Boilers	0.00	0%	0.000	0%	9,533.04	2%
Boilers - Legacy 2022 Measure	0.00	0%	0.000	0%	1,521.38	0%
Dehumidifiers	7,706.00	1%	1.771	0%	0.00	0%
Ductless mini-split heat pumps	50,847.42	6%	5.472	1%	0.00	0%
Ductless mini-split heat pumps - Legacy 2022 Measure	4,211.52	0%	0.600	0%	0.00	0%
Electric clothes dryers	2,567.04	0%	0.352	0%	0.00	0%
Furnaces	0	0%	0.000	0%	514,115.64	82%
Furnaces - Legacy 2022 Measure	0	0%	0.000	0%	68,200.24	11%
Heat pump water heaters	45,167.01	5%	2.142	0%	0.00	0%
Heat pump water heaters - Legacy 2022 Measure	1,900.85	0%	0.090	0%	0.00	0%
Pool pumps	2,565.04	0%	2.501	0%	0.00	0%
Wi-Fi thermostats	124,216.85	14%	127.215	15%	28,311.3	5%
Wi-Fi thermostats – Legacy 2022 Measure	12,858.26	1%	13.633	2%	4,246.00	1%
Total	870,583.94	100%[a]	826.968	100%[a]	625,927.60	100%[a]

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

Table 17 summarizes the audited quantity, applied in-service rates (ISR), and resulting verified quantity per measure. The evaluation team used deemed in-service rates of 100% for all measures. This is typical for larger HVAC measures that are not typically uninstalled. The evaluation team also assumed an ISR of 100% for the newer, smaller measures (air purifiers, dehumidifiers, pool pumps, and thermostats). The evaluation team did not conduct a survey in 2023 to assess in-service rates for these smaller measures. If the program continues to rebate smaller measures, the team plans to explore these in-service rates in a future evaluation. To calculate the verified measure quantity, the evaluation team multiplied the audited measure quantity by the in-service rate.

Table 17. 2023 Home Rebates Program Audited & Verified Quantities

MEASURE	UNIT OF MEASURE	AUDITED QUANTITY	ISR	VERIFIED QUANTITY
Air conditioners	Air Conditioner	777	100%	777
Air conditioners - Legacy 2022 Measure	Air Conditioner	75	100%	75
Air conditioner tune-ups	Tune-up	68	100%	68
Air purifiers	Air Purifier	61	100%	61
Air-source heat pumps	Heat Pump	35	100%	35
Air-source heat pumps - Legacy 2022 Measure	Heat Pump	1	100%	1
Air-source heat pump tune-ups	Tune-up	2	100%	2
Boilers	Boiler	46	100%	46
Boilers - Legacy 2022 Measure	Boiler	7	100%	7
Dehumidifiers	Dehumidifier	67	100%	67
Ductless mini-split heat pumps	Heat Pump	57	100%	57
Ductless mini-split heat pumps - Legacy 2022 Measure	Heat Pump	6	100%	6
Electric clothes dryers	Dryer	16	100%	16
Furnaces	Furnace	3,942	100%	3,942
Furnaces - Legacy 2022 Measure	Furnace	571	100%	571
Heat pump water heaters	Water Heater	21	100%	21
Heat pump water heaters - Legacy 2022 Measure	Water Heater	1	100%	1
Pool pumps	Pump	7	100%	7
Wi-Fi thermostats	Thermostat	1,860	100%	1,860
Wi-Fi thermostats - Legacy 2022 Measure	Thermostat	195	100%	195

Ex Post Gross Savings

The evaluation team referred to the Illinois TRM v11.0 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 used the results of the 2023 billing analysis that provided updated gas and electric savings and savings inputs used in the Illinois TRM v11.0 calculation. The evaluation team also employed measure characteristics provided in the tracking data and verified them using AHRI and ENERGY STAR QPL model number look ups 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 v11.0. The evaluation team calculated measure-specific early replacement rates for furnaces and air conditioners and calculated a blended early replacement rate for other measures with lower participation counts. The measures included in the blended early replacement rate counts are heat pumps, boilers, electric clothes dryers, and heat pump water heaters. Table 18 summarizes early replacement rates calculated during the 2022 evaluation and applied to the 2023 evaluation.

Table 18. 2023 Home 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]The evaluation team calculated a blended early replacement rate for heat pumps, boilers, electric clothes dryers, and heat pump water heaters.

The evaluation team used various sources including the results of the 2023 billing analysis, the Indiana TRM (v2.2), and deemed savings values from the 2022 evaluation for other inputs. These cases and the approach used are listed below:

- For furnaces, heat pumps, and boilers, the evaluation team used the results of the 2023 billing analysis which updated EFLH by nearest city.
- For the Legacy 2022 Measures, which include some air conditioners, air source heat pumps, boilers, ductless mini-split heat pumps, furnaces, heat pump water heaters, and Wi-Fi thermostats, the evaluation team used deemed savings values specific to each measure equal to the ex post gross savings per measure from the 2022 evaluation.
- For measures that reduce demand included 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 v11.0.
- 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 in the Indiana TRM (v2.2).

Billing Analysis

For the 2023 program year, the evaluation team conducted two billing analyses. One that examined furnace and air conditioner EFLH and one that examined electric and gas savings for smart thermostat installations.

1. The EFLH analysis examined over a year of post-install monthly usage data for a robust sample of furnace and air conditioner customers to produce updated EFLH values.
2. The smart thermostat analysis examined a year of pre-install and a year of post-install for 2020, 2021, and 2022 program year thermostat customers to produce updated thermostat savings values.

EFLH Billing Analysis

The EFLH billing analysis examined 16,282 furnace and 2,987 air conditioner participants across the 2020 to 2022 program years and examined weather-normalized monthly gas and electric billing data across 2022 and 2023 for these participants. Using a PRISM modeling approach, the analysis disaggregated the weather-sensitive components of heating gas, cooling electricity, and heating electricity usage in these time periods.[7] The EFLH for each site were then proportional to *[weather-sensitive energy usage] / [equipment capacity in tracking data]*. Site-level EFLH values were averaged to produce gas furnace heating EFLH for four Indiana TRM (v2.2) cities. This produced reliable and reasonable results for gas heating that were approximately 29% less than the values in the Indiana TRM (v2.2). These results are in-line with the EFLH values of cities with similar heating degree days in the Illinois TRM v11.0, which are derived via a metering study and likely quite robust.[8] There was a marginal decrease of approximately 2% in EFLH values from 2022 to 2023. Overall results can be found in Table 19.

While gas heating results were reasonable, electric results indicated that air conditioner cooling EFLH were approximately 140% higher than the Indiana TRM (v2.2). The EFLH values indicated were also significantly higher than those in cities with similar cooling degree days in the Illinois TRM v11.0, which also anchors its cooling EFLH in site-metered results.[9] This almost certainly indicates the presence of weather-sensitive usage that is not from cooling equipment and is a common occurrence for electric billing analyses.[10,11] Therefore, we did not use the cooling values from the billing analysis and instead used the cooling EFLH from the Indiana TRM (v2.2).

[7] Fels, M. F., *PRISM: An Introduction,* Energy and Buildings. Vol. 9, No. 1 & 2, February/May 1986

[8] Illinois Energy Efficiency Stakeholder Advisory Group. *2023 Illinois Statewide Technical Reference Manual for Energy Efficiency Version 11.0. Volume 3: Residential Measures*. September 22, 2022. Page 93. IL-TRM_Effective_010123_v11.0_Vol_3_Res_09222022_FINAL.pdf (ilsag.info)

[9] Ibid

[10] National Renewable Energy Lab. The Uniform Methods Project, Chapter 4: Small Commercial and Residential Unitary and Split System HVAC Heating and Cooling Equipment-Efficiency Upgrade Evaluation Protocol. October 2017. https://www.nrel.gov/docs/fy17osti/68560.pdf

[11] Hwang, Ho-Ling. Assessment of Princeton Scorekeeping Method space-heating estimates using end-use data from the Hood River Conservation Project. https://www.osti.gov/biblio/6297772

Table 19. EFLH Billing Analysis Results and Recommendations

ANALYSIS	INDIANA TRM (2.2) VALUE	2022 VALUES [a]	2023 VALUES	CORROBORATING EVIDENCE	RECOMMENDED VALUE
Heating	Indianapolis: 1,341 EFLH South Bend: 1,427 EFLH Fort Wayne: 1,356 EFLH Terre Haute: 804 EFLH	983 EFLH 1,008 EFLH 1,004 EFLH 1,219 EFLH	959 EFLH 989 EFLH 993 EFLH 1.181 EFLH	Aligns with values of cities with similar HDDs in the Illinois TRM v11.0	Use the 2023 billing analysis results for both the 2023 evaluation and for planning.
Cooling	South Bend: 431 EFLH Fort Wayne: 373 EFLH Terre Haute: 569 EFLH	915 EFLH 949 EFLH 3,092 EFLH	1,144 EFLH 1,222 EFLH 1,918 EFLH	The EFLH values were significantly higher than those in cities with similar CDDs in the IL TRM v11.0	Use the Indiana TRM (v2.2) value for both the 2023 evaluation and for planning.

[a] Note that we did not calculate EFLH heating or cooling values for Evansville, or EFLH cooling values for Indianapolis because there were none of these types of customers in the billing data.
[b] The large EFLH values for Terra Haute are due to having a sample size of one site.

Thermostat Billing Analysis

For the thermostat billing analysis, we followed the National Renewable Energy Lab's Uniform Methods Project evaluation protocol which outlines an approach to determine changes in usage for participants before and after measure installation and uses future participants as the control group. Specifically, the team examined 3,489 gas and 2,896 electric customers who received thermostats across the 2020, 2021, and 2022 program years. It examined weather-normalized monthly gas and electric billing data across 2021, 2022, and 2023 for these participants (the post-install year), as well as 2019, 2020, and 2021 (the pre-install year), for each participant. Changes in usage before and after thermostat installation for these participants represent the aggregate effect of thermostat installation and external effects such as changes in energy pricing. To control for these exogenous effects, the team also examined usage across similar time periods for a comparison group comprised of *future* thermostat participants—a similar population that did not yet have a thermostat installed in the participant pre- or post-period. The net savings produced by thermostat installation is the difference in savings between the participants and the comparison group. A more detailed description of the methodology and approach for this billing analysis can be found in *Billing Analysis*. The overall results can be found in Table 20.

Table 20. Thermostat Billing Analysis Results and Recommendations

ANALYSIS	UNIT	IN TRM APPROACH	BILLING ANALYSIS RESULTS 2018	2019	OVERALL (2020-2022)	CORROBORATING EVIDENCE	RECOMMENDED VALUES
Heating	Base consumption	Indiana TRM (v2.2) EFLH, 80% AFUE (~1,300 therms average)	662 therms	654 therms	715 therms	Base consumption values are reasonable, and compatible with those for heating EFLH.	Use 715 * 6.0% = 43 therms
	ESF	Indiana TRM (v2.2)[a] 12.5% (manual to smart) ESF, better deemed value [b] 13.4% (manual to smart) 7.8% (manual to programmable) 13.4% - 7.8% = 5.6% (programmable to smart) ~9.3% average	7.10%	5.40%	6.00%		
Cooling	Base consumption	Indiana TRM (v2.2) EFLH, 11.15 SEER (~1,100 kWh average for sites with cooling)	2,899 kWh	2,610 kWh	2,654 kWh	Base consumption values and cooling EFLH are far higher than reasonable, due to non-AC weather-sensitive loads picked up by billing analysis.	Use deemed EFLH and SEER for base consumption, with 9.6% ESF.
	ESF	Indiana TRM (v2.2)[c] 13.9% (manual to smart) ESF, better deemed value [d] 16.1% (manual to smart) 15.0% (manual to programmable) 16.1% - 15.0 = 1.1% (programmable to smart) ~8.5% average	8.30%	8.30%	9.60%		

[a] Cadmus. Evaluation of the 2013-2014 Programmable and Smart Thermostat Program. Prepared for Vectren Corporation. January 29, 2015. http://www.cadmusgroup.com/wp-content/uploads/2015/06/Cadmus_Vectren_Nest_Report_Jan2015.pdf

[b] Cadmus. Evaluation of the 2013-2014 Programmable and Smart Thermostat Program. Prepared for: Northern Indiana Public Service Company. January 22, 2015.

[c] Cadmus. Evaluation of the 2013-2014 Programmable and Smart Thermostat Program. Prepared for Vectren Corporation. January 29, 2015. http://www.cadmusgroup.co m/wp-content/uploads/2015/06/Cadmus_Vectren_Nest_Report_Jan2015.pdf

[d] Cadmus. Evaluation of the 2013-2014 Programmable and Smart Thermostat Program. Prepared for: Northern Indiana Public Service Company. January 22, 2015.

Using the same PRISM modeling approach, the team disaggregated the weather-sensitive components of heating gas, cooling electricity, and heating electricity usage in these time periods. This experimental design method allowed the team to examine the change in usage before and after installation for the participants, as well as changes for the comparison group over the same time. The difference between changes for the participants and comparison group reflects the net savings from installing a smart thermostat. Table 21 shows a summary of the treatment and comparison groups, and the time frames included in each analysis.

Table 21. Thermostat Treatment and Comparison Group Timing

GROUP	PARTICIPATION TIMING	ANALYSIS PERIOD 1 (PRE)	ANALYSIS PERIOD 2 (POST)[a]	EXPECTED CHANGE PERIOD 1 TO 2
2020 Participants	2020	Rolling from Jan 2019 - Dec 2020	Rolling from Jan 2020 - Dec 2021	Program Savings + Non-Program Trend
2020 Comparison Group	Mid-Late 2021, All 2022, All 2023	June 2019 - May 2020	June 2020 - May 2021	Non-Program Trend
2021 Participants	2021	Rolling from Jan 2020 - Dec 2021	Rolling from Jan 2021 - Dec 2022	Program Savings + Non-Program Trend
2021 Comparison Group	Early-Mid 2020, Mid-Late 2022, All 2023	July 2020 - June 2021	July 2021 - June 2022	Non-Program Trend
2022 Participants	2022	Rolling from Jan 2021 - Dec 2022	Rolling from Jan 2022 – Dec 2023	Program Savings + Non-Program Trend
2022 Comparison Group	All 2020, Early-Mid 2021	August 2021 - July 2022	August 2022 - July 2023	Non-Program Trend

[a] The participant sites all have rolling pre- and post-periods. Thus, the pre- and post- periods for nonparticipants are defined based on the average participation date of participants. Each analysis year, 2020, 2021, and 2022, had their own comparison groups based on the average install dates in each year and were matched by pre-period usage quartile for better matching. The comparison group periods closely resemble the average analysis period in each year although they are not the same.[12]

As with the EFLH billing analysis, the model derived reliable and reasonable usage and savings for gas customers. The evaluation team found that baseline consumption for smart thermostat customers was comparable to the previous 2018 and 2019 participants billing analysis but still approximately 50% less than estimated in previous evaluation years that used the Indiana TRM (v2.2). Previous evaluation years used the Indiana TRM (v2.2) EFLH and assumed an installed AFUE of 80%, producing baseline consumption values of ~1,300 therms. However, this evaluation found that the actual baseline consumption for smart thermostat participants was 715 therms.

[12] Cadmus. Evaluation of the 2013-2014 Programmable and Smart Thermostat Program. Prepared for Vectren Corporation. January 29, 2015.http://www.cadmusgroup.com/wp-content/uploads/2015/06/Cadmus_Vectren_Nest_Report_Jan2015.pdf;
Cadmus. Evaluation of the 2013-2014 Programmable and Smart Thermostat Program. Prepared for: Northern Indiana Public Service Company. January 22, 2015.

This is likely a result of two main factors. First, as discussed above, measured heating EFLH are approximately 29% lower than Indiana TRM (v2.2) values. Second, it is likely that average installed AFUE for smart thermostat participants is higher than the 80% value assumed in the 2019 evaluation, which further reduces actual gas energy usage.

We also found that the heating savings fraction (HSF) was lower than the Indiana TRM (v2.2) prescribed. Its prescribed HSF values are 13.4% for a manual to smart upgrade and 7.8% for a manual to programmable upgrade, indicating a 5.6% HSF for a programmable to smart upgrade.[13] For the 2019 program year, the team combined these values with known baseline thermostat fractions, producing an approximate average heating savings fraction of 10.3%. However, the present billing analysis results show an HSF of 6.0%. For sites that got only one thermostat, the measured HSF is 6.0% for 2020 – 2022.This estimate is like the 5.4%-7.1% HSF estimates from the previous billing analysis for the 2018 and 2019 program years. See the *Billing Analysis Methodology* section in *Billing Analysis* for more details.

The evaluation team used the measured net savings found during the billing analysis for 2020-2022 participants receiving one thermostat. These results were 43 therms saved per first thermostat at each site (6.0% of 715 therms base consumption). Sites that received two thermostats saw 3.8% savings per household, although these results have worse confidence and precision because of lower participant counts and are not statistically different from savings for sites that received one thermostat. The evaluation team determined that sites that received more than one thermostat would only receive savings for the first thermostat for two reasons: 1) because savings for sites receiving two or more thermostats were not statistically different from sites receiving only one thermostat and 2) because of 2019 participant survey results indicating that secondary thermostats were all installed in the same home as the first.

Billing analysis results examining thermostat electric savings showed base consumption like that for cooling EFLH, indicating that the PRISM analysis produced baseline consumption that reflected a preponderance of weather-sensitive usage that is not controlled by the thermostat. Therefore, the evaluation team did not update electric baseline consumptions based on the billing analysis and instead calculated from EFLH in the Indiana TRM (v2.2). However, although the billing analysis produces higher estimates, these are expected to be consistently high between the pre and post periods. As a result, the billing analysis produces more reasonable and reliable results for cooling savings fraction (CSF) values. The 2020 – 2022 participants showed 9.6% percent reductions in cooling usage per thermostat for sites receiving only one thermostat.

The team elected to use a CSF of 9.6% which is the result for sites that got one thermostat from the combined 2020 – 2022 participants. More detail can be seen in the *Billing Analysis Methodology* section in *Billing Analysis*. This value is not statistically different from the blended average savings value of approximately 8.5%, shown in Table 20, that would have been applied. However, that value would have been rooted in results from an older study and dependent on assumptions about baseline thermostat distributions.[14] The updated value is likely more representative of the current thermostat participant population.

[13] 13.4 – 7.8 = 5.6%

[14] Cadmus. Evaluation of the 2013-2014 Programmable and Smart Thermostat Program. Prepared for: Northern Indiana Public Service Company. January 22, 2015.

The CSF and HSF outlined above and compared to the Indiana TRM (v2.2) are used in place of the Cooling and Heating Reduction inputs assumed in the Illinois TRM v11.0.

Engineering Reviews

The evaluation team reviewed each of the measures, updated the assumptions if changes had been made to the Illinois TRM v11.0, and recalculated savings based on the specific measure characteristics of installed measures.

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 v11.0 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 evaluations prior to 2022. 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 *Appendix 1. Home Rebates Program*.

For all Legacy 2022 Measures, the evaluation team used a deemed savings value from the 2022 program evaluation results. The Legacy 2022 Measures' sources, assumptions, and notable differences are the same as in the previous evaluation and can be found in the EE Rebates chapter in the 2022 Evaluation Report.

Ex Post Gross Savings Summary

Table 22 shows the *ex ante* deemed savings and *ex post* gross per-measure savings for 2023 Home Rebates program measures.

Table 22. 2023 Home Rebates 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 conditioners	Air Conditioner	672.76	0.746	0.00	196.31	0.224	0.00
Air conditioners - Legacy 2022 Measure	Air Conditioner	688.89	0.780	0.00	286.63	0.607	0.00
Air conditioner tune-ups	Tune-up	44.34	0.101	0.00	69.94	0.062	0.00
Air purifiers	Air Purifier	401.52	0.046	0.00	377.76	0.043	0.00
Air-source heat pumps	Heat Pump	430.02	0.694	0.00	760.23	0.319	0.00
Air-source heat pumps - Legacy 2022 Measure	Heat Pump	1,184.21	0.678	0.00	1,220.89	0.676	0.00
Air-source heat pump tune-ups	Tune-up	199.57	0.063	0.00	281.12	0.055	0.00
Boilers	Boiler	0.00	0.000	207.24	0.00	0.000	281.28

MEASURE	UNIT OF MEASURE	*EX ANTE* DEEMED SAVINGS			*EX POST* GROSS PER-MEASURE SAVINGS		
		kWh	kW	THERMS	kWh	kW	THERMS
Boilers - Legacy 2022 Measure	Boiler	0.00	0.000	217.34	0.00	0.000	256.17
Dehumidifiers	Dehumidifier	115.01	0.026	0.00	167.35	0.038	0.00
Ductless mini-split heat pumps	Heat Pump	892.06	0.096	0.00	1,130.18	0.311	0.00
Ductless mini-split heat pumps - Legacy 2022 Measure	Heat Pump	701.92	0.100	0.00	1,020.83	0.294	0.00
Electric clothes dryers	Dryer	160.44	0.022	0.00	161.11	0.022	0.00
Furnaces	Furnace	0.00	0.000	130.42	67.60	0.000	189.40
Furnaces - Legacy 2022 Measure	Furnace	0.00	0.000	119.44	68.29	0.000	172.44
Heat pump water heaters	Water Heater	2,150.81	0.102	0.00	2,728.02	0.373	0.00
Heat pump water heaters - Legacy 2022 Measure	Water Heater	1,900.85	0.090	0.00	2,736.26	0.374	0.00
Pool pumps	Pump	366.43	0.357	0.00	277.44	0.291	0.00
Wi-Fi thermostats	Thermostat	66.78	0.068	15.22	104.68	0.118	40.11
Wi-Fi thermostats - Legacy 2022 Measure	Thermostat	65.94	0.070	21.77	59.02	0.060	32.09

Table 23 highlights notable differences between *ex ante* and *ex post* gross estimates. New federal standards affecting HVAC equipment become effective January 1, 2023. The new standards, require any residential HVAC equipment manufactured in, or imported into, the United States to meet new minimum efficiency ratings. In alignment with the Illinois TRM v11.0, *ex post* savings assume a sell-through period for 2023, and the new federal standards which determine assumed baselines will be adopted in 2024. In addition, an updated metric depicted as SEER2, EER2, and HSPF2, reflecting a more stringent updated test method to determine equipment efficiencies, is often being used in HVAC equipment documentation and efficiency standards. For this evaluation, all efficiency values were either converted to SEER, EER, or HSPF, or these specifications were pulled directly from the AHRI database during verification.

Table 23. 2023 Home Rebates Program 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 2021 EM&V results for assumed capacity. Heating and circulation motor savings were included for all sites.	IL TRM v11.0 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 0.61-0.76 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 v11.0. Specifically, the Illinois TRM and *ex post* excludes additional circulation and furnace fan energy savings that come from the installation of an ECM with new AC's while *ex ante* includes them. Updated standards have resulted in new SEER values already accounting for the added efficiency of the ECM. Therefore, the Illinois TRM v11.0 includes additional cooling and circulation fan electric energy savings for furnace installations alongside existing AC's instead of with newly installed AC's. This resulted in *ex post* gross savings significantly less than *ex ante.*
Air Conditioner Tune Up	*Ex ante* savings were calculated according to the Indiana TRM (v2.2) and using average capacity, SEER, and EER 2021 AC tune up data. Assumed South Bend for EFLH.	Illinois TRM v11.0 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 for AC capacity and the Illinois TRM v11.0 assumed existing air conditioner SEER of 10, when not. Varied Indiana TRM (v2.2) EFLH by closest city (all in South Bend). Assumed	Differences in the assumed maintenance demand reduction factor between the Indiana TRM (v2.2) of 0.05 and Illinois TRM v11.0 0.02 resulted in significantly less demand reduction. Higher average cooling capacity drove slightly higher energy savings in 2023. However, the largest driver for significantly higher savings was the assumption of existing air conditioner SEER of 10 from the Illinois TRM v11.0. This assumption is used in

MEASURE	*EX ANTE* SOURCES AND ASSUMPTIONS	*EX POST* GROSS SOURCES AND ASSUMPTIONS	PRIMARY REASONS FOR DIFFERENCES
		Illinois TRM v11.0 maintenance energy savings (MFe) and demand reduction (MFd) factors.	preparation for the 2024 Indiana TRM (v2.2) approach which assumes the same as the Illinois TRM v11.0
Air Purifier	*Ex ante* savings were calculated using the Illinois TRM v10.0. Specifically, aligned deemed savings according to CADR range tracked in the measure name.	Illinois TRM v11.0 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 Indiana TRM (v2.2), some inputs from the Illinois TRM v10.0, and the approach outlined in the 2021 EM&V report with baseline and efficient SEER assumed based on EIA requirements according to the measure installed, capacities, HSPF, and circulator fans savings from the 2021 EM&V, and South Bend EFLH and EERbase assumed from the Indiana TRM (v2.2).	Illinois TRM v11.0 and program tracking data. Assumed CF and cooling EFLH from the Indiana TRM (v2.2). 2023 billing analysis for heating EFLH and based on tracking data, used closest city EFLH. Used actual capacities and efficiencies confirmed during AHRI look ups. Early replacement rate from the 2022 EE Rebates participant survey. Included derating factors and SEER and HSPF adjustment factors.	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 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 2021 EM&V boiler data, TRM assumed base AFUE, 2021 EM&V billing analysis South Bend EFLH, and a 2021 EM&V average AFUE of 95%.	Illinois TRM v11.0 and program tracking data. Used actual capacity and AFUE. Used closest city EFLH from 2023 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 Indiana TRM (v2.2) and Illinois TRM v11.0. Additional early replacement savings, 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 were calculated using the Illinois TRM v10.0. Specifically, ENERGY STAR deemed savings based on measure capacity.	Illinois TRM v11.0 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*.

MEASURE	*EX ANTE* SOURCES AND ASSUMPTIONS	*EX POST* GROSS SOURCES AND ASSUMPTIONS	PRIMARY REASONS FOR DIFFERENCES
Ductless Heat Pump	*Ex ante* savings were calculated using the Illinois TRM v10.0 with baseline inputs assumed from the Indiana TRM (v2.2). Assumed capacities based on the 2021 EM&V report and EFLH heat from the 2020 billing analysis. Manual assumptions for efficiencies based on minimum AHRI certification requirements and 2-ton cooling and heating capacities.	Illinois TRM v11.0, 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 2023 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 2023 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 were calculated using the Illinois TRM v10.0.	Illinois TRM v11.0 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 2021 EM&V results for assumed AFUE and capacity (71,729 Btuh) and the 2020 billing analysis South Bend EFLH heat.	Illinois TRM v11.0, 2023 billing analysis results for EFLH heat, 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.	The Illinois TRM v11.0 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. With the added ECM savings, additional early replacement saving, plus small differences due to using actual instead of assumed AFUE and capacity (74,404 Btuh average; excluding legacy measures), *ex post* gross kWh savings were substantially larger than *ex ante*.

MEASURE	*EX ANTE* SOURCES AND ASSUMPTIONS	*EX POST* GROSS SOURCES AND ASSUMPTIONS	PRIMARY REASONS FOR DIFFERENCES
Heat Pump Water Heater	*Ex ante* savings were calculated using the Illinois TRM v10.0 with 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 v11.0 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 North Central census data for natural gas heating saturations.	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. Small differences due to the use of 2020 census data for Indiana and Ohio to determine fossil fuel space heating saturations compared with the IL specific unknown space heat type provided in the Illinois TRM v10.0.
Pool Pump	*Ex ante* savings were calculated using the Illinois TRM v10.0.	Illinois TRM v11.0, program tracking data used to determine in-ground or above ground configuration and whether an ENERGY STAR or CEE Tier 1 certified pump by ES QPL model number look-ups. If model could not be found, assumed reported characterization.	Discrepancies between the measure description assumed pool pump classification used in ex ante calculations and the reported model number used by *ex post* resulted in different pool pump classifications 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 2021 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.	Illinois TRM v11.0 algorithm assuming 2023 billing analysis savings factors and natural gas heating consumption, 2023 program average heating and cooling capacities, and a CF or 0.44 (AC/HP cooling CF of 0.88 ÷ 2). Cooling EFLH was assumed from the Indiana TRM (v2.2). Electric heating consumption was assumed from the Illinois TRM v11.0 based on matching HDD similar Indiana cities similar to Illinois cities. Assumed closest city EFLH and electric heating consumption based on tracking data.	Small differences due to differences in average capacities and using the closest city instead of broadly applying South Bend for EFLH. Largest drivers for a difference in savings was the difference in algorithms between Indiana TRM (v2.2) and the Illinois TRM v11.0. There is also a difference in assumed inputs between the 2020 and 2023 billing analyses and Illinois inputs assumed by *ex post*. Ultimately these resulted in significantly greater ex post savings than *ex ante*.

Waste Heat Factor – Therm Penalties

The evaluation team is not including therm penalties when calculating evaluated savings for the 2023 Home 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 -158.55 therms. In total, the *ex post* therm penalty for cost-effectiveness analysis is -18.76 therms (Table 24).

Table 24. 2023 Home Rebates Program Waste Heat Factor Therm Penalty

MEASURE	WASTE HEAT FACTOR THERM PENALTY
Heat pump water heaters	(18.76)
Total	**(18.76)**

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 25 through Table 27) show the program's *ex ante* reported savings, verified savings, *ex post* gross savings and total program realization rates for kWh, kW, and therms. The largest drivers for electric energy savings realization rates were air conditioners which had a 30% realization rate and made up roughly 60% of reported savings, furnaces which had 0 reported savings but 266,000 kWh *ex post* savings originating from added cooling and circulation fan energy savings, and thermostats which had a high realization rate and accounted for roughly 14% of reported electric energy savings.

Table 25. 2023 Home 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 conditioners	522,734.88	522,734.88	522,734.88	152,536.17
Air conditioners - Legacy 2022 Measure	51,666.95	51,666.95	51,666.95	21,496.96
Air conditioner tune-ups	3,015.12	3,015.12	3,015.12	4,755.98
Air purifiers	24,493.00	24,493.00	24,493.00	23,043.09
Air-source heat pumps	15,050.65	15,050.65	15,050.65	26,607.96

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-source heat pumps - Legacy 2022 Measure	1,184.21	1,184.21	1,184.21	1,220.89
Air-source heat pump tune-ups	399.14	399.14	399.14	562.24
Boilers	0.00	0.00	0.00	0.00
Boilers - Legacy 2022 Measure	0.00	0.00	0.00	0.00
Dehumidifiers	7,706.00	7,706.00	7,706.00	11,212.52
Ductless mini-split heat pumps	50,847.42	50,847.42	50,847.42	64,419.98
Ductless mini-split heat pumps - Legacy 2022 Measure	4,211.52	4,211.52	4,211.52	6,124.98
Electric clothes dryers	2,567.04	2,567.04	2,567.04	2,577.80
Furnaces	0.00	0.00	0.00	266,469.57
Furnaces - Legacy 2022 Measure	0.00	0.00	0.00	38,993.59
Heat pump water heaters	45,167.01	45,167.01	45,167.01	57,288.40
Heat pump water heaters -Legacy 2022 Measure	1,900.85	1,900.85	1,900.85	2,736.26
Pool pumps	2,565.04	2,565.04	2,565.04	1,942.11
Wi-Fi thermostats	124,216.85	124,216.85	124,216.85	194,712.37
Wi-Fi thermostats - Legacy 2022 Measure	12,858.26	12,858.26	12,858.26	11,508.88
Total Savings	**870,583.94**	**870,583.94**	**870,583.94**	**888,209.76**
Total Program Realization Rate				**102%**

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 26. 2023 Home 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 conditioners	579.948	579.948	579.948	174.065
Air conditioners - Legacy 2022 Measure	58.506	58.506	58.506	45.522
Air conditioner tune-ups	6.868	6.868	6.868	4.222
Air purifiers	2.792	2.792	2.792	2.632
Air-source heat pumps	24.274	24.274	24.274	11.181
Air-source heat pumps - Legacy 2022 Measure	0.678	0.678	0.678	0.676
Air-source heat pump tune-ups	0.126	0.126	0.126	0.110
Boilers	0.000	0.000	0.000	0.000
Boilers - Legacy 2022 Measure	0.000	0.000	0.000	0.000
Dehumidifiers	1.771	1.771	1.771	2.548
Ductless mini-split heat pumps	5.472	5.472	5.472	17.711
Ductless mini-split heat pumps - Legacy 2022 Measure	0.600	0.600	0.600	1.764
Electric clothes dryers	0.352	0.352	0.352	0.346
Furnaces	0.000	0.000	0.000	0.000
Furnaces - Legacy 2022 Measure	0.000	0.000	0.000	0.000
Heat pump water heaters	2.142	2.142	2.142	7.825
Heat pump water heaters -Legacy 2022 Measure	0.090	0.090	0.090	0.374

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.)
Pool pumps	2.501	2.501	2.501	2.037
Wi-Fi thermostats	127.215	127.215	127.215	218.721
Wi-Fi thermostats - Legacy 2022 Measure	13.633	13.633	13.633	11.760
Total Savings	**826.968**	**826.968**	**826.968**	**501.496**
Total Program Realization Rate				**61%**

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. 2023 Home 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 conditioners	0.00	0.00	0.00	0.00
Air conditioners - Legacy 2022 Measure	0.00	0.00	0.00	0.00
Air conditioner tune-ups	0.00	0.00	0.00	0.00
Air purifiers	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 2022 Measure	0.00	0.00	0.00	0.00
Air-source heat pump tune-ups	0.00	0.00	0.00	0.00
Boilers	9,533.04	9,533.04	9,533.04	12,938.94
Boilers - Legacy 2022 Measure	1,521.38	1,521.38	1,521.38	1,793.19
Dehumidifiers	0.00	0.00	0.00	0.00
Ductless mini-split heat pumps	0.00	0.00	0.00	0.00
Ductless mini-split heat pumps - Legacy 2022 Measure	0.00	0.00	0.00	0.00
Electric clothes dryers	0.00	0.00	0.00	0.00
Furnaces	514,115.64	514,115.64	514,115.64	746,620.84

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.)
Furnaces - Legacy 2022 Measure	68,200.24	68,200.24	68,200.24	98,463.24
Heat pump water heaters	0.00	0.00	0.00	0.00
Heat pump water heaters -Legacy 2022 Measure	0.00	0.00	0.00	0.00
Pool pumps	0.00	0.00	0.00	0.00
Wi-Fi thermostats	28,311.30	28,311.30	28,311.30	74,603.10
Wi-Fi thermostats - Legacy 2022 Measure	4,246.00	4,246.00	4,246.00	6,258.02
Total Savings	**625,927.60**	**625,927.60**	**625,927.60**	**940,677.33**
Total Program Realization Rate				**150%**

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 participant spillover during the 2022 evaluation and applied those results during the 2023 evaluation. To calculate NTG, the evaluation team used survey data collected from the 2022 Home Rebates participant survey, which was fielded in early 2023. Detailed results from this analysis can be found in the EE Rebates chapter in the 2022 Evaluation Report. Table 28 shows the NTG ratios by measure, which are relatively high across measures. For all measures except the HVAC tune-up, most customers would not have purchased the equipment on their own if they had not received the utility incentive.

Table 28. 2023 Home Rebates Program Net-to Gross Ratios by Measure

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.

Table 29 presents the resulting net electric savings, demand reduction, and natural gas savings.

Table 29. 2023 Home 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 conditioners	152,536.17	174.065	0.00	64%	97,623.15	111.402	0.00
Air conditioners - Legacy 2022 Measure	21,496.96	45.522	0.00	64%	13,758.05	29.134	0.00
Air conditioner tune-ups	4,755.98	4.222	0.00	47%	2,235.31	1.984	0.00
Air purifiers	23,043.09	2.632	0.00	58%	13,365.00	1.526	0.00
Air-source heat pumps	26,607.96	11.181	0.00	58%	15,432.62	6.485	0.00
Air-source heat pumps - Legacy 2022 Measure	1,220.89	0.676	0.00	58%	708.12	0.392	0.00
Air-source heat pump tune-ups	562.24	0.110	0.00	47%	264.25	0.052	0.00
Boilers	0.00	0.000	12,938.94	58%	0.00	0.000	7,504.59
Boilers - Legacy 2022 Measure	0.00	0.000	1,793.19	58%	0.00	0.000	1,040.05
Dehumidifiers	11,212.52	2.548	0.00	58%	6,503.26	1.478	0.00
Ductless mini-split heat pumps	64,419.98	17.711	0.00	58%	37,363.59	10.273	0.00
Ductless mini-split heat pumps - Legacy 2022 Measure	6,124.98	1.764	0.00	58%	3,552.49	1.023	0.00
Electric clothes dryers	2,577.80	0.346	0.00	58%	1,495.12	0.201	0.00
Furnaces	266,469.57	0.000	746,620.84	59%	157,217.05	0.000	440,506.30
Furnaces - Legacy 2022 Measure	38,993.59	0.000	98,463.24	59%	23,006.22	0.000	58,093.31
Heat pump water heaters	57,288.40	7.825	0.00	58%	33,227.27	4.539	0.00
Heat pump water heaters -Legacy 2022 Measure	2,736.26	0.374	0.00	58%	1,587.03	0.217	0.00
Pool pumps	1,942.11	2.037	0.00	58%	1,126.43	1.182	0.00

MEASURE	*EX POST* GROSS SAVINGS/REDUCTION			NTG	*EX POST* NET SAVINGS/REDUCTION		
	KWH	KW	THERMS		KWH	KW	THERMS
Wi-Fi thermostats	194,712.37	218.721	74,603.10	76%	147,981.40	166.228	56,698.36
Wi-Fi thermostats - Legacy 2022 Measure	11,508.88	11.760	6,258.02	76%	8,746.75	8.938	4,756.10
Total Savings	888,209.76	501.496	940,677.33		565,193.10	345.053	568,598.69

Table 30 shows the net-to-gross results for each fuel.

Table 30. 2023 Home 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.)	870,583.94	888,209.76	64%	565,193.10
Peak Demand Reduction (kW)	826.968	501.496	69%	345.053
Natural Gas Energy Savings (therms/yr.)	625,927.60	940,677.33	60%	568,598.69

Process Evaluation

The evaluation team did not complete any major activities related to evaluating the program process.

Conclusions and Recommendations

CONCLUSION 1: WHILE THE BILLING ANALYSIS RESULTS SHOWED REDUCED FURNACE EFLH VALUES, THE EFLH VALUES FOR AIR CONDITIONING WERE INCONCLUSIVE.

The billing analysis showed 2023 furnace EFLH values are approximately 2% less than 2022 EFLH values. Using billing analysis results for the 2023 post-year represents a more accurate and up-to-date representation of usage. Electric results indicated that air conditioner cooling EFLH were approximately 140% higher than the Indiana TRM (v2.2) and were also significantly higher than those in cities with similar cooling degree days in the Illinois TRM v11.0, which also anchors its cooling EFLH in site-metered results.[15] This almost certainly indicates the presence of weather-sensitive usage that is not from cooling equipment and is a common occurrence for electric billing analyses.[16,17]

Recommendations:

- Update inputs for measures that use heating EFLH inputs to use the results from the 2023 billing analysis to reflect a more accurate representation of usage.
- Use the new Indiana Technical Reference Manual Workbook v1.0 value for measures that use cooling EFLH inputs in program planning. Use Indiana location specific input assumptions for EFLH, which the Indiana TRM Workbook v1.0 maps to climate comparable Illinois TRM cities.

CONCLUSION 2: 2023 BILLING ANALYSIS RESULTS SHOWED INCREASED THERMOSTAT SAVINGS OVER THE SAVINGS CALCULATED IN THE 2020 BILLING ANALYSIS.

The 2023 billing analysis showed gas heating savings are approximately 75% less than Indiana TRM (v2.2) calculations but greater than the savings observed during the 2020 billing analysis, due to a combination of:

- Different base heating consumption
- Heating savings fraction
- Possibly higher furnace efficiencies for homes that install smart thermostats than observed in previous analysis
- A more established mix of post-COVID working conditions (at home or in the office)

Overall evaluated therms savings were 43 (715*0.06) therms per site based on the current 2020-2022 participation year results compared with the 35 therms (654*0.054) observed in the previous billing analysis.

[15] Ibid

[16] National Renewable Energy Lab. The Uniform Methods Project, Chapter 4: Small Commercial and Residential Unitary and Split System HVAC Heating and Cooling Equipment-Efficiency Upgrade Evaluation Protocol. October 2017. https://www.nrel.gov/docs/fy17osti/68560.pdf

[17] Hwang, Ho-Ling. Assessment of Princeton Scorekeeping Method space-heating estimates using end-use data from the Hood River Conservation Project. https://www.osti.gov/biblio/6297772

The analysis also showed cooling percent savings of approximately 9.6%, compared with 8.3% observed in the 2020 billing analysis and the 8.5% assumed by the Indiana TRM (v2.2).

Finally, the analysis showed that the small proportion of sites receiving second thermostats do not save gas or energy at a level statistically different from those receiving one thermostat. The evaluation team only claims savings for one thermostat installed.

Recommendations:

- Use the 2023 billing analysis gas savings and electric energy saving factors for smart thermostats in future program years. Therms savings are estimated to be 43 therms per site. The cooling savings factor should be updated to 9.6%.
- Monitor the proportion of participants receiving more than one thermostat; if this negatively affects overall program cost-effectiveness, consider limiting participation to one thermostat.

CONCLUSION 3: THE HOME REBATES PROGRAM ACHIEVED NEARLY DOUBLE ITS NATURAL GAS SAVINGS GOAL BUT ACHIEVED LESS THAN HALF OF THE ELECTRIC ENERGY AND PEAK DEMAND REDUCTION GOALS.

Air conditioners made up 66% of reported savings, followed by Wi-Fi thermostats which made up 16% of reported savings. The program had a 102% realization rate for kWh savings, a 61% realization rate for demand savings, and a 150% realization rate for therm savings. As in past evaluations, the evaluation team found that *ex post's* use of actual measure characteristics, updates informed by billing analysis results, and differences between the approaches outlined in the Illinois TRM v11.0 and Indiana TRM (v2.2), the latter of which includes the addition of early replacement savings for select measures, can drive realization rates to deviate from 100%.

Recommendations:

- Assess in-service rates (ISR) for smaller measures (air purifiers, dehumidifiers, pool pumps, and thermostats) in 2024. While the evaluation team deemed these ISRs at 100% this year, they are likely below 100% for smaller measures and should be evaluated in the future, which may reduce savings.

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 and other ENERGY STAR® products. By partnering with retailers and manufacturers, NIPSCO provides participating customers with instant discounts on efficient lighting and product 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 2023, NIPSCO offered program discounts on LED fixtures across a wide range of applications, package sizes, and wattages. They also offered Tier 1 and Tier 2 advanced power strips and air purifiers. Participating retailers varied and included big-box stores, do-it-yourself stores, club stores, and discount stores.

TRC implemented the Residential Lighting program 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 the 2022 Design

In 2023, NIPSCO discontinued rebates on LED specialty and reflector lamps, offering only LED fixtures. They also began offering non-lighting ENERGY STAR products like advanced power strips and air purifiers in the Residential Lighting program. This marked a transition from the lighting-only options of the past, necessitated by the DOE's full enforcement of retail sales rules beginning in July 2023.[18] In the 2022 evaluation report, the evaluation team recommended that NIPSCO discontinue buy-downs of all EISA-impacted lamp types beginning in July 2023.

Program Performance

In 2023, the Residential Lighting program discounted 158,851 light fixtures, 10,283 advanced power strips, and 873 air purifiers, reporting *ex ante* program energy savings and peak demand reduction of 7,274 MWh and 974 kW, respectively. Reported electric energy and peak demand savings in 2023 were 84% and 81%, respectively, of 2022 energy and peak demand savings, due to the reduction in lighting offerings. However, the 2023 energy savings goal was reduced to 45% of the 2022 savings goal and the 2023 peak demand savings goal was 50% of 2022 peak demand goal.

[18] 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

In terms of *ex post* gross savings, the program achieved 78% of the electric energy savings goal and 72% of the peak demand reduction goal. Table 31 summarizes savings for the full year of program performance, including program savings goals.

Table 31. 2023 Residential Lighting 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.)	5,382,618.70	7,274,360.33	7,274,360.33	7,103,696.97	4,172,016.01	2,132,849.38	78%
Peak Demand Reduction (kW)	729.406	973.955	973.955	952.489	524.458	249.071	72%

Table 32 outlines the *ex post* and NTG adjustment factors for 2023. The evaluation team calculated NTG for lighting measures in 2021 via secondary benchmarking research and used the 2021 LED fixture value for the 2023 lighting evaluation. The evaluation team used 2023 NTG results from the Residential Online Marketplace program for other, non-lighting ENERGY STAR products, like the advanced power strips and air purifiers.

Table 32. 2023 Residential Lighting Program Adjustment Factors

METRIC	REALIZATION RATE (%)[a]	FREERIDERSHIP	SPILLOVER	NTG (%)[b]
Electric Energy Savings (kWh/yr.)	57%	50%	1%	51%
Peak Demand Reduction (kW)	54%	53%	1%	47%

[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 33 lists the 2023 program budget and expenditures by fuel type. In 2023, the program spent 97% of its electric budget, compared to *ex post* electric energy and peak demand goal achievement of 78% and 72%, respectively.

Table 33. 2023 Residential Lighting Program Expenditures

FUEL	PROGRAM BUDGET	PROGRAM EXPENDITURES	BUDGET SPENT (%)
Electric	$2,425,365.80	$2,353,983.12	97%

Evaluation Methodology

To inform the 2023 NIPSCO Residential Lighting impact evaluation, the evaluation team completed the research activities listed below. The team did not complete a process evaluation for 2023.

- **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 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 Illinois TRM v11.0, 2015 Indiana TRM (v2.2) and NIPSCO's program tracking database.[19,20] For lighting with an installation date prior to July 1, 2023, the evaluation team used the IN TRM (v2.2) and the UMP lumens bin protocol for baseline wattage with the replaced bulb type determined by the type of bulb that would be used in the replaced fixture. For lighting purchased after July 1, 2023, the evaluation team used the IL TRM v11.0. The IL TRM v11.0 was used exclusively for evaluating all non-lighting measures.

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?

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 TRM (v2.2) and the IL TRM v11.0 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 product quantities by comparing product descriptions, numbers of packs, and numbers of units provided in the tracking database. The evaluation team also validated product 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.

[19] September 22, 2022. 2023 Illinois Statewide Technical Reference Manual for Energy Efficiency Version 11.0. Illinois Energy Efficiency Stakeholder Group.
[20] July 28, 2015. Indiana Technical Reference Manual Version 2.2. Cadmus.

The evaluation team thoroughly investigated energy savings and demand reduction assumptions. Throughout this investigation, the evaluation team identified inconsistencies in the way LED fixtures were categorized and assigned baseline wattages. For example, some fixtures categorized as downlights in the tracking data were standard indoor ceiling mount fixtures, causing them to be assigned the incorrect baseline wattage. Additionally, there were bulbs in the tracking database, which due to delayed manufacturer invoicing were not processed until August 2023, but had installation dates prior to the EISA backstop. These had zero reported *ex ante* savings, but the evaluation team granted *ex post* saving for these bulbs.

While the *ex ante* in-service rate (ISR) assumptions used the IL TRM v10.0 and evaluated savings used ISRs from the IL TRM v11.0, the ISRs were unchanged from v10.0. Table 34 lists the ISRs for all program-installed measures.

Table 34. 2023 Residential Lighting Program In-Service Rates by Measure

MEASURE	ISR
LED Fixture	100%
Air Purifier	100%
Advanced Power Strip Tier 2	73%*

*Weighted average ISR of 71% for tier 1 and 83% for tier 2 units from the IL TRM v11.0

Table 35 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 ISR.

Table 35. 2023 Residential Lighting Program Audited & Verified Quantities

MEASURE	UNIT OF MEASURE	AUDITED QUANTITY	ISR	VERIFIED QUANTITY
LED Fixture (Jan-Jun 2023)	Fixture	96,759	100%	96,759
LED Fixture (Jul-Dec 2023)	Fixture	62,092	100%	62,092
ENERGY STAR Air Purifier/Cleaner	Air Purifier	873	100%	873
Advanced Power Strip	Power Strip	10,283	73%	7,500
		170,007		167,224

Ex Post Gross Savings

Methodology

The evaluation team determined the program's *ex post* gross energy savings and demand reduction through an engineering analysis. For all program measures, the evaluation team used a range of data sources to ensure it used the most recent and accurate savings assumptions. Like the *ex ante* calculations, algorithms included hours of use (HOU), interactive effects, coincidence factor (CF) for demand reduction, and deemed savings assumptions for air purifiers and power strips from the Indiana TRM (v2.2) and Illinois TRM (v10.0 *ex ante*; v11.0 *ex post*). For air purifiers, the evaluation team verified model specifications against the ENERGY STAR qualified products list. For lighting measures, the evaluation team used the recommended baseline watts approach prescribed in the most recent version of the UMP Residential Lighting Evaluation Protocol with the replaced bulb type determined by the type of bulb that would be used in the replaced fixture. Evaluated savings were zero for EISA-impacted lighting measures sold after the July 1, 2023 EISA backstop.

Appendix 2. Residential Lighting Program contains the detailed equations the evaluation team used to calculate 2023 electric 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.

Ex Post Gross Savings Summary

Table 36 shows the *ex ante* deemed savings and *ex post* gross per-measure savings for 2023 Residential Lighting program measures. The overall realization rate for the program was 57% for energy savings and 54% for demand reduction (Table 39 and Table 40). 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 LED fixture calculations used the IL TRM v10.0 to establish baseline wattage. This led to significant over- or under-estimation of savings at the fixture level. The evaluation team used the UMP-recommended ENERGY STAR lumens binning approach to determine baseline wattages for each program LED fixture, consistent with previous evaluation years. This difference in calculation resulted in substantially lower *ex post* per-unit savings for LED fixtures. Evaluated savings are broken out for fixtures sold before and after the EISA backstop date of July 1, 2023. 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).

Ex ante air purifier savings used the IL TRM v10.0 deemed savings values by CADR range. Like the LED fixture *ex ante* assumptions, these deemed values can lead to over- or under-estimation of savings at the individual model level. The evaluation team calculated savings for each unit in the tracking database using actual unit characteristics available in the ENERGY STAR qualified products list rather than relying on deemed average savings for a range of products. In total, this measure category had a 118% realization rate, due to under-estimation of *ex ante* savings.

Table 36. 2023 Residential Lighting 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	kWh	kW
LED Fixture (Jan-Jun 2023)	Fixture	60.30	0.008	29.81	0.004
LED Fixture (Jul-Dec 2023)	Fixture	9.12	0.001	5.96	0.001
Air Purifier	Air Purifier	278.50	0.032	328.81	0.038
Advanced Power Strip	Power Strip	61.33	0.008	61.33	0.005

Table 37 highlights notable differences between *ex ante* and *ex post* gross estimates.

Table 37. 2023 Residential Lighting Program 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 Fixture	*Ex ante* savings are based on IL TRM v10.0 and its baseline wattage assumptions	Evaluated savings uses UMP-recommended ENERGY STAR lumens binning approach to determine baseline wattages	Deemed baseline wattages for a broad category of fixtures led to significant over- or under-estimation of savings
Air Purifier	*Ex ante* savings are based on IL TRM v10.0 and its deemed savings assumptions	Evaluated savings uses actual unit characteristics to calculate savings.	Deemed savings for a large range of CADRs led to significant over- or under-estimation of savings

Waste Heat Factor – Therm Penalties

The evaluation team excluded therm penalties from the evaluated savings, consistent with previous evaluations. However, it is important to note that results in cost-effectiveness will still incorporate 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 the gas program performance and measure performance more clearly. Table 38 shows the therm penalties calculated for the Residential Lighting program.

Table 38. 2023 Residential Lighting Program Waste Heat Factor Therm Penalty

MEASURE	EVALUATED *EX POST* SAVINGS (THERMS)
LED Fixture	(66,486.50)

It should be noted that electric waste heat factors, including cooling credits and electric heating penalties, are reported within the electric savings and peak demand reduction for the overall program, as described in *Appendix 1. Home Rebates Program*

This appendix contains the assumptions used in electric savings, demand reduction, and gas savings algorithms for the measures within the Energy Efficiency Rebates program.

Furnaces

The program tracking data contained 3,942 natural gas furnaces. Per the Illinois TRM v11.0 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 v11.0 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, 2022, and 2023.

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 v11.0 suggests multiplying the kWh saved value by two 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 v11.0 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 2023 billing analysis results based on location, and assigned an $AFUE_{BASE}$ and $AFUE_{EXIST}$ of 80% and 64.4% based on the Illinois TRM v11.0. 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 v11.0 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 226 shows the mean values for 2022.

Table 226. 2023 Furnace Mean Values

INDEPENDENT VARIABLES	2023 MEAN VALUE	SOURCE
Capacity (Furnace)	74,458.87	Actual from program tracking data
Capacity (Cooling)	33,316.95	2023 Program Average Air Conditioner Capacity
EFLH	989.39	2023 billing analysis, values vary based on nearest city to project location
AFUE ee	0.960	Actual from program tracking data
AFUE Base[a]	0.80	Illinois TRM v11.0
AFUE Exist[a]	0.644	Illinois TRM v11.0
Derating[a]	0.064	For all derating factors
ER	13.75%	2022 Home Rebates Participant Survey
kWhSavingsPerTon	220.77	Illinois TRM v11.0

[a] Constants

Evaluated unit therm savings range from 35.19 to 337.02 therms, with an average value of 189.40 therms. The *ex ante* data assigned deemed savings of 130.42 therms. The overall natural gas realization rate for this measure category is 145%. 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 (74,458.87 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 zero kWh compared with average *ex post* gross savings of 67.60 kWh. Table 227 highlights these results.

Table 227. Detailed Results from Furnaces

AUDITED COUNT	*EX ANTE* DEEMED SAVINGS PER MEASURE	*EX POST* GROSS AVERAGE SAVINGS PER MEASURE	REALIZATION RATE
3,942	130.42 therms	189.40 therms	145%

Furnaces – Legacy 2022 Measure

In the 2023 tracking data, there were 571 Furnace considered Legacy 2022 Measures for which the evaluation team assigned a deemed savings value of 172.44 therms and 68.29 kWh. These deemed savings are the *ex post* gross per measure savings from the 2022 evaluation. Reference the 2022 NIPSCO Home Rebates evaluation Appendix for details on how this measure was calculated.

Ex ante used a deemed therm savings value of 119.44 therms compared with evaluated therm savings of 172.44 resulting in a therm savings realization rate of 144% for the Furnaces - Legacy 2022 Measure.

Air Conditioners

In the 2023 tracking data, there were 777 air conditioners. The evaluation team used the following equation from the Illinois TRM v11.0 to calculate energy savings from the SEER upgrade for air conditioners:

$$\Delta kWh = (1 - ER) \times \frac{CAP}{1{,}000} \times EFLH_C \times \left(\frac{1}{(SEER_{BASE} \times (1 - DeratingCool_{BASE}))} - \frac{1}{(SEER_{EE} \times SEER_{adj} \times (1 - DeratingCool_{EE}))} \right) + ER \times \frac{CAP}{1{,}000} \times EFLH_C \times \left(\frac{1}{(SEER_{EXIST} \times (1 - DeratingCool_{BASE}))} - \frac{1}{(SEER_{EE} \times SEER_{adj} \times (1 - DeratingCool_{EE}))} \right)$$

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 v10.0 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 228 shows the mean values for 2023.

Table 228. 2022 Air Conditioner Mean Values

INDEPENDENT VARIABLES	2023 MEAN VALUE	SOURCE
Capacity	33,316.95	Actual from program tracking data
EFLHc	428.17	Indiana TRM (v2.2), values assigned based on nearest TRM city to project location
SEERbase[a]	13.00	Illinois TRM v11.0
SEERexist	11.15	Indiana TRM (v2.2)
SEERadj	1.01	Illinois TRM v11.0
SEERee	16.42	Actual from program tracking data
EERbase[a]	10.50	Illinois TRM v11.0
EERstockexist[a]	10.04	0.9*SEERexist; Indiana TRM (v2.2)
EERee	13.05	Average EER/SEER Conversion in the AHRI Database*SEERee
CF[a]	0.88	Indiana TRM (v2.2)

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 v11.0, 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 v11.0 instead provides cooling and circulation electric energy savings for furnaces. Table 229 highlights these results.

Table 229. Detailed Results from Air Conditioners

AUDITED COUNT	*EX ANTE* DEEMED SAVINGS PER MEASURE	*EX POST* GROSS AVERAGE SAVINGS PER MEASURE	REALIZATION RATE
777	672.76 kWh	196.31 kWh	29%
	0.746 kW	0.650 kW	30%

Air Conditioner – Legacy 2022 Measure

In the 2023 tracking data, there were 75 Air Conditioner Legacy 2022 measures. This measure is a Legacy 2022 Measure for which the evaluation team assigned a deemed savings value of 286.63 kWh and 0.607 kW. These deemed savings are the *ex post* gross per measure savings from the 2022 evaluation. Refer to the 2022 NIPSCO Home Rebates evaluation Appendix for details on how this measure was calculated.

Ex ante used a deemed kWh savings value of 688.89 kWh and 0.780 kW compared with evaluated kWh and kW savings of 286.63 kWh and 0.607 kW, resulting in an electric energy savings and demand reduction realization rate of 42% and 78%, respectively for the Air Conditioner - Legacy 2022 Measures.

Air Conditioner and Air Source Heat Pump Tune-up

In the 2023 tracking data, there were 68 air conditioners and 2 ASHP tune-ups. Per the Illinois TRM v11.0 the evaluation team used the following savings algorithm for air conditioner tune-ups:

$$\Delta kWh_{CAC} = EFLH_{COOL} \times \frac{Btuh_{COOL}}{1,000} \times \frac{1}{SEER_{CAC}} \times MF_E$$

And air source heat pump tune-ups:

$$\Delta kWh_{ASHP} = EFLH_{COOL} \times \frac{Btuh_{COOL}}{1,000} \times \frac{1}{SEER_{ASHP}} \times MF_E + EFLH_{heat} \times \frac{Btuh_{heat}}{1000} \times \frac{1}{HSPF_{ASHP}} \times MF_E$$

Where:

EFLH	=	Equivalent full-load cooling or Heating hours from Indiana TRM (2.2) or the 2023 Billing Analysis results
Btuh	=	Cooling or Heating capacity of equipment in Btuh
SEER	=	SEER efficiency of existing central air conditioning or ASHP unit receiving maintenance
HSPF	=	Heating season performance factor of existing air source heat pump 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 were not 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 v11.0 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 230 shows the mean values for 2023.

Table 230. 2023 AC Tune Up Mean Values

INDEPENDENT VARIABLES	2023 MEAN VALUE	SOURCE
Btuhcool cac	32,349.04	Actual and averages from program tracking data
Btuhcool ashp	29,335.71	Actual and averages from program tracking data
EFLHcool	431	Indiana TRM (v2.2), values assigned based on nearest TRM city to project location
EFLHheat	989	2023 Billing Analysis
SEERcac	10	Illinois TRM v11.0
SEERashp	10	Illinois TRM v11.0
HSPFashp	6.8	Illinois TRM v11.0
MFe[a]	0.05	Illinois TRM v11.0
EER	9.2	Assumed 0.9*SEER
MFd[a]	0.02	Illinois TRM v11.0
CF[a]	0.88	Indiana TRM (v2.2)

[a]Constants

Higher average cooling capacity drove slightly higher energy savings in 2023. However, the largest driver for significantly higher savings was the assumption of existing air conditioner SEER of 10 from the Illinois TRM v11.0. This assumption is used in preparation for the 2024 Indiana TRM approach which assumes the same as the Illinois TRM v11.0. Table 231 highlights these results.

Table 231. Detailed Results from AC and ASHP Tune Ups

	AUDITED COUNT	*EX ANTE* DEEMED SAVINGS PER MEASURE	*EX POST* GROSS AVERAGE SAVINGS PER MEASURE	REALIZATION RATE
AC	68	44.34 kWh	69.94 kWh	158%
		0.101 kW	0.062 kW	61%
ASHP	2	199.57 kWh	281.12 kWh	141%
		0.063 kW	0.055 kW	87%

Boilers

There were 46 boiler measures reported as part of the program in 2023. Per the Illinois TRM v11.0 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 2023 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

Evaluated savings used the reported model number to look up all 2023 boiler heating capacity and AFUE in the AHRI database. Table 232 shows the mean values for 2023.

Table 232. 2023 Boiler Mean Values

INDEPENDENT VARIABLES	2023 MEAN VALUE - 92% AFUE	SOURCE
Capacity	130,865.22	Actual from program tracking data
EFLH	987.94	2023 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 v11.0
AFUE Exist[a]	0.616	Illinois TRM v11.0

[a]Constants

Small differences between ex ante and evaluated are because the evaluation team used each unit's specific reported AFUE and capacities to calculate savings. Differences in approach between the Indiana TRM (v2.2) and Illinois TRM v11.0, additional early replacement savings, higher average capacity, and using the closest city instead of broadly applying South Bend for EFLH drove higher Therm savings than reported. Table 233 highlights these results.

Table 233. Detailed Results from Boilers

AUDITED COUNT	*EX ANTE* DEEMED SAVINGS PER MEASURE	*EX POST* GROSS AVERAGE SAVINGS PER MEASURE	REALIZATION RATE
46	207.24 therms	281.28 therms	136%

Boiler – Legacy 2022 Measure

In the 2023 tracking data, there was a seven Boiler Legacy 2022 measure. This measure is a Legacy 2022 Measure for which the evaluation team assigned a deemed savings value of 256.17 therms. These deemed savings are the *ex post* gross per measure savings from the 2022 evaluation. Reference the 2022 NIPSCO EE Rebates evaluation Appendix for details on how this measure was calculated.

Ex ante used a deemed therm savings value of 217.34 therms compared with evaluated therm savings of 256.17 therms, resulting in a therm savings realization rate of 118% for the Boiler - Legacy 2022 Measures.

Air Source Heat Pumps

In the 2023 tracking data, there were 35 air source heat pumps. The evaluation team used the following algorithm from the Illinois TRM v11.0 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
$EFLH_C$	=	Equivalent 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 × $EFLH_H$

$EFLH_H$	=	Equivalent full-load heating hours derived via 2023 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 2023 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 v11.0 while CF was 0.88 assumed from the Indiana TRM (v2.2) and the evaluation team found EER_{EE} in the AHRI database. Table 234 shows the mean values for 2022.

Table 234. 2023 ASHP Mean Values

INDEPENDENT VARIABLES	2023 MEAN VALUE	SOURCE
CAPc	34,977.14	Actual from AHRI equipment database
EFLHc	427.78	Indiana TRM (v2.2); values vary based on nearest city to project location
SEERbase[a]	14.00	Illinois TRM v11.0
SEERee	17.36	Actual from AHRI equipment database
SEERexist[a]	9.3	Illinois TRM v11.0
SEERadj	0.85	Illinois TRM v11.0; calculated from AHRI equipment database
CAPh	35,045.71	Actual from AHRI equipment database
EFLHh	989.22	2023 billing analysis, values vary based on nearest city to project location
HSPFbase[a]	8.2	Illinois TRM v11.0
HSPFee	8.34	Actual from AHRI equipment database
HSPFexist[a]	5.54	Illinois TRM v11.0
HSPFadj	1.01	Illinois TRM v11.0; calculated from AHRI equipment database

INDEPENDENT VARIABLES	2023 MEAN VALUE	SOURCE
Derating Factors	0.1	Illinois TRM v11.0
CF[a]	0.88	Indiana TRM (v2.2)

[a]Constants

The evaluation team used EFLH values from the TRM and 2023 billing analysis 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*. Table 235 highlights these results.

Table 235. Detailed Results from Air Source Heat Pumps

AUDITED COUNT	*EX ANTE* DEEMED SAVINGS PER MEASURE	*EX POST* GROSS AVERAGE SAVINGS PER MEASURE	REALIZATION RATE
35	430.02 kWh	760.23 kWh	177%
	0.694 kW	0.319 kW	46%

Air Source Heat Pump – Legacy 2022 Measure

In the 2023 tracking data, there was one Legacy 2022 Measure for which the evaluation team assigned a deemed savings value of 1,220.89 kWh and 0.676 kW. These deemed savings are the *ex post* gross per measure savings from the 2022 evaluation. Reference the 2022 NIPSCO EE Rebates evaluation Appendix for details on how this measure was calculated.

Ex ante used a deemed kWh savings value of 1,184.21 kWh and 0.678 kW compared with evaluated kWh and kW savings of 1,220.89 kWh and 0.676 kW, resulting in an electric energy savings and demand reduction realization rate of 103% and 100%, respectively for the Air Source Heat Pump - Legacy 2022 Measures.

Smart Wi-Fi Thermostats

There were 1,860 smart Wi-Fi thermostats installed through the program in 2023. 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 236.

Table 236. 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	840	0	0	15.66

MEASURE NAME-DEFINED CONFIGURATION	COUNT OF UNITS [a]	*EX ANTE* UNIT SAVINGS		
		KWH	KW	THERMS
Natural gas heat with air conditioner	990	110	0.125	15.31
Electric resistance heating with air conditioner	10	1,058	0.125	0
Heat pump	7	235	0.120	0
Air conditioner only	11	105	0.125	0
Electric resistance Heating only	2	942	0	0

[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 2023 billing analysis revealed net gas savings of 42.9 therms (6%). The analysis also revealed net cooling electric energy savings of 9.6%. More detail on these options can be seen in the billing analysis section. Table 237 shows the mean values for 2023.

Table 237. 2023 Thermostat Mean Values

INDEPENDENT VARIABLES	2023 MEAN VALUE - GAS HEATING ONLY	2023 MEAN VALUE - ELECTRIC COOLING AND GAS HEATING	2023 MEAN VALUE - ELECTRIC COOLING AND HEATING	2023 MEAN VALUE - ELECTRIC COOLING ONLY	2023 MEAN VALUE - HEAT PUMP	2023 MEAN VALUE - ELECTRIC HEATING ONLY	SOURCE
CAPC	-	33,316.95	33,316.95	33,316.95	33,215.83	-	Actual from the program tracking data when possible or average of program ACs or heat pumps
EER*	10.5	10.5	10.5	10.5	10.5	10.5	Illinois TRM v11.0
EFLHC	398.59	429.23	431.00	431.00	414.43	431.00	Indiana TRM (v2.2), values vary based on nearest city to project location
ESFC[a]	0.096	0.096	0.096	0.096	0.096	0.096	2023 billing analysis
HF	1	1	1	1	1	1	Illinois TRM v11.0
Gas Heating Consumption	715	715					2023 billing analysis
Electric Heating Consumption	-	-	12,222	-	20,777	12,222	Illinois TRM v11.0, values vary based on nearest city to project location
ESFH[a]	0.06	0.06	0.06	0.06	0.06	0.06	2023 billing analysis
SEER	12.00	12.00	12.00	12.00	12.00	12.00	Illinois TRM v11.0
CF	0.44	0.44	0.44	0.44	0.44	0.44	Indiana TRM (v2.2) or engineering assumption
Cooling Demand Reduction	0.164	0.164	0.164	0.164	0.164	0.164	Illinois TRM v11.0
Fe	0.0314	.0314	.0314	.0314	.0314	.0314	

[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:

$$\Delta kWh = \%AC * (\frac{EFLH_c * CAP_c * \frac{1}{SEER}}{1000}) * ESF_c + \%Eelctric\ Heat * Electric\ Heating\ Consumption * ESF_h * HF + (\Delta Therms\ Heating * F_e * 29.3)$$

For heat pump systems:

$$\Delta\, Therms = \%Gas\ Heat * Gas\ Heating\ Consumption * ESF_h * HF$$

Where:

CAP_C	=	System cooling capacity
SEER	=	System SEER
$EFLH_C$	=	Equivalent full-load cooling hours from Indiana TRM (2.2)
ESF_C	=	Savings factor for cooling derived via 2023 billing analysis, 9.6%
Electric Heating Consumption	=	Varies based on city
HF	=	Housing Factor
Fe	=	Fan Energy Factor
Gas Heating Consumption	=	2023 billing analysis Heating consumption, 715 therms
ESF_H	=	Savings factor for heating derived via 2023 billing analysis, 6%
%Gas heat	=	0 or 1 depending on system
%AC	=	0 or 1 depending on system

Here, the standard cooling CF of 0.88 is used, but divided by two:

$$\Delta kW = \%\text{AC} \times \frac{CAP_C}{EER \times 1{,}000} \times \frac{CF}{2} \times Cooling\ Demand\ Reduction$$

In this evaluation 1,860 program thermostats were delivered; with 92 thermostats (5%) 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. 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 157%, the overall kW realization rate is 172%, and the overall natural gas realization rate is 264%. Table 238 highlights these results.

Table 238. Detailed Results from Thermostats

AUDITED COUNT	*EX ANTE* DEEMED SAVINGS PER MEASURE	*EX POST* GROSS AVERAGE SAVINGS PER MEASURE	REALIZATION RATE
1,860	66.78 kWh	104.68 kWh	157%
	0.068 kW	0.118 kW	172%
	15.22 therms	40.11 therms	264%

Wi-Fi Thermostats – Legacy 2022 Measure

In the 2023 tracking data, there were 195 Wi-Fi Thermostat Legacy 2022 Measures for which the evaluation team assigned deemed *post* gross per measure savings from the 2022 evaluation. The average deemed ex post gross savings were 59.02 kWh, 0.060 kW, and 32.09 therms. Reference the 2022 NIPSCO EE Rebates evaluation Appendix for details on how this measure was calculated.

Ex ante used an average deemed kWh savings value of 65.94 kWh, 0.070 kW, and 21.77 therms, resulting in an electric energy savings, demand reduction, and therm savings realization rates of 90%, 86%, and 146%, respectively for the Wi-Fi Thermostat - Legacy 2022 Measures.

Heat Pump Water Heater

In the 2023 tracking data, there were 21 heat pump water heaters. The evaluation team used the following algorithm to calculate savings for water heaters:

$$\Delta kWh = \left(\frac{\left(\frac{1}{UEF_{BASE}} - \frac{1}{UEF_{EE}}\right) \times GPD \times Household \times 365.25 \times \gamma Water \times (T_{out} - T_{in}) \times 1.0}{3412} + kWh_{cooling} - kWh_{heating} + Deh_{reduction} \right)$$

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 v11.0.

The current standard for residential water heater efficiency is uniform energy factor (UEF). 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.

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 v10.0 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 239 shows the mean values for 2023.

Table 239. 2023 Water Heater Mean Values

INDEPENDENT VARIABLES	2023 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	3.77	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 v11.0
kWh heating	5.69	Varies based on UEF values; Input assumptions from the IL TRM v11.0

INDEPENDENT VARIABLES	2023 HEAT PUMP WATER HEATER MEAN VALUES	SOURCES
kWh cooling	65.66	Varies based on UEF values; Input assumptions from the IL TRM v11.0
Deh reduction[a]	72	Illinois TRM v11.0
LF[a]	0.22	Illinois TRM v11.0
ηHeat[a]	0.7	Illinois TRM v11.0
%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 2,728.01 kWh and 0.373 kW, respectively, compared to average *ex ante* values of 2,150.81 kWh and 0.102 kW, for a kWh realization rate of 127% and kW realization rate of 365% for this measure category. Table 240 highlights these results.

Table 240. Detailed Results from Water Heaters

AUDITED COUNT	*EX ANTE* DEEMED SAVINGS PER MEASURE	*EX POST* GROSS AVERAGE SAVINGS PER MEASURE	REALIZATION RATE
21	2,150.81 kWh	2,728.01 kWh	127%
	0.102 kW	0.373	365%

Heat Pump Water Heaters – Legacy 2022 Measure

In the 2023 tracking data, there was one Heat Pump Water Heater Legacy 2022 Measure for which the evaluation team assigned deemed *post* gross per measure savings from the 2022 evaluation. The average deemed *ex post* gross savings were 2,736 kWh and 0.374 kW. Reference the 2022 NIPSCO EE Rebates evaluation Appendix for details on how this measure was calculated.

Ex ante used an average deemed kWh savings and demand reduction value of 1,900.85 kWh and 0.090 kW, respectively, resulting in electric energy savings and demand reduction savings realization rates of 144%, and 416%, respectively for the Heat Pump Water Heater - Legacy 2022 Measure.

Ductless Mini-Split Heat Pump

In the 2023 tracking data, there were 57 ductless mini-split heat pumps. The evaluation team used the following algorithm from the Illinois TRM v11.0 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

$EFLH_{cool}$ = Equivalent 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

$EFLH_{heat}$ = Equivalent 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 2023 billing analysis and AHRI-verified capacities and efficiencies for this analysis. Existing efficiency assumptions were from the Illinois TRM v11.0. 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 v11.0 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 v11.0. Table 241 shows the mean values for 2023.

Table 241. 2023 Ductless Mini-Split Mean Values

INDEPENDENT VARIABLES	2023 MEAN VALUE	SOURCE
CAPc	18,822.22	Actual from AHRI equipment database
EFLHcool	427.32	Indiana TRM (v2.2), values vary based on nearest city to project location
SEERbase[a]	14.00	Illinois TRM v11.0
SEERee	21.23	Actual from AHRI equipment database
CAPh	20,496.83	Actual from the program tracking data[b]
EFLHh	989.25	Actual from AHRI equipment database
HSPFbase[a]	8.2	Illinois TRM v11.0

HSPFee	11.18	Actual from AHRI equipment database
EERbase[a]	11.00	Illinois TRM v11.0
EERee	12.64	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.

Table 242 highlights Ductless Mini-split Heat Pump results.

Table 242. 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
57	892.06 kWh	1,130.18 kWh	127%
	0.096 kW	0.311 kW	324%

Ductless Mini-Split Heat Pumps – Legacy 2022 Measure

In the 2023 tracking data, there were six Ductless Mini-Split Heat Pump Legacy 2022 measures. This measure is a Legacy 2022 Measure for which the evaluation team assigned a deemed savings value of 1,020.83 kWh and 0.294 kW*.* These deemed savings are the *ex post* gross per measure savings from the 2022 evaluation. Reference the 2022 NIPSCO EE Rebates evaluation Appendix for details on how this measure was calculated.

Ex ante used a deemed therm savings value of 701.92 kWh and 0.100 kW compared with evaluated electric energy and demand savings of 1,020.83 kWh and 0.294 kW, resulting in a savings realization rate of 145% for kWh savings and 294% kW for the Ductless Mini-Split Heat Pump - Legacy 2022 Measures.

Pool Pump

In the 2023 tracking data, there were seven pool pumps. The evaluation team applied the savings approach outlined in the Illinois TRM v11.0, 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 found through look ups the reported configuration and tier were assumed. The *ex ante* values were also calculated using the Illinois TRM v11.0. 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 243 shows the mean values for 2023 Pool Pumps.

Table 243. 2023 Pool Pump Mean Values

INDEPENDENT VARIABLES	MEAN VALUE-ESTAR IN-GROUND	MEAN VALUE-CEE TIER 1 ABOVE GROUND	SOURCE
WEFestar	6.31	4.43	Configuration and Tier according to ENERGY STAR QPL Look up; Values from Illinois TRM v11.0 table
WEFbase[a]	4.6	2.6	Illinois TRM v11.0
Gallons[a]	22,000	7,540	Illinois TRM v11.0
Turnovers[a]	2	2	Illinois TRM v11.0
Days[a]	122	122	Illinois TRM v11.0
GPMbase[a]	43.6	44.7	Illinois TRM v11.0
GPMestar[a]	32.20	27.3	Illinois TRM v11.0
CF[a]	0.831	0.831	Illinois TRM v11.0

[a]Constants

Table 244 highlights Pool Pump results.

Table 244. Detailed Results from Pool Pumps

AUDITED COUNT	*EX ANTE* DEEMED SAVINGS PER MEASURE	*EX POST* GROSS AVERAGE SAVINGS PER MEASURE	REALIZATION RATE
7	366.43 kWh	277.44 kWh	76%
	0.357 kW	0.291 kW	81%

Air Purifiers

In the 2023 tracking data, there were 61 air purifiers. The evaluation team applied the savings approach outlined in the Illinois TRM v11.0, 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 v11.0. Differences between *ex ante* and *ex post* come from different CADR than reported found during look ups. Table 245 documents the mean values for 2023.

Table 245. 2023 Air Purifier Mean Values

INDEPENDENT VARIABLES	2023 MEAN VALUE-CADR 30-99	2023 MEAN VALUE-CADR 101-149	2023 MEAN VALUE-CADR 150-199	2023 MEAN VALUE-CADR ≥200	SOURCE
SmokeCADRbase	83.30	127.60	175.20	288.84	Efficient CADR from ENERGY STAR QPL Look up; Base look up from Illinois TRM v11.0
SmokeCADRperWattbase	1.64	1.83	1.94	1.89	Efficient CADR from ENERGY STAR QPL Look up; Base look up from Illinois TRM v11.0
PartialOnModePowerbase	2.00	2.00	2.00	2.00	Efficient CADR from ENERGY STAR QPL Look up; Base look up from Illinois TRM v11.0
SmokeCADReff	82.60	132.17	171.60	276.86	ENERGY STAR QPL Look up
SmokeCADRperWattEff	2.63	5.07	4.48	4.66	ENERGY STAR QPL Look up
PartialOnModePowerEff	0.38	0.50	0.41	0.77	ENERGY STAR QPL Look up
Hours[a]				5840	
CF[a]				0.667	

[a]Constants

Table 246 highlights Air Purifier results.

Table 246. Detailed Results from Air Purifiers

AUDITED COUNT	*EX ANTE* DEEMED SAVINGS PER MEASURE	*EX POST* GROSS AVERAGE SAVINGS PER MEASURE	REALIZATION RATE
61	401.52 kWh	377.76 kWh	94%
	0.046 kW	0.043 kW	94%

Clothes Dryers

In the 2023 tracking data, there were 16 clothes dryers. The evaluation team used the following algorithm from the Illinois TRM v10.0 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 percentage 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 247 shows the mean values for 2023.

Table 247. 2023 Clothes Dryers Mean Values

INDEPENDENT VARIABLES	2023 MEAN VALUE	SOURCE
Load[a]	8.45	Illinois TRM v11.0
CEFbase[a]	3.11	Illinois TRM v11.0
CEFEE	3.93	Actual from ENERGY STAR QPL Look up
Ncycles[a]	283.00	Illinois TRM v11.0
%electric[a]	100%	Illinois TRM v11.0

[a]Constants

Table 248 highlights Clothes Dryer results.

Table 248. 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	161.11 kWh	100%
	0.022 kW	0.022 kW	98%

Dehumidifiers

In the 2023 tracking data, there were 67 dehumidifiers. The evaluation team used the following algorithm from the Illinois TRM v11.0 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 249 shows the mean values for 2023.

Table 249. 2023 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	21.75	43.61	85.00[a]	Actual from ENERGY STAR QPL Look up
Federal Standard L/kWh	1.30	1.60	2.80[a]	Illinois TRM v11.0
L/kWh	1.67	1.87	2.35[a]	Actual from ENERGY STAR QPL Look up
Pints to Liters[a]	0.473	0.473	0.473	Illinois TRM v11.0

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
Run Hours/year[a]	2,200	2,200	2,200	Illinois TRM v11.0
Hours/day[a]	24.00	24.00	24.00	Illinois TRM v11.0

[a]Constants

[a]Use 2022 Mean value

Table 250. Detailed Results from Dehumidifiers

TRACKING DATA	*EX ANTE* DEEMED SAVINGS PER MEASURE	*EX POST* GROSS AVERAGE SAVINGS PER MEASURE	REALIZATION RATE
67	115.01 kWh	167.35 kWh	146%
	0.026 kW	0.038 kW	144%

Billing Analysis

Billing Analysis Methodology

As part of the PY2023 evaluation, the evaluation team calculated heating and cooling energy savings factors for thermostats and EFLH for furnaces using a billing analysis. We completed the following steps in the billing analysis:

- Collect, review, and prepare billing and tracking data,
- Collect customer weather data,
- Conduct PRISM regression analysis,
- Calculate energy savings factors for thermostats and EFLH's for furnace.

Data Collection, Review, and Preparation

The evaluation team collected tracking data from 2020 – 2023 for participants who installed thermostats and from 2020 – 2022 for participants who installed furnaces. The evaluation team collected billing data from January 2019 – October 2023 to allow for sufficient pre- and post- installation periods to calculate heating and cooling energy savings factors for thermostats and EFLH values for natural gas furnaces.

For the smart thermostat savings analysis, the evaluation team used 2020, 2021 and 2022 participants as treatment groups in the analysis. The evaluation team used both future and past participants from 2020, 2021, 2022, and 2023 as comparison groups for each treatment year. The comparison group was used to detect any non-program-related changes in energy, such as economic changes or changes in usage related to the COVID pandemic. For treatment group households, the evaluation team defined the pre-period as 12 months prior to the earliest thermostat installation and the post period as 12 months after the latest thermostat installation. For comparison group households the pre- and post- periods were defined using the 12 months before and after the average installation date of the 2020, 2021 and 2022 treatment groups, respectively. Since no measures were installed in the comparison group households during this time period, it allowed the evaluation team to observe any non-program related changes in energy consumption that need to be accounted for in the savings analysis.

For the EFLH analysis the evaluation team used 2020 - 2022 participants. A comparison group was not needed for the EFLH analysis, as the evaluation team was only looking at weather normalized consumption for a specified year and not changes in consumption. The evaluation team did calculate EFLH values for 2022 and 2023 to see if there were any major differences between the two time periods.

In conducting the billing analysis for both EFLH and smart thermostats, the evaluation team completed the following steps:

- Merged treatment group thermostat data from the tracking database with electric and natural gas billing data.
- Created EFLH and smart thermostat analysis groups. Customers were included in the gas thermostat analysis if they had claimed gas thermostat savings or based on the measure name. Customers were included in the electric thermostat analysis if they had claimed electric savings or based on their measure name. Households were only included in the thermostat analysis if they were recorded as having only a smart thermostat installed and no other measure. The reason for this was that the billing analysis would not be able to distinguish the thermostat savings from other HVAC savings with reliable precision. All customers that had a natural gas furnace installed in 2020, 2021 or 2022 were included in the EFLH analysis.
- Used zip code mapping to determine the nearest weather station for each zip code.
- Obtained daily average temperature weather data (January 2019 through October 2023) for seven National Oceanic and Atmospheric Administration (NOAA) weather stations, representing all zip codes associated with participants.
- Used daily average temperatures to determine base 45°F to 85°F HDDs and CDDs for each station. For the gas thermostat and EFLH analyses only base 45°F to 70°F HDDs were used.
- Obtained typical meteorological year (TMY3; 1991–2005) annual normal HDDs and CDDs to weather normalize the billing data.
- Matched billing data periods with CDDs and HDDs from associated stations.

Comparison Group for Smart Thermostats Savings Analysis

As an important aspect of a billing analysis' quasi-experimental design, a billing analysis—whenever possible—should use a comparison group to account for exogenous factors that may have occurred simultaneously with program activity. These factors can include macroeconomic effects, increases, or decreases in energy rates, or other interactions that could affect energy consumption outside the program's influence. The potential effects of COVID-19 on energy consumption are a good example of an exogenous change in energy consumption unrelated to the HVAC program. The evaluation team established a comparison group for 2020, 2021, and 2022 participants using a mix of 2020, 2021, 2022, 2023 program participants depending on participation year. See Table 24 for details on what comparison groups were used.

Using future participants this way offered several advantages over selecting randomly from the customer population:

- Past and future participants are more representative of the participant treatment group than a random sample of residential customers—they are more likely to closely resemble participants from previous years in terms of energy awareness and pre-period building characteristics.
- As this population received program measures, the evaluation team could control and isolate the comparison group's installation periods to ensure that program impacts did not influence the analysis period.

To account for any exogenous changes in consumption over the treatment period, the evaluation team calculated the heating and cooling energy savings factors in the following manner:

$$ESF\ Heating = \frac{Treatment\ Change\ in\ Heating\ Usage}{Pre\ Treatment\ Heating\ Usage} - \frac{Comparison\ Change\ In\ Heating\ Usage}{Pre\ Comparison\ Heating\ Usage}$$

$$ESF\ Cooling = \frac{Treatment\ Change\ in\ Cooling\ Usage}{Pre\ Treatment\ Cooling\ Usage} - \frac{Comparison\ Change\ In\ Cooling\ Usage}{Pre\ Comparison\ Cooling\ Usage}$$

Because the comparison group was created using future participants, it is not guaranteed that the comparison group will have similar heating and cooling loads. There could be a variety of differences between the current and future participants that could drive differences in heating and cooling load such as home size, occupants, and heating/cooling preferences. If any of these differences are statistically significant and correlated with the change in energy consumption from the pre- to post- period, then our energy savings factors could be biased. To minimize these differences, and for better matching between the comparison and treatment groups, the evaluation team matched the comparison group usages to participant usages for each usage quartile in each participant year cohort. To verify the usage similarity of the matched comparison group in heating and cooling loads, the evaluation team performed equivalency tests on pre-period weather normalized heating and cooling sensitive consumption. Table 251 presents the results of the equivalency tests by year for baseline electric cooling and natural gas heating loads between the treatment and comparison groups. We can see that for electric cooling there were no statistically significant differences in baseline cooling consumption. Similarly for natural gas heating we did not see any statistically significant differences between the treatment and comparison group with regards to baseline heating consumption.

Table 251. Natural Gas Heating & Electric Cooling Equivalency Tests

FUEL	YEARS	TREATMENT GROUP PRE-PERIOD WEATHER SENSITIVE USAGE (COOLING/HEATING)	COMPARISON GROUP PRE-PERIOD WEATHER SENSITIVE USAGE (COOLING/HEATING) COMPARISON	DIFFERENCE	P-VALUE
Electric	2020-2022	2,654	2,640	14	0.704
Gas	2020-2022	715	709	6	0.341

Data Screening Thermostat Analysis

The evaluation team removed the following sites from the thermostat savings analysis:

- Households that did not have billing data available.
- Households with fewer than ten months of pre- data or fewer than ten months of post-data (at least 20 months total are needed).
- Households with electric consumption less than 1,000 kWh annually or 150 therms annually.
- Households with changes in energy consumption of more than 70% from the pre- to the post-installation period.

The evaluation team also removed households with outliers, apparent vacancies, seasonal usage, or nonprogrammatic equipment or occupancy changes in the pre- and post-installation periods. To determine this, the evaluation team examined monthly billing data by plotting each participant's monthly usage. Table 252 shows the attrition for the treatment and comparison group houses in each step for the 2020-2022 natural gas thermostat participants.

Table 252. 2020-2022 Natural Gas Smart Thermostat Attrition

SCREEN	TREATMENT GROUP			COMPARISON GROUP		
	N	N DROPPED	% DROPPED	N	N DROPPED	% DROPPED
Original Natural Gas Thermostat Accounts	10,502	0	0%	16,992	0	0%
Only installed thermostats	5,229	5,273	50%	9,950	7,042	41%
Billing data unavailable	5,125	104	1%	9,592	358	2%
Insufficient Pre- and Post-Installation Days (<300 days)	3,974	1,151	11%	6,919	2,673	16%
Low Usage (Less than 150 therms annually)	3,964	10	0%	6,904	15	0%
Changed Usage from the Pre- to Post-Period (>70%)	3,944	20	0%	6,885	19	0%
Individual Customer Bill Review and incorrect PRISM signs	3,654	290	3%	6,392	493	3%
Installed Only 1 Thermostat	3,489	165	2%	6,107	285	2%
Comparison Group Matching by Quartile	3,489	0	0%	5,983	124	1%
Final Analysis Group	**3,489**	**7,013**	**67%**	**5,983**	**11,009**	**65%**

Table 253 shows the attrition for the treatment and comparison group houses in each step for the 2020-2022 electric thermostat participants.

Table 253. 2020-2022 Electric AC Smart Thermostat Attrition

SCREEN	TREATMENT GROUP			COMPARISON GROUP		
	N	N DROPPED	% DROPPED	N	N DROPPED	% DROPPED
Original Homes with Electric AC Thermostat Installation	6,612	0	0%	10,683	0	0%
Homes which only installed thermostats	4,270	2,342	35%	7,674	3,009	28%
Had available billing data	4,164	106	2%	7,456	218	2%

SCREEN	TREATMENT GROUP			COMPARISON GROUP		
	N	N DROPPED	% DROPPED	N	N DROPPED	% DROPPED
Insufficient Pre- and Post-Installation Days (<300 days)	3,276	888	13%	5,318	2,138	20%
Low Usage (Less than 1,000 kWh annually)	3,275	1	0%	5,314	4	0%
Changed Usage from the Pre- to Post-Period (>70%)	3,245	30	0%	5,260	54	1%
Individual Customer Bill Review and incorrect PRISM signs	3,058	187	3%	5,016	244	2%
Installed Only 1 Thermostat	2,896	162	2%	4,746	270	3%
Comparison Group Matching by Quartile	2,896	0	0%	4,585	161	2%
Final Analysis Group	2,896	3,716	56%	4,585	6,098	57%

Data Screening EFLH Analysis

The evaluation team removed the following sites from the EFLH analysis:

- Households that did not have billing data available.
- Households with fewer than 270 days of post- data during the analysis year.
- Households with normalized annual natural gas consumption of less than 150 therms annually.
- Households where the percentage of heating load was less than 70%.
- Households with zero usage readings during winter months.
- Households with adjusted R2 values from the PRISM analysis of less than 0.8.
- Households with more than three months of missing data filled in.

These filters were applied to ensure that the billing data was representative of a household's heating load. Because there were so many furnaces included in the analysis it was not possible to review the billing data for each individual household to detect any anomalous billing data. We applied these filters to remove households which may have billing data issues that would cause incorrect EFLH calculations for a given household.

Table 254 shows the number of households removed for each of the criteria listed above. The evaluation team started with all furnaces in the 2020 – 2023 tracking data that matched the billing data.

Table 254. 2022 and 2023 Gas EFLH Analysis Attrition

SCREEN	2022 POST PERIOD			2023 POST PERIOD		
	N	N DROPPED	% DROPPED	N	N DROPPED	% DROPPED

Had available billing data	15,875	0	0%	15,875	0	0%
Insufficient Post-Installation Days (<270 days)	15,796	79	0%	15,784	91	1%
Low Usage (Less than 150 therms annually)	15,784	12	0%	15,761	23	0%
Households removed with zero reads in the winter	15,769	15	0%	15,740	21	0%
Households removed with PRISM R^2 less than 0.8	15,149	620	4%	15,021	719	5%
Households removed with heating load less than 70% of total load	12,335	2,814	19%	12,105	2,916	19%
Households removed with more than 3 months of missing data filled in	11,747	588	5%	11,639	466	4%
Final Analysis Group	**11,747**	**4,128**	**26%**	**11,639**	**4,236**	**27%**

PRISM Modeling Approach

For both the smart thermostat analysis and EFLH analysis, the evaluation team used the PRISM modeling approach. The evaluation team estimated relevant PRISM models for pre- and post-installation billing data. These models provided weather-normalized, pre- and post-installation annual usage for each account. For each electric savings home, we estimated a heating and cooling PRISM model for both the pre- and post-installation periods to weather normalize raw billing data.

For each gas household we only estimated a heating PRISM model. Each model allowed the heating reference temperature to range from 45°F to 85°F and the cooling reference temperature to range from the heating reference temperature to 85°F. For the gas models only heating reference temperatures from 45°F to 70°F were used.

The evaluation team used the following specification for the electric PRISM model:

$$ADC_{it} = \alpha_i + \beta_1 AVGHDD_{it} + \beta_2 AVGCDD_{it} + \epsilon_{it}$$

And the following specification for the gas PRISM model:

$$ADC_{it} = \alpha_i + \beta_1 AVGHDD_{it} + \epsilon_{it}$$

Where, for each customer *i* and month *t*:

ADC_{it}	=	Average daily kilowatt-hour consumption in the pre- and post-installation period
α_i	=	Participant intercept that represents the average daily energy usage baseload
β_1	=	Model space heating parameter value
$AVGHDD_{it}$	=	Base 45°F to 85°F average daily HDDs for the specific location
β_2	=	Model space cooling parameter value

$AVGCDD_{it}$ = Base 45°F to 85°F average daily CDDs for the specific location

ϵ_{it} = Error term

Using this model, the evaluation team computed weather-normalized annual consumption for each heating and cooling reference temperature:

$$Electric\ NAC_i = \alpha_i * 365 + \beta_1 * LRHDD_i + \beta_2 * LRCDD_i$$

$$Gas\ NAC_i = \alpha_i * 365 + \beta_1 * LRHDD_i + \beta_2 * LRCDD_i$$

Where, for each customer *i*:

NAC_i = Normalized annual kilowatt-hour consumption

α_i = Intercept; the average daily or baseload for each participant that represents the average daily baseload from the model

$\alpha_i * 365$ = Annual baseload kilowatt-hour usage (non-weather sensitive)

β_1 = Heating parameter value; in effect, this is usage per HDD from model above

$LRHDD_i$ = Annual, long-run HDDs of a TMY3 in the 1991–2005 series from NOAA, based on the home location

$\beta_1 * LRHDD_i$ = Weather-normalized annual weather-sensitive heating usage

β_2 = Cooling parameter value; in effect, this is usage per CDD from model above

$LRCDD_i$ = Annual, long-run CDDs of a TMY3 in the 1991–2005 series from NOAA, based on home location

$\beta_2 * LRCDD_i$ = Weather-normalized annual weather-sensitive cooling usage

Further, if the heating and cooling models above yielded negative intercepts, negative heating parameters, or negative cooling parameters, the evaluation team estimated additional models that included only the cooling usage (cooling-only models) or only the heating usage (heating-only models). From these models, with correct signs on all parameters, we selected the best model for each participant for the pre- and post-installation periods as the one with the highest R-square value.

Smart Thermostat Energy Savings Factors

The evaluation team used PRISM modeling results to create the heating and cooling energy savings factors. The evaluation team calculated the heating energy savings factor using the gas PRISM results, as most participants had gas heating and there were not sufficient electric heating participants to get a separate electric heating energy savings factor. Similarly, the evaluation team calculated the cooling energy savings factor using the electric PRISM results. The evaluation team decided to only look at changes in heating and cooling consumption, as these were the only end uses the smart thermostat should affect. This decision was made as the evaluation team observed large baseload savings that were entirely driven by an increase in comparison group consumption. It was deemed unreasonable that the baseload savings should be attributable to the smart thermostat program. Additionally, the evaluation team used percentage savings as opposed gross savings because percentage savings are more robust to any misallocation of heating and cooling load when using a PRISM modeling approach on monthly billing data, particularly on the electric side.

If both the pre- and post-period weather sensitive (heating/cooling) usages are over-estimating the percent change in usage will still be more consistent. Heating and cooling energy savings factors were calculated as follows:

$$Heating\ ESF = \frac{\Delta\ Treatment\ Heating\ Load}{Pre\ Period\ Treatment\ Heating\ Load} - \frac{\Delta\ Comparison\ Heating\ Load}{Pre\ Period\ Comparison\ Heating\ Load}$$

$$Cooling\ ESF = \frac{\Delta\ Treatment\ Cooling\ Load}{Pre\ Period\ Treatment\ Cooling\ Load} - \frac{\Delta\ Comparison\ Cooling\ Load}{Pre\ Period\ Comparison\ Cooling\ Load}$$

The gas heating and electric cooling results for the 2020-2022 participants are shown in

Table 255 and Table 256. These are the final estimates for participants installing one thermostat. For gas thermostats, natural gas percent heating savings were 6.0% - and were very significant with a ±7% relative precision at the 90% confidence level. For electric cooling, the cooling percent savings were 9.6% and these savings were also quite precise with a ±15% relative precision at the 90% confidence level.

Table 255. Smart Thermostat Gas Heating Savings Results

YEARS	TREATMENT HOUSE-HOLDS (N)	COMPARISON HOUSEHOLDS (N)	TREATMENT PRE-PERIOD HEATING SENSITIVE CONSUMPTION (THERMS)	COMPARISON PRE-PERIOD COMPARISON HEATING SENSITIVE CONSUMPTION (THERMS)	PERCENT CHANGE IN TREATMENT HEATING CONSUMPTION	PERCENT CHANGE IN COMPARISON HEATING CONSUMPTION	PERCENT HEATING SAVINGS	RELATIVE PRECISION AT 90% CONFIDENCE
2020-2022	3,489	5,983	715	709	6.07%	0.04%	6.03%	7.22%

Table 256. Smart Thermostat Electric Cooling Savings Results

YEARS	TREATMENT HOUSE-HOLDS (N)	COMPARISON HOUSEHOLDS (N)	TREATMENT PRE-PERIOD COOLING SENSITIVE CONSUMPTION (KWH)	COMPARISON PRE-PERIOD COOLING SENSITIVE CONSUMPTION (KWH)	PERCENT CHANGE IN TREATMENT COOLING CONSUMPTION	PERCENT CHANGE IN COMPARISON COOLING CONSUMPTION	PERCENT COOLING SAVINGS	RELATIVE PRECISION AT 90% CONFIDENCE
2020-2022	2896	4,585	2,654	2,640	8.02%	-1.56%	9.58%	14.98%

Table 257 and Table 258 show the gas heating and electric cooling savings by the number of thermostats purchased. The gas and electric differences in savings per thermostat were not statistically significant. There were some interesting differences observed between those that installed one vs two thermostats. Per-household savings were higher for natural gas homes that installed multiple thermostats, but lower for electric homes. Both on the gas side and electric side, homes that purchased two thermostats saved less per thermostat than homes that only installed one. Homes which purchased multiple thermostats had higher usage on average, indicating these homes are likely larger in size and it is reasonable to assume both thermostats were typically installed.

Table 257. Smart Thermostat Gas Heating Savings by Total Thermostats Purchased

YEAR	NUMBER OF THERMOSTATS	PRE-PERIOD TREATMENT HEATING CONSUMPTION (THERMS)	PER HOUSEHOLD SAVINGS (THERMS)	HEATING SAVINGS PER THERMOSTAT (THERMS)	PERCENT HEATING SAVINGS	RELATIVE PRECISION AT 90% CONFIDENCE
2020-2022	One	715	43	43	6.0%	7%
	Two	904	69	35	3.8%	24%

Table 258. Smart Thermostat Electric Cooling Savings by Total Thermostats Purchased

YEAR	NUMBER OF THERMOSTATS	PRE-PERIOD TREATMENT COOLING CONSUMPTION (KWH)	PER HOUSEHOLD SAVINGS (KWH)	COOLING SAVINGS PER THERMOSTAT (KWH)	PERCENT COOLING SAVINGS	RELATIVE PRECISION AT 90% CONFIDENCE
2020-2022	One	2,654	254	254	9.6%	15%
	Two	3,655	205	102	2.8%	95%

Gas Furnace EFLH Values

The evaluation team used the PRISM modeling results for 2021 and 2022 participants that installed gas furnaces to calculate heating EFLH values. The evaluation team did not use EFLH values for cooling because disaggregation of electric monthly billing data does not always result in precise estimates of heating, cooling, and baseload components. PRISM modeling can often overestimate the cooling component. The primary reason for this is that there are only about three summer months with cooling related usage and the PRISM model cannot always precisely disaggregate the cooling portion of these months from any other changes in energy consumption that may occur in the summer. The evaluation team calculated heating EFLH values as follows:

$$EFLH = \frac{Post\ Period\ Heating\ Usage}{Heating\ Capacity\ of\ Natural\ Gas\ Furnace}$$

The evaluation team mapped each participant household to the nearest Indiana TRM (v2.2) city by mapping each zip code to the nearest TRM city. Detailed EFLH results for 2022 and 2023 are presented in Table 259 and Table 260 below.

Table 259. 2022 & 2023 Heating EFLH Values

LOCATION	N		HEATING SENSITIVE USAGE (THERMS)		AVERAGE CAPACITY (BTUH)		EFLH	
	2022	2023	2022	2023	2022	2023	2022[a]	2023
Ft. Wayne	3,198	3,182	615	565	72,625	72,344	1,004 (±1%)	993 (±1%)
Indianapolis	607	605	611	564	72,663	72,795	983 (±3%)	953 (±3%)
South Bend	7,919	7,827	694	643	74,443	74,426	1,008 (±1%)	989(±1%)
Terre Haute	23	25	668	663	73,348	75,000	1,219 (±28%)	1,181 (±17%)

[a] Confidence intervals shown at the 90% level.

Table 260. Heating EFLH TRM Comparison

LOCATION	2023 FURNACE UNIT COUNT	IN TRM (2.2) EFLH	BILLING ANALYSIS EFLH		PERCENT DECREASE	
			2022	2023	2022	2023
Ft. Wayne	3,244	1,356	1,004	993	26%	27%
Indianapolis	611	1,341	983	953	27%	28%
South Bend	8,003	1,427	1,008	989	29%	31%
Terre Haute	27	804	1,219	1,181	-52%	-47%

Appendix 2. Residential Lighting Program. This is consistent with evaluation approaches in previous years.

Realization Rates

The next two tables (Table 39 and Table 40) show the program's *ex ante* reported savings, audited gross electric savings, verified savings, *ex post* gross savings and total program realization rates. As noted above, the variance in realization rates is largely a product of methodological differences between the evaluation team's calculation of *ex post* savings and the implementation team's calculation of *ex ante* savings. Whereas *ex ante* and *ex post* savings closely aligned for advanced power strips, these differences in methods and assumptions led to higher *ex post* savings for air purifiers and much lower *ex post* savings for LED fixtures. The high proportion of lighting savings contributed to low overall program level realization rates.

Table 39. 2023 Residential Lighting 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 Fixture (Jan-Jun 2023)	5,834,433.51	5,834,433.51	5,834,433.51	2,884,177.01
LED Fixture (Jul-Dec 2023)	566,138.92	566,138.92	566,138.92	370,162.24
Air Purifier	243,133.00	243,133.00	243,133.00	287,050.51
Advanced Power Strip	630,654.90	630,654.90	**459,991.54	630,626.25
Total Savings	7,274,360.33	7,274,360.33	7,103,696.97	4,172,016.01
Total Program Realization Rate				57%

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 ante* savings already includes an ISR, so it is double counted in verified gross savings. This does not affect the realization rate.

Table 40. 2023 Residential Lighting 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 Fixture (Jan-Jun 2023)	776.452	776.452	776.452	392.575
LED Fixture (Jul-Dec 2023)	90.227	90.227	90.227	50.384
Air Purifier	27.954	27.954	27.954	32.785
Advanced Power Strip	79.322	79.322	**57.856	48.714
Total Savings	973.955	973.955	952.489	524.458
Total Program Realization Rate				54%

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 ante* savings already includes an ISR, so it is double counted in verified gross savings. This does not affect the realization rate.

Ex Post Net Savings

The 2023 evaluation used lighting 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: NIPSCO, AES Indiana, 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.

NTG values for other ENERGY STAR products, like advanced power strips and air purifiers use the 2023 Residential Online Marketplace overall electric weighted NTG average value as a proxy.

Table 41 presents the resulting net electric savings and demand reduction.

Table 41. 2023 Residential Lighting Program *Ex Post* Net Savings

MEASURE	*EX POST* GROSS SAVINGS/REDUCTION		NTG	*EX POST* NET SAVINGS/REDUCTION	
	kWh	kW		kWh	kW
LED Fixture (Jan-Jun 2023)	2,884,177.01	392.575	39%	1,117,618.59	152.123
LED Fixture (Jul-Dec 2023)	370,162.24	50.384	39%	143,437.87	19.524
Air Purifier	287,050.51	32.785	95%	272,697.99	31.145
Advanced Power Strip	630,626.25	48.714	95%	599,094.93	46.279
Total Savings	4,172,016.01	524.458		2,132,849.38	249.071

Process Evaluation

The evaluation team did not complete any major activities related to evaluating the program process.

Conclusions and Recommendations

CONCLUSION 1: DESPITE REDUCING 2023 RESIDENTIAL LIGHTING OFFERINGS IN RESPONSE TO THE EXPANDED DEFINITION OF GENERAL SERVICE LAMPS IN THE EISA BACKSTOP LEGISLATION, THE PROGRAM ACHIEVED 78% OF ITS ELECTRIC ENERGY SAVINGS GOAL AND 72% OF ITS PEAK DEMAND REDUCTION GOAL.

In 2023, the program claimed significantly less savings in the second half of the year because of the EISA backstop. However, the program claimed some savings for EISA impacted LEDs after the EISA backstop which the evaluation team attributed zero *ex post* savings.

CONCLUSION 2: AS NIPSCO LOOKS TO REPLACE LIGHTING SAVINGS, AIR PURIFIERS MAY PROVIDE A STABLE SOURCE OF ENERGY SAVINGS.

In 2023, NIPSCO incentivized 873 air purifiers at an average *ex post* per-unit energy savings of 328.81 kWh. The evaluation team calculated *ex post* savings using actual CADR, CADR per watt, and Partial On Power Mode values for each model, resulting in a 118% realization rate. The rated smoke CADR per watt had a large impact on the calculated savings.

Recommendations:

- Promote the benefits of using air purifiers, particularly those with high CADR per watt, and the incentives NIPSCO provides.
- Provide incentives for a variety of air purifier sizes and models. The current ENERGY STAR qualified products list is long, but there is an opportunity to further expand the list of program eligible models to include those that maximize savings potential, like those with high CADR per watt.
- Determine the calculated savings of various air purifier models using the ENERGY STAR qualified products list to determine which additional models will bring the most savings to the program.

CONCLUSION 3: INACCURATE *EX ANTE* SAVINGS VALUES AND ASSUMPTIONS, LIGHT FIXTURE CLASSIFICATION AND FREERIDERSHIP AFFECTED REALIZATION RATES WHICH VARIED SUBSTANTIALLY BY MEASURE.

The team identified fixtures in the 2023 tracking data for which the default Illinois TRM baseline wattage was unsuitable. This is because the Illinois TRM groups fixtures together in broad categories that disregard the fixtures' brightness and set the baseline equal to the simple average of all ENERGY STAR qualified fixtures that fall into them. This is especially problematic when calculating savings for EISA exempt fixtures with rated lumens at either the very low or very high end of a category. The team used a more custom approach and evaluated these measures against the inefficient lighting they were designed to replace and with similar lumen output.

Recommendations

- Update the baseline wattage assumptions to account for fixture brightness and represent the fixtures they were designed to replace, e.g., LED under cabinet fixtures replace fixtures using T5 fluorescent tubes.
- Work with the evaluation team in 2024 to perform a mid-year audit of lighting tracking data and baseline assumptions used.

CONCLUSION 4: 2023 WAS A TRANSITION YEAR FOR NIPSCO'S UPSTREAM PROGRAM, AS LIGHTING OPTIONS PHASED OUT AND NEW, NON-LIGHTING ENERGY STAR PRODUCTS WERE INTRODUCED TO THE PROGRAM.

As a transition year, the evaluation team did not perform new primary NTG research in 2023 for upstream products. The evaluation team applied 2021 lighting NTG values to the 2023 lighting measures and 2023 Online Marketplace NTG values to non-lighting ENERGY STAR products.

Recommendations:

- Conduct NTG research on upstream utility programs with similar measure offerings in 2024.

5. HOME ENERGY ASSESSMENT (HEA) PROGRAM

Program Design and Delivery

Through the Home Energy Assessment (HEA) program in 2023, 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. TRC performs virtual home energy assessments, while a subcontractor does the in-home assessments. The virtual option is available through customer request only. Though the virtual option was offered by NIPSCO in 2023, there was no customer demand for this pathway.

During 2023, TRC recruited participants through a variety of marketing efforts, including bill inserts, direct mail, the program website, community outreach and events, word-of-mouth, advertising through local newspapers, newsletters, web ads, social media, and program cross-promotion. TRC also updated collateral marketing materials that were used by the subcontractors. Examples of collateral material usage include the subcontractors 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 and Virtual 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, 4W Candelabra, 6W Globe, 15W PAR 38, Downlight Fixture and Retrofit Kit) – up to 22 units
- Bathroom faucet aerator (1.0 gpm) – up to two units
- Kitchen aerator (1.5 gpm) – up to one unit

- Low-flow showerhead (1.5 gpm) * - up to two units
- Shower Start (valve only) * - up to two units
- Low-flow showerhead/shower start combo* - up to two units
- Pipe wrap- up to 10 feet
- Water heater wrap (electric only) – up to one unit
- Duct sealing - $150

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

For the virtual HEAs, the assessor performs a virtual walk-through of the customer's home via a video chat or phone call. Following the assessment, the customer receives the same Home Energy Assessment Report via email as in a regular in-home visit. If the customer qualifies, upon completion of the virtual assessment, along with the emailed report, they may also receive a home energy efficiency kit that includes energy-efficient products (listed above) for self-install.

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 the 2022 Design

In 2022, the HEA program did not include downlight fixtures and retrofit kits. This lighting measure was included for participants in 2023. There were no other significant changes in the program design.

Program Performance

In 2023, the HEA program exceeded its goals for electric energy savings, peak demand reduction, and natural gas energy savings. Reported *ex ante* savings in 2023 were lower than in 2022, despite exceeding goals. In 2023, the program reported 95% of 2022 electric, 54% of 2022 peak demand and 61% of 2022 natural gas energy savings.

Table 42 summarizes savings for the full year of program performance, including program savings goals.

Table 42. 2023 HEA 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.)	687,705.52	696,739.93	696,739.93	687,501.29	759,449.21	536,029.87	110%
Peak Demand Reduction (kW)	151.313	251.154	251.154	249.294	397.145	322.372	262%

METRIC	GROSS SAVINGS GOAL	*EX ANTE*	AUDITED	VERIFIED	*EX POST* GROSS	*EX POST* NET	*EX POST* GROSS GOAL ACHIEVEMENT
Natural Gas Energy Savings (therms/yr.)	49,431.00	100,136.16	100,136.16	98,187.67	96,426.98	82,545.96	195%

As documented in Table 2, *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 for electric energy, peak demand savings, and natural gas savings. *Ex post* gross savings exceeded program goals for all savings types. Finally, the net-to-gross (NTG) analysis reduced *ex post* net results due to the calculated NTG values.

Table 43 outlines the *ex post* and NTG adjustment factors.

Table 43. 2023 HEA Adjustment Factors

METRIC	REALIZATION RATE (%) [A]	FREERIDERSHIP	SPILLOVER	NTG (%) [B]
Electric Energy Savings (kWh/yr.)	109%	29%	0%	71%
Peak Demand Reduction (kW)	158%	19%	0%	81%
Natural Gas Energy Savings (therms/yr.)	96%	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 2023. Table 44 lists the 2023 program budget and expenditures by fuel type.

Table 44. 2023 HEA Program Expenditures

FUEL	PROGRAM BUDGET	PROGRAM EXPENDITURES	BUDGET SPENT (%)
Electric	$510,521.95	$585,691.80	115%
Natural Gas	$156,666.91	$351,032.01	224%

Evaluation Methodology

To inform the 2023 NIPSCO impact 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

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 Illinois TRM v11.0, the 2015 Indiana TRM (v2.2) and NIPSCO's program tracking database.[21,22]

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 (ISR). 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). The evaluation team used the ISRs from the 2022 survey since a participant survey was not conducted for 2023 participants. Table 34 lists the ISRs for all program-installed measures.

Table 34 lists the ISRs for all program-installed measures. The ISRs fell below 100% because some respondents reported removing items after the program installed them. The 95% ISR for assessment recommendations is based on the number of 2022 survey respondents who indicated they received an assessment report.

Table 45. 2023 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

[21] Illinois Energy Efficiency Stakeholder Advisory Group. Illinois Statewide Technical Reference Manual Version 11. September 22, 2022.
[22] Cadmus. Indiana Technical Reference Manual Version 2.2. July 28, 2015.

MEASURE	ISR	SOURCE
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

Table 46 summarizes the tracking data quantity, 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 in-service rate.

Table 46. 2023 HEA Program Audited & Verified Quantities

MEASURE	UNIT OF MEASURE	AUDITED QUANTITY	ISR	VERIFIED QUANTITY
Assessment Recommendations - Electric and Gas Savings	Home	1,214	95%	1,158
Assessment Recommendations - Electric Only	Home	25	95%	24
Assessment Recommendations - Gas Only	Home	178	95%	170
Attic Insulation (Uninsulated Hatch) - Electric Cooling and Gas Heating Savings	Per ksf	41	100%	41
Attic Insulation (Uninsulated Hatch) - Electric Cooling and Heating Savings	Per ksf	1	100%	1
Attic Insulation (Uninsulated Hatch) - Gas Heating Only Savings (Gas Only Customer)	Per ksf	3	100%	3
Bathroom Aerator 1.0 gpm - Electric	Aerator	16	92%	15
Bathroom Aerator 1.0 gpm - Gas	Aerator	363	92%	335
Duct Sealing Package - Electric Cooling and Gas Heating Savings	Home	1,046	100%	1,046
Duct Sealing Package - Electric Cooling and Heating Savings	Home	21	100%	21
Duct Sealing Package - Electric Cooling Only Savings	Home	25	100%	25
Duct Sealing Package - Gas Heating Only Savings	Home	210	100%	210
Kitchen Aerator 1.5 gpm - Electric	Aerator	13	93%	12
Kitchen Aerator 1.5 gpm - Gas	Aerator	236	93%	219
A-Line LEDs - Electric and Gas Savings	Lamp	9,591	99%	9,487
A-Line LEDs - Electric Only Savings	Lamp	213	99%	211
Candelabra LEDs - Electric and Gas Savings	Lamp	3,231	99%	3,196

MEASURE	UNIT OF MEASURE	AUDITED QUANTITY	ISR	VERIFIED QUANTITY
Candelabra LEDs - Electric Only Savings	Lamp	76	99%	75
Downlight Fixture and Retrofit Kit - Electric and Gas Savings	Lamp	645	99%	638
Downlight Fixture and Retrofit Kit - Electric Only Savings	Lamp	4	99%	4
Globe LEDs - Electric and Gas Savings	Lamp	2,098	99%	2,075
Globe LEDs - Electric Only Savings	Lamp	80	99%	79
PAR38 LEDs - Electric and Gas Savings	Lamp	680	99%	673
PAR38 LEDs - Electric Only Savings	Lamp	22	99%	22
Pipe Wrap - Electric (per foot)	Per foot	368	95%	349
Pipe Wrap - Gas (per foot)	Per foot	7,926	95%	7,516
Low-Flow Showerhead 1.5 gpm - Electric	Showerhead	6	86%	5
Low-Flow Showerhead 1.5 gpm - Gas	Showerhead	114	86%	98
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	250	86%	216
Shower Start Only - Gas	Shower Start	3	86%	3
		28,709		27,934

Note: Totals may not sum properly due to rounding.

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 Illinois TRM v11.0 for evaluation methodology and variable assumptions to calculate *ex post* gross electric energy savings, demand reduction, and natural gas savings. Where necessary, the Indiana TRM (v2.2) was used to inform geographic and climate-based inputs. *Appendix 3. Home Energy Assessment Program* contains more specific details on the specific algorithms, variable assumptions, and references for all program measure *ex post* gross calculations.

At the program level, realization rates were between 96% and 158% for all three savings types, although they varied at the measure level. Through engineering review, the evaluation team identified notable differences between *ex ante* and *ex post* savings for bathroom aerator, showerhead, shower start, pipe wrap, attic insulation, and duct sealing measures. These differences were primarily driven by the following overarching factors:

- For **bathroom aerator and showerhead/shower start measures**, the evaluation team used inputs from the Illinois TRM v11.0 which varied from the inputs in the Indiana TRM (v2.2) used in *ex ante* calculations. 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 (v11). The largest changes came from differing pre- and post-installation insulation values which resulted in higher realization rates. The baseline insulation values differ between the Indiana and Illinois TRMs and the *ex post* calculations use the actual average insulation value of the installed insulations as opposed to the Indiana TRM (v2.2) deemed value used in *ex ante* calculations.
- For **attic insulation**, discrepancies stem from the Illinois TRM v11.0 using a completely different algorithm to calculate savings than the Indiana TRM (v2.2) algorithm used to calculate *ex ante* savings. Attic insulation is calculated in the Illinois TRM v11.0 using many different inputs including the baseline and efficient insulation ratings, weather data, and heating and cooling efficiencies but the Indiana TRM (v2.2) simply has tables of default savings values for different climate zones and bins of insulation ratings.
- **Duct insulation** is calculated similarly between the Illinois TRM v11.0 and Indiana TRM (v2.2), using distribution efficiency values, heating and cooling capacities, and efficiencies. It is unclear what causes the discrepancies between *ex ante* and *ex post* savings values because *ex ante* savings use average deemed values from the 2021, 2020, and 2019 Evaluation, Measurement, and Verification (EM&V) results. The most likely discrepancy is between distribution efficiency values, but the evaluation team cannot be sure. Additionally, discrepancies between heating and cooling were not uniform. Heating received below 100% realization rates and cooling received above 100% realization rates.

Some measures showed minor differences between *ex ante* and *ex post* savings. 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 and the Illinois TRM v11.0. The planning and reporting assumptions NIPSCO used to calculate *ex ante* savings referenced the Indiana TRM (v2.2) and the 2021, 2020, and 2019 EM&V results, and sometimes included an average of the savings values provided in each year's EM&V results.
- 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 Summary

Table 47 shows the *ex ante* deemed savings and *ex post* gross per-measure savings for 2023 HEA program measures. Differences in realization rates mainly stem from the *ex post* gross savings source of the Illinois TRM v11.0 versus the *ex ante* savings source of the Indiana TRM (v2.2).

Table 47. 2023 HEA 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
Assessment Recommendations - Electric and Gas Savings	Home	21.24	0.012	2.70	21.24	0.012	2.70
Assessment Recommendations - Electric Only	Home	21.28	0.012	0.00	21.28	0.012	0.00
Assessment Recommendations - Gas Only	Home	0.00	0.000	2.70	0.00	0.000	2.70
Attic Insulation (Uninsulated Hatch) - Electric Cooling and Gas Heating Savings	Per ksf	236.00	0.102	207.00	312.40	0.377	129.78
Attic Insulation (Uninsulated Hatch) - Electric Cooling and Heating Savings	Per ksf	4,942.52	0.068	0.00	1,942.49	0.465	0.00
Attic Insulation (Uninsulated Hatch) - Gas Heating Only Savings (Gas Only Customer)	Per ksf	0.00	0.000	207.00	0.00	0.000	128.59
Bathroom Aerator 1.0 gpm - Electric	Aerator	34.10	0.003	0.00	20.63	0.002	0.00
Bathroom Aerator 1.0 gpm - Gas	Aerator	0.00	0.000	1.50	0.00	0.000	0.89
Duct Sealing Package - Electric Cooling and Gas Heating Savings	Home	61.39	0.138	56.43	130.58	0.268	50.62
Duct Sealing Package - Electric Cooling and Heating Savings	Home	1,189.56	0.354	0.00	1,139.29	0.269	0.00
Duct Sealing Package - Electric Cooling Only Savings	Home	49.48	0.112	0.00	169.16	0.268	0.00

MEASURE	UNIT OF MEASURE	*EX ANTE* DEEMED SAVINGS			*EX POST* GROSS PER-MEASURE SAVINGS		
		kWh	kW	THERMS	kWh	kW	THERMS
Duct Sealing Package - Gas Heating Only Savings	Home	0.00	0.000	56.43	0.00	0.000	49.45
Kitchen Aerator 1.5 gpm - Electric	Aerator	181.36	0.008	0.00	199.15	0.006	0.00
Kitchen Aerator 1.5 gpm - Gas	Aerator	0.00	0.000	7.98	0.00	0.000	8.55
A-Line LEDs - Electric and Gas Savings	Lamp	28.49	0.004	0.00	28.50	0.004	0.00
A-Line LEDs - Electric Only Savings	Lamp	28.49	0.004	0.00	28.40	0.004	0.00
Candelabra LEDs - Electric and Gas Savings	Lamp	30.20	0.004	0.00	29.77	0.004	0.00
Candelabra LEDs - Electric Only Savings	Lamp	30.20	0.004	0.00	29.71	0.004	0.00
Downlight Fixture and Retrofit Kit - Electric and Gas Savings	Lamp	51.53	0.007	0.00	50.16	0.007	0.00
Downlight Fixture and Retrofit Kit - Electric Only Savings	Lamp	51.53	0.007	0.00	50.16	0.007	0.00
Globe LEDs - Electric and Gas Savings	Lamp	28.52	0.004	0.00	28.50	0.004	0.00
Globe LEDs - Electric Only Savings	Lamp	28.52	0.004	0.00	28.51	0.004	0.00
PAR38 LEDs - Electric and Gas Savings	Lamp	103.36	0.014	0.00	88.09	0.012	0.00
PAR38 LEDs - Electric Only Savings	Lamp	103.36	0.014	0.00	88.08	0.012	0.00
Pipe Wrap - Electric (per foot)	Per foot	24.82	0.003	0.00	60.66	0.007	0.00
Pipe Wrap - Gas (per foot)	Per foot	0.00	0.000	1.11	0.00	0.000	2.60
Low-Flow Showerhead 1.5 gpm - Electric	Showerhead	285.65	0.017	0.00	138.99	0.002	0.00
Low-Flow Showerhead 1.5 gpm - Gas	Showerhead	0.00	0.000	12.57	0.00	0.000	5.85
Low-Flow Showerhead with Shower Start - Electric	Showerhead with Shower Start	343.79	0.059	0.00	167.68	0.006	0.00

MEASURE	UNIT OF MEASURE	*EX ANTE* DEEMED SAVINGS			*EX POST* GROSS PER-MEASURE SAVINGS		
		kWh	kW	THERMS	kWh	kW	THERMS
Low-Flow Showerhead with Shower Start - Gas	Showerhead with Shower Start	0.00	0.000	15.13	0.00	0.000	7.20
Shower Start Only - Gas	Shower Start	0.00	0.000	4.48	0.00	0.000	2.01

Table 48 highlights notable differences between *ex ante* and *ex post* gross estimates.

Table 48. 2023 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
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 Illinois TRM v11.0, 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 v11.0. The IL TRM was used for values that do not 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 v11.0 for all inputs besides shower events per day which is based on the 2022 HEA participant 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 v10.0.	*Ex post* savings are based on the Illinois TRM v11.0 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 2021 EM&V savings values for natural gas and electric water heaters.	Illinois TRM v11.0 used for all inputs.	Bare pipe and insulation R-values.
Attic Insulation	*Ex ante* savings are based on 2019, 2020, and 2021 EM&V results.	*Ex post* savings are calculated using IL TRM v11.0 algorithms and inputs with program data used for R-values.	*Ex ante* demand savings differ from *ex post* due to *ex post* using prior program averages.
Duct Sealing	*Ex ante* savings are based on 2019, 2020, and 2021 EM&V results.	*Ex post* savings are calculated using IL TRM v11.0 algorithms and inputs.	*Ex ante* demand savings differ from *ex post* due to *ex ante* using prior program averages.

Waste Heat Factor – Therm Penalties

The evaluation team did not include therm penalties when calculating evaluated savings for the 2023 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 -10,623.99 therms (from the tracking data). In total, the therm penalty for cost-effectiveness analysis is -9,891.22 therms (Table 49).

Table 49. 2023 HEA Program Waste Heat Factor Therm Penalty

MEASURE	WASTE HEAT FACTOR THERM PENALTY
A-Line LEDs - Electric and Gas Savings	(5,525.64)
A-Line LEDs - Electric Only Savings	0.00
Candelabra LEDs - Electric and Gas Savings	(1,944.05)
Candelabra LEDs - Electric Only Savings	0.00
Downlight Fixture and Retrofit Kit	(2.06)
Downlight Fixture and Retrofit Kit - Electric Only Savings	0.00
Globe LEDs - Electric and Gas Savings	(1,209.22)
Globe LEDs - Electric Only Savings	0.00
PAR38 LEDs - Electric and Gas Savings	(1,210.25)
PAR38 LEDs - Electric Only Savings	0.00
Total	(9,891.22)

Realization Rates

The next three tables (Table 50 through Table 52) show the program's *ex ante* reported savings, verified savings, *ex post* gross savings and total program realization rates for kWh, kW, and therms.

Table 50. 2023 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	25,785.36	25,785.36	24,596.65	24,596.65
Assessment Recommendations - Electric Only	532.00	532.00	507.47	507.44
Assessment Recommendations - Gas Only	0.00	0.00	0.00	0.00
Attic Insulation (Uninsulated Hatch) - Electric Cooling and Gas Heating Savings	9,595.05	9,595.05	9,152.72	12,701.37
Attic Insulation (Uninsulated Hatch) - Electric Cooling and Heating Savings	5,901.37	5,901.37	5,629.32	2,319.34
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	545.60	545.60	502.82	304.13
Bathroom Aerator 1.0 gpm - Gas	0.00	0.00	0.00	0.00
Duct Sealing Package - Electric Cooling and Gas Heating Savings	64,213.94	64,213.94	64,213.94	136,585.52
Duct Sealing Package - Electric Cooling and Heating Savings	24,980.76	24,980.76	24,980.76	23,925.15
Duct Sealing Package - Electric Cooling Only Savings	1,237.00	1,237.00	1,237.00	4,229.05
Duct Sealing Package - Gas Heating Only Savings	0.00	0.00	0.00	0.00
Kitchen Aerator 1.5 gpm - Electric	2,357.68	2,357.68	2,182.98	2,397.09
Kitchen Aerator 1.5 gpm - Gas	0.00	0.00	0.00	0.00
A-Line LEDs - Electric and Gas Savings	273,247.59	273,247.59	270,296.52	270,418.73
A-Line LEDs - Electric Only Savings	6,068.37	6,068.37	6,002.83	5,984.64
Candelabra LEDs - Electric and Gas Savings	97,576.20	97,576.20	96,522.38	95,140.86

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.)
Candelabra LEDs - Electric Only Savings	2,295.20	2,295.20	2,270.41	2,233.48
Downlight Fixture and Retrofit Kit - Electric and Gas Savings	33,236.85	33,236.85	32,877.89	32,006.23
Downlight Fixture and Retrofit Kit - Electric Only Savings	206.12	206.12	203.89	198.49
Globe LEDs - Electric and Gas Savings	59,834.96	59,834.96	59,188.74	59,143.22
Globe LEDs - Electric Only Savings	2,281.60	2,281.60	2,256.96	2,256.33
PAR38 LEDs - Electric and Gas Savings	70,284.80	70,284.80	69,525.72	59,251.93
PAR38 LEDs - Electric Only Savings	2,273.92	2,273.92	2,249.36	1,916.84
Pipe Wrap - Electric (per foot)	9,133.76	9,133.76	8,661.54	21,168.24
Pipe Wrap - Gas (per foot)	0.00	0.00	0.00	0.00
Low-Flow Showerhead 1.5 gpm - Electric	1,713.90	1,713.90	1,477.55	718.94
Low-Flow Showerhead 1.5 gpm – Gas	0.00	0.00	0.00	0.00
Low-Flow Showerhead with Shower Start - Electric	3,437.90	3,437.90	2,963.81	1,445.54
Low-Flow Showerhead with Shower Start - Gas	0.00	0.00	0.00	0.00
Shower Start Only - Gas	0.00	0.00	0.00	0.00
Total Savings	696,739.93	696,739.93	687,501.29	759,449.21
Total Program Realization Rate				109%

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 51. 2023 HEA 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.)
Assessment Recommendations - Electric and Gas Savings	14.568	14.568	13.896	13.896
Assessment Recommendations - Electric Only	0.300	0.300	0.286	0.286

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.)
Assessment Recommendations - Gas Only	0.000	0.000	0.000	0.000
Attic Insulation (Uninsulated Hatch) - Electric Cooling and Gas Heating Savings	4.148	4.148	3.957	15.328
Attic Insulation (Uninsulated Hatch) - Electric Cooling and Heating Savings	0.081	0.081	0.077	0.555
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	0.048	0.048	0.044	0.023
Bathroom Aerator 1.0 gpm - Gas	0.000	0.000	0.000	0.000
Duct Sealing Package - Electric Cooling and Gas Heating Savings	144.348	144.348	144.348	280.163
Duct Sealing Package - Electric Cooling and Heating Savings	7.434	7.434	7.434	5.649
Duct Sealing Package - Electric Cooling Only Savings	2.800	2.800	2.800	6.709
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	38.364	38.364	37.950	36.834
A-Line LEDs - Electric Only Savings	0.852	0.852	0.843	0.818
Candelabra LEDs - Electric and Gas Savings	12.924	12.924	12.784	12.956
Candelabra LEDs - Electric Only Savings	0.304	0.304	0.301	0.305
Downlight Fixture and Retrofit Kit - Electric and Gas Savings	4.515	4.515	4.466	4.356
Downlight Fixture and Retrofit Kit - Electric Only Savings	0.028	0.028	0.028	0.027
Globe LEDs - Electric and Gas Savings	8.392	8.392	8.301	8.057
Globe LEDs - Electric Only Savings	0.320	0.320	0.317	0.307

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.)
PAR38 LEDs - Electric and Gas Savings	9.520	9.520	9.417	8.065
PAR38 LEDs - Electric Only Savings	0.308	0.308	0.305	0.261
Pipe Wrap - Electric (per foot)	1.104	1.104	1.047	2.415
Pipe Wrap - Gas (per foot)	0.000	0.000	0.000	0.000
Low-Flow Showerhead 1.5 gpm - Electric	0.102	0.102	0.088	0.009
Low-Flow Showerhead 1.5 gpm – Gas	0.000	0.000	0.000	0.000
Low-Flow Showerhead with Shower Start - Electric	0.590	0.590	0.509	0.056
Low-low Showerhead with Shower Start - Gas	0.000	0.000	0.000	0.000
Shower Start Only - Gas	0.000	0.000	0.000	0.000
Total Savings	251.154	251.154	249.294	397.145
Total Program Realization Rate				158%

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 52. 2023 HEA 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 GASS ENERGY SAVINGS (THERMS/YR.)	*EX POST* GROSS NATURAL GAS ENERGY SAVINGS (THERMS/YR.)
Assessment Recommendations - Electric and Gas Savings	3,277.80	3,277.80	3,126.69	3,126.69
Assessment Recommendations - Electric Only	0.00	0.00	0.00	0.00
Assessment Recommendations - Gas Only	480.60	480.60	458.44	458.44
Attic Insulation (Uninsulated Hatch) - Electric Cooling and Gas Heating Savings	8,415.98	8,415.98	8,028.00	5,276.37
Attic Insulation (Uninsulated Hatch) - Electric Cooling and Heating Savings	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 GASS ENERGY SAVINGS (THERMS/YR.)	*EX POST* GROSS NATURAL GAS ENERGY SAVINGS (THERMS/YR.)
Attic Insulation (Uninsulated Hatch) - Gas Heating Only Savings (Gas Only Customer)	631.14	631.14	602.04	392.08
Bathroom Aerator 1.0 gpm - Electric	0.00	0.00	0.00	0.00
Bathroom Aerator 1.0 gpm - Gas	544.50	544.50	501.81	296.21
Duct Sealing Package - Electric Cooling and Gas Heating Savings	59,025.78	59,025.78	59,025.78	52,949.10
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	11,850.30	11,850.30	11,850.30	10,384.00
Kitchen Aerator 1.5 gpm - Electric	0.00	0.00	0.00	0.00
Kitchen Aerator 1.5 gpm - Gas	1,883.28	1,883.28	1,743.73	1,868.25
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
Downlight Fixture and Retrofit Kit - Electric and Gas Savings	0.00	0.00	0.00	0.00
Downlight Fixture and Retrofit Kit - 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)	8,797.86	8,797.86	8,343.01	19,544.81
Low-Flow Showerhead 1.5 gpm - Electric	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 GASS ENERGY SAVINGS (THERMS/YR.)	*EX POST* GROSS NATURAL GAS ENERGY SAVINGS (THERMS/YR.)
Low-Flow Showerhead 1.5 gpm - Gas	1,432.98	1,432.98	1,235.37	574.69
Low-Flow Showerhead with Shower Start - Electric	0.00	0.00	0.00	0.00
Low-Flow Showerhead with Shower Start - Gas	3,782.50	3,782.50	3,260.89	1,551.16
Shower Start Only - Gas	13.44	13.44	11.59	5.19
Total Savings	100,136.16	100,136.16	98,187.67	96,426.98
Total Program Realization Rate				96%

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 evaluation team based net-to-gross (NTG) ratios for most measures on self-reported responses to participant survey questions from the 2022 survey.

The 2022 participant survey NTG 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 – 2022), 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 53 shows the NTG ratios by measure.

Table 53. 2023 HEA Program Net-to Gross Ratios by Measure

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

Table 54 presents the resulting net electric savings, demand reduction, and natural gas savings.

Table 54. HEA 2023 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	24,596.65	13.896	3,126.69	100%	24,596.65	13.896	3,126.69
Assessment Recommendations - Electric Only	507.44	0.286	0.00	100%	507.44	0.286	0.00
Assessment Recommendations - Gas Only	0.00	0.000	458.44	100%	0.00	0.000	458.44
Attic Insulation (Uninsulated Hatch) - Electric Cooling and Gas Heating Savings	12,701.37	15.328	5,276.37	80%	10,161.09	12.262	4,221.09
Attic Insulation (Uninsulated Hatch) - Electric Cooling and Heating Savings	2,319.34	0.555	0.00	80%	1,855.47	0.444	0.00
Attic Insulation (Uninsulated Hatch) - Gas Heating Only Savings (Gas Only Customer)	0.00	0.000	392.08	80%	0.00	0.000	313.66
Bathroom Aerator 1.0 gpm - Electric	304.13	0.023	0.00	97%	295.36	0.022	0.00
Bathroom Aerator 1.0 gpm - Gas	0.00	0.000	296.21	97%	0.00	0.000	287.66
Duct Sealing Package - Electric Cooling and Gas Heating Savings	136,585.52	280.163	52,949.10	85%	115,507.50	236.928	44,777.95

MEASURE	*EX POST* GROSS SAVINGS/REDUCTION			NTG	*EX POST* NET SAVINGS/REDUCTION		
	kWh	kW	THERMS		kWh	kW	THERMS
Duct Sealing Package - Electric Cooling and Heating Savings	23,925.15	5.649	0.00	85%	20,233.00	4.777	0.00
Duct Sealing Package - Electric Cooling Only Savings	4,229.05	6.709	0.00	85%	3,576.42	5.674	0.00
Duct Sealing Package - Gas Heating Only Savings	0.00	0.000	10,384.00	85%	0.00	0.000	8,781.53
Kitchen Aerator 1.5 gpm - Electric	2,397.09	0.071	0.00	98%	2,337.16	0.069	0.00
Kitchen Aerator 1.5 gpm - Gas	0.00	0.000	1,868.25	98%	0.00	0.000	1,821.54
A-Line LEDs - Electric and Gas Savings	270,418.73	36.834	0.00	64%	172,297.88	23.469	0.00
A-Line LEDs - Electric Only Savings	5,984.64	0.818	0.00	64%	3,813.13	0.521	0.00
Candelabra LEDs - Electric and Gas Savings	95,140.86	12.956	0.00	64%	60,619.21	8.255	0.00
Candelabra LEDs - Electric Only Savings	2,233.48	0.305	0.00	64%	1,423.07	0.194	0.00
Downlight Fixture and Retrofit Kit - Electric and Gas Savings	32,006.23	4.356	0.00	64%	20,392.84	2.776	0.00
Downlight Fixture and Retrofit Kit - Electric Only Savings	198.49	0.027	0.00	64%	126.47	0.017	0.00
Globe LEDs - Electric and Gas Savings	59,143.22	8.057	0.00	64%	37,683.23	5.133	0.00
Globe LEDs - Electric Only Savings	2,256.33	0.307	0.00	64%	1,437.62	0.196	0.00
PAR38 LEDs - Electric and Gas Savings	59,251.93	8.065	0.00	64%	37,752.50	5.139	0.00
PAR38 LEDs - Electric Only Savings	1,916.84	0.261	0.00	64%	1,221.32	0.166	0.00
Pipe Wrap - Electric (per foot)	21,168.24	2.415	0.00	87%	18,339.59	2.092	0.00
Pipe Wrap - Gas (per foot)	0.00	0.000	19,544.81	87%	0.00	0.000	16,933.09
Low-Flow Showerhead 1.5 gpm - Electric	718.94	0.009	0.00	86%	615.46	0.007	0.00
Low-Flow Showerhead 1.5 gpm - Gas	0.00	0.000	574.69	86%	0.00	0.000	491.97

MEASURE	*EX POST* GROSS SAVINGS/REDUCTION			NTG	*EX POST* NET SAVINGS/REDUCTION		
	kWh	kW	THERMS		kWh	kW	THERMS
Low-Flow Showerhead with Shower Start - Electric	1,445.54	0.056	0.00	86%	1,237.47	0.048	0.00
Low-Flow Showerhead with Shower Start - Gas	0.00	0.000	1,551.16	86%	0.00	0.000	1,327.88
Shower Start Only - Gas	0.00	0.000	5.19	86%	0.00	0.000	4.45
Total Savings	759,449.21	397.145	96,426.98	88%	536,029.87	322.372	82,545.96

Note: Totals may not sum properly due to rounding.

Table 55 shows the net-to-gross results for each fuel.

Table 55. 2023 HEA 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.)	696,739.93	759,449.21	71%	536,029.87
Peak Demand Reduction (kW)	251.154	397.145	81%	322.372
Natural Gas Energy Savings (therms/yr.)	100,136.16	96,426.98	86%	82,545.96

Process Evaluation

The evaluation team did not complete any major activities related to evaluating the program process.

Conclusions and Recommendations

CONCLUSION 1: THE PROGRAM EXCEEDED ALL SAVINGS GOALS IN 2023.

The program exceeded savings goals in 2023, as it also did in 2022, achieving 110% of electric energy savings, 263% of peak demand reduction, and 195% of natural gas energy savings *ex post* gross goals. The program continued to see robust participation, continuing a rebound from 2021 participation rates. However, it should be noted that the program also exceeded its planned budget.

CONCLUSION 2: THE USE OF THE INDIANA TRM AND PREVIOUS PROGRAM AVERAGES IN *EX ANTE* SAVINGS CALCULATIONS LED TO *EX POST* GROSS SAVINGS BEING HIGHER THAN *EX ANTE* SAVINGS FOR ELECTRIC ENERGY SAVINGS AND DEMAND REDUCTION, AND LOWER FOR NATURAL GAS ENERGY SAVINGS.

The evaluation team identified notable measure-level differences between *ex ante* and *ex post* savings for pipe wrap, attic insulation, and duct sealing measures through the engineering review. The drivers of these measure level differences include discrepancies in insulation values, heating and cooling efficiencies, and algorithms.

Recommendations:

- Update *ex ante* savings approaches to the Illinois TRM v12.0, as instructed by the new Indiana Technical Reference Manual Workbook v1.0. Where applicable, use Indiana location specific input assumptions from Indiana TRM v1.0, which map to climate comparable Illinois TRM cities. Update measures that are passing through old program averages (like duct insulation) instead of calculating them.

CONCLUSION 3: LED LIGHTING RETROFITS COMPRISED 70% OF *EX POST* (AND 79% OF *EX ANTE*) HEA PROGRAM SAVINGS IN 2023.

Lighting continued to provide most HEA savings; however, the program may need to look for other sources of electric savings in the future. Beginning with IL TRM v12.0 for the 2024 program year, the TRM is explicit in limiting LED retrofit savings only to direct install programs where “it can be shown that the LED is replacing inefficient lighting” and that programs “should continue to use the existing inefficient lighting as a baseline and also assume a measure life of 2 years.”

Recommendations:

- Supply project documentation in the form of photographs of inefficient *in situ* lighting prior to it being replaced.
- Prioritize the installation of smart thermostats in the program to increase electric savings. Unlike the programmable thermostats offered in 2023, which can only claim heating savings according to the Illinois TRM v11.0, smart thermostats have the potential to increase heating savings as well as reintroduce cooling savings.

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).

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 Home Depot to implement the IQW program. TRC trains their subcontractors to ensure that work quality and customer service meet program standards. Threshold performs the in-home assessments and direct installation of measures. Home Depot 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 various channels including word-of-mouth, community outreach events, the NIPSCO website, and social media. TRC also developed collateral material such as door hangtags and yard signs to promote awareness.

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, 4W Candelabra, 6W Globe, 15W Par 38, Downlight Fixture and Retrofit Kit) - up to 22 units
- Bathroom faucet aerator (1.0 gpm) – up to two units
- Kitchen aerator (1.5 gpm) – up to one unit
- Low-flow showerhead (1.5 gpm) - up to two units
- Shower Start (valve only) – up to two units
- Low-flow showerhead/shower start combo – up to two units
- Pipe wrap – up to 10 feet
- Water heater wrap (electric only) – up to one unit
- Duct sealing – up to $150
- Programmable thermostat – up to one unit

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

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

- Air sealing (20% infiltration reduction) –$400 per measure.
- Attic insulation (uninsulated hatch; R-38 insulation replacing < R-11) - $2,000 per 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 - 1 unit.

At the end of the assessment, the energy advisor provides a CHA report, responding to any participants' concerns, and providing 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 the 2022 Design

In 2022, the IQW program did not include downlight fixtures and retrofit kits. This lighting measure is now included for participants in 2023. Additionally, the program changed its refrigerator replacement subcontractor from ARCA to Home Depot after ARCA ceased operations.

Program Performance

In 2023, IQW fell short of program goals for electric energy savings and natural gas energy savings. The program exceeded its peak demand reduction savings. Reported ex ante savings in 2023 were similar to 2022, when program staff indicated less opportunity for savings per household and the need to increase program awareness.[23]

Audited savings aligned with *ex ante* savings, indicating no issues with tracking data. Verified savings were somewhat lower than claimed due to in-service rates (ISR) of select measures. The engineering analysis completed for the *ex post* gross analysis increased savings across the board.

Table 56 summarizes savings for the full year of program performance, including program savings goals.

Table 56. 2023 IQW Program Saving Summary

METRIC	GROSS SAVINGS GOAL	*EX ANTE*	AUDITED	VERIFIED	*EX POST* GROSS	*EX POST* NET	GROSS GOAL ACHIEVE-MENT
Electric Energy Savings (kWh/yr.)	1,247,605.55	502,037.15	502,037.15	486,536.68	579,744.11	579,744.11	46%
Peak Demand Reduction (kW)	275.381	157.041	157.041	155.125	396.611	396.611	144%
Natural Gas Energy Savings (therms/yr.)	280,526.51	157,930.06	157,930.06	152,133.06	120,776.77	120,776.77	43%

Table 57 outlines the *ex post* and NTG adjustment factors. Note that net-to-gross (NTG) is deemed at 100%, as is common practice for income qualified programs.

Table 57. 2023 IQW Adjustment Factors

METRIC	REALIZATION RATE (%)[a]	FREERIDERSHIP	SPILLOVER	NTG (%)[b]
Electric Energy Savings (kWh/yr.)	115%	0%	0%	100%
Peak Demand Reduction (kW)	253%	0%	0%	100%
Natural Gas Energy Savings (therms/yr.)	76%	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.

Table 58 lists the 2023 program budget and expenditures by fuel type. The program underspent the budget for both electric and natural gas.

[23] In 2022, the program reported *ex ante* savings of 554,699.08 kWh, 267.032 kW, and 204,126.94 therms.

Table 58. 2023 IQW Program Expenditures

FUEL	PROGRAM BUDGET	PROGRAM EXPENDITURES	BUDGET SPENT (%)
Electric	$1,101,490.76	$538,297.11	49%
Natural Gas	$1,719,242.17	$1,045,290.94	61%

Evaluation Methodology

To inform the 2023 IQW 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.
- **Literature review,** to understand how other similar programs are operating and examine strategies for increasing participation.

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 Illinois TRM v11.0, the 2015 Indiana TRM (v2.2) and NIPSCO's program tracking database.[24,2]

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 results from the 2022 participant survey.

[24] Illinois Energy Efficiency Stakeholder Advisory Group. Illinois Statewide Technical Reference Manual Version 11. September 22, 2022.
[2] Cadmus. Indiana Technical Reference Manual Version 2.2. July 28, 2015.

Table 59 lists the ISRs for all program-installed measures. The ISRs fell below 100% because some respondents reported removing items after the program installed them. The ISR for assessment recommendations is based on the number of 2022 survey respondents who indicated they received an assessment report.

Table 59. 2023 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

Table 60 summarizes the tracking data quantity, 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.

Table 60. 2023 IQW Program Audited & Verified Quantities

MEASURE	UNIT OF MEASURE	AUDITED QUANTITY	ISR	VERIFIED QUANTITY
Air Sealing - Electric Cooling and Gas Heating Savings	Home	214	100%	214
Air Sealing - Electric Cooling and Heating Savings	Home	2	100%	2
Air Sealing - Gas Heating Only Savings (Combo Customer)	Home	9	100%	9
Air Sealing - Gas Heating Only Savings (Gas Only Customer)	Home	43	100%	43
Assessment Recommendations - Electric and Gas Savings	Home	685	92%	630
Assessment Recommendations - Electric Only	Home	20	92%	18
Assessment Recommendations - Gas Only	Home	153	92%	141
Attic Insulation (Uninsulated Hatch) - Electric Cooling and Gas Heating Savings	Per ksf	197	100%	197

MEASURE	UNIT OF MEASURE	AUDITED QUANTITY	ISR	VERIFIED QUANTITY
Attic Insulation (Uninsulated Hatch) - Electric Cooling and Heating Savings	Per ksf	2	100%	2
Attic Insulation (Uninsulated Hatch) - Gas Heating Only Savings (Combo Customer)	Per ksf	15	100%	15
Attic Insulation (Uninsulated Hatch) - Gas Heating Only Savings (Gas Only Customer)	Per ksf	37	100%	37
Bathroom Aerator 1.0 gpm - Electric	Aerator	21	96%	20
Bathroom Aerator 1.0 gpm - Gas	Aerator	261	96%	251
Duct Sealing Package - Electric Cooling and Gas Heating Savings	Home	458	100%	458
Duct Sealing Package - Electric Cooling and Heating Savings	Home	4	100%	4
Duct Sealing Package - Electric Cooling Only Savings	Home	8	100%	8
Duct Sealing Package - Gas Heating Only Savings	Home	259	100%	259
H&S - Attic Subfloor Install/Repair	Home	60	100%	60
H&S - Dryer Vent Install/Repair/Replace Plastic with Aluminum	Home	594	100%	594
H&S - Duct Work Reconnection	Home	90	100%	90
Kitchen Aerator 1.5 gpm - Electric	Aerator	15	93%	14
Kitchen Aerator 1.5 gpm - Gas	Aerator	238	93%	222
A-Line LEDs - Electric and Gas Savings	Lamp	5258	97%	5104
A-Line LEDs - Electric Only Savings	Lamp	142	97%	138
Candelabra LEDs - Electric and Gas Savings	Lamp	1572	97%	1526
Candelabra LEDs - Electric Only Savings	Lamp	11	97%	11
Downlight Fixture and Retrofit Kit - Electric and Gas Savings	Lamp	69	97%	67
Globe LEDs - Electric and Gas Savings	Lamp	810	97%	786
Globe LEDs - Electric Only Savings	Lamp	23	97%	22
PAR38 LEDs - Electric and Gas Savings	Lamp	302	97%	293
PAR38 LEDs - Electric Only Savings	Lamp	2	97%	2
Pipe Wrap - Electric (per foot)	Per foot	236	89%	210
Pipe Wrap - Gas (per foot)	Per foot	4547	89%	4042
ENERGY STAR Refrigerator replace non-ENERGY STAR refrigerator (Old Model Year: <1993, New Capacity: 18 CF) - ARCA	Refrigerator	1	100%	1
ENERGY STAR Refrigerator replace non-ENERGY STAR refrigerator (Old Model Year: <1993, New Capacity: 18 CF) - HD	Refrigerator	2	100%	2
ENERGY STAR Refrigerator replace non-ENERGY STAR refrigerator (Old Model Year: <1993, New Capacity: 20 CF) - ARCA	Refrigerator	3	100%	3
ENERGY STAR Refrigerator replace non-ENERGY STAR refrigerator (Old Model Year: <1993, New Capacity: 20 CF) - HD	Refrigerator	3	100%	3

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) - ARCA	Refrigerator	1	100%	1
ENERGY STAR Refrigerator replace non-ENERGY STAR refrigerator (Old Model Year: 1993-2010, New Capacity: 16 CF) - HD	Refrigerator	3	100%	3
ENERGY STAR Refrigerator replace non-ENERGY STAR refrigerator (Old Model Year: 1993-2010, New Capacity: 18 CF) - ARCA	Refrigerator	19	100%	19
ENERGY STAR Refrigerator replace non-ENERGY STAR refrigerator (Old Model Year: 1993-2010, New Capacity: 18 CF) - HD	Refrigerator	12	100%	12
ENERGY STAR Refrigerator replace non-ENERGY STAR refrigerator (Old Model Year: 1993-2010, New Capacity: 20 CF) - ARCA	Refrigerator	56	100%	56
ENERGY STAR Refrigerator replace non-ENERGY STAR refrigerator (Old Model Year: 1993-2010, New Capacity: 20 CF) - HD	Refrigerator	36	100%	36
Low-flow Showerhead 1.5 gpm - Electric	Showerhead	13	86%	11
Low-flow Showerhead 1.5 gpm - Gas	Showerhead	91	86%	78
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	169	86%	146
Shower Start Only - Electric	Shower Start	1	86%	1
Shower Start Only - Gas	Shower Start	4	86%	3
Programmable Thermostat - Electric Cooling and Gas Heating Savings	Thermostat	148	76%	112
Programmable Thermostat - Electric Cooling and Heating Savings	Thermostat	1	76%	1
Programmable Thermostat - Electric Cooling Only Savings	Thermostat	1	76%	1
Programmable Thermostat - Electric Heating Only Savings	Thermostat	1	76%	1
Programmable Thermostat - Gas Heating Only Savings	Thermostat	93	76%	71
Programmable Thermostat - Heat Pump Savings	Thermostat	1	76%	1
		17,025		16,059

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 Illinois TRM v11.0 for evaluation methodology and variable assumptions to calculate *ex post* gross electric energy savings, demand reduction, and natural gas savings. Where necessary, the Indiana TRM (v2.2) was used to inform geographic and climate-based inputs. *Appendix A: HEA Algorithms and Assumptions* contains more specific details on the specific algorithms, variable assumptions, and references for all program measure *ex post* gross calculations.

At the program level, realization rates were between 76% and 253% for all three savings types, although they varied at the measure level. Through the engineering review, the evaluation team identified notable differences between *ex ante* and *ex post* savings for bathroom aerator, showerhead, shower start, pipe wrap, attic insulation, air sealing, duct sealing, programmable thermostat, and refrigerator replacement measures. These differences were primarily driven by the following overarching factors:

- For **bathroom aerator and showerhead/shower start measures**, the evaluation team used inputs from the Illinois TRM v11.0 which varied from the inputs in the Indiana TRM (v2.2) used in *ex ante* calculations. 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 v11.0. The largest changes came from differing pre- and post-installation insulation values which resulted in higher realization rates. The baseline insulation values differ between the Indiana and Illinois TRMs and the *ex post* calculations use the actual average insulation value of the installed insulations as opposed to the Indiana TRM (v2.2) deemed value used in *ex ante* calcs.
- For **attic insulation and air sealing**, discrepancies stem from the Illinois TRM v11.0 using completely different algorithms to calculate savings than the Indiana TRM (v2.2) algorithms used to calculate *ex ante* savings. The Illinois TRM v11.0 calculates these measures using detailed algorithms and inputs but the Indiana TRM (v2.2) savings are mostly deemed based on geographic location.
- **Duct sealing** is calculated similarly between the Illinois TRM v11.0 and Indiana TRM (v2.2), using distribution efficiency values, heating and cooling capacities, and efficiencies. It is unclear what causes the discrepancies between *ex ante* and *ex post* savings values because *ex ante* savings use average deemed values from the 2021, 2020, and 2019 Evaluation, Measurement, and Verification (EM&V) results. The most likely discrepancy is between distribution efficiency values, but the evaluation team cannot be sure. Additionally, discrepancies between heating and cooling were not uniform. Heating received below 100% realization rates and cooling received above 100% realization rates.
- **Programmable thermostat** measures saw low realization rates because the Illinois TRM v11.0 does not incorporate cooling savings. The *ex ante* calculations do take cooling into account and thus have inflated cooling savings values.
- Some **refrigerator replacement** measures saw low realization rates because the *ex ante* savings calculated the existing refrigerator usage using the Indiana TRM (v2.2). *Ex post* savings used the Illinois TRM v11.0's algorithm to calculate refrigerator usage. This resulted in lower existing usage values for some measures and lowered savings.

Some measures showed minor differences between *ex ante* and *ex post* savings. 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 and the Illinois TRM v11.0. The planning and reporting assumptions NIPSCO used to calculate *ex ante* savings referenced the Indiana TRM (v2.2) and the 2021, 2020, and 2019 Evaluation, Measurement, and Verification (EM&V) results, and sometimes included an average of the savings values provided in each year's EM&V results.
- 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 Summary

Table 61 shows the *ex ante* deemed savings and *ex post* gross per-measure savings for 2023 Income Qualified Weatherization program measures. Differences in realization rates mainly stem from the update to the Illinois TRM v11.0 versus the *ex ante* savings source of the Indiana TRM (v2.2).

Table 61. 2023 IQW 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
Air Sealing - Electric Cooling and Gas Heating Savings	Home	104.78	0.054	123.27	386.85	0.637	80.97
Air Sealing - Electric Cooling and Heating Savings	Home	2,259.93	0.125	0.00	1,279.91	0.533	0.00
Air Sealing - Gas Heating Only Savings (Combo Customer)	Home	53.89	0.000	215.07	81.59	0.000	88.68
Air Sealing - Gas Heating Only Savings (Gas Only Customer)	Home	0.00	0.000	133.10	0.00	0.000	85.25
Assessment Recommendations - Electric and Gas Savings	Home	21.26	0.012	2.69	21.26	0.012	2.69
Assessment Recommendations - Electric Only	Home	21.28	0.012	0.00	21.28	0.012	0.00
Assessment Recommendations - Gas Only	Home	0.00	0.000	2.70	0.00	0.000	2.70
Attic Insulation (Uninsulated Hatch) - Electric Cooling and Gas Heating Savings	Per ksf	236.05	0.116	206.75	339.25	0.405	142.63
Attic Insulation (Uninsulated Hatch) - Electric Cooling and Heating Savings	Per ksf	4,942.52	0.068	0.00	2,020.56	0.485	0.00
Attic Insulation (Uninsulated Hatch) - Gas Heating Only Savings (Combo Customer)	Per ksf	102.15	0.000	210.31	140.53	0.000	142.76
Attic Insulation (Uninsulated Hatch) - Gas Heating Only Savings (Gas Only Customer)	Per ksf	0.00	0.000	213.37	0.00	0.000	137.57
Bathroom Aerator 1.0 gpm - Electric	Aerator	33.80	0.003	0.00	20.63	0.002	0.00
Bathroom Aerator 1.0 gpm - Gas	Aerator	0.00	0.000	1.49	0.00	0.000	0.88

MEASURE	UNIT OF MEASURE	*EX ANTE* DEEMED SAVINGS			*EX POST* GROSS PER-MEASURE SAVINGS		
		KWH	KW	THERMS	KWH	KW	THERMS
Duct Sealing Package - Electric Cooling and Gas Heating Savings	Home	61.39	0.138	56.43	130.78	0.268	50.62
Duct Sealing Package - Electric Cooling and Heating Savings	Home	1,189.56	0.354	0.00	1,148.48	0.268	0.00
Duct Sealing Package - Electric Cooling Only Savings	Home	49.02	0.112	0.00	258.26	0.268	0.00
Duct Sealing Package - Gas Heating Only Savings	Home	0.00	0.000	56.43	0.00	0.000	50.07
Kitchen Aerator 1.5 gpm - Electric	Aerator	180.09	0.008	0.00	199.82	0.006	0.00
Kitchen Aerator 1.5 gpm - Gas	Aerator	0.00	0.000	7.92	0.00	0.000	8.54
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	28.47	0.004	0.00
Candelabra LEDs - Electric and Gas Savings	Lamp	30.20	0.004	0.00	29.77	0.004	0.00
Candelabra LEDs - Electric Only Savings	Lamp	30.20	0.004	0.00	29.78	0.004	0.00
Downlight Fixture and Retrofit Kit - Electric and Gas Savings	Lamp	51.53	0.007	0.00	50.16	0.007	0.00
Globe LEDs - Electric and Gas Savings	Lamp	28.52	0.004	0.00	28.50	0.004	0.00
Globe LEDs - Electric Only Savings	Lamp	28.52	0.004	0.00	28.39	0.004	0.00
PAR38 LEDs - Electric and Gas Savings	Lamp	103.36	0.014	0.00	88.08	0.012	0.00
PAR38 LEDs - Electric Only Savings	Lamp	103.36	0.014	0.00	88.08	0.012	0.00
Pipe Wrap - Electric (per foot)	Per foot	24.82	0.003	0.00	60.66	0.007	0.00
Pipe Wrap - Gas (per foot)	Per foot	0.00	0.000	1.11	0.00	0.000	2.60
ENERGY STAR Refrigerator replace non-ENERGY STAR refrigerator (Old Model Year: <1993, New Capacity: 18 CF) - ARCA	Refrigerator	1,487.33	0.218	0.00	471.65	0.071	0.00
ENERGY STAR Refrigerator replace non-ENERGY STAR refrigerator (Old Model Year: <1993, New Capacity: 18 CF) - HD	Refrigerator	1,487.33	0.218	0.00	483.37	0.073	0.00
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, New Capacity: 20 CF) - HD	Refrigerator	1,618.24	0.238	0.00	513.52	0.077	0.00
ENERGY STAR Refrigerator replace non-ENERGY STAR refrigerator (Old Model Year: 1993-2010, New Capacity: 16 CF) - ARCA	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: 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	439.87	0.065	0.00	438.54	0.066	0.00

MEASURE	UNIT OF MEASURE	*EX ANTE* DEEMED SAVINGS			*EX POST* GROSS PER-MEASURE SAVINGS		
		KWH	KW	THERMS	KWH	KW	THERMS
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	473.62	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	306.39	0.017	0.00	136.61	0.002	0.00
Low-Flow Showerhead 1.5 gpm - Gas	Showerhead	0.00	0.000	13.48	0.00	0.000	5.86
Low-Flow Showerhead with Shower Start - Electric	Showerhead with Shower Start	408.32	0.046	0.00	167.68	0.002	0.00
Low-Flow Showerhead with Shower Start - Gas	Showerhead with Shower Start	0.00	0.000	17.96	0.00	0.000	7.19
Shower Start Only - Electric	Shower Start	101.93	0.007	0.00	46.83	0.007	0.00
Shower Start Only - Gas	Shower Start	0.00	0.000	4.48	0.00	0.000	2.01
Programmable Thermostat - Electric Cooling and Gas Heating Savings	Thermostat	98.15	0.000	74.35	57.33	0.000	62.31
Programmable Thermostat - Electric Cooling and Heating Savings	Thermostat	2,190.44	0.000	0.00	1,288.17	0.000	0.00
Programmable Thermostat - Electric Cooling Only Savings	Thermostat	98.15	0.000	0.00	0.00	0.000	0.00
Programmable Thermostat - Electric Heating Only Savings	Thermostat	2,092.29	0.000	0.00	1,288.17	0.000	0.00
Programmable Thermostat - Gas Heating Only Savings	Thermostat	0.00	0.000	74.35	0.00	0.000	61.93
Programmable Thermostat - Heat Pump Savings	Thermostat	496.83	0.000	0.00	1,288.17	0.000	0.00

Table 62 highlights notable differences between *ex ante* and *ex post* gross estimates.

Table 62. 2023 IQW Notable Differences Between *Ex Ante* and *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). Baseline wattage Hours per TRM. WHF values assume weighted average	*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	Discrepancies in baseline wattage.

	from South Bend per TRM tables.	guidelines and WHFs averaged across customer location, per customer type.	
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 v11.0. The IL TRM was used for values that do not 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 v11.0 for all inputs besides shower events per day which is based on the 2022 IQW participant 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 v10.0.	*Ex post* savings are based on the Illinois TRM v11.0 for all inputs besides shower events per day which is based on the 2022 IQW participant 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 2021 EM&V savings values for natural gas and electric water heaters.	Illinois TRM v11.0 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 IL TRM v11.0 which lacks cooling savings and is based on IL consumption values.	Lack of cooling savings in IL TRM v11.0 and differing consumption assumptions.
Refrigerator Replacement	*Ex ante* savings are based off historical electricity usage data.	*Ex post* savings are based on the actual refrigerator specs and tracking data.	*Ex ante* savings are an average deemed value from 2019, *ex post* savings are calculated using the actual refrigerator specifications and baseline.
Attic Insulation	*Ex ante* savings are based off 2019, 2020, and 2021 EM&V results.	*Ex post* savings are calculated using IL TRM v11.0 algorithms and inputs with program data used for R-values.	*Ex ante* demand savings differ from *ex post* due to *ex post* using prior program averages.

Duct Sealing	*Ex ante* savings are based on 2019, 2020, and 2021 EM&V results.	*Ex post* savings are calculated using IL TRM v11.0 algorithms and inputs.	*Ex ante* demand savings differ from *ex post* due to *ex ante* using prior program averages.
Air Sealing	*Ex ante* savings are calculated using the square footage and IN TRM (v2.2) deemed values.	*Ex post* savings are directly calculated from the IL TRM v11.0 using its deemed inputs.	Different methodologies/ algorithms and inputs.

Waste Heat Factor – Therm Penalties

The evaluation team did not include therm penalties when calculating evaluated savings for the 2023 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. *Ex ante* therm penalties from lighting totaled -5,174.77 therms (from the tracking data). In total, the therm penalty for cost-effectiveness analysis is -4,956.24 therms (Table 63).

Table 63. 2023 IQW Program Wast Heat Factor Therm Penalty

MEASURE	WASTE HEAT FACTOR THERM PENALTY
A-Line LEDs - Electric and Gas Savings	(2,973.61)
Candelabra LEDs - Electric and Gas Savings	(928.32)
Downlight Fixture and Retrofit Kit	(68.64)
Globe LEDs - Electric and Gas Savings	(458.15)
PAR38 LEDs - Electric and Gas Savings	(527.52)
TOTAL	(4,956.24)

Realization Rates

The next three tables (Table 64 through Table 66) show the program's *ex ante* reported savings, verified savings, *ex post* gross savings and total program realization rates for kWh, kW, and therms.

Table 64. 2023 IQW 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 Sealing - Electric Cooling and Gas Heating Savings	22,422.92	22,422.92	22,422.92	82,785.37
Air Sealing - Electric Cooling and Heating Savings	4,519.86	4,519.86	4,519.86	2,559.83

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 Sealing - Gas Heating Only Savings (Combo Customer)	485.01	485.01	485.01	734.27
Air Sealing - Gas Heating Only Savings (Gas Only Customer)	0.00	0.00	0.00	0.00
Assessment Recommendations - Electric and Gas Savings	14,563.10	14,563.10	13,398.05	13,398.05
Assessment Recommendations - Electric Only	425.60	425.60	391.55	391.55
Assessment Recommendations - Gas Only	0.00	0.00	0.00	0.00
Attic Insulation (Uninsulated Hatch) - Electric Cooling and Gas Heating Savings	46,404.88	46,404.88	46,404.88	66,693.40
Attic Insulation (Uninsulated Hatch) - Electric Cooling and Heating Savings	8,115.62	8,115.62	8,115.62	3,317.75
Attic Insulation (Uninsulated Hatch) - Gas Heating Only Savings (Combo Customer)	1,557.59	1,557.59	1,557.59	2,142.82
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	709.80	709.80	683.54	417.10
Bathroom Aerator 1.0 gpm - Gas	0.00	0.00	0.00	0.00
Duct Sealing Package - Electric Cooling and Gas Heating Savings	28,116.62	28,116.62	28,116.62	59,898.99
Duct Sealing Package - Electric Cooling and Heating Savings	4,758.24	4,758.24	4,758.24	4,593.91
Duct Sealing Package - Electric Cooling Only Savings	392.16	392.16	392.16	2,066.06
Duct Sealing Package - Gas Heating Only Savings	0.00	0.00	0.00	0.00
Kitchen Aerator 1.5 gpm - Electric	2,701.35	2,701.35	2,521.17	2,797.38
Kitchen Aerator 1.5 gpm - Gas	0.00	0.00	0.00	0.00
A-Line LEDs - Electric and Gas Savings	149,958.16	149,958.16	145,564.39	145,523.44
A-Line LEDs - Electric Only Savings	4,035.64	4,035.64	3,917.40	3,924.92
Candelabra LEDs - Electric and Gas Savings	47,474.40	47,474.40	46,083.40	45,425.25
Candelabra LEDs - Electric Only Savings	332.20	332.20	322.47	317.98
Downlight Fixture and Retrofit Kit - Electric and Gas Savings	3,555.57	3,555.57	3,451.39	3,359.89
Globe LEDs - Electric and Gas Savings	23,101.20	23,101.20	22,424.33	22,409.59

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.)
Globe LEDs - Electric Only Savings	655.96	655.96	636.74	633.91
PAR38 LEDs - Electric and Gas Savings	31,214.72	31,214.72	30,300.13	25,820.86
PAR38 LEDs - Electric Only Savings	206.72	206.72	200.66	171.00
Pipe Wrap - Electric (per foot)	5,857.52	5,857.52	5,206.75	12,724.95
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	1,487.33	1,487.33	1,487.33	471.65
ENERGY STAR Refrigerator replace non-ENERGY STAR refrigerator (Old Model Year: <1993, New Capacity: 18 CF) - HD	2,974.66	2,974.66	2,974.66	966.73
ENERGY STAR Refrigerator replace non-ENERGY STAR refrigerator (Old Model Year: <1993, New Capacity: 20 CF) - ARCA	4,854.72	4,854.72	4,854.72	1,597.16
ENERGY STAR Refrigerator replace non-ENERGY STAR refrigerator (Old Model Year: <1993, New Capacity: 20 CF) - HD	4,854.72	4,854.72	4,854.72	1,540.56
ENERGY STAR Refrigerator replace non-ENERGY STAR refrigerator (Old Model Year: 1993-2010, New Capacity: 16 CF) - ARCA	379.94	379.94	379.94	421.11
ENERGY STAR Refrigerator replace non-ENERGY STAR refrigerator (Old Model Year: 1993-2010, New Capacity: 16 CF) - HD	1,139.82	1,139.82	1,139.82	1,263.33
ENERGY STAR Refrigerator replace non-ENERGY STAR refrigerator (Old Model Year: 1993-2010, New Capacity: 18 CF) - ARCA	8,357.53	8,357.53	8,357.53	8,332.34
ENERGY STAR Refrigerator replace non-ENERGY STAR refrigerator (Old Model Year: 1993-2010, New Capacity: 18 CF) - HD	5,278.44	5,278.44	5,278.44	5,403.17
ENERGY STAR Refrigerator replace non-ENERGY STAR refrigerator (Old Model Year:	26,522.72	26,522.72	26,522.72	27,959.90

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.)
1993-2010, New Capacity: 20 CF) - ARCA				
ENERGY STAR Refrigerator replace non-ENERGY STAR refrigerator (Old Model Year: 1993-2010, New Capacity: 20 CF) - HD	17,050.32	17,050.32	17,050.32	17,295.08
Low-Flow Showerhead 1.5 gpm - Electric	3,983.07	3,983.07	3,433.80	1,531.05
Low-Flow Showerhead 1.5 gpm - Gas	0.00	0.00	0.00	0.00
Low-Flow Showerhead with Shower Start - Electric	4,083.20	4,083.20	3,520.13	1,445.54
Low-Flow Showerhead with Shower Start - Gas	0.00	0.00	0.00	0.00
Shower Start Only - Electric	101.93	101.93	87.87	40.38
Shower Start Only - Gas	0.00	0.00	0.00	0.00
Programmable Thermostat - Electric Cooling and Gas Heating Savings	14,526.20	14,526.20	11,019.58	6,436.20
Programmable Thermostat - Electric Cooling and Heating Savings	2,190.44	2,190.44	1,661.67	977.21
Programmable Thermostat - Electric Cooling Only Savings	98.15	98.15	74.46	0.00
Programmable Thermostat - Electric Heating Only Savings	2,092.29	2,092.29	1,587.21	977.21
Programmable Thermostat - Gas Heating Only Savings	0.00	0.00	0.00	0.00
Programmable Thermostat - Heat Pump Savings	496.83	496.83	376.90	977.21
Total Savings	502,037.15	502,037.15	486,536.68	579,744.11
Total Program Realization Rate				115%

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 65. 2023 IQW 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 Sealing - Electric Cooling and Gas Heating Savings	11.556	11.556	11.556	136.338
Air Sealing - Electric Cooling and Heating Savings	0.250	0.250	0.250	1.066
Air Sealing - Gas Heating Only Savings (Combo Customer)	0.000	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.)
Air Sealing - Gas Heating Only Savings (Gas Only Customer)	0.000	0.000	0.000	0.000
Assessment Recommendations - Electric and Gas Savings	8.220	8.220	7.562	7.562
Assessment Recommendations - Electric Only	0.240	0.240	0.221	0.221
Assessment Recommendations - Gas Only	0.000	0.000	0.000	0.000
Attic Insulation (Uninsulated Hatch) - Electric Cooling and Gas Heating Savings	22.804	22.804	22.804	79.678
Attic Insulation (Uninsulated Hatch) - Electric Cooling and Heating Savings	0.112	0.112	0.112	0.797
Attic Insulation (Uninsulated Hatch) - Gas Heating Only Savings (Combo Customer)	0.000	0.000	0.000	0.000
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	0.061	0.031
Bathroom Aerator 1.0 gpm - Gas	0.000	0.000	0.000	0.000
Duct Sealing Package - Electric Cooling and Gas Heating Savings	63.204	63.204	63.204	122.573
Duct Sealing Package - Electric Cooling and Heating Savings	1.416	1.416	1.416	1.071
Duct Sealing Package - Electric Cooling Only Savings	0.896	0.896	0.896	2.141
Duct Sealing Package - Gas Heating Only Savings	0.000	0.000	0.000	0.000
Kitchen Aerator 1.5 gpm - Electric	0.120	0.120	0.112	0.082
Kitchen Aerator 1.5 gpm - Gas	0.000	0.000	0.000	0.000
A-Line LEDs - Electric and Gas Savings	21.032	21.032	20.416	19.815
A-Line LEDs - Electric Only Savings	0.568	0.568	0.551	0.535
Candelabra LEDs - Electric and Gas Savings	6.288	6.288	6.104	6.185
Candelabra LEDs - Electric Only Savings	0.044	0.044	0.043	0.043
Downlight Fixture and Retrofit Kit - Electric and Gas Savings	0.483	0.483	0.469	0.457
Globe LEDs - Electric and Gas Savings	3.240	3.240	3.145	3.052
Globe LEDs - Electric Only Savings	0.092	0.092	0.089	0.087
PAR38 LEDs - Electric and Gas Savings	4.228	4.228	4.104	3.515
PAR38 LEDs - Electric Only Savings	0.028	0.028	0.027	0.023
Pipe Wrap - Electric (per foot)	0.708	0.708	0.629	1.452
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	0.218	0.218	0.218	0.071
ENERGY STAR Refrigerator replace non-ENERGY STAR refrigerator (Old Model Year: <1993, New Capacity: 18 CF) - HD	0.436	0.436	0.436	0.146

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.)
ENERGY STAR Refrigerator replace non-ENERGY STAR refrigerator (Old Model Year: <1993, New Capacity: 20 CF) - ARCA	0.714	0.714	0.714	0.241
ENERGY STAR Refrigerator replace non-ENERGY STAR refrigerator (Old Model Year: <1993, New Capacity: 20 CF) - HD	0.714	0.714	0.714	0.232
ENERGY STAR Refrigerator replace non-ENERGY STAR refrigerator (Old Model Year: 1993-2010, New Capacity: 16 CF) - ARCA	0.056	0.056	0.056	0.064
ENERGY STAR Refrigerator replace non-ENERGY STAR refrigerator (Old Model Year: 1993-2010, New Capacity: 16 CF) - HD	0.168	0.168	0.168	0.191
ENERGY STAR Refrigerator replace non-ENERGY STAR refrigerator (Old Model Year: 1993-2010, New Capacity: 18 CF) - ARCA	1.235	1.235	1.235	1.257
ENERGY STAR Refrigerator replace non-ENERGY STAR refrigerator (Old Model Year: 1993-2010, New Capacity: 18 CF) - HD	0.780	0.780	0.780	0.815
ENERGY STAR Refrigerator replace non-ENERGY STAR refrigerator (Old Model Year: 1993-2010, New Capacity: 20 CF) - ARCA	3.920	3.920	3.920	4.217
ENERGY STAR Refrigerator replace non-ENERGY STAR refrigerator (Old Model Year: 1993-2010, New Capacity: 20 CF) - HD	2.520	2.520	2.520	2.609
Low-flow Showerhead 1.5 gpm - Electric	0.221	0.221	0.191	0.019
Low-flow Showerhead 1.5 gpm - Gas	0.000	0.000	0.000	0.000
Low-flow Showerhead with Shower Start - Electric	0.460	0.460	0.397	0.019
Low-flow Showerhead with Shower Start - Gas	0.000	0.000	0.000	0.000
Shower Start Only - Electric	0.007	0.007	0.006	0.006
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 and 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 - Electric Heating Only Savings	0.000	0.000	0.000	0.000
Programmable Thermostat - Gas Heating Only Savings	0.000	0.000	0.000	0.000
Programmable Thermostat - Heat Pump Savings	0.000	0.000	0.000	0.000
Total Savings	157.041	157.041	155.125	396.611
Total Program Realization Rate				253%

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.)	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.

Table 66. 2023 IQW Program *Ex Ante* and *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 GASS ENERGY SAVINGS (THERMS/YR.)	*EX POST* GROSS NATURAL GAS ENERGY SAVINGS (THERMS/YR.)
Air Sealing - Electric Cooling and Gas Heating Savings	26,379.78	26,379.78	26,379.78	17,327.71
Air Sealing - Electric Cooling and Heating Savings	0.00	0.00	0.00	0.00
Air Sealing - Gas Heating Only Savings (Combo Customer)	1,935.63	1,935.63	1,935.63	798.10
Air Sealing - Gas Heating Only Savings (Gas Only Customer)	5,723.30	5,723.30	5,723.30	3,665.73
Assessment Recommendations - Electric and Gas Savings	1,842.65	1,842.65	1,695.24	1,695.24
Assessment Recommendations - Electric Only	0.00	0.00	0.00	0.00
Assessment Recommendations - Gas Only	413.10	413.10	380.05	380.05
Attic Insulation (Uninsulated Hatch) - Electric Cooling and Gas Heating Savings	40,644.84	40,644.84	40,644.84	28,039.66
Attic Insulation (Uninsulated Hatch) - Electric Cooling and Heating Savings	0.00	0.00	0.00	0.00
Attic Insulation (Uninsulated Hatch) - Gas Heating Only Savings (Combo Customer)	3,206.82	3,206.82	3,206.82	2,176.73
Attic Insulation (Uninsulated Hatch) - Gas Heating Only Savings (Gas Only Customer)	7,804.42	7,804.42	7,804.42	5,031.95
Bathroom Aerator 1.0 gpm - Electric	0.00	0.00	0.00	0.00
Bathroom Aerator 1.0 gpm - Gas	388.89	388.89	374.50	222.34
Duct Sealing Package - Electric Cooling and Gas Heating Savings	25,844.94	25,844.94	25,844.94	23,185.53
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 - Gas Heating Only Savings	14,615.37	14,615.37	14,615.37	12,967.53
Kitchen Aerator 1.5 gpm - Electric	0.00	0.00	0.00	0.00
Kitchen Aerator 1.5 gpm - Gas	1,884.96	1,884.96	1,759.23	1,897.50
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*[a] NATURAL GAS ENERGY SAVINGS (THERMS/YR.)	AUDITED GROSS NATURAL GAS ENERGY (THERMS/YR.)	VERIFIED GROSS NATURAL GASS ENERGY SAVINGS (THERMS/YR.)	*EX POST* GROSS NATURAL GAS ENERGY SAVINGS (THERMS/YR.)
Downlight Fixture and Retrofit Kit - Electric and Gas 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)	5,047.17	5,047.17	4,486.43	10,510.16
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: 18 CF) - HD	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, New Capacity: 20 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: 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	1,226.68	1,226.68	1,057.52	459.50
Low-Flow Showerhead with Shower Start - Electric	0.00	0.00	0.00	0.00
Low-Flow Showerhead with Shower Start - Gas	3,035.24	3,035.24	2,616.68	1,047.52
Shower Start Only - Electric	0.00	0.00	0.00	0.00
Shower Start Only - Gas	17.92	17.92	15.45	6.92

MEASURE	*EX ANTE*[a] NATURAL GAS ENERGY SAVINGS (THERMS/YR.)	AUDITED GROSS NATURAL GAS ENERGY (THERMS/YR.)	VERIFIED GROSS NATURAL GASS ENERGY SAVINGS (THERMS/YR.)	*EX POST* GROSS NATURAL GAS ENERGY SAVINGS (THERMS/YR.)
Programmable Thermostat - Electric Cooling and Gas Heating Savings	11,003.80	11,003.80	8,347.48	6,995.72
Programmable Thermostat - Electric Cooling and Heating Savings	0.00	0.00	0.00	0.00
Programmable Thermostat - Electric Cooling Only Savings	0.00	0.00	0.00	0.00
Programmable Thermostat - Electric Heating Only Savings	0.00	0.00	0.00	0.00
Programmable Thermostat - Gas Heating Only Savings	6,914.55	6,914.55	5,245.38	4,368.87
Programmable Thermostat - Heat Pump Savings	0.00	0.00	0.00	0.00
Total Savings	157,930.06	157,930.06	152,133.06	120,776.77
Total Program Realization Rate				76%

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.

Process Evaluation

The evaluation team completed a literature review 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 income qualified programs?

Literature Review Findings

The evaluation team conducted a literature review to examine how other income qualified programs operate and what strategies they use to increase participation in their programs.

The evaluation team selected several programs to compare to NIPSCO's IQW program. Table 67 describes the comparison programs.

Table 67. Income Qualified Comparison Programs

UTILITY	PROGRAM NAME	STATE	FUEL TYPE
NIPSCO	**Income Qualified Weatherization**	**Indiana**	**Natural Gas and Electric**
Ameren	Income Qualified Initiative	Illinois	Natural Gas and Electric
NYSERDA	EmPower+	New York	Natural Gas and Electric
Mass Save	Income Eligible program	Massachusetts	Natural Gas and Electric
Georgia Power	Energy Assistance for Savings and Efficiency	Georgia	Electric
Idaho Power	Weatherization program	Idaho	Natural Gas
CenterPoint	Energy Homeowner programs	Minnesota	Natural Gas and Electric
DTE	Limited Income Assistance	Michigan	Electric
SCE	Energy Savings Assistance program	California	Natural Gas and Electric

The sections below detail the findings of this research.

Program Design and Measures

Overall, the measures NIPSCO offers in their IQW program are similar to measures offered by other programs via their income qualified pathways. Table 68 shows a review of measures offered (according to current program websites) by other programs compared to NIPSCO's IQW program. All programs assessed in the table below offer some energy efficient lighting and air sealing. Most programs offer insulation and thermostats. The IQW program currently does not offer power strips, clothes dryers/washers, HVAC upgrades, HVAC repair, or windows. Five programs reviewed currently offer HVAC upgrades. Very few programs offer items such as clothes dryers, HVAC repairs/tune-ups, power strips, and windows.

Table 68. Measures Offered by Other Programs

PROGRAM	LIGHTING	FAUCET AERATORS	SHOWERHEADS	FRIDGE REPLACEMENT	PIPE WRAP	WATER HEATER WRAP	DUCT SEALING	AIR SEALING	THERMOSTATS	INSULATION	POWER STRIPS	CLOTHES DRYERS/WASHERS	HVAC UPGRADES	HVAC REPAIR	WINDOWS
NIPSCO IQW	X	X	X	X	X	X	X	X	X	X					
Ameren IL Income Qualified Initiative (PY 2021)	X	X	X		X			X	X	X	X		X		
NYSERDA EmPower+	X			X				X		X			X		
Mass Save Income Eligible program	X	X	X	X				X	X	X	X	X	X		X
Georgia Power EASE	X						X	X	X	X				X	
CenterPoint Energy Homeowner programs	X	X					X	X	X					X	
DTE Limited Income Assistance	X			X			X	X		X				X	
SCE Energy Savings Assistance program	X		X	X			X	X	X	X	X	X	X		

A 2022 American Council for an Energy-Efficient Economy (ACEEE) review of low-income programs across the country noted that energy efficiency programs targeting this specific market segment adopt a variety of program design strategies.[25] On the one hand, some programs aim to serve a greater volume of low-income customers but emphasize low-cost measures such as lighting and energy efficiency kits. On the opposite end of the spectrum are programs that aim to serve fewer customers but offer much deeper savings per home; these types of programs often include higher costs per customer served and could include a full energy audit, HVAC upgrades, and other measures.

[25] "Meeting the Challenge: A Review of Energy Efficiency Program Offerings for Low-Income Households." Diana Morales and Steven Nadel. ACEEE. November 2022.

An example of a program that offers comprehensive pathways to low-income households includes Ameren Illinois' Single-family Income Qualified Initiative from PY 2021.[26] This initiative included separate channels for participation including offering "core" measures, energy saving kits for self-installation, and partnering with the Illinois Home Weatherization Assistance program. It should also be noted that the core channel of this program offered no-cost Building Performance Institute (BPI) energy audits to identify envelope and HVAC improvements for income-eligible customers.

Though NIPSCO's IQW program offers a range of measures like other programs, it currently does not offer multiple income qualified pathways to participation or BPI energy audits. It should be noted that NIPSCO does have a kits program (HomeLife) that offers measures at no cost to customers. Additionally, HVAC measures are not currently part of the program design.

Outreach Strategies

NIPSCO uses several different outreach strategies to market the IQW program to customers such as the NIPSCO website, mail or newsletters, bill inserts, or advertisements on the internet and social media. Overall, other programs use similar tactics to target eligible customers; however, some programs use more unique strategies to reach low-income customers.

In the ACEEE review of low-income program best practices, the authors note that market segmentation can be a powerful tool for not only program design, but also in developing strategies to bolster outreach efforts.[27] The review references that Eversource and Opower (now Oracle) developed a market segmentation strategy for Eversource's low-income customers to better serve them. For this effort, Eversource and Oracle used utility data as well as other data sets (geography, household characteristics, customer demographics, etc.) to identify customers that could benefit from low-income programs[28]. The segmentation study also looked at energy burden and compared the ability for customers to pay their bills with their income level for greater insights into which customers could benefit from targeted programs. DTE, in their 2022 Annual Report, also indicated that they performed "neighborhood-level targeting to identify communities that experience the highest energy burdens…[29] This type of segmentation and targeting exercise could be beneficial to NIPSCO to strategically market to customers most in need of the IQW program.

Community-based outreach strategies might also benefit the IQW program. Mass Save, which offers a statewide income-eligible program for energy efficiency, uses a mix of broad outreach strategies (ads, flyers, etc.) and more direct outreach. They employed cross-program outreach; for example, Mass Save program administrators and their implementers reached out to households participating in Utility Discount Rate programs to let them know about their Income Eligible Energy Efficiency program.[30] It should be noted that the Mass Save program is a statewide offering and that outreach strategies did vary based on individual program administrator.

[26] "Ameren Illinois Company 2021 Residential Program Impact Evaluation Report." Opinion Dynamics. April 29, 2022.

[27] "Meeting the Challenge: A Review of Energy Efficiency Program Offerings for Low-Income Households." Diana Morales and Steven Nadel. ACEEE. November 2022.

[28] "Using Energy Affordability Analysis to Drive Participation in Low Income Programs." Kara Rodgers Marshall and Jessica Lin. Presentation at Behavior Energy and Climate Change Conference 2019. November 19, 2019.

[29] "2022 Annual Report – Energy Efficiency." DTE. 2022.

[30] "2017 Income Eligible Process Evaluation Findings (RES 38)." Navigant Consulting, ILLUME Advising, Cadeo. February 7, 2019.

Additionally, program evaluation reports indicate that participating homeowners in the Mass Save Income Eligible program indicated that they became aware of the program through their community action agency or after participating in another program offered by that agency, indicating the efficacy of community-based and cross-program outreach. DTE also indicates that they partner with community-based organizations to reach the target population for their programs. Like Mass Save, DTE coordinates with their Payment Stability Plan pilot to offer energy efficiency services to customers participating. Cross-program promotion also appears in an evaluation of Rocky Mountain Power Idaho's Low Income Weatherization program evaluation from 2020 (PY2016 – 2017); the primary method of outreach was calling participants in the Low Income Home Energy Assistance program (LIHEAP).[31] From the evaluation, 39% of program participants indicated that they heard about the program from a community agency or another program, suggesting this outreach method was successful.

Interaction with Federal Weatherization Assistance Program (WAP)

The U.S. Department of Energy (DOE) provides grants to states to implement weatherization services through the Weatherization Assistance program (WAP). The program contracts with local weatherization providers to provide these services. The measures offered through WAP include items like insulation and air sealing, high efficiency lighting, aerators and showerheads, refrigerator replacement, thermostats, heating system tune-ups, and health and safety measures. These offerings largely overlap with the IQW program offerings and target similar populations.

In some cases, utility program administrators for low-income programs partner with or engage with WAP providers in their areas. There are a range of partnership models. One utility that the evaluation team is working with in another midwestern state has indicated interest in partnering with Community Action Partnership (CAP) Agencies who deliver WAP services and other social services. CAP indicated that they have a backlog of homes enrolled in WAP, and that the wait times can be long for customers in need. The utility noted that for customers on the wait list, their low-income program might supplement their WAP participation and enhance health and safety measures offered. Though this partnership model is nascent, the utility has begun to provide information on their program to the CAP agency to ensure that customers are aware of both the WAP and utility offerings.

Massachusetts offers another example of a partnership model. The state leverages the Low-Income Energy Affordability Network (LEAN), comprised of local Community Action Agencies (CAAs), to provide energy services at no cost to eligible customers. LEAN partners with Massachusetts utilities and program administrators on the statewide Mass Save offerings. An evaluation of the Mass Save Income Eligible program indicated that most participants reported learning about the program through their CAA, indicating the importance of this partnership.[32] It should be noted that Massachusetts uses a statewide energy efficiency model where utilities or program administrators offer standardized programs under the Mass Save brand.

Other utility programs also report interacting with CAAs. For example, DTE's Income Qualified program works alongside member agencies of the Michigan Community Action Agency Association as well as other community-based organizations to reach income-eligible customers.[33]

[31] "Idaho Low Income Weatherization Program Evaluation, Measurement & Verification Report 2016-2017." ADM. November 2020.
[32] "2017 Income Eligible Process Evaluation Findings (RES 38)." Navigant Consulting, ILLUME Advising, Cadeo. February 7, 2019.
[33] "2022 Annual Report – Energy Efficiency." DTE. 2022.

Conclusions and Recommendations

CONCLUSION 1: THE PROGRAM DID NOT MEET ELECTRIC ENERGY SAVINGS GOALS OR NATURAL GAS SAVINGS GOALS BUT EXCEEDED ITS PEAK DEMAND REDUCTION GOAL.

The program fell short of its electric and natural gas energy savings goals, achieving 46% and 43%, respectively. However, it exceeded its peak demand reduction goal, achieving 144%. During the 2022 evaluation, program implementers noted less opportunity for savings per household and the need to increase program awareness. Conclusions and recommendations below on market segmentation and interacting with federal WAP providers/community-based organizations address awareness provide ways to increase participation and savings.

Recommendations:

- Prioritize the installation of smart thermostats in the program. Unlike the programmable thermostats offered in 2023, which can only claim heating savings according to the Illinois TRM v11.0, smart thermostats have the potential to increase heating savings as well as reintroduce cooling savings.

CONCLUSION 2: THE USE OF THE INDIANA TRM AND PREVIOUS PROGRAM AVERAGES IN *EX ANTE* SAVINGS CALCULATIONS LED TO *EX POST* GROSS SAVINGS BEING HIGHER THAN *EX ANTE* SAVINGS FOR ELECTRIC ENERGY SAVINGS AND DEMAND REDUCTION, AND LOWER FOR NATURAL GAS ENERGY SAVINGS.

Through the engineering review, the evaluation team identified notable measure-level differences between *ex ante* and *ex post* savings for pipe wrap, attic insulation, air sealing, and duct sealing measures. The drivers of these measure level differences include discrepancies in insulation values, heating and cooling efficiencies, and algorithms, resulting in higher *ex post* gross electric energy savings and demand reduction and lower *ex post* gross natural gas energy savings compared to *ex ante*.

Recommendations:

- Update *ex ante* savings approaches to the Illinois TRM v12.0, as instructed by the new Indiana Technical Reference Manual Workbook v1.0. Where applicable, use Indiana location specific input assumptions from Indiana TRM v1.0. Update measures that are simply passing through old program averages (like duct insulation) instead of calculating them.

CONCLUSION 3: NIPSCO'S IQW PROGRAM COULD BENEFIT FROM MARKET SEGMENTATION WHICH OTHER INCOME QUALIFIED UTILITY PROGRAMS LEVERAGE TO PROVIDE TARGETED OUTREACH.

An ACEEE study referenced in the literature review discusses market segmentation and using available data sets to target key demographics for income qualified programs. This study references an Eversource initiative that used geography, household characteristics, and customer demographics to successfully identify priority populations for their income eligible program. In particular, the segmentation study identified customers with high energy burden to target them for energy efficiency programs.

Recommendations:

- Conduct a market segmentation study to identify populations and geographies that would benefit from IQW.
- Use the study results to guide targeted outreach efforts in terms of where outreach is being done and the channels being used.

CONCLUSION 4: PARTNERING WITH COMMUNITY ACTION AGENCIES AND WAP PROVIDERS ENHANCES THE REACH OF INCOME-ELIGIBLE PROGRAMS IN OTHER AREAS.

Through the literature review, the evaluation team found that several other income-eligible programs partner with community-based organizations and WAP providers to enhance their reach. Massachusetts uses a statewide program delivery channel and interacts with CAP agencies to ensure eligible customers get the energy-efficiency support they need. Other utilities like DTE and Rocky Mountain Power in Idaho reference working with community-based organizations to foster trust in the community and increase awareness of their programs among priority populations.

Recommendations:

- Leverage local, community-based organizations for outreach to supplement existing marketing channels.
- Foster a relationship with Indiana WAP providers, CAAs, and/or CAP agencies to enhance the reach of IQW marketing.

CONCLUSION 5: LED LIGHTING RETROFITS COMPRISED 43% OF *EX POST* (AND 52% OF *EX ANTE*) IQW PROGRAM SAVINGS IN 2023.

Lighting continued to provide a significant portion of IQW savings. Beginning with IL TRM v12.0 for the 2024 program year, the TRM is explicit in limiting LED retrofit savings only to direct install programs where "it can be shown that the LED is replacing inefficient lighting" and that programs "should continue to use the existing inefficient lighting as a baseline and also assume a measure life of eight years."

Recommendations:

Supply project documentation in the form of photographs of the inefficient *in situ* lighting prior to it being replaced.

7. MULTIFAMILY DIRECT INSTALL (MFDI) PROGRAM

Program Design and Delivery

The Multifamily Direct Install (MFDI) program provides property owners and building managers of multifamily buildings with a full building energy assessment, including both commercially metered common areas and residentially metered tenant units, at no cost. After the assessment, the program provides direct installation of no-cost, energy-efficient measures in the residential tenant units. Commercially metered common area improvements that are identified in the assessment, are eligible for rebates through the existing C&I Small Business Direct Install (SBDI) program. The MFDI and SBDI programs maintain separate budgets and savings goals, but the MFDI program allows customers to submit for SBDI rebates directly through the MFDI application. The MFDI program is designed to be a single-stop program for property owners and building managers to improve the efficiency and comfort of their buildings.

TRC is the program administrator, and they subcontract 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 multifamily 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.

The program is marketed via various channels including direct outreach, industry events, word-of-mouth, the NIPSCO website, program cross-promotion, and advertising.

Once a property owner is engaged by the program, TRC conducts the initial energy assessment of the property, followed by a subcontractor to execute the direct install portion of the MFDI program. Participating building owners/managers are responsible for communicating to tenants that direct installation measures will be installed in their units. TRC will provide, at no cost, resources to help facilitate that communication, including door hangers, posters, yard signs, email templates, and tenant leave-behind postcards.

Direct install measures for each tenant unit include the following:

- ENERGY STAR certified light bulbs (9W A-Line, 4W Candelabra, 6W Globe, 15W PAR 38, Downlight Fixture and Retrofit Kit) – up to 22 units.
- Bathroom faucet aerator (1.0 gpm) – up to two units.
- Kitchen aerator (1.5 gpm) – up to one unit.
- Low-flow showerhead (1.5 gpm) – up to two units.
- Shower Start (valve only) – up to two units.
- Low-flow showerhead/shower start combo – up to two units.
- Pipe wrap – up to 10 feet.
- Programmable thermostat – up to one unit.

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

In addition, the property manager can receive a Property Bonus of $250 per property/project for participation. Measure incentives per project must equal more than the property bonus to qualify. There is no limit per property management company or ownership group.

Changes from the 2022 Design

For 2023, the program included downlight fixture and retrofit kits which were not included in previous years. Additionally, the program added a $250 Property Bonus as an incentive for property managers to participate. This feature was not in the 2022 program design.

Program Performance

The MFDI program did not meet its goals for PY2023. Though reported savings significantly increased from 2022, limited participation in 2023 remained a driving factor in the program not meeting its goals.[34]

Table 69 summarizes savings for the full year of program performance, including program savings goals.

Table 69. 2023 MFDI 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.)	1,561,851.29	1,333,235.56	1,333,235.56	1,160,051.30	929,770.66	906,251.67	60%
Peak Demand Reduction (kW)	177.454	117.013	117.013	103.519	85.025	81.869	48%
Natural Gas Energy Savings (therms/yr.)	108,823.00	59,667.70	59,667.70	50,060.61	37,851.27	36,987.03	35%

[34] In 2022, the program reported *ex ante* savings of 60,783.87 kWh, 6.856 kW, and 4,186.16 therms.

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 lower than claimed values due to applied ISRs of select measures. *Ex post* gross electric, demand and gas savings were lower than *ex ante* savings for most measures (more detail is documented in the *Ex Post Gross Savings* section*)*. Table 70 outlines the *ex post* and NTG adjustment factors.

Table 70. 2023 MFDI Program Adjustment Factors

METRIC	REALIZATION RATE (%) [a]	FREERIDERSHIP	SPILLOVER	NTG (%) [b]
Electric Energy Savings (kWh/yr.)	70%	3%	0%	97%
Peak Demand Reduction (kW)	73%	4%	0%	96%
Natural Gas Energy Savings (therms/yr.)	63%	3%	1%	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.

Both electric and natural gas spending was below planned budgets. Table 71 lists the 2023 program budget and expenditures by fuel type.

Table 71. 2023 MFDI Program Expenditures

FUEL	PROGRAM BUDGET	PROGRAM EXPENDITURES	BUDGET SPENT (%)
Electric	$575,107.44	$509,475.09	89%
Natural Gas	$308,443.66	$128,970.20	42%

Evaluation Methodology

To inform the 2023 MFDI 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.
- **Property manager interviews (n=4),** to better understand the participants' perspectives and gain insight into motivations for participation and program processes.

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 *ex post* savings methodologies and inputs for each measure on several sources: standard engineering practices, the Illinois TRM v11.0, the 2015 Indiana TRM (v2.2), equipment specifications, and NIPSCO's program tracking database.[35,36]

Audited and Verified Savings

To develop audited measure quantities and savings, the evaluation team first checked the program 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 72 lists the in-service rates (ISRs) for all program-installed measures. As part of the 2022 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 and 2023, 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 and 2023 evaluations, the evaluation team referenced in-service rates from the NYSEG/RG&E PY2019 – 2020 Impact and Process Evaluation.[37] The evaluation team utilized this source because of its recency and since the evaluation reported ISRs for in-unit measures relevant to MFDI. ISRs for direct install measures 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 72. 2023 MFDI Program In-Service Rates Ratios by Measure

MEASURE	ISR
LED Bulbs	87%
Bathroom Aerator	91%
Kitchen Aerator	91%
Low-Flow Showerhead	100%
Low-Flow Showerhead with Shower Start - Gas	100%
Programmable Thermostat - Electric Cooling and Gas Heating Savings	80%

[35] Illinois Energy Efficiency Stakeholder Advisory Group. *Illinois Statewide Technical Reference Manual Version 11*. September 22, 2022.
[36] Cadmus. Indiana Technical Reference Manual Version 2.2. July 28, 2015.
[37] NYSEG and RG&E. Multifamily Program Evaluation Report, Program Years 2019-20. December 30, 2021.

Table 73 summarizes the tracking data quantity, 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 in-service rate.

Table 73. 2023 MFDI Program Audited and Verified Quantities

MEASURE	UNIT OF MEASURE	AUDITED QUANTITY	ISR	VERIFIED QUANTITY
Assessment Recommendations - Electric and Gas Savings	Home	839	100%	839
Assessment Recommendations - Electric Only	Home	1,962	100%	1,962
Assessment Recommendations - Gas Only	Home	80	100%	80
Bathroom Aerator 1.0 gpm - Electric	Aerator	579	91%	527
Bathroom Aerator 1.0 gpm - Gas	Aerator	703	91%	640
Kitchen Aerator 1.5 gpm - Electric	Aerator	462	91%	420
Kitchen Aerator 1.5 gpm - Gas	Aerator	618	91%	562
A-Line LEDs - Electric and Gas Savings	Lamp	5,525	87%	4,807
A-Line LEDs - Electric Only Savings	Lamp	11,494	87%	10,000
Candelabra LEDs – Electric and Gas Savings	Lamp	117	87%	102
Candelabra LEDs – Electric Only Savings	Lamp	73	87%	64
Downlight Fixture and Retrofit Kit – Electric Only Savings	Lamp	160	87%	139
Globe LEDs – Electric and Gas Savings	Lamp	2,936	87%	2,554
Globe LEDs - Electric Only Savings	Lamp	4,581	87%	3,985
Pipe Wrap - Electric (per foot)	Per foot	10	95%	9
Pipe Wrap - Gas (per foot)	Per foot	2,491	95%	2,362
Low-flow Showerhead 1.5 gpm - Electric	Showerhead	678	100%	678
Low-flow Showerhead 1.5 gpm - Gas	Showerhead	657	100%	657
Programmable Thermostat - Electric Cooling and Gas Heating Savings	Thermostat	303	80%	242
Programmable Thermostat - Electric Cooling and Heating Savings	Thermostat	130	80%	104
Programmable Thermostat - Electric Cooling Only Savings	Thermostat	432	80%	346
Programmable Thermostat - Gas Heating Only Savings	Thermostat	304	80%	243
		35,134		31,323

Note: Totals may not sum properly due to rounding.

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 Indiana TRM (v2.2) and Illinois TRM v11.0 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 Qualified Product List (QPL), equipment specifications verified by the implementor, and the National Renewable Energy Laboratory (NREL) Residential Lighting Evaluation Protocol to calculate savings for lighting measures.[38] The evaluation team revised assumptions for savings estimates applicable to the NIPSCO service territory as needed. *Appendix 5. Multifamily Direct Install Program* contains details on the specific algorithms, variable assumptions, and references used for all program measure *ex post* gross calculations.

Ex Post Gross Savings Summary

Table 74 shows the *ex ante* deemed savings and *ex post* gross per-measure savings for 2023 MFDI program measures.

Table 74. 2023 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
Assessment Recommendations - Electric and Gas Savings	Home	0.00	0.000	0.00	0.00	0.000	0.00
Assessment Recommendations - Electric Only	Home	0.00	0.000	0.00	0.00	0.000	0.00
Assessment Recommendations - Gas Only	Home	0.00	0.000	0.00	0.00	0.000	0.00
Bathroom Aerator 1.0 gpm - Electric	Aerator	30.76	0.003	0.00	26.97	0.002	0.00
Bathroom Aerator 1.0 gpm - Gas	Aerator	0.00	0.000	1.35	0.00	0.000	1.35
Kitchen Aerator 1.5 gpm - Electric	Aerator	180.09	0.008	0.00	138.05	0.006	0.00
Kitchen Aerator 1.5 gpm - Gas	Aerator	0.00	0.000	6.34	0.00	0.000	6.89
A-Line LEDs - Electric and Gas Savings	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 Savings	Lamp	30.20	0.004	0.00	29.78	0.004	0.00
Candelabra LEDs - Electric Only Savings	Lamp	30.20	0.004	0.00	29.78	0.004	0.00

[38] National Renewable Energy Laboratory. 2017. UMP *Chapter 6: Residential Lighting Evaluation Protocol*. Chapter 6: Residential Lighting Evaluation Protocol. The Uniform Methods Project: Methods for Determining Energy Efficiency Savings for Specific Measures (nrel.gov)

MEASURE	UNIT OF MEASURE	*EX ANTE* DEEMED SAVINGS			*EX POST* GROSS PER-MEASURE SAVINGS		
		KWH	KW	THERMS	KWH	KW	THERMS
Downlight Fixture and Retrofit Kit - Electric Only Savings	Lamp	50.56	0.007	0.00	50.16	0.007	0.00
Globe LEDs - Electric and Gas Savings	Lamp	28.52	0.004	0.00	28.52	0.004	0.00
Globe LEDs - Electric Only Savings	Lamp	28.52	0.004	0.00	28.52	0.004	0.00
Pipe Wrap - Electric (per foot)	Per foot	24.82	0.003	0.00	51.39	0.006	0.00
Pipe Wrap - Gas (per foot)	Per foot	0.00	0.000	1.11	0.00	0.000	2.20
Low-flow Showerhead 1.5 gpm - Electric	Showerhead	238.93	0.017	0.00	193.41	0.001	0.00
Low-flow Showerhead 1.5 gpm - Gas	Showerhead	0.00	0.000	10.51	0.00	0.000	12.55
Programmable Thermostat - Electric Cooling and Gas Heating Savings	Thermostat	98.15	0.000	74.35	37.26	0.000	40.50
Programmable Thermostat - Electric Cooling and Heating Savings	Thermostat	2,190.44	0.000	0.00	837.31	0.000	0.00
Programmable Thermostat - Electric Cooling Only Savings	Thermostat	98.15	0.000	0.00	0.00	0.000	0.00
Programmable Thermostat - Gas Heating Only Savings	Thermostat	0.00	0.000	74.35	37.26	0.000	40.50

Table 75 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.

Table 75. 2023 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), actual installed LED wattage, EM&V 2019 installed LED wattage, and use post-EISA baseline wattages from ENERGY STAR listings and 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 decrease 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 4 W assumed by *ex ante.*

MEASURE	*EX ANTE* SOURCES AND ASSUMPTIONS	*EX POST* GROSS SOURCES AND ASSUMPTIONS	PRIMARY REASONS FOR DIFFERENCES
Kitchen aerator	Indiana TRM (v2.2). Average per household occupancy of 2.64 (SFH)	Illinois TRM v11.0. 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).	kWh savings decreased from ex ante. This is largely due to the difference in algorithms and assumptions between the Illinois TRM v11.0 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 v11.0 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).
Bathroom aerator	Indiana TRM (v2.2). Average per household occupancy of 2.64 (SFH).	Illinois TRM v11.0. 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 savings are closer than kitchen aerators, the main drivers for kWh savings are the same and is largely due to the difference in algorithms and assumptions between the Illinois TRM v11.0 and the Indiana TRM (v2.2). The base flow of 1.53 gpm in the Illinois TRM v11.0 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).

MEASURE	*EX ANTE* SOURCES AND ASSUMPTIONS	*EX POST* GROSS SOURCES AND ASSUMPTIONS	PRIMARY REASONS FOR DIFFERENCES
Low-flow showerhead	*Ex ante* savings are based on Indiana TRM (v2.2). TRM multifamily assumed people per home, showerheads per home, GPMbase, and actual GPMlow.	Illinois TRM v11.0. 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 like aerators and largely due to the difference in algorithms and assumptions between the Illinois TRM v11.0 and the Indiana TRM (v2.2). The base flow of 2.24 gpm in the Illinois TRM v11.0 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 were calculated using Indiana TRM (v2.2) algorithms and 2021 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.	Illinois TRM v11.0. Assigned heating consumption values based on climate similar Indiana and Illinois cities.	Illinois TRM v11.0 does not claim cooling savings for programmable thermostats, resulting in the biggest difference between *ex ante* and *ex post*, however, it does claim reduction in fan electric energy consumption. Therm savings differences are a result of the difference in methodologies between the Indiana TRM (v2.2) and Illinois TRM v11.0. Like the multifamily adjustment factor applied by evaluated savings in previous years, the Illinois TRM v11.0 approach applies a housing factor of 0.65 to account for the difference in heating square footage between single-family homes and multifamily homes. The combination of these differences results in the *ex post* gross therm and kWh savings being less than *ex ante*.

MEASURE	*EX ANTE* SOURCES AND ASSUMPTIONS	*EX POST* GROSS SOURCES AND ASSUMPTIONS	PRIMARY REASONS FOR DIFFERENCES
Pipe Wrap	Indiana TRM (v2.2). Combination of Indiana TRM (v2.2) and 2021 EM&V inputs for natural gas and electric water heaters.	Illinois TRM v11.0. *Ex post* gross used the two copper piping insulation models and sizes reported by the implementor to calculate an average of the Illinois TRM v11.0 existing pipe R input assumptions that correspond to the reported piping type and size. This resulted in an existing R value of 0.4825. The new R value is assumed to be the average R value of the two pipe insulation models reported by the implementor, plus the assumed existing piping R value (0.4825), resulting in a new-R of 5.1025.	For pipe wraps, the main driver for the difference in savings is the differences in approach and assumptions between the evaluated assumed Illinois TRM v11.0 and ex ante assumed Indiana TRM (v2.2). Additionally, there was a significant difference in R values where ex ante assumed an existing R of 1 and a new R of 3.9 while evaluated savings assumed an existing R of 0.4825 and a new R of 5.1025. These differences resulted in *ex post* gross therms and kWh savings significantly higher than *ex ante*.

Waste Heat Factor – Therm Penalties

The evaluation team did not include therm penalties when calculating evaluated savings for the 2023 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 -4,979.92 therms. In total, the *ex post* therm penalty for cost-effectiveness analysis is -4,493.82 therms (Table 76).

Table 76. 2022 MFDI Program Waste Heat Factor Therm Penalty

MEASURE	WASTE HEAT FACTOR THERM PENALTY
A-Line LEDs - Electric and Gas Savings	(2,800.85)
Candelabra LEDs - Electric and Gas Savings	(61.93)
Downlight Fixture and Retrofit Kit - Electric Only Savings	(142.66)
Globe LEDs - Electric and Gas Savings	(1,488.38)
Total	(4,493.82)

Realization Rates

The next three tables (Table 77 through Table 79) show the program's *ex ante* reported savings, verified savings, *ex post* gross savings and total program realization rates for kWh, kW, and therms.

Table 77. 2023 MFDI 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	0.00	0.00	0.00	0.00
Assessment Recommendations - Electric Only	0.00	0.00	0.00	0.00
Assessment Recommendations - Gas Only	0.00	0.00	0.00	0.00
Bathroom Aerator 1.0 gpm - Electric	17,810.04	17,810.04	16,207.14	14,212.17
Bathroom Aerator 1.0 gpm - Gas	0.00	0.00	0.00	0.00
Kitchen Aerator 1.5 gpm - Electric	83,201.58	83,201.58	75,713.44	58,037.33
Kitchen Aerator 1.5 gpm - Gas	0.00	0.00	0.00	0.00
A-Line LEDs - Electric and Gas Savings	157,407.25	157,407.25	136,944.31	137,094.47
A-Line LEDs - Electric Only Savings	327,464.06	327,464.06	284,893.73	285,206.13
Candelabra LEDs - Electric and Gas Savings	3,533.40	3,533.40	3,074.06	3,031.26
Candelabra LEDs - Electric Only Savings	2,204.60	2,204.60	1,918.00	1,891.30
Downlight Fixture and Retrofit Kit - Electric Only Savings	8,089.60	8,089.60	7,037.95	6,982.80
Globe LEDs - Electric and Gas Savings	83,734.72	83,734.72	72,849.21	72,852.37
Globe LEDs - Electric Only Savings	130,650.12	130,650.12	113,665.60	113,670.55
Pipe Wrap - Electric (per foot)	248.20	248.20	235.37	487.33
Pipe Wrap - Gas (per foot)	0.00	0.00	0.00	0.00
Low-flow Showerhead 1.5 gpm - Electric	161,994.54	161,994.54	161,994.54	131,129.87
Low-flow Showerhead 1.5 gpm - Gas	0.00	0.00	0.00	0.00
Programmable Thermostat - Electric Cooling and Gas Heating Savings	29,739.45	29,739.45	23,791.56	9,032.35
Programmable Thermostat - Electric Cooling and Heating Savings	284,757.20	284,757.20	227,805.76	87,080.56
Programmable Thermostat - Electric Cooling Only Savings	42,400.80	42,400.80	33,920.64	0.00
Programmable Thermostat - Gas Heating Only Savings	0.00	0.00	0.00	9,062.16
Total Savings	1,333,235.56	1,333,235.56	1,160,051.30	929,770.66
Total Program Realization Rate				70%

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 78. 2023 MFDI 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.)
Assessment Recommendations - Electric and Gas Savings	0.000	0.000	0.000	0.000
Assessment Recommendations - Electric Only	0.000	0.000	0.000	0.000
Assessment Recommendations - Gas Only	0.000	0.000	0.000	0.000
Bathroom Aerator 1.0 gpm - Electric	1.737	1.737	1.581	0.800
Bathroom Aerator 1.0 gpm - Gas	0.000	0.000	0.000	0.000
Kitchen Aerator 1.5 gpm - Electric	3.696	3.696	3.363	2.398
Kitchen Aerator 1.5 gpm - Gas	0.000	0.000	0.000	0.000
A-Line LEDs - Electric and Gas Savings	22.100	22.100	19.227	17.943
A-Line LEDs - Electric Only Savings	45.976	45.976	39.999	37.328
Candelabra LEDs - Electric and Gas Savings	0.468	0.468	0.407	0.397
Candelabra LEDs - Electric Only Savings	0.292	0.292	0.254	0.248
Downlight Fixture and Retrofit Kit - Electric Only Savings	1.120	1.120	0.974	0.914
Globe LEDs - Electric and Gas Savings	11.744	11.744	10.217	9.535
Globe LEDs - Electric Only Savings	18.324	18.324	15.942	14.877
Pipe Wrap - Electric (per foot)	0.030	0.030	0.028	0.056
Pipe Wrap - Gas (per foot)	0.000	0.000	0.000	0.000
Low-Flow Showerhead 1.5 gpm - Electric	11.526	11.526	11.526	0.531
Low-Flow Showerhead 1.5 gpm - 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 and 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	117.013	117.013	103.519	85.025
Total Program Realization Rate				73%

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 79. 2023 MFDI 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 GASS ENERGY SAVINGS (THERMS/YR.)	*EX POST* GROSS NATURAL GAS ENERGY SAVINGS (THERMS/YR.)
Assessment Recommendations - Electric and Gas Savings	0.00	0.00	0.00	0.00
Assessment Recommendations - Electric Only	0.00	0.00	0.00	0.00
Assessment Recommendations - Gas Only	0.00	0.00	0.00	0.00
Bathroom Aerator 1.0 gpm - Electric	0.00	0.00	0.00	0.00
Bathroom Aerator 1.0 gpm - Gas	949.05	949.05	863.64	861.19
Kitchen Aerator 1.5 gpm - Electric	0.00	0.00	0.00	0.00
Kitchen Aerator 1.5 gpm - Gas	3,918.12	3,918.12	3,565.49	3,874.49
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
Downlight Fixture and Retrofit Kit - 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
Pipe Wrap - Electric (per foot)	0.00	0.00	0.00	0.00
Pipe Wrap - Gas (per foot)	2,765.01	2,765.01	2,622.06	5,204.01
Low-Flow Showerhead 1.5 gpm - Electric	0.00	0.00	0.00	0.00
Low-Flow Showerhead 1.5 gpm - Gas	6,905.07	6,905.07	6,905.07	8,244.06
Programmable Thermostat - Electric Cooling and Gas Heating Savings	22,528.05	22,528.05	18,022.44	9,817.56
Programmable Thermostat - Electric Cooling and Heating Savings	0.00	0.00	0.00	0.00
Programmable Thermostat - Electric Cooling Only Savings	0.00	0.00	0.00	0.00
Programmable Thermostat - Gas Heating Only Savings	22,602.40	22,602.40	18,081.92	9,849.96
Total Savings	59,667.70	59,667.70	50,060.61	37,851.27
Total Program Realization Rate				63%

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 *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 and since evaluators did not survey 2023 participants, 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 2023 (*Appendix 5. Multifamily Direct Install Program*). 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 80 shows the NTG ratios by measure.

Table 80. 2023 MFDI Program Net-to Gross Ratios by Measure

MEASURE	NTG	SOURCE
Assessment and Property Bonus	100%	Deemed
Bathroom Aerators	103%	ComEd, Nicor, Peoples, Northshore 2018[39]
Kitchen Aerators	103%	ComEd, Nicor, Peoples, Northshore 2018
LEDs	96%	Ameren Illinois 2018[40]
Pipe Wrap	87%	NIPSCO HEA 2022 Participant Survey
Showerheads	101%	Nicor, Peoples, Northshore 2018[41]
Thermostats – Cooling and Heating Savings	98%	Ameren Illinois 2018
Thermostats – Electric Cooling Only	89%	Ameren Illinois 2018

Table 81 presents the resulting net electric savings, demand reduction, and natural gas savings.

Table 81. 2023 MFDI 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	0.00	0.000	0.00	100%	0.00	0.000	0.00
Assessment Recommendations - Electric Only	0.00	0.000	0.00	100%	0.00	0.000	0.00
Assessment Recommendations - Gas Only	0.00	0.000	0.00	100%	0.00	0.000	0.00
Bathroom Aerator 1.0 gpm - Electric	14,212.17	0.800	0.00	103%	14,638.54	0.824	0.00

39 ComEd. Net-to-Gross Research Results for ComEd Multifamily Market Rate Program PY9 and CY2018. September 12, 2019.
40 Ameren Illinois Company. 2018 Multifamily Initiative Tenant and Property Manager Survey NTGR Results. September 4, 2019.
41 Nicor Gas, Peoples Gas, North Shore Gas. Net-to-Gross Research Results for the Market Rate Multifamily Program for Nicor Gas, Peoples Gas, and North Shore Gas GPY6 and CY2018. August 28, 2019.

MEASURE	*EX POST* GROSS SAVINGS/REDUCTION			NTG	*EX POST* NET SAVINGS/REDUCTION		
	KWH	KW	THERMS		KWH	KW	THERMS
Bathroom Aerator 1.0 gpm - Gas	0.00	0.000	861.19	103%	0.00	0.000	887.02
Kitchen Aerator 1.5 gpm - Electric	58,037.33	2.398	0.00	103%	59,778.45	2.470	0.00
Kitchen Aerator 1.5 gpm - Gas	0.00	0.000	3,874.49	103%	0.00	0.000	3,990.72
A-Line LEDs - Electric and Gas Savings	137,094.47	17.943	0.00	96%	131,610.69	17.225	0.00
A-Line LEDs - Electric Only Savings	285,206.13	37.328	0.00	96%	273,797.88	35.835	0.00
Candelabra LEDs - Electric and Gas Savings	3,031.26	0.397	0.00	96%	2,910.01	0.381	0.00
Candelabra LEDs - Electric Only Savings	1,891.30	0.248	0.00	96%	1,815.65	0.238	0.00
Downlight Fixture and Retrofit Kit - Electric Only Savings	6,982.80	0.914	0.00	96%	6,703.49	0.877	0.00
Globe LEDs - Electric and Gas Savings	72,852.37	9.535	0.00	96%	69,938.28	9.154	0.00
Globe LEDs - Electric Only Savings	113,670.55	14.877	0.00	96%	109,123.72	14.282	0.00
Pipe Wrap - Electric (per foot)	487.33	0.056	0.00	87%	422.21	0.048	0.00
Pipe Wrap - Gas (per foot)	0.00	0.000	5,204.01	87%	0.00	0.000	4,508.61
Low-Flow Showerhead 1.5 gpm - Electric	131,129.87	0.531	0.00	101%	132,441.17	0.536	0.00
Low-Flow Showerhead 1.5 gpm - Gas	0.00	0.000	8,244.06	101%	0.00	0.000	8,326.50
Programmable Thermostat - Electric Cooling and Gas Heating Savings	9,032.35	0.000	9,817.56	98%	8,851.71	0.000	9,621.21
Programmable Thermostat - Electric Cooling and Heating Savings	87,080.56	0.000	0.00	98%	85,338.95	0.000	0.00
Programmable Thermostat - Electric Cooling Only Savings	0.00	0.000	0.00	89%	0.00	0.000	0.00
Programmable Thermostat - Gas Heating Only Savings	9,062.16	0.000	9,849.96	98%	8,880.92	0.000	9,652.97
Total Savings	929,770.66	85.025	37,851.27		906,251.67	81.869	36,987.03

Note: Totals may not sum properly due to rounding.

Table 82 shows the net-to-gross results for each fuel.

Table 82. 2023 MFDI 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.)	1,333,235.56	929,770.66	97%	906,251.67
Peak Demand Reduction (kW)	117.013	85.025	96%	81.869
Natural Gas Energy Savings (therms/yr.)	59,667.70	37,851.27	98%	36,987.03

Process Evaluation

The evaluation team completed interviews with participating property managers to answer the following research questions:

- How do property managers become aware of the program?
- What drives property manager participation in the program? What are their motivations and barriers?
- Do property managers hear any feedback from tenants about the measures? Do they have a sense of whether tenants remove any measures?
- What are the reasons participants decline or remove direct install measures?
- How satisfied are property managers with the program, including the participation process, interactions with the trade allies, and the measures installed?

The evaluation team interviewed four property managers who participated in the program. The following sections describe feedback from these participating property managers.

Program Awareness and Marketing

Most interviewed property managers (three of the four interviewed) heard about MFDI from a program representative (typically the auditor) coming in-person to their property. Participating property managers indicated this was effective as they otherwise would not have heard about the program. Further, one property manager indicated this was the best way to reach them because it can be hard to tell if programs are scams; by meeting a program representative/auditor in-person, the property manager had more assurance that the program was legitimate. Property managers reflected that they liked how the program representative/auditor officially came to them, introduced himself, and provided materials about the program.

In terms of the best ways to reach property managers, the in-person method seemed to be preferred among this group, but some property managers suggested using bill inserts, emails, or brochures. It should be noted that direct outreach and word-of-mouth channels are both listed as program-specific marketing tactics in the MFDI program abstract. Only one property manager indicated that they heard about the program through word-of-mouth. However, all four interviewees indicated that they would recommend the program to other peers, suggesting that this channel might be underutilized by the program.

Participation Motivations

The primary motivation to participate in the program for three of the four property managers interviewed was the ability to receive and install the tenant area measures for free, though reductions in building maintenance costs featured as another benefit. One property manager mentioned that it would be beneficial for their tenants and cited that as a reason for participation.

Two property managers indicated that in the absence of the program, they would not have been able to install all the items at once, if at all, as the measures would be very expensive to buy at that large of a quantity in addition to the labor cost of installing them. Property managers were also motivated by the fact that the measures were energy-efficient, and they suggested that this would reduce tenant energy bills and building maintenance costs.

As an update from the previous year, the MFDI program offered a $250 participation bonus to property managers. However, no interviewees indicated that they received the participation incentive or were aware of it, indicating that at least for these participants the bonus was not a key motivator for participation (one property manager was not eligible for the property bonus based on the value of the direct install equipment.)

Participation Process

Per program design, property managers are to receive an assessment by the program implementers that outlines both tenant area and common area upgrades that the building would benefit from. Three property managers indicated they either did not recall seeing the assessment results or did not receive them at all. One indicated that the assessment did not provide new information. Notably, none of the property managers interviewed indicated that they received common area upgrades through NIPSCO's SBDI program, which might have been identified in an assessment report. One did reflect that they were interested in getting upgrades to the building's boiler. Though program implementers are successfully targeting tenant-area measures, there could be opportunity for deeper savings by using these assessments to drive cross-program participation.

Tenant Feedback

Property managers indicated that tenants were generally pleased about receiving new measures through the MFDI program, despite some minor issues with the equipment installed. One property manager noted that some residents experienced difficulties with the new programmable thermostats, but overall, most tenants like the new products. Another property manager noted that tenants experienced some of the new LEDs burning out quickly after installation. Otherwise, there were very few instances of tenants removing products that were installed (according to the property managers).

Property managers were unable to assess tenant utility bill impacts after receiving the energy saving products since a variety of factors impact bill amounts.

At least one of the interviewed property managers indicated that they made use of NIPSCO-provided materials, such as flyers, to communicate with tenants about the MFDI program. This proved to be a useful communication tool according to that participant.

Property Manager Satisfaction

Property managers were satisfied with the program overall and very grateful for their ability to participate. Every interviewee said that the process from start to finish went smoothly and they were happy with the attentiveness and punctuality of the contractors. Every property manager was pleased with the auditor who came in, and most projects were completed in just a few days.

When asked if there were any pain points throughout the process, most respondents answered no. Some property managers had issues with specific measures such as lightbulbs that burned out quickly and thermostats that required some adjusting to as they were complicated for some residents, as noted above. However, they still indicated that they were satisfied with the program overall and would recommend it to other properties.

Conclusions and Recommendations

CONCLUSION 1: THE PROGRAM DID NOT MEET ITS SAVINGS GOALS IN 2023.

Though participation increased from the previous year, limited participation in 2023 resulted in the program not meeting savings goals. Increased volume of participation will be necessary to meet savings goals, as well as deeper savings per property. Conclusions and recommendations below also address program marketing/outreach and driving deeper savings per property.

Recommendations:

- As previously recommended, consider one-stop-shop participation models, which streamline the process and emphasize both in-unit (MFDI) and common area (SBDI) improvements as part of the same participation experience.
- Prioritize the installation of smart thermostats in the program. Unlike the programmable thermostats offered in 2023, which can only claim heating savings according to the Illinois TRM v11.0, smart thermostats have the potential to increase heating savings as well as reintroduce cooling savings.

CONCLUSION 2: REALIZATION RATES VARIED DUE TO DIFFERENCES IN ASSUMED INPUTS BETWEEN THE TECHNICAL REFERENCE MANUALS AND INSTALLED EQUIPMENT SPECIFICATIONS.

Ex ante savings used a mix of inputs and approaches from the Indiana TRM (v2.2) and past EM&V results. To anticipate the update in the 2024 Indiana TRM which aligns with the Illinois TRM, evaluated savings used approaches from the Illinois TRM v11.0 and a mix of inputs from installed equipment specifications, Illinois TRM v11.0, and Indiana TRM (v2.2).

Recommendations:

- Update *ex ante* savings approaches to the Illinois TRM v12.0, as instructed by the new Indiana Technical Reference Manual Workbook v1.0. Where applicable, use Indiana location specific input assumptions from Indiana TRM Workbook v1.0 and programmable thermostat heating consumptions, which map to climate comparable Illinois TRM cities.

CONCLUSION 3: DIRECT OUTREACH WAS A KEY FACTOR IN RECRUITING PARTICIPANTS TO THE PROGRAM, BUT OTHER CHANNELS COULD EXPAND PROGRAM REACH.

Participating property managers indicated that they heard about MFDI through direct outreach from the program implementation team. In these cases, a program representative made an in-person visit to the properties to raise awareness about the program. The in-person visits assured property managers that the program was not a scam. Additionally, all the property managers interviewed expressed high levels of satisfaction with the program and indicated that they would recommend the program to others.

Recommendations:

- Continue in-person direct outreach strategies to recruit MFDI participants.
- Foster word-of-mouth marketing or sharing among property manager peer groups by developing case studies of successful products and engaging local real estate industry trade organizations.

CONCLUSION 4: INTERVIEWED PROPERTY MANAGERS DID NOT ENGAGE WITH ENERGY ASSESSMENT REPORTS TO GUIDE THEIR DECISIONS.

Property managers that were interviewed indicated that they either did not remember reading the energy assessment report or did not recall receiving it at all (though the assessment is emailed to the property manager before work is completed). None of the property managers indicated that they received common area upgrades through the SBDI program, though some expressed interest in those types of upgrades.

Recommendations:

- Investigate ways to ensure that energy assessment reports are being delivered to property managers in a format that is readable and simple to understand. Though the assessment summary is emailed to the property manager/owner before work commences, the program could consider making the document more memorable with a clearer call to action to ensure that property managers/owners are thoroughly reviewing it.
- Ensure that MFDI participants are also connected with SBDI program offerings and clarify next steps to drive deeper savings per property.

CONCLUSION 5: LED LIGHTING RETROFITS COMPRISED 67% OF *EX POST* (53% OF *EX ANTE*) MFDI PROGRAM SAVINGS IN 2023.

Lighting continues to provide the majority of MFDI savings. Beginning with IL TRM v12.0 for the 2024 program year, the TRM is explicit in limiting LED retrofit savings only to direct install programs where “it can be shown that the LED is replacing inefficient lighting” and that programs “should continue to use the existing inefficient lighting as a baseline and also assume a measure life of 2 years.”

Recommendations:

- Supply project documentation in the form of photographs of the *in situ* inefficient lighting prior to it being replaced.

8. APPLIANCE RECYCLING PROGRAM

Program Design and Delivery

NIPSCO offers the Appliance Recycling program to incentivize customers to remove their inefficient secondary refrigerators, freezers, dehumidifiers, and room air conditioners. 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 2023 program year, the program recycled 871 appliances.

From the beginning of the year until August 1, 2023, NIPSCO continued working with Appliance Recycling Centers of America (ARCA) as the Appliance Recycling implementer. ARCA scheduled and picked up appliances, conducted the recycling functions, and processed the rebates for the NIPSCO Appliance Recycling program. In addition, the pick-up crew left behind marketing collateral for other NIPSCO programs. ARCA provided in-home appliance pick-up as well as a curbside pick-up option.

The following describes the steps customers took to participate in the program.

1. After the customers learned about the Appliance Recycling program, they could participate by scheduling a pick-up with ARCA through NIPSCO's website or over the phone.
2. Customers could schedule a pick-up date and time after ARCA confirmed their eligibility for the program. Customers received an order confirmation number and an email with the pick-up details from ARCA.
3. ARCA pick-up crew called 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 called customers one stop prior (about 10 – 15 minutes) to notify them again.[42]
4. While on site, ARCA's pick-up crew members arrived in a company-marked vehicle, dressed professionally, and presented proper identification to the customer. The ARCA pick-up crew wore protective masks and gloves if requested by the customer. If it was a curbside pick-up, the customer placed the appliance on the porch, sidewalk, driveway, or in an open garage.
5. The pick-up crew confirmed the appliances' eligibility (i.e., whether they are plugged in, operational, and the correct size) and then collected the unit's information, including their assessment of the appliance's age and other characteristics.
6. ARCA then permanently disabled the appliance and removed it for transport to the processing centers. ARCA sent pick-up tracking data to TRC and then NIPSCO monthly.
7. Customers received their rebate checks within six weeks of pick-up.

[42] 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.

NIPSCO marketed the program through a variety of ways in 2023 from the beginning of the year until August 1. Some of these avenues included bill inserts, direct mail, community outreach events, public relations, the NIPSCO website, NIPSCO social media, and cross-promotion through other programs.

Changes from the 2022 Design

The two primary changes to the program in 2023 included:

- NIPSCO suspended the program on August 1, 2023, after the implementer (ARCA) unexpectedly ended operations. The program remained suspended for the remainder of 2023.
- NIPSCO offered community recycling events for customers to bring small appliances (air conditioners and dehumidifiers) to be recycled. In 2023, there was one recycling event on June 10.

Program Performance

The 2023 program goals for electric energy savings and peak demand reduction were like the 2022 goals (2,330,676,00 kWh/yr. and 586.602 kW, respectively). The program fell short of meeting its goals for the 2023 program year, largely due to the program being suspended from August to December of 2023. Reported electric energy savings in 2023 were 61% of 2022 savings and peak demand reduction savings in 2023 were 59% of 2022 savings. Table 83 summarizes savings for the program in 2023, including program savings goals.

Table 83. 2023 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.)	2,346,435.00	716,634.35	716,634.35	716,634.35	654,205.76	405,542.88	28%
Peak Demand Reduction (kW)	524.510	116.341	116.341	116.341	96.284	59.746	18%

Table 84 outlines the *ex post* and Net-to-Gross (NTG) adjustment factors. The evaluation team used the NTG ratio calculated from the 2023 survey of program participants. The NTG ratio was 62% for electric energy and 62% for demand savings.

Table 84. 2023 Appliance Recycling Program Adjustment Factors

METRIC	REALIZATION RATE (%)[a]	FREERIDERSHIP	SPILLOVER	NTG (%)[b]
Electric Energy Savings (kWh/yr.)	91%	38%	0%	62%
Peak Demand Reduction (kW)	83%	38%	0%	62%

[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 33% of its budget in the 2023 program year. Table 85 lists the 2023 program budget and expenditures.

Table 85. 2023 Appliance Recycling Program Expenditures

FUEL	PROGRAM BUDGET	PROGRAM EXPENDITURES	BUDGET SPENT (%)
Electric	$488,058.30	$158,863.60	33%

Evaluation Methodology

To inform the 2023 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.
- **Participant surveys (n=97),** to understand the participant experience in the program and to gather information to calculate freeridership and NTG ratios.

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?
- What is the average age of appliances recycled through the program? How does this compare to 2021 and 2022?
- How effective was the program in influencing participant decision making? What are the 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: the Illinois TRM v11.0, the Pennsylvania TRM (2021), and the 2015 Indiana TRM (v2.2).[43,44,45]

[43] Cadmus. Indiana Technical Reference Manual Version 2.2. July 28, 2015.
[44] Illinois Energy Efficiency Stakeholder Group. 2023 Illinois Statewide Technical Reference Manual for Energy Efficiency Versio n 11.0. Volume 3: Residential Measures. September 22, 2022.
[45] Pennsylvania Public Utility Commission. Technical Reference Manual Volume 2: Residential Measures. February 2021.

Audited and Verified Savings

The evaluation team reviewed the program tracking data provided by the program implementer 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 evaluation team found that no measures were duplicative and all followed program guidelines and properly deemed savings amounts; the evaluation team did not remove any measures in the tracking data audit.

According to the program tracking data, the program recycled 871 appliances while it was active in January through August of 2023. This is 60% of what the program recycled in 2022 (1,446 appliances). Table 86 summarizes the tracking data quantity, audited quantity, and resulting verified quantity per measure. In-service rates are not applicable to appliance recycling programs, but the participant surveys confirmed that survey respondents recall participating in the program and data on recycled measures is correct.

Table 86. 2023 Appliance Recycling Program *Ex Ante* through Verified Quantities

MEASURE	UNIT OF MEASURE	TRACKING DATA QUANTITY	AUDITED QUANTITY	VERIFIED QUANTITY
Refrigerators	Recycled Appliance	615	615	615
Freezers	Recycled Appliance	148	148	148
Dehumidifiers	Recycled Appliance	59	59	59
Room Air Conditioners	Recycled Appliance	49	49	49
2023 Program Total		871	871	871

Ex Post Gross Savings

The evaluation team calculated *ex post* gross per-measure savings for program measures using algorithms and variable assumptions from the IL TRM v11.0 for recycled refrigerators and freezers, both the IL TRM v11.0 and the Indiana TRM (v2.2) for room AC recycling, and the Pennsylvania TRM (2021) for 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 87 below.

Table 87. 2023 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	71%	75%
Freezers	17%	17%
Dehumidifiers	7%	6%
Room Air Conditioners	6%	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 2023 participant survey results for the part-use factor, unit age, percent of refrigerators that were used as a primary unit, and percent of units that were in unconditioned spaces. Information is provided in *Appendix 6. Appliance Recycling Program* 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 88).

Table 88. 2023 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	2023 Tracking Data
Part-use factor	Accounting for units not in use for the entire year	2023 Participant Survey
Average gross per-unit energy savings	Based on per-unit energy consumption and part-use factors	2023 Tracking Data and 2023 Participant Survey

Appendix 6. Appliance Recycling Program presents 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 Summary

Table 89 shows the *ex ante* deemed savings and *ex post* gross per-measure savings for 2023 Appliance Recycling program measures.

Table 89. 2023 Appliance Recycling 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	KWH	KW
Refrigerators	Recycled appliance	922.00	0.135	795.00	0.098
Freezers	Recycled appliance	740.00	0.109	751.00	0.088
Dehumidifier	Recycled appliance	533.60	0.121	711.00	0.173
Room Air Conditioners	Recycled appliance	175.55	0.205	248.65	0.260

Table 90 highlights notable differences between *ex ante* and *ex post* gross estimates.

Table 90. 2023 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 2021 evaluation results.	IL TRM v11.0 and 2023 ARP participant survey	A 34% decrease in the proportion of refrigerators that were being used as a primary unit in 2023 (calculated from 2023 participant survey data) compared to the estimate used in the 2021 evaluation (based on 2020 participant survey data).
Freezers	*Ex ante* savings based on the 2021 evaluation results.	IL TRM v11.0 and 2023 ARP participant survey	A 78% increase in the proportion of freezers with a chest configuration and a 10% increase in the size of freezers recycled in 2023 compared to 2021.
Dehumidifiers	*Ex ante* savings based on the 2021 evaluation results.	Dehumidifier recycling is not included in the Indiana TRM (v2.2) or the IL TRM v11.0; 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.	*Ex ante* savings reference the Mid-Atlantic TRM (v10), which includes a replacement rate that reduces gross savings, while *ex post* gross savings are based on deemed values from Pennsylvania TRM (2021) which does not include a replacement rate.[46]
Room Air Conditioners	*Ex ante* savings based on the 2021 evaluation results.	IL TRM v11.0 and Indiana TRM (v2.2).	The Indiana TRM (v2.2) used for the 2021 evaluation, the source of the *ex ante* gross savings, includes a replacement rate, while *ex post* gross savings primarily based on deemed values from IL TRM v11.0 does not include a replacement rate.

[46] The evaluation team decided to use the Pennsylvania TRM (2021) because it did not include a replacement rate for dehumidifier recycling measures, like how the Illinois TRM handles room air conditioner recycling measures.

Appliance Age

The evaluation team identified the average appliance age according to the tracking and participant surveys. In the past, the evaluation team has identified this to highlight discrepancies between the appliance age in the tracking data and participant surveys. Table 91 shows that the average age of appliances in the 2023 tracking data are consistent with the average appliance age in tracking data from 2022 and 2021. For large appliances, there is a difference of 0-1 years between the 2023 tracking data and 2023 participant surveys. This difference is smaller than the difference between the tracking data and participant surveys in prior years. For smaller appliances, there is a difference of 6-8 years in the 2023 tracking data and 2023 participant surveys.

Table 91. Average Reported and Tracking Data Ages by Program Year

MEASURE	2019 SURVEY	2019 TRACKING	2020 SURVEY	2020 TRACKING	2021 TRACKING	2022 TRACKING	2023 TRACKING	2023 SURVEY
Refrigerators	18	33	17	27	20	20	20	19
Freezers	22	35	22	30	22	25	22	22
Dehumidifier	N/A	N/A	N/A	N/A	17	15	16	8
Room Air Conditioner	N/A	N/A	N/A	N/A	17	15	18	12

Source: Tracking data and participant survey. Survey questions: "About how old was the [appliance] you recycled (in years)?"

Realization Rates

The next two tables (Table 92 and Table 93) show the program's *ex ante* reported savings, verified savings, *ex post* gross savings and total program realization rates for electric energy savings and peak demand reduction.

Table 92. 2023 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.)	VERIFIED GROSS ELECTRIC ENERGY SAVINGS (KWH/YR.)	*EX POST* GROSS ELECTRIC ENERGY SAVINGS (KWH/YR.)
Refrigerators	567,030.00	567,030.00	567,030.00	488,925.00
Freezers	109,520.00	109,520.00	109,520.00	111,148.00
Dehumidifier	31,482.40	31,482.40	31,482.40	41,949.00
Room Air Conditioner	8,601.95	8,601.95	8,601.95	12,183.76
Total Savings	**716,634.35**	**716,634.35**	**716,634.35**	**654,205.76**
Total Program Realization Rate				**91%**

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 93. 2023 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.)	VERIFIED GROSS PEAK DEMAND REDUCTION (kW/YR.)	*EX POST* GROSS PEAK DEMAND REDUCTION (kW/YR.)
Refrigerators	83.025	83.025	83.025	60.284
Freezers	16.132	16.132	16.132	13.037
Dehumidifier	7.139	7.139	7.139	10.213
Room Air Conditioner	10.045	10.045	10.045	12.750
Total Savings	**116.341**	**116.341**	**116.341**	**96.284**
Total Program Realization Rate				**83%**

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 evaluation team used the 2023 participant survey results in combination with the *ex post* gross impact evaluation results to estimate NTG ratios for both refrigerators and freezers. The evaluation team calculated NTG ratios by removing freeridership and secondary market impact values (program savings that would have happened in the programs absence) from gross savings. Greater detail of NTG methodology is in *Appendix 6. Appliance Recycling Program*.

The evaluation team followed UMP methodology recommendations to exclude participant spillover to adjust net savings. The UMP suggests that although appliance recycling programs promote enrollment in other energy efficiency programs, spillover of unrelated measures is unlikely to occur.

The evaluation team found that there was a NTG of 64% for refrigerators and 53% for freezers. Using a savings weighted average of 2023 recycled refrigerator and freezers NTG estimates, the evaluation team found a total program NTG of 62% for energy savings and 62% for demand reduction. The evaluation team applied the total program NTG values as the NTG for dehumidifiers and room air conditioners. Table 94 shows the NTG ratios by measure.

Table 94. 2023 Appliance Recycling Program Net-to Gross Ratios by Measure

MEASURE	NTG
Refrigerators	64%
Freezers	53%
Dehumidifier	62%
Room Air Conditioner	62%

The 2023 refrigerator NTG ratio of 64% is higher than the 2020 NIPSCO Appliance Recycling program evaluation refrigerator NTG ratio (52%), primarily due to a higher percentage of 2023 participants reporting they would have kept their refrigerator in absence of the program compared to 2020 participants. The 2023 freezer NTG ratio of 53% is lower than the 2020 NIPSCO Appliance Recycling program evaluation freezer NTG ratio (76%), primarily due to a lower percentage of 2023 participants reporting they would have kept their freezer in absence of the program compared to 2020 participants, and due to a higher percentage of 2023 participants reporting they would have disposed of the unit on their own in absence of the program compared to 2020 participants.

Table 95 presents the resulting net electric savings and peak demand reduction savings by measure.

Table 95. 2023 Appliance Recycling Program *Ex Post* Net Savings

MEASURE	*EX POST* GROSS SAVINGS/REDUCTION		NTG	*EX POST* NET SAVINGS/REDUCTION	
	KWH	KW		KWH	KW
Refrigerators	488,925.00	60.284	64%	312,963.53	38.588
Freezers	111,148.00	13.037	53%	59,022.40	6.923
Dehumidifier	41,949.00	10.213	62%	26,004.23	6.331
Room Air Conditioner	12,183.76	12.750	62%	7,552.72	7.904
Total Savings	**654,205.76**	**96.284**	**62%**	**405,542.88**	**59.746**

Table 96 shows the net-to-gross results for each fuel.

Table 96. 2023 Appliance Recycling 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.)	716,634.35	654,205.76	62%	405,542.88
Peak Demand Reduction (kW)	116.341	96.284	62%	59.746

Process Evaluation

The evaluation team completed participant surveys to answer the following research questions:

- How do participants become aware of the program? Has it changed over time?
- What affects customer decisions to recycle their appliance?
- What was the customer's experience with scheduling the pick-up like?
- What is the participants' satisfaction with the program and NIPSCO overall?
- How familiar were participants with other NIPSCO Energy Efficiency Programs?
- What are the characteristics of recycled appliances?
- What was the customer experience of those who participated in community recycling events?

- How did customers become aware of community recycling events?
- How did the challenges with ARCA affect the customer experience?

Materials Review

To provide context on implementation, the evaluation team reviewed program materials. This included materials such as emails, mailers, check inserts, flyers, door hangers, yard signs, social media posts.

The evaluation team reviewed one social media post included with the materials that may make the purpose of the Appliance Recycling Program unclear to participants. Figure 4 below shows that the image says, “Out with the old…in with the energy efficient.” This post was made final on June 19, 2023, but did not have a scheduled date, so it may not have been sent to customers due to the program pausing in August 2023. Still, it is important to note that this type of messaging may encourage participants to recycle old appliances and replace them with energy efficient appliances. However, the program abstract states that the recycled appliance should be a secondary appliance and not be replaced by another one. If marketing encourages customers to participate who are replacing their recycled appliance with another unit, this could increase freeridership in the program and lower program savings.

Figure 4. 2023 Appliance Recycling Program Social Media Post Image

Source: 2023 Appliance Recycling Program marketing materials.

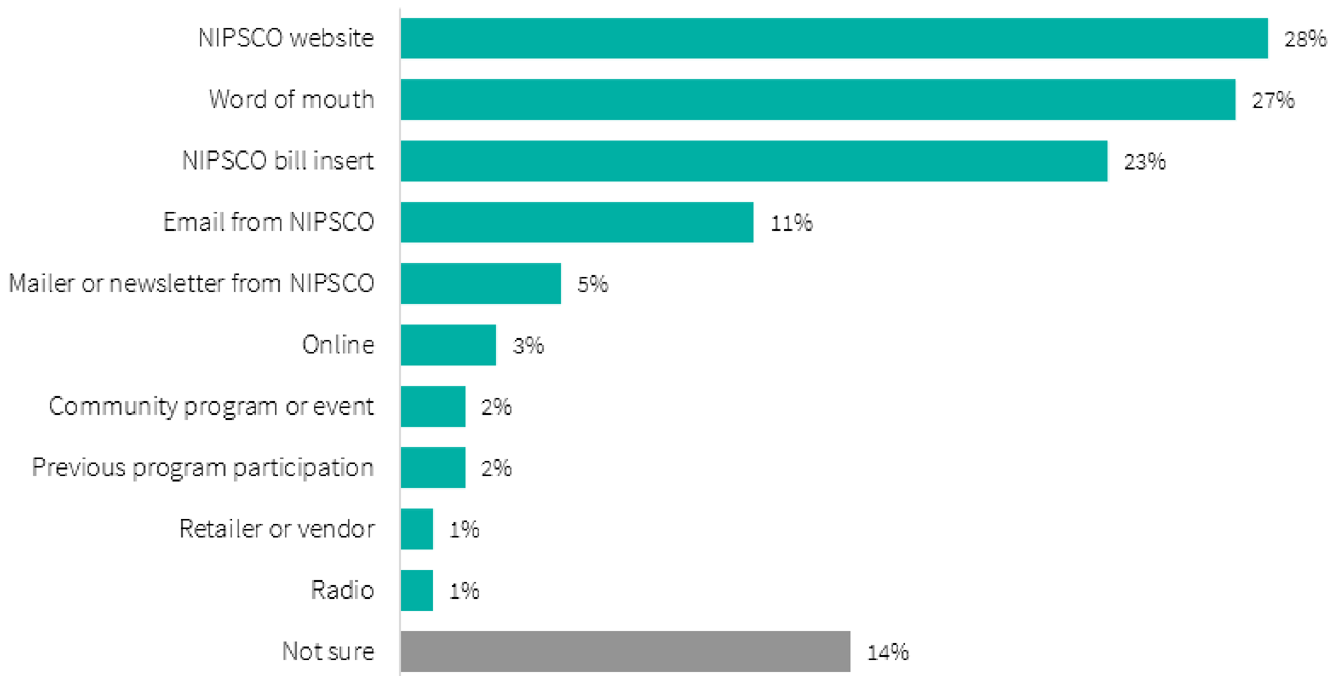
Participant Feedback

The evaluation team surveyed 97 customers who participated in the program. The following sections describe the results related to sources of awareness, reasons for participation, experience with the pick-up, satisfaction with the program and NIPSCO, familiarity with other NIPSCO programs, characteristics of appliances, and experience of the community recycling events.

Awareness and Motivations

Most respondents heard about the program from the NIPSCO website (28%), word of mouth (27%), or through a NIPSCO bill insert (23%; Figure 5). These were also the top three sources in 2020 when the evaluation team last conducted a participant survey for this program. While NIPSCO reported using social media as an outreach method, no one reported learning of the program that way.

Figure 5. 2023 Appliance Recycling Program Sources of Awareness



Source: Appliance Recycling Program Participant Survey Question C1. "How did you learn about NIPSCO's Appliance Recycling Program?"
This was a multiple response question (n=97).

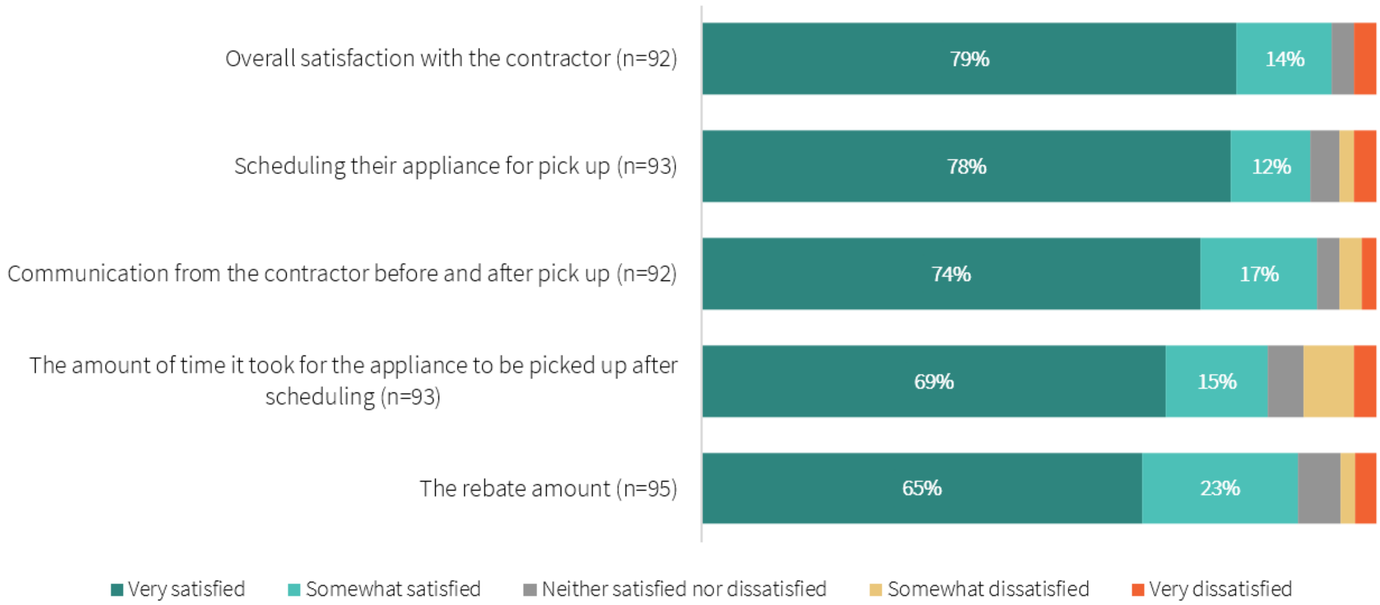
Most respondents decided to participate in the Appliance Recycling program to get rid of an extra appliance (57%) or to get the rebate/incentive (56%). Respondents also identified helping the environment (27%) and saving energy (24%) as important drivers in their decision to participate. The most common reasons respondents chose NIPSCO's program over other methods of disposing their appliance were to receive the rebate payment (39%) and for the free pick-up service (27%).

While the rebate is the main reason respondents choose to participate in NIPSCO's program over other methods, some respondents would still have participated with a lower rebate amount. Over half of respondents would have participated if the rebate amount had been less (59%) and many respondents would have participated with no rebate at all (40%).

Pick-Up Experience

Most respondents were at least somewhat satisfied with all aspects of the scheduling and pick up experience (80% or more). Figure 6 below shows customer satisfaction was high across all program components.

Figure 6. 2023 Appliance Recycling Program Respondent Satisfaction with Program Components

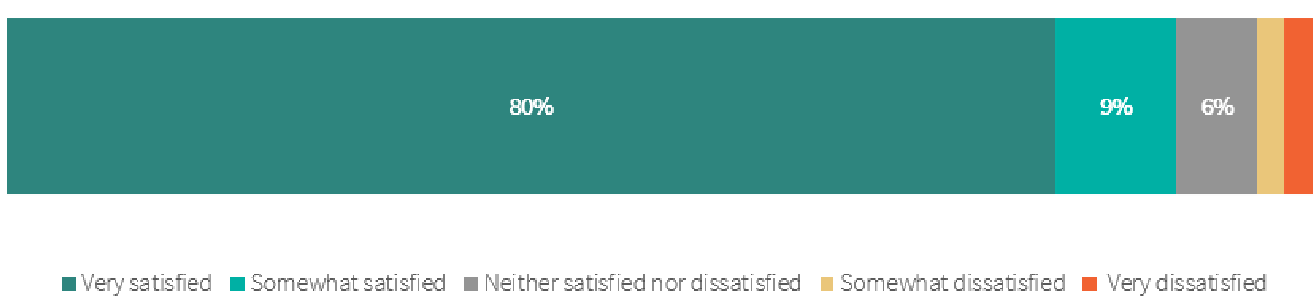


Source: Appliance Recycling Program Participant Survey Question I1. "How satisfied are you with the following aspects of the program? Scheduling your appliance for pick up. The amount of time it took for the appliance to be picked up after scheduling the pick-up. Communication from the contractor before and/or after pick-up. Your overall satisfaction with the contractor who picked up the appliance. The rebate amounts."

Satisfaction with Program and NIPSCO

Most respondents were satisfied with NIPSCO's Appliance Recycling Program overall: 89% responded that they were somewhat or very satisfied (Figure 7).

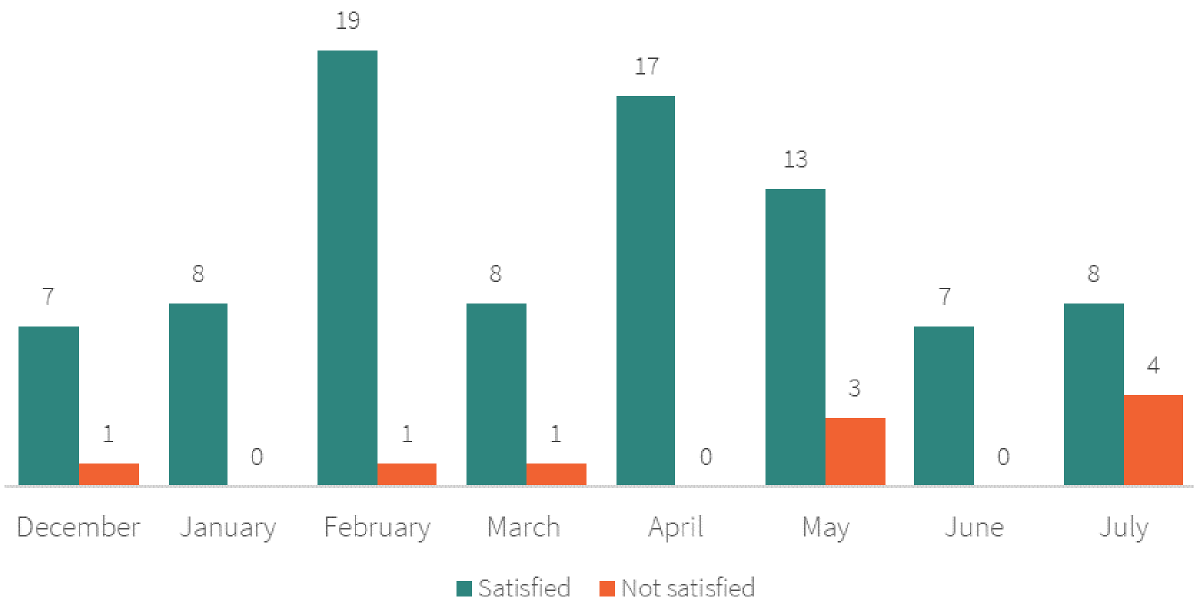
Figure 7. 2023 Appliance Recycling Program Overall Satisfaction



Source: Appliance Recycling Program Participant Survey Question I2. "How satisfied are you with NIPSCO's Appliance Recycling Program overall?"

Some survey respondents who participated later in the year reported lower levels of satisfaction, particularly those who participated in May and July (Figure 8). It is likely that these customers were affected by challenges with ARCA that resulted in them ending their operations in August 2023.

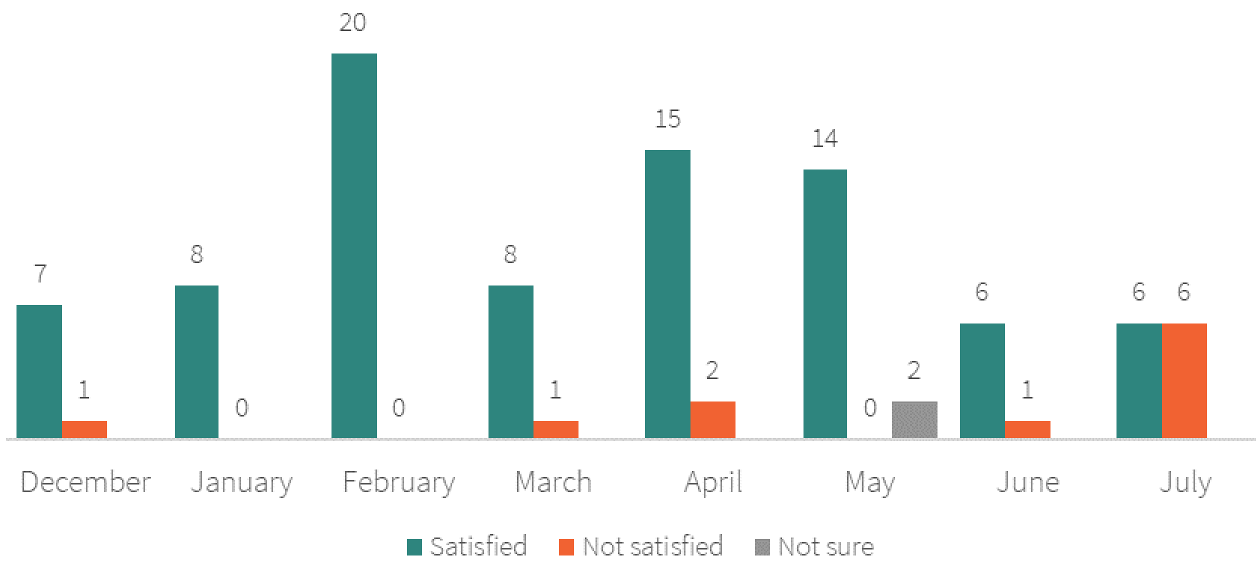
Figure 8. 2023 Appliance Recycling Program Respondent Satisfaction by Participation Month



Source: Appliance Recycling Program Participant Survey Question I2. "How satisfied are you with NIPSCO's Appliance Recycling Program overall?" Responses of "Very satisfied" or "Somewhat satisfied" classified as Satisfied and remaining responses classified as Not Satisfied.

Respondents who were satisfied explained it was because the program was easy and convenient (n=66), they were happy with the incentive (n=15), there was good customer service (n=14), and they liked that it was environmentally friendly (n=10). Those that were less satisfied explained that it was because their rebate check bounced (n=9), it took too long to receive the rebate (n=2), or they had challenges scheduling the pick-up (n=2). Of the nine respondents that mentioned that their lower satisfaction was due to the rebate checking bouncing, two participated in the program in May, two participated in June, and five participated in July. Figure 9 below shows that the number of customers who were not satisfied with the rebate increased over time, with the majority in July. While these customers were not satisfied with the rebate amount, they had similar levels of satisfaction for the other program components.

Figure 9. 2023 Appliance Recycling Program Respondent Satisfaction with Rebate by Participation Month



Source: Appliance Recycling Program Participant Survey Question I1_F. "How satisfied are you with the following aspects of th e program? The rebate amounts."

When asked how NIPSCO could improve the program, half of the respondents did not have any suggestions for improvement (52%). Some respondents suggested ensuring the check does not bounce (n=9), advertising the program more (n=8), and increasing the amount of the rebate (n=8). Most respondents are at least somewhat satisfied with NIPSCO overall as their energy service provider (81%; Figure 10).

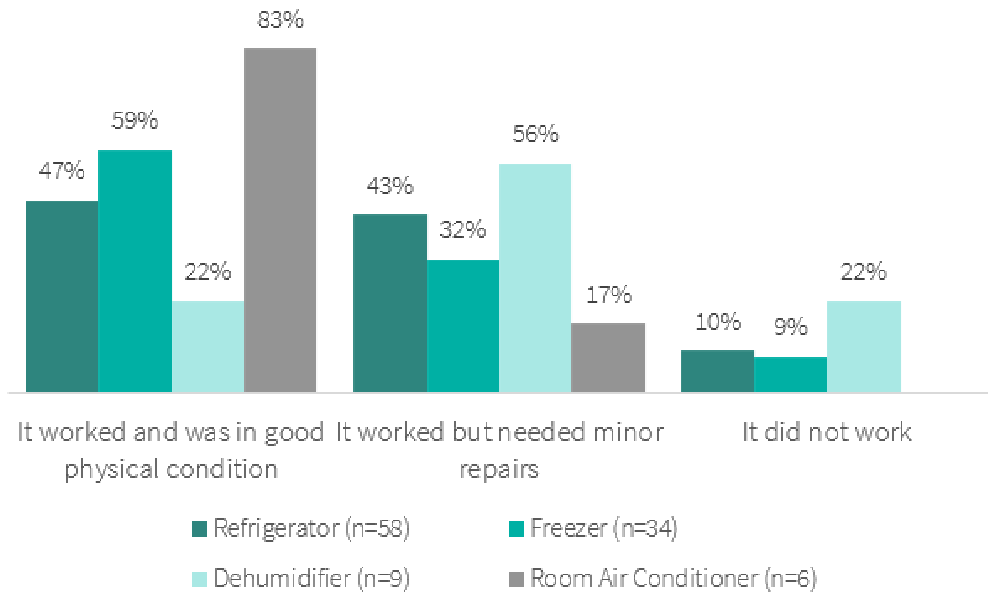
Figure 10. 2023 Appliance Recycling Program Respondent Satisfaction with NIPSCO Overall

Source: Appliance Recycling Program Participant Survey Question I5. "How satisfied are you with NIPSCO as your energy service provider?"

Characteristics of Appliances

Most of the appliances recycled through the program were in working condition. Figure 11 summarizes the condition of the appliances recycled through the program.

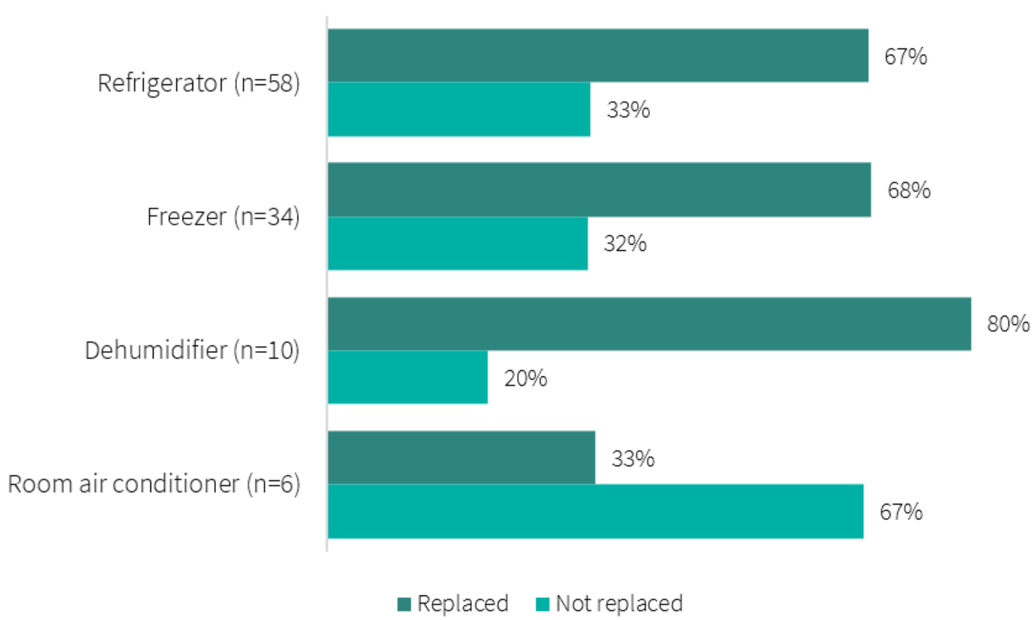
Figure 11. Condition of Appliances by Appliance Type



Source: Appliance Recycling Program Participant Survey Questions D4, E4, F4, G4. "How would you describe the condition of the [appliance] you disposed of? Would you say…"

Most refrigerators, freezers, and dehumidifiers were recycled through the program and then replaced with a new one (Figure 12). Four out of six room air conditioners were not replaced, while two were replaced. It should be noted that the sample size for respondents who answered this question and recycled a dehumidifier (n=10), or room air conditioner (n=6) was very small.

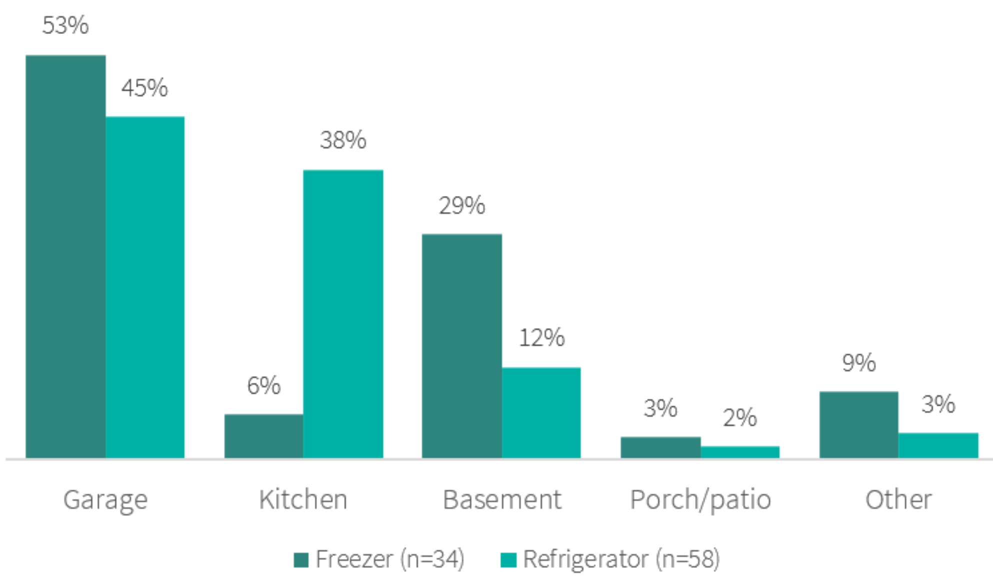
Figure 12. Percentage of Appliances Replaced



Source: Appliance Recycling Program Participant Survey Questions D8, E8, G7, F7. "Did you replace the [appliance] you recycled with another [appliance]?"

Most refrigerators were located either in the garage (45%) or the kitchen (38%; Figure 13). Most freezers were located in the garage (53%) or in the basement (29%).

Figure 13. Location in Home of Appliance Recycled



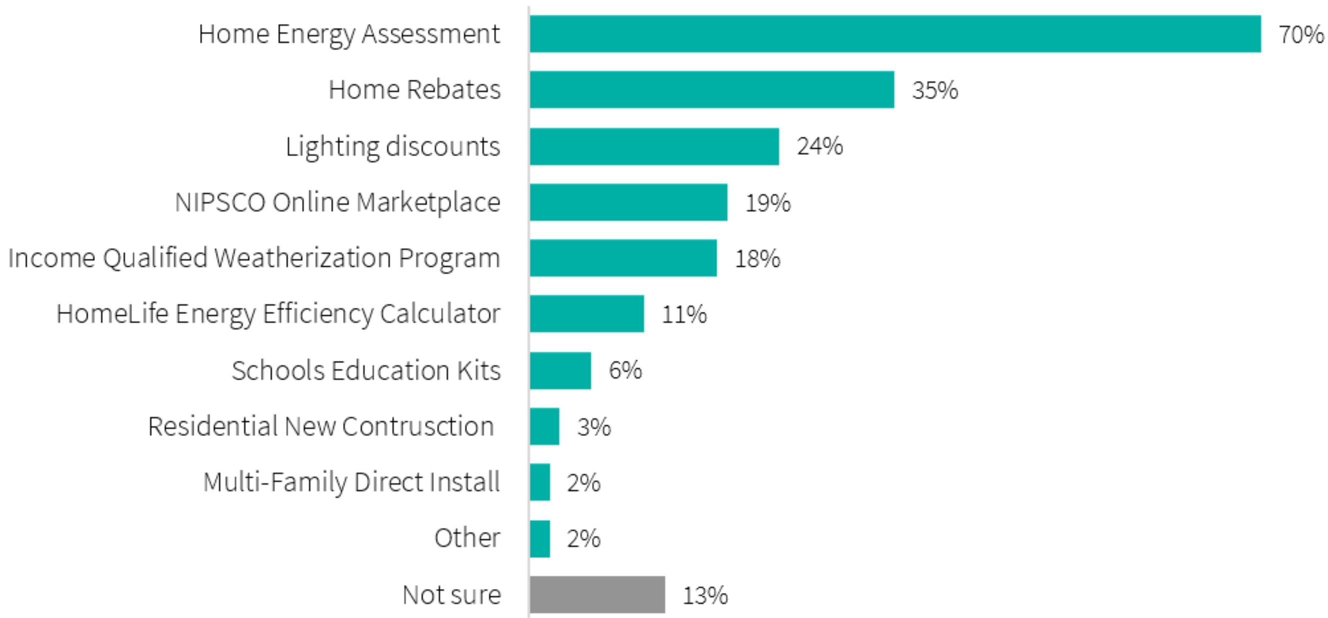
Community Recycling Events

Three survey respondents participated in a community recycling event. Of these, one respondent learned about it through an email from NIPSCO, one learned about it through a bill insert, and one learned about it through a mailer or newsletter from NIPSCO. All three of these respondents were at least somewhat satisfied with their experience at the community recycling event.

Knowledge of other NIPSCO Programs

Most participants are aware that NIPSCO offers other energy efficiency programs (65%). Specifically, respondents who were aware of other programs (n=63) had heard of the Home Energy Assessment program (70%), the Home Rebates program (35%), and lighting discounts (24%; Figure 14).

Figure 14. Respondent Awareness of Other NIPSCO Energy Efficiency Programs



Source: Appliance Recycling Program Participant Survey Question C3. "What energy efficiency programs have you heard of?" This was a multiple response question (n=63).

Most respondents had not participated in any other energy efficiency programs (64%). Of those that had (n=27), the most common program respondents participated in was the Home Energy Assessment (55%).

Participant Survey Demographics

Most respondents own their home (98%) and live in a single-family detached home (91%; Table 306). Over half have lived in their home for more than 10 years (60%). Almost half of respondents live in a household where there is a total of two occupants (49%), while some have three occupants (17%), and some have one (14%). Almost half of respondents live in a home built in 1990 or sooner (49%). Most respondents speak English at home (98%), have an average household income of $50,000 or more (73%), and are 44 years old or more (84%). More detail on participant survey demographics can be found in the *Participant Survey Demographics* section of *Appendix 6. Appliance Recycling Program*.

Conclusions and Recommendations

CONCLUSION 1: THE PROGRAM FELL SHORT OF ITS ENERGY SAVINGS AND DEMAND SAVINGS GOALS, DUE TO SUSPENDING THE PROGRAM AFTER ARCA UNEXPECTEDLY ENDED OPERATIONS BUT DID ACHIEVE A REALIZATION RATE OF 91% FOR KWH AND A REALIZATION RATE OF 83% FOR KW.

In the seven months of program tracking data evaluated, the program saved 654,205.76 kWh (28% of its goal) and 96.284 kW (18% of its goal). To inform the ex post gross savings analysis, the evaluation team used participant survey results to calculate part-use factor and ISR values, resulting in realization rates of 91% for electric savings and 83% for demand reduction.

Recommendation:

- Update the program *ex ante* savings estimates as well as evaluation metrics such as part-use factor and ISR to reflect the most recent evaluated results.

CONCLUSION 2: THE NIPSCO WEBSITE, WORD OF MOUTH, AND BILL INSERTS CONTINUE TO BE KEY SOURCES TO INFORM CUSTOMERS OF THE APPLIANCE RECYCLING PROGRAM.

The NIPSCO website, word of mouth, and bill inserts were the top three sources of awareness for survey respondents in the 2020 evaluation and they continued to be the top sources of awareness for survey respondents in the 2023 evaluation. NIPSCO also advertised the program through social media, however, no respondents reported learning of the program through social media. Additionally, one social media post the evaluation team reviewed seemed to encourage customers to replace their recycled appliance with a new, energy efficient one which does not follow program rules.

Recommendations:

- Continue to use the NIPSCO website and bill inserts to increase customer awareness of the program.
- Consider offering a referral program, where customers are incentivized to refer friends and family to the program, building upon the already strong word of mouth referrals the program benefits from.
- Ensure that all marketing materials align with program rules, such as the requirement that the recycled unit is a secondary appliance and is not being replaced with a new one.

CONCLUSION 3: WHILE MOST RESPONDENTS WERE SATISFIED WITH THE PROGRAM, SOME WHO PARTICIPATED LATER IN THE YEAR WERE LESS SATISFIED WITH THE REBATE AND THE PROGRAM OVERALL.

Most respondents (80%) were satisfied with all aspects of the scheduling and pick-up experience as well as the program overall (89%). However, nine survey respondents mentioned that they were unable to cash the rebate checks they received due to insufficient funds. All these customers participated in the last few months of the program's operation. These customers explained that this issue with the rebate check was their reason for lower satisfaction with the program. Other than this issue, survey respondents reported high levels of satisfaction with other components of the program.

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. Customers can choose to opt out of receiving HER reports. 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 enrolled 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. Oracle administers the program for NIPSCO.

The program uses a randomized control trial (RCT) design where Oracle randomly assigns customers to a treatment or control group. Customers in the treatment group receive an HER while customers in the control group do not receive a HER. The program has twelve customer groups (waves') based on when a customer began receiving the HER (Table 97). The initial five waves have respective natural gas and electric populations, known as cohorts. NIPSCO 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) kicked off with gas and electric customers in April 2019, April 2020, April 2021, and April 2022. The program retired Wave 10 after August 2023 due to persistent negative savings since launch. The twelfth wave also launched in April 2022, but as a separate wave with electric only customers.

Table 97. 2023 Customer Counts by Wave

WAVE	FIRST REPORT	FUEL	NUMBER OF ELECTRIC CUSTOMERS		NUMBER OF GAS CUSTOMERS	
			TREATMENT	CONTROL	TREATMENT	CONTROL
Wave 1	March 2011	Dual	72,332	24,048	71,963	23,932
Wave 2	June 2012	Dual	5,189	5,270	5,158	5,245
Wave 3	July 2014	Dual	22,804	5,162	22,745	5,151
Wave 4	March 2015	Dual	16,225	4,211	16,104	4,173
Wave 5	June 2017	Dual	17,709	5,738	17,661	5,743
Wave 6	September 2017	Natural Gas	-	-	33,463	8,011
Wave 7	May 2018	Electric	13,419	6,396	-	-
Wave 8	April 2019	Dual	16,270	8,011	16,298	8,026
Wave 9	April 2020	Dual	10,890	5,432	10,903	5,437
Wave 10	April 2021	Dual	15,863	7,814	15,880	7,820
Wave 11	April 2022	Dual	14,870	9,463	14,869	9,457
Wave 12	April 2022	Electric	17,120	9,093	-	-

WAVE	FIRST REPORT	FUEL	NUMBER OF ELECTRIC CUSTOMERS		NUMBER OF GAS CUSTOMERS	
			TREATMENT	CONTROL	TREATMENT	CONTROL
TOTAL		-	222,691	90,638	225,044	82,995

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 2023.
Source: ILLUME analysis of data provided by Oracle

Changes from the 2022 Design

There were three primary changes from 2022 to 2023:

1. In August 2023, NIPSCO and Oracle decided to retire Wave 10. Since its launch in April 2021, the wave has had persistent negative electric savings and low gas savings.
2. The program added cross-promotion for insulation programming in 2023, as shown in Figure 15 and Figure 16. In December, customers received HER reports with 'insulate and save' marketing.
3. HER messaging did not include specific '68 is Great' marketing in 2023. In December 2022, electric, dual fuel, and gas customers received '68 is Great' reports.

Figure 15. 2023 Program Design – Electric and Dual Fuel Customers

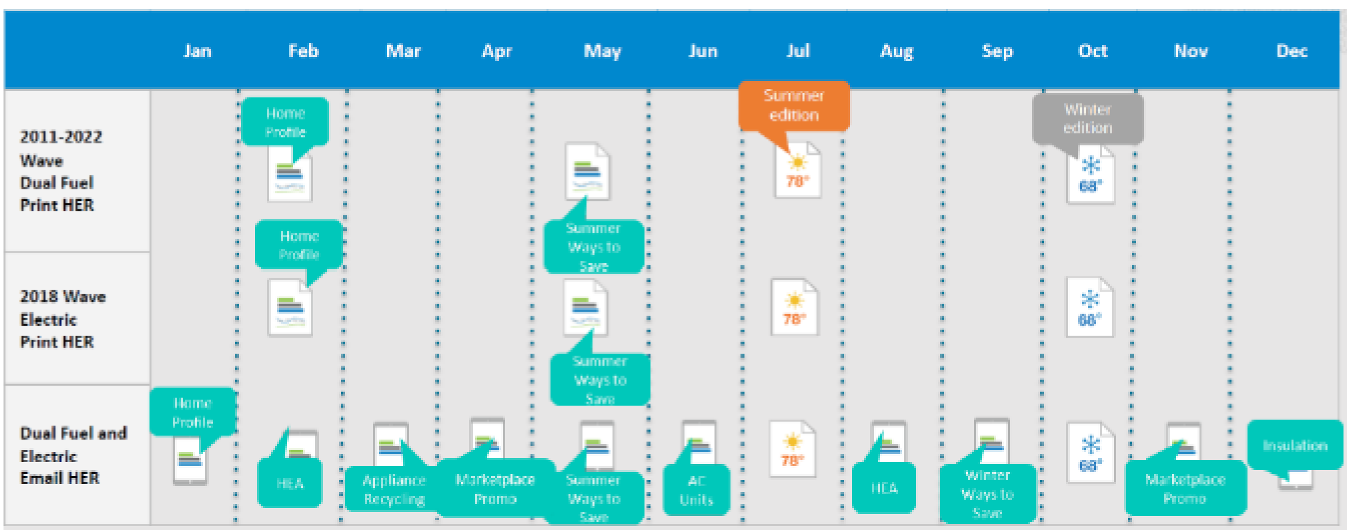
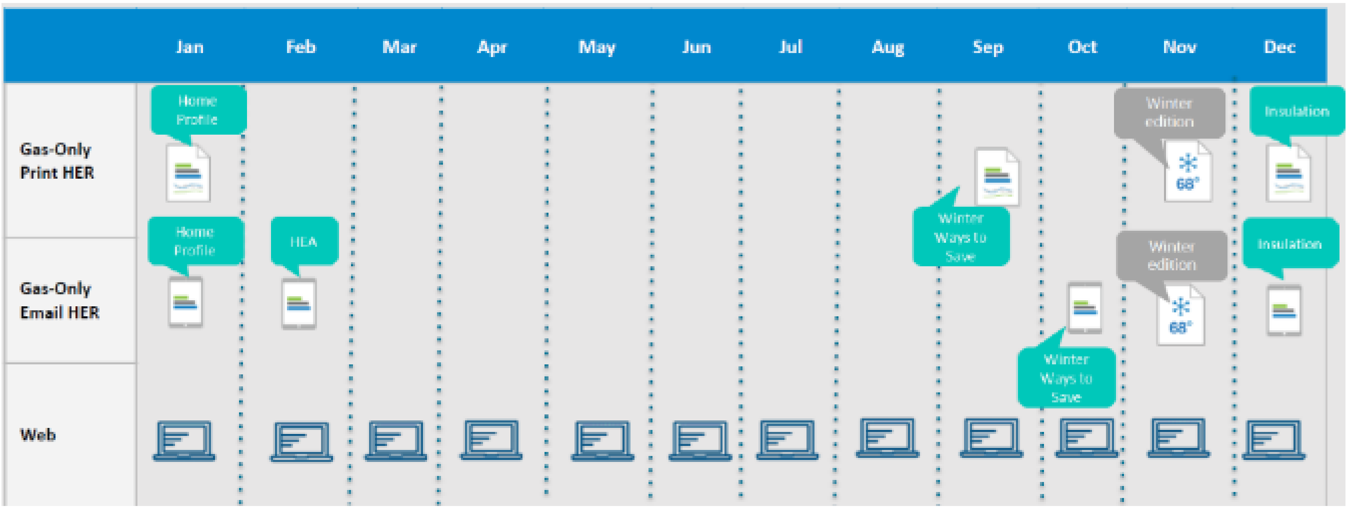


Figure 16. 2023 Program Design – Gas Customers



Program Performance

For the 2023 evaluation year, the evaluation team examined all data Oracle provided by February 1, 2024. The team received data from January to November of 2023 for all waves, plus partial data for December. On average across all waves, the team received 59% of customer data from December. The remainder of this report includes an evaluation of the available 2023 data received.

The program achieved 103% of its electric gross savings goal and 147% of its natural gas gross savings goal. Table 98 presents a savings summary for the program, including goals. The 2023 electric gross savings goal was 4% higher than the goal in 2022 and the 2023 natural gas gross savings goal was 1% higher than the goal in 2022. NIPSCO did not have a demand reduction goal for the program and did not track *ex ante* demand reduction. The Behavioral program accounts for a large portion of the electric and gas portfolio energy savings. As per NIPSCO's Energy Efficiency Scorecard (as of December 31, 2023), almost 60% of NIPSCO's residential electric energy portfolio goal for 2023 came from the Behavioral program, and almost 64% of its achieved gross energy savings; for gas, 42% of the residential portfolio goal and 57% of achieved gross energy savings.

Table 98. 2023 Behavioral Program Savings Summary

METRIC	GROSS SAVINGS GOAL	*EX ANTE*	*EX POST* GROSS	*EX POST* NET	GROSS GOAL ACHIEVEMENT
Electric Energy Savings (kWh/yr.)	23,443,500.00	23,976,172.00	24,136,790.79	24,136,790.79	103%
Peak Demand Reduction (kW)	0.000	0.000	2,755.341	2,755.341	n/a
Natural Gas Energy Savings (therms/yr.)	1,134,873.46	1,770,973.00	1,669,912.27	1,669,912.27	147%

Source: ILLUME analysis of data provided by NIPSCO
Note: Throughout the report, *ex post* data refers to implementer provided data.

Note that the experimental design and evaluation methods (a randomized study design comparing change in energy use over time between a treatment and control group) means that *ex post* savings are by design net savings. In this study design, participants would not receive reports in absence of the program (i.e., no free ridership) and any spillover within participants is captured in the evaluation as program savings (i.e., spillover is not applicable). The evaluation produces a net savings value with an NTG of 100% and no additional adjustments are needed. Table 99 outlines the *ex post* gross and NTG adjustment factors.

Table 99. 2023 Behavioral Program Adjustment Factors

METRIC	REALIZATION RATE (%)[a]	FREERIDERSHIP	SPILLOVER	NTG (%)[b]
Electric Energy Savings (kWh/yr.)	101%	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%

Source: ILLUME analysis of data provided by Oracle and NIPSCO

[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 23, 2023, the program spent 96% of its annual electric program budget and 96% of its annual natural gas program budget. Table 100 lists the 2023 program budget and expenditures by fuel type.

Table 100. 2023 Behavioral Program Expenditures

FUEL	PROGRAM BUDGET	PROGRAM EXPENDITURES	BUDGET SPENT (%)
Electric	$1,767,417.76	$1,705,312.98	96%
Natural Gas	$455,487.30	$437,870.90	96%

Source: ILLUME analysis of data provided by NIPSCO

Evaluation Methodology

To inform the 2023 NIPSCO impact and process evaluation, the evaluation team completed the following research activities:

- **Documentation and materials review,** to provide context on program implementation and understand program messaging.
- **Tracking and savings data analysis,** to audit and verify the accuracy of program savings and usage data.

The evaluation team recommends evaluating savings via billing analysis every other year. As ILLUME last completed a billing analysis in 2022, the team conducted a desk review of NIPSCO's Behavioral program in 2023 and recommends reassessing in 2024, as portfolio priorities allow.

Impact Evaluation

For 2023, the primary researchable question the evaluation team sought to answer through the impact evaluation was:

- Do program savings match implementer reports (e.g., site counts, monthly % savings, etc.)?

For the impact analysis, the evaluation team received the implementer's data for monthly energy usage and savings for each wave. With these data, the evaluation team verified the *ex ante* savings in two steps: corroborate the savings field in the implementer's data and sum savings for 2023 across waves to compare to *ex ante* numbers. Then, the evaluation team compared savings year over year to analyze saving trends or wave abnormalities.

Corroborate Implementer Provided Savings

The implementer provided monthly savings for each wave. ILLUME compared the implementer's estimated savings to a simple difference between the implementer's control and treatment average daily usage to assess the accuracy of the provided savings field. The percentage of savings the evaluation team calculated using this methodology was 0.2 percentage points higher for electric and 0.2 percentage points lower for gas than the implementer's modeled monthly savings. Based on this small degree of difference, the evaluation team believes the implementer provided savings data are valid.

Table 101 lists the simple differences in average daily usage for control and treatment groups for all waves. One of the newest waves, Wave 11, launched in 2022, shows negative gas savings when using a simple difference calculation method. This is not surprising compared to what the evaluation team has seen in past years, as early performance of waves has varied since 2019. When Wave 8 launched, the savings were positive for both electric and gas. When Wave 9 launched its simple difference for gas was negative. When Wave 10 launched, electric savings were negative. Savings within waves can fluctuate from year to year, meaning Wave 11 savings may increase in the future. In 2022, Wave 9 had positive, though not statistically significant, gas savings. However, in 2023, it again shows negative gas savings when using a simple difference calculation method. While other waves have shown increased savings over time, Wave 10 has consistently had negative electric savings and low gas savings since its launch. As a result, NIPSCO retired Wave 10 in August 2023.

Table 101. 2023 Differences Between Simple Difference Vs *Ex Post* Calculations of Savings

WAVE	FIRST REPORT	ELECTRIC		GAS	
		SIMPLE DIFFERENCE (%)	*EX POST* SAVINGS (%)	SIMPLE DIFFERENCE (%)	*EX POST* SAVINGS (%)
Wave 1	March 2011	5.30%	2.20%	0.90%	1.00%
Wave 2	June 2012	0.70%	1.60%	1.20%	1.00%
Wave 3	July 2014	0.70%	1.20%	1.00%	0.50%
Wave 4	March 2015	2.20%	1.90%	1.40%	1.00%
Wave 5	June 2017	0.70%	0.40%	1.90%	0.90%
Wave 6	September 2017	-	-	1.70%	1.40%

WAVE	FIRST REPORT	ELECTRIC		GAS	
		SIMPLE DIFFERENCE (%)	*EX POST* SAVINGS (%)	SIMPLE DIFFERENCE (%)	*EX POST* SAVINGS (%)
Wave 7	May 2018	1.20%	1.20%	-	-
Wave 8	April 2019	0.70%	0.80%	0.50%	0.60%
Wave 9	April 2020	0.20%	0.80%	-0.90%	0.60%
Wave 10	April 2021	-0.20%	-0.20%	-0.30%	0.80%
Wave 11	April 2022	2.60%	1.90%	-1.00%	0.00%
Wave 12	April 2022	0.40%	0.30%	-	-
AVERAGE		1.3%	1.1%	0.6%	0.8%

Source: ILLUME analysis of data provided by NIPSCO

Compare Implementer Provided Savings to *Ex Ante*

ILLUME compared the 2023 scorecard to the sum of Oracle’s calculated savings to verify the *ex ante* savings, as shown in Table 102. In summary, ILLUME found differences in savings of about 1% of the *ex ante* savings for electric and about 6% for natural gas, and because of the latter, recommends an *ex post* adjustment.

NIPSCO currently does not calculate *ex ante* demand savings for the Behavioral program; therefore, to calculate *ex post* demand savings for this program, the evaluation team used the conservative estimate of equally distributing savings across all 8,760 annual hours to estimate demand reduction. As such, the demand reduction estimates are directly proportional to the electric savings estimates calculated below. The total demand reduction is calculated to 2,755 kW.

Table 102. 2023 Behavioral Program *Ex Ante* and ILLUME's Summed Saving Values

	KWH	KW	THERMS
Ex Ante Savings	23,976,172.00	N/A	1,770,973.00
ILLUME Desk Review: Summed Savings	24,136,790.79	2,755.341	1,669,912.27

Source: ILLUME analysis of data provided by Oracle and NIPSCO

Compare Savings Year Over Year

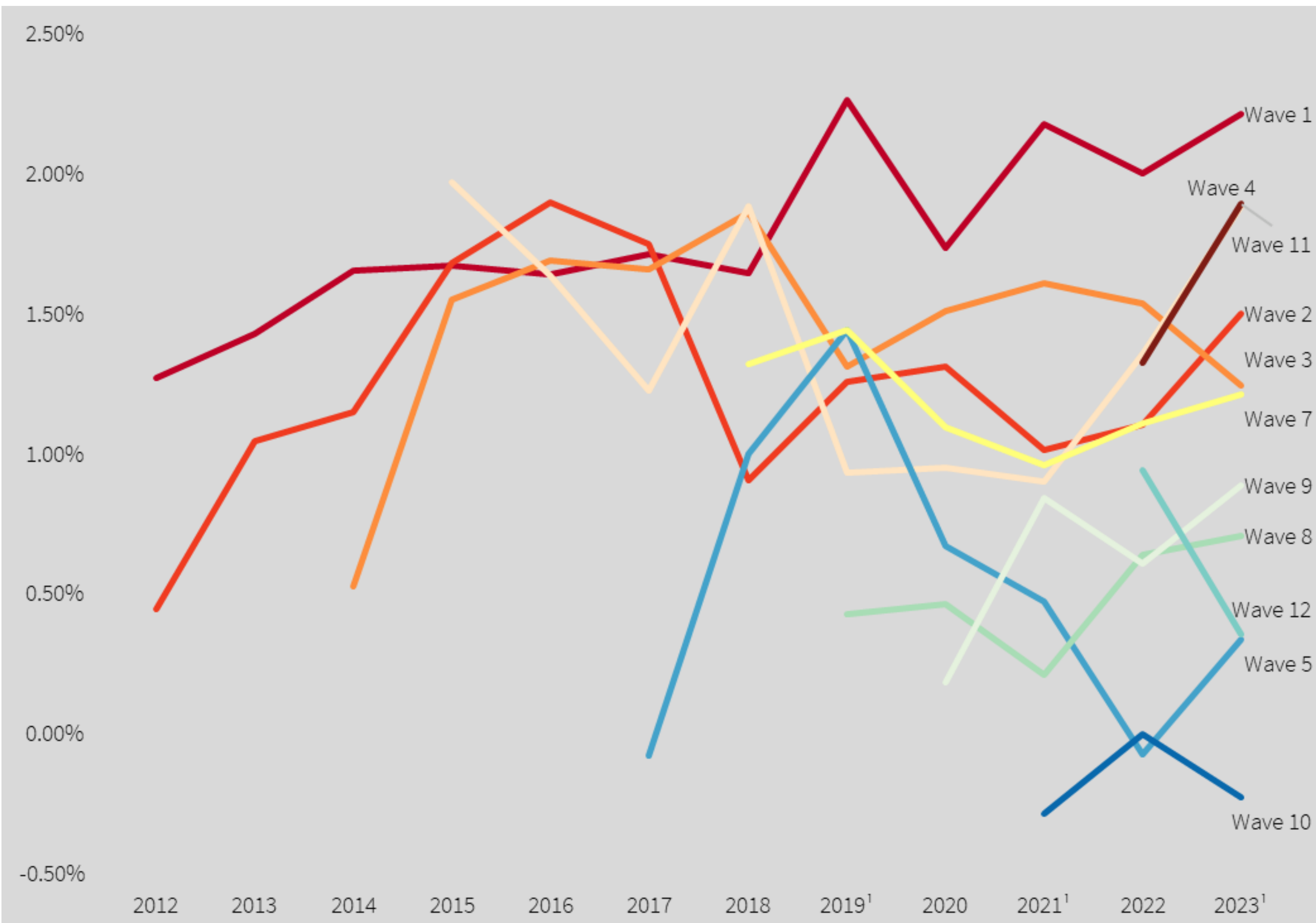
In general, industry research suggests that participants of residential behavior change programs save between 1.2% and 2.2% of household electricity usage per year and save between 0.3% and 1.6% of household natural gas usage per year; most waves exhibit a one- or two-year ramp-up period, with savings continuing at the ramped-up level for at least the following five years.[47] Within that context, the household savings percentage for most waves fall within these expectations.

The following figures (Figure 17 and

[47] 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

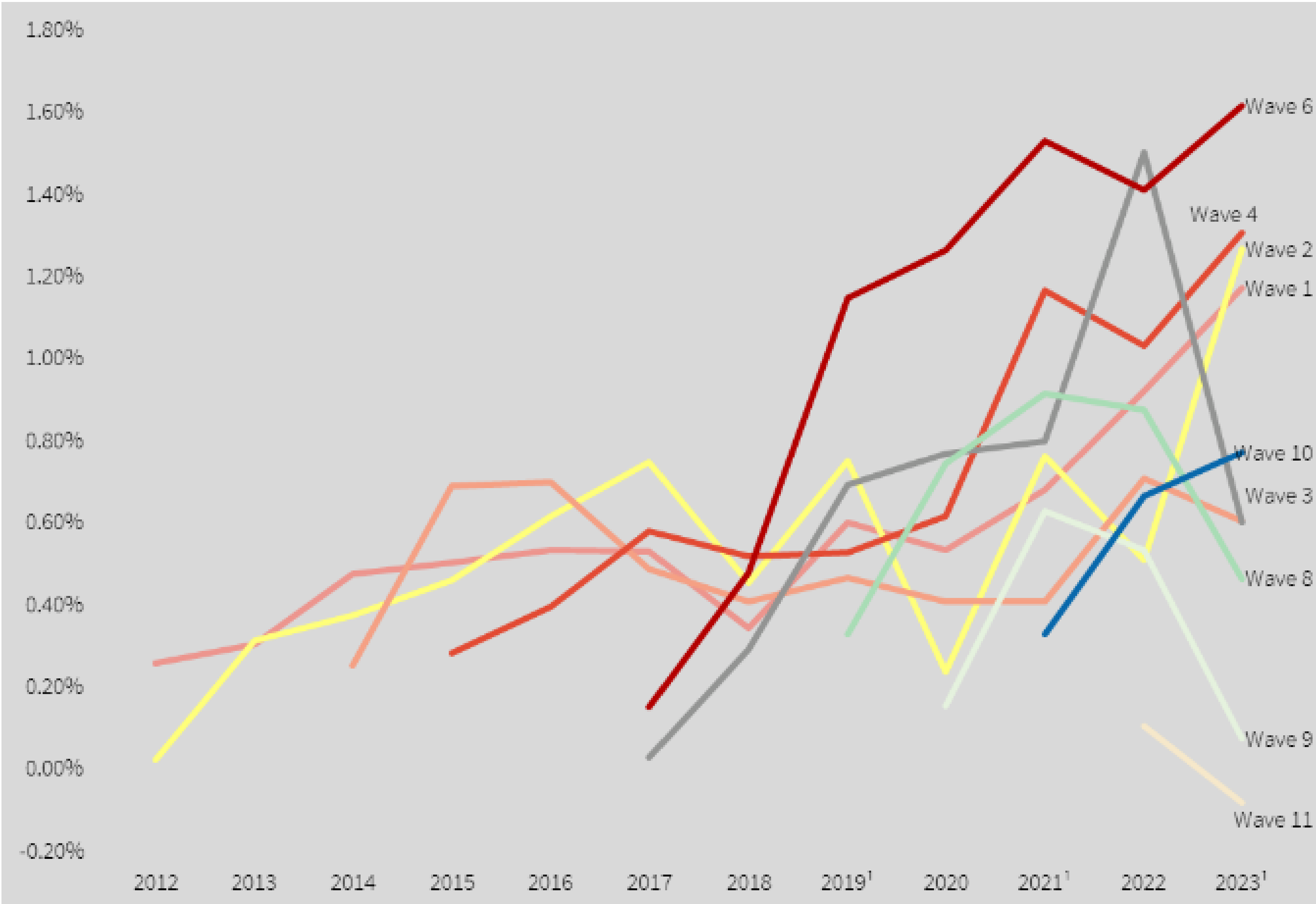
Figure 18) show average household-level electric and gas savings, respectively, as a percentage of usage for all 11 Behavioral program waves from 2012 to 2023. Some waves show a decrease in savings this year, including Wave 3 for electric and Wave 3, Wave 8, and Wave 9 for gas, but savings can recover after falling. For example, an uptick in electric savings after a previous decline can be seen in Waves 4 and 5, which showed increased electric savings from 2022 to 2023 (Figure 17). Wave 10, which started in 2021 and was retired after August 2023, had low savings since its launch and had negative savings in 2023. The two newest waves were introduced in 2022. One 2022 wave (Wave 11) increased electric savings compared to 2022 while the other (Wave 12) showed a decline in electric savings. Wave 11 also had negative gas savings in 2023.

Figure 17. Household-Level Percentage Savings of Electricity for Behavioral Program Participants, by Wave and Year



Source: ILLUME analysis of data provided by Oracle and NIPSCO
[1] The 2019, 2021, and 2023 results are based on Oracle's percent savings estimates as they were not modeled as part of this evaluation.

Figure 18. Household-Level Percentage Savings of Natural Gas for Behavioral Program Participants, by Wave and Year



Source: ILLUME analysis of data provided by Oracle and NIPSCO

[1] The 2019, 2021, and 2023 results are based on Oracle's percent savings estimates as they were not modeled as part of this evaluation.

Process Evaluation

The evaluation team sought to answer the following key researchable questions as part of the 2023 process evaluation:

- How are treatment and control group sizes changing over time and how many participants have opted out of the program?
- To what extent are treatment customers reading the electronic HER?
- Are customers using the online portal? Has usage 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?

ILLUME performed the 2023 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
- Email engagement (e.g., open rates)
- Web portal engagement (e.g., number of log ins)
- Sample printed and electronic HERs

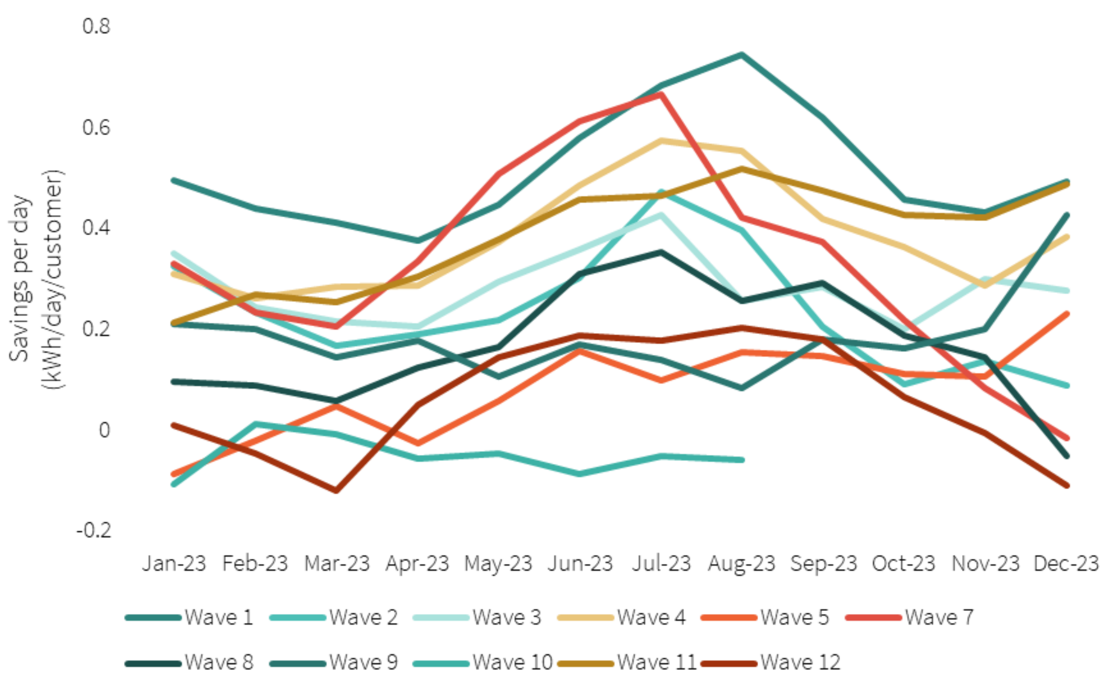
The following sections describe results related to trends in savings over time and between waves, customer counts during 2023, email engagement, and web portal engagement.

Savings Trends

The evaluation team reviewed monthly savings for each wave to identify any trends over time and between waves. In summary, the program savings in 2023 were steady, clearly identifiable and there were no signs that savings will decline substantially in 2024.

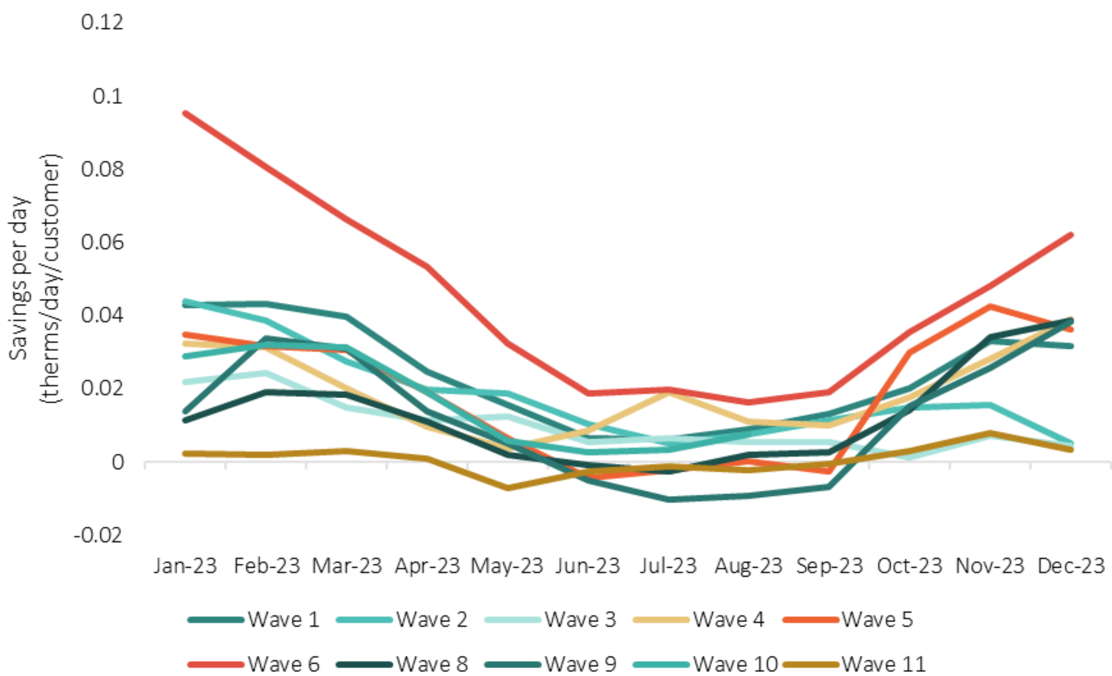
As shown in Figure 19, electric savings were relatively consistent throughout 2023, although highest in the summer across most waves. Wave 1 had the highest average household savings and Wave 10 (retired in August) showed low savings in 2023. Wave 12 (launched in 2022) also shows low savings. Savings for new waves typically build up over time. As such, it will be valuable to watch the electric savings for Wave 12 in 2024.

Figure 19. Average Daily Electric Savings by Wave and Month



As shown in Figure 20, natural gas savings followed the typical heating load shape with higher savings in the winter and lower savings in the summer. Wave 6 (a gas only wave) has the highest savings, with notably higher savings in summer months compared to other waves. Wave 11 (the new wave launched in 2022) shows relatively low savings. Lower savings could be due to the typical delayed effect of HER in new waves, where savings start to build overtime. As such, it will be important to continue to monitor savings for Wave 11 in 2024.

Figure 20. Average Daily Gas Savings by Wave and Month



Customer Count Trends

In 2023, NIPSCO's Behavioral program lost 9% (electric) and 8% (gas) of treatment participants on average, which was like rates of 10% and 9% in 2022. Available data suggests these participants left the program by moving during 2023, rather than by opting out. Based on Oracle's data, only 0.03% of participants left the program voluntarily by opting out this year.

As shown in Table 103, customers in more recent waves are moving at a higher rate than older waves, thus leaving the program. Wave 12, the new electric only wave, had the highest decline rate of 2023 (20%). Wave 2 is an older wave with a small number of participants. Newer waves have consistently had higher decline rates throughout program history. Older waves see fewer participants move out in the present, likely because the remaining participants are mostly homeowners or long-term tenants.

Table 103. January and December 2023 Customers by Wave and Fuel Type

WAVE	FIRST REPORT	ELECTRIC			GAS		
		NUMBER OF PARTICIPANTS JANUARY 2023	NUMBER OF PARTICI-PANTS DECEMBER 2023	DECLINE RATE (%)	NUMBER OF PARTICIPANTS JANUARY 2023	NUMBER OF PARTICI-PANTS DECEMBER 2023	DECLINE RATE (%)
Wave 1	March 2011	72,332	69,352	4%	71,963	68,037	5%
Wave 2	June 2012	5,189	4,897	6%	5,158	4,796	7%
Wave 3	July 2014	22,804	21,663	5%	22,745	21,289	6%
Wave 4	March 2015	16,225	15,236	6%	16,104	14,901	7%
Wave 5	June 2017	17,709	16,589	6%	17,661	16,371	7%
Wave 6	Sept. 2017	-	-	-	33,463	31,744	5%
Wave 7	May 2018	13,419	12,495	7%	-	-	-
Wave 8	April 2019	16,270	14,968	8%	16,298	14,818	9%
Wave 9	April 2020	10,890	9,778	10%	10,903	9,659	11%
Wave 10	April 2021	15,863	-	-	15,880	-	-
Wave 11	April 2022	14,870	12,723	14%	14,869	12,574	15%
Wave 12	April 2022	17,120	13,695	20%	-	-	-
AVERAGE		-	-	9%	-	-	8%

Source: ILLUME analysis of data provided by Oracle and NIPSCO

[1]Wave 10 was retired in August 2023 due to persistently low gas and electric savings, so there is no December 2023 data for this wave.

Email HER (eHER) 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. Table 104 shows email engagement by month in 2023, and historical annual averages. While those who received emails had high open rates, Oracle has email addresses for a relatively low percentage of HER recipients (28% on average across waves in 2023). To calculate the percentage of emails sent per month, the evaluation team divided the total number of emails sent by the total number of treatment and control customers per month. As seen below, Behavioral program participants who received emails opened 42% of program emails on average over the year, like 44% in 2022. Participants opened between 38% and 52% of program emails each month in 2023. 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 October and December. Participants may have opened more program emails in the fall months (as November was also relatively high) than other months because of high winter gas bills.

Table 104. Email Engagement by Month and Year

MONTH	% OF CUSTOMERS SENT EMAILS [a]	EMAILS SUCCESSFULLY RECEIVED (% OF SENT)	EMAILS OPENED (% OF RECEIVED)	EMAILS CLICKED THROUGH (% OF OPENED)
Jan. 2023	0%	100%	0%	-
Feb. 2023	37%	98%	45%	3%
Mar. 2023	30%	99%	44%	2%
Apr. 2023	32%	99%	44%	2%
May 2023	32%	95%	46%	2%
Jun. 2023	30%	98%	38%	2%
Jul. 2023	30%	97%	43%	1%
Aug. 2023	30%	97%	44%	1%
Sep. 2023	0%	97%	45%	2%
Oct. 2023	32%	97%	52%	2%
Nov. 2023	58%	99%	49%	1%
Dec. 2023	29%	98%	51%	1%
2023 AVERAGE	**28%**	**98%**	**42%**	**2%**
2022 AVERAGE	**27%[b]**	**99%**	**44% [c]**	**2%**
2021 AVERAGE	**24%**	**99%**	**41%**	**3%**

Source: ILLUME analysis of email analytics data provided by Oracle

[a] Customers sent 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. The evaluation team is using this percentage as an indicator of the percentage of emails Oracle/NIPSCO has for participants because according to the program design, NIPSCO sends email HERs to all customers with email addresses every month.

[b] The 2022 average excludes September and October, when customers received fewer emails due to a data issue.

[c] In prior years emails clicked through were presented as a percentage of total customers. Since 2022 it has been presented as a percentage of opened emails.

Web Portal Engagement

Like the 2022 program year evaluation findings, very few of NIPSCO's Behavioral program participants are engaging with the online portal; however, participants who do engage with it appear to value the portal. On average, around 500 customers (0.01% of NIPSCO's Behavioral program participants) log into the web portal each month. When they do, they stay on the site for an average of six minutes, down from nine minutes in 2022 (see Table 105). Due to the low number of logins, it is unlikely that the portal is driving additional savings.

Table 105. Web Portal Analytics by Month

MONTH	UNIQUE PARTICIPANT LOG INS (%) (n= 5061888)	AVERAGE TIME ON PORTAL (MINUTES)
Jan. 2023	0.03%	7
Feb. 2023	0.03%	8
Mar. 2023	0.02%	7
Apr. 2023	0.01%	5
May 2023	0.01%	4

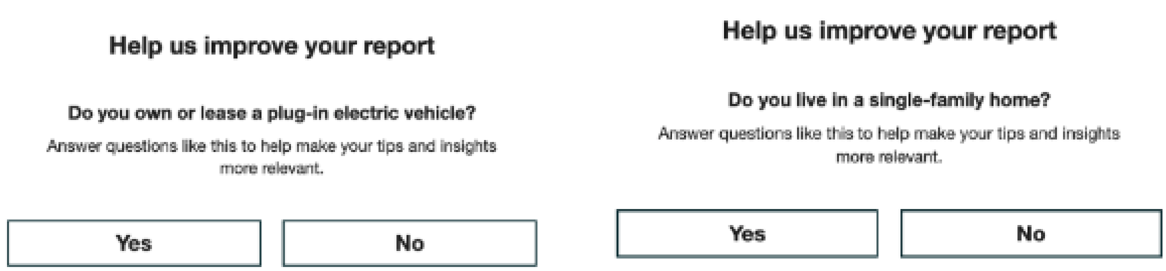
MONTH	UNIQUE PARTICIPANT LOG INS (%) (n= 5061888)	AVERAGE TIME ON PORTAL (MINUTES)
Jun. 2023	0.01%	6
Jul. 2023	0.01%	6
Aug. 2023	0.01%	8
Sep. 2023	0.01%	8
Oct. 2023	0.01%	6
Nov. 2023	0.01%	5
Dec. 2023	0.01%	4
AVERAGE	**0.01%**	**6**

Source: ILLUME analysis of web portal analytics data provided by Oracle

Home Profiles

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. In 2023, some email HER (eHER) messaging contained question prompts and links to encourage customers to update their Home Profiles (see Figure 21).

Figure 21. HER Messaging Sample: Report Accuracy



Channeling

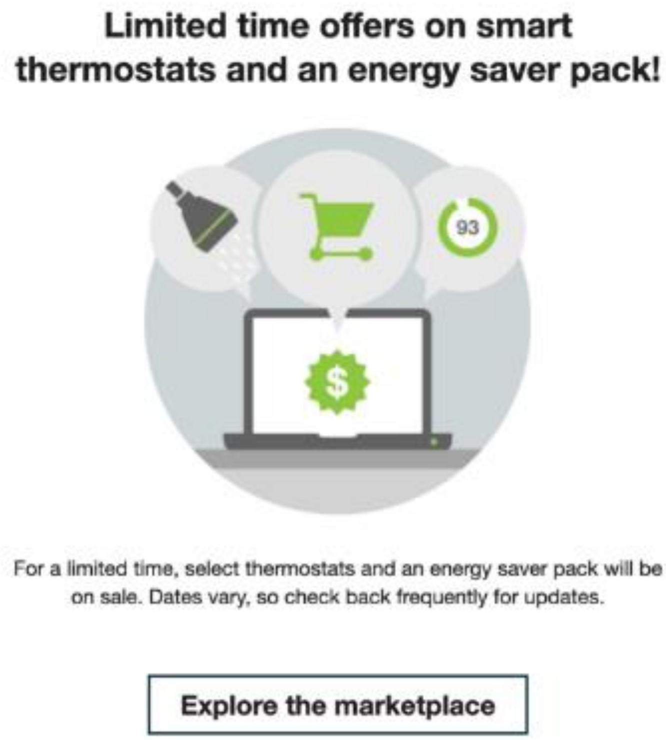
NIPSCO's Behavioral program updates its tip library once per year to ensure the energy savings tips provided on the reports promote appropriate other Energy Efficiency programs. Of the 55 tips in the tip library, 12 mention specific NIPSCO programs, measures, and/or rebates, and 7 direct customers to the NIPSCO energy efficiency website. The remaining tips provide other advice on making changes around the house to save energy.

While Oracle sends eHERs every month, they sent them to only about 28% of HER recipients in 2023. Therefore, it is difficult to understand which types of messages are more likely to drive engagement with customers. In 2022, the evaluation team recommended surveying customers about report recall determining what report formats are most effective for program channeling. The evaluation team also recommended that NIPSCO experiment with placement of channeling messages in HER messaging. As noted in 2022 and continued 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, which included language like previous years. Figure 22 is a sample print HER that encourages customers to save money through insulation, linking to NIPSCO's Home Energy Assessment program. Figure 23 is the section of a sample eHER promoting a limited time offering of smart thermostats and an energy saver pack, with a link to NIPSCO's residential online marketplace. There are similar channeling messages in print and eHERs for the Home Energy Assessment program itself and in an eHER report for AC rebates. 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 was like past years.

Figure 22. HER Messaging Sample: General Channeling (Print Version)

Figure 23. HER Messaging Sample: General Channeling (Email Version)



Conclusions and Recommendations

CONCLUSION 1: THE BEHAVIORAL PROGRAM CONTINUES TO MEET OR SURPASS PROGRAM GOALS, WITH ROOM TO INCREASE GOALS IN THE FUTURE.

For the past five program years, the evaluation team has consistently verified savings that are on goal for electric savings and considerably higher than gas savings goals. The gross goal achievement for electricity was 105% in 2022 and 103% in 2023. For natural gas, the gross goal achievement has ranged from 156% in 2018 to 211% in 2021. Electric savings were relatively consistent across the year, with peaks 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 2024 as a reliable portion of the electric and gas residential savings portfolios. Almost 60% of NIPSCO's residential electric energy portfolio goal for 2023 came from the Behavioral program, and almost 64% of its achieved gross energy savings; for gas, 42% of the residential portfolio goal and 57% achieved gross energy savings.

Recommendations:

- Continue to plan for consistent electric savings as a major source of overall portfolio savings in 2024.
- Consider increasing the gas program goal to help plan for total portfolio gas savings throughout the program year.

CONCLUSION 2: CUSTOMERS WHO RECEIVE PROGRAM EMAILS ENGAGE WITH THEM. THE PROGRAM HAS THE OPPORTUNITY TO FURTHER USE EMAILS TO PROMOTE ENERGY SAVINGS.

While Oracle sent program emails to relatively few participants (28% of participants per month, on average), those who do receive emails engage with them. Since Oracle sends emails to all participants with valid email addresses according to the program design, the team can attribute low send rates to Oracle having email information for less than 30% of participants. Customers open and click through program emails at similar rates to 2022. Participants opened 42% of electronic HERs on average in 2023, which was two percentage points lower than 2022. The click-through rate remained the same (2% on average). Open rates were highest during the last three months of the year.

Recommendations:

- Provide updated customer emails to Oracle to bolster their email distribution list. Reaching these additional customers and promoting additional programs and energy savings tips through eHERs can increase program savings.
- Conduct a brief or in-depth customer survey to better understand customer interest in energy savings tips and communication preferences. A brief survey can be a quick take on 1) participant preferences for mail, email, or both types of communication; and 2) relative interest in energy savings tips, the customer portal, or information in other NIPSCO programs. Or consider an in-depth customer survey, which the evaluation team conducted last in 2018. A more extensive survey can ask customers about preferences for email frequency, messaging, and other resources needed to inform Oracle's tip library and potentially drive program cross-participation.

CONCLUSION 3: CHANNEL MESSAGING IN HER REPORTS, AND LIKELY CHANNELED SAVINGS, IS SIMILAR TO PREVIOUS YEARS. IMPROVING CHANNEL MESSAGING CAN ENCOURAGE MORE CUSTOMERS TO ENGAGE WITH OTHER NIPSCO RESOURCES.

HER messaging often includes information about other NIPSCO programs and resources. These messages encourage customers to participate in other programs by including direct links (for eHERs) or website information. Messaging about NIPSCO programs in 2023 HERs was like previous years. Information about other programs was not significantly spotlighted in these reports, as it can be found near the bottom of eHERs and on the back of print reports.

Recommendations:

- Consider ways to reorganize the HER reports so that program information is more eye-catching to the customer. One potential solution is moving channel messaging higher up or closer to the customer's energy use breakdown in HER reports.
- Enhance seasonal channel messaging to help customers understand how the recommended program can help address seasonal concerns. NIPSCO currently sends Summer and Winter HER reports with relevant tips for the season. Since customers are often concerned about seasonal energy usage, these reports are a great opportunity to point them towards NIPSCO resources that help them save energy. Use channel messaging to show how NIPSCO programming can help with energy cost concerns in these seasonal report editions. For example, the current winter edition contains information on how to get a Home Energy Assessment. Since many customers are concerned about heating bills in the winter, use a headline that explains how the program can help with energy savings that can motivate them to look further.

CONCLUSION 4: THE NUMBER OF CONTROL AND TREATMENT CUSTOMERS CONTINUES TO DECREASE AS CUSTOMERS MOVE. TO MAINTAIN SAVINGS AS CUSTOMERS MOVE, THE PROGRAM MAY NEED TO CONSIDER REORGANIZING PARTICIPATING CUSTOMERS.

In 2023, NIPSCO's Behavioral program lost 9% (electric) and 8% (gas) treatment participants on average, which was like rates of 10% and 9% in 2022. Available data suggests these participants left the program by moving during 2023, rather than by opting out. Based on Oracle's data, only 0.03% of participants left the program voluntarily by opting out this year. Customer attrition rates, which impact statistical significance, remain consistent. Decline rates are less than 10% for waves launched before 2020 and higher for later waves.

Recommendations:

- Consider moving control customers into treatment groups to maximize savings and minimize the number of total control customers across the program as overall numbers decline. The evaluation team could conduct a study to determine how the NIPSCO team can maximize savings while decreasing control group sizes and maintaining the ability to calculate statistical significance for savings differences. This could help inform the strategy for adding participants to the program to drive savings in future years.

- Using move-out, zip code, and/or renter data at the customer level from NIPSCO, Oracle, or from the census for the whole NIPSCO service territory, investigate any fundamental differences between the waves and the service territory to take into consideration when rebalancing customers in future waves.

CONCLUSION 5: VERY FEW CUSTOMERS USE THE ONLINE PORTAL, BUT THOSE WHO DO, ARE ENGAGED.

On average, about 500 customers (0.01% of NIPSCO's Behavioral program participants) logged into the web portal each month. When they do, they stay on the site for an average of six minutes. While customers are engaging with the portal, the amount of time spent on it is down from nine minutes in 2022.

Recommendations:

- Develop new strategies to increase engagement with the online portal. With increased portal engagement, NIPSCO can better market other program offerings to program participants.
- Monitor the time customers spend on the portal in 2024. If it continues to decline, consider surveying customers to determine what changes can be made to increase portal engagement.

CONCLUSION 6: NEW WAVES LAUNCHED IN 2022 DEMONSTRATE DIFFERING BEHAVIOR FROM OLDER WAVES AND EACH OTHER IN 2023.

NIPSCO launched two waves, Wave 11 (gas) and Wave 12 (dual fuel), in April 2022. Wave 12 had low electric savings compared to other waves, and savings declined compared to 2022. Wave 5 also had low electric savings this program year, but its savings increased from 2022. Wave 11 had increased electric savings but negative gas savings. Wave 11 was the only wave with negative gas savings in 2023. Wave 11 savings also declined compared to 2022. These newer waves also have the highest decline rates due to customers moving out of the service area. While newer waves typically have the highest decline rates, Waves 11 and 12 have different decline rates despite both being launched in 2022. The decline rate of Wave 12 (20% for the electric-only wave) is even higher than the decline rate of Wave 11 (14% for electric and 15% for gas).

Recommendations:

- Continue to monitor these new waves in 2024, as savings can take a few years to build up. If differences continue, consider further exploring the customers in the two waves to pinpoint what is contributing to the different behavior. If these waves were selected based on common characteristics, such as square footage of home, home age, energy usage, cooling types, or other factors, looking at savings differences by characteristic may help explain differences in customer behavior. Additionally, some customers share information with NIPSCO by updating their Home Profiles. Home Profile data can help the evaluation team further explore what drives saving decisions.

- If these newer waves were selected based on common characteristics, conduct a statistical analysis study to determine which factors used in the wave selection or entered in the Home Profile have the greatest impact on savings. For any new waves in 2024 or 2025, use the results of this study to strategize new types of waves that target customers that may have different savings behavior. For example, targeting customers for cooling or heating consumption may help NIPSCO maximize savings and reach any gas or electric specific savings goals.
- Consider a customer behavior study to understand why behavioral savings increase over time. The study can examine savings data from the lifespan of the program, as well as demographic and educational messaging data to find drivers of long-term savings. The study can attempt to understand how much customer knowledge about energy savings comes from this program, while helping understand the persistence of savings for the program going forward.
- Conduct a message testing study with a sample of customers from waves that demonstrate high savings to evaluate the effectiveness of using targeted channeling efforts that highlight other NIPSCO programs. For example, the team could test using more targeted channeling messaging with participants who are in the oldest waves and have the highest behavioral savings. If the test results demonstrate that targeted channeling leads to higher cross-participation and additional energy savings, this could be a new model to drive more savings from the highest savings participants in the largest program in NIPSCO's residential portfolio.

CONCLUSION 7: WHILE THE PROGRAM HAS CONTINUED TO MEET OR EXCEED GOALS, SAVINGS FOR SOME WAVES DECREASED IN 2023.

Compared to 2022, electric savings decreased for one wave and gas savings decreased for three waves. Wave 3 savings decreased for electric, and Wave 3, Wave 8, and Wave 9 decreased for gas. Waves with decreased savings may rebound in the future, so it will be important to monitor them over the next few years. For example, last year, the evaluation team recommended monitoring Waves 4 and 5 after seeing a decrease in savings, and these waves showed increased savings in 2023.

Recommendation:

- Conduct research to better understand underlying reasons for persistent negative savings to inform decisions about whether to retire a wave with persistent negative savings. This research could include investigating baseline usage for waves with negative savings and attempting to collect different home data from Oracle or NIPSCO, such as square footage, home vintage, or cooling system types to understand differences between waves with positive and negative savings.

10. RESIDENTIAL NEW CONSTRUCTION PROGRAM

Program Design and Delivery

The Residential New Construction program provides a prescriptive incentive to residential home builders that are building homes to high efficiency standards, as defined by the RESNET Home Energy Rating System (HERS) Index and to homeowners of newly purchased ENERGY STAR Manufactured Homes. NIPSCO introduced the Residential New Construction program in 2019. The ENERGY STAR Manufactured homes component of the program began in 2023. For HERS measures, NIPSCO pays incentives directly to home builders that submit incentive applications or to the HERS rater if they provided an instant discount to the builder on their invoice. For ENERGY STAR Manufactured Homes, NIPSCO pays incentives directly to the homeowner. Participating homes must have active NIPSCO residential electric and/or natural gas service.

Incentive Tiers

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. Electric only homes must have an electric cooling system to be eligible for electric fuel incentives. To qualify for the electric incentive, homes with central air conditioning (A/C) must have a Seasonal Energy Efficiency Ratio (SEER) rating of 15 or higher. Natural gas service only homes must use natural gas for all space heating to be eligible for natural gas fuel incentives. Homes using ground source heat pumps (geothermal) or dual fuel systems (a heat pump used in conjunction with a natural gas furnace) are only eligible for an electric rebate.

The incentive tiers remained the same as 2022 in 2023. Table 106 outlines program tiers and incentives for 2023.

Table 106. 2023 Residential New Construction Program Incentives

HERS INDEX SCORE	ELECTRIC INCENTIVE	NATURAL GAS INCENTIVE
Silver Star (HERS 59-62)	$40	$350
Gold Star (HERS 57-58)	$50	$400
Platinum Star (HERS ≤ 56)	$60	$450
ENERGY STAR Manufactured Home - Electric [a]	$500 - $800	N/A

[a] Electric incentives on manufactured homes range based on whether the home is single- or double-wide.

Marketing

NIPSCO develops marketing collateral to promote the program and markets the program to builders, HERS raters, and ENERGY STAR Manufacturers and retailers directly and through industry organizations, such as builder associations. NIPSCO does not currently market the program directly to prospective home buyers.

Changes from the 2022 Design

In 2022, the program offered HERS measures to detached single-family, duplex, or multifamily end unit type homes only. In 2023, NIPSCO continued incentivizing HERS measures and began incentivizing qualified manufactured new homes. ENERGY STAR certified manufactured new homes must be produced in a plant certified by an Environmental Protection Agency (EPA)-recognized Quality Assurance Provider. The home design package must meet the mandatory requirements for all certified manufactured homes. Manufactured new homes must receive a valid ENERGY STAR rating Version 2 or 3.

Homes that receive a rebate in the NIPSCO Residential New Construction program, including the ENERGY STAR Certified Manufactured New Homes program, are not eligible for rebates through any other NIPSCO Residential program. Residential New Construction homes will not be eligible to receive additional NIPSCO rebates for a period of three years after the HERS Index rating date. ENERGY STAR Manufactured homes will not be eligible to participate for a period of three years after the original service activation date.

Program Performance

Throughout 2023, the program processed 730 incentives (for 693 homes): 37 homes received both the electric and natural gas incentives (74 total incentives), one home received the electric incentive only, 654 homes received the natural gas incentive only, and one ENERGY STAR Manufactured Home received an incentive. The program reported *ex ante* electric energy savings of 21,983.94 kWh, peak demand reduction of 9.120 kW, and natural gas savings of 213,019.04 therms. For *ex post* gross savings, the program achieved 9% of the electric energy savings goal, 33% of the peak demand reduction goal, and 35% of the natural gas savings goal. The 2023 electric energy savings goal of 256,092.53 kWh was over ten times higher than the 2022 goal of 22,671.01 kWh, due to the unrealized expectation the manufactured homes component of the program would launch in early 2023.

The Residential New Construction program fell short of its electric peak demand and natural gas savings targets and significantly underachieved electric energy targets. The primary drivers of the low achievement rates were lower than anticipated program participation and overstated *ex ante* savings for natural gas. Notably for electric savings, the ENERGY STAR Manufactured Homes component launched late in 2023 which resulted in significantly lower participation rates (one participant) than needed to reach savings targets. Table 107 summarizes savings for the full year of program performance, including program savings goals.

Table 107. 2023 Residential New Construction 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.)	256,092.53	21,983.94	21,983.94	21,983.94	23,727.00	8,521.87	9%
Peak Demand Reduction (kW)	28.392	9.120	9.120	9.120	9.500	1.995	33%

METRIC	GROSS SAVINGS GOAL	*EX ANTE*	AUDITED	VERIFIED	*EX POST* GROSS	*EX POST* NET	GROSS GOAL ACHIEVEMENT
Natural Gas Energy Savings (therms/yr.)	397,446.10	213,019.04	213,019.04	213,019.04	139,334.63	29,260.27	35%

Table 108 outlines the *ex post* and net-to-gross (NTG) adjustment factors. Realization rates for electric energy and peak demand were over 100%. The natural gas savings realization rate was 65% because as-built home characteristics in 2023 were different than the *ex ante*, which were based on 2021 as-built homes. For example, the average 2023 home size was 26% smaller than the average 2021 home. The evaluation team used the NTG analysis results from the 2022 Residential New Construction program evaluation and applied them to the 2023 Residential New Construction evaluation. The data gathered from builder interviews in 2022 suggested high freeridership due primarily to low engagement with the program implementation team and incentives that were too low to affect decision-making.

Table 108. 2023 Residential New Construction Program Adjustment Factors

METRIC	REALIZATION RATE (%)[a]	FREERIDERSHIP	SPILLOVER	NTG (%)[b]
Electric Energy Savings (kWh/yr.)	108%	64%	0%	36%
Peak Demand Reduction (kW)	104%	79%	0%	21%
Natural Gas Energy Savings (therms/yr.)	65%	79%	0%	21%

[a] The evaluation team defines realization rate as the *ex post* gross savings divided by *ex ante* savings.
[b] The evaluation team defines NTG as *ex post* net savings divided by *ex post* gross savings.

Table 109 lists the 2023 program budget and expenditures by fuel type. The lower expenditures reflect the low program participation and therefore fewer incentives delivered.

Table 109. 2023 Residential New Construction Program Expenditures

FUEL	PROGRAM BUDGET	PROGRAM EXPENDITURES	BUDGET SPENT (%)
Electric	$85,077.59	$8,379.81	10%
Natural Gas	$812,410.75	$431,355.71	53%

Evaluation Methodology

To inform the 2023 NIPSCO Residential New Construction impact evaluation, the evaluation team completed the following research activities listed below. The team did not complete a process evaluation for 2023.

- **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

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

- What assumptions did NIPSCO use to develop savings estimates? Are there any updates that NIPSCO should make?
- 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 standard engineering practices, the 2020 Indiana Residential Code, and NIPSCO's program tracking database.

Additionally, the evaluation team reviewed program documents and ENERGY STAR literature pertaining to the manufactured homes certification process and energy savings calculations to develop an evaluation strategy for manufactured homes going forward.

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 errors, omissions, or duplicates. Initially, the evaluation team reviewed program tracking data through October 2023 to develop a project sample size and to check the tracking data for data quality issues. The team sampled 66 projects from this data set and confirmed the HERS documentation verifying the rebate amount, HERS scores, and program tier. The evaluation team identified three duplicate projects within the initial data set which the implementer had corrected in the final tracking data provided for the full year.

The evaluation team found no inconsistencies in the final tracking data and applied an in-service rate (ISR) of 100% to all projects, as seen in Table 110.

Table 110. 2023 Residential New Construction Program In-Service Rates by Measure

MEASURE	ISR
Silver Star (HERS 62-59) - Electric	100%
Silver Star (HERS 62-59) - Natural Gas	100%
Gold Star (HERS 58-57) - Electric	100%
Gold Star (HERS 58-57) - Natural Gas	100%
Platinum Star (HERS ≤ 56) - Electric	100%

MEASURE	ISR
Platinum Star (HERS ≤ 56) - Natural Gas	100%
ENERGY STAR Manufactured Home - Electric	100%

Table 111 summarizes the tracking data quantity, 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 in-service rate.

Table 111. 2023 Residential New Construction Program Audited & Verified Quantities

MEASURE	UNIT OF MEASURE	AUDITED QUANTITY	ISR	VERIFIED QUANTITY
Silver Star (HERS 62-59) - Electric	Home	21	100%	21
Silver Star (HERS 62-59) - Natural Gas	Home	439	100%	439
Gold Star (HERS 58-57) - Electric	Home	11	100%	11
Gold Star (HERS 58-57) - Natural Gas	Home	154	100%	154
Platinum Star (HERS ≤ 56) - Electric	Home	6	100%	6
Platinum Star (HERS ≤ 56) - Natural Gas	Home	98	100%	98
ENERGY STAR Manufactured Home - Electric	Home	1	100%	1
		730		**730**

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.

Through an engineering review, the evaluation team identified notable differences between *ex ante* and *ex post* savings for natural gas homes. The following overarching factors drove these differences:

- Due to changes in home characteristics like conditioned floor area, the 2023 sampled homes had lower natural gas consumption compared to 2021 sampled homes.
- Deemed savings were based on the 2021 evaluated results, which is consistent with how NIPSCO estimated ex ante savings for Residential New Construction in past program years.

Engineering Reviews

The evaluation team created 14 prototypes (11 natural gas and 3 electric) from the 2023 sampled homes to model savings using REM/Rate (version 16.3.4) software. The evaluated savings compared the prototype home energy use and peak demand relative to the requirements of the 2020 Indiana statewide residential energy code.

The evaluation team used prototype home characteristics based on a random sample of 66 HERS certificates from 2023 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.

Silver, gold, and platinum rated homes can have a myriad of different home characteristics within each grouping, and therefore actual home characteristics are preferable to group prototypes by those ratings. The team modeled homes that reflected the construction of the sampled homes, 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. Residential New Construction Program* provides a full description of the methods used to calculate gross energy and peak demand savings.

Ex Post Gross Savings Summary

The significant differences between estimates of ex *ante* and *ex post* natural gas savings likely result from different home characteristics of the sampled homes compared to the 2021 homes.[48] These differences include the following overarching factors:

1. Home size decreased by 26% compared to 2021, due in part to most 2021 homes having conditioned basements, whereas most 2023 homes were slab-on-grade. Smaller homes have correspondingly less energy savings potential.
2. Envelope air tightness decreased (ACH50) in 2023.
3. Duct air leakage increased (CFM25/100 CFA) in 2023.

In comparison, *ex post* electric savings closely align with *ex ante* values most likely due to lighting comprising the 78% of electric savings (which are weather independent), and a home's characteristics (which affects weather dependent savings) having less influence on the total electric savings. Table 112 shows the *ex ante* deemed savings and *ex post* gross per-measure savings for 2023 Residential New Construction program measures.

Table 112. 2023 Residential New Construction 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
Silver Star (HERS 62-59) - Electric	Home	460.63	0.240	0.00	506.50	0.250	0.00
Silver Star (HERS 62-59) - Natural Gas	Home	0.00	0.000	300.26	0.00	0.000	196.40
Gold Star (HERS 58-57) - Electric	Home	460.63	0.240	0.00	506.50	0.250	0.00

[48] NIPSCO 2023 Residential New Construction *ex ante* savings were based on the evaluated results from the 2021 program year.

MEASURE	UNIT OF MEASURE	*EX ANTE* DEEMED SAVINGS			*EX POST* GROSS PER-MEASURE SAVINGS		
		kWh	kW	THERMS	kWh	kW	THERMS
Gold Star (HERS 58-57) - Natural Gas	Home	0.00	0.000	315.86	0.00	0.000	206.60
Platinum Star (HERS ≤ 56) - Electric	Home	460.63	0.240	0.00	506.50	0.250	0.00
Platinum Star (HERS ≤ 56) - Natural Gas	Home	0.00	0.000	332.27	0.00	0.000	217.34
ENERGY STAR Manufactured Home – Electric [a]	Home	4,480.00	0.000	0.00	4,480.00	0.000	0.00

[a] There was only one ENERGY STAR Manufactured New Home in the 2023 program tracking data. Therefore, the evaluation team reviewed the *ex ante* savings calculation and adopted it as the *ex post* savings value. Evaluators will likely perform a more comprehensive engineering review and evaluation in 2024 if a larger population of manufactured homes participate in the program.

Table 113 highlights differences in *ex ante* and *ex post* gross sources and assumptions for new home construction.

Table 113. 2023 Residential New Construction Differences in *Ex Ante* & *Ex Post* Gross Sources and Assumptions

MEASURE	*EX ANTE* SOURCES AND ASSUMPTIONS	*EX POST* GROSS SOURCES AND ASSUMPTIONS	PRIMARY REASONS FOR DIFFERENCES
Electric	*Ex post* values from the 2021 evaluation.	Program data and HERS certificate data from a random sample used to generate prototypes. Savings based on REM/Rate prototype model analysis with code-minimum baseline home.	kWh and kW savings differ due to different prototype home characteristics and savings compared to *ex ante* value.
Natural Gas	*Ex post* values from the 2021 evaluation.	Program data and HERS certificate data from a random sample used to generate prototypes. Savings based on REM/Rate prototype model analysis with code-minimum baseline home.	Natural gas savings differ due to different prototype home characteristics and savings compared to *ex ante* value.

Realization Rates

The realization rates for electric energy and peak demand savings were 108% and 104%, respectively. The realization rate for natural gas savings was 65%. NIPSCO used the 2021 evaluation *ex post* results to establish the 2023 *ex ante* natural gas savings values. Reasons for these realization rates are explained below.

Electric energy and peak demand savings:

- Increased LED lighting percent in 2023 compared to 2021 drove realization rates higher. LED lighting in 2021 homes was 86% interior and 56% exterior and in 2023 it was 99% for both locations.[49]
- Cooling efficiency increased in 2023 compared to the second half of 2021. 2021 sampled electric projects had an average 14.3 SEER, whereas sampled electric projects in 2023 had an average 15.0 SEER as required by the program.[50]

Natural gas savings:

- Changes in 2023 home characteristics such as home size, foundation type, duct leakage, and envelope tightness compared to 2021 drove natural gas realization rates lower.

The next three tables (Table 114 through Table 116) show the program's ex ante reported savings, verified savings, ex post gross savings and total program realization rates for kWh, kW, and therms.

Table 114. 2023 Residential New Construction 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.)
Silver Star (HERS 62-59) - Electric	9,673.23	9,673.23	9,673.23	10,636.50
Silver Star (HERS 62-59) - Natural Gas	0.00	0.00	0.00	0.00
Gold Star (HERS 58-57) - Electric	5,066.93	5,066.93	5,066.93	5,571.50
Gold Star (HERS 58-57) - Natural Gas	0.00	0.00	0.00	0.00
Platinum Star (HERS ≤ 56) - Electric	2,763.78	2,763.78	2,763.78	3,039.00
Platinum Star (HERS ≤ 56) - Natural Gas	0.00	0.00	0.00	0.00
ENERGY STAR Manufactured Home - Electric	4,480.00	4,480.00	4,480.00	4,480.00
Total Savings	21,983.94	21,983.94	21,983.94	23,727.00
Total Program Realization Rate				108%

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.

[49] Based on program year 2022 builder interview findings, the models assumed that interior, garage, and exterior lighting in homes built through the program were 100% efficient (99% LED/1% fluorescent).
[50] Natural gas projects in 2023 had average 14.1 SEER (for an overall weighted program average 14.2 SEER). Federal minimum efficiency standards for cooling systems in the Northern region increased in 2023 to 14.0 SEER (13.4 SEER2) for split AC systems and will be in effect for the 2024 program year. The 2023 analysis used 13.0 SEER since a sell-through provision for the Northern region allowed any 13.0 SEER AC equipment manufactured before January 1,2023 to be installed after January 1st.

Table 115. 2023 Residential New Construction 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.)
Silver Star (HERS 62-59) - Electric	5.040	5.040	5.040	5.250
Silver Star (HERS 62-59) - Natural Gas	0.000	0.000	0.000	0.000
Gold Star (HERS 58-57) - Electric	2.640	2.640	2.640	2.750
Gold Star (HERS 58-57) - Natural Gas	0.000	0.000	0.000	0.000
Platinum Star (HERS ≤ 56) - Electric	1.440	1.440	1.440	1.500
Platinum Star (HERS ≤ 56) - Natural Gas	0.000	0.000	0.000	0.000
ENERGY STAR Manufactured Home - Electric	0.000	0.000	0.000	0.000
Total Savings	9.120	9.120	9.120	9.500
Total Program Realization Rate				104%

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 116. 2023 Residential New Construction Program *Ex Ante* and *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.)
Silver Star (HERS 62-59) - Electric	0.00	0.00	0.00	0.00
Silver Star (HERS 62-59) - Natural Gas	131,814.14	131,814.14	131,814.14	86,218.93
Gold Star (HERS 58-57) - Electric	0.00	0.00	0.00	0.00
Gold Star (HERS 58-57) - Natural Gas	48,642.44	48,642.44	48,642.44	31,816.76
Platinum Star (HERS ≤ 56) - Electric	0.00	0.00	0.00	0.00
Platinum Star (HERS ≤ 56) - Natural Gas	32,562.46	32,562.46	32,562.46	21,298.93
ENERGY STAR Manufactured Home - Electric	0.00	0.00	0.00	0.00
Total Savings	213,019.04	213,019.04	213,019.04	139,334.63
Total Program Realization Rate				65%

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 evaluation team used the net-to-gross (NTG) analysis results from the 2022 Residential New Construction program evaluation and applied them to the 2023 Residential New Construction evaluation. The data gathered from builder interviews in 2022 suggested high freeridership due primarily to low engagement with the program implementation team and incentives that were too low to affect decision-making. For manufactured homes, the evaluation team assumed a 100% NTG for 2023. Table 117 shows the NTG ratios by measure.

Table 117. 2023 Residential New Construction Program Net-to-Gross Ratios by Measure

MEASURE	NTG
Silver Star (HERS 62-59) - Electric	21%
Silver Star (HERS 62-59) - Natural Gas	21%
Gold Star (HERS 58-57) - Electric	21%
Gold Star (HERS 58-57) - Natural Gas	21%
Platinum Star (HERS ≤ 56) - Electric	21%
Platinum Star (HERS ≤ 56) - Natural Gas	21%
ENERGY STAR Manufactured Home - Electric	100%

Table 118 presents the resulting net electric savings, demand reduction, and natural gas savings.

Table 118. 2023 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	10,636.50	5.250	0.00	21%	2,233.67	1.103	0.00
Silver Star (HERS 62-59) - Natural Gas	0.00	0.000	86,218.93	21%	0.00	0.000	18,105.98
Gold Star (HERS 58-57) - Electric	5,571.50	2.750	0.00	21%	1,170.02	0.578	0.00
Gold Star (HERS 58-57) - Natural Gas	0.00	0.000	31,816.76	21%	0.00	0.000	6,681.52
Platinum Star (HERS ≤ 56) - Electric	3,039.00	1.500	0.00	21%	638.19	0.315	0.00
Platinum Star (HERS ≤ 56) - Natural Gas	0.00	0.000	21,298.93	21%	0.00	0.000	4,472.78
ENERGY STAR Manufactured Home - Electric	4,480.00	0.00	0.00	100%	4,480.00	0.000	0.00
TOTAL SAVINGS	23,727.00	9.500	139,334.63		8,521.87	1.995	29,260.27

Table 119 shows the net-to-gross results for each fuel.

Table 119. 2023 Residential New Construction 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.)	21,983.94	23,727.00	36%	8,521.87
Peak Demand Reduction (kW)	9.120	9.500	21%	1.995
Natural Gas Energy Savings (therms/yr.)	213,019.04	139,334.63	21%	29,260.27

Process Evaluation

The evaluation team did not complete any major activities related to evaluating the program process.

Conclusions and Recommendations

CONCLUSION 1: DUE TO VARIATIONS IN HOME CHARACTERISTICS EACH YEAR, ESTABLISHING ACCURATE *EX ANTE* SAVINGS CONTINUES TO BE A CHALLENGE FOR THE PROGRAM.

Because of the differences in planning and evaluation timelines, NIPSCO uses *ex post* gross savings from two evaluation cycles previous as the current program year's *ex ante* savings for the New Construction program These evaluated savings use model prototypes to calculate savings and the home characteristics that inform these prototypes like size/foundation type, air leakage, duct tightness, and insulation levels change year over year, impacting modeled energy savings. Since mid-2021, modeled electric energy savings have fluctuated, while natural gas savings have been decreasing year over year, most likely due to home characteristic trends (average home size, equipment efficiencies, envelope insulation and air sealing, and duct tightness).

Table 120 illustrates *ex post* savings since the 2020 Indiana Residential Code went into effect.

Table 120. Residential New Construction Program *Ex Post* Savings, PY2021-PY2023

EX POST SAVINGS PER HOME	2021	2022	2023
Silver (Therms)	300.26	241.92	196.40
Gold (Therms)	315.86	254.49	206.60
Platinum (Therms)	332.27	267.71	217.34
Electric (kWh)	460.63	563.60	506.50
Electric (kW)	0.240	0.280	0.250
EX POST SAVINGS PER HOME (PER SF)	2021	2022	2023
Silver (Therms/SF)	0.092	0.085	0.081
Gold (Therms/SF)	0.096	0.089	0.085
Platinum (Therms/SF)	0.101	0.094	0.089
Electric (kWh/SF)	0.141	0.202	0.216
Peak Demand (W/SF)	0.073	0.100	0.106
Average Home Size (SF)	3,276	2,841	2,424

Recommendations:

- Consider normalizing gas and electric savings for each project on a per-square foot basis to reduce the impact of home size variations.
- Consider using the following values (most conservative between 2022 and 2023 evaluations) as a starting point.

- kWh (from 2023): 0.25 kWh/sf
- kW (from 2022): 0.000100 kW/sf
- Gas (from 2023): 0.081 therms/sf (Silver)
  0.085 therms/sf (Gold)
  0.089 therms/sf (Platinum)

CONCLUSION 2: ACHIEVING ELECTRIC SAVINGS IN NEW HOME CONSTRUCTION WILL BE CHALLENGING DUE TO FEDERAL MINIMUM EFFICIENCY INCREASES AND LIGHTING CODE CHANGES.

Federal minimum efficiency increases in 2023 and potential lighting code changes pose a risk to future electric savings. Federal energy efficiency metrics for residential air conditioners and heat pumps are now expressed in terms of Seasonal Energy Efficiency Ratio (SEER2), Energy Efficiency Ratio (EER2), and Heating Seasonal Performance Factor (HSPF2), which took effect on January 1, 2023. The new minimum efficiency requirement for cooling systems in the northern region is now 13.4 SEER2 (or 14.0 SEER). The previous efficiency requirement was 13.0 SEER, and the new minimum efficiency requirement will reduce electric cooling energy savings around 38% compared to a 15 SEER installed system. The evaluation team reviewed model prototype electric savings and found lighting comprises around 78% of all electric energy savings on average. These savings are based on the Indiana 2020 Residential Code. Any future code changes to lighting will reduce or eliminate almost all savings.

Further, electric participation remains low (~5% of program participation) compared to natural gas and overall participation has declined since the 2020 code change. Low electric participation may mean that there are additional saving opportunities in NIPSCO's electric service territory. Additionally, unlike natural gas incentives, electric incentives do not cover the costs of any program requirements—the HERS rating or the incremental cost of installing a 15 SEER A/C unit—which is likely impacting electric participation. Table 121 illustrates program participation over the last four years.

Table 121. Residential New Construction Program Participation, PY2020 – PY2023

REBATE TYPE	2020	POST 2020 CODE CHANGE		
		2021 EXTRAPOLATED [a]	2022	2023
Electric	814	24	22	38
Natural Gas	1,475	496	850	691
TOTAL REBATES	2,289	520	872	729

[a]From July through December 2021, NIPSCO processed 248 gas rebates and 12 electric under the revised 2020 Indiana Residential Code. The 2021 extrapolated value doubled this participation as a proxy for a full year of participation.

Recommendations:

- Consider increasing the minimum cooling efficiency standard for electric participation to 16.0 SEER to offset the federal minimum efficiency increase.
- Consider increasing the electric rebate value to encourage more builders to move to above code minimum equipment, offsetting the upfront cost of higher efficiency and potentially reducing freeridership.
- Consider offering "bonus" or "a la carte" rebates on top of the HERs rating rebates for high efficiency HVAC and domestic hot water equipment, energy recovery ventilation (ERV), above code envelope insulation and air sealing, high efficiency appliances, and ENERGY STAR certification, through the Residential New Construction program. While program participants could stack these rebates with builder natural gas and/or electric HERS tier rebates, there would not be additional prescriptive savings associated with these rebates. Modeled savings would theoretically increase with the higher efficiency average home characteristics driven by the builders making more efficient choices. One Michigan utility found higher average satisfaction ratings for ENERGY STAR homes than for HERS homes, regarding the overall home, energy costs and level of comfort.[51]

CONCLUSION 3: WHILE MANUFACTURED HOME PARTICIPATION WAS LIMITED IN 2023, NIPSCO SHOULD PREPARE FOR HIGHER LEVELS OF PARTICIPATION IN THE FUTURE BY CONSIDERING THE MOST APPROPRIATE *EX ANTE* ENERGY SAVINGS AS ENERGY SAVINGS BASED ON ENERGY STAR DOCUMENTS DIFFER SUBSTANTIALLY FROM REM/RATE MODEL.

The 2023 program included one manufactured home project (for envelope only/electric fuel). However, it is likely that the number of manufactured home projects will increase in 2024 and beyond.

Energy savings for manufactured homes based on ENERGY STAR documents estimate electric energy savings of 4,480 kWh compared to 2,054 kWh using the REM/Rate model. ENERGY STAR projected $672 cost savings for an ENERGY STAR manufactured home (envelope only using electric heating/DHW and a $0.121/kWh rate) in ENERGY STAR Certified Manufactured Homes, Version 2 Cost Savings Summary (July 20, 2020) document. NIPSCO used this savings amount to estimate 4,480 kWh savings. The modeling software used in ENERGY STAR's cost estimate is not an accredited RESNET software program and some modeling parameters used in their models (like indoor design air temperature) are unknown.[52]

The evaluation team used the modeling parameters outlined in the Version 2 Cost Savings Summary document where applicable and made assumptions consistent with previous RNC models to inform energy saving estimates using REM/Rate. The initial model resulted in 2,054 kWh and 0.100 kW savings for a double-wide manufactured home located in Fort Wayne, IN.[53] Modeled savings for different configurations like natural gas projects and single-wide homes have not been performed yet.

[51] 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
[52] See https://www.resnet.us/providers/accredited-providers/hers-software-tools/ for list of approved software.
[53]https://www.energystar.gov/sites/default/files/asset/document/ENERGY%20STAR%20Manufactured%20Homes%20Version%202%20Cost%20Savings%20Summary.pdf. Retrieved March 24, 2024.

Certification requirements in Version 3 will have new efficiency requirements that will impact savings.

Recommendations:

- Work with the evaluation team to determine the best approach for estimating manufactured home savings. Consider choosing between a modeled savings approach or a TRM based approach (whole home or prescriptive measures).
    - Establish a consensus for default values for modeling parameters (for example, indoor heating/cooling design temperature, skirting R-value) or TRM default variables, where not explicitly mentioned in ENERGY STAR documentation.
    - Update savings projections using ENERGY STAR Manufactured Homes Cost Savings Summary Version 3 when available.[54]
- Consider collecting ENERGY STAR Single-Family New Homes National HVAC Design Report documents or similar documentation (in lieu of the HERS certificate used for single-family homes) from program participants to inform energy models or TRM-based calculations for manufactured homes. This document should include the following information:
    - HVAC equipment capacity/efficiency/AHRI number.
    - Envelope insulation levels (ceiling, walls, floor, windows, doors, etc.) and measured air tightness.
    - Duct insulation and measured leakage.
    - Home Dimensions (length, width, height).
    - Window and door areas.

CONCLUSION 4: PRIMARY OR SECONDARY RESEARCH IS NECESSARY TO DETERMINE NET-TO-GROSS FOR ENERGY STAR MANUFACTURED HOMES IN FUTURE PROGRAM YEARS.

The evaluation team assumed a NTG ratio of 100% for ENERGY STAR Manufactured Homes for the 2023 evaluation. However, the evaluation team was unable to evaluate savings or apply NTG adjustments to ENERGY STAR Manufactured Homes in 2023 because there was only a single rebate.

Recommendations:

- Conduct ENERGY STAR manufactured homes builder interviews as part of the 2024 evaluation.
- Conduct benchmarking research on other utility programs that incentivize ENERGY STAR manufactured homes.

[54] Version 3 Cost Savings & Estimates document for manufactured homes publication expected in May 2024.

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 efficiently using electricity and gas. Through a comprehensive approach, it provides classroom instruction, posters, and activities aligned with national and state learning standards. Moreover, energy education kits filled with energy-saving products and advice are distributed, empowering students and their families to take steps toward energy efficiency. Students participate in an energy education presentation at school, learning about basic energy concepts through class lessons and hands-on activities. Then, students receive an energy education kit of quality, high-efficiency products and are instructed to install the energy-efficient products at home with their families. By participating in classroom activities, completing Home Energy Worksheets (HEWs), and involving their families in the process, students learn about energy efficiency and share energy efficiency habits with others.

TRC served as the program implementer, overseeing the comprehensive management of the program, and serving as the liaison between NIPSCO and program subcontractors. TRC contracted with the National Energy Foundation (NEF) to actualize the program's objectives. NEF's responsibility spanned a spectrum of key program components to foster the program's success, including:

- Maintaining a program website
- Marketing and outreach
- Creating educational collateral and kit materials
- Engaging teachers and explaining how to use the program's educational materials
- 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, tailored to NIPSCO customers:

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:

Combo Kit Measures

- 2 connected LEDs
- 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

The kit information card includes a QR code to connect participants with energy-related resources available on the thinkenergy.org website, providing families with a convenient array of materials designed to enhance program engagement. The website's resources include the HEW, parent letter, program presentations, installation guides and videos, and engaging games designed to reinforce key concepts.

Program participation is primarily driven by targeted outreach efforts, with a focus on schools that have previously engaged in the program. Leveraging established relationships and past successes, the implementation team prioritizes direct engagement with these schools to encourage ongoing participation and enthusiasm. Additionally, community outreach initiatives, direct mail campaigns, and social media platforms serve as effective channels for promoting the program to a wider audience.

Changes from the 2022 Design

In anticipation of the July 1, 2023, EISA backstop enforcement, which would discontinue the ability to claim LED savings, the program proactively adjusted its offerings. Specifically, the 5W candelabra LEDs in the combo and electric kits were replaced with two connected LEDs. This technology upgrade aligns with energy-efficient kit offerings and provides convenience and accessibility because the connected LEDs allow customers to schedule and control the lighting remotely through various smart devices, including smartphones, tablets, and smart speakers.

Program Performance

In 2023, the program distributed 12,014 kits, comprising 11,750 combo kits and 264 gas kits. The program exceeded its goals for energy savings and peak demand reduction, as shown in Table 122, but fell short of its natural gas savings goal.

The lower natural gas savings are mainly attributable to the difference between the *ex ante* and *ex post* savings calculation assumptions for the light switch and power outlet gasket measures. The *ex ante* calculations for the gasket measures do not include heating or cooling saturation factors, but the *ex post* calculations incorporate the saturation to account for the distribution of heating fuel type and the presence of central air conditioning. The natural gas savings achievement is lower than expected due to the *ex post* adjustment for heating fuel saturation. The adjustment also lowered the *ex post* electric savings for the gasket measures but including air conditioning and a greater than anticipated ISR for the advanced power strip measure drove the *ex post* goal achievement for the electric energy savings and peak demand reduction.

Table 122. 2023 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.)	1,486,610.00	1,486,610.00	1,486,605.69	2,095,040.33	2,136,223.59	2,025,830.21	144%
Peak Demand Reduction (kW)	105.750	105.750	107.805	173.120	177.898	162.233	168%
Natural Gas Energy Savings (therms/yr.)	160,875.00	161,139.18	161,108.84	147,116.44	104,063.40	106,016.80	65%

Differences between the *ex ante* and *ex post* gross assumptions for the advanced power strip and light switch and power outlet gaskets drove the increased realization rates overall (Table 123). The higher realization rates for energy savings and peak demand reduction were driven by a higher *ex post* ISR value for the advanced power strips than the *ex ante* assumption, in addition to energy and 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 v11.0 approach for gaskets. The *ex ante* calculation did not assign demand savings to the gasket measure. Relatedly, the lower realization rate for natural gas was driven by the in-service rates (ISRs) and fuel saturation rates for power outlet gaskets in the *ex post* gross calculations, which were lower than the *ex ante* assumptions. The evaluation team applied net to gross (NTG) from the 2023 survey results for the 2023 program year.

Table 123 outlines the *ex post* gross and NTG adjustment factors.

Table 123. 2023 School Education Adjustment Factors

METRIC	REALIZATION RATE (%)[a]	FREERIDERSHIP	SPILLOVER	NTG (%)[b]
Electric Energy Savings (kWh/yr.)	144%	19%	14%	95%
Peak Demand Reduction (kW)	168%	23%	14%	91%
Natural Gas Energy Savings (therms/yr.)	65%	12%	14%	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 2023. As shown in Table 124, the program spent 96% of the allocated electric and natural gas budgets.

Table 124. 2023 School Education Program Expenditures

FUEL	PROGRAM BUDGET	PROGRAM EXPENDITURES	BUDGET SPENT (%)
Electric	$895,181.82	$863,781.99	96%
Natural Gas	$353,510.16	$340,596.20	96%

Evaluation Methodology

To inform the 2023 NIPSCO School Education program impact and process evaluations, the evaluation team completed the following research activities:

- **Program staff 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.
- **Parent surveys (n = 70)**, to understand the participant experience in the program and to gather information to calculate freeridership and spillover rates.

Impact Evaluation

The evaluation team completed the impact evaluation to answer the following research questions for each measure and the program overall:

- 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 in-service 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 v11.0, the 2015 Indiana TRM (v2.2), and NIPSCO's program tracking database.[55,56]

Audited and Verified Savings

[1] Illinois Energy Efficiency Stakeholder Advisory Group. 2023 Illinois Statewide Technical Reference Manual for Energy Efficiency Version 11.0. Volume 3: Residential Measures. September 22, 2022.
[56] Cadmus. Indiana Technical Reference Manual Version 2.2. July 28, 2015.

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, checked for duplicates and eligibility.
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 11,750 combo kits and 264 gas-only kits distributed through the School Education program, with these figures and the scorecard values confirmed in the program tracking data audit. No adjustments were made to the quantities.

To confirm savings, the evaluation team reviewed savings documentation, which included both measure- and kit-level savings. Notably, NIPSCO included in-service rates from previous EM&V efforts in their *ex ante* assumptions for the program. The measure savings calculation file included the rates used to adjust *ex ante savings* to account for installation practices and water heater fuel saturation.

Upon review of the documentation, the evaluation team found that the measure-level savings values in the tracking data were consistent with NIPSCO's kit savings documentation. However, program tracking data savings were reported at the kit level with rounded total kit values, and NIPSCO's measure calculation file savings were reported at the measure level with unrounded per-measure values. This difference in the unit of analysis led to rounding errors, resulting in a slight deviation between the total of measure savings and the tracking data savings. These rounding errors will be noted where applicable in the remainder of this report.

In-Service Rates

The evaluation team calculated in-service rates (ISRs) for the School Education program by leveraging self-reported data from parent surveys and HEWs.

Parents whose children participated in the School Education program were encouraged to complete HEWs, which captured information on various aspects including home characteristics, energy behavior, and initial measure installation rates. The HEWs were voluntary, meaning not all parents complete them, and they were typically completed very shortly after kit distribution, possibly not reflecting long-term in-service rates as participants may install or uninstall measures over time. Recognizing this uncertainty, the primary source for in-service rates was the parent survey, fielded through this evaluation. Respondents were specifically asked to self-report whether measures were installed at the time of the survey, providing insight into the actual implementation status of the measures distributed through the program.[57]

[57] The evaluation team was unable to match 20 survey respondents to the HEW data due to a lack of contact information for these cases in the HEW data.

Following the methodology consistent with previous reports, the evaluation team examined whether the survey ISRs were representative of the broader population of customers who completed the HEW by comparing HEW ISRs for the full HEW population (n = 6,640), against the subsample of those who completed the survey (n = 70). The evaluation team was able to match 50 respondents who completed the HEW and the EM&V survey, and all 50 respondents were those who received a combo kit.

As Table 125 illustrates, compared to the full HEW population, the sample of customers who responded to the parent survey generally had higher ISRs, even at the time of the HEW. As such, the evaluation team may have primarily surveyed engaged participants more likely to have installed the kit measures.

Table 125. 2023 School Education Program In-Service Rates: HEW & EM&V Survey

MEASURE	FULL HEW POPULATION ISR (n = 6,640)	PARENTS WHO COMPLETED THE HEW AND THE EM&V SURVEY (n = 50)		RELATIVE CHANGE IN ISR [b] (HEW TO EM&V)
		HEW ISR	EM&V ISR	
Connected LEDs - Combo Kit	45%	30%	87%	43%
Bathroom Aerator - Combo Kit	22%	28%	38%	16%
Bathroom Aerator - Gas Only Kit	24%	-[a]	-	14%
Kitchen Aerator - Combo Kit	22%	26%	38%	28%
Kitchen Aerator - Gas Only Kit	22%	-	-	28%
Low-flow Showerhead - Combo Kit	22%	18%	23%	9%
Low-flow Showerhead - Gas Only Kit	13%	-	-	18%
Nightlight - Combo Kit	70%	66%	85%	14%
Advanced Power Strip - Combo Kit	70%	73%	87%	16%
Light Switch Gaskets - Combo Kit	19%	49%	36%	3%
Light Switch Gaskets - Gas Only Kit	37%	-	-	(15%)
Power Outlet Gaskets - Combo Kit	14%	49%	43%	0%
Power Outlet Gaskets - Gas Only Kit	33%	-	-	(19%)

[a] The evaluation team was unable to match gas kit HEW respondents to survey respondents. Therefore, the values are excluded fro m the table.

[b] The relative change in the ISR represents the difference between the full HEW population ISR and the program ISRs shown Table 126

To account for the timing and relatively smaller sample size of the evaluation survey, the evaluation team adjusted the ISRs to align with the likely rates of the broader participant population. The relative change in ISRs was calculated using HEW and EM&V survey responses for participants who completed the EM&V survey (n = 70) compared to the full HEW ISR.

The relative change value was then applied to the overall HEW ISR to better approximate the likely measure-level ISR for the full participant population. Table 126 lists the resulting ISRs for all program-installed measures.

Table 126. 2023 School Education Program In-Service Rates by Measure

MEASURE	ISR
Connected LEDs	88%
Bathroom Aerator	38%
Kitchen Aerator	40%
Low-flow Showerhead	31%
Nightlight	84%
Advanced Power Strip	86%
Light Switch Gaskets	22%
Power Outlet Gaskets	14%

The ISRs for water-saving devices, including bathroom aerators, kitchen aerators, and low-flow showerheads, were slightly higher than in 2021, when the previous survey was conducted, but remained below 50%. Specifically, survey results revealed that of the households that received gas kits containing two low-flow showerheads, 17% installed one showerhead, 17% installed two showerheads, and more than half (58%) did not install either showerhead. Of the electric/combo kit customers who received one showerhead in their kit, 31% installed one showerhead, and two-thirds (66%) did not install the showerhead. For the gas customers who received two bathroom faucet aerators, 25% installed only one, 17% installed both, and again more than half (58%) did not install either bathroom faucet aerator. For the combo/electric customers who received only one bathroom faucet aerator, 40% installed one aerator, and 59% did not install their aerator.

Respondents cited various reasons for not installing or removing these devices, including constraints such as lack of time, difficulty installing or device compatibility issues, inadequate showerhead pressure, and rental home restrictions.

The ISRs for the gaskets had the lowest in-service rates of all kit measures. It is important to note that the ISRs for the gaskets are specific to those installed on exterior walls because savings are claimed based on reduced infiltration. Gaskets installed on interior walls do not contribute to energy 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 2023 HEW results from the School Education program, which provided a large sample of customers who reported their water heater fuel. The results, shown in Table 127, indicate a slight discrepancy between *ex ante* and verified electric and natural gas domestic water heating saturation rates.

Table 127. 2023 School Education Program Water Heater Fuel Saturation

WATER HEATING FUEL	REPORTED EX ANTE	VERIFIED COMBO/ELECTRIC KITS [a]	VERIFIED GAS-ONLY KITS [b]
Electric	23%	23%	20%
Natural Gas	62%	64%	70%

[a] Note: 13% responded, "Other – propane gas, LP gas."
[b] Note: 10% responded, "Other – propane gas, LP gas."

Verified Savings Summary

To calculate the verified savings, the evaluation team replaced the *ex ante* ISR and water heater saturation values with verified information obtained from the 2023 parent survey and HEW. This updated data provides a more accurate representation of actual ISRs and water heater fuel saturation levels among the current program year participants. Table 128 summarizes *ex ante* and verified savings per unit.

Table 128. 2023 School Education Program *Ex Ante* & Verified Per-Unit Savings

MEASURE	*EX ANTE* ISR	*EX ANTE* SAVINGS [a]			VERIFIED ISR	VERIFIED SAVINGS		
		KWH	KW	THERMS		KWH	KW	THERMS
Connected LEDs - Combo Kit	84%	9.36	0.001	0.00	88%	9.81	0.001	0.00
Bathroom Aerator - Combo Kit	39%	2.35	0.000	0.28	38%	2.29	0.000	0.28
Bathroom Aerator - Gas Only Kit	39%	0.00	0.000	0.28	38%	0.00	0.000	0.31
Kitchen Aerator - Combo Kit	35%	26.03	0.001	3.09	40%	29.75	0.001	3.64
Kitchen Aerator - Gas Only Kit	49%	0.00	0.000	4.32	40%	0.00	0.000	3.98
Low-flow Showerhead - Combo Kit	30%	34.33	0.001	4.07	31%	35.48	0.001	4.34
Low-flow Showerhead - Gas Only Kit	30%	0.00	0.000	4.07	31%	0.00	0.000	4.75
Nightlight - Combo Kit	70%	1.29	0.000	0.00	84%	0.88	0.000	0.00
Advanced Power Strip - Combo Kit	40%	41.20	0.005	0.00	86%	88.58	0.010	0.00
Light Switch Gaskets - Combo Kit	25%	0.10	0.000	0.23	22%	0.09	0.000	0.20
Light Switch Gaskets - Gas Only Kit	25%	0.00	0.000	0.23	22%	0.00	0.000	0.20
Power Outlet Gaskets - Combo Kit	25%	0.10	0.000	0.23	14%	0.06	0.000	0.13
Power Outlet Gaskets - Gas Only Kit	25%	0.00	0.000	0.23	14%	0.00	0.000	0.13

For 2023, the *ex ante* electric energy savings, demand reduction, and therm savings for the majority of measures align with the verified savings. However, the *ex ante* ISR for the advanced power strip measure was 40%, from the Illinois TRM (v8.0), but the verified ISR was substantially higher, at 86%.

Similarly, variations in the assumed heating fuel saturation for the gasket measure contributed to differences between *ex ante* and verified savings. While the *ex ante* does not adjust for heating fuel saturation, the survey and HEW provided saturation values that were used in the verified analysis.

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 IL TRM v11.0 and the Indiana TRM (v2.2) to calculate *ex post* gross electric energy savings, demand reduction, and natural gas savings. *Appendix 9. School Education Program* 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 IL TRM v11.0 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 incorporated changes due to EISA into the impact evaluation. For the first half of the year, connected LEDs were attributed full savings including lighting controls. Starting on July 1, 2023, only the lighting controls were counted. The team used 2023 parent survey findings to calculate the *ex post* baseline wattage for connected LEDs distributed in the first half of the year.
- The evaluation team used updated in-service rates, water heater fuel saturation, space heating fuel saturation and other algorithm inputs, based on the 2023 HEW and the 2023 NIPSCO School Education program parent survey, which adjusted savings across measures.

The following sections summarize the team's findings based on the engineering review.

Ex Post Gross Savings Summary

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 kit measure using algorithms from the IL TRM v11.0. The evaluation team estimated people per household, and water and space heating fuel type saturation from the 2023 HEW and updated ISRs using the results of the 2023 parent survey, then used this information to inform *ex post* gross savings calculations.

Table 129 shows the *ex ante* deemed savings and *ex post* gross per-measure savings for the 2023 School Education program measures. *Ex post* savings calculations differed from *ex ante* analysis for the following overarching reasons:

- **Connected LED:** Updated ISR, baseline wattage, and standby power draw. Both the 2023 *ex ante* and *ex post* analyses use the IL TRM (v10.0 *ex ante* and v11.0 *ex post*) which only provides a savings estimation approach for the lighting control feature of connected lighting. The v11.0 update increased the amount of energy saved by lighting controls from 30% to 37%. *Ex ante* savings were calculated with the TRM default wattage assumption instead of the actual wattage of the lamp. The team calculated *ex post* using the actual lamp wattage and included additional savings for the difference in wattage between the LED and the lamp replaced as determined through the parent survey. This additional savings only applies to lamps in kits distributed prior to the EISA backstop (July 1, 2023). Approximately 60% of kits were distributed after this date and are attributed *ex post* savings for the lighting controls only.

- **Advanced power strip:** *Ex post* ISR of 86% from the 2023 parent survey is much higher than the *ex ante* assumption of 40%, from Illinois TRM (v8.0) for leave behind kits.
- **LED nightlight:** Updated baseline wattage and hours of use from the IL TRM v11.0 for *ex post* analysis increased energy savings compared to *ex ante*. Updated ISR from the 2023 parent survey and the incandescent replacement factor from the 2023 HEW.
- **Low-flow faucet aerators and showerheads:** Updated water heating fuel saturation percentages and household demographics based on 2023 HEW results, and updated ISRs based on the 2023 parent survey. Updated baseline and efficient flow rate assumptions to match the IL TRM v11.0. As reported in *Appendix 9. School Education Program* the verified natural gas and electric water heater saturation rates were like *ex ante*. The average number of people per home reported in the 2023 HEW was significantly higher compared to *ex ante*.
- **Outlet and switch gaskets:** Updated to IL TRM v11.0, adjusted to Indiana climate zone, and incorporated space heating fuel type saturations and assigned demand savings based on the presence of central air conditioning from the 2023 HEW results. Updated ISRs based on the 2023 parent survey. For these measures, the *ex ante* savings were 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 IL TRM v11.0, consistent with the approach for other measures in the program, and the evaluation team adjusted the IL TRM 11.0 weather variables to reflect the Indiana climate. The IL TRM v11.0 assigns savings based on industry studies and the American Society of Heating, Refrigerating, and Air Conditioning Engineers (ASHRAE) findings. Demand savings were 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 were comparably large, driving up electric savings for these measures.

Table 129. 2023 School Education Program *Ex Ante* & *Ex Post* Gross Per-Measure Savings Values

MEASURE	QUANTITY PER KIT	*EX ANTE* DEEMED SAVINGS [a]			*EX POST* GROSS PER-MEASURE SAVINGS		
		KWH	KW	THERMS	KWH	KW	THERMS
Connected LEDs - Combo Kit (Jan – Jun 2023)	2	18.72	0.002	0.00	41.42	0.004	0.00
Connected LEDs – Combo Kit (Jul - Dec 2023)	2	18.72	0.002	0.00	3.78	0.001	0.00
Bathroom Aerator - Combo Kit	1	2.35	0.000	0.28	3.56	0.000	0.42
Bathroom Aerator - Gas Only Kit	2	0.00	0.000	0.56	0.00	0.000	0.93
Kitchen Aerator - Combo Kit	1	26.03	0.001	3.09	33.80	0.001	4.03

MEASURE	QUANTITY PER KIT	*EX ANTE* DEEMED SAVINGS [a]			*EX POST* GROSS PER-MEASURE SAVINGS		
		KWH	KW	THERMS	KWH	KW	THERMS
Kitchen Aerator - Gas Only Kit	1	0.00	0.000	4.32	0.00	0.000	4.41
Low-Flow Showerhead - Combo Kit	1	34.33	0.001	4.07	27.94	0.000	3.33
Low-Flow Showerhead - Gas Only Kit	2	0.00	0.000	8.14	0.00	0.000	7.29
Nightlight - Combo Kit	1	1.29	0.000	0.00	1.96	0.000	0.00
Advanced Power Strip - Combo Kit	1	41.20	0.005	0.00	88.58	0.006	0.00
Light Switch Gaskets - Combo Kit	8	0.80	0.000	1.80	2.98	0.002	0.32
Light Switch Gaskets - Gas Only Kit	8	0.00	0.000	1.80	0.00	0.000	0.34
Power Outlet Gaskets - Combo Kit	18	1.80	0.000	4.05	4.27	0.003	0.45
Power Outlet Gaskets - Gas Only Kit	18	0.00	0.000	4.05	0.00	0.000	0.49

[a] *Ex ante* values in this table are audited savings. *Ex ante* savings in the tracking data are per-kit values, not measure specific.

Table 130 highlights notable differences between *ex ante* and *ex post* gross estimates.

Table 130. 2023 School Education Program Notable Differences Between *Ex Ante* & *Ex Post* Gross

MEASURE	*EX ANTE* SOURCES AND ASSUMPTIONS	*EX POST* GROSS SOURCES AND ASSUMPTIONS	PRIMARY REASONS FOR DIFFERENCES
Connected LED	*Ex ante* savings use IL TRM v10.0 assumptions, including default wattage, and does not include delta watts. Savings claimed past EISA backstop.	*Ex post* savings use IL TRM v11.0 assumptions, 2023 parent survey for baseline wattage of 28W and ISR. Only control savings for units distributed after EISA backstop.	*Ex post* inclusion of delta watts. EISA backstop.
Bathroom Aerator	*Ex ante* savings use IN TRM (v2.2) assumptions.	*Ex post* savings use IL TRM v11.0 assumptions. 2023 HEW for fuel saturation percentages and demographics. 2023 parent survey for ISRs.	Different TRM assumptions for flow rates and drain factor. Updated ISR.

MEASURE	*EX ANTE* SOURCES AND ASSUMPTIONS	*EX POST* GROSS SOURCES AND ASSUMPTIONS	PRIMARY REASONS FOR DIFFERENCES
Kitchen Aerator	*Ex ante* savings use IN TRM (v2.2) assumptions.	*Ex post* savings use IL TRM v11.0 assumptions. 2023 HEW for fuel saturation percentages and demographics. 2023 parent survey for ISRs.	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 v11.0 assumptions. 2023 HEW for fuel saturation percentages and demographics. 2023 parent survey for ISRs.	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 v11.0 assumptions. 2023 HEW for incandescent replacement factor. 2023 parent survey for ISRs.	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 v11.0 assumptions and 2023 parent survey ISR.	*Ex post* ISR (86%) is much higher than *ex ante* (40%)
Light Switch Gaskets	*Ex ante* savings uses online calculator at EnergyEarth.com	*Ex post* savings use IL TRM v11.0 assumptions. 2023 HEW for fuel saturation percentages and 2023 parent survey ISR.	Methodology differences. *Ex ante* does not include an adjustment for space heating fuel type or 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 v11.0 assumptions. 2023 HEW for fuel saturation percentages and 2023 parent survey 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

The evaluation team excluded therm penalties from the evaluated savings, consistent with previous evaluations. However, it is important to note that cost-effectiveness results for gas and electric programs will still incorporate 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 the gas program performance and measure performance more clearly. The total therm penalty, as shown in Table 131, was -4,493.89 therms. *Ex ante* program data did not include a therm penalty.

Table 131. 2023 School Education Program Waste Heat Factor Therm Penalty

MEASURE	WASTE HEAT FACTOR THERM PENALTY
Connected LEDs - Combo Kit (Jan - Jun 2023)	(3,947.40)
Connected LEDs - Combo Kit (Jul - Dec 2023)	(546.49)
Total Therm Penalty	**(4,493.89)**

Realization Rates

The next three tables (Table 132 through Table 134) show the program's *ex ante* reported savings, verified savings, *ex post* gross savings and total program realization rates for kWh, kW, and therms. 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.

The gasket and advanced power strip measures drove the substantial realization rates for electric energy savings and peak demand reduction. Specifically, the *ex ante* approach for calculating energy savings for the gasket measure was based only on heating fuel savings and excluded demand reduction. In comparison, the *ex post* savings calculation incorporated heating and cooling savings and assigned demand reduction based on the presence of central air conditioning. Additionally, the significant difference between the advanced power strip *ex ante* and *ex post* ISRs (40% versus 86%) contributed to the energy and demand realization rates. Additional discussion about the *ex ante* and *ex post* savings calculation assumptions is provided above in Table 130.

Table 132. 2023 School Education Program *Ex Ante* to *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.)
Connected LEDs - Combo Kit (Jan - Jun 2023)		87,339.86	91,498.90	193,215.00
Connected LEDs - Combo Kit (Jul - Dec 2023)		132,647.99	138,964.56	26,749.34
Bathroom Aerator - Combo Kit		27,565.90	26,859.09	41,772.32
Bathroom Aerator - Gas Only Kit		0.00	0.00	0.00
Kitchen Aerator - Combo Kit		305,849.88	349,542.72	397,125.39
Kitchen Aerator - Gas Only Kit		0.00	0.00	0.00
Low-flow Showerhead - Combo Kit		403,421.34	416,868.72	328,250.33
Low-flow Showerhead - Gas Only Kit		0.00	0.00	0.00
Nightlight - Combo Kit		15,130.71	10,375.34	23,067.85
Advanced Power Strip - Combo Kit		484,100.00	1,040,815.00	1,040,815.00
Light Switch Gaskets - Combo Kit		9,400.00	8,272.00	35,047.18
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		21,150.00	11,844.00	50,181.19
Power Outlet Gaskets - Gas Only Kit		0.00	0.00	0.00
Total Savings	1,486,610.00	1,486,605.69	2,095,040.33	2,136,223.59
Total Program Realization Rate				144%

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 133. 2023 School Education Program *Ex Ante* to *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.)
Connected LEDs - Combo Kit (Jan - Jun 2023)		11.358	11.899	20.934
Connected LEDs - Combo Kit (Jul - Dec 2023)		17.250	18.071	4.741
Bathroom Aerator - Combo Kit		3.411	3.324	2.157
Bathroom Aerator - Gas Only Kit		0.000	0.000	0.000
Kitchen Aerator - Combo Kit		7.778	8.890	6.855
Kitchen Aerator - Gas Only Kit		0.000	0.000	0.000
Low-Flow Showerhead - Combo Kit		13.683	14.139	5.160
Low-Flow Showerhead - Gas Only Kit		0.000	0.000	0.000
Nightlight - Combo Kit		0.000	0.000	0.000
Advanced Power Strip - Combo Kit		54.325	116.798	72.999
Light Switch Gaskets - Combo Kit		0.000	0.000	26.750
Light Switch Gaskets - Gas Only Kit		0.000	0.000	0.000
Power Outlet Gaskets - Combo Kit		0.000	0.000	38.301
Power Outlet Gaskets - Gas Only Kit		0.000	0.000	0.000
Total Savings	**105.750**	**107.805**	**173.120**	**177.898**
Total Program Realization Rate				**168%**

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 134. 2023 School Education Program *Ex Ante* to *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.)
Connected LEDs - Combo Kit (Jan - Jun 2023)		0.00	0.00	0.00
Connected LEDs - Combo Kit (Jul - Dec 2023)		0.00	0.00	0.00
Bathroom Aerator - Combo Kit		3,269.32	3,288.25	4,982.89
Bathroom Aerator - Gas Only Kit		146.91	161.61	244.90
Kitchen Aerator - Combo Kit		36,273.85	42,793.12	47,371.84
Kitchen Aerator - Gas Only Kit		1,141.01	1,051.62	1,164.14
Low-flow Showerhead - Combo Kit		47,845.84	51,035.57	39,155.95
Low-flow Showerhead - Gas Only Kit		2,150.01	2,508.34	1,924.47
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		21,150.00	18,612.00	3,701.31
Light Switch Gaskets - Gas Only Kit		475.20	418.18	89.76
Power Outlet Gaskets - Combo Kit		47,587.50	26,649.00	5,299.60
Power Outlet Gaskets - Gas Only Kit		1,069.20	598.75	128.52
Total Savings	**161,139.18**	**161,108.84**	**147,116.44**	**104,063.40**
Total Program Realization Rate				**65%**

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.

The following table (Table 135) summarizes the savings at the kit level.

Table 135. 2023 School Education Program Ex Ante to Ex Post Gross Kit Savings

MEASURE	*EX ANTE* [a]	AUDITED GROSS	VERIFIED GROSS	*EX POST* GROSS	REALIZATION RATE
Electric Energy Savings (kWh/yr.)					
Combo Kit	1,486,610.00	1,486,605.69	2,095,040.33	2,136,223.59	144%
Gas Only Kit	0.00	0.00	0.00	0.00	n/a
Peak Demand Reduction (kW/yr.)					
Combo Kit	105.750	107.805	173.120	177.898	168%
Gas Only Kit	0.000	0.000	0.000	0.000	n/a

MEASURE	*EX ANTE*[a]	AUDITED GROSS	VERIFIED GROSS	*EX POST* GROSS	REALIZATION RATE
Natural Gas Energy Savings (therms/yr.)					
Combo Kit	156,157.50	156,126.52	142,377.93	100,511.60	64%
Gas Only Kit	4,981.68	4,982.33	4,738.51	3,551.80	71%

[a] Ex ante savings are based on a rounded savings value that is applied to each kit. The audited values are calculated at the fu ll savings value, per-measure, and per-kit.

Ex Post Net Savings

The evaluation team calculated freeridership and participant spillover using the survey data collected from 2023 respondents. Like previous evaluation results, the evaluation team found varying levels of freeridership by measure. Spillover was greater this year than in previous years, indicating that the program influenced customer decisions to make energy efficiency improvements after receiving the kit. Specifically, respondents reported installing programmable thermostats and smart thermostats, and purchasing ENERGY STAR® washing machines, dishwashers, freezers, refrigerators, and air conditioners. Table 136 shows the NTG ratios by measure.

Table 136. 2023 School Education Program Net-to-Gross Ratios by Measure

MEASURE	FREE RIDERSHIP	SPILLOVER	NTG
Connected LEDs	23%	14%	91%
Bathroom Aerator	9%	14%	105%
Kitchen Aerator	12%	14%	102%
Low-Flow Showerhead	10%	14%	104%
Nightlight	19%	14%	95%
Advanced Power Strip	24%	14%	90%
Light Switch Gaskets	24%	14%	90%
Power Outlet Gaskets	24%	14%	90%

Table 137 presents the resulting net electric savings, demand reduction, and natural gas savings.

Table 137. 2023 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
Connected LEDs - Combo Kit (Jan - Jun 2023)	193,215.00	20.934	0.00	91%	175,825.65	19.050	0.00

MEASURE	*EX POST* GROSS SAVINGS/REDUCTION			NTG	*EX POST* NET SAVINGS/REDUCTION		
	KWH	KW	THERMS		KWH	KW	THERMS
Connected LEDs - Combo Kit (Jul - Dec 2023)	26,749.34	4.741	0.00	91%	24,341.90	4.314	0.00
Bathroom Aerator - Combo Kit	41,772.32	2.157	4,982.89	105%	43,860.93	2.265	5,232.03
Bathroom Aerator - Gas Only Kit	0.00	0.000	244.90	105%	0.00	0.000	257.15
Kitchen Aerator - Combo Kit	397,125.39	6.855	47,371.84	102%	405,067.89	6.993	48,319.28
Kitchen Aerator - Gas Only Kit	0.00	0.000	1,164.14	102%	0.00	0.000	1,187.42
Low-Flow Showerhead - Combo Kit	328,250.33	5.160	39,155.95	104%	341,380.34	5.366	40,722.19
Low-flow Showerhead - Gas Only Kit	0.00	0.000	1,924.47	104%	0.00	0.000	2,001.45
Nightlight - Combo Kit	23,067.85	0.000	0.00	95%	21,914.46	0.000	0.00
Advanced Power Strip - Combo Kit	1,040,815.00	72.999	0.00	90%	936,733.50	65.699	0.00
Light Switch Gaskets - Combo Kit	35,047.18	26.750	3,701.31	90%	31,542.46	24.075	3,331.18
Light Switch Gaskets - Gas Only Kit	0.00	0.000	89.76	90%	0.00	0.000	80.79
Power Outlet Gaskets - Combo Kit	50,181.19	38.301	5,299.60	90%	45,163.07	34.471	4,769.64
Power Outlet Gaskets - Gas Only Kit	0.00	0.000	128.52	90%	0.00	0.000	115.67
Total Savings	2,136,223.59	177.898	104,063.40		2,025,830.21	162.233	106,016.80

Table 138 shows the net-to-gross results for each fuel.

Table 138. 2023 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.)	1,486,610.00	2,136,223.59	95%	2,025,830.21
Peak Demand Reduction (kW/yr.)	105.750	177.898	91%	162.233
Natural Gas Energy Savings (therms/yr.)	161,139.18	104,063.40	102%	106,016.80

Process Evaluation

The evaluation team completed parent surveys to answer the following research questions:

- What is the program process like for parents?
- Are the installation instructions easy to follow? Are there difficulties with installing measures?
- Are all the questions on the HEW clear to parents?
- What are key takeaways from participating in the program? Do they remember any energy tips? Do they remember any other programs?
- How do parents feel about the kit they received? Which measures do they like the most?
- What is parents' satisfaction with the program and NIPSCO overall?
- Are parents aware of other NIPSCO programs? Have they participated?

Parent Feedback

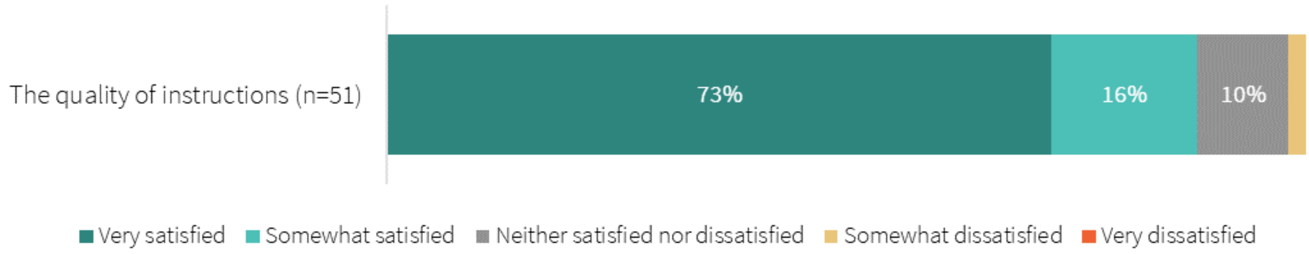
The evaluation team surveyed 70 parents whose child(ren) participated in the program and who filled out the HEW and agreed to a follow-up survey. The following sections provide insights into their experiences, the program's impact, and overall satisfaction. Among the respondents, 12 individuals (17%) received a gas only kit, and the majority, 58 respondents (83%) received a combo kit.

Program and Measure Experience

Program Experience

The survey results indicate a high level of satisfaction with the instructions provided with the kit and HEW. Specifically, most respondents reported being very or somewhat satisfied with the clarity and helpfulness of the instructions (88%). Only a small percentage said they were somewhat dissatisfied (2%).

Figure 24. 2023 School Education Program Satisfaction with Kit and HEW Instructions



Source: Schools EM&V Survey: K4. "How satisfied were you with the instructions that came with the kit and HEW?"

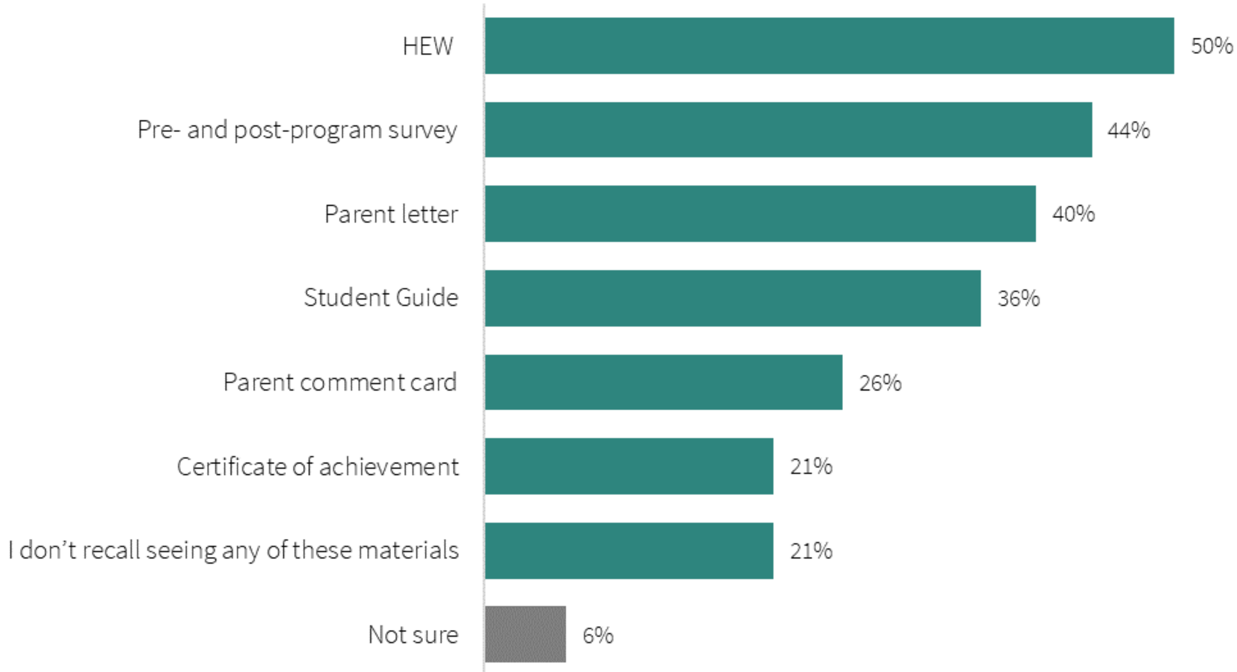
"I think its [the program] good as is. The kids seem to learn a lot, and everything that came in the package was easy to install and a really good program for the children."

"My child came home and was excited about the kit! Everything was easy to install."

"I loved that you all made it easy to set up. Thank you."

One-half of respondents recalled seeing the HEW in the kit (50%). Additionally, almost half of the respondents recalled the pre- and post-program surveys (44%). Respondents also recalled seeing other materials, such as the parent letter (40%), student guide (36%), parent comment card (26%), and certificate of achievement (21%), as shown in Figure 25. However, it is noteworthy that 21% of respondents reported not seeing any of these materials in the kit.

Figure 25. 2023 School Education Program Recollection of Kit Materials



Source: Schools EM&V Survey: K3. "Which materials do you recall seeing along with the kit?" (n = 70)

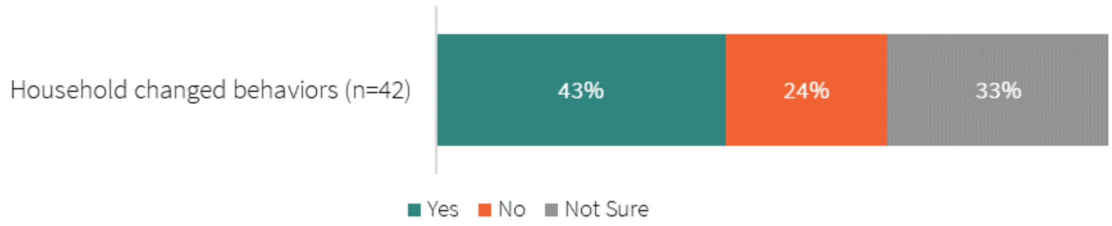
The educational component of the School Education program is designed to provide students with energy efficiency curriculum in the classroom, with the hope that they will share the information with their families at home. Survey responses indicate that this objective has been largely successful, with 82% of respondents indicating that their child shared the information with them. A small portion of respondents (14%) reported that their child did not discuss the energy efficiency topics at home, and 4% were unsure.

Survey responses indicated that students shared energy efficiency tips and facts primarily related to conservation (e.g., water conservation, energy conservation), habits and practices (e.g., turning off lights), and types of products (e.g., in the kit, types of bulbs, insulation). Some even mentioned ways their family can become a more energy-efficient household.

"Loved bonding and doing this project at home."

Survey respondents also indicated varied levels of adoption of energy saving practices based on the tips and facts their child provided. Of the 42 respondents who said that their child talked about energy efficiency tips or facts they learned in school, 43% reported making changes to their practices (Figure 26).

Figure 26. 2023 School Education Program Changes in Household Behaviors



Source: Schools EM&V Survey: K8. "Did your household change any behaviors, products, or habits based on these tips or facts?"

When further asked what behaviors, products, and habits their household changed based on the energy efficiency tips or facts shared by their children, common responses were:

1. Turning lights off when not in use (n = 9)
2. Being mindful of energy use (n = 4)
3. Adjusting temperatures in their home (n = 3)
4. Taking shorter showers (n = 3)

"It changed the electricity usage in our house."

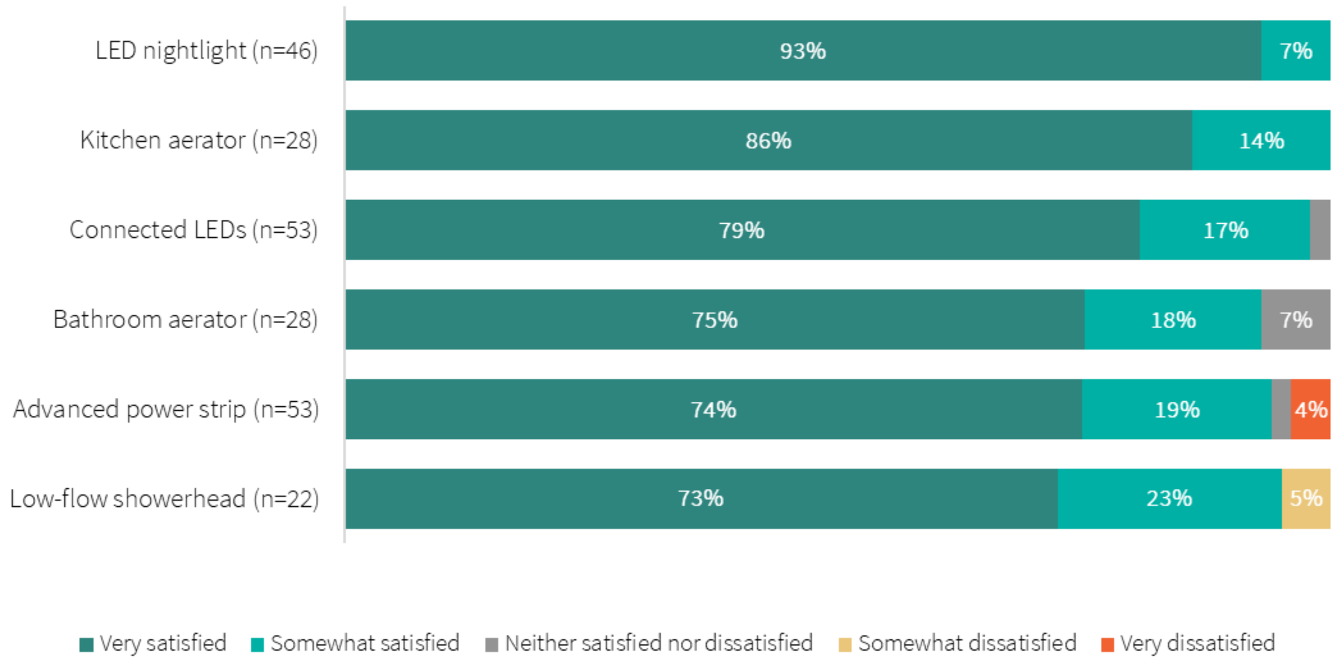
Measure Experience

Survey respondents were highly satisfied with the kit measures they installed. Specifically, LED nightlights and kitchen faucet aerators were the most positively received measures among respondents who installed them, with 93% and 86% "very satisfied" ratings, respectively.

Respondents noted: *"the nightlight is great for my 5-year-old child,"* and, *"love the idea of the (connected LED) light bulbs. Should include more in the kit."* Others noted they had previously installed low-flow showerheads and faucet aerators, stating: *"most homes already use the water saving faucets and aerators,"* and *"supplied faucet aerators and showerhead were not compatible with our existing fixtures."*

Respondents said the following about smart strips and connected LEDs: " *my favorite was definitely the power strip. It was easy to install and super easy to use."* and *"smart bulbs are awesome."*

Figure 27. 2023 School Education Program Satisfaction with Kit Contents



Note: "Not sure" responses, 2% for advanced power strips and 3% for connected LEDs, are excluded from this figure.
Source: Schools EM&V Survey: C5, D4, E5, F3, G4, H5. "How satisfied are you with the smart LED light bulbs overall?"

Most respondents (89%) did not participate in any additional NIPSCO programs after receiving the kit. A small percentage reported participating in additional NIPSCO programs (4%), indicating some level of continued involvement or interest in energy saving activities beyond the School Education program. Of those who participated in additional programs (n=3), the following programs were identified:

- Lighting discounts (n = 2)
- Home Energy Assessment (n = 1)
- Income Qualified Weatherization (n = 1)
- HomeLife Energy Efficiency Calculator (n = 1)
- Appliance Recycling Program (n = 1)

Satisfaction With Program and NIPSCO

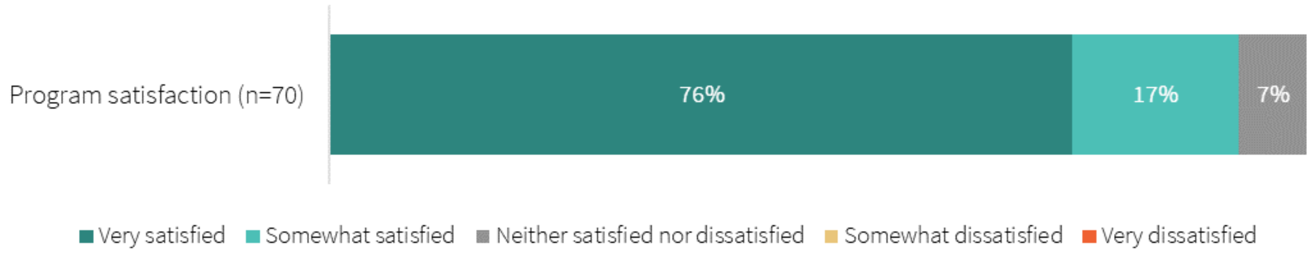
Overall Program Satisfaction

Survey respondents were highly satisfied with the School Education program (Figure 28). Almost all respondents reported being either very (76%) or somewhat (17%) satisfied with the program.

"This program is a great tool to help inform our kids how to help reduce energy and reduce energy loss with tools and guides to help with being energy efficient."

In open-ended responses, three respondents expressed issues with their satisfaction with the program, citing difficulty using all the kit contents, uncertainty about what their child learned, and feeling that some of the items were not used, resulting in a sense of wastefulness.

Figure 28. 2023 School Education Program Satisfaction



Source: Schools EM&V Survey: K1. "How satisfied are you with the Energy Efficiency Education Program overall?"

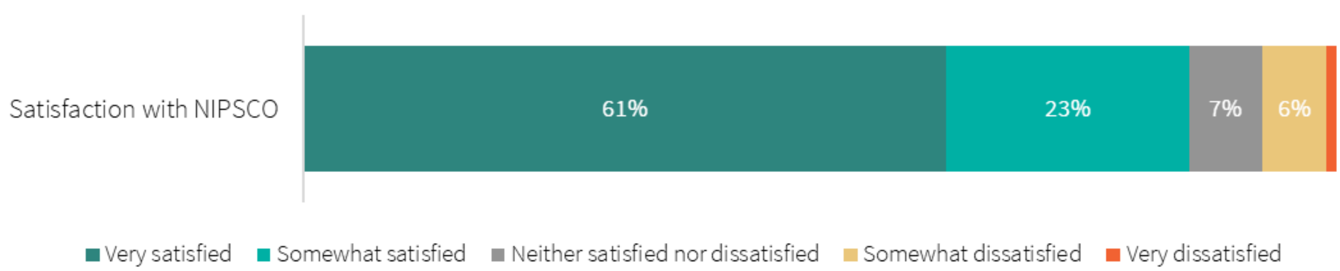
Several respondents offered suggestions on how NIPSCO could improve the program. One respondent said, *"It would be good to discuss where the energy is going in the future – As NIPSCO is changing going towards Solar and going green to discuss this with the children too."* Other suggestions were to provide:

- Kid-friendly booklets & activities
- More educational materials covering energy efficient products and programs
- Options for participants to select kit contents
- Additional products in the kit, such as door seals and more smart LEDs.

Satisfaction with NIPSCO

Respondents indicated a high level of overall satisfaction with NIPSCO as their energy service provider (Figure 29). Most respondents reported being either very or somewhat satisfied with the utility overall (84%). A small percentage of respondents expressed neutrality or dissatisfaction. Among the reasons for feeling neutral or dissatisfied, some respondents mentioned expensive energy bills.

Figure 29. 2023 School Education Program Satisfaction with NIPSCO



Source: Schools EM&V Survey: K10. "How satisfied are you with NIPSCO overall as your energy service provider?" (n = 70)

Parent Survey Demographics

About two-thirds of survey respondents own their homes (64%). Survey respondents primarily live in single-family detached houses (76%). Most individuals live with another person (93%), with most respondents (80%) living in a three, four, or five-person household. About half of the survey respondents were born between 1980 and 1989 (51%) who are aged between their mid-30s to 40s. Approximately 20% were born between 1960 and 1979 (21%), who are aged between their mid-40s to 60s and another 20% were born between 1990 and 1999 (21%), who are aged between their mid-20s to 30s.

Almost a quarter of survey respondents have earned a high school degree or equivalent (21%), followed by a graduate or professional degree (19%), four-year college degree (17%), and some college but no degree (16%). Many survey respondents refused to report their 2023 household income (23%). However, of the 55 respondents who did report their 2023 household income, most earned under $25,000 (14%), $100,000 to $150,000 (14%), and over $150,000 (14%).

Most respondents were White (59%), Hispanic, Latino, or Spanish origin (19%), or Black or African American (19%). More detail on respondent demographics and home characteristics can be found in *Appendix 9. School Education Program Respondent Demographics and Home Characteristics*.

Conclusions and Recommendations

CONCLUSION 1: PARENTS ARE HIGHLY SATISFIED WITH THE PROGRAM AND KITS, PROVIDING POSITIVE FEEDBACK ABOUT THE PROGRAM.

Survey respondents appreciated the School Education program and the educational component, providing high satisfaction ratings for both the program overall and kits received. Almost all (93%) of respondents were very or somewhat satisfied with the program and 84% were very or somewhat satisfied with NIPSCO overall. Additionally, respondents commented about the ease of installing kit components and provided thoughts on incorporating the future of energy in the educational materials. The program continues to positively influence customer behavior around energy use, with 43% indicating their family has changed habits by implementing some of the tips provided through program materials.

Recommendations:

- Include behavior tips in the kit marketing collateral to encourage easy-to-adopt energy efficiency habits.
- Consider enhancing educational materials and activities to include additional energy topics, including renewable energy and how energy production is changing.

CONCLUSION 2: IN-SERVICE RATES VARIED GREATLY BY MEASURE, RANGING FROM 14% FOR POWER OUTLET GASKETS TO 88% FOR CONNECTED LEDS.

In-service rates for gaskets were the lowest of all kit measures, 14% for power outlet gaskets and 22% for light switch gaskets, inclusive only of gaskets installed on exterior walls. This reduced the program's overall energy savings achievement because gaskets are an insulation measure and generate savings only when installed on exterior walls. Increasing customer awareness and understanding of where gaskets should be installed for energy savings should improve the measure ISR and program savings.

Relatedly, bathroom aerators (38%) and showerheads (31%) also had low ISRs. More than half of the HEW respondents, as well as the survey respondents, indicated that they did not install the measures. Some noted that they had already installed aerators and low-flow showerheads, while others noted that the devices were not compatible with their fixtures.

Recommendations:

- Explore opportunities to highlight and emphasize gasket placement on exterior walls, including additional educational materials and visual aids.
- Consider adding a question to the HEW, to gather data on how many installed gaskets were installed on exterior walls. Include a diagram illustrating an "exterior wall" and information reminding participants that gasket energy savings occur when gaskets are installed on exterior walls.
- Assess whether it is cost-effective to continue offering bathroom aerators and low-flow showerheads in the kits.

CONCLUSION 3: OPPORTUNITIES EXIST TO BETTER PROMOTE NIPSCO'S OTHER ENERGY EFFICIENCY PROGRAMS TO SCHOOL EDUCATION PARTICIPANTS.

The kit inserts include information about NIPSCO's other programs (Home Online Marketplace, Appliance Recycling, Home Rebate Program, Home Energy Assessment, and Income-Qualified Weatherization). However, survey findings indicated that 89% of respondents did not participate in additional NIPSCO programs after receiving the energy efficiency kit and 7% expressed uncertainty about whether they had participated in additional programs. Only three respondents participated in other NIPSCO programs.

Recommendations

- Send follow-up fliers or emails to parents of School Education program participants reminding them of NIPSCO's other programs. Explore opportunities for and channels to educate participants about other NIPSCO programs through the School Education program, such as the program website and other program materials including the kit insert.
- Improve the visibility of NIPSCO's programs on the kit insert and identify ways to highlight savings opportunities by participating in other NIPSCO programs.

CONCLUSION 4: REALIZATION RATES FOR ELECTRIC ENERGY SAVINGS AND DEMAND REDUCTION EXCEEDED 100%, WHILE THE REALIZATION RATE FOR NATURAL GAS SAVINGS FELL WELL BELOW 100%.

Like last year's evaluation, the realization rates for electric energy savings (144%) and peak demand reduction (168%) were well over 100% while the realization rate for natural gas savings was well below 100%. These disparities were primarily caused by the different sources used to calculate savings, the high *ex post* ISR for advanced power strips compared to the *ex ante* assumption, and the *ex post* adjustment to the gasket measures to account for heating fuel type and assigning cooling savings.

Recommendations:

- Update *ex ante* ISRs to reflect the recent evaluation available each year.
- Adjust the *ex ante* assumptions for gaskets to reflect the distribution of heating system fuel type and the presence of central air conditioning.

12. HOMELIFE ENERGY EFFICIENCY CALCULATOR PROGRAM

Program Design and Delivery

The HomeLife Energy Efficiency Calculator (HomeLife Calculator) program provides residential customers with the opportunity to assess their home's energy usage through a user-friendly online platform. By offering a 'do-it-yourself' home audit and a complimentary energy savings kit, the program aims to achieve several key goals: 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 diverse range of energy efficiency programs available to them through NIPSCO's residential energy efficiency portfolio. TRC is the implementer of this program.

Access to the online calculator is available through NIPSCO's website and is exclusive to residential customers with a valid account number. Eligibility for receiving a kit is contingent upon active electric and/or gas customer status, along with other eligibility criteria. The calculator is a comprehensive resource, providing practical tips on low-to-no-cost improvements designed to save customers energy and money. Additionally, the calculator provides an analysis of each customer's energy consumption along with tailored recommendations to improve the efficiency of their homes.

The HomeLife Calculator energy efficiency kit eligibility extends to all categories of NIPSCO residential customers, including combo, electric-only, and gas-only, who have not had an assessment through the Home Energy Assessment (HEA) or Income Qualified Weatherization (IQW) programs and have not received an energy efficiency kit in the last three years. Electric-only customers receive the combo kit, but NIPSCO does not claim savings for the gas measures. Gas-only customers receive a kit with additional water-saving devices.

Combo and Electric Only Kit Measures

- 2 connected LEDs
- 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 the 2022 Design

TRC made updates to the combo and electric kits for the 2023 program year in preparation for the EISA backstop that took effect July 1, 2023. Specifically, the 5W candelabra LEDS in the 2022 kit were substituted with two connected LEDs. These LEDs offer enhanced functionality, enabling customers to schedule and control lighting remotely through various smart devices, such as smartphones, tablets, or smart speakers.

Program Performance

The success of the HomeLife Calculator program in surpassing its goals in 2023 can be attributed to TRC's continued proactive efforts in expanding the reach of program information to a broader audience. Unlike previous years, where TRC primarily relied on past participant data for outreach, 2022 saw a notable increase in program participation after TRC leveraged mailing lists provided by NIPSCO to connect with customers. Building on this success, TRC continued to utilize NIPSCO's mailing lists for customer outreach in 2023, further raising the program's visibility and engagement.

In 2023, the program distributed a total of 2,246 kits, comprised of 1,341 combo kits, 107 electric kits, and 798 gas kits. Although this is a 19% reduction from the number of kits distributed in 2022 (2,759), the program exceeded its 2023 goals for electric, peak demand, and gas savings. Table 139 summarizes results for the full year of program performance.

Table 139. 2023 HomeLife Calculator 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.)	114,002.50	173,786.75	173,791.03	232,956.54	287,575.98	274,949.22	252%
Peak Demand Reduction (kW)	9.500	14.480	14.654	21.795	36.169	33.694	381%
Natural Gas Energy Savings (therms/yr.)	12,234.00	29,268.63	29,266.22	42,332.61	27,681.59	27,496.65	226%

Table 140 provides an overview of the *ex post* gross and net-to-gross (NTG) adjustment factors. The HomeLife Calculator program continues to have a small effect on energy-efficient decisions, as indicated by the spillover rate (10%). The spillover rate for 2023 shows a slight decrease from 2022, when the spillover rate was 12%.

Table 140. 2023 HomeLife Calculator Adjustment Factors

METRIC	REALIZATION RATE (%)[A]	FREERIDERSHIP	SPILLOVER	NTG (%)[B]
Electric Energy Savings (kWh/yr.)	165%	14%	10%	96%
Peak Demand Reduction (kW)	250%	16%	10%	93%
Natural Gas Energy Savings (therms/yr.)	95%	10%	10%	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.

The realization rates for electric energy savings and peak demand reduction exceeded 100%, primarily due to the gasket and advanced power strip measures. The *ex ante* assumptions for the gasket measures did not account for the presence of central air conditioning, however, the evaluation team incorporated central air conditioning in the *ex post* savings calculations, which increased savings. Additionally, the substantial increase between the *ex ante* and *ex post* ISR values for the advanced power strip measure significantly contributed to the *ex post* energy and demand savings for this measure. Additional discussion about the *ex ante* and *ex post* savings calculation assumptions is provided in Table 146, in the Impact Evaluation section.

Table 141 lists the 2023 HomeLife Calculator program budget and expenditures by fuel type. Given the increased participation and popularity of the HomeLife Calculator program in 2023, the expenditures for each fuel type exceeded the budgeted values.

Table 141. 2023 HomeLife Calculator Program Expenditures

FUEL	PROGRAM BUDGET	PROGRAM EXPENDITURES	BUDGET SPENT (%)
Electric	$71,349.71	$104,949.73	147%
Natural Gas	$29,491.32	$77,929.56	264%

Evaluation Methodology

To inform the 2023 NIPSCO evaluations, 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.
- **Participant surveys (n=120),** to understand the participant experience in the program and to gather information to calculate freeridership and spillover rates.
- **Uplift analysis,** to understand the level of participation in other programs after a customer participated in the HomeLife Calculator 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?
- What are *ex post* program savings? Do these suggest any needed updates to program design, delivery, or savings assumptions?
- What are in-service rates (ISRs) 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)?

The evaluation team compared the engineering calculations and NIPSCO's *ex ante* savings across all measure types. These savings methodologies and inputs for each measure were derived from several sources, including standard engineering practices, the Illinois TRM v11.0, the 2015 Indiana TRM (v2.2), and NIPSCO's program tracking database.[58,59]

Audited and Verified Savings

To audit program savings, the evaluation team performed the following reviews to verify alignment with the program's scorecard:

4. **Audited Kits Quantity.** Reviewed program tracking data provided by the implementer and audited the number of kits distributed.
5. **Confirm Measure-Level Savings Calculations.** Reviewed per-measure and per-kit savings in the documentation provided by NIPSCO.
6. **Savings Estimate Review.** Confirmed program-level total savings.

NIPSCO reported the distribution of 1,341 combo kits, 798 gas-only kits, and 107 electric-only kits distributed through the HomeLife Calculator program. These reported values from the scorecard were cross-checked against the program tracking data, and no adjustments were necessary in the audited phase.

To confirm savings, the evaluation team reviewed the kit savings documentation, which included both measure-level and kit-level savings. Notably, NIPSCO included ISRs from previous EM&V efforts in its *ex ante* assumptions for the program. The measure savings calculation file included the rates used to adjust *ex ante savings* to account for installation practices and water heater fuel saturation.

[1] Illinois Energy Efficiency Stakeholder Advisory Group. 2023 Illinois Statewide Technical Reference Manual for Energy Efficiency Version 11.0. Volume 3: Residential Measures. September 24, 2021.
[59] Cadmus. Indiana Technical Reference Manual Version 2.2. July 28, 2015.

Upon review of the documentation, the evaluation team found that measure-level savings values in the tracking data were consistent with NIPSCO's kit savings documentation. However, program tracking data savings were reported at the kit level, with rounded total kit values, and NIPSCO's measure calculation file savings were reported at the measure level, with unrounded per-measure values. This difference in the unit of analysis led to rounding errors, resulting in a slight deviation between the total of measure savings and 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). Table 34 lists the ISRs for all program-installed measures.

Table 34 lists the ISRs for all program-installed measures.

Table 142. 2023 HomeLife Calculator Program Survey In-Service Rates by Measure

MEASURE	ISR
Connected LEDs	83%
Bathroom Aerators	52%
Kitchen Aerators	60%
Low-Flow Showerheads	48%
Nightlights	88%
Advanced Power Strips	89%
Light Switch Gaskets	36%
Power Outlet Gaskets	35%

There were many reasons why ISRs were low for low-flow showerheads and bathroom faucet aerators. For low-flow showerheads, the primary reasons included respondents having only one shower and needing only one showerhead, not having the opportunity to install a new showerhead, using an alternative showerhead, or being satisfied with their current showerhead. For the surveyed gas kit participants who received two showerheads, about half (49%) installed only one showerhead, 22% of participants installed both showerheads, and 27% did not install either showerhead. For electric/combo kit participants, 48% installed the one showerhead they received, and 52% did not.

For bathroom faucet aerator(s), survey respondents cited not having the chance to install them or having only one bathroom faucet. Specifically for gas kit participants who received two bathroom faucet aerators, 33% installed both bathroom faucet aerators, 36% installed only one, and 24% installed neither of the two bathroom faucet aerators. For electric/combo kit participants, bathroom faucet aerator installation was almost equal, with 49% who installed the one bathroom faucet aerator they received and 48% who did not.

Though they increased from 2022, ISRs remained low for light switch (from 17% in 2022 to 36% in 2023) and power outlet gaskets (from 15% in 2022 to 35% in 2023). It is important to note that the ISRs for the gaskets are specific to those installed on exterior walls because savings are claimed based on reduced infiltration. Gaskets installed on interior walls do not contribute to energy 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 2023 HomeLife Calculator participant survey. This survey provided insights into the types of fuel customers use for their water heaters, as shown in Table 143. The results highlight discrepancies between *ex ante* and verified electric and natural gas water heating saturation rates.

Table 143. 2023 HomeLife Calculator Program Water Heater Fuel Saturation

WATER HEATING FUEL	REPORTED *EX ANTE*	VERIFIED COMBO/ELECTRIC KITS[a]	VERIFIED GAS-ONLY KITS
Electric	23%	16%	27%
Natural Gas	62%	81%	73%

[a] Note: 3% responded, "Other – propane gas, LP gas."

Verified Savings Summary

To calculate the verified savings, the evaluation team replaced the *ex ante* ISR and water heater saturation values with verified information from the 2023 participant survey. This updated data provides a more accurate representation of actual ISRs and water heater fuel saturation levels among the current program year participants. Table 144 summarizes the audited and verified savings per unit.

Table 144. 2023 HomeLife Calculator Program Audited & Verified Per Unit Savings

MEASURE	*EX ANTE* ISR	*EX ANTE* SAVINGS[a]			VERIFIED ISR	VERIFIED SAVINGS		
		KWH	KW	THERMS		KWH	KW	THERMS
Connected LEDs - Combo Kit	92%	10.25	0.001	0.00	83%	9.25	0.001	0.00
Connected LEDs - Electric Only Kit	92%	10.25	0.001	0.00	83%	9.25	0.001	0.00
Bathroom Aerator - Combo Kit	36%	2.59	0.000	0.31	52%	2.60	0.000	0.58
Bathroom Aerator - Electric Only Kit	36%	2.59	0.000	0.00	52%	2.60	0.000	0.00
Bathroom Aerator - Gas Only Kit	36%	0.00	0.000	0.31	52%	0.00	0.000	0.52
Kitchen Aerator - Combo Kit	49%	20.34	0.001	2.41	60%	17.33	0.001	3.86
Kitchen Aerator - Electric Only Kit	49%	20.46	0.001	0.00	60%	17.43	0.001	0.00
Kitchen Aerator - Gas Only Kit	49%	0.00	0.000	2.48	60%	0.00	0.000	3.58
Low Flow Showerhead - Combo Kit	42%	30.15	0.002	3.58	48%	23.97	0.001	5.34
Low Flow Showerhead - Electric Only Kit	42%	30.29	0.002	0.00	48%	24.08	0.001	0.00
Low Flow Showerhead - Gas Only Kit	42%	0.00	0.000	3.66	48%	0.00	0.000	4.92
Nightlight - Combo Kit	87%	2.61	0.000	0.00	88%	3.12	0.000	0.00
Nightlight - Electric Only Kit	87%	2.61	0.000	0.00	88%	3.12	0.000	0.00
Advanced Power Strip - Combo Kit	40%	41.20	0.005	0.00	89%	91.67	0.010	0.00
Advanced Power Strip - Electric Only Kit	40%	41.20	0.005	0.00	89%	91.67	0.010	0.00
Light Switch Gaskets - Combo Kit	25%	0.10	0.000	0.23	36%	0.14	0.000	0.32
Light Switch Gaskets - Electric Only Kit	25%	0.10	0.000	0.00	36%	0.14	0.000	0.00
Light Switch Gaskets - Gas Only Kit	25%	0.00	0.000	0.23	36%	0.00	0.000	0.32
Power Outlet Gaskets - Combo Kit	25%	0.10	0.000	0.23	35%	0.14	0.000	0.32
Power Outlet Gaskets - Electric Only Kit	25%	0.10	0.000	0.00	35%	0.14	0.000	0.00
Power Outlet Gaskets - Gas Only Kit	25%	0.00	0.000	0.23	35%	0.00	0.000	0.32

[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 IL TRM v11.0 and the Indiana TRM (v2.2) to calculate *ex post* gross electric energy savings, demand reduction, and natural gas savings. ***Error! Reference source not found.*** 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 IL TRM v11.0 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 incorporated changes due to EISA into the impact evaluation. For the first half of the year, connected LEDs were attributed full savings including lighting controls. Starting on July 1, 2023, only the lighting controls were counted. The team used 2023 participant survey findings to calculate the *ex post* baseline wattage for connected LEDs distributed in the first half of the year.
- The evaluation team used updated in-service rates, water heater fuel saturation, space heating fuel saturation, and other algorithm inputs based on the 2023 participant survey, which adjusted savings across measures.

The following sections summarize the team's findings based on the engineering review.

Ex Post Gross Savings Summary

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 IL TRM v11.0 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.

Table 145 shows the *ex ante* deemed savings and *ex post* gross per-measure savings for 2023 HomeLife Calculator program measures. *Ex post* savings calculations differed from *ex ante* analysis as follows:

- **Connected LED**: Updated ISR, baseline wattage, and standby power draw. Both the 2023 *ex ante* and *ex post* analyses use the IL TRM (v10.0 *ex ante* and v11.0 *ex post*) which only provides a savings estimation approach for the lighting control feature of connected lighting. The v11.0 update increased the amount of energy saved by lighting controls from 30% to 37%.

  Ex ante savings were calculated with the TRM default wattage assumption instead of the actual wattage of the lamp. The team calculated *ex post* savings using the actual lamp wattage and included additional savings for the difference in wattage between the LED and the lamp replaced as determined through the participant survey. This additional savings only applied to lamps in kits distributed prior to the EISA backstop (July 1, 2023). Approximately 10% of kits were distributed after this date and were attributed *ex post* savings for the lighting controls only.

- **Advanced power strip**: *Ex post* ISR of 89% from the 2023 participant survey was much higher than the *ex ante* assumption of 40%, from Illinois TRM (v8.0) for leave behind kits.
- **LED Nightlight:** Updated baseline wattage and hours of use from the IL TRM v11.0 for *ex post* analysis increased energy savings compared to *ex ante*. Updated ISR and the incandescent replacement factor from the 2023 participant survey.
- **Low-flow faucet aerators and showerheads:** Updated water heating fuel saturation percentages, people per home, home characteristics, and ISRs based on the 2023 participant survey. Updated baseline and efficient flow rate assumptions to match the IL TRM v11.0. As reported in Table 143, the verified natural gas water heater saturation rates were higher than *ex ante*.
- **Outlet and switch gaskets:** Updated to IL TRM v11.0, adjusted to Indiana climate zone, incorporated space heating fuel type saturations and ISRs, and assigned demand savings based on the presence of central air conditioning from the 2023 participant survey results. For these measures, the *ex ante* savings were evaluated by sourcing an online calculator that excludes demand savings and assumes natural gas heating and air conditioning for all homes. *Ex post* savings sourced the IL TRM v11.0, consistent with the approach for other measures in the program, and the evaluation team adjusted the IL TRM v11.0 weather variables to reflect the Indiana climate. The IL TRM v11.0 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 reported heating their homes electrically, and in-service rates were low, these savings were comparably large, driving up electric savings for these measures.

Table 145. 2023 HomeLife Calculator Program *Ex Ante*[a] & *Ex Post* Gross Per-Kit Savings Values

MEASURE	QUANTITY PER KIT	*EX ANTE* DEEMED SAVINGS			*EX POST* GROSS PER-MEASURE SAVINGS		
		KWH	KW	THERMS	KWH	KW	THERMS
Connected LEDs - Combo Kit (Jan - Jun 2023)	2	20.51	0.003	0.00	54.20	0.006	0.00
Connected LEDs - Combo Kit (Jul - Dec 2023)	2	20.51	0.003	0.00	3.56	0.001	0.00
Connected LEDs - Electric Only Kit (Jan - Jun 2023)	2	20.51	0.003	0.00	54.20	0.006	0.00
Connected LEDs - Electric Only Kit (Jul - Dec 2023)	2	20.51	0.003	0.00	3.56	0.001	0.00
Bathroom Aerator - Combo Kit	1	2.59	0.000	0.31	2.12	0.000	0.46

MEASURE	QUANTITY PER KIT	*EX ANTE* DEEMED SAVINGS			*EX POST* GROSS PER-MEASURE SAVINGS		
		KWH	KW	THERMS	KWH	KW	THERMS
Bathroom Aerator - Electric Only Kit	1	2.59	0.000	0.00	2.12	0.000	0.00
Bathroom Aerator - Gas Only Kit	2	0.00	0.000	0.61	0.00	0.000	0.83
Kitchen Aerator - Combo Kit	1	20.34	0.001	2.41	19.12	0.001	4.15
Kitchen Aerator - Electric Only Kit	1	20.46	0.001	0.00	19.12	0.001	0.00
Kitchen Aerator - Gas Only Kit	1	0.00	0.000	2.48	0.00	0.000	3.74
Low Flow Showerhead - Combo Kit	1	30.15	0.002	3.58	18.32	0.000	3.98
Low Flow Showerhead - Electric Only Kit	1	30.29	0.002	0.00	18.32	0.000	0.00
Low Flow Showerhead - Gas Only Kit	2	0.00	0.000	7.32	0.00	0.000	7.17
Nightlight - Combo Kit	1	2.61	0.000	0.00	6.68	0.000	0.00
Nightlight - Electric Only Kit	1	2.61	0.000	0.00	6.68	0.000	0.00
Advanced Power Strip - Combo Kit	1	41.20	0.005	0.00	91.67	0.006	0.00
Advanced Power Strip - Electric Only Kit	1	41.20	0.005	0.00	91.67	0.006	0.00
Light Switch Gaskets - Combo Kit	8	0.80	0.000	1.80	3.59	0.004	1.55
Light Switch Gaskets - Electric Only Kit	8	0.80	0.000	0.00	3.59	0.004	0.00
Light Switch Gaskets - Gas Only Kit	8	0.00	0.000	1.80	0.00	0.000	1.70
Power Outlet Gaskets - Combo Kit	18	1.80	0.000	4.05	7.86	0.008	1.52
Power Outlet Gaskets - Electric Only Kit	18	1.80	0.000	0.00	7.86	0.008	0.00
Power Outlet Gaskets - Gas Only Kit	18	0.00	0.000	4.05	0.00	0.000	1.66

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

Table 146 highlights notable differences between *ex ante* and *ex post* gross estimates.

Table 146. 2023 HomeLife Calculator Program Notable Differences Between *Ex Ante* and *Ex Post* Gross

MEASURE	*EX ANTE* SOURCES AND ASSUMPTIONS	*EX POST* GROSS SOURCES AND ASSUMPTIONS	PRIMARY REASONS FOR DIFFERENCES
Connected LED	*Ex ante* savings use IL TRM v10.0 assumptions, including default wattage, and does not include delta watts. Savings claimed past EISA backstop.	*Ex post* savings use IL TRM v11.0 assumptions, 2023 participant survey for baseline wattage of 37W and ISR. Only control savings for units distributed after EISA backstop.	*Ex post* inclusion of delta watts. EISA backstop.
Bathroom Aerator	*Ex ante* savings use IN TRM (v2.2) assumptions.	*Ex post* savings use IL TRM v11.0 assumptions. 2023 participant survey for fuel saturation percentages, demographics. and ISRs.	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 v11.0 assumptions. 2023 participant survey for fuel saturation percentages, demographics. and ISRs.	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 v11.0 assumptions. 2023 participant survey for fuel saturation percentages, demographics. and ISRs.	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 v11.0 assumptions. 2023 participant survey for ISRs and incandescent replacement factor.	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 v11.0 assumptions and 2023 participant survey ISR.	*Ex post* ISR (89%) is much higher than *ex ante* (40%).
Light Switch Gaskets	*Ex ante* savings uses online calculator at EnergyEarth.com	*Ex post* savings use IL TRM v11.0 assumptions. 2023 participant survey ISR and fuel saturation percentages.	Methodology differences. *Ex ante* does not include an adjustment for 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 v11.0 assumptions. 2023 participant survey ISR and fuel saturation percentages.	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

The evaluation team excluded therm penalties from the evaluated savings, consistent with previous evaluations. However, it is important to note that cost-effectiveness results for gas and electric programs will still incorporate 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 the gas program performance and measure performance more clearly. The total therm penalty, as shown in Table 147, was -1,346.16 therms. *Ex ante* program data did not include a therm penalty.

Table 147. 2023 HomeLife Calculator Program Waste Heat Factor Therm Penalty

MEASURE	WASTE HEAT FACTOR THERM PENALTY
Connected LEDs - Combo Kit (Jan - Jun 2023)	(1,336.41)
Connected LEDs - Combo Kit (Jul - Dec 2023)	(9.75)
Total Savings	(1,346.16)

Realization Rates

The next three tables (Table 148 through Table 150) show the program's *ex ante* reported savings, verified savings, *ex post* gross savings and total program realization rates for kWh, kW, and therms. 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.

The gasket and advanced power strip measures drove the substantial realization rates for electric energy savings and peak demand reduction. Specifically, the *ex ante* approach for calculating energy savings for the gasket measure was based only on heating fuel savings and excluded demand reduction. In comparison, the *ex post* savings calculation incorporated heating and cooling savings and assigned demand reduction based on the presence of central air conditioning. Additionally, the significant difference between the advanced power strip *ex ante* and *ex post* ISRs (40% versus 89%) contributed to the energy and demand realization rates. Additional discussion about the *ex ante* and *ex post* savings calculation assumptions is provided above in Table 146.

Table 148. 2023 HomeLife Calculator Program *Ex Ante* to *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.)
Connected LEDs - Combo Kit (Jan - Jun 2023)		24,750.08	22,328.88	65,413.96
Connected LEDs - Combo Kit (Jul - Dec 2023)		2,747.73	2,478.93	477.17
Connected LEDs - Electric Only Kit (Jan - Jun 2023)		2,030.04	1,831.45	5,365.35
Connected LEDs - Electric Only Kit (Jul - Dec 2023)		164.04	148.00	28.49

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.)
Bathroom Aerator - Combo Kit		3,474.13	3,490.92	2,843.81
Bathroom Aerator - Electric Only Kit		277.21	278.54	226.91
Bathroom Aerator - Gas Only Kit		0.00	0.00	0.00
Kitchen Aerator - Combo Kit		27,278.95	23,236.73	25,637.57
Kitchen Aerator - Electric Only Kit		2,188.82	1,864.48	2,045.65
Kitchen Aerator - Gas Only Kit		0.00	0.00	0.00
Low Flow Showerhead - Combo Kit		40,437.04	32,148.70	24,571.36
Low Flow Showerhead - Electric Only Kit		3,241.29	2,576.93	1,960.58
Low Flow Showerhead - Gas Only Kit		0.00	0.00	0.00
Nightlight - Combo Kit		3,500.02	4,183.93	8,963.65
Nightlight - Electric Only Kit		279.27	333.84	715.22
Advanced Power Strip - Combo Kit		55,249.20	122,929.47	122,929.47
Advanced Power Strip - Electric Only Kit		4,408.40	9,808.69	9,808.69
Light Switch Gaskets - Combo Kit		1,072.80	1,544.83	4,819.55
Light Switch Gaskets - Electric Only Kit		85.60	123.26	384.56
Light Switch Gaskets - Gas Only Kit		0.00	0.00	0.00
Power Outlet Gaskets - Combo Kit		2,413.80	3,379.32	10,542.77
Power Outlet Gaskets - Electric Only Kit		192.60	269.64	841.22
Power Outlet Gaskets - Gas Only Kit		0.00	0.00	0.00
Total Savings	173,786.75	173,791.03	232,956.54	287,575.98
Total Program Realization Rate				165%

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 149. 2023 HomeLife Calculator Program *Ex Ante* to *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.)
Connected LEDs - Combo Kit (Jan - Jun 2023)		3.219	2.904	7.167
Connected LEDs - Combo Kit (Jul - Dec 2023)		0.357	0.322	0.085
Connected LEDs - Electric Only Kit (Jan - Jun 2023)		0.264	0.238	0.588
Connected LEDs - Electric Only Kit (Jul - Dec 2023)		0.021	0.019	0.005
Bathroom Aerator - Combo Kit		0.359	0.360	0.234
Bathroom Aerator - Electric Only Kit		0.029	0.029	0.019
Bathroom Aerator - Gas Only Kit		0.000	0.000	0.000
Kitchen Aerator - Combo Kit		1.246	1.061	0.816
Kitchen Aerator - Electric Only Kit		0.100	0.085	0.065
Kitchen Aerator - Gas Only Kit		0.000	0.000	0.000
Low Flow Showerhead - Combo Kit		2.190	1.741	0.634
Low Flow Showerhead - Electric Only Kit		0.176	0.140	0.051
Low Flow Showerhead - Gas Only Kit		0.000	0.000	0.000
Nightlight - Combo Kit		0.000	0.000	0.000
Nightlight - Electric Only Kit		0.000	0.000	0.000
Advanced Power Strip - Combo Kit		6.200	13.795	8.622
Advanced Power Strip - Electric Only Kit		0.495	1.101	0.688
Light Switch Gaskets - Combo Kit		0.000	0.000	4.996
Light Switch Gaskets - Electric Only Kit		0.000	0.000	0.399
Light Switch Gaskets - Gas Only Kit		0.000	0.000	0.000
Power Outlet Gaskets - Combo Kit		0.000	0.000	10.928
Power Outlet Gaskets - Electric Only Kit		0.000	0.000	0.872

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.)
Power Outlet Gaskets - Gas Only Kit		0.000	0.000	0.000
Total Savings	14.480	14.654	21.795	36.169
Total Program Realization Rate				250%

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 150. 2023 HomeLife Calculator Program *Ex Ante* to *Ex Post* Gross Natural Gas Savings

MEASURE	*EX ANTE* [a] NATURAL GAS ENERGY SAVINGS (THERMS/YR.)	AUDITED GROSS NATURAL GAS ENERGY SAVINGS (THERMS/YR.)	VERIFIED GROSS NATURAL GAS ENERGY SAVINGS (THERMS/YR.)	*EX POST* GROSS NATURAL GAS ENERGY SAVINGS (THERMS/YR.)
Connected LEDs - Combo Kit (Jan - Jun 2023)		0.00	0.00	0.00
Connected LEDs - Combo Kit (Jul - Dec 2023)		0.00	0.00	0.00
Connected LEDs - Electric Only Kit (Jan - Jun 2023)		0.00	0.00	0.00
Connected LEDs - Electric Only Kit (Jul - Dec 2023)		0.00	0.00	0.00
Bathroom Aerator - Combo Kit		412.03	777.55	617.17
Bathroom Aerator - Electric Only Kit		0.00	0.00	0.00
Bathroom Aerator - Gas Only Kit		490.38	834.00	661.99
Kitchen Aerator - Combo Kit		3,235.29	5,175.61	5,563.94
Kitchen Aerator - Electric Only Kit		0.00	0.00	0.00
Kitchen Aerator - Gas Only Kit		1,979.75	2,854.28	2,983.97
Low Flow Showerhead - Combo Kit		4,795.84	7,160.61	5,332.55
Low Flow Showerhead - Electric Only Kit		0.00	0.00	0.00
Low Flow Showerhead - Gas Only Kit		5,839.78	7,858.14	5,719.74
Nightlight - Combo Kit		0.00	0.00	0.00
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

MEASURE	*EX ANTE* [a] NATURAL GAS ENERGY SAVINGS (THERMS/YR.)	AUDITED GROSS NATURAL GAS ENERGY SAVINGS (THERMS/YR.)	VERIFIED GROSS NATURAL GAS ENERGY SAVINGS (THERMS/YR.)	*EX POST* GROSS NATURAL GAS ENERGY SAVINGS (THERMS/YR.)
Light Switch Gaskets - Combo Kit		2,413.80	3,475.87	2,079.75
Light Switch Gaskets - Electric Only Kit		0.00	0.00	0.00
Light Switch Gaskets - Gas Only Kit		1,436.40	2,068.42	1,354.09
Power Outlet Gaskets - Combo Kit		5,431.05	7,603.47	2,040.11
Power Outlet Gaskets - Electric Only Kit		0.00	0.00	0.00
Power Outlet Gaskets - Gas Only Kit		3,231.90	4,524.66	1,328.28
Total Savings	29,268.63	29,266.22	42,332.61	27,681.59
Total Program Realization Rate				95%

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.

The following table (Table 151) summarizes the savings at the kit level.

Table 151. 2023 HomeLife Calculator Program Ex Ante to Ex Post Gross Kit Savings

MEASURE	*EX ANTE* [a]	AUDITED GROSS	VERIFIED GROSS	*EX POST* GROSS	REALIZATION RATE
Electric Energy Savings (kWh/yr.)					
Combo Kit	160,920.00	160,923.76	215,721.71	266,199.31	165%
Electric Only Kit	12,866.75	12,867.27	17,234.83	21,376.37	166%
Gas Only Kit	0.00	0.00	0.00	0.00	n/a
Peak Demand Reduction (kW/yr.)					
Combo Kit	13.410	13.570	20.184	33.483	250%
Electric Only Kit	1.070	1.084	1.612	2.686	251%
Gas Only Kit	0.000	0.000	0.000	0.000	n/a
Natural Gas Energy Savings (therms/yr.)					
Combo Kit	16,293.15	16,288.01	24,193.11	15,633.51	96%
Electric Only Kit	0.000	0.000	0.000	0.000	n/a
Gas Only Kit	12,975.48	12,978.21	18,139.50	12,048.08	93%

[a] *Ex ante* savings are based on a rounded savings value that is applied to each kit. The audited values are calculated at the full savin gs value, per-measure, and per-kit.

Ex Post Net Savings

The evaluation team calculated freeridership and participant spillover using the survey data collected from 2023 respondents. Like previous evaluation results, the evaluation team found varying levels of freeridership by measure. Survey information indicated that the program influenced customer decisions to make energy efficiency improvements after receiving the kit. Specifically, respondents reported installing programmable thermostats and smart thermostats, and purchasing ENERGY STAR® washing machines, dishwashers, freezers, refrigerators, windows, and air conditioners. Table 152 provides the NTG ratios by measure.

Table 152. 2023 HomeLife Calculator Program Net-to Gross Ratios

MEASURE	FREERIDERSHIP	SPILLOVER	NTG
Connected LEDs	11%	10%	98%
Bathroom Aerator	8%	10%	101%
Kitchen Aerator	8%	10%	102%
Low Flow Showerhead	7%	10%	102%
Nightlight	16%	10%	93%
Advanced Power Strip	17%	10%	92%
Light Switch Gaskets	19%	10%	90%
Power Outlet Gaskets	19%	10%	90%

Table 153 presents the resulting net electric savings, demand reduction, and natural gas savings.

Table 153. 2023 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
Connected LEDs - Combo Kit (Jan - Jun 2023)	65,413.96	7.167	0.00	98%	64,177.64	7.032	0.00
Connected LEDs - Combo Kit (Jul - Dec 2023)	477.17	0.085	0.00	98%	468.15	0.083	0.00
Connected LEDs - Electric Only Kit (Jan - Jun 2023)	5,365.35	0.588	0.00	98%	5,263.95	0.577	0.00
Connected LEDs - Electric Only Kit (Jul - Dec 2023)	28.49	0.005	0.00	98%	27.95	0.005	0.00
Bathroom Aerator - Combo Kit	2,843.81	0.234	617.17	101%	2,883.06	0.238	625.69
Bathroom Aerator - Electric Only Kit	226.91	0.019	0.00	101%	230.04	0.019	0.00
Bathroom Aerator - Gas Only Kit	0.00	0.000	661.99	101%	0.00	0.000	671.12
Kitchen Aerator - Combo Kit	25,637.57	0.816	5,563.94	102%	26,152.89	0.833	5,675.78

MEASURE	*EX POST* GROSS SAVINGS/REDUCTION			NTG	*EX POST* NET SAVINGS/REDUCTION		
	KWH	KW	THERMS		KWH	KW	THERMS
Kitchen Aerator - Electric Only Kit	2,045.65	0.065	0.00	102%	2,086.77	0.066	0.00
Kitchen Aerator - Gas Only Kit	0.00	0.000	2,983.97	102%	0.00	0.000	3,043.95
Low Flow Showerhead - Combo Kit	24,571.36	0.634	5,332.55	102%	25,183.19	0.650	5,465.33
Low Flow Showerhead - Electric Only Kit	1,960.58	0.051	0.00	102%	2,009.40	0.052	0.00
Low Flow Showerhead - Gas Only Kit	0.00	0.000	5,719.74	102%	0.00	0.000	5,862.17
Nightlight - Combo Kit	8,963.65	0.000	0.00	93%	8,357.70	0.000	0.00
Nightlight - Electric Only Kit	715.22	0.000	0.00	93%	666.87	0.000	0.00
Advanced Power Strip - Combo Kit	122,929.47	8.622	0.00	92%	113,390.14	7.953	0.00
Advanced Power Strip - Electric Only Kit	9,808.69	0.688	0.00	92%	9,047.54	0.635	0.00
Light Switch Gaskets - Combo Kit	4,819.55	4.996	2,079.75	90%	4,359.28	4.519	1,881.13
Light Switch Gaskets - Electric Only Kit	384.56	0.399	0.00	90%	347.83	0.361	0.00
Light Switch Gaskets - Gas Only Kit	0.00	0.000	1,354.09	90%	0.00	0.000	1,224.78
Power Outlet Gaskets - Combo Kit	10,542.77	10.928	2,040.11	90%	9,535.93	9.884	1,845.28
Power Outlet Gaskets - Electric Only Kit	841.22	0.872	0.00	90%	760.88	0.789	0.00
Power Outlet Gaskets - Gas Only Kit	0.00	0.000	1,328.28	90%	0.00	0.000	1,201.43
Total Savings	287,575.98	36.169	27,681.59		274,949.22	33.694	27,496.65

Table 154 shows the net-to-gross results for each fuel.

Table 154. 2023 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.)	173,786.75	287,575.98	96%	274,949.22
Peak Demand Reduction (kW)	14.480	36.169	93%	33.694
Natural Gas Energy Savings (therms/yr.)	29,268.63	27,681.59	99%	27,496.65

Process Evaluation

The evaluation team conducted Homelife Calculator participant surveys (n=120) to answer the following research questions:

- How do participants become aware of the program?
- What is the primary motivator(s) for customers to participate?
- Are participants aware of other NIPSCO programs? Have they participated?
- What is the program process like for participants?
- What information within the calculator did participants find most useful? Least useful?
- Is the calculator easy to find? Are there barriers to finding the right page? If so, which?
- Are all the questions within the tool clear to customers? Is the tool itself easy to use?
- What are key customer takeaways from using the tool? Do they remember any energy tips? Do they remember any other programs?
- How do customers feel about the kit they receive? Which measures do they like most?
- What is participants' satisfaction with the program and NIPSCO overall?

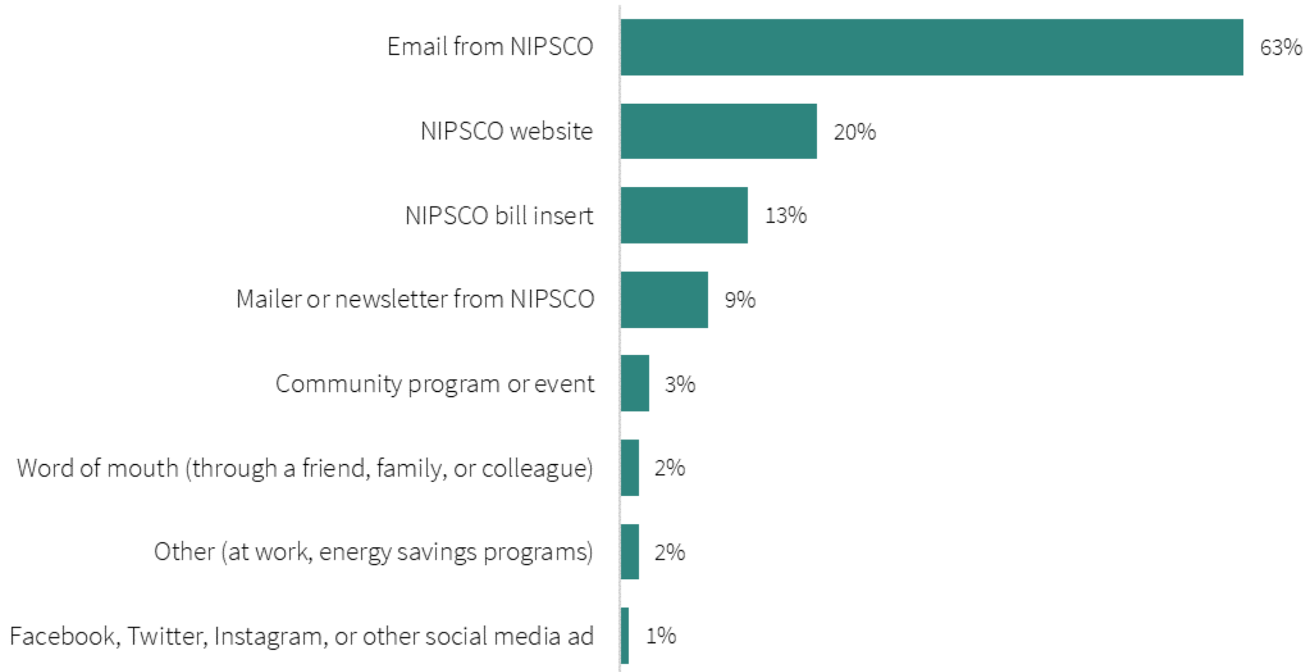
Participant Feedback

The evaluation team conducted surveys with 120 customers who participated in the program. The following sections provide insights into various aspects related to their participation, including the source of awareness, reasons for participation, experience with the kits, satisfaction with the program, and program impacts on customers.

Energy Efficiency Awareness and Marketing

In 2023, respondents learned about the program through a variety of channels, with the primary source being email communication from NIPSCO (63%). Figure 30 provides more detail on how respondents learned about the HomeLife Calculator program.

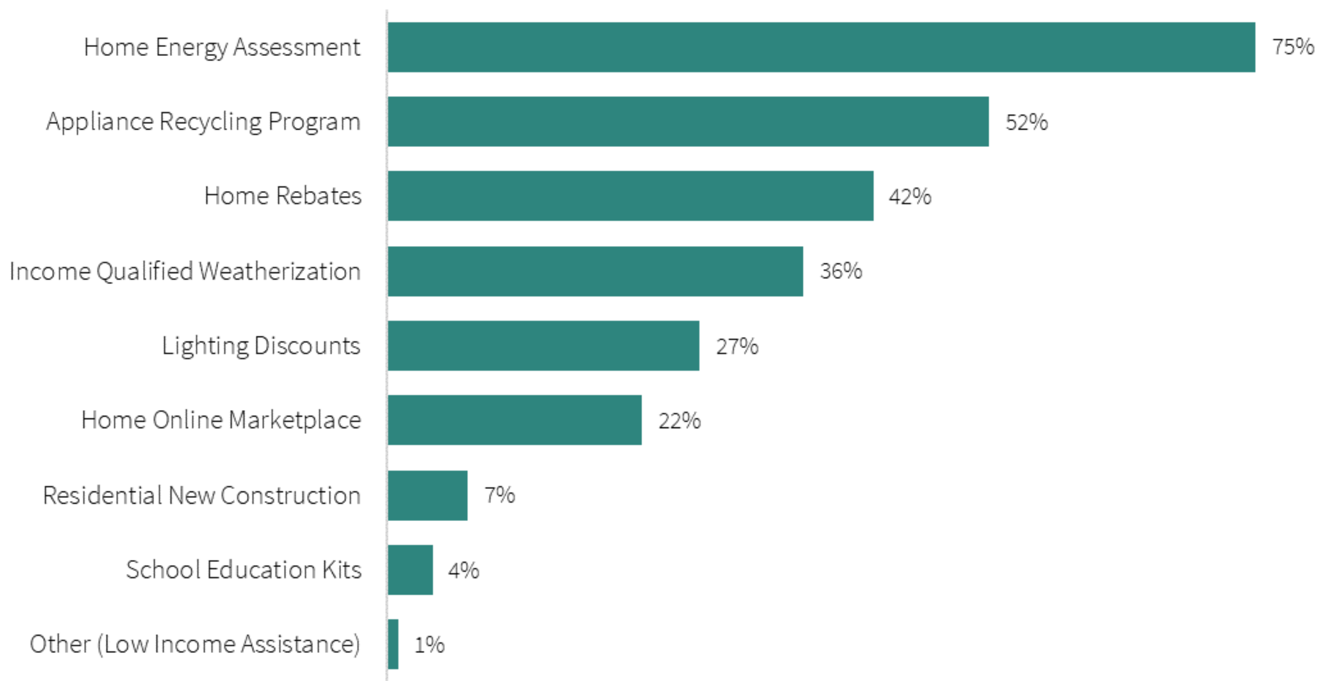
Figure 30. 2023 HomeLife Calculator Program How Customers Learned About the Program



Source: HomeLife Calculator Participant Survey: C1. "How did you learn about NIPSCO's Homelife Energy Efficiency Calculator Program? This was a multiple response question (n = 120).

Over one-half of survey respondents were aware of other NIPSCO energy efficiency programs (56%). Of those who knew of NIPSCO programs (n=67), three-fourths had heard of the Home Energy Assessment (HEA) program, followed by the Appliance Recycling program (52%) and the Home Rebates program (42%). Additional details can be found in Figure 31 below.

Figure 31. 2023 HomeLife Calculator Program Customer Awareness of Other NIPSCO Programs



Source: HomeLife Calculator Participant Survey: C3. "What energy efficiency programs have you heard of?" This was a multiple response question (n = 67).

Participation Drivers

Nearly two-thirds of respondents participated in the program with the primary goal of saving energy (64%), while a similar proportion aimed to save money on their utility bills (63%). Other common reasons for participation included:

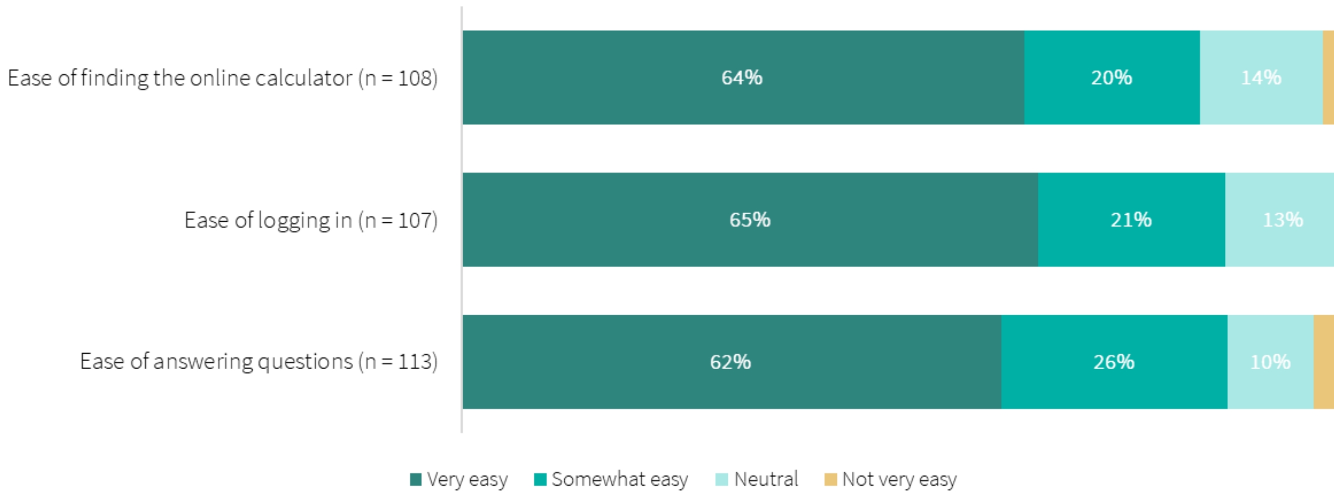
- To receive items such as LED lightbulbs and showerheads at no cost (45%)
- To help the environment or be green (31%)
- To get a home assessment report (19%)
- To replace old equipment (17%).

Program and Measure Experience

Program Experience

More than three-quarters of respondents said it was very or somewhat easy to find the HomeLife Calculator online (84%). Only two respondents found it not very easy to locate the calculator. Additionally, most respondents found the process of logging onto the HomeLife Calculator and answering questions about their homes to be very or somewhat easy (86% and 88%, respectively).

Figure 32. 2023 HomeLife Calculator Program Ease of Use

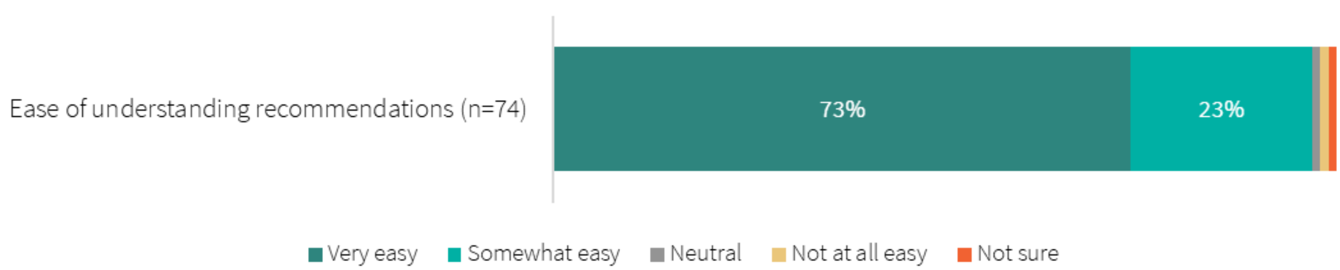


Source: HomeLife Calculator Participant Survey: D1. "How easy was it to find the HomeLife energy efficiency calculator online? D2. How easy was it to log onto the HomeLife energy efficiency calculator? D3. How easy was it to answer the questions about your home while completing the HomeLife energy efficiency calculator online?"

Almost two-thirds of respondents recalled receiving energy-saving recommendations after completing the HomeLife Calculator (62%). Conversely, 8% of respondents reported not receiving recommendations and 30% were unsure if they had received recommendations.

Of the 74 respondents who recalled receiving energy-saving recommendations, nearly all found them very or somewhat easy to understand (96%). Only three respondents answered neutrally, not at all easy, or not sure.

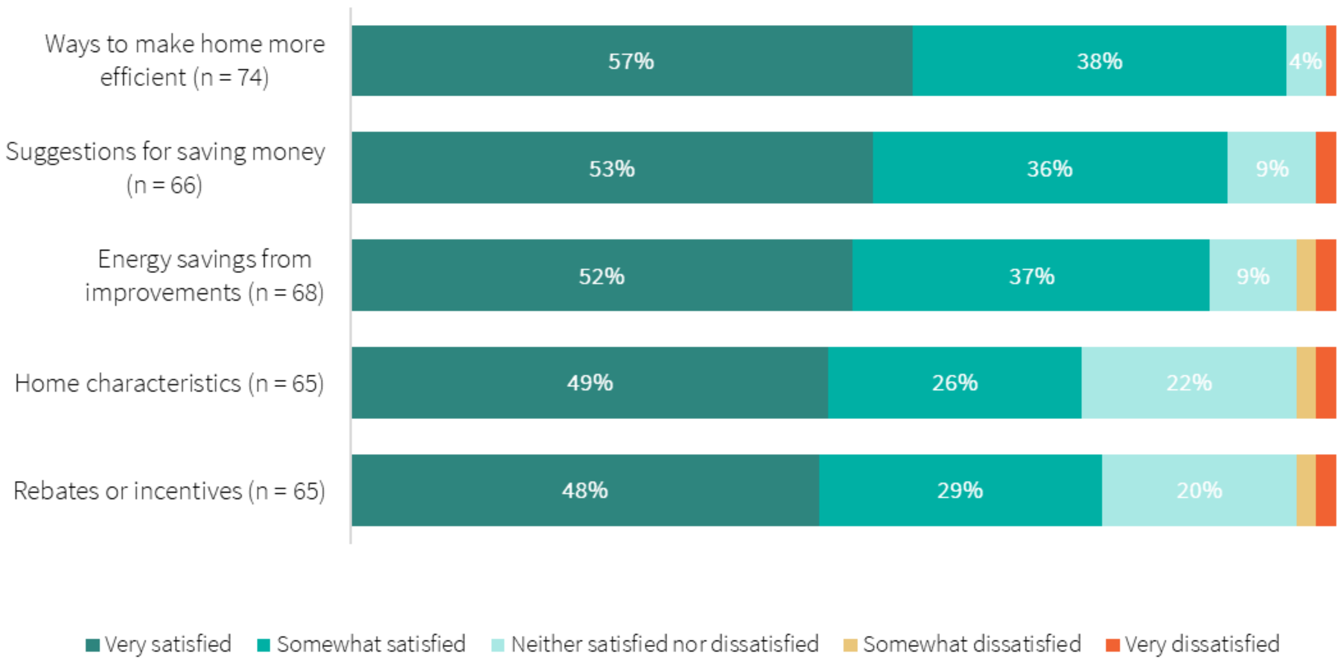
Figure 33. 2023 HomeLife Calculator Program Ease of Understanding Recommendations



Source: HomeLife Calculator Participant Survey: D7. "Overall, how easy was it to understand the energy-saving recommendations? Would you say it was…?."

Overall, respondents who recalled receiving recommendations (n=74) expressed high levels of satisfaction with how the recommendations were explained after completing the online audit as shown in Figure 34. Few respondents, less than 4%, expressed dissatisfaction with the recommendations.

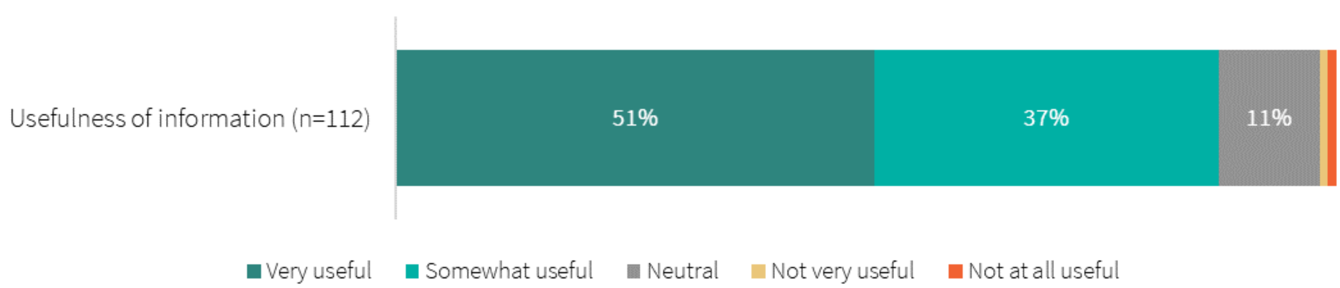
Figure 34. 2023 HomeLife Calculator Program Satisfaction with Energy-Saving Recommendations



Source: HomeLife Calculator Participant Survey: D5. “How satisfied or dissatisfied were you with how the energy-saving recommendations explained each of the following?”

Most respondents indicated that the information provided by the HomeLife Calculator program was very or somewhat useful (82%; Figure 35).

Figure 35. 2023 HomeLife Calculator Program Usefulness of Information Provided by the Calculator

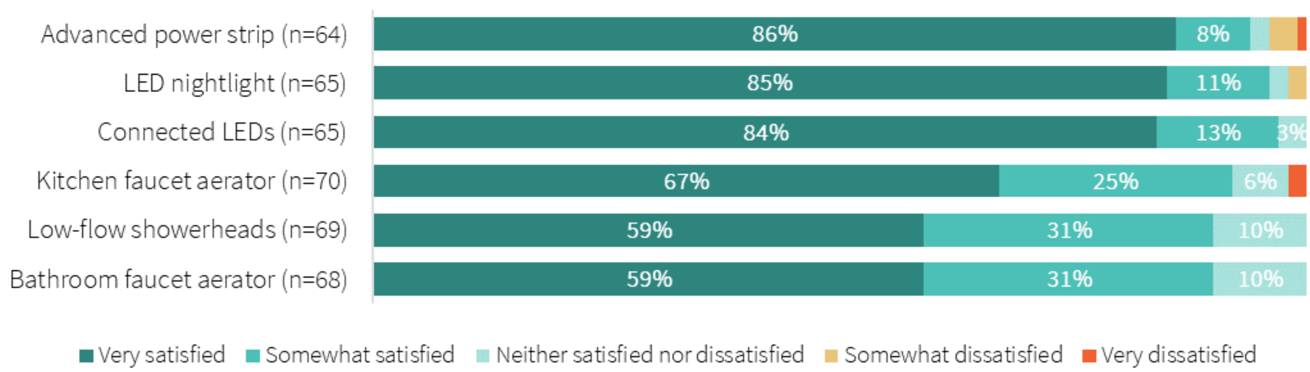


Source: HomeLife Calculator Participant Survey: D8. “Overall, how useful was the information provided to you by the HomeLife energy efficiency calculator program?”

Measure Experience

Overall, respondents expressed satisfaction with all kit measures. Connected LED bulbs, LED nightlights and advanced power strips received the highest number of “very satisfied” ratings from respondents. The survey did not ask respondents about satisfaction with the gaskets.

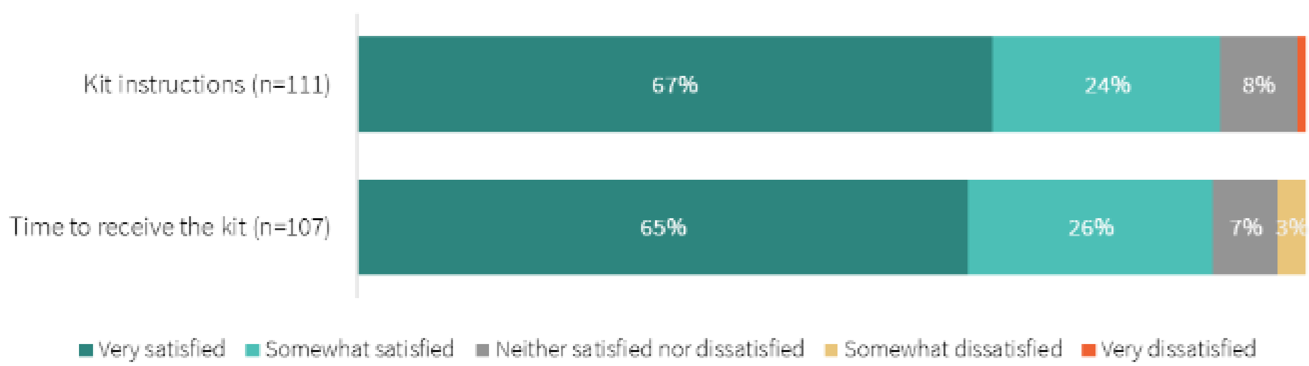
Figure 36. 2023 HomeLife Calculator Program Satisfaction with Kit Contents



Source: HomeLife Calculator Participant Survey: E5. F4. G5. H3. I4. J5. “How satisfied are you with the [kit item(s)] overall?”

Most respondents expressed being very or somewhat satisfied with the instructions provided in the kit and the kit’s delivery time (91%).

Figure 37. 2023 HomeLife Calculator Program Overall Satisfaction with the Kit



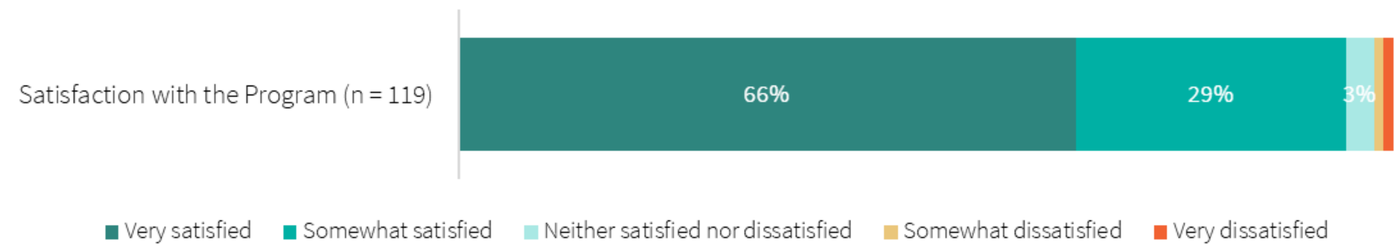
Source: HomeLife Calculator Participant Survey: L1. “How satisfied are you with the following aspects of the program?”

Satisfaction With Program and NIPSCO

Overall Program Satisfaction

As shown in Figure 38, overall satisfaction with the HomeLife Calculator program was high. Most respondents reported being very or somewhat satisfied with the program overall (95%). Only four respondents expressed neutrality, while one respondent each reported being somewhat or very dissatisfied with the program. Among the reasons cited by respondents for feeling dissatisfied or neutral, were not saving any money and poor quality of the kit items.

Figure 38. 2023 HomeLife Calculator Program Overall Satisfaction with the Program



Source: HomeLife Calculator Participant Survey: L2. "How satisfied are you with the HomeLife Energy Efficiency Calculator program overall?" (n = 119)

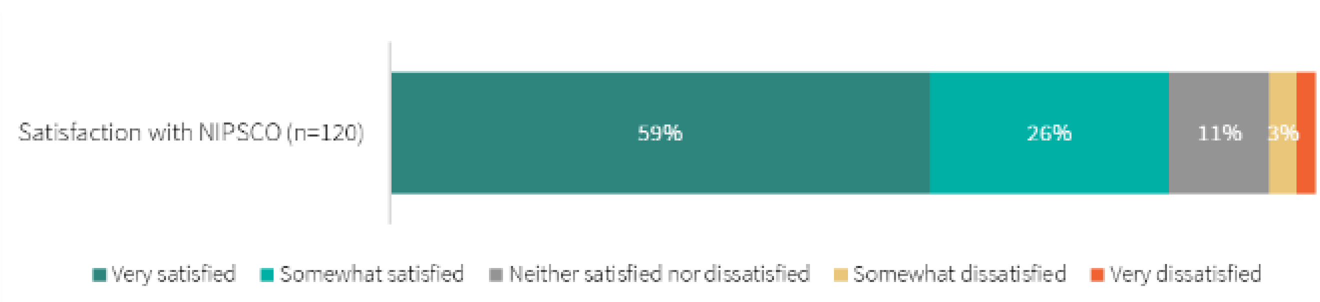
"I liked the program and plan to reach out to NIPSCO in the future for other programs they offer."

"Keep promoting the advantages the program has on the utility bill."

Satisfaction with NIPSCO

Satisfaction with NIPSCO as a service provider was also high, as shown in Figure 39. Most respondents, 85%, indicated they were very or somewhat satisfied. Among the respondents who provided dissatisfactory or neutral ratings (n=18), the most common reasons cited were high cost of bills (n=5) and high delivery and service fees (n=5).

Figure 39. 2023 HomeLife Calculator Program Overall Satisfaction with NIPSCO



Source: HomeLife Calculator Participant Survey: QL5. "How satisfied are you with NIPSCO overall as your energy service provider?"

Participant Survey Demographics

Most survey respondents own their home (86%) and live in single-family detached houses (81%). Most individuals live with another person (54%), followed by living alone (22%). Survey respondents tend to be older, with the majority born between 1940 – 1959 (42%) who are aged between their mid-60s to 80s followed by those born between 1960 – 1979 (31%) who are aged between their mid-40s and 60s.

Over a quarter of survey respondents have earned some college but no degree (27%), followed by a four-year college degree (20%), high school graduate or equivalent (16%), and two-year college degree (13%).

Many survey respondents refused to report their 2023 household income (28%). Of the 87 respondents who reported their 2023 household income, most earn between $50,000 and $75,000 (25%), followed by earning under $25,000 (18%), $35,000 to under $50,000 (17%). More detail on respondent demographics can be found in *Appendix 10. Homelife Calculator Program Participant Demographics and Home Characteristics*.

Uplift Analysis

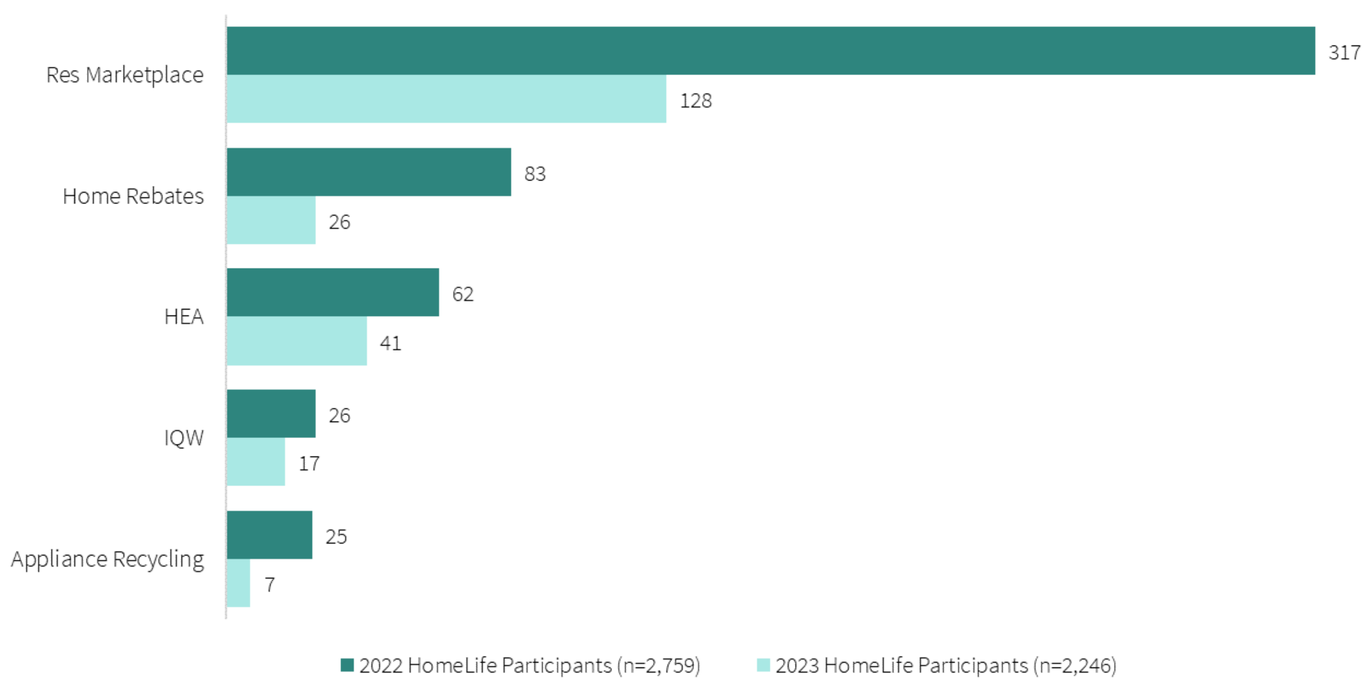
The evaluation team conducted an uplift analysis to determine the number of HomeLife Calculator program participants that participated in other NIPSCO programs after the HomeLife Calculator program. The team analyzed residential participant tracking data from 2022 and 2023 for the Appliance Recycling, Home Rebates, Residential Online Marketplace, Home Energy Assessment (HEA), and Income-Qualified Weatherization (IQW) programs.

For 2022 participants, the team cross-referenced tracking data from both 2022 and 2023 to determine participation in other programs in either year *after* participating in the HomeLife Calculator program in 2022. For 2023 participants, the team cross-referenced 2023 tracking data to determine participation in other programs in 2023 *after* participating in the HomeLife Calculator program in 2023.

Of 2022 participants (n=2,759), 513 participated in additional NIPSCO programs in 2022 or 2023 after participating in HomeLife Calculator (19%). Of 2023 participants (n=2,246), 219 participated in additional NIPSCO programs in 2023 after participating in HomeLife Calculator (10%).

HomeLife Calculator participants most often participated in the Residential Online Marketplace after participating in HomeLife Calculator, followed by the Home Rebates program and the HEA program. Figure 40 below contains the counts of 2022 and 2023 HomeLife Calculator participants who went on to participate in other NIPSCO programs.

Figure 40. 2022-2023 HomeLife Calculator Program Uplift



Conclusions and Recommendations

CONCLUSION 1: WHILE RESPONDENTS WERE HIGHLY SATISFIED WITH THE ONLINE CALCULATOR, KIT, AND NIPSCO, SOME STILL HAD NOT HEARD OF OTHER NIPSCO OFFERINGS.

The survey revealed that 95% of respondents were satisfied with the HomeLife Calculator program, and most respondents (85%) were very or somewhat satisfied with NIPSCO as their service provider. Specifically, respondents were very or somewhat satisfied with each of the kit contents (90-97%), instructions (91%), and time to receive the kit (91%).

Despite high levels of satisfaction and engagement with the program, 44% of survey respondents had not heard of other NIPSCO programs. Those who had heard of other NIPSCO programs, were most familiar with the Home Energy Assessment, Appliance Recycling and Home Rebate programs.

An analysis of participation data showed that almost 20% of 2022 and 10% of 2023 HomeLife Calculator participants went on to participate in other NIPSCO programs, most commonly the Residential Online Marketplace, indicating that the program is encouraging some cross-participation.

Recommendations:

- Build upon satisfaction with the HomeLife Calculator program to generate interest in other programs. Send follow-up emails to participating customers, including links and information about other NIPSCO programs, as well as links for coupons for the Residential Online Marketplace.
- Expand on the uplift analysis in a future evaluation to look at cross-program participation in more detail, including the average time between participating in the HomeLife Calculator program and other programs, participation in multiple programs, and trends in overall program participation pathways.

CONCLUSION 2: ADVANCED POWER STRIPS WERE AN IMPORTANT SOURCE OF SAVINGS AND SATISFACTION. NIGHTLIGHTS AND CONNECTED LEDS WERE ALSO POPULAR AMONG SURVEY RESPONDENTS BUT WILL NOT CONTRIBUTE TO SAVINGS AS MUCH IN THE FUTURE.

Advanced power strips emerged as a favorite among survey respondents this year, with an ISR of 89%, consistent with last year's ISR of 81%, and 94% of respondents indicating they were very or somewhat satisfied with the power strip. The power strips provided nearly half the *ex post* program savings this year. However, it is noteworthy that the difference between the evaluated ISR (89%) and *ex ante* ISR (40%) drove the electric energy savings and peak demand reduction realization rates for both combo and electric kits.

Nightlights and connected LEDs were also favorites among survey respondents, with ISRs of 88% and 83%, respectively, and 97% of respondents indicating that they were very or somewhat satisfied with these devices. These measures are both popular, but LED nightlights will not contribute as much to the *ex post* savings as incandescent nightlights are phased out of the marketplace, and connected LEDs will contribute minimally to savings in future evaluations due to post-EISA conditions. Going forward, the connected LED savings will be attributed only to the LED smart controller rather than both the controller and the replaced bulb, as in the first half of this year's evaluation.

Recommendations:

- Continue offering popular kit measures, such as advanced power strips, nightlights, and connected LEDs to generate interest in the kits.
- Update the *ex ante* ISR assumptions to reflect 2023 evaluation results.

CONCLUSION 3: EMPHASIZING GASKET INSTALLATION ON EXTERIOR WALLS MAY INCREASE ISRS.

The team found that more respondents installed gaskets on both interior and exterior walls compared to last year, but interior installations are not counted towards the ISR because they do not generate energy savings.

Kit materials were updated in 2023 to include gasket installation instructions and information that energy savings occur when used in exterior wall receptacles. However, the gasket measure ISR (35%) indicates there continues to be a misalignment in customer understanding or interest in installing gaskets on exterior walls.

Recommendations:

- Continue to offer light switches and power outlet gaskets as these provide measurable savings to the program.
- Investigate ways to clarify the distinction between exterior and interior wall installation to the participants and highlight that energy savings only occur when gaskets are installed on exterior walls.

CONCLUSION 4: MOST PARTICIPANTS RECALLED RECEIVING ENERGY-SAVING RECOMMENDATIONS, WHICH THEY FOUND EASY TO UNDERSTAND.

Over half (62%) of respondents recalled receiving recommendations after completing the HomeLife Calculator. Almost all respondents (96%) who remembered receiving recommendations found them very or somewhat easy to understand, and 82% found the information in the HomeLife Calculator very or somewhat useful. Additionally, respondents were most satisfied with the way the recommendations explained ways to make their home more energy efficient (95% very or somewhat satisfied) and gave suggestions for saving money (89% very or somewhat satisfied).

Recommendations:

- Include multiple languages in marketing materials to expand customer reach and engagement. Expand this approach to other NIPSCO programs if successful.

CONCLUSION 5: *EX ANTE* SAVINGS FOR ELECTRIC ENERGY SAVINGS AND DEMAND REDUCTION WERE SUBSTANTIALLY LOWER THAN *EX POST* WHEREAS THE *EX ANTE* AND *EX POST* SAVINGS FOR NATURAL GAS SAVINGS WERE CLOSELY ALIGNED.

The realization rates for both electric energy savings (165%) and demand reduction (250%) were well over 100% compared to natural gas which was very close to 100% (95%). This disparity in *ex ante and ex post* electric energy savings and demand reduction was driven by the high *ex post* ISR for advanced power strips (89%) compared to the *ex ante* assumption (40%), and the *ex post* adjustment to the gasket measures to account for heating fuel type and assigning cooling savings.

Recommendations:

- Update *ex ante* ISRs to reflect the most recent evaluation available each year.
- Adjust the *ex ante* assumptions for gaskets to assign energy and natural gas savings consistent with the distribution of heating system fuel type. Include cooling energy savings and demand reduction aligning with the percentage of participants with central air conditioning.

13. RESIDENTIAL ONLINE MARKETPLACE (OLM) 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. Each measure has a prescriptive incentive amount paid per unit, 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. Additional manufacturer discounts may further reduce the end cost to customers.

This program is implemented by TRC, who partnered with TechniArt in 2023 to implement the Online Marketplace. TechniArt was 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 bought through the OLM are not eligible for rebates through other NIPSCO programs.

The energy efficient items are fulfilled by TechniArt 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 affected by inventory issues. The supplier accepts returns for products bought 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 keep 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 buy in a calendar year:

- Advanced power strip *(limit of four advanced power strips per residential account per calendar year)*
- Bathroom aerator 1.0 gpm
- Energy Star Air Purifier/Cleaner *(limit of two air purifiers per residential account per calendar year)*
- Kitchen aerator 1.5 gpm
- LED indoor and outdoor string lighting *(limit of four LED string light sets of any combination per residential account per calendar year)*
- LED light bulbs *(limit of 24 total LED light bulbs of any combination per residential account per calendar year)*
- Low-flow showerhead and handheld showerhead
- Low-flow showerhead and handheld showerhead w/ShowerStart
- LTO EE Week Savings Kit *(limit of one kit per residential account per calendar year)*

- One Smart LED
- One Tier Two APS
- One Desk Lamp
- Two Nightlights
- Optional two or four-pack add-on – 6" recessed downlight fixture and retrofit kit

- Pipe wrap
- ShowerStart
- Smart plug *(limit of eight smart plugs per residential account per calendar year)*
- Wi-Fi thermostat, including LTO specials *(limit of one Wi-Fi thermostat per residential account per calendar year)*

In 2023, the OLM promoted certain offerings through limited time offerings (LTOs), including EE Week Savings kits (also known as Energy Saver Starter Packs) and Wi-Fi thermostats. The kit products were only available during the LTOs, which were offered from late September to October 2023, and for Black Friday (November 2023). Other products, such as Wi-Fi thermostats, were offered at an additional discount from the manufacturer during the LTO. The Online Marketplace ran thirteen LTOs during 2023, eleven for Wi-Fi thermostats, and two for EE Week Savings kits.

Changes from the 2022 Design

Kit measures differed slightly from the 2022 Home Office kit to the 2023 EE Week Savings kit. The number of measures included changed in some places: two Smart LEDs were offered in the 2022 kit while only one was in the 2023 kit, and one nightlight was offered in the 2022 kit while two were in the 2023 kit. Moreover, the optional add-on changed between the 2022 kit (a three-pack of an LED candelabra or reflector) and the 2023 kit (a two or four-pack recessed downlight fixture and retrofit kit).

Per-measure savings were changed mid-year for certain lighting products (smart LEDs, LED reflectors, and specialty LEDs) due to the 2023 EISA backstop enforcement. This limits the savings that can be claimed from installations. Additionally, the in-service rate (ISR) for Tier 1 advanced power strips was corrected during the program year. The invoiced measures were credited and re-billed with an updated ISR.

Program Performance

In 2023, the program exceeded both its electric energy and peak demand savings goals. The program achieved 118% of its electric energy goal and 173% of its peak demand reduction goal. Electric savings were driven by kits and Wi-Fi thermostats, which accounted for 61% and 32% of program savings, respectively. Demand savings came largely from Wi-Fi thermostats, which drove 81% of demand savings. The OLM program did not claim any natural gas savings in 2023.

2023 electric energy savings were 32% lower than 2022 savings, and 2023 peak demand savings were about 3% higher than 2022 savings. Table 155 summarizes savings for the full year of program performance, including program savings goals.

Table 155. 2023 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.)	441,244.08	583,497.96	583,490.52	434,889.24	520,118.68	491,922.76	118%
Peak Demand Reduction (kW)	131.431	147.243	146.245	118.637	227.632	218.407	173%

Table 156 outlines the *ex post* and NTG adjustment factors. The 89% electric energy realization rate was driven largely by the loss of any *ex post* lighting savings for recessed downlight fixtures distributed after the July 1, 2023, EISA enforcement deadline. The high peak demand realization rate can be attributed to the evaluation team using the Illinois TRM v11.0 algorithm for *ex post* calculations, whereas *ex ante* savings were calculated using the 2021 evaluation inputs. The 2023 NTG ratios of 95% for energy and 96% for peak demand were consistent with 2022 values of 97% and 98%, respectively.

Table 156. 2023 Residential Online Marketplace Adjustment Factors

METRIC	REALIZATION RATE [a]	FREERIDERSHIP	SPILLOVER	NTG [b]
Electric Energy Savings (kWh/yr.)	89%	10%	5%	95%
Peak Demand Reduction (kW)	155%	9%	5%	96%

[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 in 2023, reaching 175% of the budget spent. The higher electric spend was driven by the increased cost of kits in 2023, which was the measure with the highest participation. Compared to 2022, there was also a higher incentive spend for the kits: the 2022 kit incentive was $57.00 while the 2023 kit incentive was $78.50. Table 157 lists the 2023 program budget and expenditures by fuel type.

Table 157. 2023 Residential Online Marketplace Program Expenditures

FUEL	PROGRAM BUDGET	PROGRAM EXPENDITURES	BUDGET SPENT (%)
Electric	$208,893.93	$365,875.83	175%

Evaluation Methodology

To inform the 2023 OLM 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.
- **Mixed-mode participant surveys (n=210),** to understand the participant experience in the program and to gather information to calculate freeridership and spillover rates.

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 in-service rates for kit measures and thermostats? 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 v11.0, the 2015 Indiana TRM (v2.2) and NIPSCO's program tracking database.[60,61]

Audited and Verified Savings

Audited Savings

According to the 2023 tracking data, the program rebated a total of 15,548 items, distributed to 3,341 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. The tracking data was found to be accurate and complete. No cases were removed from the tracking data.

The evaluation team reviewed the *ex ante* savings documentation ("NIPSCO Residential 22-23 program Design v2.4"), which had measure-level savings for standalone measures and measures included in kits sold through the Online Marketplace. 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 design file were reported both at the kit- and measure-level and used un-rounded values. Throughout the report, the evaluation team split kit items into individual measures, to reflect in-service rates and *ex post* gross adjustments, which were applied at the measure level.

[60] Illinois Energy Efficiency Stakeholder Group. 2023 Illinois Statewide Technical Reference Manual for Energy Efficiency Version 11.0. Volume 3: Residential Measures. September 22, 2022.
[61] Cadmus. Indiana Technical Reference Manual Version 2.2. July 28, 2015.

Splitting kit items into multiple rows and applying unrounded measure-level savings resulted in a rounding discrepancy, meaning that the sum of total measure savings was slightly off from the tracking data savings. These rounding discrepancies will be noted where applicable in the rest of this report.

The evaluation team summed savings values in the program tracking data and compared them 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 rounding discrepancies, as described above.

Verified Savings

The evaluation team prioritized updating in-service rates for measures with higher participation rates, consistent with previous evaluation years. In 2023, the EE Week Savings kits, add-on recessed downlight fixtures, and Wi-Fi thermostats had sufficient participation to survey for these measures.

There was insufficient 2023 participation for the evaluation team to assess in-service rates through a survey for the remaining standalone measures. The team developed proxy in-service rates for these measures from similar NIPSCO programs, including Home Energy Assessment and Residential Lighting, or used deemed values from the IL TRM v11.0. The evaluation team applied a 0% in-service rate (ISR) to the Smart Plugs sold through the Online Marketplace, as the team was unable to find a valid source for calculating savings for this measure. Table 158 lists the ISRs for all program-installed measures.

Table 158. 2023 Residential Online Marketplace Program In-Service Rates by Measure

MEASURE	*EX ANTE* ISR	VERIFIED ISR	VERIFIED SOURCE	N[a]
Advanced Power Strips - Tier 1	87%	71%	IL TRM v11.0	n/a
Advanced Power Strips - Tier 2	83%	83%	IL TRM v11.0	n/a
Air Purifier	100%	100%	IL TRM v11.0	n/a
Bathroom Aerator 1.0 GPM	44%	92%	2022 HEA participant survey	51
Kitchen Aerator 1.5 GPM	44%	93%	2022 HEA participant survey	27
LED Reflector	82%	86%	2022 Residential Lighting program evaluation	n/a
LED Specialty	82%	86%	2022 Residential Lighting program evaluation	n/a
LED String	89%	100%	IL TRM v11.0	n/a
Smart LED	98%	86%	2022 Residential Lighting program evaluation	n/a
Low-Flow Showerhead 1.5 GPM	88%	86%	2022 HEA participant survey	58
Low-Flow Showerhead with ShowerStart 1.5 GPM	88%	86%	2022 HEA participant survey	58
ShowerStart - Electric	88%	86%	2022 HEA participant survey	58
Smart Plug	0%	0%	2023 Residential OLM evaluation	n/a
Wi-Fi Thermostat - Electric Cooling and Gas Heating Savings	79%	77%	2023 Residential OLM participant survey	70
Wi-Fi Thermostat - Electric Cooling and Heating Savings	79%	77%	2023 Residential OLM participant survey	70

MEASURE	*EX ANTE* ISR	VERIFIED ISR	VERIFIED SOURCE	N[a]
Wi-Fi Thermostat - Electric Cooling Only Savings	79%	77%	2023 Residential OLM participant survey	70
Wi-Fi Thermostat - Electric Heating Only Savings	79%	77%	2023 Residential OLM participant survey	70
EE Week Savings kit - Smart LED Bulb (Jul-Dec 2023)	98%	67%	2023 Residential OLM participant survey	136
EE Week Savings kit - Desk Lamp	100%	83%	2023 Residential OLM participant survey	140
EE Week Savings kit - Nightlights (2)	85%	77%	2023 Residential OLM participant survey	138
EE Week Savings kit - Tier 2 APS	83%	59%	2023 Residential OLM participant survey	135
EE Week Savings kit - Add-on - 6" recessed downlight fixture (Jul-Dec 2023)	100%	43%	2023 Residential OLM participant survey	61

The column n[a] represents the sample size for survey ISRs, if applicable.

In many cases, the evaluation team assigned lower in-service rates than those assumed in the *ex ante* calculations, though in-service rates are still relatively high across measures.

The evaluation team applied different ISRs to standalone advanced power strips and kit advanced power strips based on the belief that time-of-sale ISRs from the IL TRM v11.0 are a better proxy for the standalone advanced power strips than ISRs calculated from kit survey data. Customers buying standalone power strips specifically seek out this measure, while kit purchasers could be motivated by a variety of different measures included in the kit. This is a departure in the methodology the evaluation team applied in 2021 and 2022, when survey ISRs for advanced power strips from the kit were applied to all delivery methods.

Kit measures, including the smart LEDs, advanced power strips (those specific to the kits), and desk lamps also had lower ISRs than *ex ante*, which may be due to respondents being interested in some, but not all measures included in the kit. The Process Evaluation section has more information on measure-level satisfaction and drivers of dissatisfaction.

The in-service rate adjustment for add-on recessed downlight two and four-packs and advanced power strips in the EE Week Savings kits had the largest impact on program savings due to the large quantity of add-on packs and EE Week Savings kits distributed. The add-on downlight fixtures saw a 57% decrease in savings and the kit advanced power strips saw a 29% decrease in savings, after applying updated ISRs from the survey.

For a few measures, the evaluation team assigned higher verified in-service rates compared to *ex ante*. These measures included bathroom and kitchen aerators, and standalone LED specialty bulbs and LED reflectors. For the standalone 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.

To calculate the verified savings, the evaluation team replaced the *ex ante* ISR with the verified ISR from the 2023 participant survey. This updated data provides a more accurate representation of actual ISRs among the current program year participants.

Table 159 summarizes the audited and verified savings per unit.

Table 159. 2023 Residential Online Marketplace Program Audited and Verified Gross Per-Measure Savings

MEASURE	UNIT OF MEASURE	*EX ANTE* ISR	*EX ANTE* PER-MEASURE DEEMED SAVINGS			VERIFIED ISR	VERIFIED GROSS PER-MEASURE SAVINGS		
			KWH	*EX ANTE* ISR	THERMS		KWH	KW	THERMS
Advanced Power Strips - Tier 1	Power Strip	100%; 87%*	89.61	0.010	0.00	71%	73.13	0.008	0.00
Advanced Power Strips - Tier 2	Power Strip	83%	96.70	0.018	0.00	83%	96.71	0.018	0.00
Air Purifier	Purifier	100%	303.00	0.035	0.00	100%	303.00	0.035	0.00
Bathroom Aerator 1.0 GPM	Aerator	44%	14.98	0.001	0.00	92%	31.31	0.003	0.00
Kitchen Aerator 1.5 GPM	Aerator	44%	79.24	0.004	0.00	93%	167.49	0.008	0.00
LED Reflector (Jan-Jun 2023)	LED Reflector	82%	39.42	0.005	0.00	86%	44.77	0.006	0.00
LED Specialty (Jan-Jun 2023)	LED Specialty	82%	24.59	0.003	0.00	86%	25.94	0.004	0.00
LED String	Strand	89%	26.59	0.000	0.00	100%	26.60	0.000	0.00
Smart LED (Jan-Jun 2023)	Bulb	98%	1.82	0.000	0.00	86%	1.60	0.000	0.00
Smart LED (Jul-Dec 2023)	Bulb	98%	1.83	0.000	0.00	86%	1.60	0.000	0.00
Low-flow Showerhead 1.5 GPM	Showerhead	88%	251.32	0.015	0.00	86%	245.60	0.015	0.00
Low-flow Showerhead with ShowerStart 1.5 GPM	Showerhead and ShowerStart	88%	325.34	0.040	0.00	86%	317.95	0.040	0.00
ShowerStart - Electric	ShowerStart	88%	68.25	0.004	0.00	86%	66.70	0.004	0.00
Smart Plug	Smart Plug	0%	14.60	0.000	0.00	0%	14.60	0.000	0.00
Wi-Fi Thermostat - Electric Cooling and Gas Heating Savings	Thermostat	79%	85.91	0.098	0.00	77%	83.74	0.095	0.00
Wi-Fi Thermostat - Electric Cooling and Heating Savings	Thermostat	79%	925.19	0.098	0.00	77%	904.52	0.095	0.00
Wi-Fi Thermostat - Electric Cooling Only Savings	Thermostat	79%	85.91	0.098	0.00	77%	83.74	0.031	0.00
Wi-Fi Thermostat - Electric Heating Only Savings	Thermostat	79%	816.44	0.000	0.00	77%	795.77	0.000	0.00
EE Week Savings kit - Smart LED Bulb (Jul-Dec 2023)	Bulb	98%	1.88	0.000	0.00	67%	1.28	0.000	0.00
EE Week Savings kit - Desk Lamp	Lamp	100%	10.20	0.000	0.00	83%	8.47	0.000	0.00
EE Week Savings kit - Nightlights (2)	Nightlight	85%	2.09	0.000	0.00	77%	3.78	0.000	0.00
EE Week Savings kit - Tier 2 APS	Power Strip	83%	96.70	0.018	0.00	59%	68.74	0.013	0.00
EE Week Savings kit - Add-on - 6" recessed downlight fixture (Jul-Dec 2023)	Fixture	100%	103.07	0.014	0.00	43%	44.32	0.006	0.00

*The *ex ante* ISR for the Tier 1 APS was updated from 100% to 87% mid-year (August 2023).

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 IL TRM v11.0 and the Indiana TRM (v2.2) to calculate *ex post* gross electric energy savings, demand reduction, and natural gas savings. *Appendix A. Residential Online Marketplace (OLM) Program* 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 the *ex ante* and *ex post* gross savings. These differences were primarily driven by the following overarching factors:

- The evaluation team used IL TRM v11.0 algorithms and non-climate-related assumptions to calculate *ex post* while *ex ante* was calculated using the IL TRM v10.0, Indiana TRM (v2.2) algorithms and assumptions, and historical EM&V results.
- The evaluation team used the installation zip code to match each customer to 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.
- The evaluation team used updated in-service rates for kit components and Wi-Fi thermostats based on the 2023 NIPSCO Residential OLM program participant survey, which adjusted savings across measures.
- For Wi-Fi thermostats, the evaluation team used the IL TRM v11.0 algorithms, and inputs from the 2023 HVAC evaluation, including variables from the 2023 billing analysis.
- For evaluation purposes, LED lighting sold on the OLM in 2023 was split into two categories: January-June sales and July-December sales. This was due to the June 30, 2023, cut-off date for the Department of Energy's (DOE) full enforcement of retail sales of EISA-impacted lamps.[62]
    - The OLM sold standalone LED reflector and specialty lamps only during the January-June timeframe, while standalone Smart LEDs were sold over the entire program year.
    - The EE Week Savings Kit Smart LEDs and add-on recessed downlights were only sold in the second half of the year.

The following sections summarize the team's findings and recommendations based on the engineering review.

[62] 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

Ex Post Gross Savings Summary

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 IL TRM v11.0, the Indiana TRM (v2.2), customer location to account for weather effects, inputs from other NIPSCO programs, inputs from past evaluation results, inputs from the 2023 billing analysis, as well as survey data when appropriate.

Table 160 shows the *ex ante* deemed savings and *ex post* gross per-measure savings for 2023 Residential Online Marketplace program measures. *Ex post* savings calculations differed from *ex ante* analysis as follows:

- **Wi-Fi Thermostats:** *Ex ante* electric energy savings used the Indiana TRM (v2.2) while *ex post* used the IL TRM v11.0. Additionally, *ex ante* savings used 2021 NIPSCO EM&V values for several inputs, while the evaluation team used the recently completed 2023 thermostat billing analysis to calculate *ex post* savings. The 2023 billing analysis found slightly increased savings factors from the 2020 analysis (cooling savings were 9.6% up from 8.3% in 2020, and heating savings were 6.0% up from 5.4% in 2020). More information on this billing analysis can be found in the *2023 NIPSCO Residential Energy Efficiency Rebates Program* chapter. *Ex post* gas savings were calculated, but not included in savings summaries (see more information below).
- **Smart LEDs:** For the smart LED measure, both sold as standalone and included in the EE Week Savings Kit, the *ex ante* calculation used the IL TRM v10.0 connected LED lamps savings algorithm, which assumes an LED baseline. For standalone Smart LEDs in the January – June 2023 period, the evaluation team used the Indiana TRM (v2.2) and calculated savings using the residential ENERGY STAR lighting algorithm and the UMP protocol for baseline wattage and added the IL TRM v11.0 connected watts savings, resulting in higher *ex post* savings. For the Smart LED sold standalone after June 30, 3023, and distributed through the EE Week Savings Kit, the evaluation team only granted savings associated with the connected LED watts, per the IL TRM v11.0. Because all kits were distributed after June 30, 2023, the evaluation team calculated smart LED *in-situ* baseline wattages for information purposes but did not use the *in-situ* baselines in the savings calculations.
  - Survey ISRs were 67% for Smart LEDs, compared to an *ex ante* ISR of 98%.
  - Survey *in-situ* watts were 23.11 watts compared to the *ex ante* assumption of a 9-watt LED.
- **Add-On Kit Recessed Downlight LEDs:** All recessed downlights sold through the OLM were distributed after June 30, 2023, the cut-off date for the Department of Energy's (DOE) full enforcement of retail sales of EISA-impacted lamps. These recessed downlight fixtures mimic BR30 can lights and have historically been evaluated as reflectors. The BR30 is an EISA-impacted bulb, therefore, the evaluation team assumed an LED baseline wattage and calculated zero *ex post* savings. By contrast, *ex ante* savings used a baseline wattage of 72.80. With 1,296 recessed downlight LEDs distributed with kits, this discrepancy had a substantial negative impact on savings. The issue was further compounded by an inadvertent double-counting of savings in the *ex ante* savings calculation formula. Both the baseline and efficient input wattages were multiplied by two, likely to account for the 2-pack of fixtures. However, the savings were then multiplied again by a quantity of two in the formula. As kit participants were surveyed in 2023, the survey data on recessed downlight *in-situ* wattages and ISRs are presented for information only below.

    - Survey ISRs were 43% for add-on LED recessed downlights, compared to an *ex ante* ISR of 100%.
    - Survey *in-situ* watts for the optional add-on LED recessed downlights to the kit were 44.14 watts compared to the *ex ante* assumption of 72.80 watts.
- **Tier 1 and Tier 2 Advanced Power Strips:** The participant survey measured a lower ISR (59%) for Tier 2 advanced power strips included in kits than the ISR reported in *ex ante* savings (83%), which referenced the IL TRM v10.0 for time-of-sale Tier 2 advanced power strips. The evaluation team applied the IL TRM v11.0 time-of-sale ISR to the standalone Tier 2 advanced power strips and the 2023 survey ISR to the Tier 2 advanced power strips distributed with the kits. Likewise, the evaluation team applied the IL TRM v11.0 time-of-sale ISR (71%) to the standalone Tier 1 advanced power strip, while *ex ante* savings used an 87% ISR from the 2021 EM&V kit survey value.
- **Low-Flow Showerheads and ShowerStarts:** *Ex ante* savings were calculated using the IL TRM v10.0 and sourcing a 2.63 GPM baseline from the IN TRM (v2.2), whereas for *ex post* savings the evaluation team used the IL TRM v.11.0 and the 2.35 GPM baseline it specified therein. This resulted in lower *ex post* energy and demand savings for all the shower measures.
- **Kitchen Aerators:** The evaluation team used a 93% ISR for kitchen aerators from the 2022 HEA participant survey to calculate *ex post* savings. The *ex ante* savings mistakenly use a 44% ISR, which is a bathroom faucet aerator ISR from the 2021 Residential OLM participant survey. The kitchen aerator ISR from the 2021 survey was 86%.

Table 160 shows the *ex ante* deemed savings and *ex post* per-measure savings for the 2023 Residential OLM program measures. *Ex ante* assumptions include ISRs in the calculations, and therefore *ex post* gross per unit savings algorithms also include ISRs.

Table 160. 2023 Residential Online Marketplace Program *Ex Ante* and *Ex Post* Gross Per Measure Savings Values

MEASURE	UNIT OF MEASURE	*EX ANTE* PER-MEASURE SAVINGS		*EX POST* GROSS PER-MEASURE SAVINGS	
		KWH	KW	KWH	KW
Advanced Power Strips - Tier 1	Power Strip	89.61	0.010	73.13	0.005
Advanced Power Strips - Tier 2	Power Strip	96.70	0.018	96.70	0.018
Air Purifier	Purifier	303.00	0.035	243.40	0.028
Bathroom Aerator 1.0 GPM	Aerator	14.98	0.001	17.39	0.001
Kitchen Aerator 1.5 GPM	Aerator	79.24	0.004	169.77	0.005
LED Reflector (Jan-Jun 2023)	LED Reflector	39.42	0.005	41.65	0.006
LED Specialty (Jan-Jun 2023)	LED Specialty	24.59	0.003	25.89	0.004
LED String	LED String	26.59	0.000	29.88	0.000
Smart LED (Jan-Jun 2023)	Smart LED Bulb	1.82	0.000	30.55	0.006
Smart LED (Jul-Dec 2023)	Smart LED Bulb	1.83	0.000	2.12	0.002

MEASURE	UNIT OF MEASURE	*EX ANTE* PER-MEASURE SAVINGS		*EX POST* GROSS PER-MEASURE SAVINGS	
		KWH	KW	KWH	KW
Low-Flow Showerhead 1.5 GPM	Showerhead	251.32	0.015	169.05	0.002
Low-Flow Showerhead with ShowerStart 1.5 GPM	Showerhead and ShowerStart	325.34	0.040	199.42	0.032
ShowerStart - Electric	ShowerStart	68.25	0.004	46.34	0.007
Smart Plug	Smart Plug	14.60	0.000	0.00	0.000
Wi-Fi Thermostat - Electric Cooling and Gas Heating Savings	Thermostat	85.91	0.098	154.44	0.230
Wi-Fi Thermostat - Electric Cooling and Heating Savings	Thermostat	925.19	0.098	848.76	0.230
Wi-Fi Thermostat - Electric Cooling Only Savings	Thermostat	85.91	0.098	111.43	0.230
Wi-Fi Thermostat - Electric Heating Only Savings	Thermostat	816.44	0.000	729.24	0.000
EE Week Savings kit - Smart LED Bulb (Jul-Dec 2023)	LED Bulb	1.88	0.000	1.69	0.001
EE Week Savings kit - Desk Lamp	LED Lamp	10.20	0.000	4.86	0.002
EE Week Savings kit - Nightlights	Nightlight	2.09	0.000	23.82	0.000
EE Week Savings kit - Tier 2 APS	Power Strip	96.70	0.018	68.73	0.013
EE Week Savings kit - Add-on - 6" recessed downlight fixture (Jul-Dec 2023)	Fixture	103.07	0.014	0.00	0.000

Table 161 highlights notable differences between *ex ante* and *ex post* gross estimates.

Table 161. 2023 Residential Online Marketplace Notable Differences Between *Ex Ante* and *Ex Post* Gross

MEASURE	*EX ANTE* SOURCES AND ASSUMPTIONS	*EX POST* GROSS SOURCES AND ASSUMPTIONS	PRIMARY REASONS FOR DIFFERENCES
Advanced Power Strip Tier 1	IL TRM v10.0; assumed 7-plug kWh (103) and kW, and 0.80 CF; assumed 87% ISR from 2021 EM&V results.	IL TRM v11.0; assumed 7-plug kWh (103) and 71% ISR from IL TRM v11.0; assumed Indiana TRM (v2.2) 0.50 CF.	*Ex ante* ISR higher than *ex post*. *Ex ante* used IL TRM for CF, while *ex post* used IN TRM for CF.
Advanced Power Strip Tier 2	IL TRM v10.0 deemed values	IL TRM v11.0; confirmed infrared or infrared and occupancy sensor with model numbers, 83% ISR from IL TRM v11.0 for standalone and 59% ISR from survey for kit distribution;	*Ex ante* savings higher than *ex post* for kit APS because *ex post* used survey ISR (59%), which was significantly lower than IL TRM v10.0 ISR of 83%. *Ex ante* used IL TRM for CF,

MEASURE	*EX ANTE* SOURCES AND ASSUMPTIONS	*EX POST* GROSS SOURCES AND ASSUMPTIONS	PRIMARY REASONS FOR DIFFERENCES
		assumed Indiana TRM (v2.2) 0.50 CF.	while *ex post* used IN TRM for CF.
Air Purifier	IL TRM v10.0 deemed savings	IL TRM v11.0 calculated savings	*Ex post* confirmed CADR, CADR per watt, and Partial On Power Mode with ENERGYSTAR Qualified Products List (QPL)
Bathroom and Kitchen Aerator	Indiana TRM (v2.2) and 2020 EMV; assumed single-family for all applicable measures and 100% water heating saturation; used 2020 EM&V value for cold water inlet temperature; assumed ISR of 44% from the 2021 Res OLM survey for the bathroom kit aerator.	IL TRM v11 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. 2022 HEA survey ISRs of 92% for bathroom and 95% for kitchen.	The IL TRM v11.0 specifies lower GPMbase values and higher drain loss values for both kitchen and bath, resulting in lower savings. However, the much higher survey ISR than *ex ante* resulted in higher savings.
Reflector and Specialty LEDs	Indiana TRM (v2.2) and ENERGY STAR baseline watts; assumed South Bend as closest city for all weighted average waste heat factors; 81.5% ISR.	Indiana TRM (v2.2). Weighted average waste heat factors determined by matching to closest city from tracking data. Standalone LED ISRs (86%) from 2023 Residential Lighting	*Ex post* savings slightly higher because of higher *ex post* ISRs
Smart LED	IL TRM v10.0 savings algorithm is used with some inputs from Indiana TRM (v2.2); assumed 98% ISR from IL TRM v10.0 time of sale; assumed hours of use and South Bend as closest city for all weighted average waste heat factors from Indiana TRM (v2.2).	Jan-Jun 2023: Standalone lamps use UMP baseline and ISRs from 2023 Res Lighting + IL TRM v11.0 for connected watts savings. Jul-Dec 2023: IL TRM v11.0 for connected watts savings for both standalone and kit; standalone ISRs from 2023 Res Lighting (86%), kit ISRs (67%) from 2023 OLM survey. Weighted average waste heat factors determined by matching to closest city from tracking data.	UMP baselines resulted in higher standalone *ex post* savings for the first half of the year. Lower *ex post* ISRs for Smart LEDs distributed in kits from the 2023 OLM survey resulted in lower realization rates for the second half of the year.
Low-flow Showerhead (with and without ShowerStart)	Indiana TRM (v2.2) and 2021 EMV; assumed single-family for all applicable measures and 100% water heating saturation; used EMV 2021 value for cold water inlet temperature and 2021 HEA survey ISR of 88%.	IL TRM v11.0; calculated showers per household per day from 2022 HEA survey, as well as showerheads per household. Cold water inlet temperature is sourced from Indiana TRM (v2.2) by matching to closest city from tracking data. 100% water heater	*Ex post* savings used IL TRM v11.0 specifying 2.35 GPMbase, while Indiana TRM (v2.2) used in *ex ante* specifies 2.63 GPMbase. The *ex ante* ISR (88% from 2021 survey) and ex *post* ISR (86% from 2022 HEA survey) were very similar.

MEASURE	*EX ANTE* SOURCES AND ASSUMPTIONS	*EX POST* GROSS SOURCES AND ASSUMPTIONS	PRIMARY REASONS FOR DIFFERENCES
	ShowerStart inputs are sourced from EM&V 2021, Indiana TRM (v2.2) and IL TRM v10.0.	saturation value based on customers reporting their water heater fuel type at checkout.	
Smart Plug	Deemed value from EnergyEarth	Not included in the IL TRM v11.0 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 demand with other inputs from EMV 2020 and 2021. ISR of 79% from 2021 EMV. Assumed 0 therms for *ex ante*.	IL TRM v11.0 savings algorithm for electric savings, deemed heating and cooling reduction savings values from 2023 billing analysis; EFLHcool determined by matching to closest city from tracking data and used EFLHheat from 2023 billing analysis. ISR of 77% from 2023 OLM survey was not applied because the ISR is inherent to the billing analysis. Deemed therms savings of 42.9 from 2023 billing analysis for gas savings, which were estimated but not included in reported savings (see further discussion below).	Methodology differences with *ex ante* using IN TRM (v2.2) and 2020 billing analysis and *ex post* using IL TRM v11.0 and 2023 billing analysis.
LED Nightlight	Indiana TRM (v2.2); EMV 2019 for incandescent replacement factor (IRF)	IL TRM v11.0	The IL TRM v11.0 does not contemplate an IRF for time-of-sale, so that significant discount is not applied to *ex post* savings.
Desk Lamp	Indiana TRM (v2.2); calculated electric savings as an LED, did not attribute demand savings or therm penalty; Wattsbase of 38; assumed ISR of 100%	Indiana TRM (v2.2); calculated all savings as an LED; Wattsbase of 25 from IN TRM v11.0 (5.5.13 EISA Exempt Lighting); ISR of 83% from 2023 OLM participant survey	Difference in baseline wattage assumptions and ISRs both led to lower *ex post* savings. The evaluation team attributed demand savings and therm penalty as an LED measure.
String LED	IL TRM v10.0 deemed values; applied 2021 EM&V 89% ISR from specialty bulbs	IL TRM v11.0 deemed values, including 100% ISR	*Ex post* savings slightly higher because *ex post* assumed 100% ISR, whereas *ex ante* used 89% ISR
LED Recessed	IL TRM v10.0 deemed values; applied 100% ISR. Accidentally double-counted	IL TRM v11.0 deemed values, resulting in zero *ex post* savings	EISA enforcement deadline of June 30, 2023.

MEASURE	*EX ANTE* SOURCES AND ASSUMPTIONS	*EX POST* GROSS SOURCES AND ASSUMPTIONS	PRIMARY REASONS FOR DIFFERENCES
Downlight (Kit Add-on)	savings by multiplying Wattsbase and WattsEE by two and multiplying by a quantity of two for pack size.	because fixtures are impacted by EISA	

Water Heater Saturation

During the Online 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.

Waste Heat Factor – Therm Penalties

The evaluation team did not include therm penalties when calculating evaluated savings for the 2023 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* savings for most standalone LED measures and LED kit add-on packs included therm penalties totaling -50.76 therms. In total, the *ex post* therm penalty for cost-effectiveness analysis was -228.59 therms (Table 162).

For the smart LEDs, LED string lights, lighting measures within the EE Week Savings Kit (Smart LED and desk lamps), as well as all the LED add-on measures, there was no heating fuel designation in the tracking data, so the evaluation team made the conservative assumption that all smart LED and kit customers were dual fuel customers and therefore assigned therm penalties.

Table 162. 2023 Residential Online Marketplace Program Waste Heat Factor Therm Penalty

MEASURE	WASTE HEAT FACTOR THERM PENALTY	
	EX ANTE	*EX POST*
LED Reflector (Jan-Jun 2023)	(26.60)	(28.08)
LED Specialty (Jan-Jun 2023)	(24.16)	(25.47)
Smart LED (Jan-Jun 2023)	-	(34.33)
Smart LED (Jul-Dec 2023)	-	(1.38)
EE Week Savings Kit – Smart LED (1) (Jul-Dec 2023)	-	(89.95)
EE Week Savings Kit – Desk Lamp (Jul-Dec 2023)	-	(25.83)
LED String	-	(23.55)
Total	(50.76)	(228.59)

Realization Rates

Table 163 and Table 164 show the program's *ex ante* reported savings, verified savings, *ex post* gross savings and total program realization rates for kWh and kW. The program did not report any therm savings in 2023.

Table 163. 2023 Residential 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.)
Advanced Power Strips - Tier 1		4,301.28	3,510.24	3,510.24
Advanced Power Strips - Tier 2		2,127.40	2,127.68	2,127.29
Air Purifier		19,998.00	19,998.00	16,064.32
Bathroom Aerator 1.0 GPM		134.82	281.83	156.55
Kitchen Aerator 1.5 GPM		950.88	2,009.85	2,037.29
LED Reflector (Jan-Jun 2023)		1,301.00	1,477.48	1,374.30
LED Specialty (Jan-Jun 2023)		1,180.08	1,245.27	1,242.59
LED String		877.58	877.65	986.12
Smart LED (Jan-Jun 2023)		100.15	87.89	1,680.36
Smart LED (Jul-Dec 2023)		58.41	51.26	67.73
Low-flow Showerhead 1.5 GPM		3,267.16	3,192.85	2,197.66
Low-flow Showerhead with ShowerStart 1.5 GPM		1,301.36	1,271.80	797.69
ShowerStart - Electric		273.00	266.80	185.36
Smart Plug		175.20	175.20	0.00
Wi-Fi Thermostat - Electric Cooling and Gas Heating Savings		65,892.97	64,226.57	118,456.47
Wi-Fi Thermostat - Electric Cooling and Heating Savings		1,850.38	1,809.04	1,697.53
Wi-Fi Thermostat - Electric Cooling Only Savings		2,663.21	2,595.86	3,454.47
Wi-Fi Thermostat - Electric Heating Only Savings		49,802.84	48,541.92	44,483.64
EE Week Savings kit - Smart LED Bulb (Jul-Dec 2023)		4,888.00	3,328.00	4,401.77

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.)
EE Week Savings kit - Desk Lamp		26,520.00	22,011.60	12,639.84
EE Week Savings kit - Nightlights		10,849.12	19,656.05	123,846.46
EE Week Savings kit - Tier 2 APS		251,407.00	178,711.00	178,711.00
EE Week Savings kit - Add-on - 6" recessed downlight fixture (Jul-Dec 2023)		133,570.68	57,435.39	0.00
Total Savings	**583,497.96**	**583,490.52**	**434,889.24**	**520,118.68**
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 164. 2023 Residential Online Marketplace 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.)
Advanced Power Strips - Tier 1		0.480	0.394	0.246
Advanced Power Strips - Tier 2		0.396	0.389	0.389
Air Purifier		2.310	2.310	1.835
Bathroom Aerator 1.0 GPM		0.009	0.027	0.009
Kitchen Aerator 1.5 GPM		0.048	0.092	0.066
LED Reflector (Jan-Jun 2023)		0.177	0.184	0.187
LED Specialty (Jan-Jun 2023)		0.160	0.170	0.170
LED String		0.000	0.000	0.000
Smart LED (Jan-Jun 2023)		0.000	0.000	0.315
Smart LED (Jul-Dec 2023)		0.000	0.000	0.059
Low-flow Showerhead 1.5 GPM		0.195	0.190	0.025

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.)
Low-flow Showerhead with ShowerStart 1.5 GPM		0.160	0.158	0.127
ShowerStart - Electric		0.016	0.016	0.030
Smart Plug		0.000	0.000	0.000
Wi-Fi Thermostat - Electric Cooling and Gas Heating Savings		75.166	73.193	176.484
Wi-Fi Thermostat - Electric Cooling and Heating Savings		0.196	0.191	0.460
Wi-Fi Thermostat - Electric Cooling Only Savings		3.038	0.954	7.133
Wi-Fi Thermostat - Electric Heating Only Savings		0.000	0.000	0.000
EE Week Savings kit - Smart LED Bulb (Jul-Dec 2023)		0.000	0.000	2.282
EE Week Savings kit - Desk Lamp		0.000	0.000	5.175
EE Week Savings kit - Nightlights (2)		0.000	0.000	0.000
EE Week Savings kit - Tier 2 APS		45.919	32.641	32.641
EE Week Savings kit - Add-on - 6" recessed downlight fixture (Jul-Dec 2023)		17.975	7.729	0.000
Total Savings	**147.243**	**146.245**	**118.637**	**227.632**
Total Program Realization Rate				**155%**

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

Like in 2022, NIPSCO did not claim 2023 gas savings for measures through the OLM due to cost-effectiveness issues. In general, program offerings were limited to electric-only measures. The exception is Wi-Fi 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 significant gas savings. The evaluation team estimated these savings as part of the engineering analysis, and a summary of these savings is included in Table 165 below.

Table 165. 2023 Residential Online Marketplace Program *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	42.90
***Total *Ex Post* Gross Wi-Fi Thermostat Natural Gas Savings**	**32,904.30**

*In 2023 there were 767 Electric Cooling and Gas Heating Wi-Fi thermostats

Ex Post Net Savings

The team estimated freeridership and spillover for select measures using survey data collected from 2023 kit and thermostat participants. Details on the freeridership and spillover analysis are in *Freeridership and Spillover Analysis*. Table 166 shows the NTG ratios by measure for surveyed measures only.

Table 166. 2023 Residential Online Marketplace Program Net-to Gross Ratios by Measure (Surveyed Measures)

MEASURE	RESPONSES (N)	FREERIDERSHIP [a]	PARTICIPANT SPILLOVER	NTG
Wi-Fi Thermostats	54	9%	5%	96%
EE Week Savings Kit – Smart LED Bulb (Jul-Dec 2023)	91	8%	5%	97%
EE Week Savings Kit – Desk Lamp	93	10%	5%	95%
EE Week Savings Kit – Nightlights (2)	102	14%	5%	91%
EE Week Savings Kit – Tier 2 APS	71	9%	5%	96%
EE Week Savings Kit – Add-on – 6” recessed downlight fixture (Jul-Dec 2023)	44	7%	5%	98%

[a] Freeridership score is an average weighted by verified quantity of measure installed

The 2023 Residential OLM participant survey only surveyed kit measures and Wi-Fi thermostats. For all remaining standalone measures, if measures were surveyed in 2021 or 2022, those participant survey results were used for 2023 NTG values. For measures where respondents have never been surveyed, including air purifier, smart plug, and ShowerStart, the evaluation team applied the overall program-level NTG ratios, developed from measures with 2021-2023 survey respondents, weighted by *ex post* gross population savings. Table 167 shows the NTG ratio by measure for all program measures. Note the spillover estimate for 2023 survey respondents was 5%, compared to 10% in 2022 and 7% in 2021.

Table 167. 2023 Residential Online Marketplace Program Net-to Gross Ratios by Measure

MEASURE	FREERIDERSHIP [a]	SPILLOVER	NTG	SOURCE
Advanced Power Strips - Tier 1	10%	5%	95%	OLM overall electric weighted average
Advanced Power Strips - Tier 2	10%	5%	95%	OLM overall electric weighted average
Air Purifier	10%	5%	95%	OLM overall electric weighted average
Bathroom Aerator 1.0 GPM	17%	7%	90%	2021 Res OLM Survey
Kitchen Aerator 1.5 GPM	17%	7%	90%	2021 Res OLM Survey
LED Reflector (Jan-Jun 2023)	19%	10%	91%	2022 Res OLM Survey
LED Specialty (Jan-Jun 2023)	21%	10%	89%	2022 Res OLM Survey
LED String	10%	5%	95%	OLM overall electric weighted average
Smart LED (Jan-Jun 2023)	10%	5%	95%	OLM overall electric weighted average
Smart LED (Jul-Dec 2023)	10%	5%	95%	OLM overall electric weighted average
Low-Flow Showerhead 1.5 GPM	27%	7%	80%	2021 Res OLM Survey
Low-flow Showerhead with ShowerStart 1.5 GPM	27%	7%	80%	2021 Res OLM Survey
ShowerStart – Electric	10%	5%	95%	OLM overall electric weighted average
Smart Plug	10%	5%	95%	OLM overall electric weighted average
Wi-Fi Thermostat – Electric Cooling and Gas Heating	9%	5%	96%	2023 Res OLM Survey
Wi-Fi Thermostat – Electric Cooling and Heating	9%	5%	96%	2023 Res OLM Survey

MEASURE	FREERIDERSHIP [a]	SPILLOVER	NTG	SOURCE
Wi-Fi Thermostat – Electric Cooling Only	9%	5%	96%	2023 Res OLM Survey
Wi-Fi Thermostat – Electric Heating Only	9%	5%	96%	2023 Res OLM Survey
EE Week Savings Kit – Smart LED Bulb (Jul-Dec 2023)	8%	5%	97%	2023 Res OLM Survey
EE Week Savings Kit – Desk Lamp	10%	5%	95%	2023 Res OLM Survey
EE Week Savings Kit – Nightlights (2)	14%	5%	91%	2023 Res OLM Survey
EE Week Savings Kit – Tier 2 APS	9%	5%	96%	2023 Res OLM Survey
EE Week Savings Kit – Add-on – 6" Recessed Downlight	7%	5%	98%	2023 Res OLM Survey

Resulting Net Savings

Table 168 presents the resulting net electric savings, demand reduction, and natural gas savings.

Table 168. 2023 Residential Online Marketplace Program *Ex Post* Net Savings

MEASURE	*EX POST* GROSS SAVINGS/REDUCTION		NTG	*EX POST* NET SAVINGS/REDUCTION	
	KWH	KW		KWH	KW
Advanced Power Strips - Tier 1	3,510.24	0.246	95%[a]	3,319.95	0.233
Advanced Power Strips - Tier 2	2,127.29	0.389	95%[a]	2,011.97	0.367
Air Purifier	16,064.32	1.835	95%[a]	15,193.47	1.735
Bathroom Aerator 1.0 GPM	156.55	0.009	90%	140.89	0.008
Kitchen Aerator 1.5 GPM	2,037.29	0.066	90%	1,833.56	0.059
LED Reflector (Jan-Jun 2023)	1,374.30	0.187	91%	1,250.62	0.170
LED Reflector (Jul-Dec 2023)	N/A	0.000	N/A	0.00	0.000
LED Specialty (Jan-Jun 2023)	1,242.59	0.170	89%	1,105.91	0.151
LED Specialty (Jul-Dec 2023)	N/A	0.000	N/A	0.00	0.000
LED String	986.12	0.000	95%[a]	932.66	0.000
Smart LED (Jan-Jun 2023)	1,680.36	0.315	95%[a]	1,589.26	0.298
Smart LED (Jul-Dec 2023)	67.73	0.059	95%[a]	64.06	0.055
Low-Flow Showerhead 1.5 GPM	2,197.66	0.025	80%	1,758.13	0.020
Low-Flow Showerhead with ShowerStart 1.5 GPM	797.69	0.127	80%	638.15	0.102

MEASURE	*EX POST* GROSS SAVINGS/REDUCTION		NTG	*EX POST* NET SAVINGS/REDUCTION	
	KWH	KW		KWH	KW
ShowerStart – Electric	185.36	0.030	95%[a]	175.31	0.028
Smart Plug	0.00	0.000	95%[a]	0.00	0.000
Wi-Fi Thermostat – Electric Cooling and Gas Heating	118,456.47	176.484	96%	113,718.21	169.425
Wi-Fi Thermostat – Electric Cooling and Heating	1,697.53	0.460	96%	1,629.63	0.442
Wi-Fi Thermostat – Electric Cooling Only	3,454.47	7.133	96%	3,316.30	6.848
Wi-Fi Thermostat – Electric Heating Only	44,483.64	0.000	96%	42,704.29	0.000
EE Week Savings Kit – Smart LED Bulb (Jul-Dec 2023)	4,401.77	2.282	97%	4,269.71	2.213
EE Week Savings Kit – Desk Lamp	12,639.84	5.175	95%	12,007.85	4.916
EE Week Savings Kit – Nightlights (2)	123,846.46	0.000	91%	112,700.28	0.000
EE Week Savings Kit – Tier 2 APS	178,711.00	32.641	96%	171,562.56	31.336
EE Week Savings Kit – Add-on – 6” Recessed Downlight	0.00	0.000	98%	0.00	0.000
Total Savings	**520,118.68**	**227.632**		**491,922.76**	**218.407**

Note: Totals may not sum properly due to rounding.

[a]Uses OLM overall electric weighted average of 95%

Table 169 shows the net-to-gross results for each fuel.

Table 169. 2023 Residential Online Marketplace 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.)	583,497.96	520,118.68	95%	491,922.76
Peak Demand Reduction (kW)	147.243	227.632	96%	218.407

Process Evaluation

The evaluation team looked to answer the following research questions:

- How do participants learn about the Online Marketplace?
- What motivates participants to use the Online Marketplace instead of another retailer?
- Would participants use the Online Marketplace again and/or recommend it to others?
- How easy is the Online Marketplace to use?
- Are participants satisfied with the variety and quality of the products on the Online Marketplace?
- For those who did not 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=210) to understand customers' 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 in-service rates and net-to-gross for these measures. In the tracking data through November 2023, the ILLUME team observed sufficient samples for the following measures:

- EE Week Savings kits (referred to as Energy Saver Starter Packs in the survey)
- Two and four-packs of 6" recessed downlight fixture and retrofit kits, available as an add-on to the EE Week Savings kits, and
- Wi-Fi thermostats.

Participant Feedback

The following sections describe results from the participant survey related to program awareness, reasons for participation, experience with the Online Marketplace, satisfaction with the program, and program impacts on customers. The following is a summary of the measures that survey respondents bought from the OLM:

- One-third of respondents bought an EE Week Savings kit and at least one add-on 2-pack or 4-pack of 6" recessed downlight fixtures and retrofit kit (n=70)
- One-third of respondents bought an EE Week Savings kit with no add-on pack (n=70)
- One-third of respondents bought a Wi-Fi thermostat (n=70)

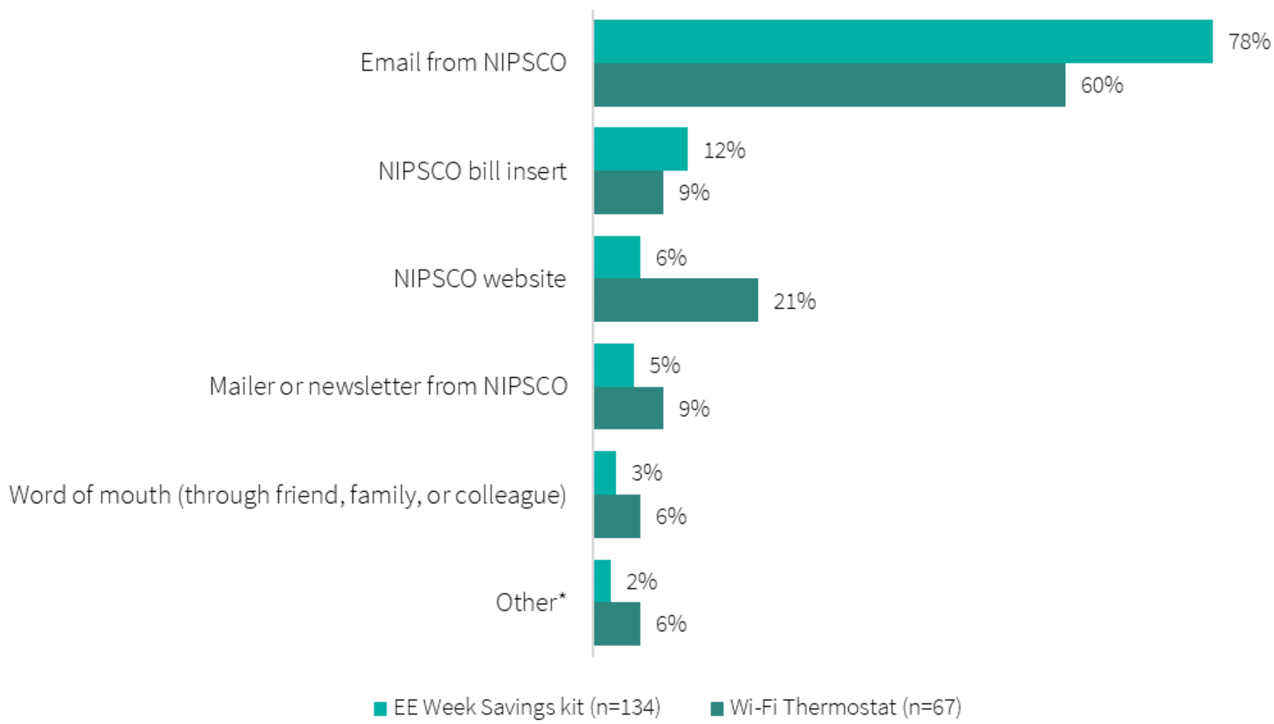
Energy Efficiency Awareness and Marketing

Emails from NIPSCO were the leading source of awareness of the Online Marketplace, regardless of the measure bought (Figure 41). Almost 80% of EE Week Savings kit recipients and 60% of Wi-Fi thermostat recipients heard about the Online Marketplace this way.

The second most common source of awareness for Wi-Fi thermostats was the NIPSCO website (21%). By contrast, the second most common source of awareness for EE Week savings kits was a bill insert from NIPSCO (12%).

Less than 1% of respondents reported hearing about the Online Marketplace through the following sources: a NIPSCO representative, social media ads, or a contractor.

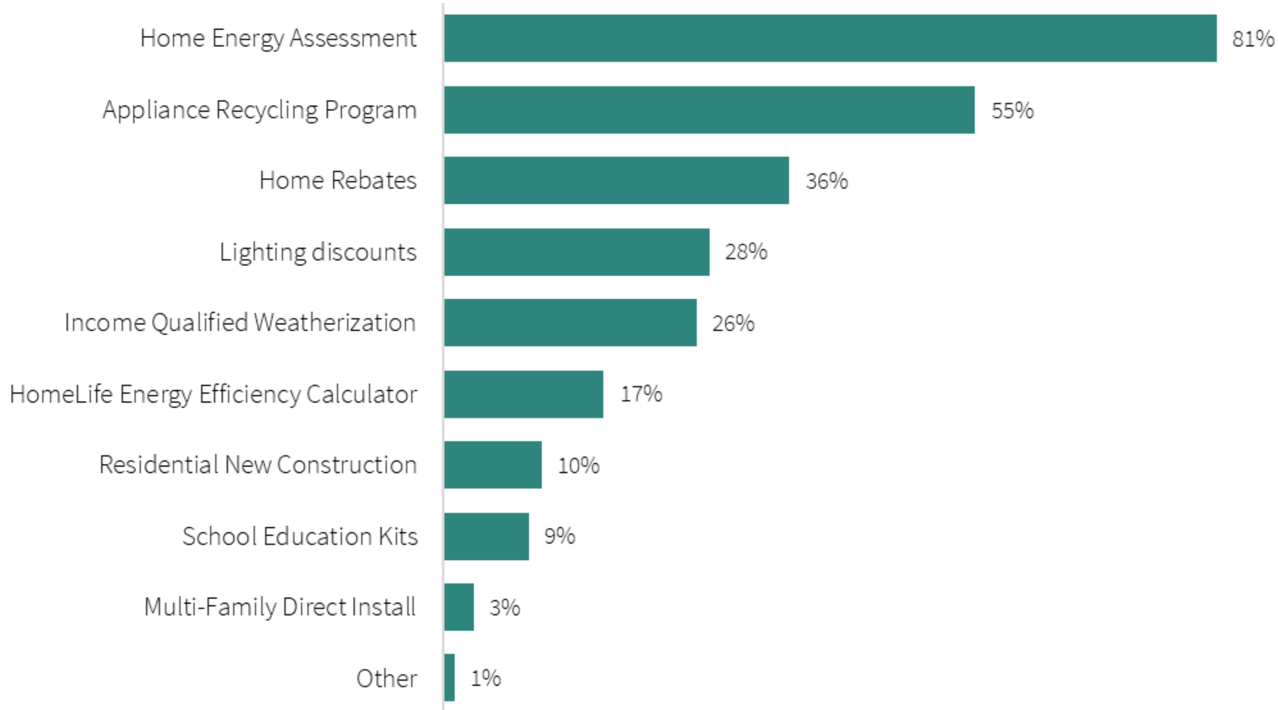
Figure 41. 2023 Residential Online Marketplace Program Sources of Awareness



Source: Residential Online Marketplace Participant Survey Question C1. "How did you learn about the NIPSCO Online Marketplace?" This was a multiple response question.

Across measures, almost three-quarters of OLM respondents (74%) were aware that NIPSCO offers other energy efficiency programs. Of those who were aware of other NIPSCO programs (n=155), the programs that respondents were most aware of are the Home Energy Assessment (HEA), the Appliance Recycling program, and the Home Rebates program (Figure 42).

Figure 42. 2023 Residential Online Marketplace Program Awareness



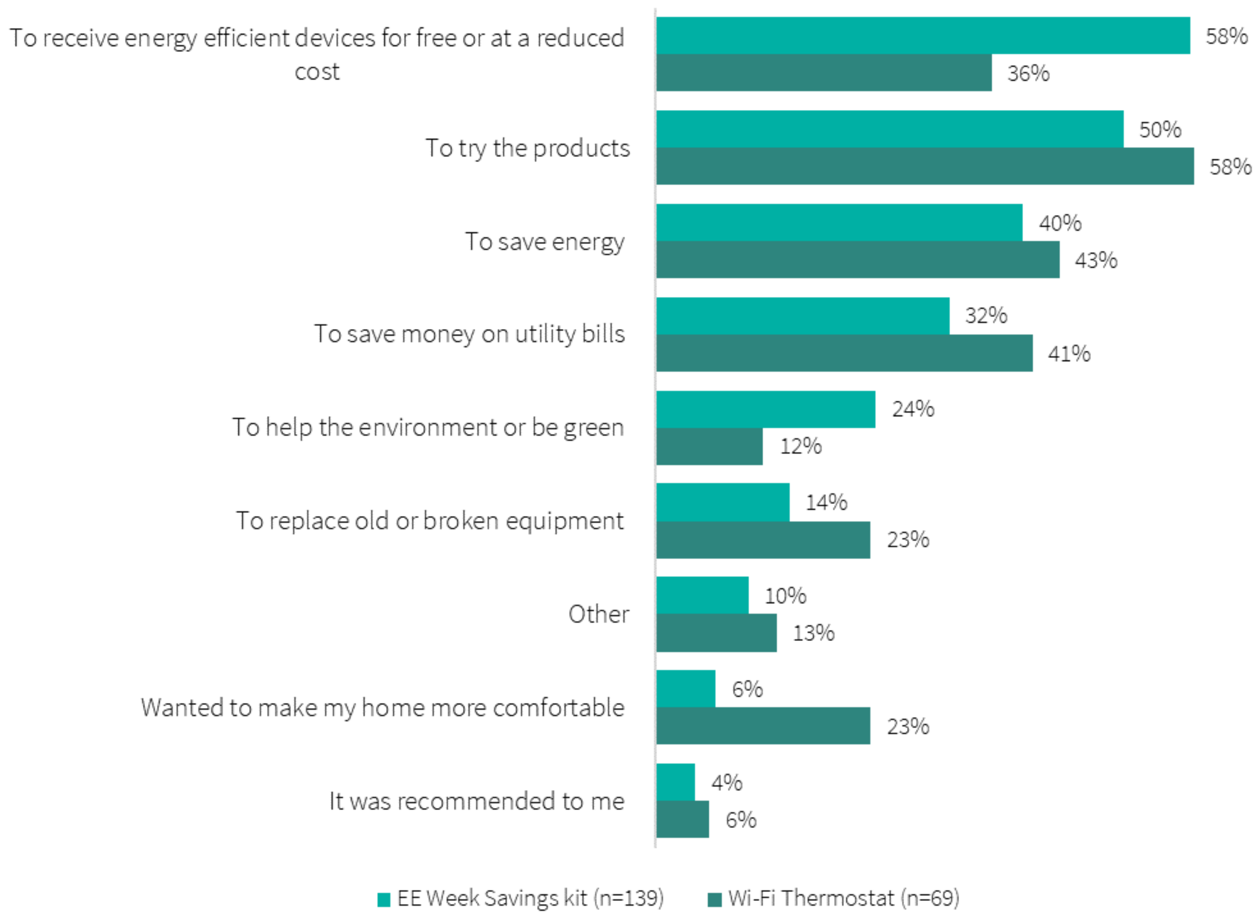
Source: Residential Online Marketplace Participant Survey Question C3. "What energy efficiency programs are you aware of?" This was a multiple response question (n=155).

Despite high awareness, most respondents (64%) had not participated in any other programs besides the Online Marketplace. Of those who had participated in other programs (n=41), the Home Rebates program (n=18), the Home Energy Assessment (n=17), and the Appliance Recycling program (n=11) were most often participated in.

Participation Drivers

Respondents who ordered the EE Week Savings kit said they ordered these items to receive energy efficient devices for free or at a reduced cost (58%) or to simply try the products included in the pack (50%; Figure 43). Notably, a third of these respondents (30%) got their products to replace old or broken equipment. Most respondents who received Wi-Fi thermostats did so to try the new thermostat products (58%) or to save energy (43%).

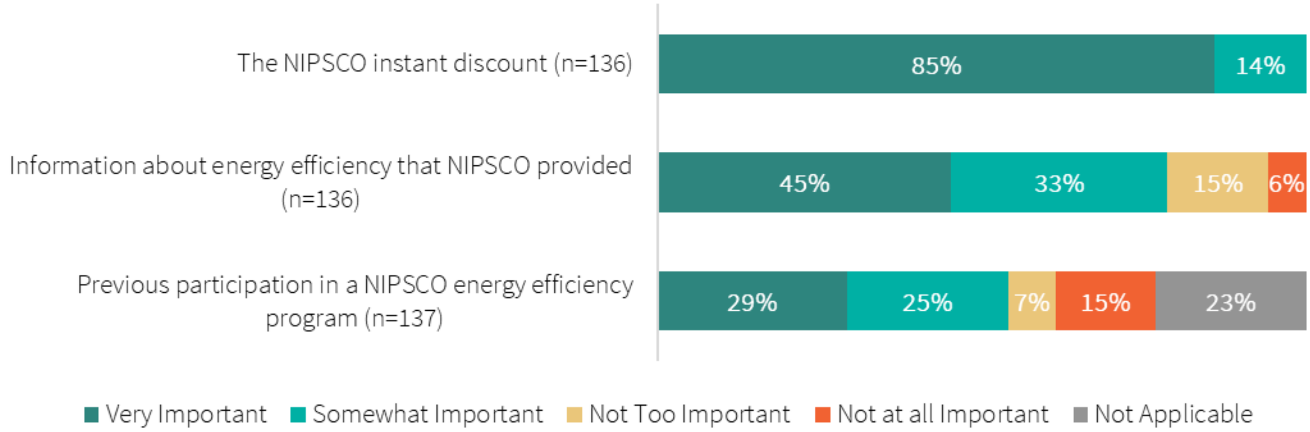
Figure 43. 2023 Residential Online Marketplace Program Motivations for Purchasing Products



Source: Residential Online Marketplace Participant Survey Question D1. "Why were you interested in buying a [MEASURE]?" This was a multiple response question, and categories are mutually exclusive.

Most respondents found the NIPSCO instant discount to be very important in their decision to purchase from the Online Marketplace (85%). Most respondents also felt that the information about energy efficiency that NIPSCO provided through the Online Marketplace was at least somewhat important (78%). Few respondents found that previous participation in a NIPSCO energy efficiency program was important to their decision to buy from the OLM (Figure 44).

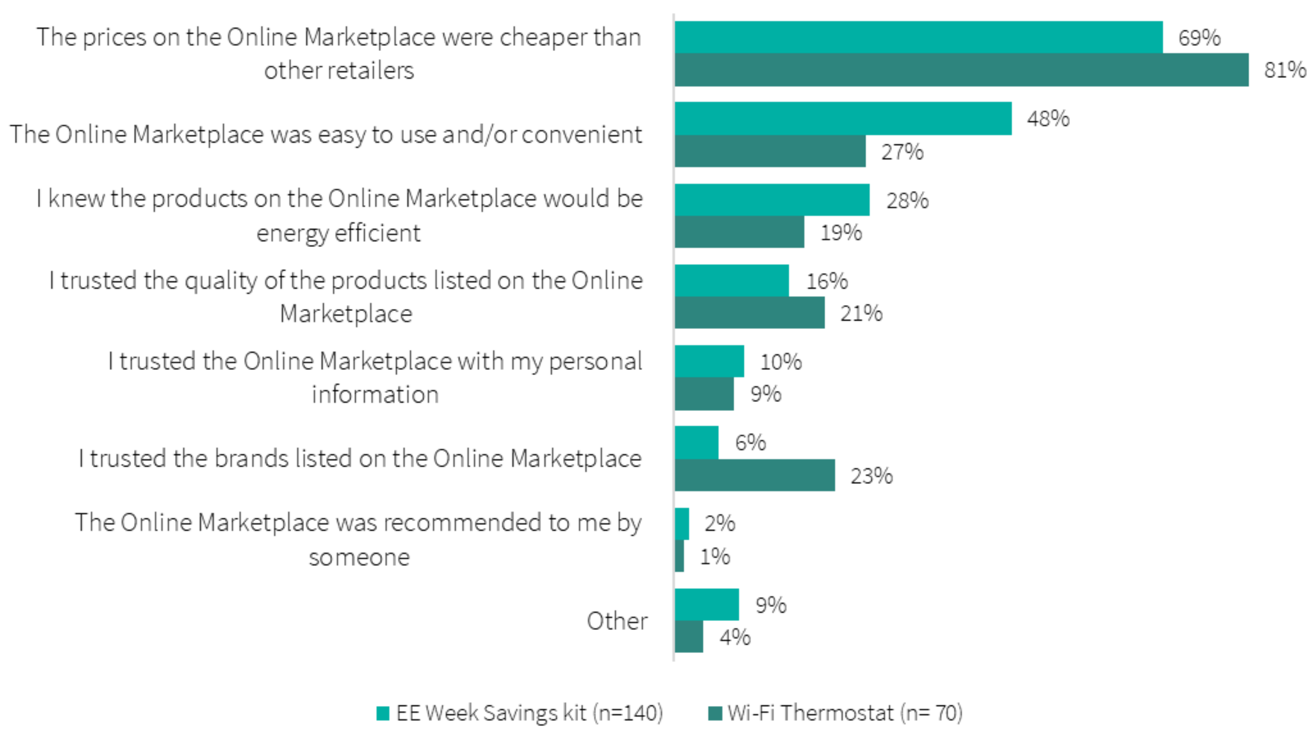
Figure 44. 2023 Residential Online Marketplace Program Importance of Motivations



Source: Residential Online Marketplace Participant Survey Questions F38 and H6. “Please rate the importance of the following factors on your decision to purchase a [MEASURE] from the NIPSCO Online Marketplace.”

Most respondents bought their products from the NIPSCO Marketplace and not another retailer because the prices on the Marketplace were cheaper than other retailers (Figure 45). The second most common motivation was that the Online Marketplace was easy and/or convenient to use. Like last year, the least common motivation was that the Marketplace was recommended to the respondent by someone else, at 1-3% for all measures.

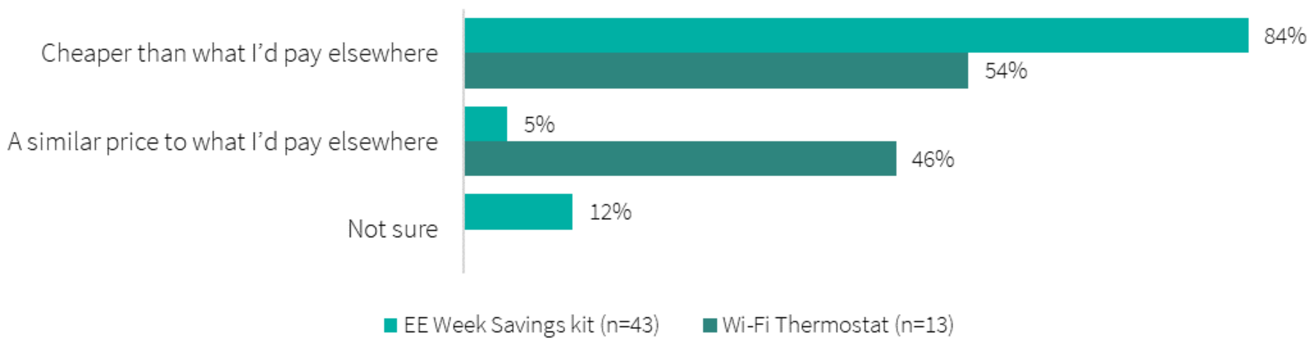
Figure 45. 2023 Residential Online Marketplace Program Motivations for using NIPSCO OLM



Source: Residential Online Marketplace Participant Survey Question D2. “Why did you receive the [MEASURE] from the NIPSCO Online Marketplace?” This was a multiple response question, and categories are mutually exclusive.

Of those who did not cite cheaper prices as a motivation to buy from the Online Marketplace (n=56), most expressed that the prices they paid for their products were cheaper on the OLM than elsewhere. Notably, almost half of the thermostat respondents (46%) believed that their OLM thermostat was priced similarly to what they would pay elsewhere. No respondents said that the prices were more expensive than what they would pay elsewhere.

Figure 46. 2023 Residential Online Marketplace Program OLM Pricing



Source: Residential Online Marketplace Participant Survey Question D4. "Thinking about the price you paid for the [MEASURE] you purchased on the NIPSCO Marketplace, would you say that the price you paid was generally…?" Categories are mutually exclusive.

Most respondents said that they would use the Online Marketplace again in the future to buy the products received (88%).Interestingly, of the remaining customers who did not say that they would use the OLM again, more customers said they were *not sure* if they would use the OLM again (n=20), as opposed to saying they would *not* use the OLM again (n=5). Most of the respondents who said they would not use the OLM again said that they would buy from Amazon.com instead (n=3).

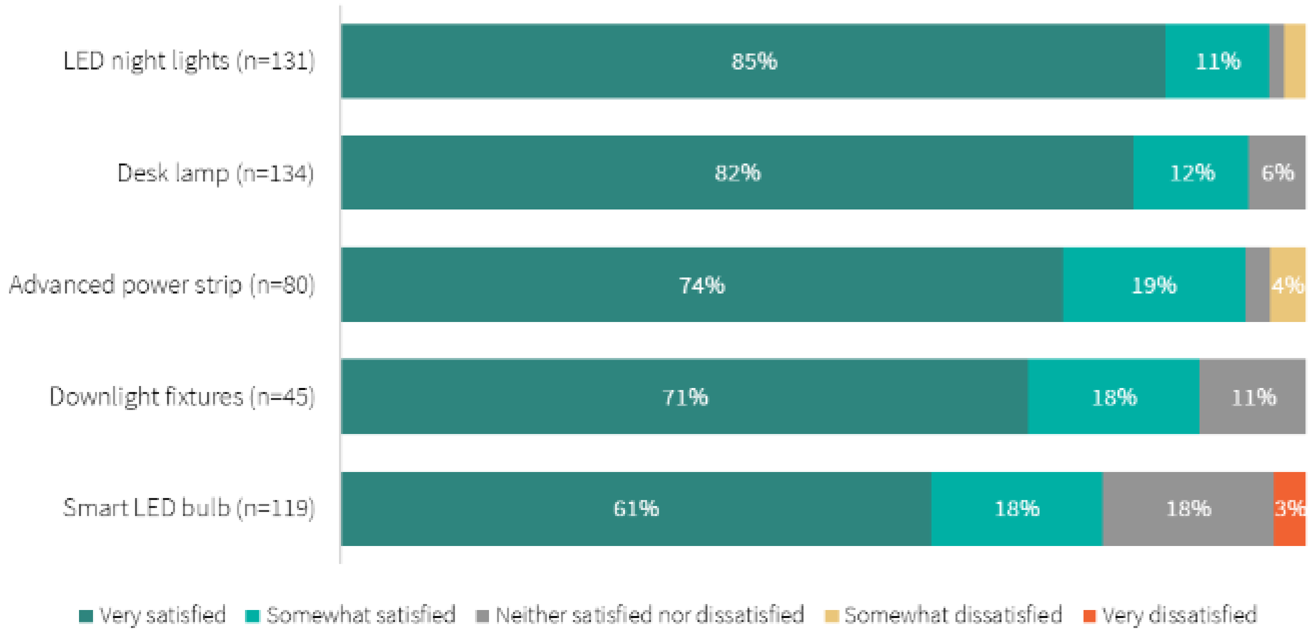
Satisfaction With Program and NIPSCO

Most respondents were somewhat or very satisfied with the variety of products available through the Online Marketplace (88%) and said that it was very easy to buy the energy efficient products they got on the Online Marketplace (77%). Over three quarters of respondents had no suggestions to improve the Online Marketplace (76%). Responses from participants with suggestions on how to improve the Marketplace are summarized in the Suggestions for Improvement section below.

Kit Satisfaction

Customers who received the EE Week Savings kits were generally satisfied with the products provided (Figure 47). The LED night lights had the highest levels of satisfaction.

Figure 47. 2023 Residential Online Marketplace Program EE Week Savings Kit Measure Satisfaction



Source: Residential Online Marketplace Participant Survey Questions F7, F14, F25, F34, F44. "How satisfied or dissatisfied ar e you with the [MEASURE] overall? Would you say you are…?"

Customers who were less than satisfied with their EE Savings week products gave several reasons. These are addressed in turn by kit measure:

- Of those who felt less than satisfied with the smart LED bulb (n=26), many reported problems with the app (n=4). Others had not used the bulb (n=3) or gave it away (n=2). Finally, there were some respondents (n=3) that gave specific issues with the function of the bulb (it did not connect, had a pulsing light, etc.). Eight respondents answered, "Not sure."
  - Of those who installed the smart LED bulb (n=91), 59% use an app to control it. The remaining 41% of respondents answered that they do not use an app.
- Of the respondents who were less than satisfied with the desk lamp (n=8), most (n=3) said that they did not like the design or look of it.
- Eight respondents were less than satisfied with the LED night lights, and some respondents (n=3) attribute this to the LED not being bright enough.
- Six respondents were less than satisfied with the advanced power strip, and most of them (n=4) said that the smart strip was difficult to use.
- Of the respondents who were less than satisfied with the downlight fixtures and retrofit kits (n=5), some said that the fixtures in the kit did not fit in the place of the old fixtures (n=2).

Thermostat Satisfaction

As seen in the Verified Savings section of this chapter, most respondents who bought a thermostat from the Marketplace installed it in their home (77%). Of those who said that they did not install their thermostat (n=16), only four said they did not plan to install them at all in the future. Three out of those four said that this was due to the thermostat being incompatible with their HVAC equipment.

Thermostat customers were generally satisfied with their purchase, with 71% of respondents stating that they were very satisfied with the product (Figure 48). Only one respondent said they were dissatisfied.

Figure 48. 2023 Residential Online Marketplace Program Wi-Fi Thermostat Satisfaction

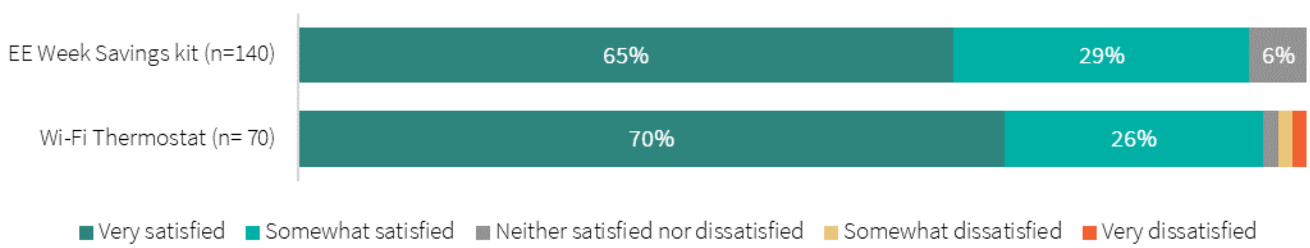
Source: Residential Online Marketplace Participant Survey Question G6. "How satisfied or dissatisfied are you with the smart thermostat you purchased from the Online Marketplace overall?"

Respondents giving neutral or dissatisfied answers said that they had not had the chance to install or use the thermostat (n=5); the function of the thermostat was not compatible with the home/customer preference (n=2); the respondent had issues with installation (n=1); or the thermostat did not work (n=1).

Overall Program Satisfaction

Across measures, around two-thirds of respondents were very satisfied with the NIPSCO Online Marketplace overall (Figure 49). This was generally lower than the individual measure satisfaction (the average "very satisfied" level across measures was around 74%). However, only two respondents were somewhat or very dissatisfied with the Online Marketplace overall, and both were thermostat customers.

Figure 49. 2023 Residential Online Marketplace Program Overall Satisfaction

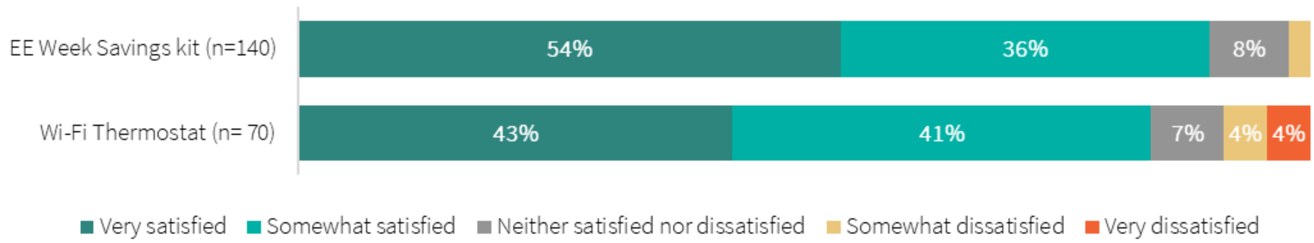


Source: Residential Online Marketplace Participant Survey Question J2. "How satisfied are you with the NIPSCO Online Marketplace overall?"

NIPSCO Satisfaction

Across measures, most respondents were either somewhat or very satisfied with NIPSCO overall as their energy service provider. Of the EE Week Savings kit participants (n=140), 90% were somewhat or very satisfied with NIPSCO. Similarly, 84% of respondents who bought Wi-Fi thermostats were somewhat or very satisfied. A greater percentage of thermostat recipients were less than satisfied with NIPSCO (15%), compared to the EE Week Savings kit recipients (10%).

Figure 50. 2023 Residential Online Marketplace Program Satisfaction with NIPSCO



Source: Residential Online Marketplace Participant Survey Question J5. "How satisfied are you with NIPSCO overall as your energy service provider?"

Customers who were less than satisfied with NIPSCO (n=20) felt that their bills were too high/NIPSCO charges too much (n=12); customers have no other choice for their service provider (n=6); or other, specific reasons, including difficulty reaching someone at NIPSCO unless it is an emergency and that "NIPSCO doesn't do anything about energy efficiency." (n=2).

Suggestions For Improvement

There were 32 respondents who provided suggestions to improve the Online Marketplace. Like in 2022, the most common suggestion this year was a desire for more options or a wider variety of products available on the Online Marketplace (44%). These themes are described in more detail in Table 170 below.

Table 170. 2023 Residential Online Marketplace Suggestions for Improvement

THEME	COUNT	PERCENT	REPRESENTATIVE QUOTE
Greater product variety/selection	14	44%	*"Offer safety items like smoke and gas detectors.*
Better online functionality	4	13%	*"Navigation was tricky."*
Better pricing of the products	3	9%	*"Offer better deals."*
Allow purchasing of more products on the Marketplace	2	6%	*"Please allow customers to purchase more than 1 kit."*
Increase customer awareness of the Marketplace to customers	2	6%	*"I would try to find a way to make [the Marketplace] more visible to consumers/advertise. I only happened upon it by chance, and none of my co-workers had any idea it existed."*
Provide more information on systems compatible with the products	2	6%	*"They should let consumers know if [the product] needs professional installation and what they are compatible with."*
Other (specific issues, requests for other programs, etc.)	6	19%	
	35*	100%	

Source: Residential Online Marketplace Participant Survey Question J4. "Do you have any suggestions for how to improve NIPSCO's Online Marketplace?" *The number of responses is greater than the number of respondents to this question (n=32) because some respondents offered more than one suggestion.

Participant Survey Demographics

Most respondents (87%) live in a single-family home and 92% own their home. The household size of survey respondents was mostly two (40%) or one (25%), and half of the respondents had lived in their homes for more than ten years (50%). Respondents' homes varied in age, though almost a quarter of homes were built between 1960 and 1979.

Most respondents (41%) were born between 1960 and 1970, though a large proportion (38%) were born between 1940 and 1959. Most respondents (84%) identified as white, and almost all respondents (95%) primarily speak English at home.

Most respondents (24%) reported an annual household income of $75,000 to under $100,000, and another 20% reported an annual income of $50,000 to under $75,000.

Additional detail on participant demographics can be found in *Appendix 11. Residential Online Marketplace Program Participant Survey Demographics and Home Characteristics*.

Conclusions and Recommendations

CONCLUSION 1: SAVINGS FROM LED LIGHTING WERE GREATLY REDUCED IN 2023 DUE TO DOE ENFORCEMENT OF EISA BACKSTOP LEGISLATION IN JULY 2023.

The quantity and selection of LED lighting that was incentivized through the Residential Online Marketplace in 2023 was greatly reduced due to the EISA backstop legislation. Pre-EISA-level savings were granted *ex post* through June 30, 2023, but after that date, the only lighting savings considered for *ex post* were savings associated with connected LED wattages and for EISA-exempt fixture types.

Recommendations:

- Connected LEDS and desk lamps/task lighting can continue to be offered in 2024, but most varieties of residential LEDs lighting will be EISA-impacted and therefore ineligible for claimed savings.

CONCLUSION 2: REALIZATION RATES FOR W-FI-THERMOSTATS WERE HIGH DUE TO *EX POST* ALGORITHM USING HEATING AND COOLING ENERGY SAVINGS FRACTIONS FROM THE 2023 BILLING ANALYSIS.

The evaluation team used inputs from the billing analysis in *ex post* gross calculations for Wi-Fi thermostats, including the cooling energy savings fraction and the heating energy savings fraction, which were higher than the inputs used in *ex ante* savings and therefore reduced *ex post* gross savings.

The in-service rate for Wi-Fi thermostats in 2023 was 77%, decreasing from 91% in 2022, but 79% in 2021. It should be noted that the evaluation team did not apply an ISR to the *ex post* savings because the ISR is embedded in the billing analysis results.

Recommendations:

- Apply inputs and deemed savings values from the 2023 billing analysis to all Wi-Fi thermostats, and do not apply an ISR to the *ex ante* savings, as this is already accounted for in the billing analysis results.
- Consider prioritizing a re-evaluation of the thermostat billing analysis within the EE Rebates program in the next 3-year cycle, to update savings inputs.

CONCLUSION 3: THE SMART PLUG MEASURE HAD VERY LOW PARTICIPATION AND WAS GRANTED ZERO *EX POST* SAVINGS BECAUSE VALID SOURCES OF SAVINGS COULD NOT BE IDENTIFIED.

Ex ante savings for smart plugs 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, the team granted zero *ex post* savings for the measure. Twelve smart plugs were sold through the online marketplace in 2023, as opposed to 34 in 2022. While the overall impact of removing these savings is small, 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.

CONCLUSION 4: THE LACK OF CUSTOMER HEATING FUEL TYPE IN THE TRACKING DATA FOR KIT LEDS AND SMART LEDS LED THE EVALUATION TEAM TO MAKE ASSUMPTIONS REGARDING THERM PENALTIES FOR LED MEASURES.

Within the tracking data for this program, there is a lack of clarity on customer heating fuel types which impacts the evaluation team's ability to correctly assign therm penalties. Because the tracking data does not consistently identify the customer's actual fuel service from NIPSCO, the evaluation team is forced to make assumptions which could lead to inaccurate assignment of therm penalties.

For example, for the smart LEDs, LED string lights, lighting measures within the EE Week Savings Kit (Smart LED and desk lamps), as well as all the LED add-on measures, there was no heating fuel designation in the tracking data so the evaluation team made the conservative assumption that all Smart LED and kit customers were dual fuel customers and therefore assigned therm penalties for all LED kit measures during the *ex post* gross step.

Recommendations:

- Identify customers as electric, gas, or combo customers in the tracking data for OLM and all other NIPSCO programs, so savings can be accurately assigned. This will allow the evaluation team to confirm *ex ante* savings and assign accurate savings to customers.
- Include water heating fuel and home heating fuel, which are both required inputs during the OLM check-out process, for every measure in the tracking data.
- Include therm penalties in the tracking data and consistently apply these for all lighting measures installed in natural gas heated homes.

CONCLUSION 5: THE MOST IMPACTFUL WAY TO INCREASE AIR PURIFIER SAVINGS IS TO SELECT MODELS WITH HIGH SMOKE CLEAN AIR DELIVERY RATE (CADR) PER WATT AND AT THE BOTTOM OF EACH CADR SIZE RANGE.

The low CADR per watt of the air purifier model offered through the OLM resulted in a realization rate below 100%. The calculation for the air purifier model sold through the OLM is heavily dependent on the unit's rated smoke CADR per watt. The smoke CADR per watt of the unit sold in 2023 was 3.1. If the OLM had sold a model like what was incentivized in the Lighting program, ENERGY STAR ID 2390582, for example, with a smoke CADR per watt of 5, the *ex post* savings would increase by over 40%.

Recommendations:

- Determine the calculated savings of various air purifier models using the ENERGY STAR qualified products list, to determine the models that will bring the most savings to the program, and then offer those specific model numbers on the OLM.

CONCLUSION 6: EMAILS FROM NIPSCO AND LOW PRICES DRIVE PARTICIPATION IN THE ONLINE MARKETPLACE.

Like in previous evaluation years, emails from NIPSCO were the leading source of awareness for the Online Marketplace for the most common measures purchased. Other common sources were the NIPSCO website and NIPSCO bill inserts.

Lower prices were also a primary motivation to use the Online Marketplace. Many survey respondents were interested in buying their measures to receive energy efficient devices for free or at a reduced cost, and the NIPSCO discount was the most important factor on respondents' decisions to buy their measure specifically from the OLM.

While most respondents had no suggestions to improve the Online Marketplace, some respondents commented that they wished the Marketplace was more visible. One respondent commented, *"I would try to find a way to make [the Marketplace] more visible to consumers/advertise. I only happened upon it by chance, and none of my co-workers had any idea it existed."* This is consistent with feedback collected last year.

Recommendations:

- Continue to promote the Online Marketplace through customer email, as it is the strongest channel for Marketplace participation. Emphasize how prices on the Online Marketplace may be lower than other retailers, as this continues to be a primary participation driver.
- Consider sending re-engagement emails to customers who have already bought Online Marketplace products, reminding them of limited time offers.
- Consider increasing the marketing presence of the Online Marketplace on other common sources of information, like bill inserts or the NIPSCO website.

CONCLUSION 7: THE ONLINE MARKETPLACE DOES NOT APPEAR TO PROMOTE PARTICIPATION IN OTHER NIPSCO PROGRAMS.

Most survey respondents were aware that NIPSCO offers other energy efficiency programs, with the most common being the Home Energy Assessment (HEA), Appliance Recycling, and Home Rebates programs. Despite high awareness, most of these respondents had not participated in any other programs besides the Online Marketplace.

Recommendations:

- Consider more opportunities to cross-channel customers of the Online Marketplace to other EE programs, or vice versa. For example, remind customers who complete a Home Energy Assessment that they can buy products from the Online Marketplace for their specific needs at a typically lower price.

CONCLUSION 8: RESPONDENTS CONTINUED TO BE SATISFIED WITH ONLINE MARKETPLACE PRODUCTS AND WITH NIPSCO.

Most respondents were somewhat or very satisfied with products from the Online Marketplace, though satisfaction with both the thermostats and the kits decreased slightly compared to 2022. The most common suggestion for improvement of the Online Marketplace was to offer a greater variety or selection of products.

Across measures, most respondents were either somewhat or very satisfied with NIPSCO overall as their energy service provider.

CONCLUSION 9: MANY RESPONDENTS DID NOT CORRECTLY USE "SMART" PRODUCTS.

Of the EE Savings Week kit measures, the Smart LED bulb had the lowest number of respondents who were very satisfied (61%) and only 59% of respondents who installed the bulb use the app to control it. Survey respondents in 2023 also reported having difficulties with the app for the smart LED bulb. Similarly, some customers reported confusion with the smart power strip in the kit. These issues with the bulb and the strip coincide with those reported last year.

Recommendations:

- Include instructional materials on these measures in the kits. The evaluation team recommends 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.
- Emphasize in the instructional materials for smart LEDs that customers should use the app to achieve greater energy savings than if they do not use the app.
- Offer more types of kits that are more customizable to the customer. For example, offer an LTO with "smart" products and an LTO with traditional products.

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. NIPSCO offers the following programs to nonresidential customers.

Custom program. The Custom program offers incentives for nonprescriptive projects that involve more complex technologies or equipment changes than are covered in the Prescriptive program. Custom incentives are based on a project's estimated electric or natural gas energy savings.

Schools Strategic Energy Management (SEM) program. The Schools SEM program started in 2022. SEM is a method to operate educational buildings efficiently and effectively. Energy is a cost that can be managed with a plan and SEM integrates energy management into everyday business and operations practices. This results in persistent energy savings. School districts form teams that are coached to maximize the performance within their facilities. School districts 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.

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.

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.

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 participating customers can also apply for Prescriptive and Custom program incentives for equipment that falls outside the scope of the SBDI program. Approved SBDI trade allies identify potential projects.

Trade allies walk through customer sites and identify potential measures to add or replace, presenting findings to the customer and obtaining permission to install energy-efficient measures. Once approval is obtained, the trade ally installs the measures.

Commercial Online Marketplace. This program is discussed in a separate chapter of this report.

Changes from 2022 Design

The program designs were essentially the same as in 2022. Partway through the program year in 2023, to encourage higher participation, the Prescriptive and Custom programs offered an additional 10% bonus over established incentive amounts for projects completed between April 1 and October 1, 2023, then increased it to a 20% bonus if the project was completed between October 1 and December 31, 2023. Similarly, the SBDI program offered an additional 25% bonus for projects completed during April 1 to December 31, 2023.

Program Performance

The C&I programs attracted 719 unique customer participants in 2023, as compared to 711 in 2022, 810 in 2021, and 847 in 2020. Unique customer participants were identified as the count of unique parent project site identification within the 2023 population. The participant counts offered in the program descriptions below sum to greater than 719 because some customers participated in more than one C&I program. Those customers are counted where they participated in each program but are only counted once in the cumulative C&I portfolio customer count. Comparing the *ex post* gross savings with savings goals, the C&I portfolio fell short of its electric goals at the portfolio level, achieving 82% of electric energy savings, and 69% of peak demand savings. The portfolio met its natural gas goal at 104% of natural gas savings. The gross goal achievement varied by program and fuel type:

- The **Custom program** fell short of its electric energy and demand savings goals (62% and 13% respectively). Gas goal achievement was relatively high (93%). Goal levels for this program were largely unchanged from 2022. The program experienced a 26% increase in *ex ante* electric savings and 12% increase in *ex ante* gas savings in 2023 as compared to 2022. The program made up approximately 32% of the C&I portfolio based on *ex ante* electric savings and attracted 227 unique customers to participate.
- The **Schools Strategic Energy Management (SEM)** program was new in 2022 and is gradually increasing participation. The program exceeded the electric energy and peak demand saving goals (122% and 154% respectively). The program did not achieve any gas savings, despite its goal of 7,840 therms. The program made up just 1% of the C&I portfolio based on *ex ante* electric savings, and a single school district made up the participation in the program.
- The **New Construction program** dramatically overachieved all goals (555% of electric energy savings, 818% of peak demand savings, and 340% of natural gas savings). The goal achievement results, and goal thresholds were similar to 2022. The New Construction program was the highest electric saving C&I program in 2023, achieving higher *ex ante* electric savings than either the Custom or Prescriptive programs, and doubling *ex ante* electric savings from the New Construction program in 2022. The program made up approximately 36% of the C&I portfolio based on *ex ante* electric savings and attracted 101 unique customers to participate.
- The **Prescriptive program** fell short of its electric energy and demand savings goals (47% and 51% respectively) and had the lowest gas goal achievement among these programs (31%). All goals for this program remained very similar to 2022, however the program experienced a 21% reduction in *ex ante* electric savings in 2023 as compared to 2022. Despite not reaching its goal, gas savings achieved in 2023 were significantly higher than in 2022 (demonstrating a 257% increase). The program made up approximately 28% of the C&I portfolio based on *ex ante* electric savings and attracted 425 unique customers to participate.
- The **SBDI program** fell short of its electric energy and peak demand savings goals (89% and 94% respectively). The program did not achieve any gas savings, despite its goal of 248,150.66 therms. The demand savings goal for this program decreased from 2022, while all other goals remained similar to 2022. The program experienced a notable increase in *ex ante* electric savings from 2022 (over one million kWh increase resulting in 172% of 2022 *ex ante* electric savings). The program made up just 3% of the C&I portfolio based on *ex ante* electric savings and attracted 108 unique customers to participate.

Table 171 summarizes savings for 2023 program performance, including savings goals. Total *ex ante* savings of 74,929,257 kWh in 2023 represented an increase over 2022 *ex ante* savings of about 60 million kWh and 2021 *ex ante* savings of about 52 million kWh. Total *ex ante* demand reduction of 9,368 also demonstrated an increase over 2022 *ex ante* demand reduction of 8,480 kW and 2021 demand reduction of 6,921 kW. There was moderate growth in *ex ante* therms savings year over year, growing from 1,445,286 therms in 2022, to 1,527,816 therms in 2023.

Table 171. 2023 C&I Programs Saving Summary

METRIC	GROSS SAVINGS GOAL	*EX ANTE*	AUDITED	VERIFIED	*EX POST* GROSS	*EX POST* NET	*EX POST* GROSS GOAL ACHIEVE-MENT
Custom Program							
Electric Energy Savings (kWh/yr.)	37,480,553.00	24,332,557.50	24,332,557.50	24,332,557.50	23,302,902.36	17,710,205.79	62%
Peak Demand Reduction (kW)	4,417.435	605.314	605.314	605.314	567.214	431.083	13%
Natural Gas Energy Savings (therm/yr.)	600,874.96	552,740.74	552,740.74	552,740.74	560,489.66	425,972.14	93%
Schools SEM Program							
Electric Energy Savings (kWh/yr.)	468,805.00	581,116.72	581,116.72	572,099.28	572,099.28	572,099.28	122%
Peak Demand Reduction (kW)	92.563	149.732	149.732	142.101	142.101	142.101	154%
Natural Gas Energy Savings (therm/yr.)	7,839.48	-	-	-	-	-	0%
New Construction Program							
Electric Energy Savings (kWh/yr.)	4,688,050.00	26,813,891.38	26,813,891.11	26,259,011.38	25,997,162.85	13,518,524.68	555%
Peak Demand Reduction (kW)	502.189	4,204.870	4,204.870	4,107.766	4,108.398	2,136.367	818%
Natural Gas Energy Savings (therm/yr.)	251,232.27	865,298.22	865,298.22	865,298.22	853,983.41	444,071.37	340%

METRIC	GROSS SAVINGS GOAL	*EX ANTE*	AUDITED	VERIFIED	*EX POST* GROSS	*EX POST* NET	*EX POST* GROSS GOAL ACHIEVE-MENT
Prescriptive Program							
Electric Energy Savings (kWh/yr.)	43,946,641.36	20,670,499.61	20,670,499.61	20,670,499.61	20,605,024.42	16,277,969.29	47%
Peak Demand Reduction (kW)	8,077.250	4,089.794	4,089.794	4,089.794	4,079.444	3,222.761	51%
Natural Gas Energy Savings (therm/yr.)	367,168.18	109,777.00	109,777.00	109,777.00	112,668.75	89,008.31	31%
SBDI Program							
Electric Energy Savings (kWh/yr.)	2,832,573.64	2,531,192.20	2,531,192.20	2,531,192.20	2,530,178.47	1,543,408.87	89%
Peak Demand Reduction (kW)	330.348	318.346	318.346	318.346	310.733	189.547	94%
Natural Gas Energy Savings (therm/yr.)	248,150.66	-	-	-	-	-	0%
Total C&I Portfolio [a]							
Electric Energy Savings (kWh/yr.)	89,416,623.00	74,929,257.41	74,929,257.14	74,365,359.97	73,007,367.37	49,622,207.91	82%
Peak Demand Reduction (kW)	13,419.785	9,368.056	9,368.056	9,263.321	9,207.889	6,121.858	69%
Natural Gas Energy Savings (therm/yr.)	1,475,265.55	1,527,815.96	1,527,815.96	1,527,815.96	1,527,141.82	959,051.83	104%

[a] 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 172 outlines the *ex post* gross and net-to-gross (NTG) adjustment factors. The evaluation team developed NTG ratios through survey data collected from the 2023 C&I participant survey, as described in the *Ex Post* Gross Savings section. Realization rates were relatively high throughout all programs, ranging from 94% - 103%. For programs that were surveyed, NTG values range from 52% - 79%.

Table 172. 2023 C&I Programs Adjustment Factors

METRIC	REALIZATION RATE (%)[a]	FREERIDERSHIP	SPILLOVER	NTG (%)[b]
Custom Program				
Electric Energy Savings (kWh/yr.)	96%	24%	0%	76%
Peak Demand Reduction (kW)	94%			
Natural Gas Energy Savings (therms/yr.)	101%			
SEM Program				
Electric Energy Savings (kWh/yr.)	98%	0%	0%	100%
Peak Demand Reduction (kW)	95%			
Natural Gas Energy Savings (therms/yr.)	N/A			
New Construction Program				
Electric Energy Savings (kWh/yr.)	97%	48%	0%	52%
Peak Demand Reduction (kW)	98%			
Natural Gas Energy Savings (therms/yr.)	99%			
Prescriptive Program				
Electric Energy Savings (kWh/yr.)	100%	21%	0%	79%
Peak Demand Reduction (kW)	100%			
Natural Gas Energy Savings (therms/yr.)	103%			
SBDI Program				
Electric Energy Savings (kWh/yr.)	100%	39%	0%	61%
Peak Demand Reduction (kW)	98%			
Natural Gas Energy Savings (therms/yr.)	N/A			
Total C&I Programs				
Electric Energy Savings (kWh/yr.)	97%	32%	0%	68%
Peak Demand Reduction (kW)	98%			
Natural Gas Energy Savings (therms/yr.)	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.

At the C&I portfolio level, NIPSCO spent 84% of its electric and nearly 100% of its natural gas budgets in 2023. The proportion of spending aligned with performance towards savings goals at the portfolio level. Within programs, most were under or at budget, some (New Construction) exceeded their budgets significantly. Table 173 lists the 2023 program budgets and program trackable expenditures by fuel type.

Table 173. 2023 C&I Programs Expenditures

FUEL	PROGRAM BUDGET	PROGRAM EXPENDITURES	BUDGET SPENT (%)
Custom Program			
Electric	$5,589,776.20	$3,983,210.69	71%
Natural Gas	$885,492.69	$758,337.03	86%
SEM Program			
Electric	$69,106.34	$83,175.19	120%
Natural Gas	$11,127.78	$441.03	4%
New Construction Program			
Electric	$680,934.56	$3,513,755.68	516%
Natural Gas	$370,234.00	$1,127,771.11	305%
Prescriptive Program			
Electric	$6,420,167.24	$2,966,824.01	46%
Natural Gas	$413,509.57	$147,342.55	36%
SBDI Program			
Electric	$383,665.92	$489,495.33	128%
Natural Gas	$370,478.10	$14,683.41	4%
Total C&I Programs			
Electric	$13,143,650.26	$11,036,460.91	84%
Natural Gas	$2,050,842.14	$2,048,575.14	100%

Evaluation Methodology

To inform the 2023 impact and process evaluation, the evaluation team completed the following research activities:

- **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=83),** to understand the participant experience in the program and to gather information to calculate freeridership and spillover rates.

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)?
- Are tracking database savings sourced with proper documentation?

For all measure categories, 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 v11.0, 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 checked the program tracking data for 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. Examples include wattages, quantities, square footage, and other metrics that might have differed between *ex ante* calculations and the application data. To determine audited and verified savings, the team used the same method of savings calculation used for the reported *ex ante* savings.

Ex Post Gross Savings

The evaluation team adjusted 2023 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 customer interviews, online schedules, posted store schedules, logged data, IL TRM v11.0 values for the building type or equipment type.
- Coincident factors (CFs) consistent with the IL TRM v11.0.
- Methodologies or simple calculation methods from the IL TRM v11.0.

Impact Sampling Strategy

The evaluation team selected a representative sample of measures[63] for desk reviews and virtual audits, targeting a minimum of a 90% confidence interval with ±10% precision for each program across the two-year cycle. While results are presented at the C&I portfolio and individual program levels, this report is primarily organized by measure category to better illustrate measure category trends across all commercial programs.

The evaluation team classified measures into measure categories and stratified the sample into: (1) lighting measures and (2) non-lighting measures. The team further defined the measures by category within those groups, but estimated and extrapolated savings within the two broader groups.

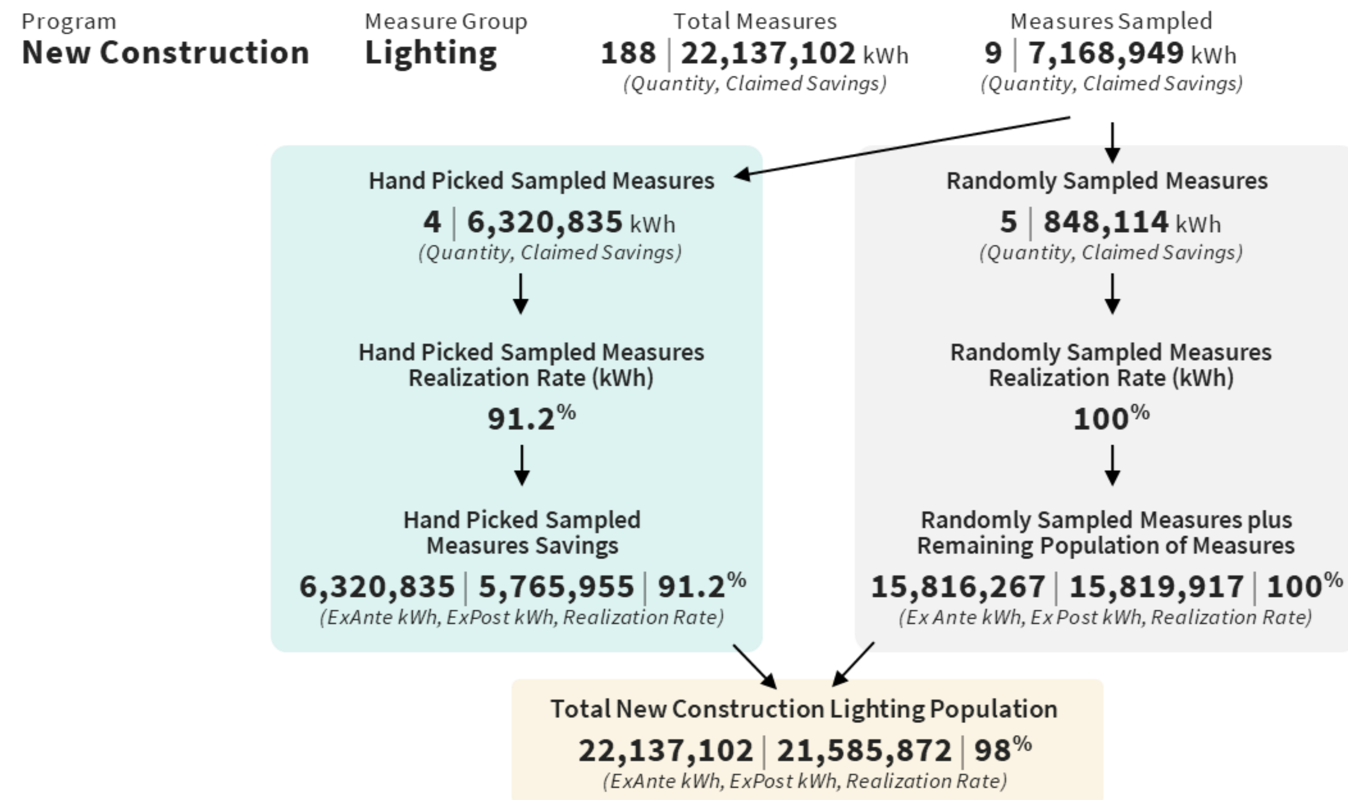
Out of the 2,897 unique measures in the population, the evaluation sample conducted an engineering review of 118 total unique measures, 23 through purposive (handpicked) sampling and 95 through proportional (random) sampling. All 118 measures received desk reviews and 45 additionally received virtual audits to confirm and support the desk review findings.

- The team proportionally sampled measures from the remaining measures by program, 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**. The evaluation team determined realization rates from randomly sampled measures by program and by two measure categories: lighting and non-lighting. Non-lighting is an aggregate of all measure categories excluding the lighting measure category. The realization rates determined by the random sample ex post gross results were applied to all non-sampled measures to determine cumulative ex post gross savings.
- For each program, the team purposively sampled 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 the highest saving measures were sampled) the results were not extrapolated to the population. These measures are referred to as **handpicked measures**. Handpicked measures received a realization rate specific to the individual measure, which were not extrapolated to the rest of the population. Ex post gross savings from handpicked measures were added to ex post savings from the rest of the population to determine the cumulative ex post savings for the program.

An outline of this methodology is shown in Figure 51, using the lighting measure category within the 2023 New Construction program to illustrate the example.

[63] Measures are defined as a unique line item in the implementer's tracking data, representing an incentivized measure installed by a customer account. A project could be composed of one or multiple measures. Bonus measures have been excluded from the measure count.

Figure 51. Example of 2023 C&I Programs Sampling Methodology (New Construction Program)



This report chapter breaks out measures into measure categories 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 categories beyond lighting and non-lighting groups by program.

Table 174 summarizes the number of evaluated measures and the proportion of *ex ante* program savings the evaluated measures represent by program. The 2023 C&I programs sample covered 21% of cumulative portfolio electricity savings and 48% of gas savings.

Table 174. 2023 C&I Combined Programs Sampled Measures by Program

PROGRAM	POPULATION MEASURES [a]	NUMBER OF SAMPLED MEASURES	SAMPLED HANDPICKED	SAMPLED RANDOM	NUMBER OF VIRTUAL SITE VISIT MEASURES	PERCENT *EX ANTE* ELECTRIC SAVINGS SAMPLED	PERCENT *EX ANTE* DEMAND SAVINGS SAMPLED	PERCENT *EX ANTE* GAS SAVINGS SAMPLED
Custom	548	33	2	31	19	12%	14%	44%
SEM	33	10	6	4	7	82%	85%	N/A
NC	392	24	7	17	13	31%	26%	54%
Prescriptive	1,624	31	3	28	6	16%	10%	25%
SBDI	300	20	5	15	-	14%	20%	N/A

[a] Excludes Bonus Measures. The total measure count is 3,704 including bonus measures. Measures are defined as a unique line item in the implementer's tracking data, representing an incentivized measure installed by a customer account. A project could be composed of one or multiple measures.

Table 175 summarizes the proportion of *ex ante* program savings the sampled measures represent. The lighting measure category was the largest measure category in 2023, and the sample captured 23% of total lighting electricity savings. The non-lighting measure category shows all other measures combined; the cumulative non-lighting sample captured 17% of electricity savings and 48% of gas savings. The evaluation team sampled 20% of C&I program s' lighting and 12% of C&I programs' non-lighting kW demand savings.

Table 175. 2023 C&I Combined Programs *Ex Ante* Sampled Measures

MEASURE CATEGORY	MEASURE COUNTS				TOTAL *EX ANTE* SAVINGS			SAMPLED *EX ANTE* SAVINGS & PROPORTION OF SAVINGS SAMPLED					
	TOTAL [a]	SAMPLE TOTAL	HAND PICKED	RANDOM	KWH	KW	THERMS	KWH	KWH %	KW	KW %	THERMS	THERMS %
Lighting	2,064	55	16	39	**47,180,294.44**	**8,390.076**	**-**	**10,834,066.00**	**23%**	**1,670.275**	**20%**	**-**	
Non-Lighting	833	63	7	56	**27,748,962.97**	**977.980**	**1,527,815.96**	**4,586,941.58**	**17%**	**114.123**	**12%**	**740,251.03**	**48%**
Building Redesign	5	-	-	-	116,291.00	-	-	-	0%	-		-	
Compressed Air	217	13	1	12	17,185,996.49	159.949	-	2,104,774.96	12%	66.548	42%	-	
Controls	48	4	-	4	1,994,930.25	-	16,534.00	491,993.03	25%	-		3,744.00	23%
HVAC	398	29	5	24	3,256,248.01	616.422	1,202,792.93	1,080,440.59	33%	25.672	4%	457,845.00	38%
Kitchen	9	2	-	2	75,762.00	11.972	629.00	36,864.00	49%	5.930	50%	629.00	100%
Motors	31	2	-	2	1,936,976.00	73.320	-	211,698.00	11%	-	0%	-	
Process	11	4	1	3	1,750,642.17	59.490	258,867.02	431,400.00	25%	-	0%	258,867.02	100%
Refrigeration	93	4	-	4	1,390,738.67	41.951	-	208,457.00	15%	8.501	20%	-	
Ventilation	9	3	-	3	40,100.38	14.804	41,505.01	20,036.00	50%	7.400	50%	18,586.01	45%
Water Heat	12	2	-	2	1,278.00	0.072	7,488.00	1,278.00	100%	0.072	100%	580.00	8%
Total	2,897	118	23	95	74,929,257.41	9,368.056	1,527,815.96	15,421,007.58	21%	1,784.398	19%	740,251.03	48%

* Excludes Bonus Measures. Total measure count is 3,704 including bonus measures.

Engineering Reviews, Realization Rates and *Ex Post* Gross Savings

The evaluation team completed engineering desk reviews on 118 measures for the 2023 C&I programs. The team sampled 93 unique customer sites (as defined by NIPSCO tracking data site codes) as a subset of the 118 evaluated measures. The evaluation team conducted project sampling waves three to four times per year for all C&I programs evaluated, providing opportunity for the implementer to make real-time adjustments. The following sections summarize the results of the engineering review by lighting and non-lighting measures.

Lighting Measures

All five C&I programs contained lighting measures. Table 176 documents the number of measures, sample sizes, and proportion of savings by each program. The team evaluated 55 lighting measures across the C&I programs.

Table 176. 2023 C&I Combined Programs Sampled Lighting Measures

PROGRAM	NUMBER OF MEASURES				PROPORTION OF PROGRAM SAVINGS EVALUATED		
	TOTAL	SAMPLED TOTAL	HAND PICKED	RANDOM	KWH	KW	THERMS
Custom	179	4	-	4	9%	15%	N/A
SEM	32	9	5	4	81%	84%	N/A
New Construction	188	9	4	5	32%	29%	N/A
Prescriptive	1,365	13	2	11	14%	9%	N/A
SBDI	300	20	5	15	14%	20%	N/A
Total	2,064	55	16	39	23%	20%	N/A

The reasons for *ex post* savings adjustments are detailed below, organized by interior and exterior lighting measures.

Lighting - Interior. Of the 55 total lighting measures evaluated this year, 43 were interior lighting measures. The evaluation team adjusted measure savings for the following reasons:

- *Ex ante* calculations excluded waste heat factors (WHFs) for interior lighting measures. The team calculated WHF therm penalties for cost-effectiveness testing but did not include them in *ex post* gross savings.
- The total square footage of one new construction lighting power density measure was adjusted to include only the new construction portion of the facility, rather than the existing plus new construction total square footage. The modification resulted in a 46% realization rate for both kWh and kW savings.
- There were a few changes to the coincidence factors (CFs) to better match the specific building type where measures were installed. In one instance, the lighting measure was installed on the exterior of the building, resulting in 0% realization rate for kW savings for the measure.

- 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 12 exterior lighting measures. All 12 achieved a 100% realization rate.

Table 177 shows the complete list of lighting measure subcategories in the 2023 C&I population. The sum of units refers to the type of units specified within the IL TRM v11.0 algorithms. Units can refer to the number of lamps, bulbs, fixtures, watts reduced, or linear feet reduced, depending on the specific measure subcategory algorithm. The sum of measures refers to the count of each measure subcategory installed as part of a completed project across all C&I programs. The team sampled at the measure level for each program, sampling 55 lighting measures (from the 2,064 total lighting measures.

Table 177. 2023 C&I Programs Lighting Measures by Subcategory

MEASURE SUBCATEGORY	SUM OF UNITS	SUM OF MEASURES	SUM OF SAMPLED MEASURES
Interior Lighting	**715,700**	**1,364**	**45**
250-309 lumens. Omnidirectional (3.5W)	20	1	
310-749 lumens. Omnidirectional (6W)	26	2	
Daylight Sensor (Indoor Only)	32,405	2	
Delamping 4 Ft Fluor.	1,644	16	1
Delamping 8 Ft Fluor.	669	10	
Dual Occupancy & Daylight Sensor (Indoor Only)	193,759	23	
Interior	6,322	109	8
Interior LED Replacing Inefficient Lighting	7,012	135	4
Interior Occupancy Sensor	112,327	8	
LED 1x4 Fixture Replacing 1-Lamp Fluor.	439	12	1
LED 1x4 Fixture Replacing 2-Lamp Fluor.	1,425	41	
LED 1x4 Fixture Replacing 3-Lamp Fluor.	307	8	1
LED 2x2 Fixture Replacing 2-Lamp Fluor.	726	34	1
LED 2x2 Fixture Replacing 3-Lamp Fluor.	58	4	
LED 2x4 Fixture Replacing 2-Lamp Fluor.	671	19	
LED 2x4 Fixture Replacing 3-Lamp Fluor.	4,253	34	2
LED 2x4 Fixture Replacing 4-Lamp Fluor.	5,755	126	4
LED Exit Sign Fixture with Battery Backup Replacing CFL or Incandescent Exit Sign	33	4	2

MEASURE SUBCATEGORY	SUM OF UNITS	SUM OF MEASURES	SUM OF SAMPLED MEASURES
LED Exit Sign Replacing CFL or Incandescent Exit Sign	132	20	
LED High Bay Replacing 4-Lamp Fluor.	1,954	34	1
LED High Bay Replacing 6-Lamp Fluor.	1,678	55	
LED High Bay Replacing 8-Lamp Fluor.	380	12	
LED Interior Replacing HID ≤ 175W Replacing HID ≤ 175W	200	13	
LED Interior Replacing HID 1000W Replacing HID 1000W	430	17	2
LED Interior Replacing HID 176-250W Replacing HID176-250W	147	5	1
LED Interior Replacing HID 251-400W Replacing HID 251-400W	1,613	80	3
LED Interior Replacing HID176-250W Replacing HID176-250W	103	4	
LED Low Bay Replacing 3-Lamp Fluor.	219	5	2
LED Tube Relamp Replacing 2 Ft Fluor.	791	15	
LED Tube Relamp Replacing 4 Ft Fluor.	108,148	378	2
LED Tube Relamp Replacing 4 Ft HO Fluor.	2,458	18	1
LED Tube Relamp Replacing 8 Ft Fluor.	1,612	60	
Lighting	1,975	32	8
Occupancy Sensor	226,009	28	1
Exterior Lighting	**123,935**	**700**	**10**
Exterior	5,704	79	1
Exterior LED Replacing Inefficient Lighting	410	42	
Exterior Occupancy Sensor	113,592	9	
LED Exterior Replacing HID ≤ 175W Replacing HID ≤ 175W	1,249	175	1
LED Exterior Replacing HID 1000W Replacing HID 1000W	228	30	2
LED Exterior Replacing HID 176-250W Replacing HID176-250W	211	45	1

MEASURE SUBCATEGORY	SUM OF UNITS	SUM OF MEASURES	SUM OF SAMPLED MEASURES
LED Exterior Replacing HID 251-400W Replacing HID 251-400W	1,896	250	3
LED Exterior Replacing HID176-250W Replacing HID176-250W	644	69	2
Others Exterior (Please Describe)	1	1	
Total	**839,635**	**2,064**	**55**

Table 178 shows the *ex ante* savings and the measure-specific realization rates from the sampled lighting measures in the 2023 C&I programs. For the lighting measure category, the team extrapolated the randomly sampled realization rates to the rest of the lighting population by program. Later in this chapter, Table 184 shows the complete set of extrapolated realization rates by program.

Table 178. 2023 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	HAND PICKED	RANDOM	HAND PICKED	RANDOM
Custom	275,051.76	63.163	-	N/A	100%	N/A	100%
SEM	448,245.08	118.393	-	98%	100%	97%	100%
New Construction	7,168,948.79	1,107.012	-	91%	100%	90%	100%
Prescriptive	2,578,066.22	318.072	-	100%	100%	100%	100%
SBDI	363,754.15	63.635	-	100%	100%	100%	97%
Total	10,834,066.00	1,670.275	-				

Figure 52 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 New Construction projects had the most variability. The SBDI and SEM projects tended to be smaller, while the New Construction projects were generally the largest.

Figure 52. 2023 C&I Programs Sampled Lighting Measures *Ex Ante* Impact and Realization Rates

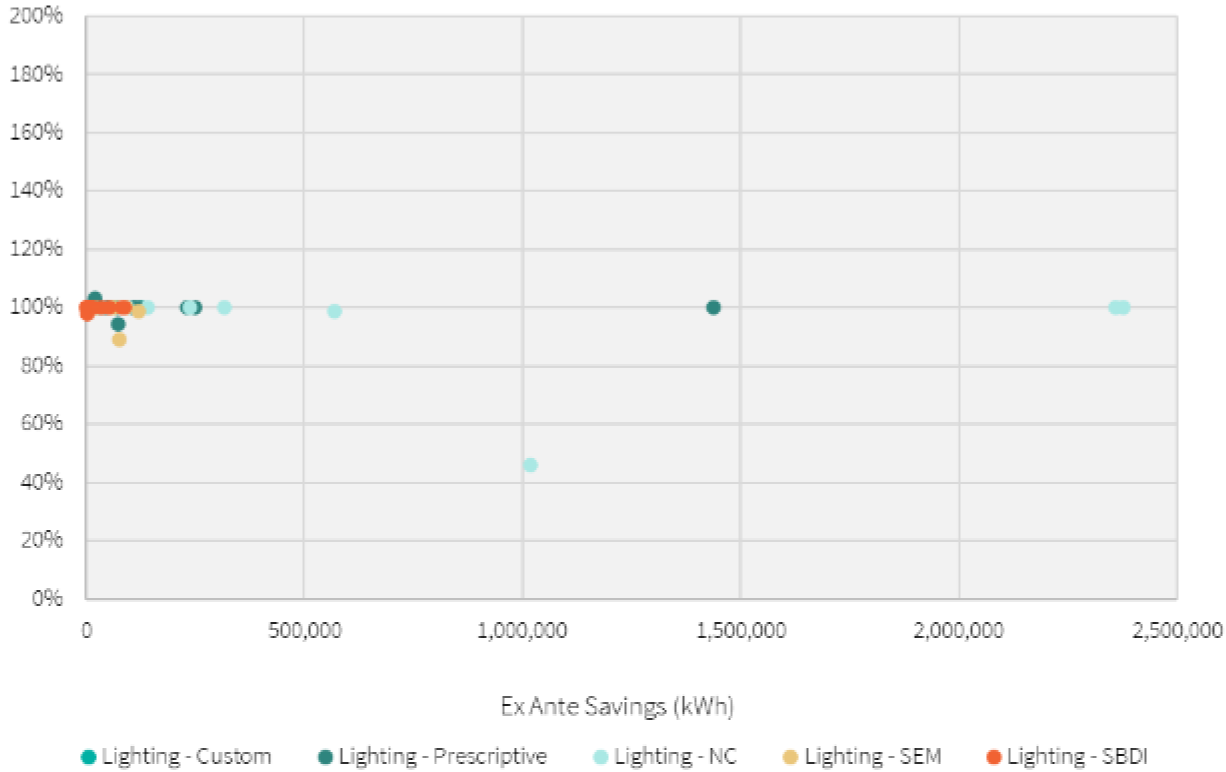


Table 179 highlights notable differences between *ex ante* and *ex post* gross savings from the measures sampled.

Table 179. 2023 C&I Programs Notable Differences Between *Ex Ante* & *Ex Post* Gross Sources

MEASURE CATEGORY	*EX ANTE* SOURCES AND ASSUMPTIONS	*EX POST* GROSS SOURCES AND ASSUMPTIONS	PRIMARY REASONS FOR DIFFERENCES
Lighting	*Ex ante* savings are from IL TRM v11.0 volume II C&I. Application data submitted provides the basis for calculation assumptions.	IL TRM v11.0 vol II C&I, information in program tracking data, and project application data provided. Customer provided data obtained from evaluation interviews. Therm waste heat factor penalties were determined as part of *ex post* calculations and are included in this report but are not incorporated into final *ex post* gross or net savings values.	kWh and kW savings align with *ex ante*, but the therm penalty differs. Slight modifications were made in *ex post* to CFs, HOUs, wattages and space types based on application data and customer interview data. In a single instance, a larger modification was made to total square footage of a new construction Lighting Power Density (LPD) measure.

Waste Heat Factor - Therm Penalties

Waste heat factors (WHF) are adjustments applied to lighting measures to represent 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 both *ex ante* and *ex post* savings.

In discussions with NIPSCO, the evaluation team did not include negative therm WHFs in *ex post* therm calculations. However, Table 180 shows the therm penalties included in cost-effectiveness calculations. This table shows the therm penalties calculated for randomly sampled and handpicked interior lighting projects and the proportions of those penalties when compared to cumulative population interior lighting savings. The team applied these to the remaining unsampled interior lighting projects and summed them to derive the total therm penalty estimates for all programs. Between handpicked and randomly sampled measures, there was a -111,851 therm penalty from sampled interior lighting measures. When extrapolated to the remaining population of interior lighting measures, the total therm penalty is -537,526 therms for the entire C&I portfolio.

Table 180. 2023 C&I Programs Waste Heat Factor Penalties

PROGRAM	WASTE HEAT FACTOR THERM PENALTY	
	EX ANTE	*EX POST*
Custom	-	(14,053.85)
SEM	-	(6,991.09)
New Construction	-	(329,751.23)
Prescriptive	-	(170,936.84)
SBDI	-	(15,792.87)
Total C&I Portfolio	-	(537,525.88)

Non-Lighting Measures

The evaluation team sampled at least one measure from most non-lighting measure categories across the five C&I programs. Only building redesign projects were not represented in the random or handpicked samples.

Table 181 lists the number of measures, savings, and sample sizes for each program. The team evaluated 63 non-lighting measures, representing a range of measure categories. HVAC measures constituted the greatest proportion of non-lighting measure categories (n=29), followed by compressed air (n=13), refrigeration, process, and controls (each n=4).

Table 181. 2023 C&I Programs Sampled Non-Lighting Measures

MEASURE CATEGORY /PROGRAM[a]	NUMBER OF MEASURES				SAMPLED *EX ANTE*			PROPORTION OF PROGRAM SAVINGS EVALUATED		
	TOTAL	SAMPLE TOTAL	HAND PICKED	RANDOM	KWH	KW	THERMS	KWH	KW	THERM
Compressed Air										
Custom	200	9	-	9	1,552,647.00	11.890	-	10%	75%	N/A
NC	5	1	-	1	108,482.40	-	-	20%	0%	N/A
Prescriptive	12	3	1	2	443,645.56	54.658	-	60%	43%	N/A
Controls										
Custom	42	3	-	3	491,993.03	-	-	27%	N/A	0%
NC	6	1	-	1	-	-	3,744.00	0%	N/A	55%
HVAC										
Custom	85	10	2	8	82,434.00	9.368	214,789.00	10%	11%	43%
SEM	1	1	1	-	27,882.86	8.534	-	100%	100%	N/A
NC	134	8	2	6	920,987.00	-	215,356.00	50%	0%	36%

MEASURE CATEGORY /PROGRAM[a]	NUMBER OF MEASURES				SAMPLED *EX ANTE*			PROPORTION OF PROGRAM SAVINGS EVALUATED		
	TOTAL	SAMPLE TOTAL	HAND PICKED	RANDOM	KWH	KW	THERMS	KWH	KW	THERM
Prescriptive	178	10	-	10	49,136.73	7.770	27,700.00	9%	4%	25%
Kitchen										
Custom	1	1	-	1	-	-	629.00	N/A	N/A	100%
Prescriptive	8	1	-	1	36,864.00	5.930	-	49%	50%	N/A
Motors										
Custom	14	1	-	1	98,481.00	-	-	9%	0%	N/A
NC	17	1	-	1	113,217.00	-	-	14%	N/A	N/A
Process										
Custom	7	2	-	2	431,400.00	-	7,047.30	35%	0%	100%
NC	4	2	1	1	-	-	251,819.72	0%	0%	100%
Refrigeration										
Custom	15	1	-	1	6,294.00	-	-	3%	0%	N/A
NC	25	1	-	1	65,026.00	-	-	10%	-	N/A
Prescriptive	53	2	-	2	137,137.00	8.501	-	25%	21%	N/A
Ventilation										
Custom	5	2	-	2	-	-	18,586.01	-	-	45%
Prescriptive	4	1	-	1	20,036.00	7.400	-	50%	50%	N/A
Water Heat										
NC	8	1	-	1	-	-	580.00	N/A	N/A	9%
Prescriptive	4	1	-	1	1,278.00	0.072	-	100%	100%	0%
Total					4,586,941.58	114.123	740,251.03			

[a] Table excludes Building Redesign, as that measure category was not sampled. The table includes data only for programs where measures were present.

The evaluation team adjusted savings for several of the sampled measures, which resulted in realization rates that deviated from 100%. The following paragraphs summarize the reasons for the most high-impact adjustments the evaluation team made.

Compressed Air

Compressed air sampled measures in 2023 included new VSD air compressor installations and compressed air leak repairs. Most of these measures received a 100% realization rate. The standard calculator tool for one air compressor replacement measure was adjusted to correct programming errors. All project specific inputs remained unchanged. The modification resulted in an electric realization rate of 67% for this measure.

Controls

Four controls measures were sampled in the 2023 population, all of which related to building automation system upgrades. All measures received a 100% realization rate.

HVAC

Furnace unit heater installations made up most of the sampled measures in the HVAC measure category. The savings claimed for these measures were supported by custom energy models. The team reviewed the energy model inputs against the application data and customer interview data collected through virtual site visits. The team adjusted the model when deviations were found, primarily from the application data rather than customer provided information. Examples of deviations include errors in data transcription, HOUs, setback temperatures and timing, and R values. The modifications to the models resulted in deviations from *ex ante* therms savings ranging from 78% - 147%.

There were several furnace or boiler replacement measures evaluated, most received a 100% realization rate. The EFLH was adjusted for one project based on the space type the unit was serving, confirmed by the application data and customer interview. The resulting therms realization rate was 67%. One boiler replacement measure was adjusted for the MBH provided by the application data. The resulting realization rate was 127%.

Two VSD installation measures resulted in at or near 100% realization.

The SEM program had one non lighting measure included in the 2023 population. The VSD installation on HVAC fan measure was handpicked to ensure the category was sampled. *Ex post* savings calculation results differed from *ex ante* in the kW demand savings calculation. The same source for the calculation was used in both, but it is likely that *ex ante* used different input values for peak load reduction (PLR) than *ex post*. PLR values used in *ex post* were supported by the application-provided data (discharge dampers to VFD at 90% flow fraction). Note that because this was the only sampled non-lighting measure for the program, the kW realization for the program was derived by this kW difference only, but the real impact of the kW demand savings reduction was very slight (4.6 kW).

There were two inefficient HVAC replacement measures sampled. One received a 100% realization rate. One was adjusted in several ways: an error was made in the savings calculation which was based on the IL TRM v11.0 prescriptive measure. *Ex post* adjustments were also made to the EER, CF, and capacity of the system based on the provided specification for the installed equipment and space type the equipment served.

The remaining HVAC measures consisted of steam trap leak fix/replacement, smart thermostat installation, pipe insulation and other gas savings measures, none of which had any modifications made to *ex ante* savings claimed.

Kitchen

Two kitchen measures were sampled, and both received a 100% realization rate (one for kWh, the other for therms savings).

Motors

Both sampled motors measures received near 100% electric realization rates.

Process

Four process measures were sampled. Two measures received 100% gas realization rates (one handpicked and one randomly selected). One small process measure was adjusted due to an error in calculating the mass of water in *ex ante* calculations. When corrected, the resulting gas realization rate was 107%. One electric process measure was adjusted to reduce the impact of the production rate of the efficient case, based on an error found in the *ex ante* calculations.

Refrigeration

Four refrigeration measures were sampled and all of them received 100% realization rates.

Ventilation

Three small ventilation measures were sampled, and two from the same customer were adjusted to correct the burner efficiency modeled in the baseline case. The measure configuration is such that baseline and efficient model cases should use the same assumed efficiency. The resulting therms realization rates were 71% for both measures.

Water Heat

Two water heat measures were sampled, one from each fuel type. Both received a 100% realization rate.

Non-Lighting Measure Category Summary

Table 182 shows the *ex ante* savings and the measure-specific realization rates from sampled non-lighting measures in the 2023 C&I programs. The team only applied measure-specific realization rates from the handpicked sampled projects to those specific projects and extrapolated the randomly sampled realization rates to the rest of the non-lighting population by program. Later in this chapter, Table 184 shows the complete set of extrapolated realization rates by program.

Table 182. 2023 C&I Programs Realization Rates for Sampled Non-Lighting Measures

PROGRAM	REALIZATION RATES (KWH)		REALIZATION RATES (KW)		REALIZATION RATES (THERMS)	
	HANDPICKED	RANDOM	HANDPICKED	RANDOM	HANDPICKED	RANDOM
Custom	N/A	95%	N/A	79%	107%	100%
SEM	102%	N/A	46%*	N/A	N/A	N/A
New Construction	100%	93%	N/A	N/A	100%	98%
Prescriptive	100%	100%	100%	100%	N/A	103%
SBDI	N/A	N/A	N/A	N/A	N/A	N/A

* Realization rate reported is based on a single handpicked measure. This measure is the only non-lighting measure in the CY 2023 SEM population.

Figure 53 and Figure 54 illustrate the distribution of realization rates for the individually sampled projects, by program and by fuel source. Most of the smaller impact electric measures realized close to 100% of kWh savings. The largest impact kWh measure (HVAC measure) realized 100% savings. The second largest kWh measure (process measure) had a slightly lower realization rate of 71%. Most of the largest kWh measures fell into the process, HVAC, controls, and refrigeration measure categories. There was more variability in deviations in therms realization rates, with most larger projects clustered at the 100% realization mark, but most smaller impact projects varying from 100%. While there was a larger deviation in the therms savings realization rates, the five largest impact measures received at or near 100% realization.

Figure 53. 2023 C&I Programs Sampled Non-Lighting Electric Measures *Ex Ante* Impact and Realization Rates

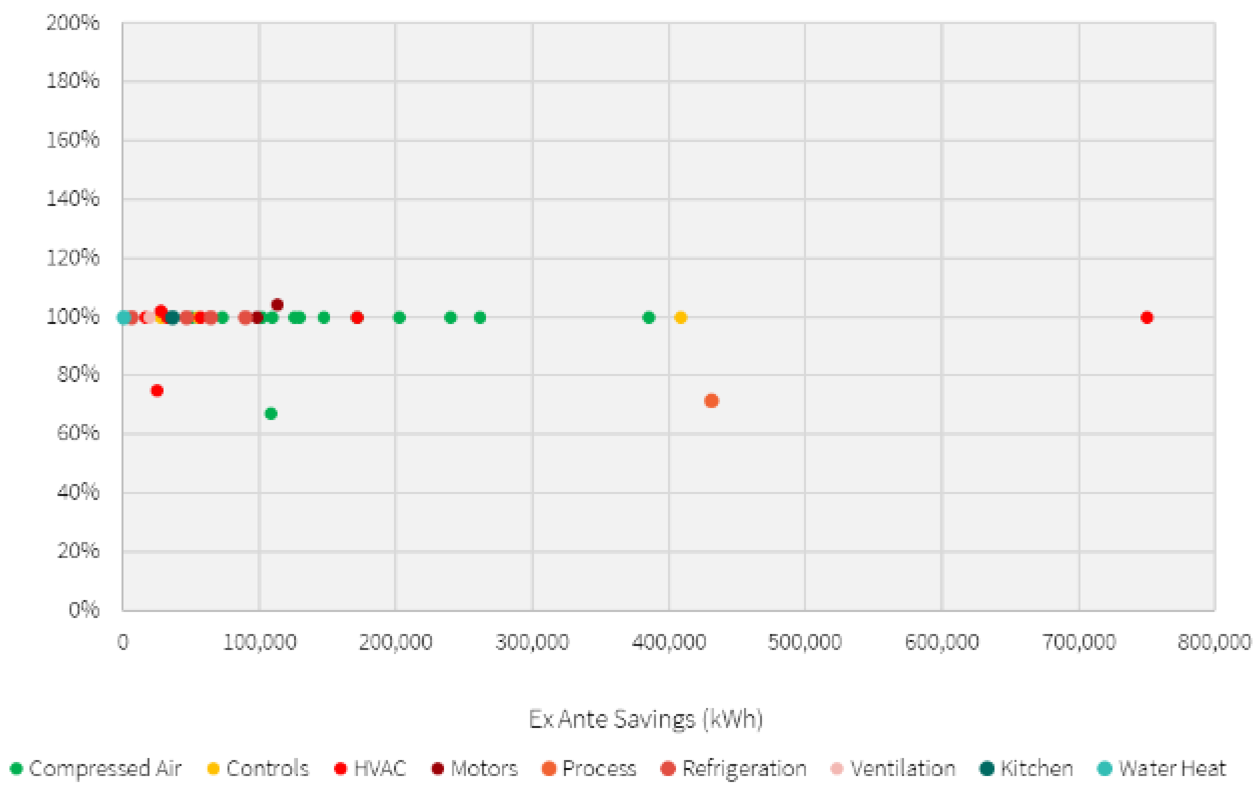


Figure 54. 2023 C&I Programs Sampled Non-Lighting Gas Measures *Ex Ante* Impact and Realization Rates

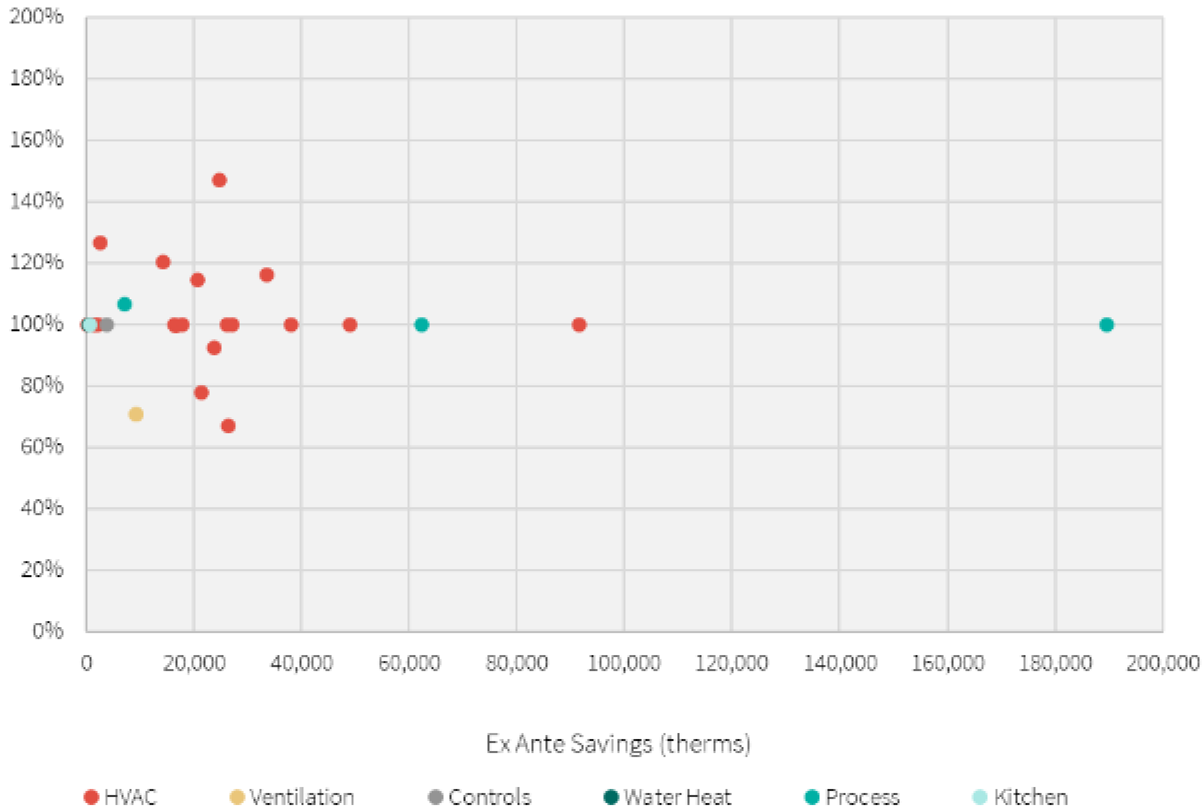


Table 183 summarizes notable differences between *ex ante* and *ex post* gross savings for sampled non-lighting measures.

Table 183. 2023 C&I Programs Notable Differences Between *Ex Ante* & *Ex Post* Gross Sources

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 v11.0 for VFD measures, and from WI TRM v2023 for compressed air system leak repair measures.	IL TRM v11.0 for VFD measures, and WI TRM v2023 for leak measures. All inputs were verified through project documentation, virtual site visits or interviews.	Modifications made to correct calculation errors in *ex ante* calculations.
Controls	*Ex ante* savings were determined by custom calculations.	Custom calculations. All inputs were verified through project documentation, virtual site visits or interviews.	No modifications were made to *ex ante* calculations.

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 v11.0 for all measures sampled except destratification furnaces which used modeling software to determine savings.	IL TRM v11.0 for all sampled measures except destratification furnace measures, which were verified through the modeling outputs provided. All inputs were verified through project documentation, virtual site visits or interviews.	Modifications made to EFLH, EER, CF temperature, HOU and capacity values, confirmed by application documentation and customer interviews. Modifications made to correct calculation errors in *ex ante* calculations.
Kitchen	*Ex ante* savings were determined by the IL TRM v11.0 and MI Energy Measures Database	IL TRM v11.0, and MI Energy Measures Database. All inputs were verified through project documentation, virtual site visits or interviews.	No modifications were made to *ex ante* calculations.
Motor	*Ex ante* savings were determined through custom calculations	Custom calculations. All inputs were verified through project documentation, virtual site visits or interviews.	No modifications were made to *ex ante* calculations.
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 made to correct calculation errors in *ex ante* calculations.
Refrigeration	*Ex ante* savings were determined by the IL TRM v11.0	IL TRM v11.0. All inputs were verified through project documentation, virtual site visits or interviews.	No modifications were made to *ex ante* calculations.
Ventilation	*Ex ante* savings were determined through custom calculations	Custom calculations. All inputs were verified through project documentation, virtual site visits or interviews.	Assumed baseline efficiency values were modified to reflect an accurate baseline comparison case
Water Heat	*Ex ante* savings were determined by the IL TRM v11.0	IL TRM v11.0. All inputs were verified through project documentation, virtual site visits or interviews.	No modifications were made to *ex ante* calculations.

Adjustment Summary – All C&I Measures

Table 184 provides the realization rates for lighting and non-lighting projects by each C&I program. The evaluation team determined cumulative realization rates by extrapolating the random sample realization rates to the full population. The handpicked realization rate has a greater effect on the cumulative realization rate when those projects are larger and constitute a greater portion of savings.

Table 184. 2023 C&I Programs Sample Realization Rates

PROGRAM/MEASURE CATEGORY	HANDPICKED SAMPLE REALIZATION RATE			RANDOM SAMPLE REALIZATION RATE		
	KWH	KW	THERMS	KWH	KW	THERMS
Custom Program						
Lighting	N/A	N/A	N/A	100%	100%	N/A
Non-Lighting	N/A	N/A	107%	95%	79%	100%
SEM Program						
Lighting	98%	97%	N/A	100%	100%	N/A
Non-Lighting	102%	46%	N/A	N/A	N/A	N/A
New Construction Program						
Lighting	91%	90%	N/A	100%	100%	N/A
Non-Lighting	100%	N/A	100%	93%	N/A	98%
Prescriptive Program						
Lighting	100%	100%	N/A	100%	100%	N/A
Non-Lighting	100%	100%	N/A	100%	100%	103%
SBDI Program						
Lighting	100%	100%	N/A	100%	97%	N/A
Non-Lighting	N/A	N/A	N/A	N/A	N/A	N/A

Summary C&I Program Realization Rates and *Ex Post* Gross Savings

Table 185 through Table 187 show the program's *ex ante* reported savings, verified savings, *ex post* gross savings and total program realization rates for kWh, kW, and therms.

As shown in Table 185, the lighting measure category achieved a high electric realization rate of 99%. Realization rates were generally very consistent across the non-lighting measure category, with an average rate of 95%, largely affected by the Custom and New Construction extrapolated non-lighting realization rates of 95% and 93% respectively shown in Table 184 above. The overall realization rate for electric savings across programs in 2023 was 97%.

Table 185. 2023 C&I Programs *Ex Ante* & *Ex Post* Gross Electric Energy Savings

MEASURE CATEGORY	*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	**47,180,294.44**	**47,180,294.17**	**46,615,840.86**	**46,553,000.71**	**99%**
Non-Lighting	**27,748,962.97**	**27,748,962.97**	**27,749,519.11**	**26,454,366.67**	**95%**
Building Redesign	116,291.00	116,291.00	116,291.00	108,429.02	93%
Compressed Air	17,185,996.49	17,185,996.49	17,185,996.49	16,374,100.32	95%
Controls	1,994,930.25	1,994,930.25	1,994,930.25	1,893,951.33	95%
HVAC	3,256,248.01	3,256,248.01	3,256,804.15	3,140,300.93	96%
Kitchen	75,762.00	75,762.00	75,762.00	75,762.03	100%
Motors	1,936,976.00	1,936,976.00	1,936,976.00	1,827,489.29	94%
Process	1,750,642.17	1,750,642.17	1,750,642.17	1,655,828.26	95%
Refrigeration	1,390,738.67	1,390,738.67	1,390,738.67	1,337,127.08	96%
Ventilation	40,100.38	40,100.38	40,100.38	40,100.40	100%
Water Heat	1,278.00	1,278.00	1,278.00	1,278.00	100%
Total Savings	**74,929,257.41**	**74,929,257.14**	**74,365,359.97**	**73,007,367.37**	
Total Program Realization Rate					**97%**

Note: Totals may not sum properly due to rounding.

As shown in Table 186 below, the C&I portfolio collectively achieved a 98% demand realization rate, driven primarily by the lighting measure category, which made up 90% of the *ex ante* savings and achieved a realization rate of 99%. The non-lighting demand realization rates varied by measure category, with most measure categories achieving high realization rates. Project variability in the motors measure category in particular drove the realization rate of collective non-lighting category downward to 96%.

Table 186. 2023 C&I Program *Ex Ante* and *Ex Post* Gross Peak Demand Reduction

MEASURE CATEGORY	*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	**8,390.076**	**8,390.076**	**8,289.940**	**8,272.597**	**99%**
Non-Lighting	**977.980**	**977.980**	**973.381**	**935.292**	**96%**
Building Redesign	-	-	-	-	N/A
Compressed Air	159.949	159.949	159.949	156.611	98%
Controls	-	-	-	-	N/A
HVAC	616.422	616.422	611.823	593.738	96%
Kitchen	11.972	11.972	11.972	11.972	100%
Motors	73.320	73.320	73.320	57.802	79%
Process	59.490	59.490	59.490	58.487	98%
Refrigeration	41.951	41.951	41.951	41.806	100%
Ventilation	14.804	14.804	14.804	14.804	100%
Water Heat	0.072	0.072	0.072	0.072	100%
Total Savings	9,368.056	9,368.056	9,263.321	9,207.889	
Total Program Realization Rate					98%

Note: Totals may not sum properly due to rounding.

As shown in Table 187 below, realization rates were very consistent across all measure categories in the gas fuel type. The C&I Portfolio gas realization rate of 100% is driven primarily by the impactful HVAC measure category, which contains 79% of the *ex ante* therm savings for the C&I portfolio and received 100% realization.

Table 187. 2023 C&I Programs *Ex Ante* and *Ex Post* Gross Natural Gas Savings

MEASURE CATEGORY	*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	1,527,815.96	1,527,815.96	1,527,815.96	1,527,141.82	100%
Building Redesign	-	-	-	-	N/A

MEASURE CATEGORY	*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
Compressed Air	-	-	-	-	N/A
Controls	16,534.00	16,534.00	16,534.00	16,450.06	99%
HVAC	1,202,792.93	1,202,792.93	1,202,792.93	1,203,277.77	100%
Kitchen	629.00	629.00	629.00	632.11	100%
Motors	-	-	-	-	N/A
Process	258,867.02	258,867.02	258,867.02	257,696.53	100%
Refrigeration	-	-	-	-	N/A
Ventilation	41,505.01	41,505.01	41,505.01	41,710.53	100%
Water Heat	7,488.00	7,488.00	7,488.00	7,374.81	98%
Total Savings	1,527,815.96	1,527,815.96	1,527,815.96	1,527,141.82	
Total Program Realization Rate					**100%**

Note: Totals may not sum properly due to rounding.

Table 188 shows the realization rates and *ex post* gross savings values for each program and the overall C&I portfolio. The lighting measure category 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 188. 2023 C&I Programs *Ex Post* Gross Savings and Realization Rates

MEASURE CATEGORY/ PROGRAM	*EX POST* GROSS SAVINGS			REALIZATION RATE		
	KWH	KW	THERMS	KWH	KW	THERMS
Custom Program	**23,302,902.36**	**567.214**	**560,489.66**	**96%**	**94%**	**101%**
Lighting	3,199,226.60	425.301	-	100%	100%	N/A
Non-Lighting	20,103,675.76	141.913	560,489.66	95%	79%	101%
SEM Program	**572,099.28**	**142.101**	**-**	**98%**	**95%**	**N/A**
Lighting	543,660.28	138.166	-	98%	98%	N/A
Non-Lighting	28,439.00	3.935	-	102%	46%	N/A

MEASURE CATEGORY/ PROGRAM	*EX POST* GROSS SAVINGS			REALIZATION RATE		
	KWH	KW	THERMS	KWH	KW	THERMS
New Construction Program	**25,997,162.85**	**4,108.398**	**853,983.41**	**97%**	**98%**	**99%**
Lighting	21,585,871.01	3,727.019	-	98%	98%	N/A
Non-Lighting	4,411,291.84	381.379	853,983.41	94%	100%	99%
Prescriptive Program	**20,605,024.42**	**4,079.444**	**112,668.75**	**100%**	**100%**	**103%**
Lighting	18,694,064.35	3,671.378	-	100%	100%	N/A
Non-Lighting	1,910,960.07	408.065	112,668.75	100%	100%	103%
SBDI Program	**2,530,178.47**	**310.733**	**-**	**100%**	**98%**	**N/A**
Lighting	2,530,178.47	310.733	-	100%	98%	N/A
Non-Lighting	-	-	-	N/A	N/A	N/A
Total C&I	**73,007,367.37**	**9,207.889**	**1,527,141.82**	**97%**	**98%**	**100%**

Ex Post Net Savings

The evaluation team conducted a participant survey focused on calculating NTG ratios for the 2023 C&I program evaluation for all programs except SEM. Table 189 shows the freeridership, spillover and NTG ratios for the C&I programs in 2023. Freeridership was highest in the New Construction program, followed by the SBDI program. New Construction NTG values have declined since a survey was last performed in 2021.

Table 189. 2023 C&I Programs Net-to Gross Ratios By Program

PROGRAM	FREERIDERSHIP [a]	PARTICIPANT SPILLOVER	NTG
Custom	24%	0%	76%
SEM [b]	0%	0%	100%
New Construction	48%	0%	52%
Prescriptive	21%	0%	79%
SBDI	39%	0%	61%

[a] Weighted by survey sample *ex post* gross program MMBtu savings.

[b] SEM program was not surveyed for analysis in PY 2023. The program had a single unique customer participant. Given the prescriptive nature of the measures installed and confirmation of installation gained from impact activities conducted in PY 2023, the evaluation team determined that 100% NTG was appropriate.

Freeridership

To determine freeridership, the evaluation team asked respondents questions about whether they would have installed equipment of the same efficiency level, at the same time, and in same amount, in absence of the C&I programs to understand their intention to install equipment and the influence of the program. By combining the intention score with the influence score, the team produced a freeridership score for the program by averaging savings-weighted intention and influence freeridership scores.

Intention Freeridership

The evaluation team estimated intention freeridership scores for all participants, based on their responses to the intention-focused freeridership questions. These questions are aimed at understanding what the customer would have done in the absence of the program and the incentive. The C&I programs intention freeridership scores are shown in Table 190.

Table 190. 2023 C&I Programs Intention Freeridership Results

PROGRAM	RESPONSES	INTENTION FREERIDERSHIP SCORE[a]
Prescriptive	52	32%
Custom	21	45%
New Construction	11	95%
SBDI	10	64%

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

Influence Freeridership

The evaluation team assessed the influence of freeridership by asking participants how important various elements of the program were in their purchasing decision-making process. These questions are aimed at understanding how much the program's design exerted influence on the customer's decision to participate. The respondents' maximum influence ratings ranged from 1 (not at all important) to 4 (very important). A maximum score of 1 meant the customer ranked all factors from the table as not at all important, while a maximum score of 4 meant the customer ranked at least one factor as very important.

Custom

Table 191 shows Custom program elements participants rated for importance, along with a count and average rating for each factor. For the Custom program, the incentive was the most influential factor in customers' decision to participate, followed by the customer's previous participation in the program. Information provided by NIPSCO on saving opportunities was ranked as least influential to the customer's decision making.

Table 191. 2023 C&I Custom Program Influence Freeridership Responses

INFLUENCE RATING	INFLUENCE SCORE	THE NIPSCO INCENTIVE	INFORMATION PROVIDED BY NIPSCO ON ENERGY SAVING OPPORTUNITIES	RECOMMENDATION FROM CONTRACTOR OR VENDOR	PREVIOUS PARTICIPATION IN A NIPSCO ENERGY EFFICIENCY PROGRAM
1 - Not at all important	100%	0	2	0	1
2	75%	2	4	3	2
3	25%	7	9	4	4
4 - Very important	0%	12	5	7	12
Not sure / Not applicable / Skipped	50%	0	1	7	2
Average Rating		3.5	2.9	3.3	3.4

Table 192 shows the summary influence freeridership results and a maximum influence rating of 3.9 for the Custom program. Counts refer to the number of "maximum influence" responses for each factor, or influence score, response option.

Table 192. 2023 C&I Custom Program Influence Freeridership Score

MAXIMUM INFLUENCE RATING	INFLUENCE SCORE	COUNT	TOTAL SURVEY SAMPLE *EX POST* MMBTU SAVINGS	INFLUENCE SCORE MMBTU SAVINGS
1 - Not at all important	100%	0	0	0
2	75%	0	0	0
3	25%	2	259	65
4 - Very important	0%	19	3,531	0
Average Maximum Influence Rating - Simple Average				**3.9**
Average Influence Score				**2%**

[a]The average influence score of 2% for the 2023 Custom program was weighted by *ex post* gross MMBtu program savings.

New Construction

Table 193 shows New Construction program elements participants rated for importance, along with a count and average rating for each factor. For the New Construction program, recommendations from the contractor or vendor were the most influential factor in the customer's decision to participate. All other factors were much less influential to the customer's decision to participate in the program.

Table 193. 2023 C&I New Construction Program Influence Freeridership Responses

INFLUENCE RATING	INFLUENCE SCORE	THE NIPSCO INCENTIVE	INFORMATION PROVIDED BY NIPSCO ON ENERGY SAVING OPPORTUNITIES	RECOMMENDATION FROM CONTRACTOR OR VENDOR	PREVIOUS PARTICIPATION IN A NIPSCO ENERGY EFFICIENCY PROGRAM
1 - Not at all important	100%	2	0	1	0
2	75%	0	2	0	1
3	25%	4	5	0	4
4 - Very important	0%	4	3	6	2
Not sure/ Not Applicable /Skipped	50%	1	1	4	4
Average Rating		3.0	3.1	3.6	3.1

Table 194 shows the summary influence freeridership results and a maximum influence rating of 3.9 for the New Construction program.

Table 194. 2023 C&I New Construction Program Influence Freeridership Score

MAXIMUM INFLUENCE RATING	INFLUENCE SCORE	COUNT	TOTAL SURVEY SAMPLE *EX POST* MMBTU SAVINGS	INFLUENCE SCORE MMBTU SAVINGS
1 - Not at all important	100%	0	0	0
2	75%	0	0	0
3	25%	1	665	166
4 - Very important	0%	9	12,317	0
Average Maximum Influence Rating - Simple Average				**3.9**
Average Influence Score[a]				**1%**

[a] The average influence score of 1% for the 2023 New Construction program was weighted by ex post gross MMBtu program savings.

Prescriptive

Table 195 shows the program elements participants rated for importance, along with a count and average rating for each factor. Respondents indicate that the incentive was the most influential factor in their decision, followed by information provided by NIPSCO on energy saving opportunities, and the customer's previous participation in the program. Recommendations from the contractor or vendor scored as least influential to the customer's decision making.

Table 195. 2023 C&I Prescriptive Program Influence Freeridership Responses

INFLUENCE RATING	INFLUENCE SCORE	THE NIPSCO INCENTIVE	INFORMATION PROVIDED BY NIPSCO ON ENERGY SAVING OPPORTUNITIES	RECOMMENDATION FROM CONTRACTOR OR VENDOR	PREVIOUS PARTICIPATION IN A NIPSCO ENERGY EFFICIENCY PROGRAM
1 - Not at all important	100%	7	4	9	4
2	75%	4	8	5	4
3	25%	8	10	8	8
4 - Very important	0%	32	26	9	18
Not Sure / Not Applicable / Skipped	50%	1	4	21	18
Average Rating		**3.3**	**3.2**	**2.5**	**3.2**

Table 196 shows each respondent's influence freeridership rate using the maximum rating provided for any factor included in Table 195. Counts refer to the number of "maximum influence" responses for each factor, or influence score, response option. For Prescriptive, the maximum influence rating was 3.6.

Table 196. 2023 C&I Prescriptive Program Influence Freeridership Score

MAXIMUM INFLUENCE RATING	INFLUENCE SCORE	COUNT	TOTAL SURVEY SAMPLE *EX POST* MMBTU SAVINGS	INFLUENCE SCORE MMBTU SAVINGS
1 - Not at all important	100%	2	131	131
2	75%	3	202	152
3	25%	9	850	213
4 - Very important	0%	37	5129	0
Not applicable	50%	1	375	188
Average Maximum Influence Rating - Simple Average				**3.6**
Average Influence Score [a]				**10%**

[a] The average *influence* score of 10% for the 2023 Prescriptive program was weighted by *ex post* gross MMBtu program savings.

Small Business Direct Install

Table 197 shows SBDI program elements participants rated for importance, along with a count and average rating for each factor. The two most important factors that influenced the customer's decision to participate were the incentive provided and previous participation in the program. Information provided by NIPSCO on saving opportunities was ranked as least influential to the customer's decision making.

Table 197. 2023 C&I SBDI Program Influence Freeridership Responses

INFLUENCE RATING	INFLUENCE SCORE	THE NIPSCO INCENTIVE	INFORMATION PROVIDED BY NIPSCO ON ENERGY SAVING OPPORTUNITIES	RECOMMENDATION FROM CONTRACTOR OR VENDOR	PREVIOUS PARTICIPATION IN A NIPSCO ENERGY EFFICIENCY PROGRAM
1 – Not at all important	100%	0	1	0	0
2	75%	1	2	0	0
3	25%	2	2	3	3
4 – Very important	0%	7	4	1	5
Not Sure / Not Applicable / Skipped	50%	0	1	6	2
Average Rating		3.6	3.0	3.3	3.6

Table 198 shows the summary influence freeridership results and a maximum influence rating of 3.8 for the SBDI program.

Table 198. 2023 C&I SBDI Program Influence Freeridership Score

MAXIMUM INFLUENCE RATING	INFLUENCE SCORE	COUNT	TOTAL SURVEY SAMPLE *EX POST* MMBTU SAVINGS	INFLUENCE SCORE MMBTU SAVINGS
1 – Not at all important	100%	0	0	0
2	75%	0	0	0
3	25%	2	653	163
4 – Very important	0%	8	473	0
Average Maximum Influence Rating – Simple Average				**3.8**
Average Influence Score				**14%**

[a] The average *influence* score of 14% for the 2023 SBDI program was weighted by *ex post* gross MMBtu program savings.

Final Freeridership

The evaluation team calculated the mean of intention and the influence of freeridership components to estimate final freeridership for the C&I programs:

$$Final\ Freeridership = \frac{Intention\ FR\ Score\ + Influence\ FR\ Score}{2}$$

A higher freeridership score translates to more savings, which are deducted from the gross savings estimates. Table 199 lists the intention, influence, and final freeridership scores for the 2023 C&I programs.

Table 199. 2023 C&I Programs Freeridership Score

PROGRAM	INTENTION SCORE	INFLUENCE SCORE	FREERIDERSHIP SCORE
Custom	45%	2%	24%
New Construction	95%	1%	48%
Prescriptive	32%	10%	21%
SBDI	64%	14%	39%

Participant Spillover

The evaluation team estimated participant spillover measure savings using specific information about participants determined through the evaluation, using the Illinois TRM v11.0 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. The evaluation team found no evidence of meaningful spillover savings attributed to programs, as shown Table 200.

Table 200. 2023 C&I Programs Participant Spillover Results

PROGRAM	SPILLOVER SAVINGS (MMBTU)	PARTICIPANT PROGRAM SAVINGS (MMBTU)	PARTICIPANT SPILLOVER
Prescriptive	0	6,688.13	0%
Custom	0	3,789.49	0%
New Construction	0	13,016.81	0%
SBDI	0	1,126.49	0%

Resulting Net Savings

Table 201 through Table 205 show the resulting net electric savings, demand reduction, and natural gas savings by program.

For the **Custom** program one influential factor in the final NTG value was that 8 of the 21 surveyed projects, which represented 46% of the sampled savings, had a 100% intention freeridership score, and had final freeridership greater than or equal to 50%.

The survey response for **SBDI** was low, producing a small number of total respondents that effectively have a higher proportion of sampled savings. There were respondents that represented 51% or more of the savings sampled, and therefore their responses to freeridership questions have a more influential effect on the overall scores for the program.

In the **New Construction** program, one respondent represented 83% of the survey sample savings and had an overall 50% freeridership score, which heavily influenced the final program freeridership score.

For the **Prescriptive** program, the two survey respondents with the highest reported savings represented 37% of the analysis sample savings, and both had a final freeridership score of 0%, heavily influencing the final freeridership score for the program overall.

Table 201. 2023 C&I Custom Program *Ex Post* Net Savings

MEASURE	*EX POST* GROSS SAVINGS/REDUCTION			NTG	*EX POST* NET SAVINGS/REDUCTION		
	KWH	KW	THERMS		KWH	KW	THERMS
Compressed Air	15,128,984.79	12.445	-	76%	11,498,028.44	9.458	-
Controls	1,707,207.75	-	9,765.12	76%	1,297,477.89	-	7,421.49
HVAC	810,910.95	67.386	501,299.71	76%	616,292.32	51.213	380,987.78
Kitchen	-	-	632.11	76%	-	-	480.41
Lighting	3,199,226.60	425.301	-	76%	2,431,412.22	323.229	-
Motors	1,081,265.54	57.802	-	76%	821,761.81	43.929	-
Process	1,185,816.88	3.737	7,082.20	76%	901,220.83	2.840	5,382.47
Refrigeration	189,489.85	0.544	-	76%	144,012.29	0.413	-
Ventilation	-	-	41,710.53	76%	-	-	31,700.00
Total Savings	**23,302,902.36**	**567.214**	**560,489.66**	**76%**	**17,710,205.79**	**431.083**	**425,972.14**

Table 202. 2023 C&I SEM Program *Ex Post* Net Savings

MEASURE	*EX POST* GROSS SAVINGS/REDUCTION			NTG	*EX POST* NET SAVINGS/REDUCTION		
	KWH	KW	THERMS		KWH	KW	THERMS
HVAC	28,439.00	3.935	-	100%	28,439.00	3.935	-
Lighting	543,660.28	138.166	-	100%	543,660.28	138.166	-
Total Savings	572,099.28	142.101	-	100%	572,099.28	142.101	-

Table 203. 2023 C&I 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
Building Redesign	108,429.02	-	-	52%	56,383.09	-	-
Compressed Air	510,719.15	16.000	-	52%	265,573.96	8.320	-
Controls	186,743.58	-	6,684.95	52%	97,106.66	-	3,476.17
HVAC	1,783,622.98	310.629	590,024.67	52%	927,483.95	161.527	306,812.83
Lighting	21,585,871.01	3,727.019	-	52%	11,224,652.92	1,938.050	-
Motors	746,223.75	-	-	52%	388,036.35	-	-
Process	470,011.38	54.750	250,614.34	52%	244,405.92	28.470	130,319.45
Refrigeration	605,541.98	-	-	52%	314,881.83	-	-
Water Heat	-	-	6,659.45	52%	-	-	3,462.91
Total Savings	**25,997,162.85**	**4,108.398**	**853,983.41**	**52%**	**13,518,524.68**	**2,136.367**	**444,071.37**

Table 204. 2023 C&I Prescriptive Program *Ex Post* Net Savings

MEASURE	*EX POST* GROSS SAVINGS/REDUCTION			NTG	*EX POST* NET SAVINGS/REDUCTION		
	KWH	KW	THERMS		KWH	KW	THERMS
Compressed Air	734,396.38	128.166	-	79%	580,173.14	101.251	-
HVAC	517,328.01	211.788	111,953.39	79%	408,689.13	167.313	88,443.18
Kitchen	75,762.03	11.972	-	79%	59,852.01	9.458	-
Lighting	18,694,064.35	3,671.378	-	79%	14,768,310.84	2,900.389	-
Refrigeration	542,095.24	41.262	-	79%	428,255.24	32.597	-
Ventilation	40,100.40	14.804	-	79%	31,679.31	11.695	-
Water Heat	1,278.00	0.072	715.36	79%	1,009.62	0.057	565.13
Total Savings	**20,605,024.42**	**4,079.444**	**112,668.75**	**79%**	**16,277,969.29**	**3,222.761**	**89,008.31**

Table 205. 2023 C&I SBDI Program *Ex Post* Net Savings

MEASURE	*EX POST* GROSS SAVINGS/REDUCTION			NTG	*EX POST* NET SAVINGS/REDUCTION		
	KWH	KW	THERMS		KWH	KW	THERMS
Lighting	2,530,178.47	310.733	-	61%	1,543,408.87	189.547	-
Total Savings	**2,530,178.47**	**310.733**	**-**	**61%**	**1,543,408.87**	**189.547**	**-**

Table 206 shows the net-to-gross results for each fuel.

Table 206. 2023 C&I Programs 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.)	74,929,257.41	73,007,367.37	68%	49,622,207.91
Peak Demand Reduction (kW)	9,368.056	9,207.889	66%	6,121.858
Natural Gas Energy Savings (therms/yr.)	1,527,815.96	1,527,141.82	63%	959,051.83

Process Evaluation

In 2023, the evaluation team conducted a short participant survey to assess NTG. The team surveyed participants from the C&I Prescriptive, Custom, SBDI and New Construction programs. The newer Schools SEM program had just one school district participant and was not included. The primary purpose of this process evaluation was to collect updated data for calculating NTG values, but the survey also collected some program satisfaction data.

In addition to the C&I programs participant survey, the evaluation team also conducted a nonparticipant survey in the fall of 2023 to gain insight into how to increase engagement and savings within the C&I portfolio. The memo detailing results of this survey was presented to NIPSCO in late 2023 and is included as an appendix.

In addition to gathering data to assess the program's net savings, the evaluation team sought answers to the following process research questions:

- Are participants satisfied with the programs and their components, and what opportunities exist to improve participants' experience with the programs?
- How satisfied are customers with NIPSCO as their energy service provider?
- What types of businesses is NIPSCO reaching?

Survey Sampling Strategy

Due to the low participation numbers, the evaluation team opted to take a census of participants rather than sampling within program groups. After removing cases with no useable contact information and selecting one program per participant, the participation data used for survey recruiting included:

- Prescriptive: 244 participants
- Custom: 112 participants
- SBDI: 47 participants
- New Construction: 31 participants

When participants had participated in more than one program, the team used the following program priority hierarchy when selecting which program to ask about in the survey: New Construction, Custom, SBDI, and Prescriptive.

The evaluation team achieved a response rate of 19% for each program, resulting in 83 completed surveys. Split out by program these were:

- Prescriptive: 47
- Custom: 21
- SBDI: 9
- New Construction: 6

Note that due to small sample sizes, the findings in this process evaluation section should be seen as qualitative and general indicators of customer sentiment and experiences.

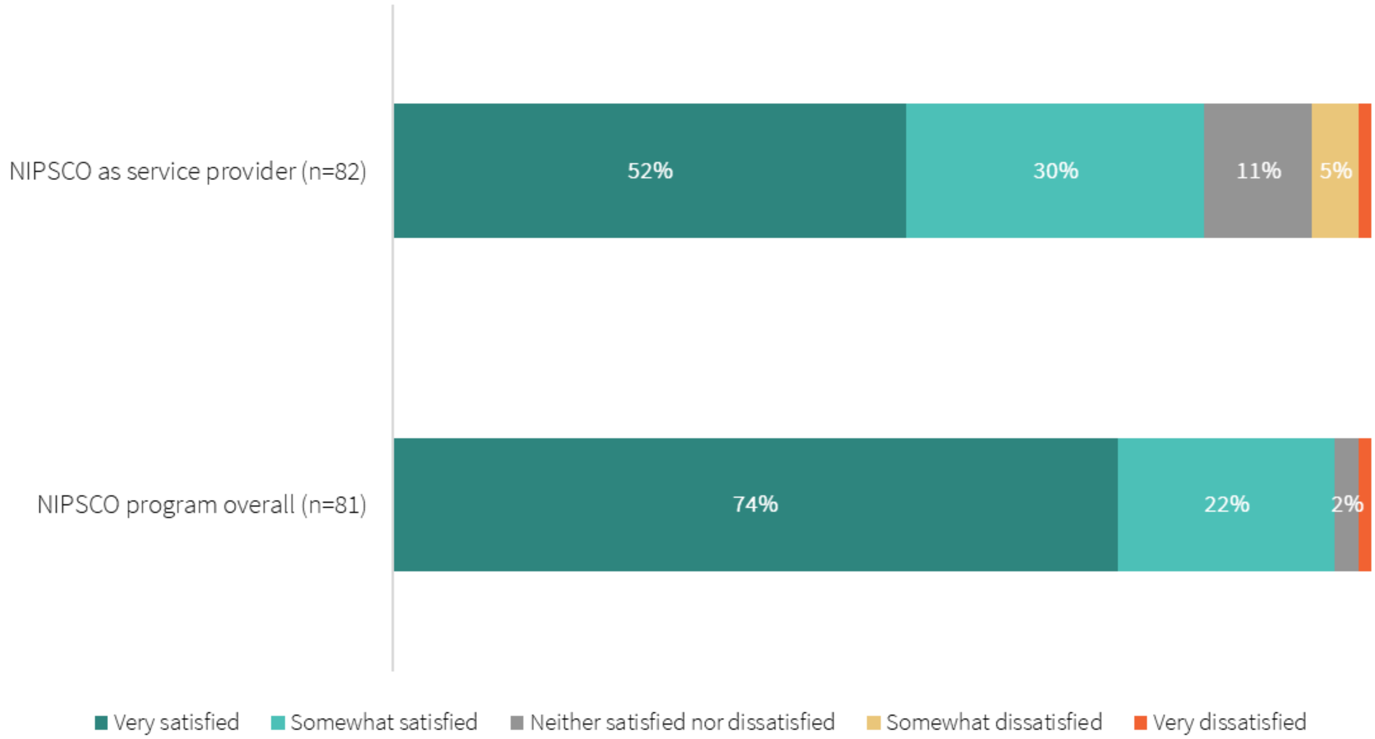
Participant Feedback

The following sections describe the results related to customer satisfaction with the program and customer firmographics.

Satisfaction With Program and NIPSCO

Participants in NIPSCO's C&I programs gave high satisfaction ratings to the programs overall, and to all aspects they were specifically asked about. Overall, 96% of respondents were very satisfied or somewhat satisfied with the NIPSCO C&I programs. Most customers were also very or somewhat satisfied with NIPSCO as their energy service provider (82%;Figure 55).

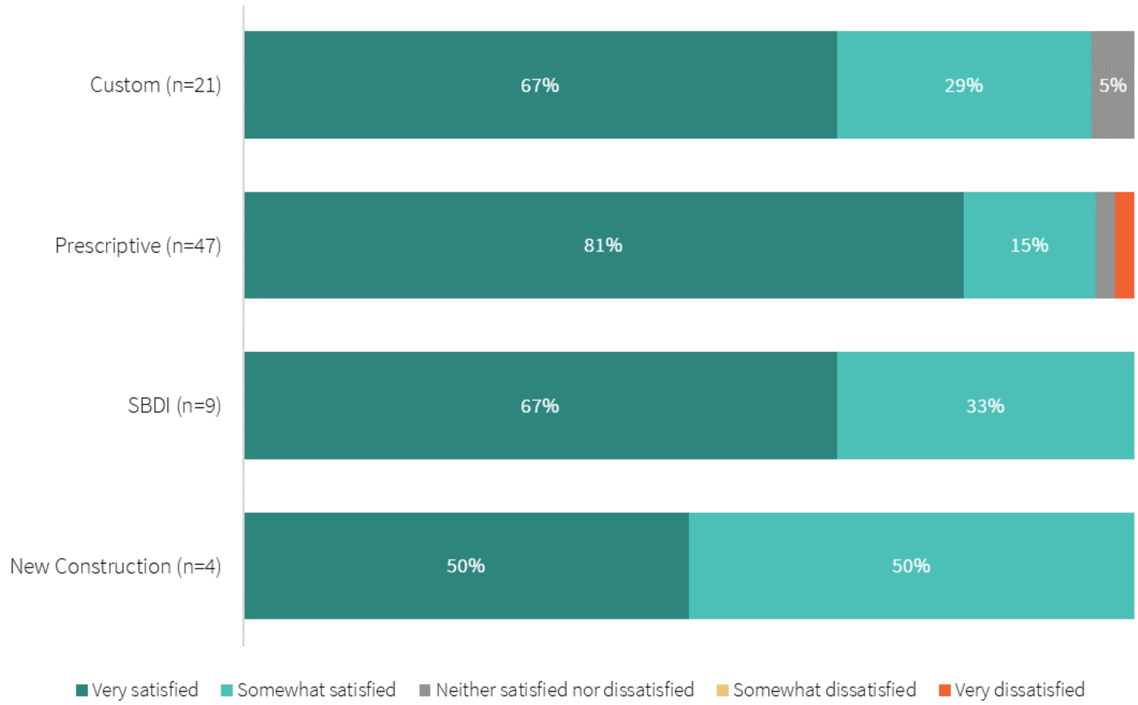
Figure 55. 2023 Overall Program and Service Provider Satisfaction



Source: C&I Program Participant Survey Questions C.2 “How satisfied are you with NIPSCO’s [Program] program overall?” and C.4. “How satisfied are you with NIPSCO overall as your organization’s utility service provider?”

Satisfaction with each program was overwhelmingly positive (Figure 55). Out of all survey respondents, only one Prescriptive participant expressed any level of dissatisfaction with the program. That respondent said they were very dissatisfied with the program and gave the reason “it’s limited in scope”.

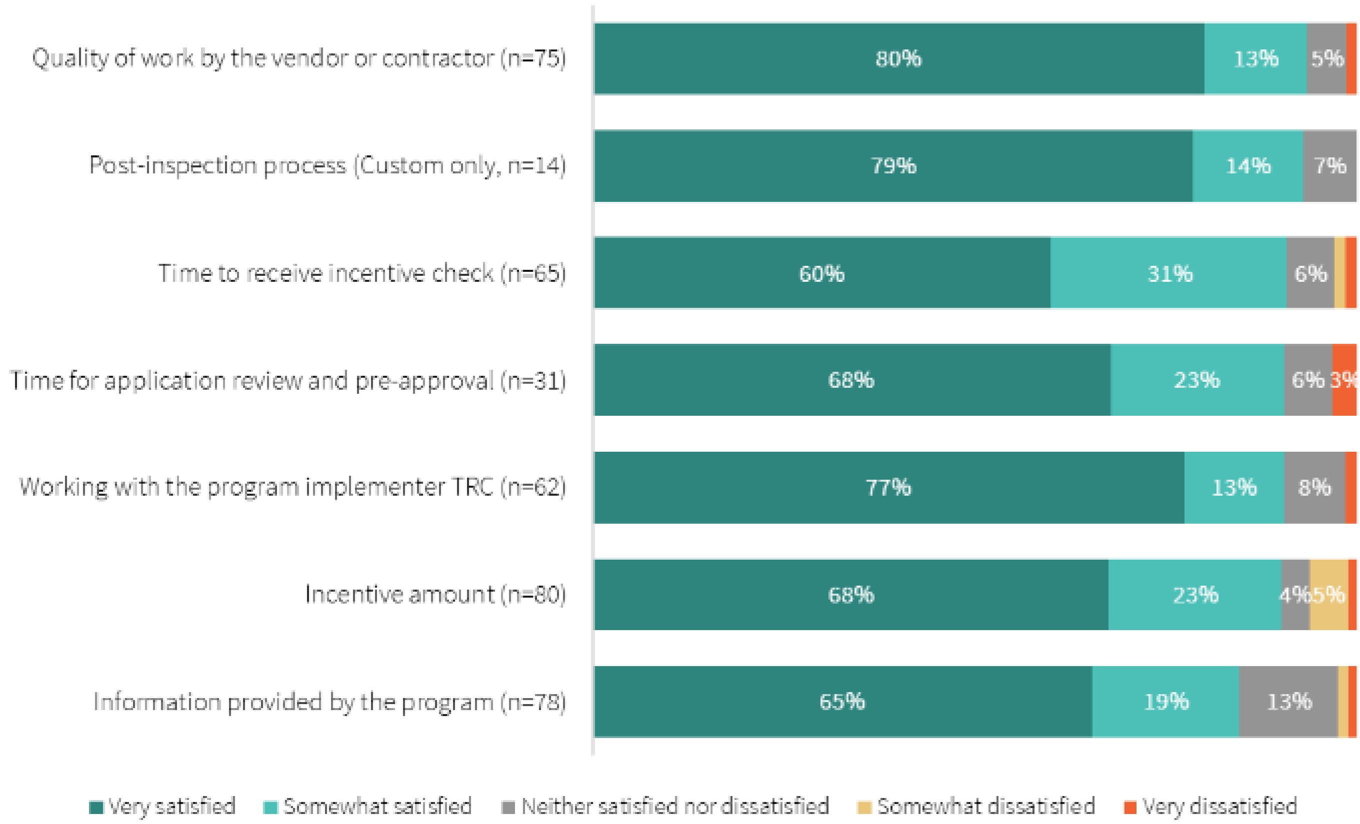
Figure 56. 2023 C&I Programs Satisfaction



Source: C&I Program Participant Survey Question C.2 “How satisfied are you with NIPSCO’s [Program] program overall?”

Most respondents were somewhat or very satisfied with each of the list of program components described in the survey. The quality of work by the vendor or contractor and the post-inspection approval process were given the highest satisfaction ratings at 93% each. The program aspect respondents were least satisfied with was information provided by the program for which 85% were very satisfied or somewhat satisfied (Figure 57).

Figure 57. 2023 C&I Combined Programs Satisfaction with Various Program Aspects

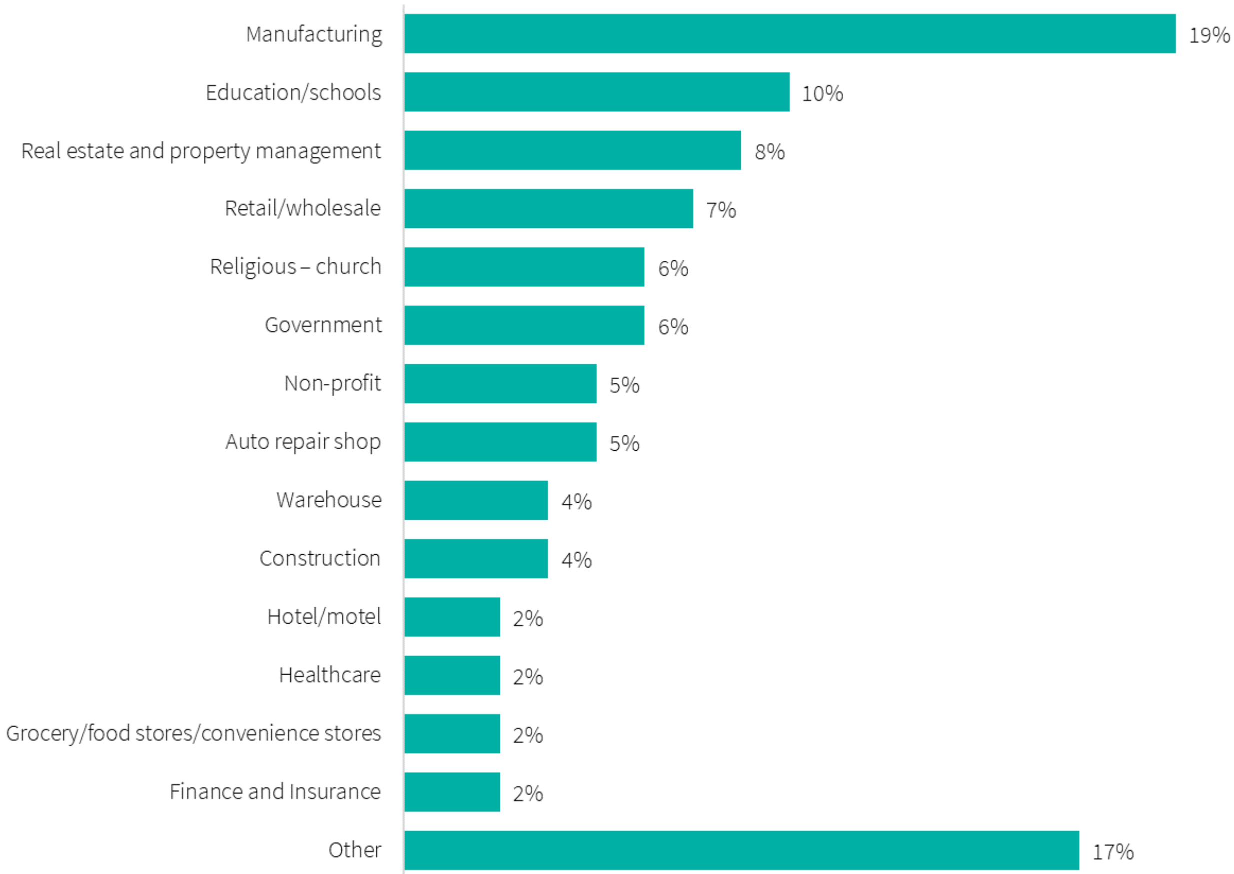


Source: C&I Program Participant Survey Question C.1 “We would like to ask you about some different components of the [Program] program. Please rate your level of satisfaction with each of these components…”

Participant Survey Firmographics

Respondents to the C&I programs participant survey were predominantly owners of the buildings (82%) that received efficiency improvements. Of the others, 16% said they leased their space, and 2% did not know. Respondents represented a mix of industry types. The most common industry among respondents was manufacturing (19%) and the second was education/schools (10%; Figure 58).

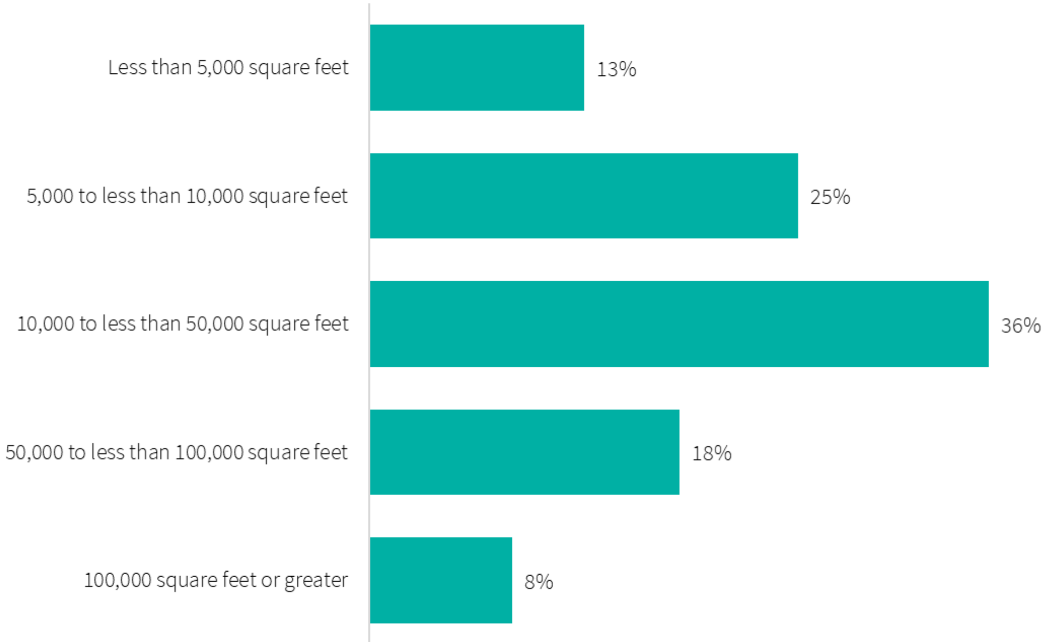
Figure 58. 2023 C&I Survey Respondent Industries



Source: C&I Program Participant Survey Question F.1. "What industry is your organization in?" (n=83)

Most facilities that received efficiency upgrades were 10,000 to less than 50,000 square feet (36%). The next most common was 5,000 to less than 10,000 square feet (25%), then 50,000 to less than 100,000 square feet (18%; Figure 59).

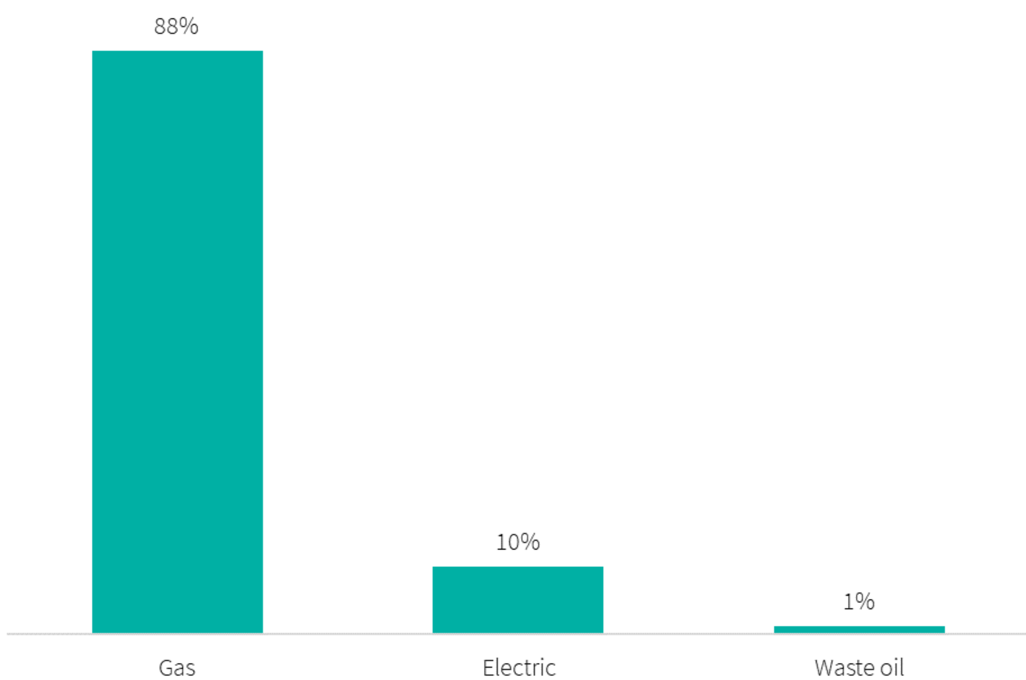
Figure 59. 2023 C&I Facility Sizes



Source: C&I Program Participant Survey Question F.2. "What is the approximate square footage of space in the facility where y ou made the efficiency improvements?" (n=83)

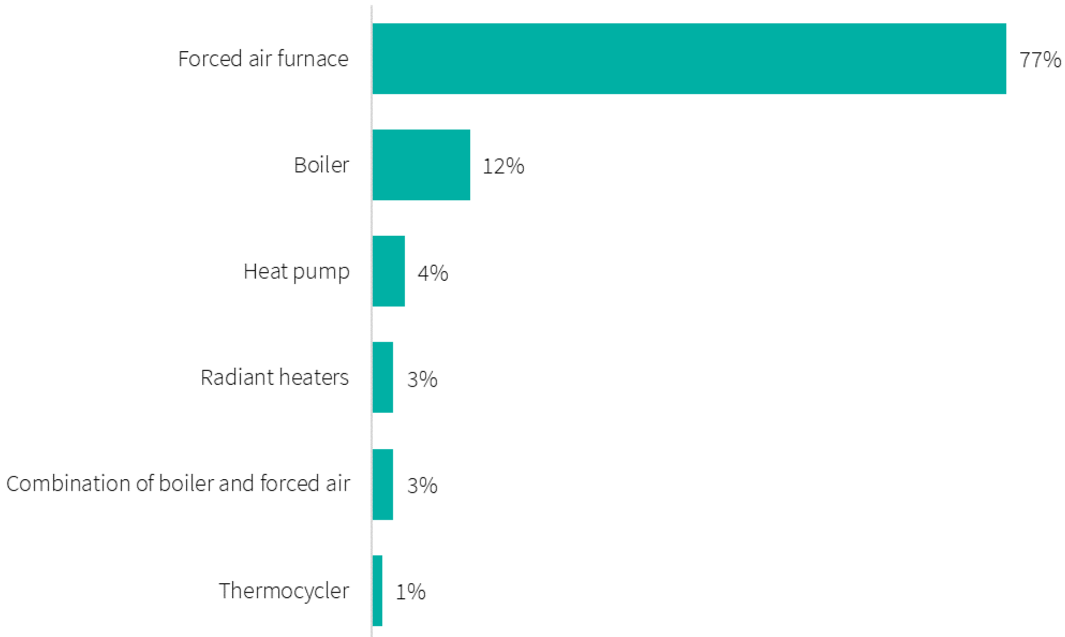
Respondents predominantly heated their facilities with natural gas (88%) and used forced air furnaces (77%). About 12% had a boiler for space heat, and about 4% had a heat pump (Figure 60 and Figure 61).

Figure 60. 2023 C&I Fuel Used for Space Heating



Source: C&I Program Participant Survey Question F.3. “What is the main fuel type used for space heating the facility?” (n=83)

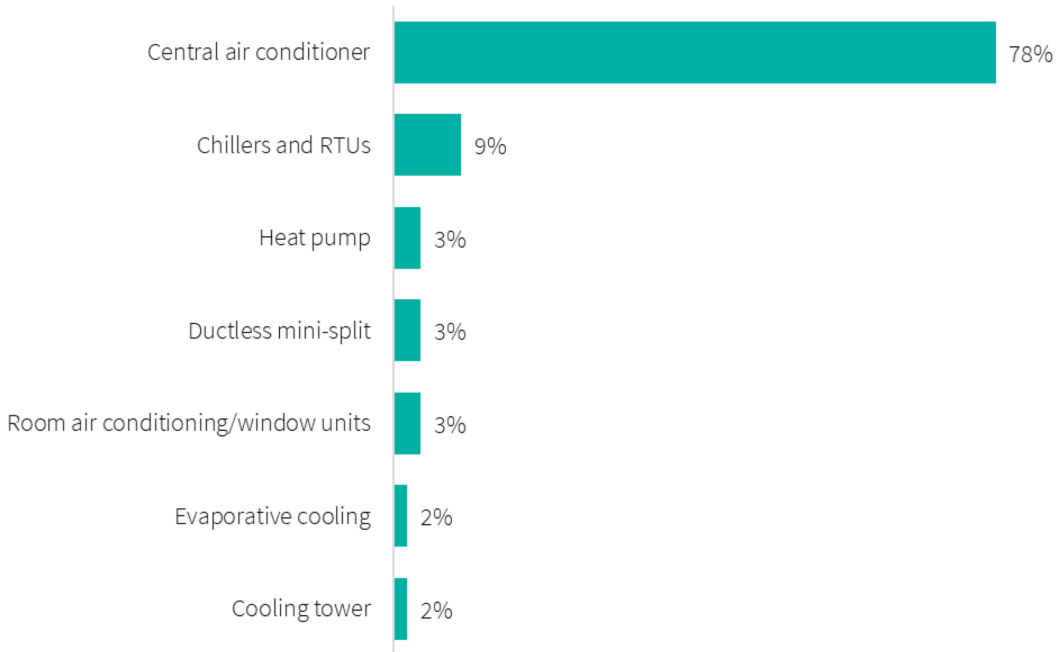
Figure 61. 2023 C&I Types of Space Heating Equipment



Source: C&I Program Participant Survey Question F.4. “What is the type of space heating used in the facility?” (n=75)

Most respondents reported having space cooling in their facilities (80%). Of these (n=58), the most common equipment type was central air conditioning (78%) followed distantly by chillers and RTUs (9%). Nearly 7% reported using a heat pump or ductless mini-split for space cooling (Figure 62).

Figure 62. 2023 C&I Types of Space Cooling



Source: C&I Program Participant Survey Question F.6 and F.6O. “What is the type of space cooling used in the facility?” (n=58)

Of respondents who knew what fuel type was used for water heat at their facilities (n=76), 62% used natural gas and 38% used electricity to heat their water. Six% (n=5) did not know what fuel was used to heat their water.

Conclusions and Recommendations

CONCLUSION 1: REALIZATION RATES WERE CLOSE TO 100% ACROSS ALL PROGRAMS, INDICATING SOUND *EX ANTE* SAVINGS CALCULATION METHODOLOGIES.

Electric energy, peak demand and therm realization rates were at or exceeded 94% for all programs, with several at or slightly over 100%. This highlights an attention to detail and accuracy in the *ex ante* calculations that leads to reliable reported savings.

Recommendations:

- Use existing savings calculation methodologies, paying close attention to TRM revisions and code changes that could impact claimed savings.
- Continue to consult with the evaluation team on the front end of complex Custom projects that require engineering assumptions or modeled savings to ensure accuracy of ex ante savings.
- Continue to incorporate findings from incremental evaluation waves throughout the program year into reported savings calculations for all C&I programs.

CONCLUSION 2: NIPSCO NONRESIDENTIAL CUSTOMERS WERE OVERWHELMINGLY SATISFIED WITH THE COMPANY'S C&I ENERGY EFFICIENCY PROGRAMS.

Surveyed customers virtually all expressed satisfaction with the program they participated in and each of the program components described in the survey. Overall, 96% of respondents were very satisfied or somewhat satisfied with the NIPSCO C&I programs and most respondents were also very or somewhat satisfied with NIPSCO as their energy service provider (82%). Further, only one survey respondent expressed any level of dissatisfaction with the program. For all programs, respondents rated their satisfaction with the quality of work done by the vendor or contractor, and the post-inspection process the highest. These were followed closely by the time it took to receive the incentive check.

CONCLUSION 3: THE INCENTIVE WAS THE MOST INFLUENTIAL FACTOR IN SBDI, PRESCRIPTIVE, AND CUSTOM PARTICIPANTS' PURCHASING DECISION.

Across the C&I programs, freeridership ranged from 21% for the Prescriptive program to 48% for the New Construction program. Because there was only one participant in the Schools SEM program, the evaluation team did not calculate freeridership and assumed a freeridership of 0%. The influence of the incentive is followed closely by previous participation in a NIPSCO rebate program and then recommendations from a contractor for the Custom and SBDI programs.

The SBDI and Prescriptive programs had the highest influence on a customer's decision to make improvements. In both programs, the NIPSCO incentive was rated as the most influential factor. While the Custom program did not have as much influence on a customer's decision to make improvements, the Custom respondents rated the NIPSCO incentive as the most influential factor in participation as well. In contrast, the participants in the New Construction program rated the NIPSCO incentive as the least influential participation driver of the program elements offered and were instead influenced by the recommendation from a contractor or vendor. These insights can be leveraged to increase the NTG ratios for the C&I programs.

Recommendations:

- Provide and market incentives at a high enough level so that customers feel the incentive makes it possible to implement the project.
- Target customers who have already participated in other C&I programs with additional recommendations and offers for ongoing program participation.
- Consider trade ally incentives to widely promote the NIPSCO rebate programs to potential customers.

CONCLUSION 4: SBDI PROGRAM FREERIDERSHIP SURVEY RESULTS INDICATE HIGH INTENTION FREERIDERSHIP AND POSSIBLE INCONSISTENCIES IN PROGRAM IMPLEMENTATION.

Four SBDI survey respondents indicated that they already purchased, and in some cases, already installed the equipment they received an incentive for prior to the contractor arriving on site. This finding appears to indicate that the program may not always be implemented as designed with the contractor providing and installing the equipment. Survey responses indicate that past participation in the SBDI program was highly influential in their decision to participate in the program again. Repeat participation in the program could be driving down the final NTG score for the program.

Recommendations:

- Ensure the SBDI program delivery matches the program abstract process narrative which states that the trade ally will identify potential measures that could benefit the customer and then install those measures.
- Conduct targeted outreach for the SBDI program to those who have not yet participated in the program.

CONCLUSION 5: NEW CONSTRUCTION LIGHTING POWER DENSITY SAVINGS WILL DECREASE IN THE 2024 PROGRAM YEAR WITH A BASELINE CHANGE.

The Indiana building code still references ASHRAE 90.1-2007 as the baseline for lighting power density (LPD) calculations. This is how both *ex ante* and *ex post* savings were calculated for 2023. However, the new Indiana TRM (*Priority Measures_VEIC Review_FINAL_06.01.2023)* points to IECC 2018 and IL TRM v11.0 as the recommended code baseline. Further, in the update from the IL TRM v11.0 to v12.0, the baseline changed from IECC 2018 to IECC 2021.

The evaluation team pulled 10 sampled LPD projects from the 2022 and 2023 NIPSCO tracking data to run sensitivity on the baseline change. Moving from ASHRAE 90.1-2007 to IECC 2018 represents about a 50% reduction in claimed savings and moving from ASHRAE 90.0-2007 to IECC 2021 represents about a 57% reduction in claimed savings.

Recommendations:

- Change the baseline for calculating LPD savings from ASHRAE 90.1-2007 to IECC 2018, which is the Indiana assumption called out in the new Indiana Technical Reference Manual Workbook v1.0.

CONCLUSION 6: CUSTOM PROGRAM FREERIDERSHIP SURVEY RESULTS INDICATE HIGH INTENTION FREERIDERSHIP.

Eight of the 21 survey respondents for the Custom program had an intention freeridership score of 50% or higher, indicating that the customer would have carried out the project without the NIPSCO program offering the incentive. Custom projects receive a high level of touch from the implementation team throughout the project timeline, allowing opportunity for NIPSCO to understand customer motivations that drive project selection, adoption, and implementation.

Recommendations:

- Find ways to motivate participating customers to seek out additional savings not already considered. For example, providing additional technical support services, with the intent of driving scope expansion, could encourage greater adoption of measures.
- Consider a tiered incentive approach or higher minimum savings requirements to encourage participants to achieve higher savings, and to provide an incentive commensurate with savings. For example, if a measure produces high savings but has a low incremental cost to the customer, the incentive might be lower than it would be if it were based on savings alone. In this way, customers that may need greater assistance to implement a measure would be prioritized.
- Adopt payback criteria such as projects must have >1 year simple payback before the incentive is applied to qualify for an incentive.

15. COMMERCIAL AND INDUSTRIAL (C&I) ONLINE MARKETPLACE (OLM) PROGRAM

Program Design and Delivery

The Commercial and Industrial (C&I) Online Marketplace program provides instant discounts to eligible businesses 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. In 2023 this program was implemented by TRC, who partnered with TechniArt to implement the C&I Online Marketplace. TechniArt was 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 2023, NIPSCO offered kits to C&I customers at no cost. They also offered a variety of energy efficient products, such as LED fixtures, smart thermostats, advanced power strips, air purifiers, pre-rinse spray valves, door sweeps and pipe insulation, 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 207 lists the measures offered through the C&I Online Marketplace in 2023. A single customer account can order up to five kits (any combination) in a calendar year. In 2023, NIPSCO offered a Water Saver Kit and an Office Kit.

Table 207. 2023 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)*
Water Saver Kits (650049, 650057, 650059, 650060)						
Pre-rinse spray valve	1	$35.00	5	456.23	-	26.33
Fixed Showerhead	1	$10.00	10	232.37	0.024	16.01
Bathroom Aerator	2	$2.00	10	43.52	0.014	3.01
Kitchen Aerator	1	$3.00	10	27.19	0.009	2.05
Hot Water Temp card	1	$2.00	1	-	-	0.13
Pipe Insulation	1	$3.00	15	-	-	18.04
Desk Lamp	1	$10.00	12	71.72	0.014	-

PRODUCTS	QTY	INCENTIVE VALUE	EUL	*EX ANTE* KWH SAVINGS	*EX ANTE* KW SAVINGS	*EX ANTE* THERMS SAVINGS *(DUAL FUEL ONLY)*
Office Kits (650050, 650058, 650061, 650062)						
Desk Lamp	1	$10.00	12	71.72	0.014	-
Advanced Powerstrip (APS)	1	$15.00	7	93.00	-	-
Bathroom Aerator	2	$2.00	10	21.76	0.007	1.50
Kitchen Aerator	1	$3.00	10	13.60	0.004	1.03
Hot Water Temp card	1	$2.00	1	-	-	0.13
Fridge thermometer	1	$2.00	0	-	-	-
Switch/Outlet Gaskets	10	$0.25	15	17.65	0.000	1.35
LED Exit Sign Retrofit (Red)	2	$18.00	5	15.42	0.001	0.00
Individual Products:						
650010 4-Pack 25w T8 LED	4	$5.00	15	172.25	0.041	-
650011 2x4 LED Panel	1	$20.00	15	141.27	0.034	-
650012 2x2 LED Panel	1	$18.00	15	96.56	0.023	-
650016 Ext Wall Pack 55w	1	$65.00	13	606.82	-	-
650017 Ext Corn Bulb 54w	1	$65.00	12	579.24	-	-
650018 Smart Tstat - Gas Heating Only	1	$55.00	11	-	-	86.40
650020 Pipe Insulation Wrap	1	$1.25	15	-	-	2.10
650021 Ext Wall Pack 80w	1	$80.00	13	860.68	-	-
650024 Ext Corn Bulb 100w	1	$80.00	12	776.34	-	-
650025 Smart Tstat - Elec Cooling Only	1	$65.00	11	472.41	0.353	-
650026 Smart Tstat Elec Cooling Gas Heating	1	$65.00	11	667.35	0.353	86.40
650027 Tier 1 Power Strip	1	$5.00	5	64.13	-	-
650032 Pre-Rinse Spray Valve Gas DHW	1	$10.00	5	-	-	29.00

PRODUCTS	QTY	INCENTIVE VALUE	EUL	*EX ANTE* KWH SAVINGS	*EX ANTE* KW SAVINGS	*EX ANTE* THERMS SAVINGS *(DUAL FUEL ONLY)*
650035 Pre-Rinse Spray Valve Elec DHW	1	$25.00	5	684.00	0.104	-
650046 Foam Foil Wrap Insulation	1	$1.25	5	-	-	35.06
650051 ENERGY STAR Air Purifier (Sm)	1	$70.00	9	298.50	0.054	-
650052 ENERGY STAR Air Purifier (Med)	1	$70.00	9	433.00	0.078	-
650053 ENERGY STAR Air Purifier (Lg)	1	$70.00	9	664.50	0.119	-
650054 Door Sweep	1	$5.00	5	-	-	7.98
650055 Ext Corn Bulb 54w	1	$65.00	12	611.03	-	-
650056 Smart Tstat - Elec Cooling and Heating	1	$65.00	11	1,795.64	0.353	-

*Note: The kit revisions did not differ in product composition, energy savings or incentive values and have been combined in this table. Electric only kits do not claim gas savings, as noted in the therms column.

Changes from the 2022 Design

The products offered in the Commercial & Industrial Online Marketplace shifted to more non-lighting measures in 2023, offering a wide selection of all types of non-lighting products applicable to small businesses. The kits were redesigned to remove all screw-based LED lighting. The restaurant kit and retail kits were discontinued, and the water saver kit was new in 2023. Measures that result in hot water savings had a greater presence in the program.

Program Performance

The C&I Online Marketplace program fell short of its goals, achieving 30% of electric energy savings, 17% of peak demand savings, and 14% of natural gas therms savings. The program did not meet its 2023 performance goals, which was a common outcome amongst most commercial programs in 2023.

The online marketplace offerings changed in 2023, and screw-based lighting was removed from all kits and as individual products. Screw-based lighting provided a reliable savings source in 2022, making up over 90% of the *ex ante* kWh savings. The removal of screw-based lighting products from the offerings appears to have affected the savings achieved by the program in 2023, as compared to 2022. Reported electric energy savings in 2023 were 43% of 2022 savings, reflecting this reduction in lighting offerings. Conversely, natural gas savings in 2023 were 292% of 2022 savings, due primarily to an increase in smart thermostats distributed to dual fuel customers.

Table 208 summarizes savings for the full year of program performance, including program savings goals.

Table 208. 2023 C&I Online Marketplace Program Saving Summary

METRIC	GROSS SAVINGS GOAL	*EX ANTE*	AUDITED	VERIFIED	*EX POST* GROSS	*EX POST* NET	*EX POST* GROSS GOAL ACHIEVE-MENT
Electric Energy Savings (kWh/yr.)	4,344,377.00	1,343,156.91	1,359,586.27	1,330,782.10	1,294,522.33	1,123,924.89	30%
Peak Demand Reduction (kW)	761.046	129.654	130.655	127.457	128.037	111.521	17%
Natural Gas Energy Savings (therms/yr.)	92,629.45	18,201.80	18,194.60	12,885.01	12,896.49	11,263.36	14%

The evaluation team adjusted savings in several ways which resulted in realization rates lower than 100%. Adjustments to ISR values generally made up the largest differences in savings values.

Table 209 outlines the *ex post* and NTG adjustment factors. The evaluation team developed these values by analyzing survey data collected from the 2023 C&I Online Marketplace participant survey, as described in the *Participant Survey* section.

Table 209. 2023 C&I Online Marketplace Adjustment Factors

METRIC	REALIZATION RATE (%)[a]	FREERIDERSHIP	SPILLOVER	NTG (%)[b]
Electric Energy Savings (kWh/yr.)	96%	13%	0%	87%
Peak Demand Reduction (kW)	99%	13%	0%	87%
Natural Gas Energy Savings (therms/yr.)	71%	13%	0%	87%

[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.

Compared to 2022, the electric program budget increased by 12% and the gas program budget increased by 11%. The electric program expenditures increased by 82%, and the gas program expenditures increased by 93% from 2022 to 2023, while attaining less savings. NIPSCO spent 75% of the electric program budget and 20% of the natural gas program budget. Gas spending aligned with the savings goal achieved (14%) however the proportion of electric spending did not align to the achievement of electric savings goals (75% of budget spent, 30% of goal savings achieved). Table 210 lists the 2023 C&I Online Marketplace program budget and expenditures by fuel type.

Table 210. 2023 C&I Online Marketplace Program Expenditures

FUEL	PROGRAM BUDGET	PROGRAM EXPENDITURES	BUDGET SPENT (%)
Electric	$579,137.93	$434,205.41	75%
Natural Gas	$109,343.98	$22,362.83	20%

Evaluation Methodology

To inform the 2023 C&I Online Marketplace program 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.
- **Participant surveys (n=57),** 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 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 in-service 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? 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 v11.0, 2015 Indiana TRM (v2.2), NIPSCO's program tracking 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. To audit program savings, the evaluation team performed the following reviews to verify alignment with the program's scorecard:

- **Audited product quantity.** Reviewed program tracking data provided by the implementer and audited the number of energy efficiency measures and 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 Quantities of Kits and Products

Table 211 shows the number of reported and audited kits and products distributed through the C&I Online Marketplace program in 2023. The evaluation team checked reported ex ante values against the program tracking data and found no discrepancies.

Table 211. 2023 C&I Online Marketplace Program Audited Kit and Product Quantities

KIT OR PRODUCT TYPE	MEASURE ID	TRACKING DATA	AUDITED
4-Pack 25w T8 LED	650010	308	308
2x4 LED Panel	650011	1,505	1,505
2x2 LED Panel	650012	475	475
Ext Wall Pack 55w	650016	7	7
Ext Corn Bulb 54w	650017	287	287
Smart Tstat - Gas Heating Only	650018	4	4
Pipe Insulation Wrap	650020	6	6
Ext Wall Pack 80w	650021	299	299
Ext Corn Bulb 100w	650024	300	300
Smart Tstat - Elec Cooling Only	650025	4	4
Smart Tstat Elec Cooling Gas Heating	650026	61	61
Tier 1 Power Strip	650027	2	2
Pre-Rinse Spray Valve Gas DHW	650032	4	4
Pre-Rinse Spray Valve Elec DHW	650035	3	3
Foam Foil Wrap Insulation	650046	2	2
Water Saver KIT - Dual Fuel	650049	65	65
Office KIT - Dual Fuel	650050	149	149
ENERGY STAR Air Purifier (Sm)	650051	19	19
ENERGY STAR Air Purifier (Med)	650052	4	4
ENERGY STAR Air Purifier (Lg)	650053	1	1
Door Sweep	650054	9	9
Ext Corn Bulb 54w	650055	9	9
Smart Tstat - Elec Cooling and Heating	650056	14	14
Water Saver KIT REV 1 - Dual Fuel	650057	102	102

KIT OR PRODUCT TYPE	MEASURE ID	TRACKING DATA	AUDITED
Office KIT REV 2 - Dual Fuel	650058	191	191
Water Saver KIT - Electric Only	650059	22	22
Water Saver KIT REV 1 - Electric Only	650060	32	32
Office KIT REV 1 - Electric Only	650061	46	46
Office KIT REV 2 - Electric Only	650062	59	59
Total		**3,989**	**3,989**

Kit and Measure Savings Review

The evaluation team reviewed the kit and measure savings documentation, which contained measure-level and kit-level savings.[64] Importantly, NIPSCO's implementer included ISR values from this program's past EM&V efforts and ISRs based on engineering judgement 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. Corrections made in the tracking data audit included any calculation or transcription errors, as described below.

- **Measure 650010 4-Pack LED T8 is reported as 172.25 kWh and 0.041 kW for the pack of four bulbs.** These reported values are not supported by the calculations provided. The implementor's calculation file calculates this measure as 192.56 kWh and 0.046 kW in savings, which are the correct savings values for the measure based on the specifications of the product.
- **Measure 650017 LED Corn Bulb is reported as 579.24 kWh for the single exterior bulb.** The reported value is not supported by the calculations provided. The implementor's calculation file calculates this measure as 611.03 kWh in savings which are the correct savings values for the measure based on the specifications of the product.
- **Measure 650035 Pre-Rinse Spray Valve (Elec DHW) incorrectly reports demand savings** of 0.104 kW demand savings. This value appears in the Captures *ex ante* output for the measure but is not supported by the calculations for the measure, which results in no demand savings.
- All six kit measures contain kitchen aerators. The kitchen aerator measure calculation has a calculated input, EPG Electric, which in the calculations provided was a fixed value. When calculated based on other inputs, the audited value for EPG Electric is slightly different, resulting in slightly different savings for the measure. This measure rolls up into the cumulative kit savings value, which is in turn slightly different than *ex ante* for this reason.

[64] TRC Companies. April 2023. Online Marketplace Calcs_04.21.2023.

Table 212 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 report per-measure values, not total savings from the entire Online Marketplace population.

Table 212. 2023 C&I Online Marketplace Program Audited Per-Kit and Per-Measure Savings

MEASURE	*EX ANTE* SAVINGS			AUDITED SAVINGS		
	KWH	KW	THERMS	KWH	KW	THERMS
650010 4-Pack 25w T8 LED	172.25	0.041	0.00	192.56	0.046	0.00
650011 2x4 LED Panel	141.27	0.034	0.00	141.27	0.034	0.00
650012 2x2 LED Panel	96.56	0.023	0.00	96.56	0.023	0.00
650016 Ext Wall Pack 55w	606.82	0.000	0.00	606.82	0.000	0.00
650017 Ext Corn Bulb 54w	579.24	0.000	0.00	611.03	0.000	0.00
650018 Smart Tstat - Gas Heating Only	0.00	0.000	86.40	0.00	0.000	86.40
650020 Pipe Insulation Wrap	0.00	0.000	2.10	0.00	0.000	2.10
650021 Ext Wall Pack 80w	860.68	0.000	0.00	860.68	0.000	0.00
650024 Ext Corn Bulb 100w	776.34	0.000	0.00	776.34	0.000	0.00
650025 Smart Tstat - Elec Cooling Only	472.41	0.353	0.00	472.41	0.353	0.00
650026 Smart Tstat Elec Cooling Gas Heating	667.35	0.353	86.40	667.35	0.353	86.40
650027 Tier 1 Power Strip	64.13	0.000	0.00	64.13	0.000	0.00
650032 Pre-Rinse Spray Valve Gas DHW	0.00	0.000	29.00	0.00	0.000	29.00
650035 Pre-Rinse Spray Valve Elec DHW	684.00	0.104	0.00	684.00	0.000	0.00
650046 Foam Foil Wrap Insulation	0.00	0.000	35.06	0.00	0.000	35.06
650049 Water Saver KIT - Dual Fuel	831.04	0.060	65.58	833.42	0.061	65.55
650050 Office KIT - Dual Fuel	233.14	0.027	4.01	234.33	0.027	4.00
650051 ENERGY STAR Air Purifier (Sm)	298.50	0.054	0.00	298.50	0.054	0.00
650052 ENERGY STAR Air Purifier (Med)	433.00	0.078	0.00	433.00	0.078	0.00
650053 ENERGY STAR Air Purifier (Lg)	664.50	0.119	0.00	664.50	0.119	0.00
650054 Door Sweep	0.00	0.000	7.98	0.00	0.000	7.98
650055 Ext Corn Bulb 54w	611.03	0.000	0.00	611.03	0.000	0.00
650056 Smart Tstat - Elec Cooling and Heating	1,795.64	0.353	0.00	1,795.64	0.353	0.00
650057 Water Saver KIT REV 1 - Dual Fuel	831.04	0.060	65.58	833.42	0.061	65.55

MEASURE	*EX ANTE* SAVINGS			AUDITED SAVINGS		
	KWH	KW	THERMS	KWH	KW	THERMS
650058 Office KIT REV 2 - Dual Fuel	233.14	0.027	4.01	234.33	0.027	4.00
650059 Water Saver KIT - Electric Only	831.04	0.060	0.00	833.42	0.061	0.00
650060 Water Saver KIT REV 1 - Electric Only	831.04	0.060	0.00	833.42	0.061	0.00
650061 Office KIT REV 1 - Electric Only	233.14	0.027	0.00	234.33	0.027	0.00
650062 Office KIT REV 2 - Electric Only	233.14	0.027	0.00	234.33	0.027	0.00

Verified In-Service Rate

The evaluation team calculated verified savings using in-service rate (ISR) values obtained through the C&I Online Marketplace participant survey. The evaluation team surveyed all customers that received a kit between January 1, 2023, and December 31, 2023, and received complete ISR related responses from 57 customers. To determine ISR, the customers were asked how many units of each measure they installed from the kits they specifically received.

The kits (Water-Saver and Office) made up almost 20% of the Online Marketplace products distributed, and the customers receiving kits were targeted for survey response. The customer survey did not include any questions regarding the non-kit products, due to the relatively small number of unique customers who purchased non-kit products. Therefore, the ISRs the evaluation team used to calculate verified savings for individual products were unaltered from the *ex ante* ISRs, as these appeared to be reasonable assumptions.

Across measures, verified kit ISRs varied when compared to *ex ante* assumptions. For some measures included in the kits, like pre-rinse spray valves, power strips, kitchen aerators and pipe insulation, ISRs measured in evaluation surveys were relatively close to the *ex ante* assumptions. The evaluation team found somewhat lower ISRs for showerheads, hot water temperature cards, outlet gaskets and desk lamps. The evaluation team found higher ISRs for bathroom aerators (in water savings kits but not in office kits) and exit signs. Table 34 lists the ISRs for all program-installed measures.

Table 34 lists the *ex ante* and verified ISRs and resulting verified savings for all program-installed measures.

Table 213. 2023 C&I Online Marketplace Program In-Service Rates by Measure

MEASURES	QUANTITY PER KIT	*EX ANTE* ISR	VERIFIED ISR	VERIFIED ISR SOURCE
Water Saver Kits (650049, 650057, 650059, 650060)				
Pre-rinse spray valve	1	33%	33%	2023 NIPSCO C&I OLM Survey
Fixed Showerhead	1	42%	10%	2023 NIPSCO C&I OLM Survey
Bathroom Aerator	2	42%	88%	2023 NIPSCO C&I OLM Survey
Kitchen Aerator	1	42%	42%	2023 NIPSCO C&I OLM Survey
Hot Water Temp card	1	40%	10%	2023 NIPSCO C&I OLM Survey

MEASURES	QUANTITY PER KIT	*EX ANTE* ISR	VERIFIED ISR	VERIFIED ISR SOURCE
Pipe Insulation	1	40%	42%	2023 NIPSCO C&I OLM Survey
Desk Lamp	1	98%	69%	2023 NIPSCO C&I OLM Survey
Office Kits (650050, 650058, 650061, 650062)				
Desk Lamp	1	98%	69%	2023 NIPSCO C&I OLM Survey
Advanced Power Strip	1	83%	82%	2023 NIPSCO C&I OLM Survey
Bathroom Aerator	2	42%	34%	2023 NIPSCO C&I OLM Survey
Kitchen Aerator	1	42%	34%	2023 NIPSCO C&I OLM Survey
Hot Water Temp card	1	40%	10%	2023 NIPSCO C&I OLM Survey
Fridge thermometer	1	N/A	N/A	2023 NIPSCO C&I OLM Survey
Switch/Outlet Gaskets	10	50%	38%	2023 NIPSCO C&I OLM Survey
LED Exit Sign Retrofit (Red)	2	18%	33%	2023 NIPSCO C&I OLM Survey
Individual Products				
650010 4-Pack 25w T8 LED	4	93%	93%	TRC Determined ISR
650011 2x4 LED Panel	1	98%	98%	TRC Determined ISR
650012 2x2 LED Panel	1	98%	98%	TRC Determined ISR
650016 Ext Wall Pack 55w	1	98%	98%	TRC Determined ISR
650017 Ext Corn Bulb 54w	1	98%	98%	TRC Determined ISR
650018 Smart Tstat - Gas Heating Only	1	100%	100%	IL TRM v11.0
650020 Pipe Insulation Wrap	1	100%	95%	IL TRM v11.0
650021 Ext Wall Pack 80w	1	98%	98%	TRC Determined ISR
650024 Ext Corn Bulb 100w	1	98%	98%	TRC Determined ISR
650025 Smart Tstat - Elec Cooling Only	1	100%	100%	IL TRM v11.0
650026 Smart Tstat Elec Cooling Gas Heating	1	100%	100%	IL TRM v11.0
650027 Tier 1 Power Strip	1	100%	100%	IL TRM v11.0
650032 Pre-Rinse Spray Valve Gas DHW	1	100%	95%	IL TRM v11.0
650035 Pre-Rinse Spray Valve Elec DHW	1	100%	95%	IL TRM v11.0
650046 Foam Foil Wrap Insulation	1	100%	100%	IL TRM v11.0
650051 ENERGY STAR Air Purifier (Sm)	1	100%	100%	IL TRM v11.0
650052 ENERGY STAR Air Purifier (Med)	1	100%	100%	IL TRM v11.0
650053 ENERGY STAR Air Purifier (Lg)	1	100%	100%	IL TRM v11.0
650054 Door Sweep	1	50%	50%	TRC Determined ISR
650055 Ext Corn Bulb 54w	1	98%	98%	TRC Determined ISR
650056 Smart Tstat - Elec Cooling and Heating	1	100%	100%	IL TRM v11.0

Verified Savings

Table 214 shows the comparison between *ex ante* and verified savings. Per-measure discrepancies between *ex ante* and verified values in the table below are primarily a result of differences between the tracking data per-measure values and the calculated per-measure values provided by the implementor. Modifications for those issues were made to Audited values, described in the Kit and Measure Savings Review section above. Differences in verified savings for kits are primarily the result of applying ISR values determined by the 2023 NIPSCO C&I Online Marketplace survey to each component within the kits, as described in the Verified ISR section above.

In some instances, the verified savings values reflect a correction made to the measure-level savings calculation to consistently apply the same reference between kit and non-kit products, and to verify savings using the specifications of the actual products used. For example:

- The verified savings calculation for Air Purifiers was modified to reference the actual specification of the products offered rather than using the deemed value presented in *ex ante* calculations. Inputs from the specifications include the annual energy use (kWh), partial on mode power (watts), and smoke free clean air delivery rate per watt (watts).
- The verified savings calculation for APS Power Strips (non-kit distribution) was modified to reference the IL TRM v11.0 measure, to be consistent with the kit distributed APS Power Strip measure. ISR was adjusted to 100% to reflect the difference in the distribution channel.

The values reported are for a single kit or measure and do not represent the entire Online Marketplace population.

Table 214. 2023 C&I Online Marketplace Program Verified Per-Kit or Per-Measure Savings

MEASURE/KIT TYPE	*EX ANTE* SAVINGS			VERIFIED SAVINGS		
	KWH	KW	THERMS	KWH	KW	THERMS
650010 4-Pack 25w T8 LED	172.25	0.041	0.00	192.56	0.046	0.00
650011 2x4 LED Panel	141.27	0.034	0.00	141.27	0.034	0.00
650012 2x2 LED Panel	96.56	0.023	0.00	96.56	0.023	0.00
650016 Ext Wall Pack 55w	606.82	0.000	0.00	606.82	0.000	0.00
650017 Ext Corn Bulb 54w	579.24	0.000	0.00	611.03	0.000	0.00
650018 Smart Tstat - Gas Heating Only	0.00	0.000	86.40	0.00	0.000	86.40
650020 Pipe Insulation Wrap	0.00	0.000	2.10	0.00	0.000	2.10
650021 Ext Wall Pack 80w	860.68	0.000	0.00	860.68	0.000	0.00
650024 Ext Corn Bulb 100w	776.34	0.000	0.00	776.34	0.000	0.00

MEASURE/KIT TYPE	*EX ANTE* SAVINGS			VERIFIED SAVINGS		
	KWH	KW	THERMS	KWH	KW	THERMS
650025 Smart Tstat - Elec Cooling Only	472.41	0.353	0.00	472.41	0.353	0.00
650026 Smart Tstat Elec Cooling Gas Heating	667.35	0.353	86.40	667.35	0.353	86.40
650027 Tier 1 Power Strip	64.13	0.000	0.00	112.05	0.000	0.00
650032 Pre-Rinse Spray Valve Gas DHW	0.00	0.000	29.00	0.00	0.000	29.00
650035 Pre-Rinse Spray Valve Elec DHW	684.00	0.104	0.00	684.00	0.000	0.00
650046 Foam Foil Wrap Insulation	0.00	0.000	35.06	0.00	0.000	35.06
650051 ENERGY STAR Air Purifier (Sm)	298.50	0.054	0.00	63.52	0.022	0.00
650052 ENERGY STAR Air Purifier (Med)	433.00	0.078	0.00	94.03	0.011	0.00
650053 ENERGY STAR Air Purifier (Lg)	664.50	0.119	0.00	117.52	0.013	0.00
650054 Door Sweep	0.00	0.000	7.98	0.00	0.000	7.98
650055 Ext Corn Bulb 54w	611.03	0.000	0.00	611.03	0.000	0.00
650056 Smart Tstat - Elec Cooling and Heating	1,795.64	0.353	0.00	1,795.64	0.353	0.00
650049 Water Saver KIT - Dual Fuel	831.04	0.060	65.58	763.86	0.059	35.83
650050 Office KIT - Dual Fuel	233.14	0.027	4.01	218.24	0.023	2.98
650057 Water Saver KIT REV 1 - Dual Fuel	831.04	0.060	65.58	763.86	0.059	35.83
650058 Office KIT REV 2 - Dual Fuel	233.14	0.027	4.01	218.24	0.023	2.98
650059 Water Saver KIT - Electric Only	831.04	0.060	0.00	763.86	0.059	0.00
650060 Water Saver KIT REV 1 - Electric Only	831.04	0.060	0.00	763.86	0.059	0.00
650061 Office KIT REV 1 - Electric Only	233.14	0.027	0.00	218.24	0.023	0.00

MEASURE/KIT TYPE	*EX ANTE* SAVINGS			VERIFIED SAVINGS		
	KWH	KW	THERMS	KWH	KW	THERMS
650062 Office KIT REV 2 - Electric Only	233.14	0.027	0.00	218.24	0.023	0.00

Ex Post Gross Savings

The evaluation team referred to the IL TRM v11.0 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. The following sections summarize the team's findings and recommendations based on the engineering review.

Fuel Saturation

During 2023, 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 2023, *ex ante* calculations relied on the 2021 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 215.

Table 215. 2023 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	42%	58%	0%	100%
Ex Post Gross	48%	52%	11%	89%

Waste Heat Factor – Therm Penalties

The C&I Online Marketplace program did not report electric or therm waste heat factors (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 v11.0, 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., 89% WHF impact for gas heating and AC, 11% WHF impact for electric HP).

Table 216 shows the therm waste heat penalties by applicable measure and kit for the total 2023 population for inclusion in cost-effectiveness calculations. There was a -4,255.63 therm penalty for the entire C&I Online Marketplace program in 2023. The penalty is much lower than 2022 because there were fewer interior light bulbs distributed in 2023.

Table 216. 2023 C&I Online Marketplace Program Waste Heat Factor Penalties

APPLICABLE MEASURES	MEASURE ID	WHF PENALTY BY INDIVIDUAL MEASURE (THERMS)	POPULATION OF KIT COUNTS	WHF PENALTY TOTAL POPULATION
Individual Measures:				
4-Pack 25w T8 LED	650010	(2.38)	308	(733.14)
2x4 LED Panel	650011	(1.75)	1505	(2,628.02)
2x2 LED Panel	650012	(1.19)	475	(566.96)
Water Saver Kit (Dual Fuel Only)				
Desk Lamp	650049, 650057	(0.41)	167	(68.09)
Office Kit (Dual Fuel Only)				
Desk Lamp	650050, 650058	(0.41)	340	(138.62)
LED Exit Sign Retrofit (Red)	650050, 650058	(0.36)	340	(120.80)
Total				**(4,255.63)**

Ex Post Gross Savings

For all kit measures, the *ex ante* and *ex post* calculations predominately relied on inputs from the IL TRM v11.0. 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. Table 217 shows the deviations between *ex ante* and *ex post* inputs for applicable measures.

Table 217. 2023 C&I Online Marketplace Program *Ex Post* Measure Input Modifications

MEASURE	*EX ANTE* VALUE	*EX POST* VALUE	MODIFICATION MADE
Applicable to most measures	ISR, varies	ISR, varies	ISR differences. Most *ex ante* kit measures' ISRs based on 2021 and 2022 NIPSCO EM&V C&I reported values. *Ex post* values based on 2023 NIPSCO C&I Online Marketplace survey values. Most *ex ante* individual product measure ISRs based on engineering judgement or various TRM references. *Ex post* ISR values based on IL TRM v11.0 references for best match applicable measure
Applicable to hot water saving measures	42% electric DHW, 58% gas DHW	48% electric DHW, 52% gas DHW	DHW fuel ratio differences. *Ex ante* calculations uniformly use 42% electric and 58% gas DHW inputs, derived from 2021 NIPSCO EM&V C&I Online Marketplace reported values. *Ex post* values (48% electric/52% gas) derived from 2023 NIPSCO C&I Online Marketplace survey values.
Pipe Insulation (Measure 650020)	15 feet	5 feet	The product is a 15-foot roll of insulation wrap tape, meant to be wrapped around a pipe with overlap. *Ex ante* used 15 feet as the total linear distance covered. The evaluation team determined that given the typical

MEASURE	*EX ANTE* VALUE	*EX POST* VALUE	MODIFICATION MADE
			circumference of a hot water pipe and assuming 50% overlap, the actual linear distance the wrap could likely cover is approximately 5 feet.
Pipe Insulation (Measure 650020)	100% gas DHW ratio applied	52% gas DHW ratio applied	By omission, *ex ante* assumes 100% gas DHW across the portfolio of installations, which differs from the ratio applied to all other hot water saving measures. *Ex post* applies the same gas DHW % ratio as applied to all other hot water saving measures.
LED Exit Sign Retrofit	0.67 CF	1 CF	Given 24/7 operation, CF should be 1.0
Bath Aerator	41 Hours Water Saver, 20 Hours Office	40.82 Hours Water Saver, 20.24 Hours Office	Water Saver Kits *ex ante* fixed value of 41 hours, but based on the inputs the calculated value equates to 40.82 hours. Office Kits *ex ante* fixed value of 20 hours, but based on the inputs the calculated value equates to 20.41 hours. Results in minor difference.
Kitchen Aerator	0.097 EPG Electric	0.105 EPG Electric	EPG Electric input into the measure savings equation is static in *ex ante* and calculated based on the IL TRM v11.0 savings equation inputs in *ex post*, resulting in slight difference in output savings
Kitchen Aerator	0.0134 CF	0.0128 CF	*Ex ante* uses 0.0134 CF for water saver kits, but the value does not align with the referenced IL TRM v11.0 for CF for any space type provided. *Ex post* uses 0.0128 CF referenced in IL TRM v11.0 for 'Other' space type given the water saver kits are not necessarily designed for a specific space type
Showerhead	2.67 GPM_Base	2.5 GPM_Base	Referenced resource for *ex ante* (IL TRM v11) indicates 2.5 GPM for baseline. Assume this input was an error.
Pre Rinse Spray Valve	1.8 Hours/day	1.3 Hours/day	1.8 hours in *ex ante* derived from an average of small, medium, and large restaurant establishments. This kit is designed for small commercial businesses, which appears to align with the small quick service restaurants (1 hour/day) more closely, and Medium sized casual dining restaurants (1.5 hours/day). *Ex post* is an average of the two space types.

Table 218 highlights all reference source differences between *ex ante* and *ex post* gross estimates by measure type.

Table 218. 2023 C&I Online Marketplace Source Differences Between *Ex Ante* & *Ex Post* Gross

MEASURE TYPE	*EX ANTE* SOURCES	*EX POST* GROSS SOURCES	PRIMARY REASONS FOR DIFFERENCES
Pre Rinse Spray Valve - Non-Kit	MEMD 2023	IL TRM v11.0	Within kits, *ex ante* references IL TRM v11.0 for savings calculation, and outside of kits *ex ante* references MEMD 2023 for savings calculation. Except for applied ISR, it is not clear why the same measure should derive savings from different sources. For consistency, *ex post* utilizes IL TRM v11.0 when an applicable measure exists and maintains the same savings calculation for within kit and outside of kit measures, with different and appropriate ISRs applied to each distribution type.
APS Power Strip - Non-Kit	MEMD 2023	IL TRM v11.0	Within kits, *ex ante* references IL TRM v11.0 for savings calculation, and outside of kits *ex ante* references MEMD 2023 for savings calculation. Except for applied ISR, it is not clear why the same measure should derive savings from different sources. For consistency, *ex post* utilizes IL TRM v11.0 when an applicable measure exists and maintains the same savings calculation for within kit and outside of kit measures, with different and appropriate ISRs applied to each distribution type.
Door Sweep	NICOR 2021 EM&V 2021	IL TRM v11.0	IL TRM v11.0 has an applicable measure.
Pipe Insulation – Kit	MEMD 2023	IL TRM v11.0	IL TRM v11.0 has an applicable measure. Within kits, *ex ante* references MEMD 2023 for savings calculation, and outside of kits *ex ante* references MA TRM 2025 for savings. Except for applied ISR, it is not clear why the same measure should derive savings from different sources. For consistency, *ex post* utilizes IL TRM v11.0 when an applicable measure exists and maintains the same savings calculation for within kit and outside of kit measures, with different and appropriate ISRs applied to each distribution type.
Pipe Insulation - Non-Kit	MA TRM 2025	IL TRM v11.0	IL TRM v11.0 has an applicable measure. Within kits, *ex ante* references MEMD 2023 for savings calculation, and outside of kits *ex ante* references MA TRM 2025 for savings. Except for applied ISR, it is not clear why the same measure should derive savings from different sources. For consistency, *ex post* utilizes IL TRM v11.0 when an applicable measure exists and maintains the same savings calculation for within kit and outside of kit measures, with different and appropriate ISRs applied to each distribution type.
Outlet Gaskets	NICOR 2021 EM&V report	IL TRM v11.0	IL TRM v11.0 has an applicable measure.

MEASURE TYPE	*EX ANTE* SOURCES	*EX POST* GROSS SOURCES	PRIMARY REASONS FOR DIFFERENCES
	(therms), and PA TRM 2021 (electric)		
Hot Water Temp Card	NICOR 2021 EM&V report residential kits	IL TRM v11.0 5.4.6 Water Heater Temperature Setback	*Ex post* determined that the value of the product was to prompt DHW setback to a lower temperature, thus saving hot water heating energy. IL TRM v11.0 has a commercial measure for this.
Air Purifiers (all sizes)	MEMD 2023	Actual product specifications and ENERGY STAR % improvement value	Ex ante utilized deemed values presumably based on approximate size of equipment. Ex post utilized the actual kW consumption from the product specifications. ENERGY STAR indicates that the qualification threshold is at least 25% more efficient than a standard non-qualified product. The kW savings are calculated as the difference in *ex post*.

Table 219 shows the *ex ante* deemed savings and *ex post* gross per-measure savings for 2023 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 219. 2023 C&I Online Marketplace Program *Ex Ante* & *Ex Post* Gross Per-Measure Savings Values

MEASURES	QUANTITY IN KIT	*EX ANTE* SAVINGS			*EX POST* SAVINGS		
		KWH	KW	THERMS	KWH	KW	THERMS
Water Saver Kits (650049, 650057, 650059, 650060)							
Pre-rinse spray valve	1	456.23	0.000	26.33	355.50	0.000	16.10
Fixed SH	1	232.37	0.024	16.01	54.04	0.006	2.92
Bathroom Aerator	2	43.52	0.014	3.01	104.22	0.033	5.63
Kitchen Aerator	1	27.19	0.009	2.05	33.80	0.011	1.83
Hot Water Temp card	1	0.00	0.000	0.13	0.00	0.000	0.13
Pipe Insulation	1	0.00	0.000	18.04	0.00	0.000	5.48
Desk Lamp	1	71.72	0.014	0.00	50.39	0.010	0.00
Office Kits (650050, 650058, 650061, 650062)							
Desk Lamp	1	71.72	0.014	0.00	50.39	0.01	0.00
Advanced Power Strip	1	93.00	0.000	0.00	91.88	0.000	0.00
Bathroom Aerator	2	21.76	0.007	1.50	20.13	0.006	1.09
Kitchen Aerator	1	13.60	0.004	1.03	13.68	0.004	0.74
Hot Water Temp card	1	0.00	0.000	0.13	0.00	0.000	0.13
Fridge thermometer	1	0.00	0.000	0.00	0.00	0.000	0.00
Switch/Outlet Gaskets	10	17.65	0.000	1.35	4.56	0.000	1.79

MEASURES	QUANTITY IN KIT	*EX ANTE* SAVINGS			*EX POST* SAVINGS		
		KWH	KW	THERMS	KWH	KW	THERMS
LED Exit Sign Retrofit (Red)	2	15.42	0.001	0.00	28.74	0.004	0.00
Individual Products							
650010 4-Pack 25w T8 LED	4	172.25	0.041	0.00	192.56	0.046	0.00
650011 2x4 LED Panel	1	141.27	0.034	0.00	141.27	0.034	0.00
650012 2x2 LED Panel	1	96.56	0.023	0.00	96.56	0.023	0.00
650016 Ext Wall Pack 55w	1	606.82	0.000	0.00	606.82	0.000	0.00
650017 Ext Corn Bulb 54w	1	579.24	0.000	0.00	611.03	0.000	0.00
650018 Smart Tstat - Gas Heating Only	1	0.00	0.000	86.40	0.00	0.000	86.40
650020 Pipe Insulation Wrap	1	0.00	0.000	2.10	0.00	0.000	23.85
650021 Ext Wall Pack 80w	1	860.68	0.000	0.00	860.68	0.000	0.00
650024 Ext Corn Bulb 100w	1	776.34	0.000	0.00	776.34	0.000	0.00
650025 Smart Tstat - Elec Cooling Only	1	472.41	0.353	0.00	472.41	0.353	0.00
650026 Smart Tstat Elec Cooling Gas Heating	1	667.35	0.353	86.40	667.35	0.353	86.40
650027 Tier 1 Power Strip	1	64.13	0.000	0.00	112.05	0.000	0.00
650032 Pre-Rinse Spray Valve Gas DHW	1	0.00	0.000	29.00	0.00	0.000	89.12
650035 Pre-Rinse Spray Valve Elec DHW	1	684.00	0.104	0.00	2,132.11	0.000	0.00
650046 Foam Foil Wrap Insulation	1	0.00	0.000	35.06	0.00	0.000	35.06
650051 ENERGY STAR Air Purifier (Sm)	1	298.50	0.054	0.00	63.52	0.022	0.00
650052 ENERGY STAR Air Purifier (Med)	1	433.00	0.078	0.00	94.03	0.011	0.00
650053 ENERGY STAR Air Purifier (Lg)	1	664.50	0.119	0.00	117.52	0.013	0.00
650054 Door Sweep	1	0.00	0.000	7.98	0.00	0.000	8.67
650055 Ext Corn Bulb 54w	1	611.03	0.000	0.00	611.03	0.000	0.00
650056 Smart Tstat - Elec Cooling and Heating	1	1,795.64	0.353	0.00	1,795.64	0.353	0.00

Realization Rates

The next three tables (Table 220 through Table 222) show the program's *ex ante* reported savings, audited gross, verified gross, and *ex post* gross electric and therm savings for the total population of the C&I Online Marketplace program.

Table 220. 2023 C&I 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.)	REALIZATION RATE
Water Saver Kit - Dual Fuel (650057)					
Pre-rinse spray valve	76,189.94	76,189.94	87,074.21	59,368.78	78%
Fixed SH	38,806.47	38,806.47	9,025.29	9,025.29	23%
Bathroom Aerator	7,268.58	7,268.58	17,405.03	17,405.03	239%
Kitchen Aerator	4,541.34	4,938.68	5,644.20	5,644.20	124%
Hot Water Temp card	0.00	0.00	0.00	0.00	N/A
Pipe Insulation	0.00	0.00	0.00	0.00	N/A
Desk Lamp	11,976.68	11,976.68	8,415.39	8,415.39	70%
Office Kit - Dual Fuel (650058)					
Desk Lamp	24,383.66	24,383.66	17,133.12	17,133.12	70%
Advanced Power Strip	31,620.34	31,620.34	31,239.37	31,239.37	99%
Bathroom Aerator	7,399.15	7,399.15	6,845.47	6,845.47	93%
Kitchen Aerator	4,622.92	5,027.40	4,651.20	4,651.20	101%
Hot Water Temp card	0.00	0.00	0.00	0.00	N/A
Fridge thermometer	0.00	0.00	0.00	0.00	N/A
Switch/Outlet Gaskets	6,001.00	6,001.00	4,560.76	1,550.40	26%
LED Exit Sign Retrofit (Red)	5,241.62	5,241.62	9,772.51	9,772.51	186%
Water Saver Kits - Electric Only (650059, 650060)					
Pre-rinse spray valve	24,636.27	24,636.27	28,155.73	19,197.09	78%
Fixed SH	12,548.20	12,548.20	2,918.36	2,918.36	23%
Bathroom Aerator	2,350.32	2,350.32	5,627.97	5,627.97	239%
Kitchen Aerator	1,468.46	1,596.94	1,825.07	1,825.07	124%
Hot Water Temp card	0.00	0.00	0.00	0.00	N/A
Pipe Insulation	0.00	0.00	0.00	0.00	N/A
Desk Lamp	3,872.70	3,872.70	2,721.14	2,721.14	70%
Office Kits - Electric Only (650061, 650062)					
Desk Lamp	7,530.25	7,530.25	5,291.11	5,291.11	70%
Advanced Power Strip	9,765.10	9,765.10	9,647.45	9,647.45	99%
Bathroom Aerator	2,285.03	2,285.03	2,114.04	2,114.04	93%
Kitchen Aerator	1,427.67	1,552.58	1,436.40	1,436.40	101%

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
Hot Water Temp card	0.00	0.00	0.00	0.00	N/A
Fridge thermometer	0.00	0.00	0.00	0.00	N/A
Switch/Outlet Gaskets	1,853.25	1,853.25	1,408.47	478.80	26%
LED Exit Sign Retrofit (Red)	1,618.73	1,618.73	3,017.98	3,017.98	186%
Individual Products					
650010 4-Pack 25w T8 LED	53,053.00	59,309.83	59,309.83	59,309.83	112%
650011 2x4 LED Panel	212,611.35	212,604.09	212,604.09	212,604.09	100%
650012 2x2 LED Panel	45,866.00	45,866.48	45,866.48	45,866.48	100%
650016 Ext Wall Pack 55w	4,247.74	4,247.72	4,247.72	4,247.72	100%
650017 Ext Corn Bulb 54w	166,241.88	175,366.93	175,366.93	175,366.93	105%
650018 Smart Tstat - Gas Heating Only	0.00	0.00	0.00	0.00	N/A
650020 Pipe Insulation Wrap	0.00	0.00	0.00	0.00	N/A
650021 Ext Wall Pack 80w	257,343.32	257,342.56	257,342.56	257,342.56	100%
650024 Ext Corn Bulb 100w	232,902.00	232,901.60	232,901.60	232,901.60	100%
650025 Smart Tstat - Elec Cooling Only	1,889.64	1,889.64	1,889.64	1,889.64	100%
650026 Smart Tstat Elec Cooling Gas Heat	40,708.35	40,708.05	40,708.05	40,708.05	100%
650027 Tier 1 Power Strip	128.26	128.26	224.10	224.10	175%
650032 Pre-Rinse Spray Valve Gas DHW	0.00	0.00	0.00	0.00	N/A
650035 Pre-Rinse Spray Valve Elec DHW	2,052.00	2,052.00	2,052.00	6,396.34	312%
650046 Foam Foil Wrap Insulation	0.00	0.00	0.00	0.00	N/A
650051 ENERGY STAR Air Purifier (Sm)	5,671.50	5,671.50	1,206.93	1,206.93	21%
650052 ENERGY STAR Air Purifier (Med)	1,732.00	1,732.00	376.13	376.13	22%
650053 ENERGY STAR Air Purifier (Lg)	664.50	664.50	117.52	117.52	18%
650054 Door Sweep	0.00	0.00	0.00	0.00	N/A

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
650055 Ext Corn Bulb 54w	5,499.27	5,499.31	5,499.31	5,499.31	100%
650056 Smart Tstat - Elec Cooling and Heat	25,138.96	25,138.93	25,138.93	25,138.93	100%
Total Program Savings	**1,343,156.91**	**1,359,586.27**	**1,330,782.10**	**1,294,522.33**	**96%**

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 221. 2023 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
Water Saver Kit - Dual Fuel (650057)					
Pre-rinse spray valve	0.000	0.000	0.000	0.000	N/A
Fixed SH	3.987	3.987	0.990	0.990	25%
Bathroom Aerator	2.269	2.269	5.458	5.458	241%
Kitchen Aerator	1.484	1.614	1.770	1.770	119%
Hot Water Temp card	0.000	0.000	0.000	0.000	N/A
Pipe Insulation	0.000	0.000	0.000	0.000	N/A
Desk Lamp	2.310	2.310	1.623	1.623	70%
Office Kit - Dual Fuel (650058)					
Desk Lamp	4.703	4.703	3.305	3.305	70%
Advanced Power Strip	0.000	0.000	0.000	0.000	N/A
Bathroom Aerator	2.368	2.368	2.147	2.147	91%
Kitchen Aerator	1.479	1.609	1.459	1.459	99%
Hot Water Temp card	0.000	0.000	0.000	0.000	N/A
Fridge thermometer	0.000	0.000	0.000	0.000	N/A
Switch/Outlet Gaskets	0.102	0.005	0.003	0.003	3%
LED Exit Sign Retrofit (Red)	0.482	0.482	0.899	1.342	278%
Water Saver Kits - Electric Only (650059, 650060)					
Pre-rinse spray valve	0.000	0.000	0.000	0.000	N/A
Fixed SH	1.289	1.289	0.320	0.320	25%
Bathroom Aerator	0.734	0.734	1.765	1.765	241%
Kitchen Aerator	0.480	0.522	0.572	0.572	119%
Hot Water Temp card	0.000	0.000	0.000	0.000	N/A
Pipe Insulation	0.000	0.000	0.000	0.000	N/A

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
Desk Lamp	0.747	0.747	0.525	0.525	70%
Office Kits - Electric Only (650061, 650062)					
Desk Lamp	1.452	1.452	1.021	1.021	70%
Advanced Power Strip	0.000	0.000	0.000	0.000	N/A
Bathroom Aerator	0.731	0.731	0.663	0.663	91%
Kitchen Aerator	0.457	0.497	0.450	0.450	99%
Hot Water Temp card	0.000	0.000	0.000	0.000	N/A
Fridge thermometer	0.000	0.000	0.000	0.000	N/A
Switch/Outlet Gaskets	0.032	0.002	0.001	0.001	3%
LED Exit Sign Retrofit (Red)	0.149	0.149	0.278	0.414	278%
Individual Products					
650010 4-Pack 25w T8 LED	12.628	14.156	14.156	14.156	112%
650011 2x4 LED Panel	51.170	50.743	50.743	50.743	99%
650012 2x2 LED Panel	10.925	10.947	10.947	10.947	100%
650016 Ext Wall Pack 55w	0.000	0.000	0.000	0.000	N/A
650017 Ext Corn Bulb 54w	0.000	0.000	0.000	0.000	N/A
650018 Smart Tstat - Gas Heating Only	0.000	0.000	0.000	0.000	N/A
650020 Pipe Insulation Wrap	0.000	0.000	0.000	0.000	N/A
650021 Ext Wall Pack 80w	0.000	0.000	0.000	0.000	N/A
650024 Ext Corn Bulb 100w	0.000	0.000	0.000	0.000	N/A
650025 Smart Tstat - Elec Cooling Only	1.412	1.412	1.412	1.412	100%
650026 Smart Tstat Elec Cooling Gas Heating	21.533	21.538	21.538	21.538	100%
650027 Tier 1 Power Strip	0.000	0.000	0.000	0.000	N/A
650032 Pre-Rinse Spray Valve Gas DHW	0.000	0.000	0.000	0.000	N/A
650035 Pre-Rinse Spray Valve Elec DHW	0.312	0.000	0.000	0.000	0%
650046 Foam Foil Wrap Insulation	0.000	0.000	0.000	0.000	N/A
650051 ENERGY STAR Air Purifier (Sm)	1.026	1.017	0.413	0.413	40%
650052 ENERGY STAR Air Purifier (Med)	0.312	0.310	0.043	0.043	14%
650053 ENERGY STAR Air Purifier (Lg)	0.119	0.119	0.013	0.013	11%
650054 Door Sweep	0.000	0.000	0.000	0.000	N/A

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
650055 Ext Corn Bulb 54w	0.000	0.000	0.000	0.000	N/A
650056 Smart Tstat - Elec Cooling and Heating	4.942	4.943	4.943	4.943	100%
Total Savings	129.654	130.655	127.457	128.037	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.

Table 222. 2023 C&I Online Marketplace 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.)	REALIZATION RATE
Water Saver Kit - Dual Fuel (650057)					
Pre-rinse spray valve	4,397.66	4,397.66	3,942.73	2,688.22	61%
Fixed SH	2,674.50	2,674.50	487.96	487.96	18%
Bathroom Aerator	502.22	500.94	941.02	941.02	187%
Kitchen Aerator	343.02	340.37	305.16	305.16	89%
Hot Water Temp card	22.04	22.04	21.71	21.71	98%
Pipe Insulation	3,012.01	3,012.01	285.06	915.47	30%
Desk Lamp	0.00	0.00	0.00	0.00	N/A
Office Kit - Dual Fuel (650058)					
Desk Lamp	0.00	0.00	0.00	0.00	N/A
Advanced Power Strip	0.00	0.00	0.00	0.00	N/A
Bathroom Aerator	511.24	509.94	370.11	370.11	72%
Kitchen Aerator	349.18	346.48	251.47	251.47	72%
Hot Water Temp card	44.88	44.88	44.20	44.20	98%
Fridge thermometer	0.00	0.00	0.00	0.00	N/A
Switch/Outlet Gaskets	459.00	459.00	348.84	607.24	132%
LED Exit Sign Retrofit (Red)	0.00	0.00	0.00	0.00	N/A
Individual Products					
650010 4-Pack 25w T8 LED	0.00	0.00	0.00	0.00	N/A
650011 2x4 LED Panel	0.00	0.00	0.00	0.00	N/A
650012 2x2 LED Panel	0.00	0.00	0.00	0.00	N/A
650016 Ext Wall Pack 55w	0.00	0.00	0.00	0.00	N/A
650017 Ext Corn Bulb 54w	0.00	0.00	0.00	0.00	N/A
650018 Smart Tstat - Gas Heating Only	345.60	345.61	345.61	345.61	100%

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
650020 Pipe Insulation Wrap	12.60	12.60	12.60	143.07	1135%
650021 Ext Wall Pack 80w	0.00	0.00	0.00	0.00	N/A
650024 Ext Corn Bulb 100w	0.00	0.00	0.00	0.00	N/A
650025 Smart Tstat - Elec Cooling Only	0.00	0.00	0.00	0.00	N/A
650026 Smart Tstat Elec Cooling Gas Heating	5,270.40	5,270.61	5,270.61	5,270.61	100%
650027 Tier 1 Power Strip	0.00	0.00	0.00	0.00	N/A
650032 Pre-Rinse Spray Valve Gas DHW	116.00	116.00	116.00	356.46	307%
650035 Pre-Rinse Spray Valve Elec DHW	0.00	0.00	0.00	0.00	N/A
650046 Foam Foil Wrap Insulation	70.12	70.12	70.12	70.12	100%
650051 ENERGY STAR Air Purifier (Sm)	0.00	0.00	0.00	0.00	N/A
650052 ENERGY STAR Air Purifier (Med)	0.00	0.00	0.00	0.00	N/A
650053 ENERGY STAR Air Purifier (Lg)	0.00	0.00	0.00	0.00	N/A
650054 Door Sweep	71.82	71.82	71.82	78.06	109%
650055 Ext Corn Bulb 54w	0.00	0.00	0.00	0.00	N/A
650056 Smart Tstat - Elec Cooling and Heating	0.00	0.00	0.00	0.00	N/A
Total Savings	**18,201.80**	**18,194.60**	**12,885.01**	**12,896.49**	**71%**

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 evaluation team calculated freeridership and participant spillover using survey data collected from the 2023 C&I Online Marketplace participant survey, which was fielded in early 2024. The survey focused exclusively on questions related to the primary kit offerings (Water Saver and Office), rather than on the individual products. Details on the freeridership and spillover analysis are in *Appendix 13. C&I Online Marketplace (OLM) Program.* Table 223 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 through the C&I Online Marketplace program.

Table 223. 2023 C&I Online Marketplace Program Net-to Gross Ratios by Measure

MEASURE	RESPONSES (n)	FREERIDERSHIP [a]	PARTICIPANT SPILLOVER	NTG
Desk Lamp	46	16%	0%	84%
Pre-rinse Spray Valve	16	10%	0%	90%
Fixed Showerhead	9	14%	0%	86%
Bathroom Aerator	25	8%	0%	92%
Kitchen Aerator	24	14%	0%	86%
Hot Water Temp card	25	5%	0%	95%
Pipe Insulation	17	23%	0%	77%
Advanced Power Strip	47	23%	0%	77%
Fridge Thermometer	29	20%	0%	80%
Switch/Outlet Gaskets	29	14%	0%	86%
LED Exit Sign Retrofit (Red)	28	20%	0%	80%

[a] This score is an average weighted by verified quantity of measure installed.

Resulting Net Savings

Table 224 presents the resulting net electric savings, demand reduction, and natural gas savings.

Table 224. 2023 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
Desk Lamp	33,560.76	6.473	0.00	84%	28,191.04	5.438	0.00
Pre-rinse Spray Valve	78,565.87	0.000	2,688.22	90%	70,709.29	0.000	2,419.40
Fixed SH	11,943.64	1.310	487.96	86%	10,271.53	1.127	419.64
Bathroom Aerator	31,992.52	10.033	1,311.12	92%	29,433.12	9.230	1,206.23
Kitchen Aerator	13,556.87	4.251	556.63	86%	11,658.91	3.656	478.70
Hot Water Temp card	0.00	0.000	65.91	95%	0.00	0.000	62.61
Pipe Insulation	0.00	0.000	915.47	77%	0.00	0.000	704.91
Advanced Power Strip	40,886.82	0.000	0.00	77%	31,482.85	0.000	0.00
Fridge Thermometer	0.00	0.000	0.00	80%	0.00	0.000	0.00
Switch/Outlet Gaskets	2,029.20	0.004	607.24	86%	1,745.11	0.003	522.23
LED Exit Sign Retrofit (Red)	12,790.48	1.756	0.00	80%	10,232.39	1.405	0.00
4-Pack LED T8	59,309.83	14.156	0.00	87% [a]	51,599.56	12.316	0.00
2X4 LED Panel	212,604.09	50.743	0.00	87% [a]	184,965.56	44.147	0.00
2X2 LED Panel	45,866.48	10.947	0.00	87% [a]	39,903.84	9.524	0.00
LED Wall Pack 55 W	4,247.72	0.000	0.00	87% [a]	3,695.52	0.000	0.00

MEASURE	*EX POST* GROSS SAVINGS/REDUCTION			NTG	*EX POST* NET SAVINGS/REDUCTION		
	KWH	KW	THERMS		KWH	KW	THERMS
LED Corn Bulb	413,767.84	0.000	0.00	87% [a]	359,978.02	0.000	0.00
Smart Thermostat - Gas Heating	0.00	0.000	345.61	87% [a]	0.00	0.000	300.68
Pipe Insulation (≤1/2" Pipe)	0.00	0.000	143.07	87% [a]	0.00	0.000	124.47
LED Wall Pack	257,342.56	0.000	0.00	87% [a]	223,888.03	0.000	0.00
Smart Thermostat - Electric Cooling Only	1,889.64	1.412	0.00	87% [a]	1,643.99	1.229	0.00
Smart Thermostat - Electric Cooling and Gas Heating	40,708.05	21.538	5,270.61	87% [a]	35,416.00	18.738	4,585.43
Tier 1 Power Strip	224.10	0.000	0.00	87% [a]	194.97	0.000	0.00
Pre-Rinse Spray Valve Natural Gas Water Heating	0.00	0.000	356.46	87% [a]	0.00	0.000	310.12
Pre-Rinse Spray Valve Electric Water Heating	6,396.34	0.000	0.00	87% [a]	5,564.81	0.000	0.00
Foam Foil Wrap Insulation (17FT)	0.00	0.000	70.12	87% [a]	0.00	0.000	61.01
ENERGY STAR Air Purifier	1,700.58	0.470	0.00	87% [a]	1,479.51	0.409	0.00
Door Sweep	0.00	0.000	78.06	87% [a]	0.00	0.000	67.91
Smart Thermostat - Electric Cooling and Heating	25,138.93	4.943	0.00	87% [a]	21,870.87	4.300	0.00
Total Savings	**1,294,522.33**	**128.037**	**12,896.49**		**1,123,924.89**	**111.521**	**11,263.36**

[a] The program level average *ex post* gross MMBtu savings weighted NTG value derived from 2023 surveyed measures was applied to this measure category. The survey focused exclusively on questions related to the primary kit offerings.

Table 225 shows the net-to-gross results for each fuel.

Table 225. 2023 C&I Online Marketplace 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.)	1,343,156.91	1,294,522.33	87%	1,123,924.89
Peak Demand Reduction (kW)	129.654	128.037	87%	111.521
Natural Gas Energy Savings (therms/yr.)	18,201.80	12,896.49	87%	11,263.36

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 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 future improvements to the C&I Online Marketplace itself or the measure offerings?

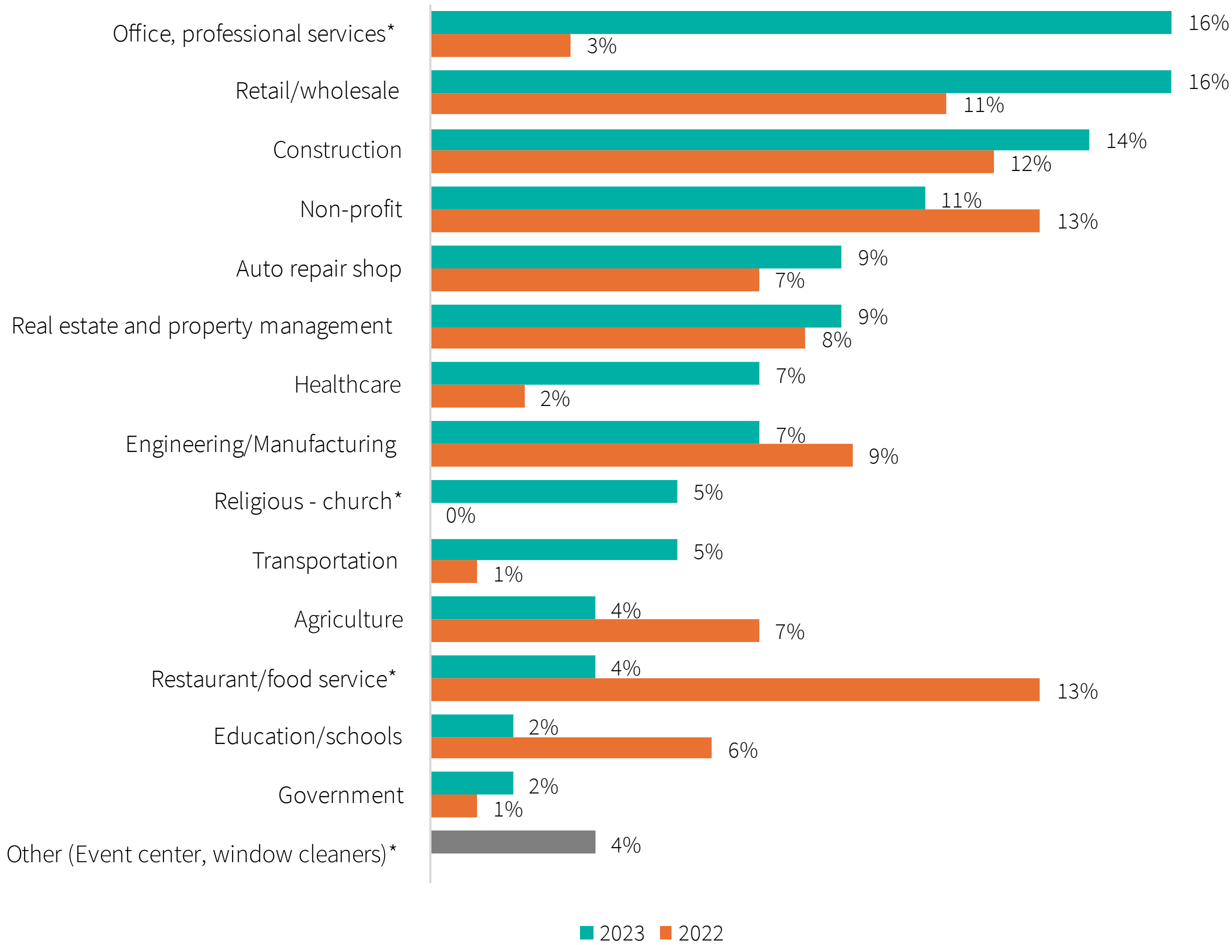
Participant Survey

The evaluation team surveyed 57 customers who ordered a kit between January 2023 and December 2023. Almost all respondents ordered an office kit (95%), and half ordered a water kit (53%). Over half (58%) of respondents ordered more than one kit, with eleven customers (19%) ordering the maximum five kits. Overall, there were far fewer kits ordered in 2023 compared to 2022 (666 compared to 1,244), and fewer individual customers ordered kits as well -192 in 2023 and 462 in 2022. The following sections describe the findings related to sources of awareness, reasons for participation, satisfaction with the program, and program impacts on customers. Where appropriate, results from 2023 are compared to findings from the 2022 participant survey.

Participant Firmographics

This year's survey again reached a wide variety of businesses, but in different proportions than the 2022 survey. Most notably there were more offices and fewer restaurants than last year, possibly influenced by the fact that there was no longer a restaurant-specific kit. This year's skew towards offices over restaurants may explain some of the differences seen in comparisons later in this section.

Figure 63. Business Industry Representation of Survey Respondents



*Indicates differences between groups are significant at the p ≤ 0.05 level.

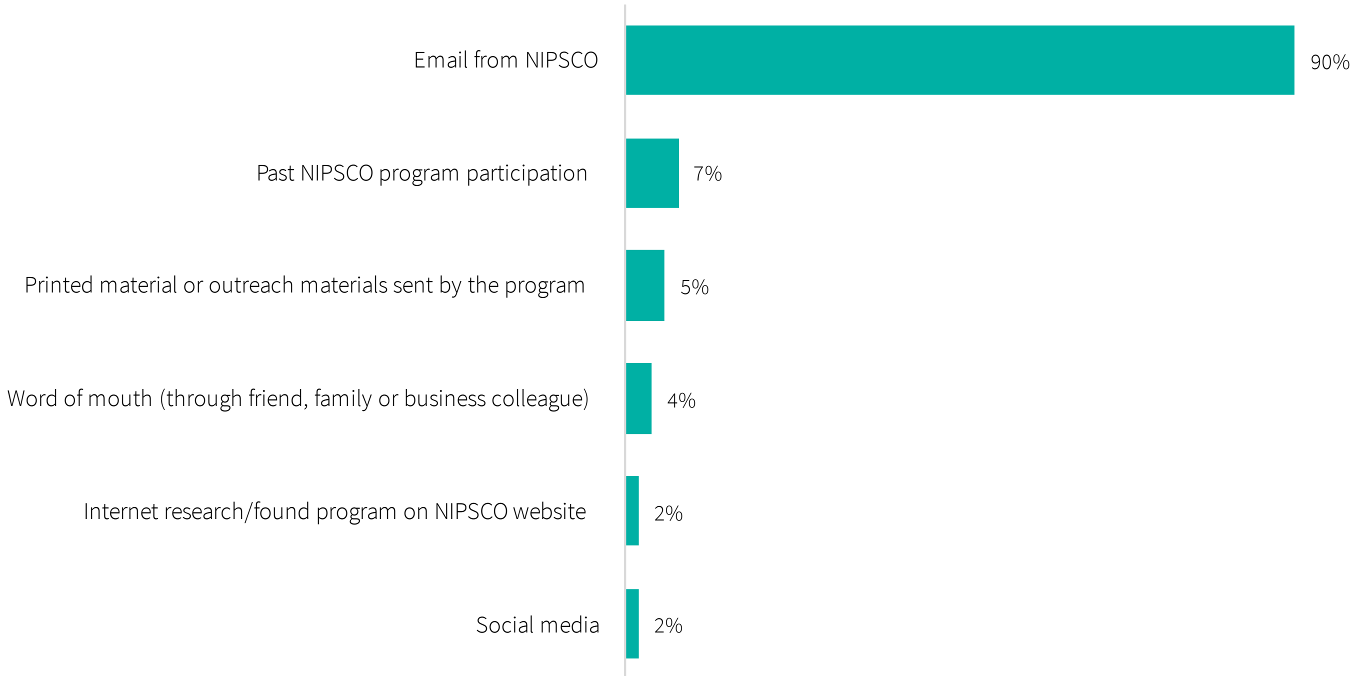
Source: C&I Online Marketplace Survey Question I1. "What industry is your organization in?" 2023 n=57, 2022 n=89, multiple responses allowed.

Over half of respondents reported having smaller facilities, with 42% in spaces less than 5,000 square feet, 18% in spaces between 5,000 and 10,000 square feet, and 22% in spaces between 10,000 and 50,000 square feet. Some respondents reported installing items in larger facilities: 8% (n=5) had facilities between 50,000 and 100,000 square feet. No respondents were in spaces larger than 100,000 square feet. Like 2022, two thirds of respondents owned their facility (n=38) and one third leased (n=16).

Energy Efficiency Awareness and Marketing

The C&I Online Marketplace Program was marketed by email directly to NIPSCO business customers. Orders were shipped with cross-promotional marketing material that highlighted other NIPSCO Business and Residential energy efficiency programs. Like 2022, most respondents heard about the program through an email from NIPSCO (90%). Now that the program has run for multiple years, a few respondents said they learned about the program through past participation (7%), followed by printed materials (5%), word of mouth (4%), internet searches/NIPSCO website (2%), and social media (2%).

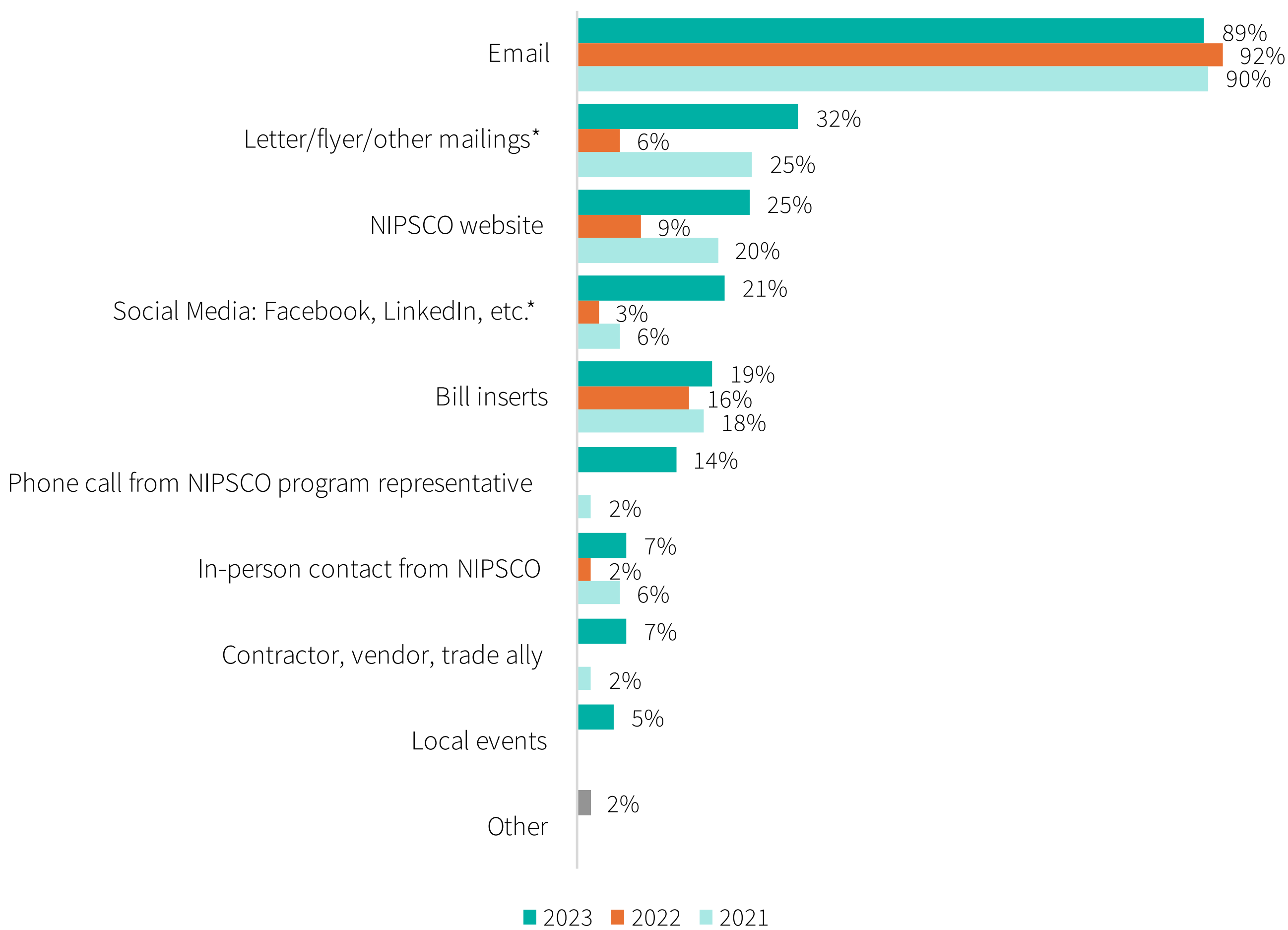
Figure 64. How Participants Learned about the Business Online Marketplace



Source: C&I Online Marketplace Survey Question C1. "How did you learn about NIPSCO's Business Online Marketplace? (Please select all that apply)" n=57, multiple responses allowed.

As seen below in Figure 65, most respondents preferred to hear about energy saving opportunities through email (89%), letters/flyers/other mailings (32%), and the NIPSCO website (25%). This year's respondents were notably more receptive to letters and social media than 2022 respondents. Interestingly, communication preferences from 2023 respondents aligned more closely with 2021 survey respondents than in 2022.

Figure 65. Preferred Energy Efficiency Communication Channel



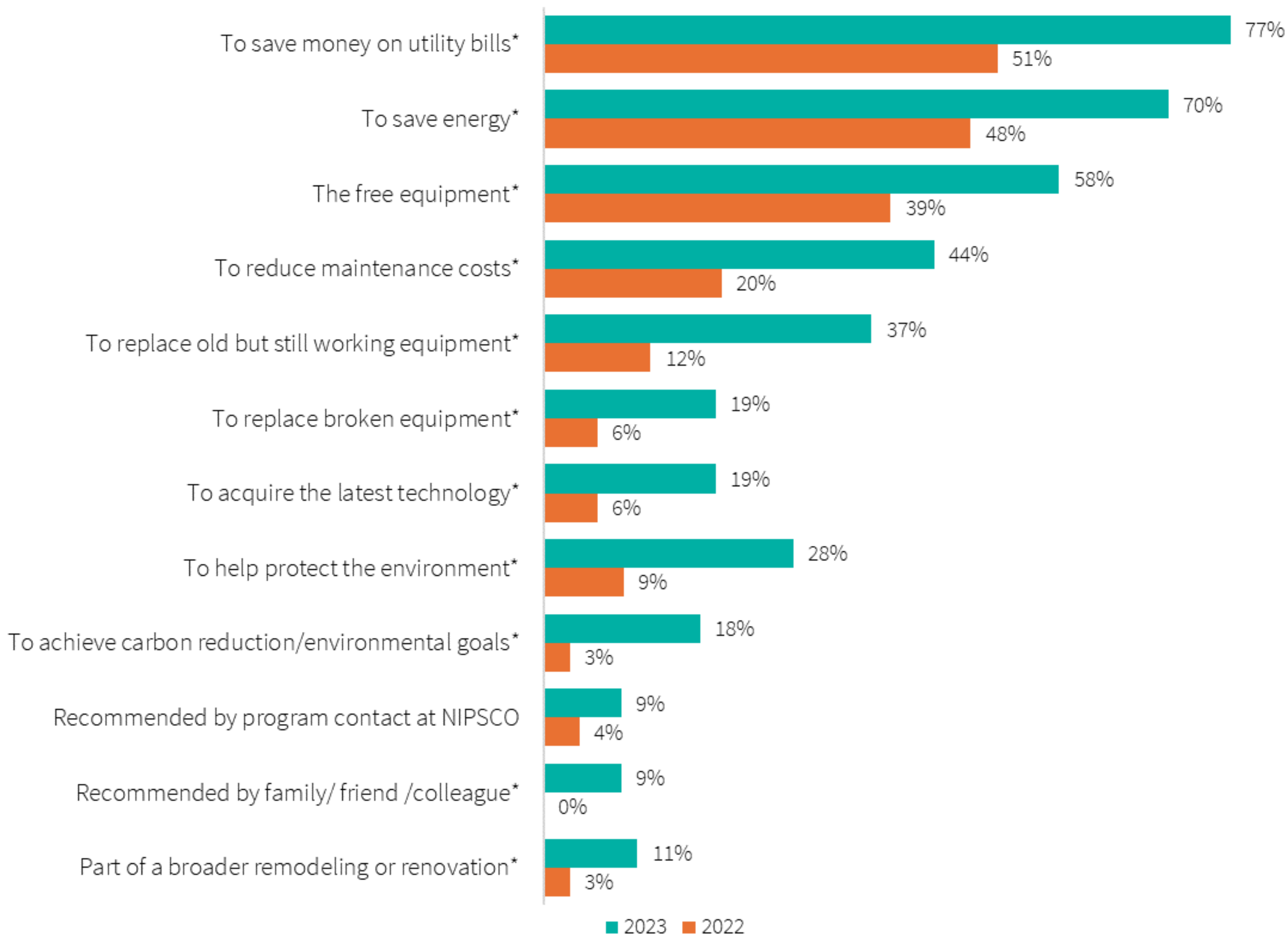
Source: C&I Online Marketplace Survey Question C4. "In your opinion, what is the best way for NIPSCO to keep organizations like yours informed about opportunities to save energy?" 2023 n=57, 2022 n=89, 2021 n=54, multiple responses allowed.

A majority (70%) of respondents were aware of other NIPSCO incentives, closely aligning with the proportion from 2022 (66%). Of the C&I Online Marketplace's respondents that reported they were aware of other offerings (n=40), almost all were aware of incentives for lighting measures (90%), HVAC replacements (55%), thermostats (55%), and appliances (50%).

Participation Drivers

Overall, 2023 respondents reported more motivations for program participation than 2022's respondents. Saving money on utility bills (77%), saving energy (70%), and free equipment (58%) were still the top three reasons for participating. Other motivations that saw notable increases were reducing maintenance costs (44% in 2023 vs. 20% in 2022), replacing old but still working equipment (37% in 2023 vs. 12% in 2022), and helping protect the environment (28% in 2023 vs. 9% in 2022).

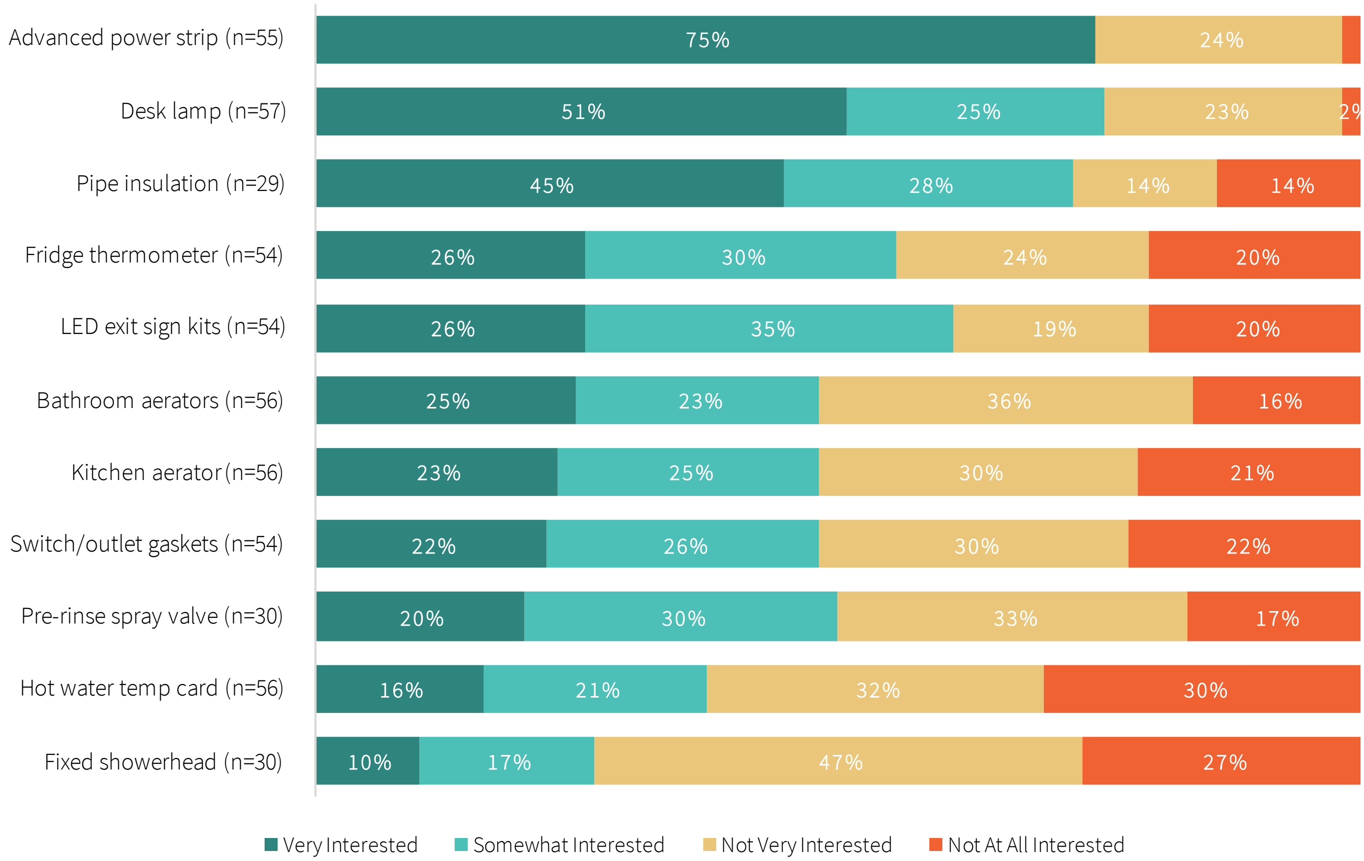
Figure 66. Primary Motivation for Ordering the Kit



Source: C&I Online Marketplace Survey Question H1. “What factors were the most important in your decision to order a kit from the Business Online Marketplace?” 2023 n=57, 2022 n=89, multiple responses allowed.

Respondents indicated they were the most interested in receiving advanced power strips, desk lamps, and pipe insulation from the kit. The hot water temperature cards and fixed showerheads were the least important kit items to this year’s respondents (Figure 67). LED bulbs, which were most of the top items of interest in 2022, were not offered in the kits in 2023.

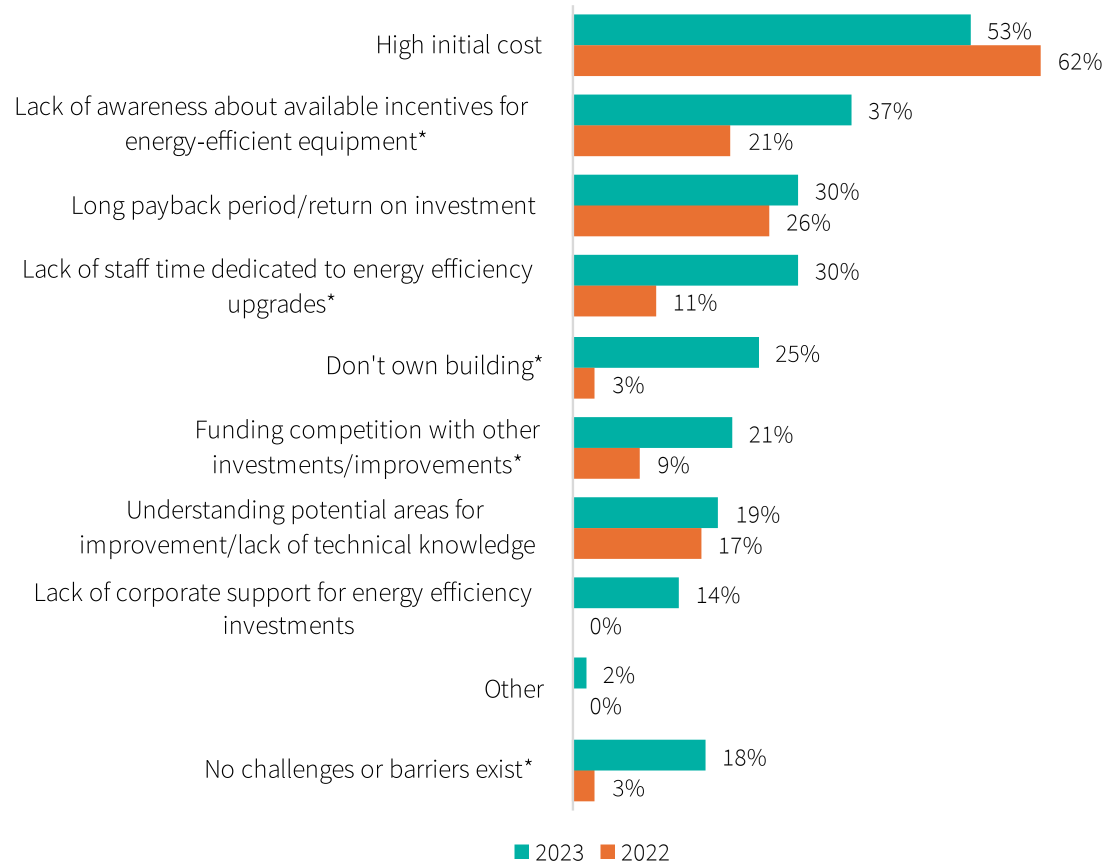
Figure 67. Interest in Each Kit Item Before Receiving Kit



Source: C&I Online Marketplace Survey Question H2. "How interested were you in each of the following items from the Business Online Marketplace kit(s)?"

High initial cost remained the top challenge organizations face when making energy-efficient improvements. Compared to 2022, this year's respondents had more issues with lack of awareness about available incentives (37% in 2023 vs. 21% in 2022), lack of staff time for energy efficiency upgrades (30% in 2023 vs. 11% in 2022), and not owning their building (25% in 2023 vs. 3% in 2022). Interestingly, more respondents this year said that no challenges or barriers exist with regards to energy efficiency (18% in 2023 vs. 3% in 2022). Figure 68 below summarizes and compares this year's responses to 2022.

Figure 68. Challenges to Energy Efficiency



Source: C&I Online Marketplace Survey Question D1. “When considering improvements to increase commercial and industrial energy efficiency, what are the most significant challenges that your organization faces?” 2023 n=57, 2022 n=89, multiple responses allowed.

When asked how NIPSCO could assist with energy-efficiency challenges, respondents said they wanted higher incentives (60%), a smoother application process (36%), and more technical support (28%). One respondent requested an onsite visit from NIPSCO to see what could be improved. Other respondents wanted more details about program participation, saying:

“Tell us how this energy efficiency works; what it will cost, how much will I save, give more details of the benefit.”

Lastly, one respondent suggested that NIPSCO provide a list of vetted contractors, saying:

“Finding reputable contractors is a problem, so NIPSCO vetting some companies that they will stand behind and offer their information or make that information available to businesses.”

The top challenge that businesses faced in 2022 prevailed in 2023: increased costs due to inflation (53%; Figure 69). However, this year's respondents seemed to have experienced fewer challenges overall. Businesses have also had more time to recover from COVID-19-related economic hardship.

Figure 69. Business Challenges in the Past Year

Source: C&I Online Marketplace Survey Question D3. "Has your business faced any of the following challenges this year?" 2023 n=57, 2022 n=89, multiple responses allowed.

Reduced business challenges may also explain why this year's respondents were more proactive with their energy efficiency upgrades, as seen before in Figure 68. Less pressure on businesses gives them space to do things like upgrading equipment before failure and considering the overall environmental impacts of their operation.

Satisfaction with NIPSCO and the Program

Overall Program Satisfaction

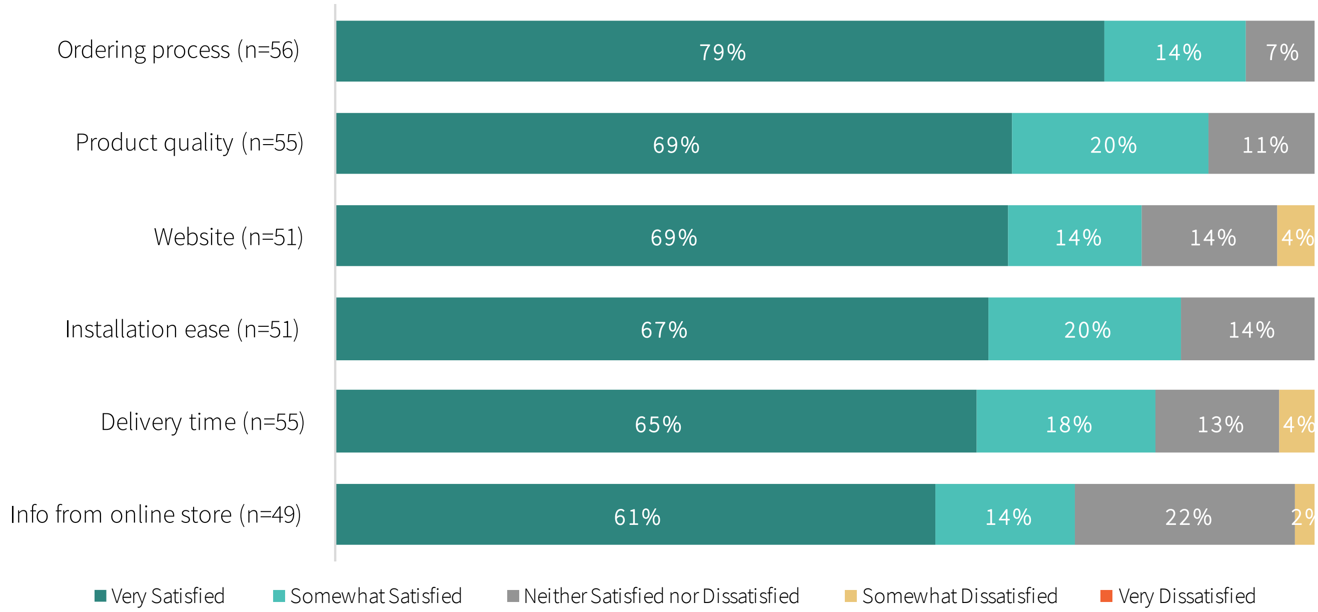
Respondents expressed high levels of satisfaction with the marketplace, with 69% saying they were very or somewhat satisfied, and only 4% (n=2) respondents saying they were either somewhat or very dissatisfied.

"Keep it up, it's great. I appreciated learning about products that I would not have known about."

"Keep up the good work and spread the word about this program."

Respondents were also generally satisfied with various components of the program, with no respondents saying they were "very dissatisfied" with any of the options. The ordering process had the highest rate of "very satisfied" responses (79%) where the information from the online store itself had the lowest rate (61%), as seen below in Figure 70.

Figure 70. Satisfaction with Various Components of the Program



Source: C&I Online Marketplace Survey Question H3. "Please rate your satisfaction with each of these components."

One respondent said they had an issue with the advanced power strips.

"The advanced power strips were lousy, or maybe I didn't know how to use them. I ended up removing them all. We tried to plug in different battery chargers… tried using them in different plug outlets, they all didn't work or randomly worked."

Two respondents said they had issues with the online ordering process, including the website being unable to accept their business address. Another respondent said they were accidentally charged for the kits but were quickly refunded once they let NIPSCO know.

NIPSCO Satisfaction

Respondents were less satisfied with NIPSCO as a service provider than the C&I Online Marketplace program itself, with 25% saying they were either very or somewhat dissatisfied (Figure 71).

Figure 71. Satisfaction with NIPSCO as a Service Provider

Source: C&I Online Marketplace Survey Question H9. “How satisfied are you with NIPSCO overall as your utility service provide r?” n=55

Suggestions For Improvement

In final comments, respondents provided a few suggestions for the program.

A one-stop shop for all programs: Three respondents wanted a website link or person to contact to learn about all the possible incentives they could apply for. They did not mention the existing business energy efficiency webpage, either because they are unaware of it or want a webpage more customized for their business.

More installation guidance: Three respondents said they wanted more guidance on installation, with one suggesting a QR code with more detailed instructions. Similarly, the respondent who had difficulty with the advanced power strip requested information on how to troubleshoot items in the kit.

Bring back the light bulbs: Lastly, one respondent wanted to see the free light bulbs come back, as they were the item with highest interest in 2022 but were not offered this year.

Conclusions and Recommendations

CONCLUSION 1: THE PROGRAM DID NOT ACHIEVE SAVINGS GOALS IN 2023, PRIMARILY DUE TO THE REMOVAL OF SCREW-BASED LIGHTING.

The program fell short of its goals for a variety of reasons. The C&I Online Marketplace program achieved 30% of electric energy savings, 17% of peak demand savings, and 14% of natural gas therms savings goals. Screw-based lighting provided a reliable savings source in 2022, making up over 90% of the *ex ante* kWh savings. The removal of screw-based lighting products from the offerings appears to have affected the savings achieved by the program in 2023, as compared to 2022. Products replacing screw-based lighting will take time to ramp up and gain customer awareness.

Recommendations:

- Use evaluation findings on the most important items in the kit and influential messages to inform future outreach. Respondents mentioned that they purchased kits for the advanced power strip, desk lamp, and pipe insulation. Additionally, respondents cited motivations and attitudes toward efficiency (specifically reducing utility bills and energy use, getting equipment at no cost), and economic challenges faced by businesses (specifically inflation and high up-front costs) most frequently as reasons for participating.

CONCLUSION 2: *EX ANTE* MEASURE LEVEL SAVINGS CALCULATIONS AND SOURCES DIFFERED FOR PRODUCTS OFFERED WITHIN A KIT VERSUS THE SAME PRODUCT OFFERED FOR INDIVIDUAL SALE.

Several products appeared both within kits and external to kits (available for purchase individually), such as pre rinse spray valves and pipe insulation. For these measures, the *ex ante* savings calculations were built on different metrics and referenced different sources. It is reasonable that ISR would be different for measures distributed in a kit and outside of kit distribution, but it is not clear why the foundational savings assumptions would be different between the two distribution avenues.

Recommendations:

- Maintain the same measure level calculation and referenced sources for products that appear both within kits and are available for individual sale. The evaluation team recommends using the IL TRM v11.0 as the primary reference, when the measure exists. ISRs should be adjusted to reflect the likely installation of the product based on the distribution.

CONCLUSION 3: LOWER MEASURE-LEVEL ISRS RESULTED IN PROGRAM LEVEL AND MEASURE LEVEL REALIZATION RATES THAT ARE IN SOME CASES LOWER THAN 2022 REALIZATION RATES.

The program level therms realization rate was lower in 2023 than in 2022. There are several factors that influenced the program-level realization rate, but differences in ISR at the measure level were a primary driver.

In large part, lower measure level realization rate achievement was attributable to ISR updates from 2023 survey results.

Kit measure level *ex ante* savings generally used ISR values determined in the 2021 evaluation survey, and *ex post* savings used the ISR values determined in the 2023 evaluation survey. For new products offered in 2023, ISR values used in *ex ante* savings were generally adopted from other like product ISRs.

Recommendations:

- Update ISR values used for *ex ante* savings to those provided in this evaluation report which are based on the most recent survey data available.
- Use lower estimated ISRs in the first year of offering any new products as new products will carry risks to ISR shifts in *ex post* savings.
- Consider discontinuing products with ISRs less than 20%.

CONCLUSION 4: DECREASED ECONOMIC HARDSHIP GAVE SOME BUSINESSES SPACE TO BE PROACTIVE ABOUT ENERGY EFFICIENCY.

Compared to 2022, businesses surveyed this year experienced fewer economic issues such as increased costs due to inflation and general concerns over economic uncertainty. Additionally, far more respondents said they ordered kits to replace old but still working equipment and to achieve carbon reduction/environmental goals. With fewer economic hardships, some businesses appear to have more time and resources to put towards energy efficiency.

Recommendations:

- Continue to invest in program marketing as businesses invest in themselves. If challenges related to the economy continue to decrease, businesses may have increased interest in energy efficiency programs like the C&I Online Marketplace.

CONCLUSION 5: KITS SPECIFIC TO BUSINESS TYPES MAY BE MORE APPEALING TO CUSTOMERS.

In 2022, the C&I Online Marketplace offered a restaurant kit and 13% of respondent businesses were restaurants. This year, NIPSCO offered only an office kit and water kit and subsequently only 4% of survey respondents were restaurants. In addition, there were far fewer kits ordered this year as well as individual customers that ordered kits.

Recommendations:

- Consider offering industry-specific kits again, or developing industry-specific messaging for existing kits, especially if there is a target industry for future iterations of the C&I Online Marketplace and monitor effects on uptake with targeted customer segments.

CONCLUSION 6: PARTICIPANTS WERE MORE SATISFIED WITH THE C&I ONLINE MARKETPLACE PROGRAM THAN NIPSCO AS THEIR OVERALL SERVICE PROVIDER.

Respondents overall were satisfied with the C&I Online Marketplace, with no respondents saying they were “very dissatisfied” with any parts of the program. However, 11% of respondents said they were “somewhat dissatisfied” and 14% said they were “very dissatisfied” with NIPSCO as their service provider, totaling a quarter of respondents. While the program may be garnering goodwill, there is something else provoking this dissatisfaction with NIPSCO as an energy service provider.

Recommendations:

- Investigate the root cause of C&I customer dissatisfaction with NIPSCO through surveys and/or conversations with NIPSCO key account managers and program implementers.
- Continue using programs like the C&I Online Marketplace to build rapport.

APPENDIX

Appendix 1. Home Rebates Program

Appendix 2. Residential Lighting Program

Appendix 3. Home Energy Assessment Program

Appendix 4. Income-Qualified Weatherization Program

Appendix 5. Multifamily Direct Install Program

Appendix 6. Appliance Recycling Program

Appendix 7. Behavioral Program (no appendix this year)

Appendix 8. Residential New Construction Program

Appendix 9. School Education Program

Appendix 10. Homelife Calculator Program

Appendix 11. Residential Online Marketplace Program

Appendix 12. Commercial and Industrial (C&I) Programs

Appendix 13. C&I Online Marketplace (OLM) Program

Appendix 1. Home Rebates Program

This appendix contains the assumptions used in electric savings, demand reduction, and gas savings algorithms for the measures within the Energy Efficiency Rebates program.

Furnaces

The program tracking data contained 3,942 natural gas furnaces. Per the Illinois TRM v11.0 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 v11.0 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, 2022, and 2023.

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 v11.0 suggests multiplying the kWh saved value by two 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 v11.0 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 2023 billing analysis results based on location, and assigned an $AFUE_{BASE}$ and $AFUE_{EXIST}$ of 80% and 64.4% based on the Illinois TRM v11.0. 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 v11.0 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 226 shows the mean values for 2022.

Table 226. 2023 Furnace Mean Values

INDEPENDENT VARIABLES	2023 MEAN VALUE	SOURCE
Capacity (Furnace)	74,458.87	Actual from program tracking data
Capacity (Cooling)	33,316.95	2023 Program Average Air Conditioner Capacity
EFLH	989.39	2023 billing analysis, values vary based on nearest city to project location
AFUE ee	0.960	Actual from program tracking data
AFUE Base[a]	0.80	Illinois TRM v11.0
AFUE Exist[a]	0.644	Illinois TRM v11.0
Derating[a]	0.064	For all derating factors
ER	13.75%	2022 Home Rebates Participant Survey
kWhSavingsPerTon	220.77	Illinois TRM v11.0

[a] Constants

Evaluated unit therm savings range from 35.19 to 337.02 therms, with an average value of 189.40 therms. The *ex ante* data assigned deemed savings of 130.42 therms. The overall natural gas realization rate for this measure category is 145%. 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 (74,458.87 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 zero kWh compared with average *ex post* gross savings of 67.60 kWh. Table 227 highlights these results.

Table 227. Detailed Results from Furnaces

AUDITED COUNT	*EX ANTE* DEEMED SAVINGS PER MEASURE	*EX POST* GROSS AVERAGE SAVINGS PER MEASURE	REALIZATION RATE
3,942	130.42 therms	189.40 therms	145%

Furnaces – Legacy 2022 Measure

In the 2023 tracking data, there were 571 Furnace considered Legacy 2022 Measures for which the evaluation team assigned a deemed savings value of 172.44 therms and 68.29 kWh. These deemed savings are the *ex post* gross per measure savings from the 2022 evaluation. Reference the 2022 NIPSCO Home Rebates evaluation Appendix for details on how this measure was calculated.

Ex ante used a deemed therm savings value of 119.44 therms compared with evaluated therm savings of 172.44 resulting in a therm savings realization rate of 144% for the Furnaces - Legacy 2022 Measure.

Air Conditioners

In the 2023 tracking data, there were 777 air conditioners. The evaluation team used the following equation from the Illinois TRM v11.0 to calculate energy savings from the SEER upgrade for air conditioners:

$$\begin{aligned}\Delta kWh = {} & (1 - ER) \times \frac{CAP}{1{,}000} \times EFLH_C \\ & \times \left(\frac{1}{(SEER_{BASE} \times (1 - DeratingCool_{BASE}))} - \frac{1}{\left(SEER_{EE} \times SEER_{adj} \times (1 - DeratingCool_{EE})\right)} \right) \\ & + ER \times \frac{CAP}{1{,}000} \times EFLH_C \\ & \times \left(\frac{1}{(SEER_{EXIST} \times (1 - DeratingCool_{BASE}))} - \frac{1}{\left(SEER_{EE} \times SEER_{adj} \times (1 - DeratingCool_{EE})\right)} \right)\end{aligned}$$

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 v10.0 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 228 shows the mean values for 2023.

Table 228. 2022 Air Conditioner Mean Values

INDEPENDENT VARIABLES	2023 MEAN VALUE	SOURCE
Capacity	33,316.95	Actual from program tracking data
EFLHc	428.17	Indiana TRM (v2.2), values assigned based on nearest TRM city to project location
SEERbase[a]	13.00	Illinois TRM v11.0
SEERexist	11.15	Indiana TRM (v2.2)
SEERadj	1.01	Illinois TRM v11.0
SEERee	16.42	Actual from program tracking data
EERbase[a]	10.50	Illinois TRM v11.0
EERstockexist[a]	10.04	0.9*SEERexist; Indiana TRM (v2.2)
EERee	13.05	Average EER/SEER Conversion in the AHRI Database*SEERee
CF[a]	0.88	Indiana TRM (v2.2)

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 v11.0, 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 v11.0 instead provides cooling and circulation electric energy savings for furnaces. Table 229 highlights these results.

Table 229. Detailed Results from Air Conditioners

AUDITED COUNT	*EX ANTE* DEEMED SAVINGS PER MEASURE	*EX POST* GROSS AVERAGE SAVINGS PER MEASURE	REALIZATION RATE
777	672.76 kWh	196.31 kWh	29%
	0.746 kW	0.650 kW	30%

Air Conditioner – Legacy 2022 Measure

In the 2023 tracking data, there were 75 Air Conditioner Legacy 2022 measures. This measure is a Legacy 2022 Measure for which the evaluation team assigned a deemed savings value of 286.63 kWh and 0.607 kW. These deemed savings are the *ex post* gross per measure savings from the 2022 evaluation. Refer to the 2022 NIPSCO Home Rebates evaluation Appendix for details on how this measure was calculated.

Ex ante used a deemed kWh savings value of 688.89 kWh and 0.780 kW compared with evaluated kWh and kW savings of 286.63 kWh and 0.607 kW, resulting in an electric energy savings and demand reduction realization rate of 42% and 78%, respectively for the Air Conditioner - Legacy 2022 Measures.

Air Conditioner and Air Source Heat Pump Tune-up

In the 2023 tracking data, there were 68 air conditioners and 2 ASHP tune-ups. Per the Illinois TRM v11.0 the evaluation team used the following savings algorithm for air conditioner tune-ups:

$$\Delta kWh_{CAC} = EFLH_{COOL} \times \frac{Btuh_{COOL}}{1{,}000} \times \frac{1}{SEER_{CAC}} \times MF_E$$

And air source heat pump tune-ups:

$$\Delta kWh_{ASHP} = EFLH_{COOL} \times \frac{Btuh_{COOL}}{1{,}000} \times \frac{1}{SEER_{ASHP}} \times MF_E + EFLH_{heat} \times \frac{Btuh_{heat}}{1000} \times \frac{1}{HSPF_{ASHP}} \times MF_E$$

Where:

EFLH	=	Equivalent full-load cooling or Heating hours from Indiana TRM (2.2) or the 2023 Billing Analysis results
Btuh	=	Cooling or Heating capacity of equipment in Btuh
SEER	=	SEER efficiency of existing central air conditioning or ASHP unit receiving maintenance
HSPF	=	Heating season performance factor of existing air source heat pump 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 were not 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 v11.0 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 230 shows the mean values for 2023.

Table 230. 2023 AC Tune Up Mean Values

INDEPENDENT VARIABLES	2023 MEAN VALUE	SOURCE
Btuhcool cac	32,349.04	Actual and averages from program tracking data
Btuhcool ashp	29,335.71	Actual and averages from program tracking data
EFLHcool	431	Indiana TRM (v2.2), values assigned based on nearest TRM city to project location
EFLHheat	989	2023 Billing Analysis
SEERcac	10	Illinois TRM v11.0
SEERashp	10	Illinois TRM v11.0
HSPFashp	6.8	Illinois TRM v11.0
MFe[a]	0.05	Illinois TRM v11.0
EER	9.2	Assumed 0.9*SEER
MFd[a]	0.02	Illinois TRM v11.0
CF[a]	0.88	Indiana TRM (v2.2)

[a]Constants

Higher average cooling capacity drove slightly higher energy savings in 2023. However, the largest driver for significantly higher savings was the assumption of existing air conditioner SEER of 10 from the Illinois TRM v11.0. This assumption is used in preparation for the 2024 Indiana TRM approach which assumes the same as the Illinois TRM v11.0. Table 231 highlights these results.

Table 231. Detailed Results from AC and ASHP Tune Ups

	AUDITED COUNT	*EX ANTE* DEEMED SAVINGS PER MEASURE	*EX POST* GROSS AVERAGE SAVINGS PER MEASURE	REALIZATION RATE
AC	68	44.34 kWh	69.94 kWh	158%
		0.101 kW	0.062 kW	61%
ASHP	2	199.57 kWh	281.12 kWh	141%
		0.063 kW	0.055 kW	87%

Boilers

There were 46 boiler measures reported as part of the program in 2023. Per the Illinois TRM v11.0 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 2023 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

Evaluated savings used the reported model number to look up all 2023 boiler heating capacity and AFUE in the AHRI database. Table 232 shows the mean values for 2023.

Table 232. 2023 Boiler Mean Values

INDEPENDENT VARIABLES	2023 MEAN VALUE - 92% AFUE	SOURCE
Capacity	130,865.22	Actual from program tracking data
EFLH	987.94	2023 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 v11.0
AFUE Exist[a]	0.616	Illinois TRM v11.0

[a]Constants

Small differences between ex ante and evaluated are because the evaluation team used each unit's specific reported AFUE and capacities to calculate savings. Differences in approach between the Indiana TRM (v2.2) and Illinois TRM v11.0, additional early replacement savings, higher average capacity, and using the closest city instead of broadly applying South Bend for EFLH drove higher Therm savings than reported. Table 233 highlights these results.

Table 233. Detailed Results from Boilers

AUDITED COUNT	*EX ANTE* DEEMED SAVINGS PER MEASURE	*EX POST* GROSS AVERAGE SAVINGS PER MEASURE	REALIZATION RATE
46	207.24 therms	281.28 therms	136%

Boiler – Legacy 2022 Measure

In the 2023 tracking data, there was a seven Boiler Legacy 2022 measure. This measure is a Legacy 2022 Measure for which the evaluation team assigned a deemed savings value of 256.17 therms. These deemed savings are the *ex post* gross per measure savings from the 2022 evaluation. Reference the 2022 NIPSCO EE Rebates evaluation Appendix for details on how this measure was calculated.

Ex ante used a deemed therm savings value of 217.34 therms compared with evaluated therm savings of 256.17 therms, resulting in a therm savings realization rate of 118% for the Boiler - Legacy 2022 Measures.

Air Source Heat Pumps

In the 2023 tracking data, there were 35 air source heat pumps. The evaluation team used the following algorithm from the Illinois TRM v11.0 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
$EFLH_C$	=	Equivalent 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 × $EFLH_H$

$EFLH_H$	=	Equivalent full-load heating hours derived via 2023 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 2023 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 v11.0 while CF was 0.88 assumed from the Indiana TRM (v2.2) and the evaluation team found EER_{EE} in the AHRI database. Table 234 shows the mean values for 2022.

Table 234. 2023 ASHP Mean Values

INDEPENDENT VARIABLES	2023 MEAN VALUE	SOURCE
CAPc	34,977.14	Actual from AHRI equipment database
EFLHc	427.78	Indiana TRM (v2.2); values vary based on nearest city to project location
SEERbase[a]	14.00	Illinois TRM v11.0
SEERee	17.36	Actual from AHRI equipment database
SEERexist[a]	9.3	Illinois TRM v11.0
SEERadj	0.85	Illinois TRM v11.0; calculated from AHRI equipment database
CAPh	35,045.71	Actual from AHRI equipment database
EFLHh	989.22	2023 billing analysis, values vary based on nearest city to project location
HSPFbase[a]	8.2	Illinois TRM v11.0
HSPFee	8.34	Actual from AHRI equipment database
HSPFexist[a]	5.54	Illinois TRM v11.0
HSPFadj	1.01	Illinois TRM v11.0; calculated from AHRI equipment database

INDEPENDENT VARIABLES	2023 MEAN VALUE	SOURCE
Derating Factors	0.1	Illinois TRM v11.0
CF[a]	0.88	Indiana TRM (v2.2)

[a]Constants

The evaluation team used EFLH values from the TRM and 2023 billing analysis 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*. Table 235 highlights these results.

Table 235. Detailed Results from Air Source Heat Pumps

AUDITED COUNT	*EX ANTE* DEEMED SAVINGS PER MEASURE	*EX POST* GROSS AVERAGE SAVINGS PER MEASURE	REALIZATION RATE
35	430.02 kWh	760.23 kWh	177%
	0.694 kW	0.319 kW	46%

Air Source Heat Pump – Legacy 2022 Measure

In the 2023 tracking data, there was one Legacy 2022 Measure for which the evaluation team assigned a deemed savings value of 1,220.89 kWh and 0.676 kW. These deemed savings are the *ex post* gross per measure savings from the 2022 evaluation. Reference the 2022 NIPSCO EE Rebates evaluation Appendix for details on how this measure was calculated.

Ex ante used a deemed kWh savings value of 1,184.21 kWh and 0.678 kW compared with evaluated kWh and kW savings of 1,220.89 kWh and 0.676 kW, resulting in an electric energy savings and demand reduction realization rate of 103% and 100%, respectively for the Air Source Heat Pump - Legacy 2022 Measures.

Smart Wi-Fi Thermostats

There were 1,860 smart Wi-Fi thermostats installed through the program in 2023. 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 236.

Table 236. 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	840	0	0	15.66

MEASURE NAME-DEFINED CONFIGURATION	COUNT OF UNITS [a]	*EX ANTE* UNIT SAVINGS		
		KWH	KW	THERMS
Natural gas heat with air conditioner	990	110	0.125	15.31
Electric resistance heating with air conditioner	10	1,058	0.125	0
Heat pump	7	235	0.120	0
Air conditioner only	11	105	0.125	0
Electric resistance Heating only	2	942	0	0

[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 2023 billing analysis revealed net gas savings of 42.9 therms (6%). The analysis also revealed net cooling electric energy savings of 9.6%. More detail on these options can be seen in the billing analysis section. Table 237 shows the mean values for 2023.

Table 237. 2023 Thermostat Mean Values

INDEPENDENT VARIABLES	2023 MEAN VALUE - GAS HEATING ONLY	2023 MEAN VALUE - ELECTRIC COOLING AND GAS HEATING	2023 MEAN VALUE - ELECTRIC COOLING AND HEATING	2023 MEAN VALUE - ELECTRIC COOLING ONLY	2023 MEAN VALUE - HEAT PUMP	2023 MEAN VALUE - ELECTRIC HEATING ONLY	SOURCE
CAPC	-	33,316.95	33,316.95	33,316.95	33,215.83	-	Actual from the program tracking data when possible or average of program ACs or heat pumps
EER*	10.5	10.5	10.5	10.5	10.5	10.5	Illinois TRM v11.0
EFLHC	398.59	429.23	431.00	431.00	414.43	431.00	Indiana TRM (v2.2), values vary based on nearest city to project location
ESFC[a]	0.096	0.096	0.096	0.096	0.096	0.096	2023 billing analysis
HF	1	1	1	1	1	1	Illinois TRM v11.0
Gas Heating Consumption	715	715					2023 billing analysis
Electric Heating Consumption	-	-	12,222	-	20,777	12,222	Illinois TRM v11.0, values vary based on nearest city to project location
ESFH[a]	0.06	0.06	0.06	0.06	0.06	0.06	2023 billing analysis
SEER	12.00	12.00	12.00	12.00	12.00	12.00	Illinois TRM v11.0
CF	0.44	0.44	0.44	0.44	0.44	0.44	Indiana TRM (v2.2) or engineering assumption
Cooling Demand Reduction	0.164	0.164	0.164	0.164	0.164	0.164	Illinois TRM v11.0
Fe	0.0314	.0314	.0314	.0314	.0314	.0314	

[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:

$$\Delta kWh = \%AC * \left(\frac{EFLH_c * CAP_c * \frac{1}{SEER}}{1000}\right) * ESF_c + \%Eelctric\ Heat * Electric\ Heating\ Consumption * ESF_h * HF + (\Delta Therms\ Heating * F_e * 29.3)$$

For heat pump systems:

$$\Delta\ Therms = \%Gas\ Heat * Gas\ Heating\ Consumption * ESF_h * HF$$

Where:

CAP_C	=	System cooling capacity
SEER	=	System SEER
$EFLH_C$	=	Equivalent full-load cooling hours from Indiana TRM (2.2)
ESF_C	=	Savings factor for cooling derived via 2023 billing analysis, 9.6%
Electric Heating Consumption	=	Varies based on city
HF	=	Housing Factor
Fe	=	Fan Energy Factor
Gas Heating Consumption	=	2023 billing analysis Heating consumption, 715 therms
ESF_H	=	Savings factor for heating derived via 2023 billing analysis, 6%
%Gas heat	=	0 or 1 depending on system
%AC	=	0 or 1 depending on system

Here, the standard cooling CF of 0.88 is used, but divided by two:

$$\Delta kW = \%\mathrm{AC} \times \frac{CAP_C}{EER \times 1{,}000} \times \frac{CF}{2} \times Cooling\ Demand\ Reduction$$

In this evaluation 1,860 program thermostats were delivered; with 92 thermostats (5%) 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.[65] 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 157%, the overall kW realization rate is 172%, and the overall natural gas realization rate is 264%. Table 238 highlights these results.

Table 238. Detailed Results from Thermostats

AUDITED COUNT	*EX ANTE* DEEMED SAVINGS PER MEASURE	*EX POST* GROSS AVERAGE SAVINGS PER MEASURE	REALIZATION RATE
1,860	66.78 kWh	104.68 kWh	157%
	0.068 kW	0.118 kW	172%
	15.22 therms	40.11 therms	264%

Wi-Fi Thermostats – Legacy 2022 Measure

In the 2023 tracking data, there were 195 Wi-Fi Thermostat Legacy 2022 Measures for which the evaluation team assigned deemed *post* gross per measure savings from the 2022 evaluation. The average deemed ex post gross savings were 59.02 kWh, 0.060 kW, and 32.09 therms. Reference the 2022 NIPSCO EE Rebates evaluation Appendix for details on how this measure was calculated.

Ex ante used an average deemed kWh savings value of 65.94 kWh, 0.070 kW, and 21.77 therms, resulting in an electric energy savings, demand reduction, and therm savings realization rates of 90%, 86%, and 146%, respectively for the Wi-Fi Thermostat - Legacy 2022 Measures.

Heat Pump Water Heater

In the 2023 tracking data, there were 21 heat pump water heaters. The evaluation team used the following algorithm to calculate savings for water heaters:

$$\Delta kWh = \left(\frac{\left(\frac{1}{UEF_{BASE}} - \frac{1}{UEF_{EE}}\right) \times GPD \times Household \times 365.25 \times \gamma Water \times (T_{out} - T_{in}) \times 1.0}{3412} + kWh_{cooling} - kWh_{heating} + Deh_{reduction} \right)$$

Where:

GPD	=	Gallons per day per person
Household	=	Average number of people per household

[65] 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

365.25	=	Days per year
$\gamma Water$	=	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 v11.0.

The current standard for residential water heater efficiency is uniform energy factor (UEF).[66] 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.

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 v10.0 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 239 shows the mean values for 2023.

[66] UEF became the standard on July 13, 2015. https://www.energy.gov/sites/prod/files/2015/03/f20/water_heater_conversionfactor_nopr.pdf

Table 239. 2023 Water Heater Mean Values

INDEPENDENT VARIABLES	2023 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	3.77	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 v11.0
kWh heating	5.69	Varies based on UEF values; Input assumptions from the IL TRM v11.0
kWh cooling	65.66	Varies based on UEF values; Input assumptions from the IL TRM v11.0
Deh reduction[a]	72	Illinois TRM v11.0
LF[a]	0.22	Illinois TRM v11.0
ηHeat[a]	0.7	Illinois TRM v11.0
%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 2,728.01 kWh and 0.373 kW, respectively, compared to average *ex ante* values of 2,150.81 kWh and 0.102 kW, for a kWh realization rate of 127% and kW realization rate of 365% for this measure category. Table 240 highlights these results.

Table 240. Detailed Results from Water Heaters

AUDITED COUNT	*EX ANTE* DEEMED SAVINGS PER MEASURE	*EX POST* GROSS AVERAGE SAVINGS PER MEASURE	REALIZATION RATE
21	2,150.81 kWh	2,728.01 kWh	127%
	0.102 kW	0.373	365%

Heat Pump Water Heaters – Legacy 2022 Measure

In the 2023 tracking data, there was one Heat Pump Water Heater Legacy 2022 Measure for which the evaluation team assigned deemed *post* gross per measure savings from the 2022 evaluation. The average deemed *ex post* gross savings were 2,736 kWh and 0.374 kW. Reference the 2022 NIPSCO EE Rebates evaluation Appendix for details on how this measure was calculated.

Ex ante used an average deemed kWh savings and demand reduction value of 1,900.85 kWh and 0.090 kW, respectively, resulting in electric energy savings and demand reduction savings realization rates of 144%, and 416%, respectively for the Heat Pump Water Heater - Legacy 2022 Measure.

Ductless Mini-Split Heat Pump

In the 2023 tracking data, there were 57 ductless mini-split heat pumps. The evaluation team used the following algorithm from the Illinois TRM v11.0 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
$EFLH_{cool}$	=	Equivalent 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
$EFLH_{heat}$	=	Equivalent 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 2023 billing analysis and AHRI-verified capacities and efficiencies for this analysis. Existing efficiency assumptions were from the Illinois TRM v11.0. 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 v11.0 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 v11.0. Table 241 shows the mean values for 2023.

Table 241. 2023 Ductless Mini-Split Mean Values

INDEPENDENT VARIABLES	2023 MEAN VALUE	SOURCE
CAPc	18,822.22	Actual from AHRI equipment database
EFLHcool	427.32	Indiana TRM (v2.2), values vary based on nearest city to project location
SEERbase[a]	14.00	Illinois TRM v11.0
SEERee	21.23	Actual from AHRI equipment database
CAPh	20,496.83	Actual from the program tracking data[b]
EFLHh	989.25	Actual from AHRI equipment database
HSPFbase[a]	8.2	Illinois TRM v11.0
HSPFee	11.18	Actual from AHRI equipment database
EERbase[a]	11.00	Illinois TRM v11.0
EERee	12.64	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.

Table 242 highlights Ductless Mini-split Heat Pump results.

Table 242. 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
57	892.06 kWh	1,130.18 kWh	127%
	0.096 kW	0.311 kW	324%

Ductless Mini-Split Heat Pumps – Legacy 2022 Measure

In the 2023 tracking data, there were six Ductless Mini-Split Heat Pump Legacy 2022 measures. This measure is a Legacy 2022 Measure for which the evaluation team assigned a deemed savings value of 1,020.83 kWh and 0.294 kW. These deemed savings are the *ex post* gross per measure savings from the 2022 evaluation. Reference the 2022 NIPSCO EE Rebates evaluation Appendix for details on how this measure was calculated.

Ex ante used a deemed therm savings value of 701.92 kWh and 0.100 kW compared with evaluated electric energy and demand savings of 1,020.83 kWh and 0.294 kW, resulting in a savings realization rate of 145% for kWh savings and 294% kW for the Ductless Mini-Split Heat Pump - Legacy 2022 Measures.

Pool Pump

In the 2023 tracking data, there were seven pool pumps. The evaluation team applied the savings approach outlined in the Illinois TRM v11.0, 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 found through look ups the reported configuration and tier were assumed. The *ex ante* values were also calculated using the Illinois TRM v11.0. 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 243 shows the mean values for 2023 Pool Pumps.

Table 243. 2023 Pool Pump Mean Values

INDEPENDENT VARIABLES	MEAN VALUE-ESTAR IN-GROUND	MEAN VALUE-CEE TIER 1 ABOVE GROUND	SOURCE
WEFestar	6.31	4.43	Configuration and Tier according to ENERGY STAR QPL Look up; Values from Illinois TRM v11.0 table
WEFbase[a]	4.6	2.6	Illinois TRM v11.0
Gallons[a]	22,000	7,540	Illinois TRM v11.0
Turnovers[a]	2	2	Illinois TRM v11.0
Days[a]	122	122	Illinois TRM v11.0
GPMbase[a]	43.6	44.7	Illinois TRM v11.0
GPMestar[a]	32.20	27.3	Illinois TRM v11.0
CF[a]	0.831	0.831	Illinois TRM v11.0

[a]Constants

Table 244 highlights Pool Pump results.

Table 244. Detailed Results from Pool Pumps

AUDITED COUNT	*EX ANTE* DEEMED SAVINGS PER MEASURE	*EX POST* GROSS AVERAGE SAVINGS PER MEASURE	REALIZATION RATE
7	366.43 kWh	277.44 kWh	76%
	0.357 kW	0.291 kW	81%

Air Purifiers

In the 2023 tracking data, there were 61 air purifiers. The evaluation team applied the savings approach outlined in the Illinois TRM v11.0, 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 v11.0. Differences between *ex ante* and *ex post* come from different CADR than reported found during look ups. Table 245 documents the mean values for 2023.

Table 245. 2023 Air Purifier Mean Values

INDEPENDENT VARIABLES	2023 MEAN VALUE-CADR 30-99	2023 MEAN VALUE-CADR 101-149	2023 MEAN VALUE-CADR 150-199	2023 MEAN VALUE-CADR ≥200	SOURCE
SmokeCADRbase	83.30	127.60	175.20	288.84	Efficient CADR from ENERGY STAR QPL Look up; Base look up from Illinois TRM v11.0
SmokeCADRperWattbase	1.64	1.83	1.94	1.89	Efficient CADR from ENERGY STAR QPL Look up; Base look up from Illinois TRM v11.0
PartialOnModePowerbase	2.00	2.00	2.00	2.00	Efficient CADR from ENERGY STAR QPL Look up; Base look up from Illinois TRM v11.0
SmokeCADReff	82.60	132.17	171.60	276.86	ENERGY STAR QPL Look up
SmokeCADRperWattEff	2.63	5.07	4.48	4.66	ENERGY STAR QPL Look up
PartialOnModePowerEff	0.38	0.50	0.41	0.77	ENERGY STAR QPL Look up
Hours[a]				5840	
CF[a]				0.667	

[a]Constants

Table 246 highlights Air Purifier results.

Table 246. Detailed Results from Air Purifiers

AUDITED COUNT	*EX ANTE* DEEMED SAVINGS PER MEASURE	*EX POST* GROSS AVERAGE SAVINGS PER MEASURE	REALIZATION RATE
61	401.52 kWh	377.76 kWh	94%
	0.046 kW	0.043 kW	94%

Clothes Dryers

In the 2023 tracking data, there were 16 clothes dryers. The evaluation team used the following algorithm from the Illinois TRM v10.0 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 percentage 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 247 shows the mean values for 2023.

Table 247. 2023 Clothes Dryers Mean Values

INDEPENDENT VARIABLES	2023 MEAN VALUE	SOURCE
Load[a]	8.45	Illinois TRM v11.0
CEFbase[a]	3.11	Illinois TRM v11.0
CEFEE	3.93	Actual from ENERGY STAR QPL Look up
Ncycles[a]	283.00	Illinois TRM v11.0
%electric[a]	100%	Illinois TRM v11.0

[a]Constants

Table 248 highlights Clothes Dryer results.

Table 248. 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	161.11 kWh	100%
	0.022 kW	0.022 kW	98%

Dehumidifiers

In the 2023 tracking data, there were 67 dehumidifiers. The evaluation team used the following algorithm from the Illinois TRM v11.0 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 249 shows the mean values for 2023.

Table 249. 2023 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	21.75	43.61	85.00[a]	Actual from ENERGY STAR QPL Look up
Federal Standard L/kWh	1.30	1.60	2.80[a]	Illinois TRM v11.0
L/kWh	1.67	1.87	2.35[a]	Actual from ENERGY STAR QPL Look up

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
Pints to Liters[a]	0.473	0.473	0.473	Illinois TRM v11.0
Run Hours/year[a]	2,200	2,200	2,200	Illinois TRM v11.0
Hours/day[a]	24.00	24.00	24.00	Illinois TRM v11.0

[a]Constants

[a]Use 2022 Mean value

Table 250. Detailed Results from Dehumidifiers

TRACKING DATA	*EX ANTE* DEEMED SAVINGS PER MEASURE	*EX POST* GROSS AVERAGE SAVINGS PER MEASURE	REALIZATION RATE
67	115.01 kWh	167.35 kWh	146%
	0.026 kW	0.038 kW	144%

Billing Analysis

Billing Analysis Methodology

As part of the PY2023 evaluation, the evaluation team calculated heating and cooling energy savings factors for thermostats and EFLH for furnaces using a billing analysis. We completed the following steps in the billing analysis:

- Collect, review, and prepare billing and tracking data,
- Collect customer weather data,
- Conduct PRISM regression analysis,
- Calculate energy savings factors for thermostats and EFLH's for furnace.

Data Collection, Review, and Preparation

The evaluation team collected tracking data from 2020 – 2023 for participants who installed thermostats and from 2020 – 2022 for participants who installed furnaces. The evaluation team collected billing data from January 2019 – October 2023 to allow for sufficient pre- and post- installation periods to calculate heating and cooling energy savings factors for thermostats and EFLH values for natural gas furnaces.

For the smart thermostat savings analysis, the evaluation team used 2020, 2021 and 2022 participants as treatment groups in the analysis. The evaluation team used both future and past participants from 2020, 2021, 2022, and 2023 as comparison groups for each treatment year.[67] The comparison group was used to detect any non-program-related changes in energy, such as economic changes or changes in usage related to the COVID pandemic. For treatment group households, the evaluation team defined the pre-period as 12 months prior to the earliest thermostat installation and the post period as 12 months after the latest thermostat installation. For comparison group households the pre- and post- periods were defined using the 12 months before and after the average installation date of the 2020, 2021 and 2022 treatment groups, respectively. Since no measures were installed in the comparison group households during this time period, it allowed the evaluation team to observe any non-program related changes in energy consumption that need to be accounted for in the savings analysis.

For the EFLH analysis the evaluation team used 2020 - 2022 participants. A comparison group was not needed for the EFLH analysis, as the evaluation team was only looking at weather normalized consumption for a specified year and not changes in consumption. The evaluation team did calculate EFLH values for 2022 and 2023 to see if there were any major differences between the two time periods.

[67] See Table 21 for the details about the comparison groups.

In conducting the billing analysis for both EFLH and smart thermostats, the evaluation team completed the following steps:

- Merged treatment group thermostat data from the tracking database with electric and natural gas billing data.
- Created EFLH and smart thermostat analysis groups. Customers were included in the gas thermostat analysis if they had claimed gas thermostat savings or based on the measure name. Customers were included in the electric thermostat analysis if they had claimed electric savings or based on their measure name. Households were only included in the thermostat analysis if they were recorded as having only a smart thermostat installed and no other measure. The reason for this was that the billing analysis would not be able to distinguish the thermostat savings from other HVAC savings with reliable precision. All customers that had a natural gas furnace installed in 2020, 2021 or 2022 were included in the EFLH analysis.
- Used zip code mapping to determine the nearest weather station for each zip code.
- Obtained daily average temperature weather data (January 2019 through October 2023) for seven National Oceanic and Atmospheric Administration (NOAA) weather stations, representing all zip codes associated with participants.
- Used daily average temperatures to determine base 45°F to 85°F HDDs and CDDs for each station. For the gas thermostat and EFLH analyses only base 45°F to 70°F HDDs were used.
- Obtained typical meteorological year (TMY3; 1991–2005) annual normal HDDs and CDDs to weather normalize the billing data.
- Matched billing data periods with CDDs and HDDs from associated stations.

Comparison Group for Smart Thermostats Savings Analysis

As an important aspect of a billing analysis' quasi-experimental design, a billing analysis—whenever possible—should use a comparison group to account for exogenous factors that may have occurred simultaneously with program activity. These factors can include macroeconomic effects, increases, or decreases in energy rates, or other interactions that could affect energy consumption outside the program's influence. The potential effects of COVID-19 on energy consumption are a good example of an exogenous change in energy consumption unrelated to the HVAC program. The evaluation team established a comparison group for 2020, 2021, and 2022 participants using a mix of 2020, 2021, 2022, 2023 program participants depending on participation year. See Table 24 for details on what comparison groups were used.

Using future participants this way offered several advantages over selecting randomly from the customer population:

- Past and future participants are more representative of the participant treatment group than a random sample of residential customers—they are more likely to closely resemble participants from previous years in terms of energy awareness and pre-period building characteristics.
- As this population received program measures, the evaluation team could control and isolate the comparison group's installation periods to ensure that program impacts did not influence the analysis period.

To account for any exogenous changes in consumption over the treatment period, the evaluation team calculated the heating and cooling energy savings factors in the following manner:

$$ESF\ Heating = \frac{Treatment\ Change\ in\ \ Heating\ Usage}{Pre\ Treatment\ Heating\ Usage} - \frac{Comparison\ Change\ In\ Heating\ Usage}{Pre\ Comparison\ Heating\ Usage}$$

$$ESF\ Cooling = \frac{Treatment\ Change\ in\ Cooling\ Usage}{Pre\ Treatment\ Cooling\ Usage} - \frac{Comparison\ Change\ In\ Cooling\ Usage}{Pre\ Comparison\ Cooling\ Usage}$$

Because the comparison group was created using future participants, it is not guaranteed that the comparison group will have similar heating and cooling loads. There could be a variety of differences between the current and future participants that could drive differences in heating and cooling load such as home size, occupants, and heating/cooling preferences. If any of these differences are statistically significant and correlated with the change in energy consumption from the pre- to post- period, then our energy savings factors could be biased. To minimize these differences, and for better matching between the comparison and treatment groups, the evaluation team matched the comparison group usages to participant usages for each usage quartile in each participant year cohort. To verify the usage similarity of the matched comparison group in heating and cooling loads, the evaluation team performed equivalency tests on pre-period weather normalized heating and cooling sensitive consumption. Table 251 presents the results of the equivalency tests by year for baseline electric cooling and natural gas heating loads between the treatment and comparison groups. We can see that for electric cooling there were no statistically significant differences in baseline cooling consumption. Similarly for natural gas heating we did not see any statistically significant differences between the treatment and comparison group with regards to baseline heating consumption.

Table 251. Natural Gas Heating & Electric Cooling Equivalency Tests

FUEL	YEARS	TREATMENT GROUP PRE-PERIOD WEATHER SENSITIVE USAGE (COOLING/HEATING)	COMPARISON GROUP PRE-PERIOD WEATHER SENSITIVE USAGE (COOLING/HEATING) COMPARISON	DIFFERENCE	P-VALUE
Electric	2020-2022	2,654	2,640	14	0.704
Gas	2020-2022	715	709	6	0.341

Data Screening Thermostat Analysis

The evaluation team removed the following sites from the thermostat savings analysis:

- Households that did not have billing data available.
- Households with fewer than ten months of pre- data or fewer than ten months of post-data (at least 20 months total are needed).
- Households with electric consumption less than 1,000 kWh annually or 150 therms annually.
- Households with changes in energy consumption of more than 70% from the pre- to the post-installation period.

The evaluation team also removed households with outliers, apparent vacancies, seasonal usage, or nonprogrammatic equipment or occupancy changes in the pre- and post-installation periods. To determine this, the evaluation team examined monthly billing data by plotting each participant's monthly usage. Table 252 shows the attrition for the treatment and comparison group houses in each step for the 2020-2022 natural gas thermostat participants.

Table 252. 2020-2022 Natural Gas Smart Thermostat Attrition

SCREEN	TREATMENT GROUP			COMPARISON GROUP		
	N	N DROPPED	% DROPPED	N	N DROPPED	% DROPPED
Original Natural Gas Thermostat Accounts	10,502	0	0%	16,992	0	0%
Only installed thermostats	5,229	5,273	50%	9,950	7,042	41%
Billing data unavailable	5,125	104	1%	9,592	358	2%
Insufficient Pre- and Post-Installation Days (<300 days)	3,974	1,151	11%	6,919	2,673	16%
Low Usage (Less than 150 therms annually)	3,964	10	0%	6,904	15	0%
Changed Usage from the Pre- to Post-Period (>70%)	3,944	20	0%	6,885	19	0%
Individual Customer Bill Review and incorrect PRISM signs	3,654	290	3%	6,392	493	3%
Installed Only 1 Thermostat	3,489	165	2%	6,107	285	2%
Comparison Group Matching by Quartile	3,489	0	0%	5,983	124	1%
Final Analysis Group	**3,489**	**7,013**	**67%**	**5,983**	**11,009**	**65%**

Table 253 shows the attrition for the treatment and comparison group houses in each step for the 2020-2022 electric thermostat participants.

Table 253. 2020-2022 Electric AC Smart Thermostat Attrition

SCREEN	TREATMENT GROUP			COMPARISON GROUP		
	N	N DROPPED	% DROPPED	N	N DROPPED	% DROPPED
Original Homes with Electric AC Thermostat Installation	6,612	0	0%	10,683	0	0%
Homes which only installed thermostats	4,270	2,342	35%	7,674	3,009	28%
Had available billing data	4,164	106	2%	7,456	218	2%
Insufficient Pre- and Post-Installation Days (<300 days)	3,276	888	13%	5,318	2,138	20%
Low Usage (Less than 1,000 kWh annually)	3,275	1	0%	5,314	4	0%
Changed Usage from the Pre- to Post-Period (>70%)	3,245	30	0%	5,260	54	1%
Individual Customer Bill Review and incorrect PRISM signs	3,058	187	3%	5,016	244	2%
Installed Only 1 Thermostat	2,896	162	2%	4,746	270	3%
Comparison Group Matching by Quartile	2,896	0	0%	4,585	161	2%
Final Analysis Group	2,896	3,716	56%	4,585	6,098	57%

Data Screening EFLH Analysis

The evaluation team removed the following sites from the EFLH analysis:

- Households that did not have billing data available.
- Households with fewer than 270 days of post- data during the analysis year.
- Households with normalized annual natural gas consumption of less than 150 therms annually.[68]
- Households where the percentage of heating load was less than 70%.
- Households with zero usage readings during winter months.

[68] This was increased to 150 therms here – because we want to make sure that they have natural gas heating here – and we are not picking up lower usage water heaters. Furthermore, we are not reviewing each EFLH HVAC site's usage graphs – and we increased this to preventively screen out vacancies. Low/ vacant usage estimates would likely skew EFLH results.

- Households with adjusted R2 values from the PRISM analysis of less than 0.8.
- Households with more than three months of missing data filled in.

These filters were applied to ensure that the billing data was representative of a household's heating load. Because there were so many furnaces included in the analysis it was not possible to review the billing data for each individual household to detect any anomalous billing data. We applied these filters to remove households which may have billing data issues that would cause incorrect EFLH calculations for a given household.

Table 254 shows the number of households removed for each of the criteria listed above. The evaluation team started with all furnaces in the 2020 – 2023 tracking data that matched the billing data.

Table 254. 2022 and 2023 Gas EFLH Analysis Attrition

SCREEN	2022 POST PERIOD			2023 POST PERIOD		
	N	N DROPPED	% DROPPED	N	N DROPPED	% DROPPED
Had available billing data	15,875	0	0%	15,875	0	0%
Insufficient Post-Installation Days (<270 days)	15,796	79	0%	15,784	91	1%
Low Usage (Less than 150 therms annually)	15,784	12	0%	15,761	23	0%
Households removed with zero reads in the winter	15,769	15	0%	15,740	21	0%
Households removed with PRISM R^2 less than 0.8	15,149	620	4%	15,021	719	5%
Households removed with heating load less than 70% of total load	12,335	2,814	19%	12,105	2,916	19%
Households removed with more than 3 months of missing data filled in	11,747	588	5%	11,639	466	4%
Final Analysis Group	**11,747**	**4,128**	**26%**	**11,639**	**4,236**	**27%**

PRISM Modeling Approach

For both the smart thermostat analysis and EFLH analysis, the evaluation team used the PRISM modeling approach. The evaluation team estimated relevant PRISM models for pre- and post-installation billing data. These models provided weather-normalized, pre- and post-installation annual usage for each account. For each electric savings home, we estimated a heating and cooling PRISM model for both the pre- and post-installation periods to weather normalize raw billing data.

For each gas household we only estimated a heating PRISM model. Each model allowed the heating reference temperature to range from 45°F to 85°F and the cooling reference temperature to range from the heating reference temperature to 85°F. For the gas models only heating reference temperatures from 45°F to 70°F were used.

The evaluation team used the following specification for the electric PRISM model:

$$ADC_{it} = \alpha_i + \beta_1 AVGHDD_{it} + \beta_2 AVGCDD_{it} + \epsilon_{it}$$

And the following specification for the gas PRISM model:

$$ADC_{it} = \alpha_i + \beta_1 AVGHDD_{it} + \epsilon_{it}$$

Where, for each customer *i* and month *t*:

ADC_{it}	=	Average daily kilowatt-hour consumption in the pre- and post-installation period
α_i	=	Participant intercept that represents the average daily energy usage baseload
β_1	=	Model space heating parameter value
$AVGHDD_{it}$	=	Base 45°F to 85°F average daily HDDs for the specific location
β_2	=	Model space cooling parameter value
$AVGCDD_{it}$	=	Base 45°F to 85°F average daily CDDs for the specific location
ϵ_{it}	=	Error term

Using this model, the evaluation team computed weather-normalized annual consumption for each heating and cooling reference temperature:

$$Electric\ NAC_i = \alpha_i * 365 + \beta_1 * LRHDD_i + \beta_2 * LRCDD_i$$

$$Gas\ NAC_i = \alpha_i * 365 + \beta_1 * LRHDD_i + \beta_2 * LRCDD_i$$

Where, for each customer *i*:

NAC_i	=	Normalized annual kilowatt-hour consumption
α_i	=	Intercept; the average daily or baseload for each participant that represents the average daily baseload from the model
$\alpha_i * 365$	=	Annual baseload kilowatt-hour usage (non-weather sensitive)
β_1	=	Heating parameter value; in effect, this is usage per HDD from model above
$LRHDD_i$	=	Annual, long-run HDDs of a TMY3 in the 1991–2005 series from NOAA, based on the home location
$\beta_1 * LRHDD_i$	=	Weather-normalized annual weather-sensitive heating usage
β_2	=	Cooling parameter value; in effect, this is usage per CDD from model above
$LRCDD_i$	=	Annual, long-run CDDs of a TMY3 in the 1991–2005 series from NOAA, based on home location

$\beta_2 * LRCDD_i$ = Weather-normalized annual weather-sensitive cooling usage

Further, if the heating and cooling models above yielded negative intercepts, negative heating parameters, or negative cooling parameters, the evaluation team estimated additional models that included only the cooling usage (cooling-only models) or only the heating usage (heating-only models). From these models, with correct signs on all parameters, we selected the best model for each participant for the pre- and post-installation periods as the one with the highest R-square value.[69]

Smart Thermostat Energy Savings Factors

The evaluation team used PRISM modeling results to create the heating and cooling energy savings factors. The evaluation team calculated the heating energy savings factor using the gas PRISM results, as most participants had gas heating and there were not sufficient electric heating participants to get a separate electric heating energy savings factor. Similarly, the evaluation team calculated the cooling energy savings factor using the electric PRISM results. The evaluation team decided to only look at changes in heating and cooling consumption, as these were the only end uses the smart thermostat should affect. This decision was made as the evaluation team observed large baseload savings that were entirely driven by an increase in comparison group consumption. It was deemed unreasonable that the baseload savings should be attributable to the smart thermostat program. Additionally, the evaluation team used percentage savings as opposed gross savings because percentage savings are more robust to any misallocation of heating and cooling load when using a PRISM modeling approach on monthly billing data, particularly on the electric side. If both the pre- and post-period weather sensitive (heating/cooling) usages are over-estimating the percent change in usage will still be more consistent. Heating and cooling energy savings factors were calculated as follows:

$$Heating\ ESF = \frac{\Delta\, Treatment\ Heating\ Load}{Pre\ Period\ Treatment\ Heating\ Load} - \frac{\Delta\, Comparison\ Heating\ Load}{Pre\ Period\ Comparison\ Heating\ Load}$$

$$Cooling\ ESF = \frac{\Delta\, Treatment\ Cooling\ Load}{Pre\ Period\ Treatment\ Cooling\ Load} - \frac{\Delta\, Comparison\ Cooling\ Load}{Pre\ Period\ Comparison\ Cooling\ Load}$$

The gas heating and electric cooling results for the 2020-2022 participants are shown in

Table 255 and Table 256. These are the final estimates for participants installing one thermostat.[70] For gas thermostats, natural gas percent heating savings were 6.0% - and were very significant with a ±7% relative precision at the 90% confidence level. For electric cooling, the cooling percent savings were 9.6% and these savings were also quite precise with a ±15% relative precision at the 90% confidence level.

[69] R-square is a measure of statistical fit. In this case it represents the amount of variance in average daily consumption explained by different combinations of HDDs or CDDs. Higher R-square values indicate that more of the variance is explained by a specific model and therefore is considered the best model at explaining consumption relative to weather in each household.
[70] In the previous billing analysis, the final savings estimates were developed using only one thermostat. The comparison group matching was also performed with customers installing one thermostat only. The customers that installed more than one thermostat often participated in multiple years and this would complicate assigning them to a specific cohort year.

Table 255. Smart Thermostat Gas Heating Savings Results

YEARS	TREATMENT HOUSE-HOLDS (N)	COMPARISON HOUSEHOLDS (N)	TREATMENT PRE-PERIOD HEATING SENSITIVE CONSUMPTION (THERMS)	COMPARISON PRE-PERIOD COMPARISON HEATING SENSITIVE CONSUMPTION (THERMS)	PERCENT CHANGE IN TREATMENT HEATING CONSUMPTION	PERCENT CHANGE IN COMPARISON HEATING CONSUMPTION	PERCENT HEATING SAVINGS	RELATIVE PRECISION AT 90% CONFIDENCE
2020-2022	3,489	5,983	715	709	6.07%	0.04%	6.03%	7.22%

Table 256. Smart Thermostat Electric Cooling Savings Results

YEARS	TREATMENT HOUSE-HOLDS (N)	COMPARISON HOUSEHOLDS (N)	TREATMENT PRE-PERIOD COOLING SENSITIVE CONSUMPTION (KWH)	COMPARISON PRE-PERIOD COOLING SENSITIVE CONSUMPTION (KWH)	PERCENT CHANGE IN TREATMENT COOLING CONSUMPTION	PERCENT CHANGE IN COMPARISON COOLING CONSUMPTION	PERCENT COOLING SAVINGS	RELATIVE PRECISION AT 90% CONFIDENCE
2020-2022	2896	4,585	2,654	2,640	8.02%	-1.56%	9.58%	14.98%

Table 257 and Table 258 show the gas heating and electric cooling savings by the number of thermostats purchased. The gas and electric differences in savings per thermostat were not statistically significant. There were some interesting differences observed between those that installed one vs two thermostats. Per-household savings were higher for natural gas homes that installed multiple thermostats, but lower for electric homes. Both on the gas side and electric side, homes that purchased two thermostats saved less per thermostat than homes that only installed one. Homes which purchased multiple thermostats had higher usage on average, indicating these homes are likely larger in size and it is reasonable to assume both thermostats were typically installed.[71]

[71] Many homes that installed two thermostats participated in multiple years. The wide installation period makes it more likely that other factors may be contributing to the changes in usage. Furthermore, low sample sizes contributed to very high standard errors for customers installing two thermostats. The billing analysis including the comparison group matching focused only on the customers installing one thermostat.

Table 257. Smart Thermostat Gas Heating Savings by Total Thermostats Purchased

YEAR	NUMBER OF THERMOSTATS	PRE-PERIOD TREATMENT HEATING CONSUMPTION (THERMS)	PER HOUSEHOLD SAVINGS (THERMS)	HEATING SAVINGS PER THERMOSTAT (THERMS)	PERCENT HEATING SAVINGS	RELATIVE PRECISION AT 90% CONFIDENCE
2020-2022	One	715	43	43	6.0%	7%
	Two	904	69	35	3.8%	24%

Table 258. Smart Thermostat Electric Cooling Savings by Total Thermostats Purchased

YEAR	NUMBER OF THERMOSTATS	PRE-PERIOD TREATMENT COOLING CONSUMPTION (KWH)	PER HOUSEHOLD SAVINGS (KWH)	COOLING SAVINGS PER THERMOSTAT (KWH)	PERCENT COOLING SAVINGS	RELATIVE PRECISION AT 90% CONFIDENCE
2020-2022	One	2,654	254	254	9.6%	15%
	Two	3,655	205	102	2.8%	95%

Gas Furnace EFLH Values

The evaluation team used the PRISM modeling results for 2021 and 2022 participants that installed gas furnaces to calculate heating EFLH values. The evaluation team did not use EFLH values for cooling because disaggregation of electric monthly billing data does not always result in precise estimates of heating, cooling, and baseload components. PRISM modeling can often overestimate the cooling component. The primary reason for this is that there are only about three summer months with cooling related usage and the PRISM model cannot always precisely disaggregate the cooling portion of these months from any other changes in energy consumption that may occur in the summer. The evaluation team calculated heating EFLH values as follows:

$$EFLH = \frac{Post\ Period\ Heating\ Usage}{Heating\ Capacity\ of\ Natural\ Gas\ Furnace}$$

The evaluation team mapped each participant household to the nearest Indiana TRM (v2.2) city by mapping each zip code to the nearest TRM city. Detailed EFLH results for 2022 and 2023 are presented in Table 259 and Table 260 below.

Table 259. 2022 & 2023 Heating EFLH Values

LOCATION	N		HEATING SENSITIVE USAGE (THERMS)		AVERAGE CAPACITY (BTUH)		EFLH	
	2022	2023	2022	2023	2022	2023	2022[a]	2023
Ft. Wayne	3,198	3,182	615	565	72,625	72,344	1,004 (±1%)	993 (±1%)
Indianapolis	607	605	611	564	72,663	72,795	983 (±3%)	953 (±3%)
South Bend	7,919	7,827	694	643	74,443	74,426	1,008 (±1%)	989(±1%)
Terre Haute	23	25	668	663	73,348	75,000	1,219 (±28%)	1,181 (±17%)

[a] Confidence intervals shown at the 90% level.

Table 260. Heating EFLH TRM Comparison

LOCATION	2023 FURNACE UNIT COUNT	IN TRM (2.2) EFLH	BILLING ANALYSIS EFLH		PERCENT DECREASE	
			2022	2023	2022	2023
Ft. Wayne	3,244	1,356	1,004	993	26%	27%
Indianapolis	611	1,341	983	953	27%	28%
South Bend	8,003	1,427	1,008	989	29%	31%
Terre Haute	27	804	1,219	1,181	-52%	-47%

Appendix 2. Residential Lighting Program

For the 2023 evaluation, the evaluation team referenced the IL TRM v11.0 and Indiana TRM (v2.2) for savings algorithms.

LED Fixture

The team used the following equations to calculate electric energy and peak demand savings, as well as natural gas energy penalties, for LED fixtures.

$$kWh\ savings\ per\ lamp = \frac{(WattsBase - WattsEE) * Hours * (1 + WHFe)}{1{,}000} * ISR$$

$$kW\ reduction\ per\ lamp = \frac{(WattsBase - WattsEE) * CF * (1 + WHFd)}{1{,}000} * ISR$$

$$therm\ savings\ per\ lamp = \frac{(WattsBase - WattsEE) * Hours * WHFg * 10}{1{,}000} * ISR$$

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 261 lists the input assumptions and source of each assumption for the LED candelabra measure savings calculations.

Table 261. *Ex Post* Variable Assumptions for LED fixtures

INPUT	VALUE	SOURCE
WattsBase	varies	UMP lumens bin approach
WattsEE	Actual	ENERGY STAR qualified products list, tracking data
Hours	902	Indiana TRM (v2.2)
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	100%	Illinois TRM (v11.0)

Tier 1 Advanced Power Strip

The team used the following equations from IL TRM v11.0 p. 78 to calculate electric energy savings for advanced power strips (tier 1):

$$kWh\ savings = \text{kWh} * \text{ISR}$$

$$kW\ reduction = \frac{\text{kWh savings}}{Hours} * \text{CF}$$

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 262 lists the input assumptions and source of each assumption for the advanced power strips measure savings calculations.

Table 262. *Ex Post* Variable Assumptions for Advanced Power Strips

INPUT	VALUE	SOURCE
kWh, 7-plug	103	IL TRM v11.0
kWh, 5-plug	56.5	IL TRM v11.0
ISR	71%	IL TRM v11.0, TOS
Hours	7,129	IL TRM v11.0
CF	50%	Indiana TRM (v2.2)

Tier 2 Advanced Power Strip

The evaluation team used the following equations from IL TRM v11.0 p. 82 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 263 lists the assumptions and source of each assumption for advanced power strip tier 2 measure savings calculations.

Table 263. *Ex Post* Variable Assumption for Advance Power Strip Tier 2

INPUT	VALUE	SOURCE
ERP	40%	IL TRM v11.0, infrared only
	25%	IL TRM v11.0, infrared and occupancy sensor
$BaselineEnergy_{AV}$	466	IL TRM v11.0
ISR	73%	IL TRM v11.0, infrared only
	83%	IL TRM v11.0, infrared and occupancy sensor
Hours	4,380	IL TRM v11.0
CF	0.50	Indiana TRM (v2.2)

Air Purifier

The team used the following equation from IL TRM v11.0 p. 6 to calculate electric energy savings and peak demand savings for air purifiers:

$$\Delta kWh = kWh\_base - kWh\_eff$$

$$kWh\_base = hours * SmokeCADR_{base}/(SmokeCADR_{perwatt_{base}} * 1000)) + (8760 - hours) * PartialOnModePower\_base/1000)$$

$$kWh\_eff = hours * SmokeCADR_{Eff}/(SmokeCADR_{perwatt_{Eff}} * 1000)) + (8760 - hours) * PartialOnModePower\_eff/1000)$$

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

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 264 lists the input assumptions and source of each assumption for the air purifier measure savings calculations.

Table 264. *Ex Post* Variable Assumptions for Air Purifiers

INPUT	VALUE	SOURCE
SmokeCADR_base (CADR 100-149)	127.6	IL TRM v11.0
SmokeCADR_per_watt_base (CADR 100-149)	1.83	IL TRM v11.0
PartialOnModePower_base (CADR 100-149)	2.0	IL TRM v11.0
SmokeCADR_base (CADR 150-199)	175.2	IL TRM v11.0
SmokeCADR_per_watt_base (CADR 150-199)	1.94	IL TRM v11.0
PartialOnModePower_base (CADR 150-199)	2.0	IL TRM v11.0
SmokeCADR_eff	Varies	Actual
SmokeCADR_per_watt_eff	Varies	Actual
PartialOnModePower_eff	Varies	Actual
Hours	5840	IL TRM v11.0
CF	0.667	IL TRM v11.0

Appendix 3. Home Energy Assessment 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 v11.0, the Indiana TRM (v2.2), the Pennsylvania TRM 2016, and the Uniform Methods Project. 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 265 lists the assumptions of the *ex post* per-measure savings.

Table 265. 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 266 lists the input assumptions and source of each assumption for the LED measure savings calculations.

Table 266. *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_{base} (Downlight Retrofit)	72.8	ENERGY STAR QPL for lumens, UMP for baseline equivalent

INPUT	VALUE	SOURCE
W_{LED} (Candelabra)	4.5	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
W_{LED} (Downlight Retrofit)	13	Actual installed wattage
Daily hours of use x 365	902	Indiana TRM (v2.2)
WHFe	-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
WHFd	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
WHFg	-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:

$$kWh\ savings = \left(GPM_{base} - GPM_{low\ flow}\right) * MPD * \frac{PH}{FH} * DF * 8.33 * (T_{mix} - T_{inlet}) * \frac{365}{RE * 3412}$$

$$kW\ savings = \left(GPM_{base} - GPM_{low\ flow}\right) * 60 * DF * 8.33 * \frac{T_{mix} - T_{inlet}}{RE * 3412} * CF$$

$$therm\ savings = \left(GPM_{base} - GPM_{low\ flow}\right) * MPD * \frac{PH}{FH} * DF * 8.33 * (T_{mix} - T_{inlet}) * \frac{365}{RG * 100{,}000}$$

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
DF	=	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 267 lists the assumptions and source of each assumption for kitchen and bathroom faucet aerator measure savings calculations.

Table 267. *Ex Post* Variable Assumption for Kitchen and Bathroom Faucet Aerators

INPUT	VALUE	SOURCE
GPM_{base} (Kitchen)	1.63	Illinois TRM v11.0
GPM_{base} (Bathroom)	1.53	Illinois TRM v11.0
$GPM_{low\text{-}flow}$ (Kitchen)	0.94	Illinois TRM v11.0
$GPM_{low\text{-}flow}$ (Bathroom)	0.94	Illinois TRM v11.0
MPD (Kitchen)	4.5	Illinois TRM v11.0
MPD (Bathroom)	1.6	Illinois TRM v11.0
PH	2.64	Indiana TRM (v2.2)
FH (Kitchen)	1.0	Illinois TRM v11.0
FH (Bathroom)	2.83	Illinois TRM v11.0
DF (Kitchen)	0.75	Illinois TRM v11.0
DF (Bathroom)	0.9	Illinois TRM v11.0
T_{mix} (Kitchen)	93.00	Illinois TRM v11.0
T_{mix} (Bathroom)	86.00	Illinois TRM v11.0

INPUT	VALUE	SOURCE
T_{inlet}	57.36	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 v11.0
RG	0.78	Illinois TRM v11.0
CF (Kitchen)	0.0033	Illinois TRM v11.0
CF (Bathroom)	0.0012	Illinois TRM v11.0
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 268 lists the assumptions and source of each assumption for low-flow showerhead measure savings calculations.

Table 268. *Ex Post* Variable Assumptions for Low-Flow Showerheads

INPUT	VALUE	SOURCE
GPM_{base}	2.24	Illinois TRM v11.0
$GPM_{low\text{-}flow}$	1.5	Actual
MS	7.8	Illinois TRM v11.0
SPH	1.065	NIPSCO 2022 Survey Results
SH	1.79	Illinois TRM v11.0
T_{mix}	101	Illinois TRM v11.0
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 v11.0
RG	0.78	Illinois TRM v11.0
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	365.25	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:

$$kWh\ savings = \ GPM * \frac{8.33}{3412} * (T_{out} - T_{in}) * \frac{SPH}{SH} * \frac{WS}{RE} * 365.25$$

$$kW\ savings = kWh\ savings * \frac{CF}{Hours}$$

$$therm\ savings = GPM * \frac{8.33}{100{,}000} * (T_{out} - T_{in}) * \frac{SPH}{SH} * \frac{WS}{RG} * 365.25$$

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 269 lists the assumptions and source of each assumption for shower start measure savings calculations.

Table 269. *Ex Post* Variable Assumptions for Shower Start

INPUT	VALUE	SOURCE
GPM_{base}	2.24	Illinois TRM v11.0
$GPM_{low\text{-}flow}$	1.5	Actuals. 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 v11.0
WS	0.89	PA TRM 2016
T_{mix}	101	Illinois TRM v11.0

INPUT	VALUE	SOURCE
T_{inlet}	57.4	Illinois TRM v11.0
RE	0.98	Illinois TRM v11.0
RG	0.78	Illinois TRM v11.0
CF	0.0023	Indiana TRM (v2.2)
Hours	14.43	Illinois TRM v11.0
Conversion Factor	8.33	Specific weight of water (pounds per gallon)
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:

$$kWh\ savings = \left(\frac{1}{R_{Exist}} - \frac{1}{R_{New}}\right) * \frac{L * C * \Delta T * 8{,}766}{\eta_{DHWE} * 3{,}412}$$

$$kW\ savings = \frac{kWh\ savings}{8{,}766}$$

$$therm\ savings = \left(\frac{1}{R_{Exist}} - \frac{1}{R_{New}}\right) * \frac{L * C * \Delta T * 8{,}766}{\eta_{DHWG} * 100{,}000}$$

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
η_{DHWE}	=	Recovery efficiency of electric water heater
η_{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 270 lists the assumptions and source of each assumption for pipe wrap savings calculations.

Table 270. *Ex Post* Variable Assumptions for Pipe Wrap

INPUT	VALUE	SOURCE
R_{Exist}	0.4825	Illinois TRM v11.0
R_{New}	5.1025	Actuals. Based on insulation R-value of 4.6 (average of program data insulation values) and bare-pipe R-value of 0.48 (per Illinois TRM v11.0).
L	8.43	Value shown is the program average, not the value used to calculate savings for each participant.
C	0.21	Actuals. Based on assumed pipe diameter of 0.75 inches
ΔT	60	Illinois TRM v11.0
η_{DHWE}	.98	Illinois TRM v11.0
η_{DHWG}	.78	Illinois TRM v11.0
Conversion Factor	3,412	Constant to convert Btu to kWh
Conversion Factor	8,766	Constant to convert hours to years
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:

$$kWh\ savings = kWh_{cooling} + kWh_{heatingElectric} + kWh_{heatingFurnace}$$

$$kWh_{cooling} = \frac{\left(\left(\frac{1}{R_{old}} - \frac{1}{R_{attic}}\right) * A_{attic} * (1 - FF) * 24 * CDD * DUA\right)}{1000 * eff_{cool}} * ADJ_{ac} * IE_{nc}$$

$$kWh_{heatingElectric} = \frac{\left(\left(\frac{1}{R_{old}} - \frac{1}{R_{attic}}\right) * A_{attic} * (1 - FF) * 24 * HDD\right)}{eff_{elecheat} * 3412} * ADJ_{aeh}$$

$$kWh_{heatingFurnace} = (therm\ savings) * F_e * 29.3 * ADJ_{ahf}$$

$$kW\ savings = kWh_{cooling}/EFLH_{cooling} * CF$$

$$therm\ savings = \frac{\left(\frac{1}{R_{old}} - \frac{1}{R_{attic}}\right) * A_{attic} * (1 - FF) * 24 * HDD}{eff_{gasheat} * 100000} * ADJ_{agh} * IE_{nc}$$

Where:

R_{old} = R-value of existing assembly and any existing insulation

R_{attic} = R-value of new attic assembly

A_{attic} = Total area of insulated attic (kft^2)

FF = Adjustment to account for area of framing

CDD = Cooling degree days

DUA = Discretionary use adjustment

Eff_{cool} = Seasonal Energy Efficiency Ratio (SEER) of system

ADJ_{ac} = Adjustment for cooling savings to account for inaccuracies of engineering algorithms

IE_{nc} = Income eligibility net correction

HDD = Heating degree days

$Eff_{elecheat}$ = Efficiency of electric heating system

ADJ_{aeh} = Adjustment for electric heating savings to account for inaccuracies of engineering algorithms

F_e = Furnace fan energy consumption as a percentage of annual fuel consumption

$EFLH_{cooling}$ = Full load hours of air conditioner

CF = Coincidence factor

$Eff_{gasheat}$ = Efficiency of gas heating system

ADJ_{agh} = Adjustment for gas heating savings to account for inaccuracies of engineering algorithms

24 = Hours per day

1,000 = Btu per kBtu

3,412 = Btu per kWh

29.3 = kWh per therm

100,000 = Btu per therm

Table 271 lists the assumptions and source of each assumption for attic insulation savings calculations.

Table 271. *Ex Post* Variable Assumptions for Attic Insulation

INPUT	VALUE	SOURCE
R_{old}	5.78	NIPSCO program data
R_{attic}	33.69	NIPSCO program data
A_{attic}	1.07	Value shown is the program average, not the value used to calculate savings for each participant.
FF	0.07	Illinois TRM v11.0
CDD	777	Calculated via NOAA weather data. Value shown is the program average, not the value used to calculate savings for each participant.
DUA	0.75	Illinois TRM v11.0

INPUT	VALUE	SOURCE
Eff_{cool}	10.5	Illinois TRM v11.0
ADJ_{ac}	1.21	Illinois TRM v11.0
IE_{nc}	1	Illinois TRM v11.0
HDD	4051	Calculated via NOAA weather data. Value shown is the program average, not the value used to calculate savings for each participant.
$Eff_{elecheat}$	1.28	Illinois TRM v11.0
ADJ_{aeh}	0.6	Illinois TRM v11.0
Fe	0.0314	Illinois TRM v11.0
$EFLH_{cooling}$	428	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
CF	0.88	IN TRM (v2.2)
$Eff_{gasheat}$	0.72	Illinois TRM v11.0
ADJ_{ahf}	1.07	Illinois TRM v11.0
Conversion Factor	24	Constant to convert days to hours
Conversion Factor	1000	Constant to convert Btu to kBtu
Conversion Factor	3412	Constant to convert Btu to kWh
Conversion Factor	29.3	Constant to convert therms to kWh
Conversion Factor	10000	Constant to convert Btu to therms

Duct Sealing

The evaluation team used the following equations to calculate electric and natural gas energy savings for duct sealing.

$$kWh\ savings = kWh_{cool} + kWh_{heat}$$

$$kWh_{cool} = \frac{DE_{coolafter} - DE_{coolbefore}}{DE_{coolafter}} * \frac{EFLH_{cool} * Btuh_{cool} * TRF_{cool}}{SEER * 1{,}000}$$

$$kWh_{heat} = \frac{DE_{heatafter} - DE_{heatbefore}}{DE_{heatafter}} * \frac{EFLH_{heat} * Btuh_{heat} * TRF_{heat}}{Eff_{elecheat} * 3{,}412}$$

$$kW\ savings = \frac{kWh_{cool}}{EFLH_{cool}} * CF$$

$$therm\ savings = \frac{DE_{heatafter} - DE_{heatbefore}}{DE_{heatafter}} * \frac{EFLh_{heat} * Btuh_{heat} * TRF_{heat} * Eff_{gasheat}}{Eff_{system} * 100000}$$

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
$EFLH_{cool}$	= 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)
SEER	= Seasonal average efficiency of air conditioning equipment
TRF_{cool}	= Thermal regain factor for cooling
$Eff_{elecheat}$	= Efficiency in COP of heating equipment
TRF_{heat}	= Thermal regain factor for heating
CF	= Coincidence factor
$Eff_{gasheat}$	= Gas heating equipment efficiency
Eff_{system}	= Pre duct sealing heating system efficiency
1,000	= Btu per kBtu
3,412	= Btu per kWh
100,000	= Btu per therm

Table 272 lists the assumptions and source of each assumption for the smart duct sealing savings calculations.

Table 272. *Ex Post* Variable Assumptions for Duct Sealing

INPUT	VALUE	SOURCE
$DE_{coolafter}$	0.79	Building Performance Institute (as recommended by the Illinois TRM v11.0)
$DE_{coolbefore}$	0.65	Building Performance Institute (as recommended by the Illinois TRM v11.0)
$DE_{heatafter}$	0.85	Building Performance Institute (as recommended by the Illinois TRM v11.0)
$DE_{heatbefore}$	0.76	Building Performance Institute (as recommended by the Illinois TRM v11.0)

INPUT	VALUE	SOURCE
$EFLH_{heat}$	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
$EFLH_{cool}$	426	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	10.5	Illinois TRM v11.0
TRF_{cool}	0.4	Illinois TRM v11.0
$Eff_{elecheat}$	1.28	Illinois TRM v11.0
$BtuH_{cool}$	28,944	Illinois TRM v11.0
$BtuHh_{eat}$	77,386	Illinois TRM v11.0
TRF_{heat}	0.4	Illinois TRM v11.0
CF	0.88	IN TRM (v2.2)
$Eff_{gasheat}$	0.8	Illinois TRM v11.0
$Eff_{gassystem}$	0.7	Illinois TRM v11.0
Conversion Factor	1,000	Converts Btu to kBtu
Conversion Factor	3,412	Converts Btu to kWh
Conversion Factor	100,000	Converts Btu to therms

Appendix 4. Income-Qualified Weatherization 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 v11.0, the Indiana TRM (v2.2), the Pennsylvania TRM 2016, and the Uniform Methods Project. 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
- Air Sealing
- Programmable Thermostats
- Refrigerator Replacement

Table 273 lists the assumptions of the *ex post* per-measure savings.

Table 273. 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
Air Sealing	Heating and cooling equipment efficiencies, infiltration values, and weather data
Programmable Thermostats	Heating consumption, heating reduction, and heating efficiency
Refrigerator Replacement	New and baseline energy use

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 274 lists the input assumptions and source of each assumption for the LED measure savings calculations.

Table 274. *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

INPUT	VALUE	SOURCE
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_{base} (Downlight Retrofit)	72.8	ENERGY STAR QPL for lumens, UMP for baseline equivalent
W_{LED} (Candelabra)	4.5	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
W_{LED} (Downlight Retrofit)	13	Actual installed wattage
Daily hours of use x 365	902	Indiana TRM (v2.2)
WHFe	-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
WHFd	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
WHFg	-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:

$$kWh\ savings = (GPM_{base} - GPM_{low\ flow}) * MPD * \frac{PH}{FH} * DF * 8.33 * (T_{mix} - T_{inlet}) * \frac{365}{RE * 3412}$$

$$kW\ savings = (GPM_{base} - GPM_{low\ flow}) * 60 * DF * 8.33 * \frac{T_{mix} - T_{inlet}}{RE * 3412} * CF$$

$$therm\ savings = \left(GPM_{base} - GPM_{low\ flow}\right) * MPD * \frac{PH}{FH} * DF * 8.33 * (T_{mix} - T_{inlet}) * \frac{365}{RG * 100{,}000}$$

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
DF	=	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 275 lists the assumptions and source of each assumption for kitchen and bathroom faucet aerator measure savings calculations.

Table 275. *Ex Post* Variable Assumption for Kitchen and Bathroom Faucet Aerators

INPUT	VALUE	SOURCE
GPM_{base} (Kitchen)	1.63	Illinois TRM v11.0
GPM_{base} (Bathroom)	1.53	Illinois TRM v11.0
$GPM_{low\text{-}flow}$ (Kitchen)	0.94	Illinois TRM v11.0
$GPM_{low\text{-}flow}$ (Bathroom)	0.94	Illinois TRM v11.0
MPD (Kitchen)	4.5	Illinois TRM v11.0
MPD (Bathroom)	1.6	Illinois TRM v11.0

INPUT	VALUE	SOURCE
PH	2.64	Indiana TRM (v2.2)
FH (Kitchen)	1.0	Illinois TRM v11.0
FH (Bathroom)	2.83	Illinois TRM v11.0
DF (Kitchen)	0.75	Illinois TRM v11.0
DF (Bathroom)	0.9	Illinois TRM v11.0
T_{mix} (Kitchen)	93.00	Illinois TRM v11.0
T_{mix} (Bathroom)	86.00	Illinois TRM v11.0
T_{inlet}	57.38	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 v11.0
RG	0.78	Illinois TRM v11.0
CF (Kitchen)	0.0033	Illinois TRM v11.0
CF (Bathroom)	0.0012	Illinois TRM v11.0
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 276 lists the assumptions and source of each assumption for low-flow showerhead measure savings calculations.

Table 276. *Ex Post* Variable Assumptions for Low-Flow Showerheads

INPUT	VALUE	SOURCE
GPM_{base}	2.24	Illinois TRM v11.0
$GPM_{low\text{-}flow}$	1.5	Actual
MS	7.8	Illinois TRM v11.0
SPH	1.065	NIPSCO 2022 Survey Results
SH	1.79	Illinois TRM v11.0
T_{mix}	101	Illinois TRM v11.0
T_{inlet}	57.34	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 v11.0
RG	0.78	Illinois TRM v11.0
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	365.25	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:

$$kWh\ savings = GPM * \frac{8.33}{3412} * (T_{out} - T_{in}) * \frac{SPH}{SH} * \frac{WS}{RE} * 365.25$$

$$kW\ savings = kWh\ savings * \frac{CF}{Hours}$$

$$therm\ savings = GPM * \frac{8.33}{100{,}000} * (T_{out} - T_{in}) * \frac{SPH}{SH} * \frac{WS}{RG} * 365.25$$

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 277 lists the assumptions and source of each assumption for shower start measure savings calculations.

Table 277. *Ex Post* Variable Assumptions for Shower Start

INPUT	VALUE	SOURCE
GPM_{base}	2.24	Illinois TRM v11.0
$GPM_{low\text{-}flow}$	1.5	Actuals. 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 v11.0
WS	0.89	PA TRM 2016
T_{mix}	101	Illinois TRM v11.0
T_{inlet}	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	0.98	Illinois TRM v11.0
RG	0.78	Illinois TRM v11.0
CF	0.0023	Indiana TRM (v2.2)
Hours	14.43	Illinois TRM v11.0
Conversion Factor	8.33	Specific weight of water (pounds per gallon)
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:

$$kWh\ savings = \left(\frac{1}{R_{Exist}} - \frac{1}{R_{New}}\right) * \frac{L * C * \Delta T * 8{,}766}{\eta_{DHWE} * 3{,}412}$$

$$kW\ savings = \frac{kWh\ savings}{8{,}766}$$

$$therm\ savings = \left(\frac{1}{R_{Exist}} - \frac{1}{R_{New}}\right) * \frac{L * C * \Delta T * 8{,}766}{\eta_{DHWG} * 100{,}000}$$

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
η_{DHWE}	=	Recovery efficiency of electric water heater
η_{DHWG}	=	Recovery efficiency of gas water heater
8,766	=	Hours per year
3,412	=	Constant to convert Btu to kWh
100,000	=	Constant to convert Btu to therms

Table 278 lists the assumptions and source of each assumption for pipe wrap savings calculations.

Table 278. *Ex Post* Variable Assumptions for Pipe Wrap

INPUT	VALUE	SOURCE
R_{Exist}	0.4825	Illinois TRM v11.0
R_{New}	5.1025	Actuals. Based on insulation R-value of 4.6 (average of program data insulation values) and bare-pipe R-value of 0.48 (per Illinois TRM v11.0).
L	8.63	Value shown is the program average, not the value used to calculate savings for each participant.
C	0.21	Actuals. Based on assumed pipe diameter of 0.75 inches
ΔT	60	Illinois TRM v11.0
η_{DHWE}	.98	Illinois TRM v11.0
η_{DHWG}	.78	Illinois TRM v11.0
Conversion Factor	3,412	Constant to convert Btu to kWh
Conversion Factor	8,766	Constant to convert hours to years
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:

$$kWh\ savings = kWh_{cooling} + kWh_{heatingElectric} + kWh_{heatingFurnace}$$

$$kWh_{cooling} = \frac{\left(\left(\frac{1}{R_{old}} - \frac{1}{R_{attic}}\right) * A_{attic} * (1 - FF) * 24 * CDD * DUA\right)}{1000 * eff_{cool}} * ADJ_{ac} * IE_{nc}$$

$$kWh_{heatingElectric} = \frac{\left(\left(\frac{1}{R_{old}} - \frac{1}{R_{attic}}\right) * A_{attic} * (1 - FF) * 24 * HDD\right)}{eff_{elecheat} * 3412} * ADJ_{aeh}$$

$$kWh_{heatingFurnace} = (therm\ savings) * F_e * 29.3 * ADJ_{ahf}$$

$$kW\ savings = \ kWh_{cooling}/EFLH_{cooling} * CF$$

$$therm\ savings = \frac{\left(\frac{1}{R_{old}} - \frac{1}{R_{attic}}\right) * A_{attic} * (1 - FF) * 24 * HDD}{eff_{gasheat} * 100000} * ADJ_{agh} * IE_{nc}$$

Where:

R_{old} = R-value of existing assembly and any existing insulation

R_{attic} = R-value of new attic assembly

A_{attic} = Total area of insulated attic (kft^2)

FF = Adjustment to account for area of framing

CDD = Cooling degree days

DUA = Discretionary use adjustment

Eff_{cool} = Seasonal Energy Efficiency Ratio (SEER) of system

ADJ_{ac} = Adjustment for cooling savings to account for inaccuracies of engineering algorithms

IE_{nc} = Income eligibility net correction

HDD = Heating degree days

$Eff_{elecheat}$ = Efficiency of electric heating system

ADJ_{aeh} = Adjustment for electric heating savings to account for inaccuracies of engineering algorithms

F_e = Furnace fan energy consumption as a percentage of annual fuel consumption

$EFLH_{cooling}$ = Full load hours of air conditioner

CF = Coincidence factor

$Eff_{gasheat}$ = Efficiency of gas heating system

ADJ_{agh} = Adjustment for gas heating savings to account for inaccuracies of engineering algorithms

24 = Hours per day

1,000 = Btu per kBtu

3,412 = Btu per kWh

29.3 = kWh per therm

100,000 = Btu per therm

Table 279 lists the assumptions and source of each assumption for attic insulation savings calculations.

Table 279. *Ex Post* Variable Assumptions for Attic Insulation

INPUT	VALUE	SOURCE
R_{old}	5.78	NIPSCO program data
R_{attic}	33.69	NIPSCO program data

INPUT	VALUE	SOURCE
A_{attic}	1.11	Value shown is the program average, not the value used to calculate savings for each participant.
FF	0.07	Illinois TRM v11.0
CDD	785	Calculated via NOAA weather data. Value shown is the program average, not the value used to calculate savings for each participant.
DUA	0.75	Illinois TRM v11.0
Eff_{cool}	10.5	Illinois TRM v11.0
ADJ_{ac}	1.21	Illinois TRM v11.0
IE_{nc}	1.1	Illinois TRM v11.0
HDD	4031	Calculated via NOAA weather data. Value shown is the program average, not the value used to calculate savings for each participant.
$Eff_{elecheat}$	1.28	Illinois TRM v11.0
ADJ_{aeh}	0.6	Illinois TRM v11.0
Fe	0.0314	Illinois TRM v11.0
$EFLH_{cooling}$	430	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
CF	0.88	IN TRM (v2.2)
$Eff_{gasheat}$	0.72	Illinois TRM v11.0
ADJ_{ahf}	1.07	Illinois TRM v11.0
Conversion Factor	24	Constant to convert days to hours
Conversion Factor	1000	Constant to convert Btu to kBtu
Conversion Factor	3412	Constant to convert Btu to kWh
Conversion Factor	29.3	Constant to convert therms to kWh
Conversion Factor	10000	Constant to convert Btu to therms

Duct Sealing

The evaluation team used the following equations to calculate electric and natural gas energy savings for duct sealing.

$$kWh\ savings = kWh_{cool} + kWh_{heat}$$

$$kWh_{cool} = \frac{DE_{coolafter} - DE_{coolbefore}}{DE_{coolafter}} * \frac{EFLH_{cool} * Btuh_{cool} * TRF_{cool}}{SEER * 1{,}000}$$

$$kWh_{heat} = \frac{DE_{heatafter} - DE_{heatbefore}}{DE_{heatafter}} * \frac{EFLH_{heat} * Btuh_{heat} * TRF_{heat}}{Eff_{elecheat} * 3{,}412}$$

$$kW\ savings = \frac{kWh_{cool}}{EFLH_{cool}} * CF$$

$$therm\ savings = \frac{DE_{heatafter} - DE_{heatbefore}}{DE_{heatafter}} * \frac{EFLh_{heat} * Btuh_{heat} * TRF_{heat} * Eff_{gasheat}}{Eff_{system} * 100000}$$

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
$EFLH_{cool}$	= 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)
SEER	= Seasonal average efficiency of air conditioning equipment
TRF_{cool}	= Thermal regain factor for cooling
$Eff_{elecheat}$	= Efficiency in COP of heating equipment
TRF_{heat}	= Thermal regain factor for heating
CF	= Coincidence factor
$Eff_{gasheat}$	= Gas heating equipment efficiency
Eff_{system}	= Pre duct sealing heating system efficiency
1,000	= Btu per kBtu
3,412	= Btu per kWh
100,000	= Btu per therm

Table 280 lists the assumptions and source of each assumption for the smart duct sealing savings calculations.

Table 280. *Ex Post* Variable Assumptions for Duct Sealing

INPUT	VALUE	SOURCE
$DE_{coolafter}$	0.79	Building Performance Institute (as recommended by the Illinois TRM v11.0)
$DE_{coolbefore}$	0.65	Building Performance Institute (as recommended by the Illinois TRM v11.0)
$DE_{heatafter}$	0.85	Building Performance Institute (as recommended by the Illinois TRM v11.0)
$DE_{heatbefore}$	0.76	Building Performance Institute (as recommended by the Illinois TRM v11.0)
$EFLH_{heat}$	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
$EFLH_{cool}$	431	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	10.5	Illinois TRM v11.0
TRF_{cool}	0.4	Illinois TRM v11.0
$Eff_{elecheat}$	1.28	Illinois TRM v11.0
$BtuH_{cool}$	28,944	Illinois TRM v11.0
$BtuHh_{eat}$	77,386	Illinois TRM v11.0
TRF_{heat}	0.4	Illinois TRM v11.0
CF	0.88	IN TRM (v2.2)
$Eff_{gasheat}$	0.8	Illinois TRM v11.0
$Eff_{gassystem}$	0.7	Illinois TRM v11.0
Conversion Factor	1,000	Converts Btu to kBtu
Conversion Factor	3,412	Converts Btu to kWh
Conversion Factor	100,000	Converts 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.

$$kWh\ savings = HC_{elec} * HR * HF + therm\ savings * F_e * 29.3$$

$$therm\ savings = HC_{gas} * HR * HF$$

Where:

HC_{elec} = Electric heating consumption in kWh

HR = Heating reduction

HF = Household factor

F_e = Furnace fan energy consumption

HC_{gas} = Gas heating consumption in therms

29.3 = kWh per therm

Table 281 lists the assumptions and source of each assumption for the smart thermostat measure savings calculations.

Table 281. *Ex Post* Variable Assumptions for Programmable Thermostats

INPUT	VALUE	SOURCE
HC_{elec}	15,683	Illinois TRM v11.0
HR	0.062	Illinois TRM v11.0
HF	1	Illinois TRM v11.0
F_e	0.0314	Illinois TRM v11.0
HC_{gas}	22,900	Illinois TRM v11.0
Conversion Factor	29.3	Conversion from therms to kWh

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.

$$kWh = UEC_{existing} - UEC_{efficient}$$

$$kW = \frac{kWh}{8760} * TAF * LSAF$$

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 282 lists the assumptions and source of each assumption for the refrigerator replacement measure savings calculations.

Table 282. *Ex Post* Variable Assumptions for Refrigerator Replacement

INPUT	VALUE	SOURCE
UEC_{exist}	862.2	Illinois TRM v11.0 Value shown is the program average, not the value used to calculate savings for each participant
$UEC_{efficient}$	383.0	Actual model specification. Value shown is the program average, not the value used to calculate savings for each participant
TAF	1.25	Illinois TRM v11.0
LSAF	1.06	Illinois TRM v11.0
Conversion Factor	8760	Hours per year

Air Sealing

The evaluation team used the following equations to calculate electric energy, peak demand, and natural gas energy savings for air sealing:

$$kWh\ cooling\ savings = \frac{\Delta CFM50}{Nfactor} * \frac{60 * 24 * CDD * DUA * 0.018}{1000 * Eff_{cool}} * LM * ADJ_{asc} * IE_{nc}$$

$$kWh\ heating\ savings = \frac{\Delta CFM50}{Nfactor} * \frac{60 * 24 * HDD * 0.018}{3412 * Eff_{elecheat}} + therm\ savings * F_e * 29.3 * ADJ_{ashf}$$

$$kW\ savings = \frac{kWh\ cooling\ savings}{EFLH_{cool}} * CF$$

$$therm\ savings = \frac{\Delta CFM50}{Nfactor} * \frac{60 * 24 * HDD * 0.018}{100000 * Eff_{gasheat}} * ADJ_{asfh} * IE_{nc}$$

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
CDD	=	Cooling degree days
DUA	=	Discretionary use adjustment
Eff_{cool}	=	Cooling equipment efficiency
LM	=	Latent multiplier to account for latent cooling demand
ADJ_{asc}	=	Adjustment for cooling savings to account for inaccuracies in engineering algorithms

IE_{NC} = Income eligible net correction

HDD = Heating degree days

$Eff_{elecheat}$ = Electric heating equipment efficiency

F_e = Furnace fan energy consumption

ADJ_{ashf} = Adjustment for fan savings during heating season to account for inaccuracies in engineering algorithm

$EFLH_{cool}$ = Effective full load cooling hours

CF = Coincidence factor

$Eff_{gasheat}$ = Gas heating equipment efficiency

ADJ_{asfh} = Adjustment for fossil heating savings to account for inaccuracies in engineering algorithms

24*60 = Minutes per day

0.018 = Btu/(cubic foot * F) (specific heat of air)

1,000 = Btu per kBtu

3,412 = Btu per kWh

29.3 = kWh per therm

100,000 = Btu per therm

Table 283 lists the assumptions and source of each assumption for the air sealing measure.

Table 283. *Ex Post* Variable Assumptions for Air Sealing

INPUT	VALUE	SOURCE
ΔCFM50	836.8	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)
CDD	785	Calculated via NOAA weather data. Value shown is the program average, not the value used to calculate savings for each participant.
DUA	0.75	Illinois TRM v11.0
Eff_{cool}	10.5	Illinois TRM v11.0
LM	3.24	Illinois TRM v11.0. Value shown is the program average, not the value used to calculate savings for each participant.
ADJ_{asc}	1	Illinois TRM v11.0
IE_{nc}`	1.1	Illinois TRM v11.0
HDD	4026	Calculated via NOAA weather data. Value shown is the program average, not the value used to calculate savings for each participant.

INPUT	VALUE	SOURCE
$Eff_{elecheat}$	1.28	Illinois TRM v11.0
F_e	0.0314	Illinois TRM v11.0
ADJ_{ashf}	1	Illinois TRM v11.0
$EFLH_{cool}$	430	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
CF	0.88	Indiana TRM (v2.2)
$Eff_{gasheat}$	0.72	Illinois TRM v11.0
ADJ_{asfh}	1	Illinois TRM v11.0
Conversion Factor	60*24	Converts minutes to days
Conversion Factor	1000	Converts Btu to kBtu
Conversion Factor	0.018	Specific heat capacity of air
Conversion Factor	29.3	Converts therms to kWh
Conversion Factor	100000	Converts Btu to therms
Conversion Factor	3412	Converts Btu to kWh

Appendix 5. Multifamily Direct Install 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 v11.0, 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
- Pipe Wrap

Table 284 lists our assumptions for the *ex post* per measure savings.

Table 284. 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	Furnace energy consumption, housing factor, heating consumption for electric and gas equipment types, and energy savings fractions for heating and cooling
Pipe Wrap	New and existing pipe heat loss factor, interior pipe circumference, length of pipe, average temperature difference between outside air temperature and supplied water, hours per year, recovery efficiency

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 285 lists the input assumptions and source of each assumption for the LED measure savings calculations.

Table 285. *Ex Post* Variable Assumptions for LEDs

INPUT	VALUE	SOURCE
$Watts_{Base}$ (9 W LEDs, Globe LEDs, Candelabras, Downlight Fixture and Retrofit Kit)	43, 40, 40, 72.8	Indiana TRM V2.2; NREL Residential Lighting Protocol Post-EISA and post-EISA exempt baseline wattages based on a 2023 ENERGY STAR QPL analysis
$Watts_{Eff}$ (9 W LEDs, Globe LEDs, Candelabras, Downlight Fixture and Retrofit Kit)	9, 6, 4.5, 13	Actual installed wattage; Verified during model number look ups
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 286 lists the input assumptions and source of each assumption for the kitchen and bathroom faucet aerator measure savings calculations.

Table 286. Variable Assumptions for Faucet Aerators

INPUT	KITCHEN VALUE	BATHROOM VALUE	SOURCE
GPM_{base}	1.63	1.53	Illinois TRM v11.0
GPM_{low}	0.94	0.94	Illinois TRM v11.0
L_{base}	4.5	1.6	Illinois TRM v11.0
L_{low}	4.5	1.6	Illinois TRM v11.0
Household	1.83	1.83	Illinois TRM v11.0 for multifamily housing
DF	0.75	0.9	Illinois TRM v11.0
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:

$$therm\ savings = (GPM_{base} * L_{base} - GPM_{low} * L_{low}) * Household * SPCD * \frac{365.25}{SH} * 8.33 * 1.0 * \frac{(T_{shower} - T_{supply})}{(RG * 100{,}000)}$$

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
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 287 lists the input assumptions and source of each assumption for the low-flow showerhead measure savings calculations.

Table 287. *Ex Post* Variable Assumptions for Low-flow Showerheads

INPUT	VALUE	SOURCE
GPM_{base}	2.24	Illinois TRM v11.0
GPM_{low}	1.5	Actual
L_{base}	7.8	Illinois TRM v11.0
L_{low}	7.8	Illinois TRM v11.0
SPCD	0.60	Illinois TRM v11.0
Household	1.83	Indiana TRM (v2.2) for multifamily housing
SH	1.3	Illinois TRM v11.0
T_{shower}	101	Illinois TRM v11.0
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 v11.0
Conversion Factor	8.33	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:

$$therm\ savings = (GPM_{base} * L_{shower\ device}) * Household * SPCD * \frac{365.25}{SH} * 8.33 * 1.0 * \frac{(T_{shower} - T_{supply})}{(RG * 100{,}000)}$$

Where:

GPM_{base} = Gallons per minute of baseline showerhead

$L_{shower\ device}$ = Hot water waste time avoided due to thermostatic restrictor valve

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 288 lists the input assumptions and source of each assumption for the low-flow showerhead measure savings calculations.

Table 288. *Ex Post* Variable Assumptions for Thermostatic Restrictor Valves

INPUT	VALUE	SOURCE
GPM_{base}	2.24 or 1.5	Illinois TRM v11.0; 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 v11.0
SPCD	0.60	Illinois TRM v11.0
Household	1.83	Indiana TRM (v2.2) for multifamily housing
SH	1.3	Illinois TRM v11.0
T_{shower}	101	Illinois TRM v11.0
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 v11.0
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 unique equipment configurations exist within this measure category, and each was established within the measure name. In 2023, this was either:

- Electric cooling only savings,
- Electric cooling and heating,
- Electric cooling and gas heating savings, or
- Gas heating savings only.

The algorithm used was from the Illinois TRM v11.0. To determine electric energy savings, the evaluation team used the following equations:

$$kWh\ savings = \%Electric\ Heat * Electric\ Heating\ Consumption * Heating\ Reduction * HF + (Therm\ Savings * F_e * 29.3)$$

$$therm\ savings = \%Fossil\ Heat * Gas\ Heating\ Consumption * Heating\ Reduction * HF$$

Where:

%Electric Heat	= percentage of heating savings assumed to be electric
%Fossil Heat	= percentage of heating savings assumed to be gas
Electric Heating Consumption	= Estimate of annual household electric heating consumption
Gas Heating Consumption	= Estimate of annual household gas heating consumption
Heating Reduction	= Assumed percentage reduction in heating energy consumption
HF	= Household factor, to adjust single-family heating consumption for Multifamily
F_e	= Furnace fan energy consumption as a percentage of annual fuel consumption
29.3	= kWh per therm

Table 289 lists the input assumptions and sources of each assumption for the programmable thermostat savings calculation.

Table 289. *Ex Post* Variable Assumptions for Programmable Thermostats

INPUT	ELECTRIC COOLING AND GAS HEATING VALUES	ELECTRIC COOLING ONLY VALUES	ELECTRIC COOLING AND HEATING VALUES	GAS HEATING ONLY VALUES	SOURCE
%Electric Heat	0	0	1	0	Illinois TRM v11.0
%Fossil Heat	1	0	0	1	Illinois TRM v11.0

INPUT	ELECTRIC COOLING AND GAS HEATING VALUES	ELECTRIC COOLING ONLY VALUES	ELECTRIC COOLING AND HEATING VALUES	GAS HEATING ONLY VALUES	SOURCE
Electric Heating Consumption (kWh)	0	0	20,777	0	Illinois TRM v11.0 values assigned based on similar climate Indiana TRM (v2.2) city. South Bend was the only reported location and assumed for values. South bend aligns with Chicago in the Illinois TRM v11.0
Gas Heating Consumption (therm)	1,005	0	0	1,005	Illinois TRM v11.0
Heating Reduction	6.2%	6.2%	6.2%	6.2%	Illinois TRM v11.0
HF	0.65	0.65	0.65	0.65	Illinois TRM v11.0
F_e	3.14%	3.14%	3.14%	3.14%	Illinois TRM v11.0

Pipe Wrap

The evaluation team used the following equations to calculate natural gas and electric energy savings for pipe wraps:

$$kWh\ savings = \%Electric\ DHW * \frac{\left(\frac{1}{R_{exist}} - \frac{1}{Rnew}\right) * C_{inside} * L * \Delta T * 8{,}766}{\eta DHW * 3{,}412}$$

$$Therm\ savings = \%Fossil\ DHW * \frac{\left(\frac{1}{R_{exist}} - \frac{1}{Rnew}\right) * C_{inside} * L * \Delta T * 8{,}766}{\eta DHW * 100{,}000}$$

Where:

%Electric DHW = Percentage of DHW savings assumed to be electric

%Fossil DHW = Percentage of DHW savings assumed to be gas

R_{exist} = Pipe heat loss coefficient of uninsulated pipe

R_{new} = Pipe heat loss coefficient of insulated pipe

C_{inside} = Inside circumference of the pipe (ft)

L = Length of pipe covered by pipe insulation

ΔT = Average temperature difference between outside air and supply temperature (°F)

8,766 = Hours per year

ηDHW = Recovery Efficiency of hot water heater

3412 = Conversion from Btu to kWh

100,000 = Conversion from Btu to Therms

Table 290. *Ex Post* Variable Assumptions for Pipe Wrap

INPUT	VALUE	SOURCE
%Electric DHW	0 or 1	Illinois TRM v11.0
%Fossil DHW	0 or 1	Illinois TRM v11.0
R_{exist}	0.4825	Illinois TRM v11.0; average of ½" and ¾" copper pipe based on model number look up of pipe insulation
R_{new}	5.1025	Average of actual R values based on model number look up of pipe insulation plus R_{exist}
C_{inside}	0.1741	Illinois TRM v11.0; average of ½" and ¾" copper pipe based on model number look up of pipe insulation
L	quantity Installed	Illinois TRM v11.0; Program Tracking data quantity
ΔT	60	Illinois TRM v11.0
ηDHW	0.78 or 0.98	Illinois TRM v11.0

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 2023 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 IL TRM v11.0. The IL TRM v11.0 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 IL TRM v11.0 to estimate savings resulting from the Appliance Recycling program. Table 291 lists the IL TRM v11.0 model specification used to estimate the annual unit energy consumption (UEC) of refrigerators recycled in 2023, along with the model's estimated coefficients.

Table 291. 2023 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 291, 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 292 lists the regression model recommended in the IL TRM v11.0 used to estimate the annual UEC of freezers recycled in 2023, along with the model's estimated coefficients.

Table 292. 2023 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 293 lists the mean values derived from 2023 data used to estimate the annual UEC of refrigerators recycled in 2023, along with the model's estimated coefficients. It also includes our model coefficients and means derived from 2023 data for recycled freezers.

Table 293. 2023 Appliance Recycling Program Participant Mean Variables and Model Coefficients

	INDEPENDENT VARIABLES	2023 MEAN VALUE	2023 MODEL COEFFICIENT
Refrigerator	Intercept	1.00	83.324
	Age (years)	19.491	3.678
	Dummy: Manufactured pre-1990	0.059	485.037
	Size (cubic feet)	19.667	27.149
	Dummy: Side-by-Side	0.374	406.779
	Dummy: Primary	0.379	161.857
	Interaction: Unconditioned Space * HDDs[a]	8.003	-11.067
	Interaction: Unconditioned Space * CDDs[a]	1.417	15.366
Freezer	Intercept	1.00	132.122
	Age (years)	22.047	12.130
	Dummy: Manufactured pre-1990	0.122	156.181
	Size (cubic feet)	17.128	31.839
	Dummy: Chest Freezer	0.601	-19.709
	Interaction: Unconditioned Space * HDDs	9.817	-12.755
	Interaction: Unconditioned Space * CDDs	1.707	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 IL TRM v11.0-defined model was used. For the refrigerator UEC calculation, this included average appliance characteristics:

$$UEC_{Ref} = [83.324 + (3.678 * (19.491\ years\ old)) + (485.037 * (5.9\%\ units\ manufactured\ before\ 1990)) + (27.149 * 19.667\ unit\ size\ ft.^3) + (406.779 * 37.4\%\ side-by-side\ units) + (161.857 * 37.9\%\ primary\ usage) + (-11.067 * 8.003\ unconditioned\ HDDs) + (15.366 * 1.417\ Unconditioned\ CDDs)] = 864\ kWh/Year$$

The following regression model shows how the UMP-defined model was used. For the freezer UEC calculation, this included average appliance characteristics:

$$UEC_{Frz} = [132.122 + (12.130 * (22.047\ years\ old)) + (156.181 * (12.2\%\ units\ manufactured\ before\ 1990)) + (31.839 * 17.128\ unit\ size\ ft.^3) + (-19.709 * 60.1\%\ units\ that\ are\ chest\ freezers) + (-12.755 * 9.817\ unconditioned\ HDDs) + (9.778 * 1.707\ Unconditioned\ CDDs)] = 844\ kWh/Year$$

Using the values from Table 294, the evaluation team estimated the *ex post* annual UEC for an average program refrigerator and freezer.

Table 294. 2023 Appliance Recycling Program Average Unit Energy Consumption by Appliance Type

MEASURE	AVERAGE PER-UNIT ENERGY CONSUMPTION (KWH/YEAR)
Refrigerators	864
Freezers	844

Demand Impacts

To calculate demand reduction, the team used the coincident factors shown in Table 295, drawn from the IL TRM v11.0, 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 295. 2023 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 296 the evaluation team estimated the *ex post* annual gross peak demand reduction for an average program refrigerator and freezer.

Table 296. 2023 Appliance Recycling Program Average Unit Energy Demand Reduction by Appliance Type

APPLIANCE	AVERAGE PER-UNIT GROSS PEAK DEMAND REDUCTION (KW/YEAR)
Refrigerators	0.107
Freezers	0.099

Part-Use Factor

Part-use, an adjustment factor specific to appliance recycling, is used to convert a UEC into an average per-unit gross savings value. The UEC itself does not equal the gross savings value due to two considerations:

- The UEC model yields an estimate of annual consumption.
- Not all recycled refrigerators would have operated year-round if they had not been decommissioned through the program.

The part-use methodology applied in 2023 relies on information collected from surveyed customers regarding pre-program usage patterns. It asks them how many months of the year, prior to recycling, the customer had the appliance plugged in and running.

The final part-use estimate reflects how appliances would likely have been operated, had they not been recycled. For example, a primary refrigerator that is operated year-round could become a secondary appliance that operates part-time.

This methodology accounts for potential shifts in usage; specifically, it calculates part-use with a weighted average of three prospective part-use categories and factors:

- Appliances that would have been run full-time (part-use = 1.0).
- Appliances that would not have been run at all (part-use = 0.0).
- Appliances that would have been operated for a portion of the year (part-use = between 0.0 and 1.0).

The evaluation team calculated a weighted average part-use factor representing the three participant usage categories as defined by each appliance's operational status during the year prior to recycling. For example, the team assigned a part-use factor of zero to participants who did not use their appliance at all during the year prior to recycling, as no immediate savings were generated by retiring the appliance. Using information gathered through the 2023 participant surveys, the evaluation team employed the following multistep process to determine part use:

- The team asked respondents whether the refrigerator or freezer that was recycled remained unplugged, operated year-round, or operated for a portion of the preceding year.
- If participants said that their refrigerator or freezer operated for only a portion of the preceding year, the team asked participants for the total number of months that the appliance was plugged in. In 2023, responses from this participant subset resulted in secondary refrigerators operating an average of 5.1 months and secondary freezers operating an average of 5.6 months.
- The team divided each value by 12 to convert months of operation into an annual part-use factor for all refrigerators and freezers. In 2023, for those refrigerators and freezers that operated part of the time, the average refrigerator had a part-use factor of 0.43 and the average freezer had a part-use factor of 0.47.
- If participants said that they would have discarded their appliance independently of the program, the team did not follow up about that appliance's future use as those actions would be determined by another customer. Since future use of discarded refrigerators remained unknown, the team applied the 0.93 weighted part-use average of all units (primary and secondary, including those that were expected to be in operation full time) to this subset. It is possible that discarded appliances may be used as primary or secondary units in a would-be recipient's home.

Table 297 lists the resulting part-use factor results by category.

Table 297. Appliance Recycling Program Part-Use Factor by Category

USAGE TYPE AND PART-USE CATEGORY	REFRIGERATORS			FREEZERS		
	RECYCLED UNITS (%)	PART-USE FACTOR	PER-UNIT ENERGY SAVINGS (KWH/YR.)	RECYCLED UNITS (%)	PART-USE FACTOR	PER-UNIT ENERGY SAVINGS (KWH/YR.)
Secondary Units Only		n = 36				
Not in Use	0%	0.00	-			
Used Part Time	19%	0.43	370		N/A	
Used Full Time	81%	1.00	864			
Weighted Average	100%	0.89	768			
All Units (Primary and Secondary)		n = 58			n = 34[a]	

USAGE TYPE AND PART-USE CATEGORY	REFRIGERATORS			FREEZERS		
	RECYCLED UNITS (%)	PART-USE FACTOR	PER-UNIT ENERGY SAVINGS (KWH/YR.)	RECYCLED UNITS (%)	PART-USE FACTOR	PER-UNIT ENERGY SAVINGS (KWH/YR.)
Not in Use	0%	0.00	-	3%	0.00	-
Used Part Time	12%	0.43	370	15%	0.47	394
Used Full Time	88%	1.00	864	82%	1.00	844
Weighted Average	**100%**	**0.93**	**804**	**100%**	**0.89**	**753**

Note: Totals may not sum properly due to rounding.

[a] All freezer units are considered secondary.

Combining the part-use factors shown in Table 297 with participants' self-reported likely actions in the program's absence resulted in the distribution of future-use scenarios and corresponding part-use estimates for refrigerators, as shown in Table 298. As the table shows, the weighted average of these future scenarios produced a final part-use factor for refrigerators of 0.92 for the 2023 program. The final part-use estimate of 0.89 for freezers, shown in Table 297, with all freezer units considered secondary units and no additional weighting needed.

Table 298. Appliance Recycling Program Refrigerator Weighted Average Part-Use

USE PRIOR TO RECYCLING	LIKELY USE INDEPENDENT OF RECYCLING	REFRIGERATORS	
		GROSS SAVINGS FACTOR	PARTICIPANTS (%)
Secondary	Kept	1.00	9%
	Discarded	0.89	7%
Primary	Kept (as primary unit)	0.93	22%
	Kept (as secondary unit)	0.89	26%
	Discarded	0.93	36%
Overall		0.92	100%

Note: Totals may not sum properly due to rounding.

From 2020 to 2023, the part-use factor for refrigerators increased from 0.89 to 0.92. For freezers, the part-use factor decreased slightly from 0.90 in 2020 to 0.89 in 2023.

Applying the part-use factors calculated from the 2023 survey to the modeled annual consumption and demand reduction from Table 294 and Table 296 yielded average gross, per-unit energy savings and demand reductions. Table 299 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 2023 evaluation.

Table 299. 2023 Appliance Recycling Program *Ex post* Per-Unit Energy Savings and Demand Reduction

SAVINGS TYPE	AVERAGE PER-UNIT ANNUAL ENERGY SAVINGS (KWH/YR.)	AVERAGE PER-UNIT ANNUAL PEAK DEMAND REDUCTION (KW/YR.)	PART-USE FACTOR	*EX POST* PER-UNIT GROSS ENERGY SAVINGS (KWH/YR.)	*EX POST* PER-UNIT PEAK DEMAND REDUCTION (KW/YR.)
Refrigerators	864	0.107	0.92	795.00	0.098
Freezers	844	0.099	0.89	751.00	0.088

Dehumidifiers

Dehumidifier recycling is not included in the Indiana TRM (v2.2) or the IL TRM v11.0; 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 300 shows a summary of the recycled dehumidifier savings assumptions and assumption source.

Table 300. 2023 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 301 shows resulting *ex post* per-unit savings for recycled dehumidifiers.

Table 301. 2023 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 IL TRM v11.0 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 302 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 (v2.2) to develop a weighted average FLH_{RoomAC} value of 287.

Table 302. 2023 Appliance Recycling Program Variable Assumptions for Recycled Room Air Conditioners

VARIABLE	ROOM AIR CONDITIONER VALUE	SOURCE
Full-Load Cooling Hours (FLH_{RoomAC})	287	Indiana TRM (v2.2)
Size of retired unit (Btu/H)	8,500	IL TRM v11.0
Energy Efficiency Rating – Existing (EER_{exist})	9.8	
Coincidence Factor (CF)	0.30	

Table 303 shows resulting *ex post* per-unit savings for recycled room air conditioners.

Table 303. 2023 Appliance Recycling Program Room air Conditioner *Ex Post* Per-Unit Savings

MEASURE	*EX POST* PER-UNIT SAVINGS	
	KWH	KW
Room Air Conditioner	249.65	0.260

Net-to-Gross

In the case of appliance recycling, programs generate net savings only when the recycled appliances would have continued to operate without program intervention (either in the participating customer's home or at the home of another utility customer).

The evaluation team employed a decision-tree approach to calculate net program savings and used a weighted average of these scenarios to calculate net savings attributable to the program. The decision tree—populated by responses from surveyed 2023 participants and by information gathered from local market actors interviewed during other recent evaluations—represents all a program's possible savings scenarios. Discussion of specific portions of the decision tree will continue throughout this chapter, highlighting aspects of the net savings analysis.

The decision-tree approach not only accounts for what a participating household would have done independently of the program, but it also addresses the possibility that the recycled unit would have transferred to another household, and whether the recipient of that appliance would have found an alternate unit instead.

Freeridership

Independent of program intervention, participant refrigerators and freezers were generally subject to one of three scenarios:

- **Scenario One:** The participant keeps the refrigerator.
- **Scenario Two:** The participant discards the refrigerator by a method that transfers it to another customer for continued use.
- **Scenario Three:** The participant discards the refrigerator by a method that removes the unit from service.

The evaluation team applied freeridership only under Scenario Three, as the unit would have been removed from service and destroyed in the absence of the program, even though it was recycled through the program. As such, the program could not claim energy savings generated by recycling this appliance.

To determine the percentage of participants in each of the scenarios and to assess freeridership, the team asked each surveyed participant what would likely have happened to the appliance had it not been recycled by NIPSCO. Participants provided the following responses:

- Kept it and continued to operate the appliance.
- Kept it, but stored it unplugged indefinitely.
- Sold it to a private party, either to someone known or by running an ad.
- Sold it to a used appliance dealer.
- Gave it to a private party, such as a friend or neighbor.
- Had it removed by the dealer from whom the new or replacement appliance was purchased.
- Hauled it to the dump or recycling center.
- Hired someone to haul it away for junking or dumping.

To ensure the highest quality of responses possible and to mitigate socially responsible response bias, the evaluation team asked some participants follow-up questions to test the reliability of their initial responses. For example, in previous evaluations the team conducted interviews with local market actors for other evaluations who indicated that used appliance dealers usually do not purchase appliances more than 15 years old. Therefore, the team asked participants who recycled an appliance that was more than 15 years old and who indicated they would have sold their unit to a used appliance dealer, what they would have done had they been unable to carry through with their plans. The evaluation team used the respondent's self-reported unit age during this process.

Upon determining the final assessments of participants' actions independently of the program, the team calculated the percentage of refrigerators and freezers that would have been kept or discarded. Table 304 shows the results.

Table 304. Appliance Recycling Program Final Distribution of Kept and Discarded Appliances

STATED ACTION ABSENT PROGRAM	INDICATIVE OF FREERIDERSHIP	REFRIGERATORS (N=54) [a]	FREEZERS (N=34) [a]
Kept	No	44%	32%
Discarded	Varies by discard method	56%	68%
Total		100%	100%

[a.] Does not include "*don't know"* responses and refusals.

Secondary Market Impacts

After determining that a participant would have directly or indirectly (through a market actor) transferred the unit to another customer on the electric grid, the evaluation team addressed what the recipient would have done had the recycled unit been unavailable. Three possible scenarios resulted:

- **Scenario One: None of the potential recipients would find another unit.** Program participation would result in a one-for-one reduction in the total number of refrigerators operating on the electric grid. In this case, total energy consumption of avoided transfers (participating appliances that otherwise would have been used by another customer) would be credited as program savings. This position is consistent with the theory that participating appliances are essentially convenience goods for would-be acquirers: the recipient would have accepted the refrigerator had it been readily available, but, as the refrigerator was not a necessity, the would-be acquirer would not have sought an alternate unit.
- **Scenario Two: All potential recipients would find another unit.** Thus, program participation would not affect the total number of refrigerators operating on the grid. This position is consistent with the concept that participating appliances are necessities and customers always seek alternative units when participating appliances are unavailable.
- **Scenario Three: Some potential recipients would find another unit, while others would not.** This scenario reflects the awareness that some acquirers were in the market for a refrigerator and would acquire another unit, while others were not and would have taken the unit only opportunistically.

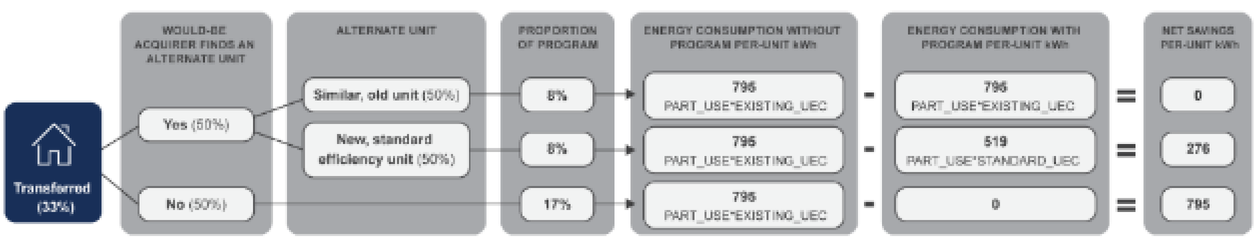
After the team determined if a participant would have directly or indirectly (through a market actor) transferred the unit to another customer on the electric grid, the question became what the potential recipient would have done had the recycled unit been unavailable. The evaluation team assumed one-half of would-be acquirers of avoided transfers would have found alternate units—an assumption consistent with the UMP.

The evaluation team then addressed the likelihood that the alternate unit would be another used appliance (like those recycled through the program) or—with fewer used appliances presumably available in the market due to program activity—the customer would acquire a new standard-efficiency unit. Even if a would-be acquirer could select a new ENERGY STAR® unit, the evaluation team assumed it likely that a customer in the market for a used appliance would upgrade to the next lowest price point. For reasons previously discussed, the team applied a midpoint approach, with one-half of potential program unit recipients finding a similar used appliance and one-half acquiring a new standard-efficiency unit.[72]

Figure 72 explains the methodology used for assessing the program's impact on the secondary refrigerator market and the application of recommended midpoint assumptions (when primary data proved unavailable). As shown, accounting for market effects resulted in three savings scenarios:

- Full savings (that is, per-unit gross savings)
- No savings (that is, the difference in energy consumption of the program unit and a similar unit)
- Partial savings (that is, the difference between the energy consumption of the program unit and that of a new, standard-efficiency appliance)

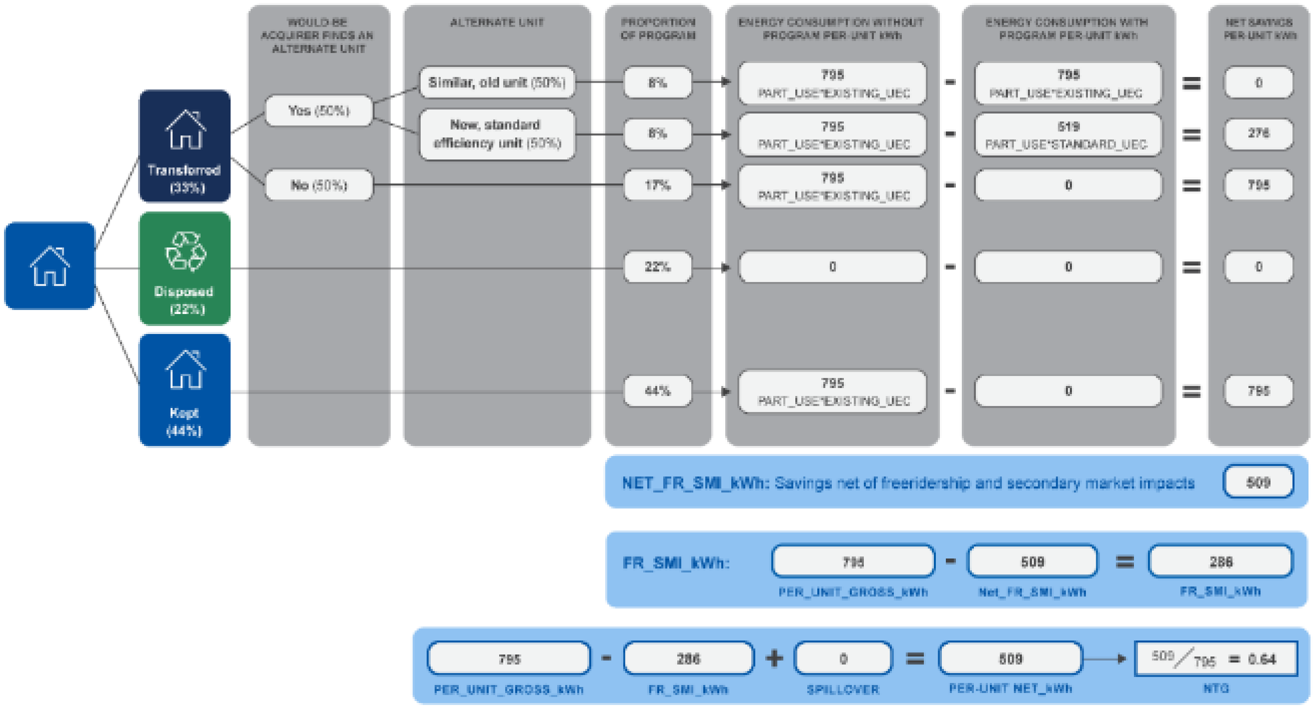
Figure 72. Secondary Market Impacts—Refrigerators



After estimating the parameters of freeridership impacts and secondary market impacts, the evaluation team used the UMP decision tree to calculate average per-unit program savings. Figure 73 shows how these values were integrated into a combined savings estimate as a weighted average, net of freeridership and secondary market impacts.

[72] The evaluation team calculated the energy consumption of a new, standard-efficiency appliance using the ENERGY STAR website, taking the average energy consumption of new, comparably sized, and standard-efficiency appliances with similar configurations as the program units. U.S. Environmental Protection Agency. ENERGY STAR. "Refrigerator Retirement Savings Calculator." (http://www.energystar.gov/index.cfm?fuseaction=refrig.calculator)

Figure 73. Savings Net of Freeridership and Secondary Market Impacts—Refrigerators



Participant Spillover

As recommended in the UMP, the evaluation team did not include spillover in program net savings estimates for 2023. The UMP suggests that although appliance recycling programs promote enrollment in other energy efficiency programs, spillover of unrelated measures is unlikely to occur because appliance recycling programs do not provide comprehensive energy education like other programs.

Summary of Verified Net Program Impacts

The evaluation team calculated final verified per-unit net savings using the following equation:

$$\begin{aligned} &\mathit{Net\ Program\ Savings\ (kWh\ per\ year)} \\ &\qquad = \mathit{Gross\ Program\ Savings} - \mathit{Freeridership\ \&\ Secondary\ Market\ Impact} + \mathit{Spillover} \end{aligned}$$

Table 305 lists all per-unit net impacts discussed in this chapter, and overall NTG ratios by appliance type.

Table 305. 2023 Appliance Recycling Program Net-to-gross Ratios

SAVINGS TYPE	GROSS PER-UNIT SAVINGS (KWH/YR.)	PER-UNIT FREERIDERSHIP AND SECONDARY MARKET IMPACTS (KWH/YR.)	ADDITIONAL (SPILLOVER) PER-UNIT ELECTRIC ENERGY SAVINGS (KWH/YR.)	NET PER-UNIT ELECTRIC ENERGY SAVINGS (KWH/YR.)	NTG RATIO
Refrigerators	795	286	0	509	64%
Freezers	751	352	0	399	53%

Participant Survey Demographics

The table below contains additional information regarding home characteristics and demographics from the 2023 Appliance Recycling Program participant survey.

Table 306. 2023 Appliance Recycling Participant Survey Home Characteristics and Demographics

DEMOGRAPHICS	PERCENTAGE
Home Ownership (n=93)	
Own	98%
Rent	2%
Type of Residence (n=91)	
Single-family detached home	91%
Multifamily apartment or condo building (with 4 or more units)	3%
Attached house (townhouse, row house, or twin)	2%
Mobile or manufactured home	3%
Years Lived in Current Home (n=92)	
One year or less	8%
2-3 years	12%
4-5 years	5%
6-10 years	15%
More than 10 years	60%
Number of People in the Home (n=83)	
One	14%
Two	49%
Three	17%
Four	10%
Five or more	10%
Year Home Built (n=83)	
Before 1900	8%
1900 to 1939	2%
1940 to 1959	11%
1960 to 1979	18%
1980 to 1989	11%

DEMOGRAPHICS	PERCENTAGE
1990 to 1999	23%
2000 to 2004	12%
2005 or later	14%
Household Income (n=66)	
Under $25,000	9%
$25,000 to under $35,000	5%
$35,000 to under $50,000	14%
$50,000 to under $75,000	24%
$75,000 to under $100,000	14%
$100,000 to under $150,000	17%
Over $150,000	18%
Age (n=82)	
64 to 83 years old	46%
44 to 63 years old	38%
34 to 43 years old	7%
24 to 33 years old	9%
Language Spoken at Home (n=89)	
English	98%
Spanish	2%

Source: Appliance Recycling Program Participant Survey Questions K1, K2, K3, K4, K9, K10, K11, K13: "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?" "When was your home built?" "Including yourself, how many people live in your home?" "Which of the following best represents your annual household income from all sources in 2023 before taxes?" "In what year were you born?" "What language(s) do you primarily speak at home?"

Appendix 7. Behavioral Program

There is no appendix for the Behavioral Program this year.

Appendix 8. Residential New Construction Program

Program Savings Methodology

The evaluation team's impact evaluation of the Residential New Construction program included homes with attributable electric savings and natural gas savings, including the following:

- Silver Star Homes (natural gas and electric)
- Gold Star Homes (natural gas and electric)
- Platinum Star Homes (natural gas and electric)

Estimating 2023 Program Impacts

The evaluation team evaluated gross savings for Residential New Construction program homes by drawing a random representative sample of 66 builder applications from 2023 participants and recording critical home data, such as square footage, insulation levels, and HVAC efficiencies from HERS certificates.

The evaluation team 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.

The evaluation team developed energy models using REM/Rate V16.3.4 to evaluate the electric and natural gas savings of the homes built under program requirements and found alignment between electric energy and peak demand savings with the *ex ante* savings. Meanwhile, natural gas savings were lower than *ex ante* assumed savings.

HERs Certificate Review

The evaluation team reviewed 66 Ekotrope-generated HERS reports representing 58 of 654 natural gas service-only homes and 8 of 37 electric and natural gas service homes. No reports represented the single electric only home.[73] Based on these reports, the evaluation team compiled the homes' characteristics, such as insulation levels, air tightness, equipment efficiencies, and square footage, into a database for energy modeling.

Table 307 shows the number of participating homes in 2023 and the sample of these homes by fuel type.

Table 307. 2023 Residential New Construction Program HERs Certificate Sample by Fuel

FUEL	PARTICIPATING HOMES	SAMPLE
Natural Gas Only	654	58
Electric & Gas	37	8

[73] The 2023 program year issued a total of 38 electric rebates, including electric only and electric and natural gas rebates, and 691 natural gas rebates, including natural gas only and electric and natural gas rebates.

FUEL	PARTICIPATING HOMES	SAMPLE
Electric Only	1	0
TOTAL	**692**	**66**

Table 308 shows the number of participating homes in 2023 and the sample of these homes by measure type.

Table 308. 2023 Residential New Construction Program HERs Certificate Sample by Measure

MEASURE	PARTICIPATING HOMES	PERCENT OF PARTICIPANT TOTAL	SAMPLE	PERCENT OF SAMPLE
Silver Star (HERS 62-59) - Electric	21	3%	4	5%
Silver Star (HERS 62-59) - Natural Gas	439	60%	41	55%
Gold Star (HERS 58-57) - Electric	11	2%	3	4%
Gold Star (HERS 58-57) - Natural Gas	154	21%	16	22%
Platinum Star (HERS ≤ 56) - Electric	6	<1%	1	1%
Platinum Star (HERS ≤ 56) - Natural Gas	98	13%	9	12%
ENERGY STAR Manufactured Home - Electric	1	<1%	N/A	N/A
TOTAL	**730**	**100%**	**74[a]**	**100%**

[a] There are 66 unique HERs certificates. Of these, eight are for homes with both electric and natural gas fuel and appear more than once in this table as they account for more than one measure type.

Table 309 presents the average home characteristics from the 2023 sample homes as found in the HERS certificates the evaluation team received. The table shows that homes with electric and/or natural gas rebates had similar physical characteristics, while homes with electric participation had higher air conditioner SEER. All homes in the sample had natural gas furnaces. Water heating equipment consisted of 26 electric water heaters, 25 natural gas tankless, and 15 natural gas storage water heaters in the sampled homes (all electric water heaters were in natural gas rebate homes). No homes in the 2023 sample had heat pump space conditioning or heat pump water heaters. Finally, the evaluation team did not have sufficient data to estimate the percentage of efficient lightbulbs for the prototypes since Ekotrope generated certificates do not provide lighting details in rated homes (all HERS certificates used Ekotrope modeling software). Instead, the evaluation team updated the models 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).

Table 309. 2023 Residential New Construction Program Home Characteristics

HOME CHARACTERISTIC	ELECTRIC HOMES [a]	NATURAL GAS HOMES [a]
Sample Size	8	66
Participants	38	691
Precision at 90% Confidence [b]	26%	10%
Home Size	2,349	2,433
Ceiling R Value	42	44
Walls R Value	15	15
Basement Wall R Value	11.0	11.3
Windows U Factor [c]	0.273	0.294
Home Tightness ACH50[c]	2.91	3.00
Duct Tightness CFM25/100 sq. ft. [c]	2.08	2.12
Furnace AFUE	94.7	95.4
Air Conditioner SEER	15.0	14.1
Percentage High-Efficiency Lighting	100%	100%
Gas Water Heat Energy Factor	0.878	0.841
Electric Water Heat Energy Factor	None in Sample	0.922

[a] All values rounded.

[b] The evaluation team calculated precision estimates based on each year's population and sample size, assuming standard variability. Note that the evaluation team did not calculate confidence and precision for individual metrics.

[c] Lower value represents higher efficiency.

Table 310 compares program home characteristics from 2021 to 2023 sampled homes. The table shows that home size, home tightness, and duct tightness has decreased since 2021 while HVAC efficiencies have increased.

Table 310. Residential New Construction Program Home Historical Characteristics

HOME CHARACTERISTIC	PROGRAM YEAR[1]			NOTES
	2021	2022	2023	
Sample Size	62	71	74	
Participants	260	872	729	Participation decreased in 2023
Precision at 90% Confidence[2]	9%	9%	9%	
Home Size	3,276	2,841	2,424	Home size decreased since 2021
Ceiling R Value	42	43	44	R-value slight increase since 2021
Walls R Value	15	16	15	
Basement Wall R Value	11.2	12.4	11.3	

HOME CHARACTERISTIC	PROGRAM YEAR[1]			NOTES
	2021	2022	2023	
Windows U Factor[3]	0.292	0.291	0.292	
Home Tightness ACH50[3]	2.81	3.20	2.99	Home tightness decreased since 2021
Duct Tightness CFM25/100 sq. ft.[3]	1.63	1.84	2.12	Duct tightness decreased since 2021
Furnace AFUE	94.9	95.0	95.3	AFUE slight increase since 2021
Air Conditioner SEER	13.6	13.9	14.2	SEER increased since 2021
Percentage High-Efficiency Lighting	86%	100%	100%	
Gas Water Heat Energy Factor	0.635	0.744	0.845	Gas water heating efficiency increasing since 2021
Electric Water Heat Energy Factor	0.950	0.923	0.922	

[1] All values rounded. 2021 program year metrics reflect the second half post code change values.

[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.

Prototype Modeling

To evaluate electric and natural gas savings for the participating homes, the evaluation team developed 14 prototype energy models (11 natural gas and three electric) using the characteristics of the homes documented in the HERS certificates. The models represented typical characteristics of the sampled participant homes as they varied by water heater type, foundation type, and nearest weather station. The evaluation team established assumptions for the prototype energy models where the HERS certificates lacked information necessary to complete the model in REM/Rate. These assumptions reflected typical construction industry methods and included the following:

- Single-family detached building types with two stories above grade
- Uninsulated slabs for basements
- R-10 sub-slab insulation for slab-on-grade homes
- 2" x 6" at 16" on center wall framing
- Heating and cooling setpoints at 70°F and 78°F, respectively for the reference and prototype home

Table 311 shows key input parameters for the baseline home used in the analysis, which referenced 2020 Indiana Statewide Residential Energy Code Version 1 (January 2020) values.[74]

[74] 2020 Indiana Statewide Residential Energy Code Version 2 was published in July 2022.

Table 311. 2023 Residential New Construction Program Baseline Home Characteristics

COMPONENT	BASELINE HOME
Cooling Setpoint	78 (prototype matches baseline)
Heating Setpoint	70 (prototype matches baseline)
Home Size	Same as prototype
Ceiling U-value	0.030
Above Grade Wall U-factor	0.067
Window & Door U-factor	0.035
Slab on grade R-value	10.0
Infiltration (ACH50)	5.0
Duct Leakage (CFM25/CFA)	0.02 supply / 0.02 return
Heating Capacity	Same as prototype
Gas Heat Forced Air AFUE	80%
Gas Heat Hydronic AFUE	82%
Cooling Capacity	Same as prototype
Cooling Efficiency	13 SEER
ASHP Efficiency	7.7 HSPF / 13 SEER
Lighting	90% LED, 0% Fluorescent
Appliance Efficiency	Same as prototype
Gas DHW	0.59 EF / 0.76 RE / 50 gal
Electric DHW	0.91 EF / 0.98 RE / 50 gal

The team then developed average weighted therms, kWh, and kW savings by the number of sampled homes that fit into each prototype.

Table 312 shows the natural gas prototypes, as well as the modeled savings using the 2020 Indiana Statewide Residential Energy Code for baseline home characteristics.

Table 312. 2023 Residential New Construction Program Natural 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	354
Conditioned Basement	Natural Gas	Tank	South Bend	11	369
Conditioned Basement	Natural Gas	Tankless	South Bend	11	318

FOUNDATION TYPE	WATER HEATER FUEL	WATER HEATER TYPE	NEAREST WEATHER STATION	NUMBER OF HOMES	MODELED THERMS SAVINGS
Slab on Grade	Natural Gas	Tank	South Bend	1	331
Slab on Grade	Natural Gas	Tankless	South Bend	4	101
Conditioned Basement	Electric	Tank	Fort Wayne	1	243
Conditioned Basement	Natural Gas	Tank	Fort Wayne	1	288
Conditioned Basement	Natural Gas	Tankless	Fort Wayne	3	353
Slab on Grade	Electric	Tank	Fort Wayne	24	86
Slab on Grade	Natural Gas	Tank	Fort Wayne	2	87
Slab on Grade	Natural Gas	Tankless	Fort Wayne	7	120

Table 313 shows the electric prototypes and modeled savings. As with natural gas homes, the evaluation team weighted the prototype home savings by the number of homes in the sample.

Table 313. 2023 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	Natural Gas	Tank	South Bend	2	526	0.3
Conditioned Basement	Natural Gas	Tankless	South Bend	2	812	0.5
Slab on Grade	Natural Gas	Tankless	South Bend	4	344	0.1

Calculating Realization Rates

The evaluation team created program-level realization rates by comparing average weighted evaluated savings informed by the prototype models (*ex post*) to average weighted reported savings (*ex ante*). The natural gas savings realization rate was 65%, indicating an overestimate in reported savings.[75] Realization

[75] NIPSCO used the results of the 2021 evaluation to inform the 2023 *ex ante* estimate for natural gas. For this report, the evaluation team defined an over- or underestimate as a difference of +/- 15% between the evaluated amount and the reported amount.

rates for electric energy and peak demand were near 100% indicating alignment between reported and evaluated results. Table 314 shows the program-level realization rates for therms, kWh, and kW savings.

Table 314. 2023 Residential New Construction Program Realization Rates

METRIC	SAMPLE	SAMPLE WEIGHTED AVERAGE REPORTED (*EX ANTE*) SAVINGS	SAMPLE WEIGHTED AVERAGE EVALUATED (*EX POST*) SAVINGS	REALIZATION RATE
Therms Savings	66	308.41	201.73	65%
kWh Savings [a]	8	460.63	506.50	110%
kW Savings [a]	8	0.240	0.250	104%

[a] There was only one ENERGY STAR Manufactured New Home in the 2023 program tracking data. Therefore, the evaluation team assigned 100% NTG to the manufactured home. 110% is the sampled single family home realization rate. When the manufactured home factored in at 100%, it brings the overall electric energy RR down to 108%. Evaluators will likely perform a more comprehensive NTG analysis in 2024 if a larger population of manufactured homes participate in the program.

Engineering Review of 2023 ENERGY STAR Manufactured Homes Savings

In 2023, NIPSCO derived *ex ante* savings for four, electric only, manufactured home configurations from ENERGY STAR's Certified Manufactured Homes, Version 2 Cost Savings Summary (July 20, 2020) document. Table 315 lists the four configurations.

Table 315. 2023 ENERGY STAR Manufactured Homes *Ex Ante* Deemed Savings

CONFIGURATION	KWH SAVINGS	KW SAVINGS	THERM SAVINGS
ENERGY STAR Manufactured Home – Envelope Only – Single-wide – Electric Savings	2,240.00	0.000	0.00
ENERGY STAR Manufactured Home – Envelope Only – Double-wide – Electric Savings	4,480.00	0.000	0.00
ENERGY STAR Manufactured Home – Heat Pump – Single-wide – Electric Savings	5,476.67	0.000	0.00
ENERGY STAR Manufactured Home – Heat Pump – Double-wide – Electric Savings	10,953.33	0.000	0.00

NIPSCO also referenced the HUD Code Thermal Zone 3 (Chicago, IL) and the ENERGY STAR v2 Annual Purchased Energy Savings. ENERGY STAR provides an example of a double-wide manufactured home configuration. NIPSCO calculated double-wide manufactured home savings using this example and assumed a single-wide manufactured home would generate 50% of the energy savings. Table 316 illustrates NIPSCO's input data for calculating energy savings.

Table 316. 2023 ENERGY STAR Manufactured Homes Savings Methodology

ENERGY STAR PACKAGE NAME – HEATING FUEL	ANNUAL PURCHASED ENERGY SAVINGS	NIPSCO RATE ($/KWH)	KWH SAVINGS
Envelope Only – Electric Savings (Single-wide)			2,240.00
Envelope Only – Electric Savings (Double-wide)	$672	$0.15	4,480.00
Electric Heat Pump – Electric Savings (Single-wide)			5,476.67
Electric Heat Pump – Electric Savings (Double-wide)	$1,643	$0.15	10,953.33

The evaluation team used the modeling parameters outlined in ENERGY STAR Certified Manufactured Homes, Version 2 Cost Savings Summary (July 20, 2020) document, which reflects a double-wide home, to model energy savings using REM/Rate. The model outputs produced 2,054 kWh and 0.100 kW savings for a double-wide manufactured home located in Fort Wayne, IN. This represents a 46% realization rate compared to *ex ante*. The modeling software used in ENERGY STAR's cost estimate, ICF's Beacon Residential energy modeling tool, is not an accredited RESNET software program and some modeling parameters used in their models (like indoor design air temperature) are unknown. Table 317 outlines the modeling parameters used to calculate savings for the envelope only package (double-wide manufactured home electric only).

Table 317. Manufactured Home Modeling Parameter Summary – Envelope Only Package

MODEL PARAMETERS (DOUBLE-WIDE)	
Common Model Parameters	
IECC Climate Zone	5A
Housing Type	Mobile home
Foundation Type	Enclosed crawl space
Number of Bedrooms	3
Number of stories	1
Dimensions (ft)	29 x 55 x 7.5
Conditioned area (sq ft)	1,568
Volume (cu ft)	11,760
Primary Heating Equipment	Electric air distribution, Electric, 100.0 AFUE.
Primary Cooling Equipment	Air conditioner, Electric, 14.0 SEER.
Primary Water Heating Equipment	Conventional, Electric, 0.95 EF, 40.0 Gal.
Setpoint Temperatures (°F)	68 heating/78 cooling
Ceiling Attic Area (sq ft)	1,568
Exterior Walls Area (sq ft)	1,073
Framed Floor Area (sq ft)	1,568
Buffer Foundation Area (sq ft)	336
Buffer Foundation R	12.5
Window Area	151.2

MODEL PARAMETERS (DOUBLE-WIDE)		
Window U	0.350	
Window SHGC	0.340	
Door Area (sq ft)	36.0	
Door R	4	
Infiltration	8.0 ACH50	
Variable Model Inputs	**HUD Baseline**	**ENERGYSTAR**
Ceiling Attic R	31.1	40.7
Exterior Wall R	14.9	20.4
Framed Floor R	20.3	26.3
Model Outputs	**HUD Baseline**	**ENERGYSTAR**
Annual kWh	25,195	23,141

Manufactured homes produced on or after January 1, 2024, must be certified using Version 3 of the ENERGY STAR program requirements.[76] The evaluation team could not locate a similar Cost Savings Summary document for Version 3, but did note that there are several program requirements that would drive higher savings, including wall insulation increasing from R-11 to R-21, and decreased coefficients of heat transmission.

For the 2024 program year and evaluation, NIPSCO should collect an ENERGY STAR Single-Family New Homes National HVAC Design Report document or similar documentation (in lieu of the HERS certificate used for single-family homes) from program participants to inform energy models or TRM-based calculations. This document should include the following information:

- HVAC equipment capacity/efficiency/AHRI number.
- Envelope insulation levels (ceiling, walls, floor, windows, doors, etc.)
- Envelope air tightness.
- Duct insulation and leakage.
- Home Dimensions (length, width, height).
- Window and door areas.

[76] https://www.energystar.gov/sites/default/files/asset/document/Manufactured%20Program%20Requirements%20Version%203_Rev%2001.pdf. Retrieved March 24, 2024.

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 IL TRM v11.0 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:

- Connected LEDs
- Bathroom Faucet Aerators
- Kitchen Faucet Aerators
- Low-Flow Showerheads
- Nightlights
- Advanced Power Strips
- Light Switch Gaskets
- Power Outlet Gaskets

Table 318 lists the assumptions of the *ex post* per-measure savings.

Table 318. 2023 School Education Program Measures

MEASURE	REVIEWED ASSUMPTIONS
Connected LED	New and baseline wattages, hours of use, waste heat factors, coincidence factor, lighting control savings
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
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
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.

Connected LEDs

The team used the following equations to calculate electric energy and peak demand savings, as well as natural gas energy penalties, for LEDs.

$$kWh\ savings\ per\ lamp = \frac{(WattsBase - WattsEE) * Hours * (1 + WHFe)}{1{,}000} * ISR$$

$$kW\ reduction\ per\ lamp = \frac{(WattsBase - WattsEE) * CF * (1 + WHFd)}{1{,}000} * ISR$$

$$therm\ savings\ per\ lamp = \frac{(WattsBase - WattsEE) * Hours * WHFg * 10}{1{,}000} * ISR$$

$$Connected\ kWh\ savings\ per\ lamp = \left(\frac{WattsEE * Hours * (1 + WHFe) * SVGe}{1{,}000} - Standby\ kWh\right) * ISR$$

$$Connected\ kW\ reduction\ per\ lamp = \left(\frac{WattsEE * (1 + WHFd) * SVGd}{1{,}000}\right) * CF * ISR$$

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
SVGe	= Percentage of annual lighting energy saved by lighting control
SVGd	= Percentage of annual lighting demand saved by lighting control
Standby kWh	= Standby power draw of the controlled lamp

Table 319 lists the input assumptions and source of each assumption for the Connected LED measure savings calculations.

Table 319. Ex post Variable Assumptions for Connected LEDS

INPUT	VALUE	SOURCE
WattsBase	28	NIPSCO 2023 parent survey
WattsEE	9	Program data

INPUT	VALUE	SOURCE
Hours	1089	Illinois TRM v11.0
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	88%	NIPSCO 2023 parent survey
SVGe	0.37	Illinois TRM v11.0
SVGd	0.37	Illinois TRM v11.0
Standby kWh	1.23	Actual from manufacturer spec sheet

Table 320 provides the survey findings used to calculate the connected LED baseline wattage.

Table 320. Ex Post Baseline Wattage Assumptions For Connected LEDs

BULB TYPE	BASELINE WATTAGE	FREQUENCY	PERCENT
Incandescent	60	22	33%
Halogen	43	4	6%
CFL	13	2	3%
LED	9	39	58%
Total	-	67	100%
Weighted Baseline	28		

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:

$$kWh\ savings = \%ElectricDHW * (\mathrm{GPM_{base}} * \mathrm{L_{base}} - \mathrm{GPM_{low}} * \mathrm{L_{low}}) * \mathrm{Household} * 365.25 * \frac{\mathrm{DF}}{\mathrm{FPH}} * \mathrm{EPG\_electric} * \mathrm{ISR}$$

$$EPG_{electric} = 8.33 * 1.0 * \frac{\mathrm{WaterTemp} - \mathrm{SupplyTemp}}{\mathrm{RE_{electric}} * 3412}$$

$$kW\ reduction = \frac{\Delta kWh}{Hours} * CF$$

$$Hours = GPM_{base} * L_{base} * \frac{Household}{FPH} * 365.25 * DF * \frac{\%HotWater}{GPH}$$

$$therm\ savings = \%GasHW * (\mathrm{GPM_{base}} * \mathrm{L_{base}} - \mathrm{GPM_{low}} * \mathrm{L_{low}}) * \mathrm{Household} * 365.25 * \frac{\mathrm{DF}}{\mathrm{FPH}} * \mathrm{EPG\_gas} * \mathrm{ISR}$$

$$EP\ G_{gas} = 8.33 * 1.0 * \frac{\text{WaterTemp} - \text{SupplyTemp}}{\text{RE}_{\text{gas}} * 100{,}000}$$

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 321 lists the input assumptions and source of each assumption for the kitchen and bathroom faucet aerator measure savings calculations.

Table 321. Ex *P*ost Variable Assumptions for Kitchen and Bathroom Faucet Aerators

INPUT	KITCHEN VALUE	BATHROOM VALUE	SOURCE
GPM_base	1.63	1.53	IL TRM v11.0
GPM_low	0.94	0.94	IL TRM v11.0
L_base	4.5	1.6	IL TRM v11.0
L_low	4.5	1.6	IL TRM v11.0
Household	4.87	4.87	NIPSCO 2023 HEW
DF	0.75	0.9	IL TRM v11.0

INPUT	KITCHEN VALUE	BATHROOM VALUE	SOURCE
FPH	1	2.65	NIPSCO 2023 parent survey
WaterTemp	93	86	IL TRM v11.0
SupplyTemp	57.4	57.4	Indiana TRM (v2.2), South Bend value
RE_electric	0.98	0.98	IL TRM v11.0
RE_gas	0.78	0.78	IL TRM v11.0
CF	0.0033	0.0012	Indiana TRM (v2.2)
ISR	40%	38%	NIPSCO 2023 parent survey
%ElectricDHW	23%	23%	NIPSCO 2023 HEW
%GasDHW	64%	64%	NIPSCO 2023 HEW
%ElectricDHW (gas only kit)	20%	20%	NIPSCO 2023 HEW
%GasDHW (gas only kit)	70%	70%	NIPSCO 2023 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 322 lists the input assumptions and source of each assumption for the low-flow showerhead measure savings calculations.

Table 322. *Ex Post* Variable Assumptions for Low-flow Showerheads

INPUT	VALUE	SOURCE
GPM_base	2.35	IL TRM v11.0
GPM_low	1.5	Program Data
L_base	7.8	IL TRM v11.0
L_low	7.8	IL TRM v11.0
Household	4.87	NIPSCO 2023 HEW
SPCD	0.6	IL TRM v11.0
SPH	1.95	NIPSCO 2023 parent survey
ShowerTemp	101	IL TRM v11.0
SupplyTemp	57.4	Indiana TRM (v2.2), South Bend value
RE_electric	0.98	IL TRM v11.0
RE_gas	0.78	IL TRM v11.0
CF	0.0023	Indiana TRM (v2.2)

INPUT	VALUE	SOURCE
ISR	31%	NIPSCO 2023 parent survey
%ElectricDHW (combo kit)	23%	NIPSCO 2023 HEW
%GasDHW (combo kit)	64%	NIPSCO 2023 HEW
%ElectricDHW (gas only kit)	20%	NIPSCO 2023 HEW
%GasDHW (gas only kit)	70%	NIPSCO 2023 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
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 323 lists the input assumptions and source of each assumption for the nightlights measure savings calculations.

Table 323. *Ex Post* Variable Assumptions for LED Nightlights

INPUT	VALUE	SOURCE
WattsBase	7	IL TRM v11.0
WattsEE	0.33	Program data
Hours	4,380	IL TRM v11.0
IRF	8%	NIPSCO 2023 HEW
ISR	84%	NIPSCO 2023 parent survey

Advanced Power Strips

The team used the following equation to calculate electric energy savings for advanced power strips:

$$kWh\ savings = \mathrm{kWh} * \mathrm{ISR}$$

$$kW\ reduction = \frac{\text{kWh savings}}{Hours} * \text{CF}$$

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 324 lists the input assumptions and source of each assumption for the advanced power strips measure savings calculations.

Table 324. *Ex Post* Variable Assumptions for Advanced Power Strips

INPUT	VALUE	SOURCE
kWh	103	IL TRM v11.0
ISR	86%	NIPSCO 2023 parent survey
Hours	7,129	IL TRM v11.0
CF	50%	Indiana TRM (v2.2)

Outlet and Switch Gaskets

The team used the following equation to calculate electric energy savings for outlet and switch gaskets:

$$kWh\ savings = (\%\text{Electric} * \text{kWh}_{\text{heating}} * \text{FLH}_{\text{HeatRatio}} + \%\text{Cool} * \text{kWh}_{\text{cooling}} * \text{FLH}_{\text{CoolRatio}}) * \text{ISR}$$

$$kW\ reduction = \frac{\%\text{Cool} * \text{kWh}_{\text{cooling}} * FLH_{CoolRatio}}{FLH_{cooling}} * \text{CF} * \text{ISR}$$

$$therm\ savings = \%\text{Gas} * \text{Therms}_{\text{heating}} * \text{FLH}_{\text{HeatRatio}} * \text{ISR}$$

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

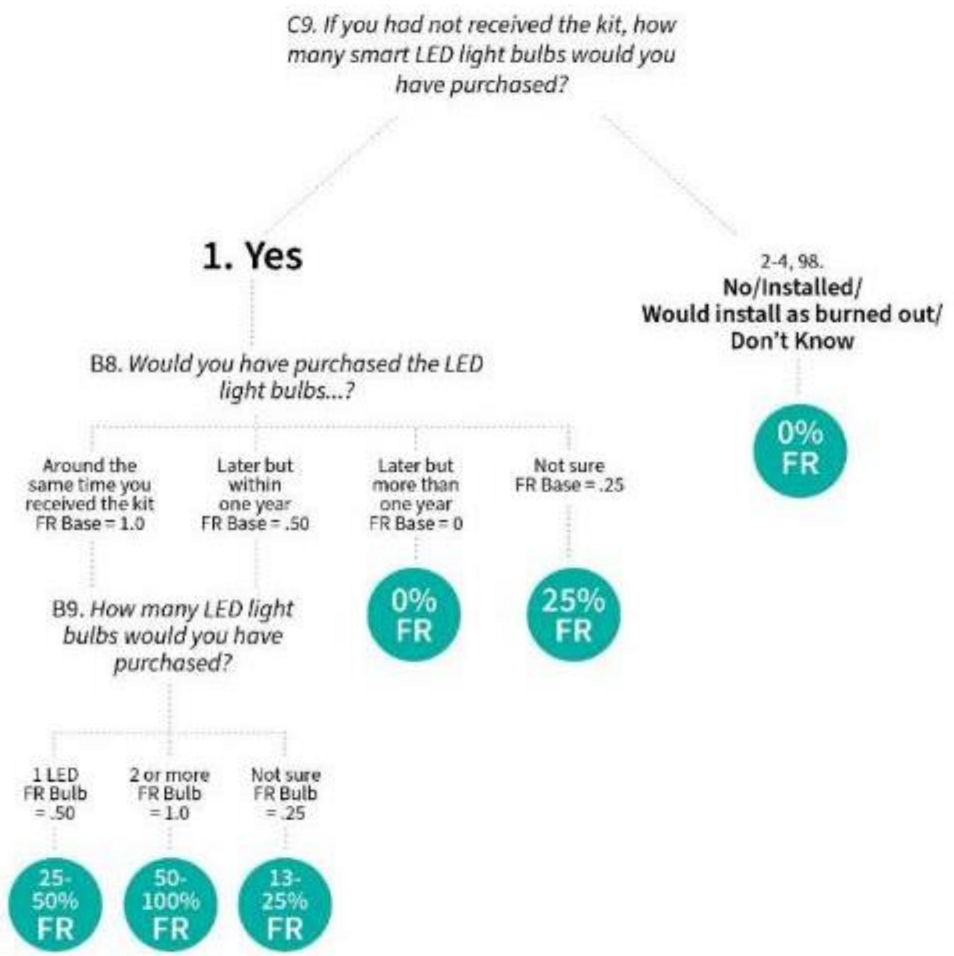
Table 325. *Ex post* Variable Assumptions for Outlet and Switch Gaskets

INPUT	VALUE	SOURCE
%Electric	19%	NIPSCO 2023 HEW
kWh_heating	7.7	IL TRM v11.0 weighted average of Rockford heat pump and electric resistance values
FLH_HeatRatio	72%	IL TRM v11.0 Rockford value and Indiana TRM (v2.2) South Bend value
%Cool	81%	Indiana TRM (v2.2)
kWh_cooling	0.93	IL TRM v11.0
FLH_CoolRatio	84%	IL TRM v11.0 Rockford value and Indiana TRM (v2.2) South Bend value
ISR (Light Switch Gaskets)	22%	NIPSCO 2023 parent survey
ISR (Power Outlet Gaskets)	14%	NIPSCO 2023 parent survey
FLH_cooling	431	Indiana TRM (v2.2) South Bend value
CF	0.88	Indiana TRM (v2.2)
%Gas	63%	NIPSCO 2023 HEW
%Gas (gas only kit)	68%	NIPSCO 2023 HEW
Therms_heating	0.39	IL TRM v11.0 Rockford value

Freeridership

Below in Figure 74 is a flow chart detailing the evaluation approach to assessing freeridership for LEDs.

Figure 74. Freeridership Approach



Respondent Demographics and Home Characteristics

Most respondents (76%) live in a single-family home and 64% are owners. Natural gas was the primary heating source for most homes (73%).

Most respondents (70%) have one or two showers in their home. Over half of respondents (53%) have one- or two-bathroom faucets and over three fourths have one kitchen sink (76%) in their home.

The following is a snapshot of self-reported home characteristics:

- Heating equipment: 77% heat their homes with a furnace.
- Cooling equipment: 81% have central air conditioning and 10% use room or window air conditioners.

Table 326. Home Characteristics of 2023 HomeLife Calculator Survey Respondents

HOME CHARACTERISTICS	COUNT	PERCENT
Type of residence		
Single-family detached home	53	76%
Multifamily apartment or condo building (with 4 or more units)	8	11%
Attached house (townhouse, row house, or twin)	2	3%
Mobile or manufactured home	5	7%
Other	1	1%
Prefer not to answer	1	1%
Total	**70**	**100%**
Ownership of residence		
Own	45	64%
Rent	23	33%
Prefer not to answer	2	3%
Total	**70**	**100%**
Primary fuel source for heating		
Electricity	11	16%
Natural gas	51	73%
Not sure/other	5	7%
Prefer not to answer	3	4%
Total	**70**	**100%**
Year home was built		
Before 1900	1	1%
1900 to 1939	3	4%
1940 to 1959	4	6%
1960 to 1979	10	14%
1980 to 1989	7	10%
1990 to 1999	7	10%
2000 to 2004	4	6%
2005 or later	16	23%

HOME CHARACTERISTICS	COUNT	PERCENT
Not sure	17	24%
Prefer not to answer	1	1%
Total	**70**	**100%**
Number of kitchen sinks		
1	53	76%
2	14	20%
Not sure	1	1%
Prefer not to answer	2	3%
Total	**70**	**100%**
Number of bathroom faucets		
1	18	26%
2	19	27%
3	14	20%
4	9	13%
5	3	4%
6	4	6%
7	1	1%
Prefer not to answer	2	3%
Total	**70**	**100%**
Number of showers		
1	24	34%
2	25	36%
3	14	20%
4	2	3%
Skipped	1	1%
Prefer not to answer	2	3%
Total	**70**	**100%**

Demographic characteristics were varied among surveyed parents. More than two-thirds of respondents (61%) reported having lived in their home for four years or more (n=70). More than a third (36%) had at least a four-year college degree (n=70). Most frequently, family households were made up of three to five people (80%).

Table 327. Demographics of 2023 Energy Efficiency Education (Schools) Survey Respondents

RESPONDENT DEMOGRAPHICS	COUNT	PERCENT
Number of people living in home		
1-2	2	3%
3-4	36	51%
5-6	23	33%

RESPONDENT DEMOGRAPHICS	COUNT	PERCENT
7	5	7%
Not sure	1	1%
Prefer not to answer	3	4%
Total	**70**	**100%**
Number of years living in home		
One year or less	9	13%
2-3 years	16	23%
4-5 years	12	17%
6-10 years	15	21%
More than 10	16	23%
Prefer not to answer	2	3%
Total	**70**	**100%**
Year born		
1940 to 1959	1	1%
1960 to 1979	15	21%
1980 to 1989	36	51%
1990 to 1999	15	21%
Prefer not to answer	3	4%
Total	**70**	**100%**
Highest level of education completed		
High school or less	6	9%
High school graduate or equivalent	15	21%
Some college, no degree	11	16%
Technical college degree or certificate	6	9%
Two-year college degree	3	4%
Four-year college degree	12	17%
Graduate or professional degree	13	19%
Prefer not to answer	4	6%

RESPONDENT DEMOGRAPHICS	COUNT	PERCENT
Total	**70**	**100%**
Income		
Under $25,000	10	14%
$25,000 to under $35,000	5	7%
$35,000 to under $50,000	6	9%
$50,000 to under $75,000	8	11%
$75,000 to under $100,000	6	9%
$100,000 to under $150,000	10	14%
Over $150,000	10	14%
Not sure	6	9%
Prefer not to answer	9	13%
Total	**70**	**100%**
Race/Ethnicity		
White	41	59%
Hispanic, Latino, or Spanish origin	13	19%
Black or African American	13	19%
Other, please specify:	1	1%
Prefer not to answer	3	4%
Total	**71 (*Multiple Response)**	**101%**

Appendix 10. Homelife Calculator Program

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 IL TRM v11.0 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:

- Connected LEDs
- Bathroom faucet aerators
- Kitchen faucet aerators
- Low-flow showerheads
- Nightlights
- Advanced Power Strips
- Light Switch Gaskets
- Power Outlet Gaskets

Table 328 lists the assumptions of the *ex post* per-measure savings.

Table 328. 2023 HomeLife Calculator Program Measures

MEASURE	REVIEWED ASSUMPTIONS
Connected LED	New and baseline wattages, hours of use, waste heat factors, coincidence factor, lighting control savings
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
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
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 per measure follow.

Connected LEDs

The team used the following equations to calculate electric energy and peak demand savings, as well as natural gas energy penalties, for LEDs.

$$kWh\ savings\ per\ lamp = \frac{(WattsBase - WattsEE) * Hours * (1 + WHFe)}{1{,}000} * ISR$$

$$kW\ reduction\ per\ lamp = \frac{(WattsBase - WattsEE) * CF * (1 + WHFd)}{1{,}000} * ISR$$

$$therm\ savings\ per\ lamp = \frac{(WattsBase - WattsEE) * Hours * WHFg * 10}{1{,}000} * ISR$$

$$Connected\ kWh\ savings\ per\ lamp = \left(\frac{WattsEE * Hours * (1 + WHFe) * SVGe}{1{,}000} - Standby\ kWh\right) * ISR$$

$$Connected\ kW\ reduction\ per\ lamp = \left(\frac{WattsEE * (1 + WHFd) * SVGd}{1{,}000}\right) * CF * ISR$$

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
SVGe	= Percentage of annual lighting energy saved by lighting control
SVGd	= Percentage of annual lighting demand saved by lighting control
Standby kWh	= Standby power draw of the controlled lamp

Table 329 lists the input assumptions and source of each assumption for the Connected LED measure savings calculations.

Table 329. *Ex Post* Variable Assumptions for Connected LEDS

INPUT	VALUE	SOURCE
WattsBase	37	NIPSCO 2023 participant survey
WattsEE	9	Program data
Hours	1089	Illinois TRM v11.0
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	83%	NIPSCO 2023 participant survey
SVGe	0.37	Illinois TRM v11.0
SVGd	0.37	Illinois TRM v11.0
Standby kWh	1.23	Actual from manufacturer spec sheet

Table 330 provides the survey findings used to calculate the connected LED baseline wattage.

Table 330. *Ex Post* Baseline Wattage Assumptions for Connected LEDs

BULB TYPE	BASELINE WATTAGE	FREQUENCY	PERCENT
Incandescent	60	61	53%
Halogen	43	2	2%
CFL	13	27	23%
LED	9	26	22%
Total	-	116	100%
Weighted Baseline	37		

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:

$$kWh\ savings = \%ElectricDHW * (GPM_{base} * L_{base} - GPM_{low} * L_{low}) * Household * 365.25 * \frac{DF}{FPH} * EPG\_electric * ISR$$

$$EPG_{electric} = 8.33 * 1.0 * \frac{WaterTemp - SupplyTemp}{RE_{electric} * 3412}$$

$$kW\ reduction = \frac{\Delta kWh}{Hours} * CF$$

$$Hours = GPM_{base} * L_{base} * \frac{Household}{FPH} * 365.25 * DF * \frac{\%HotWater}{GPH}$$

$$therm\ savings = \%GasHW * (GPM_{base} * L_{base} - GPM_{low} * L_{low}) * Household * 365.25 * \frac{DF}{FPH} * EPG\_gas * ISR$$

$$EPG_{gas} = 8.33 * 1.0 * \frac{WaterTemp - SupplyTemp}{RE_{gas} * 100{,}000}$$

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 331 lists the input assumptions and source of each assumption for the kitchen and bathroom faucet aerator measure savings calculations.

Table 331. Ex Post Variable Assumptions for Kitchen and Bathroom Faucet Aerators

INPUT	KITCHEN VALUE	BATHROOM VALUE	SOURCE
GPM_base	1.63	1.53	IL TRM v11.0
GPM_low	0.94	0.94	IL TRM v11.0
L_base	4.5	1.6	IL TRM v11.0
L_low	4.5	1.6	IL TRM v11.0
Household	2.64	2.64	Indiana TRM (v2.2)
DF	0.75	0.9	IL TRM v11.0
FPH	1	2.29	NIPSCO 2023 HomeLife survey
WaterTemp	93	86	IL TRM v11.0
SupplyTemp	57.4	57.4	Indiana TRM (v2.2), South Bend value
RE_electric	0.98	0.98	IL TRM v11.0
RE_gas	0.78	0.78	IL TRM v11.0
CF	0.0033	0.0012	Indiana TRM (v2.2)
ISR	60%	52%	NIPSCO 2023 HomeLife survey
%ElectricDHW (Combo/Electric Kit)	16%	16%	NIPSCO 2023 HomeLife survey
%ElectricDHW (gas only kit)	27%	27%	NIPSCO 2023 HomeLife survey
%GasDHW (Combo/Electric Kit)	81%	81%	NIPSCO 2023 HomeLife survey
%GasDHW (gas only kit)	73%	73%	NIPSCO 2023 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:

$$kWh\ savings = \%ElectricDHW * (\mathrm{GPM_{base}} * \mathrm{L_{base}} - \mathrm{GPM_{low}} * \mathrm{L_{low}}) * 365.25 * \mathrm{SPCD} * \frac{\mathrm{Household}}{\mathrm{SPH}} * \mathrm{EPG\_electric} * \mathrm{ISR}$$

$$EPG_{electric} = 8.33 * 1.0 * \frac{ShowerTemp - SupplyTemp}{RE_{electric} * 3412}$$

$$kW\ reduction = \frac{\Delta kWh}{Hours} * CF$$

$$Hours = GPM_{base} * L_{base} * Household * SPCD * 365.25 * \frac{\%HotWater}{GPH}$$

$$therm\ savings = \%GasDHW * (GPM_{base} * L_{base} - GPM_{low} * L_{low}) * 365.25 * SPCD * \frac{Household}{SPH} * EPG\_gas * ISR$$

$$EPG_{gas} = 8.33 * 1.0 * \frac{ShowerTemp - SupplyTemp}{RE_{gas} * 100{,}000}$$

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 332 lists the input assumptions and source of each assumption for the low-flow showerhead measure savings calculations.

Table 332. *Ex post* Variable Assumptions for Low-Flow Showerheads

INPUT	VALUE	SOURCE
GPM_base	2.35	IL TRM v11.0
GPM_low	1.5	Program Data
L_base	7.8	IL TRM v11.0
L_low	7.8	IL TRM v11.0
Household	2.64	Indiana TRM (v2.2)
SPCD	0.6	IL TRM v11.0
SPH	1.74	NIPSCO 2023 HomeLife survey
ShowerTemp	101	IL TRM v11.0
SupplyTemp	57.4	Indiana TRM (v2.2), South Bend value
RE_electric	0.98	IL TRM v11.0
RE_gas	0.78	IL TRM v11.0
CF	0.0023	Indiana TRM (v2.2)
ISR	48%	NIPSCO 2023 HomeLife survey
%ElectricDHW (Combo/Electric Kit)	16%	NIPSCO 2023 HomeLife survey
%ElectricDHW (gas only kit)	27%	NIPSCO 2023 HomeLife survey
%GasDHW (Combo/Electric Kit)	81%	NIPSCO 2023 HomeLife survey
%GasDHW (Gas Only Kit)	73%	NIPSCO 2023 HomeLife survey

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
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 333 lists the input assumptions and source of each assumption for the nightlights measure savings calculations.

Table 333. *Ex Post* Variable Assumptions for LED Nightlights

INPUT	VALUE	SOURCE
WattsBase	7	IL TRM v11.0
WattsEE	0.33	Program data
Hours	4,380	IL TRM v11.0
IRF	26%	NIPSCO 2023 HomeLife survey
ISR	88%	NIPSCO 2023 HomeLife survey

Advanced Power Strips

The team used the following equation to calculate electric energy savings for advanced power strips:

$$kWh\ savings = kWh * ISR$$

$$kW\ reduction = \frac{kWh\ savings}{Hours} * CF$$

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 334 lists the input assumptions and source of each assumption for the advanced power strips measure savings calculations.

Table 334. *Ex Post* Variable Assumptions for Advanced Power Strips

INPUT	VALUE	SOURCE
kWh	103	IL TRM v11.0
ISR	89%	NIPSCO 2023 HomeLife survey
Hours	7,129	IL TRM v11.0
CF	50%	Indiana TRM (v2.2)

Outlet and Switch Gaskets

The team used the following equation to calculate electric energy savings for outlet and switch gaskets:

$$kWh\ savings = (\%Electric * kWh_{heating} * FLH_{HeatRatio} + \%Cool * kWh_{cooling} * FLH_{CoolRatio}) * ISR$$

$$kW\ reduction = \frac{\%Cool * kWh_{cooling} * FLH_{CoolRatio}}{FLH_{cooling}} * CF * ISR$$

$$therm\ savings = \%Gas * Therms_{heating} * FLH_{HeatRatio} * ISR$$

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

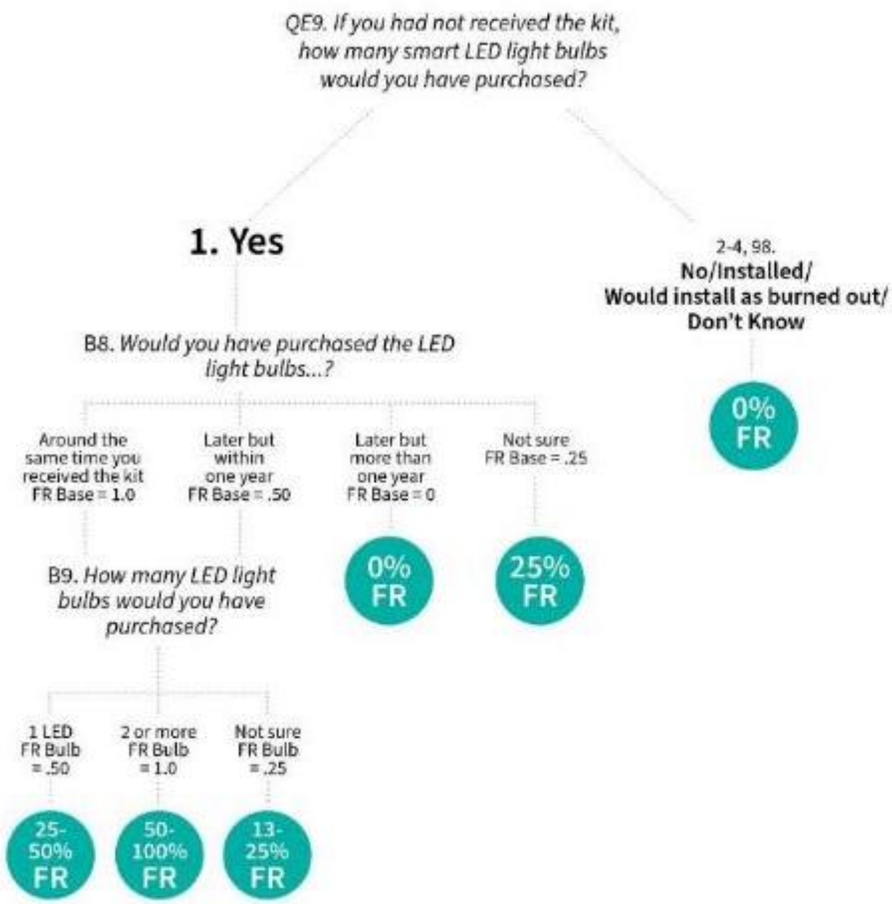
Table 335. *Ex Post* Variable Assumptions for Outlet and Switch Gaskets

INPUT	VALUE	SOURCE
%Electric (Combo/Electric Kit)	11%	NIPSCO 2023 HomeLife survey
kWh_heating	7.7	IL TRM v11.0 weighted average of Rockford heat pump and electric resistance values
FLH_HeatRatio	72%	IL TRM v11.0 Rockford value and Indiana TRM (v2.2) South Bend value
%Cool	81%	NIPSCO 2023 HomeLife survey
kWh_cooling	0.93	IL TRM v11.0
FLH_CoolRatio	84%	IL TRM v11.0 Rockford value and Indiana TRM (v2.2) South Bend value
ISR (Light Switch Gaskets)	36%	NIPSCO 2023 HomeLife survey
ISR (Power Outlet Gaskets)	35%	NIPSCO 2023 HomeLife survey
FLH_cooling	431	Indiana TRM (v2.2) South Bend value
CF	0.88	Indiana TRM (v2.2)
%Gas (Combo/Electric Kit)	85%	NIPSCO 2023 HomeLife survey
%Gas (gas only kit)	93%	NIPSCO 2023 HomeLife survey
Therms_heating	0.39	IL TRM v11.0 Rockford value

Freeridership

Below in Figure 74 is a flow chart detailing the evaluation approach to assessing freeridership for LEDs.

Figure 75. Freeridership Approach



Participant Demographics and Home Characteristics

Most respondents (81%) live in a single-family home and 86% are owners. Natural gas was the primary heating source for most homes (87%).

Most respondents (88%) have one or two showers in their home. Two thirds of respondents (63%) have one- or two-bathroom faucets and almost all have one kitchen sink (88%) in their home.

The following is a snapshot of self-reported home characteristics:

- Heating equipment: 87% heat their homes with a furnace.
- Cooling equipment: 80% have central air conditioning and 16% use room or window air conditioners.

Table 336. Home Characteristics of Surveyed 2023 HomeLife Calculator Program Participants

HOME CHARACTERISTICS	COUNT	PERCENT
Type of residence		
Single-family detached home	97	81%
Multifamily apartment or condo building (with 4 or more units)	11	9%
Attached house (townhouse, row house, or twin)	6	5%
Mobile or manufactured home	5	4%
Prefer not to answer	1	1%
Total	**120**	**100%**
Ownership of residence		
Own	103	86%
Rent	16	13%
Prefer not to answer	1	1%
Total	**120**	**100%**
Primary fuel source for heating		
Electricity	10	8%
Natural Gas	104	87%
Other, please specify	4	3%
Not sure	1	1%
Prefer not to answer	1	1%
Total	**120**	**100%**

HOME CHARACTERISTICS	COUNT	PERCENT
Year home was built		
Before 1900	4	3%
1900 to 1939	15	13%
1940 to 1959	19	16%
1960 to 1979	16	13%
1980 to 1989	9	8%
1990 to 1999	17	14%
2000 to 2004	9	8%
2005 or later	16	13%
Not sure	13	11%
Prefer not to answer	2	2%
Total	**120**	**100%**
Number of kitchen sinks		
1	106	88%
2	9	8%
3	1	1%
4	1	1%
Skipped	1	1%
Not sure	1	1%
Prefer not to answer	1	1%
Total	**120**	**100%**
Number of bathroom faucets		
1	29	24%
2	47	39%
3	26	22%
4	10	8%
5	4	3%
7	1	1%
Not sure	1	1%
Prefer not to answer	2	2%
Total	**120**	**100%**

HOME CHARACTERISTICS	COUNT	PERCENT
Number of showers		
1	46	38%
2	60	50%
3	11	9%
4	2	2%
Prefer not to answer	1	1%
Total	**120**	**100%**

Demographic characteristics were varied among surveyed respondents. More than two-thirds of respondents (69%) reported having lived in their home for six years or more (n=120). Approximately a third (33%) had at least a 4-year college degree (n=120). Most frequently, family households were made up of one or two people (76%).

Table 337. Demographics of Surveyed 2023 HomeLife Calculator Program Participants

PARTICIPANT DEMOGRAPHICS	COUNT	PERCENT
Number of people living in home		
1-2	91	76%
3-4	19	16%
5	2	2%
9	1	1%
Prefer not to answer	7	6%
Total	**120**	**100%**
Number of years living in home		
One year or less	7	6%
2-3 years	12	10%
4-5 years	17	14%
6-10 years	24	20%
More than 10	59	49%
Prefer not to answer	1	1%
Total	**120**	**100%**
Year born		
1940 to 1959	50	42%
1960 to 1979	37	31%

PARTICIPANT DEMOGRAPHICS	COUNT	PERCENT
1980 to 1989	14	12%
1990 to 1999	8	7%
2000 to 2004	1	1%
Prefer not to answer	10	8%
Total	**120**	**100%**
Highest level of education completed		
High school or less	4	3%
High school graduate or equivalent	19	16%
Some college, no degree	32	27%
Technical college degree or certificate	8	7%
Two-year college degree	16	13%
Four-year college degree	24	20%
Graduate or professional degree	15	13%
Prefer not to answer	2	2%
Total	**120**	**100%**
Income		
Under $25,000	16	13%
$25,000 to under $35,000	10	8%
$35,000 to under $50,000	15	13%
$50,000 to under $75,000	22	18%
$75,000 to under $100,000	11	9%
$100,000 to under $150,000	11	9%
Over $150,000	2	2%
Prefer not to answer	33	28%
Total	**120**	**100%**
Race/Ethnicity		
White	98	82%
American Indian or Alaska Native	1	1%
Asian	2	2%
Hispanic, Latino, or Spanish origin	10	8%
Black or African American	4	3%
Prefer not to answer	10	8%
Total	**125* (Multiple response)**	**104%**

Appendix 11. Residential 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 Residential Online Marketplace program. The team examined each assumption behind the algorithms to capture savings and compared it against the IL TRM v11.0 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
- EE Savings Week Kit – Smart LED
- EE Savings Week Kit – Advanced Power Strip Tier 2
- EE Savings Week Kit – Desk Lamp
- EE Savings Week Kit – LED Nightlight (2)
- EE Savings Week Kit Add-On – LED Recessed Downlight

Advanced Power Strip Tier 1

The evaluation team used the following equations from IL TRM v11.0 p. 78 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 338 lists the assumptions and source of each assumption for advanced power strip tier 1 measure savings calculations.

Table 338. *Ex Post* Variable Assumption for Advance Power Strip Tier 1

INPUT	VALUE	SOURCE
kWh (7-unit plug)	103	IL TRM v11.0
ISR	71%	IL TRM v11.0
Hours	7,129	IL TRM v11.0
CF	0.50	Indiana TRM (v2.2)

Advanced Power Strip Tier 2

The evaluation team used the following equations from IL TRM v11.0 p. 82 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 339 lists the assumptions and source of each assumption for advanced power strip tier 2 measure savings calculations.

Table 339. *Ex Post* Variable Assumption for Advance Power Strip Tier 2

INPUT	VALUE	SOURCE
ERP	40%	IL TRM v11.0, infrared only
	25%	IL TRM v11.0, infrared, and occupancy sensor
$\text{Baseline Energy}_{AV}$	466	IL TRM v11.0
ISR (Kit)	59%	2023 NIPSCO Residential OLM survey
ISR (Standalone)	83%	IL TRM v11.0

INPUT	VALUE	SOURCE
Hours	4,380	IL TRM v11.0
CF	0.50	Indiana TRM (v2.2)

Air Purifier

The team used the following equation from IL TRM v11.0 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 340 lists the input assumptions and source of each assumption for the air purifier measure savings calculations.

Table 340. *Ex Post* Variable Assumptions for Air Purifiers

INPUT	VALUE	SOURCE
SmokeCADR_base	175.2	IL TRM v11.0 for CADR range between 150 - 200
SmokeCADR_eff	154	Actual
SmokeCADR_per_watt_base	1.94	IL TRM v11.0 for CADR range between 150 - 200
SmokeCADR_per_watt_eff	3.1	Actual
PartialOnModePower_base	2.0	IL TRM v11.0 for CADR range between 150 – 200
PartialOnModePower_eff	0.48	Actual
Hours	5840	IL TRM v11.0
CF	0.667	IL TRM v11.0

Kitchen and Bathroom Faucet Aerators

The evaluation team used the following equations from IL TRM v11.0 p.258 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 341 lists the input assumptions and source of each assumption for the kitchen and bathroom faucet aerator measure savings calculations.

Table 341. *Ex Post* Variable Assumptions for Kitchen and Bathroom Faucet Aerators

INPUT	KITCHEN VALUE	BATHROOM VALUE	SOURCE
GPM_base	1.63	1.53	IL TRM v11.0
GPM_low	0.94	0.94	IL TRM v11.0
L_base	4.5	1.6	IL TRM v11.0
L_low	4.5	1.6	IL TRM v11.0
Household	2.42	2.42	IL TRM v11.0
DF	0.75	0.90	IL TRM v11.0
FPH	1	2.83	IL TRM v11.0
WaterTemp	93	86	IL TRM v11.0
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	IL TRM v11.0
RE_gas	0.78	0.78	IL TRM v11.0
Hours	102	20	IL TRM v11.0
CF	0.0033	0.0012	Indiana TRM (v2.2)
ISR	92%	93%	2022 HEA participant survey
%ElectricDHW	100%	100%	Actual, electric WH only
%GasDHW	100%	100%	Actual, electric WH only

Low-Flow Showerhead

The evaluation team used the following equations from IL TRM v11.0 p.269 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 342 lists the input assumptions and source of each assumption for the low-flow showerhead savings calculations.

Table 342. *Ex Post* Variable Assumptions for Low-Flow Showerheads

INPUT	VALUE	SOURCE
GPM_base	2.35	IL TRM (v11.0)
GPM_low	1.5	IL TRM (v11.0)
L_base	7.8	IL TRM (v11.0)
L_low	7.8	IL TRM (v11.0)
Household*SPCD	1.065	2022 HEA participant survey
SPH	1.64	IL TRM (v11.0)
GPH	26.1	IL TRM (v11.0)
Hours	198	IL TRM (v11.0)
ShowerTemp	101	IL TRM (v11.0)
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	IL TRM (v11.0)
RE_gas	0.78	IL TRM (v11.0)
CF	0.0023	Indiana TRM (v2.2)
ISR	86%	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 v11.0 p.284 to calculate electric energy, peak demand, and natural gas energy savings for Thermostatic Restrictor Shower Valves ("ShowerStarts"):

$$kWh\ savings = \%ElectricDHW * \left((\text{GPM\_showerhead}_{\square} * \text{L\_showerdevice}) * \text{Household} * \text{SPCD} * \frac{365.25}{\text{SPH}} \right) * \text{EPG\_electric} * \text{ISR}$$

$$EPG_{electric} = \frac{(8.33 * 1.0 * (\text{ShowerTemp} - \text{SupplyTemp}))}{\text{RE}_{\text{electric}} * 3412}$$

$$kW\ reduction = \frac{\Delta kWh}{Hours} * CF$$

$$Hours = ((GPM_{base} * L_{base}) * Household * SPCD * 365.25) * 0.726/GPH$$

$$therm\ savings = \%FossilDHW * (\mathrm{GPM_{showerhead}} * \mathrm{L_{showerdevice}}) * \mathrm{Household} * \mathrm{SPCD} * 365.25/\mathrm{SPH}) * \mathrm{EPG\_gas} * \mathrm{ISR}$$

$$EPG_{gas} = \frac{(8.33 * 1.0 * (\mathrm{WaterTemp} - \mathrm{SupplyTemp}))}{\mathrm{RE_{gas}} * 100{,}000}$$

Where:

GPM_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 343 lists the input assumptions and source of each assumption for the ShowerStart savings calculations.

Table 343. *Ex Post* Variable Assumptions for ShowerStart

INPUT	VALUE	SOURCE
GPM_showerhead	2.35	Illinois TRM (v11.0) or actual (1.5 if with low-flow showerhead)
L_showerdevice	0.89	Illinois TRM (v11.0)

INPUT	VALUE	SOURCE
Household*SPCD	1.065	2022 HEA participant survey
SPH	1.64	Illinois TRM (v11.0)
GPH	26.1	Illinois TRM (v11.0)
Hours	22.63	Illinois TRM (v11.0)
ShowerTemp	101	Illinois TRM (v11.0)
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 (v11.0)
RE_gas	0.78	Illinois TRM (v11.0)
CF	0.0023	Indiana TRM (v2.2)
ISR	86%	2022 HEA participant survey
%ElectricDHW	100%	Actual, electric WH only
%GasDHW	0%	Actual, electric WH only

LEDs and Smart 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 and Smart LEDs prior to July 1, 2023:

$$\Delta kWh = \frac{(W_{base} - W_{LED})}{1{,}000} * (ISR * Hours) * (1 + WHF_e)$$

$$\Delta kW = \frac{(W_{base} - W_{LED})}{1{,}000} * Coincidence\ Factor * ISR * (1 + WHF_d)$$

$$\Delta MMBtu_{WH} = \frac{(W_{base} - W_{LED})}{1{,}000} * (ISR * Hours) * \left(WHF_g\right)$$

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 344 lists the input assumptions and source of each assumption for the LED measure savings calculations up through June 30, 2023.

Table 344. *Ex Post* Variable Assumptions for LEDs

INPUT	VALUE	SOURCE
W_{base} for 4-watt (Decorative/ Mini LED)	40	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 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)	43	Ch. 6 Residential Lighting Evaluation Protocol, UMP
W_{base} for 8-watt (Smart LED)	65	Ch. 6 Residential Lighting Evaluation Protocol, UMP
W_{LED} for 4-watt (Decorative/ Mini LED)	4	Actual installed wattage
W_{LED} for 9-watt (MR/Par)	9	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
%ElectricDHW	100%	Actual, electric WH only
%GasDHW	0%	Actual, electric WH only
Hours	902	Indiana TRM (v2.2)
WHFe	-0.070	Indiana TRM (v2.2), averaged across participant location
WHFd	0.038	Indiana TRM (v2.2), averaged across participant location
WHFg	-0.0019	Indiana TRM (v2.2), averaged across participant location
Coincidence Factor	0.11	Indiana TRM (v2.2)

INPUT	VALUE	SOURCE
ISR (Kit, Smart LED)	67%	2023 NIPSCO Residential OLM survey
ISR (Standalone)	86%	Blended ISR from 2023 Residential Lighting evaluation

The evaluation team used the following equations from IL TRM v11.0 to calculate electric energy and peak demand savings, as well as natural gas energy penalties, for Smart LEDs for the entire PY2023 (connected watt savings were additive to savings above for first half of the year):

$$\Delta kWh = (((WattsEE/1000) * HOURS * SVGe * WHFe) - StandbykWh) * ISR * (1 - Leakage)$$

$$\Delta kW = (WattsEE/1000) * SVGd * WHFd * ISR * (1 - Leakage) * CF$$

Where:

W_{EE} = Wattage of the LED

Hours = Average hours of use per year, hr.

SVGe = Percentage of annual lighting energy saved by lighting control

SVGd = Percentage of annual lighting demand saved by lighting control

Leakage = Adjustment to account for percentage of program bulbs that move out of the utility jurisdiction

Standbykwh = Standby power draw of the controlled lamp

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

Table 345 lists the input assumptions and source of each assumption for the Smart LED measure savings calculations up through June 30, 2023.

Table 345. *Ex Post* Variable Assumptions for Smart LEDS

INPUT	VALUE	SOURCE
W_{EE} for 9-watt (Smart LED)	9	Actual installed wattage
W_{EE} for 8-watt (Smart LED)	8	Actual installed wattage
SVGe	0.37	IL TRM v11.0

INPUT	VALUE	SOURCE
SVGd	0.37	IL TRM v11.0
Hours	902	Indiana TRM (v2.2)
WHFe	-0.070	Indiana TRM (v2.2), averaged across participant location
WHFd	0.038	Indiana TRM (v2.2), averaged across participant location
WHFg	-0.0019	Indiana TRM (v2.2), averaged across participant location
Standbykwh	0.63	IL TRM v11.0
Leakage	0	IL TRM v11.0
Coincidence Factor	0.11	Indiana TRM (v2.2)
ISR (Kit, Smart LED) ISR (Standalone)	67% 86%	2023 NIPSCO Residential OLM survey Blended ISR from 2023 Residential Lighting evaluation

LED Desk Lamp

The evaluation team used the following equations from IL TRM v11.0 p. 359 to calculate electric energy and peak demand savings, as well as natural gas energy penalties, for the desk lamp:

$$kWh\ savings = \frac{((WattsBase - \mathrm{WattsEE})}{1{,}000} * (1 - Leakage) * \ \ Hours * WHFe$$

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

Leakage = Adjustment to account for percentage of program bulbs that move out of the utility jurisdiction

WHF_e = Waste heat factor for energy to account for HVAC interactions with lighting (depends on location)

Table 346 lists the input assumptions and source of each assumption for the nightlights measure savings calculations.

Table 346. *Ex Post* Variable Assumptions for LED Desk Lamp

INPUT	VALUE	SOURCE
WattsBase	7	IL TRM v11.0
WattsEE	0.30	Actual
Hours	300	Res Lighting End-Use Consumption Study, DOE
ISR	83%	2023 NIPSCO Residential OLM survey
Leakage	0	IL TRM v11.0
WHFe	-0.070	Indiana TRM (v2.2), averaged across participant location

Nightlights

The evaluation team used the following equation from the Illinois TRM v11.0 p.349 to calculate electric energy savings for LED nightlights:

$$kWh\ savings = \frac{((WattsBase - \mathrm{WattsEE})}{1{,}000} * (1 - Leakage) * \ \ Hours * WHFe$$

Where:

WattsBase = Input wattage of baseline system

WattsEE = Wattage of the LED bulb, W

Hours = Average annual hours of use, hours

ISR = In-service rate

Leakage = Adjustment to account for percentage of program bulbs that move out of the utility jurisdiction

WHF_e = Waste heat factor for energy to account for HVAC interactions with lighting (depends on location)

Table 347 lists the input assumptions and source of each assumption for the nightlights measure savings calculations.

Table 347. *Ex Post* Variable Assumptions for LED Nightlights

INPUT	VALUE	SOURCE
WattsBase	25	IL TRM v11.0
WattsEE	4	Actual
Hours	300	IL TRM v11.0
ISR	77%	2023 NIPSCO Residential OLM survey

INPUT	VALUE	SOURCE
Leakage	0	IL TRM v11.0
WHFe	1.054	IL TRM v11.0

String LEDs

The evaluation team used the following equation from the Illinois TRM v11.0 p.344 to calculate electric energy savings for LED string lights:

$$kWh\ savings = \frac{((WattsBase - \mathrm{WattsEE})}{1{,}000} * (1 - Leakage) * \ \ Hours * WHFe$$

Where:

WattsBase = Input wattage of baseline system

WattsEE = Wattage of the LED bulb, W

Hours = Average annual hours of use, hours

ISR = In-service rate

Leakage = Adjustment to account for percentage of program bulbs that move out of the utility jurisdiction

WHF_e = Waste heat factor for energy to account for HVAC interactions with lighting (depends on location)

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 String Lights

INPUT	VALUE	SOURCE
C7 WattsBase C9 WattsBase	125 175	IL TRM v11.0
C7 WattsEE C9 WattsEE	2.4 2.4	Actual
Hours	210	IL TRM v11.0
ISR	100%	IL TRM v11.0
Leakage	0	IL TRM v11.0
WHFe	1.0	IL TRM v11.0

Wi-Fi Thermostat

The evaluation team used the following equation from the Illinois TRM v11.0 p.204 to calculate electric energy savings for Wi-Fi thermostats:

$$DkWh = DkWhheating + DkWhcooling$$

$$DkWhheating = \%ElectricHeat * Elec\_Heating\_Consumption * Heating\_Reduction * HF * Eff\_ISR\_Heat + (DTherms * Fe * 29.3)$$

$$DkWhcool = \%AC * \left(\frac{FLH * Capacity * \frac{1}{SEER}}{1{,}000} \right) * Cooling\_Reduction * Eff\_ISR\_Cool$$

$$DkW = \%AC * \left(Cooling\_DemandReduction * \frac{Btu}{hr} * \frac{\frac{1}{EER}}{1{,}000} \right) * EFF\_ISR\_Cool * CF$$

The evaluation team referenced recent research to inform the 2023 analysis of Wi-fi thermostats. The variables taken from the 2023 NIPSCO EM&V report include cooling system capacity and heating system capacity, averaged across all HVAC units (by type). The inputs used from the 2023 billing analysis include cooling reduction and heating reduction percentages, which the billing analysis determined 9.6% and 6.0%, respectively. For gas savings, the evaluation team applied a deemed value of 42.9 therms from the billing analysis.

Where:

%ElectricHeat	=	Percentage of heating savings assumed to be electric
SEER	=	Seasonal average efficiency ratio
Elec_Heating_Consumption	=	estimate of annual household heating consumption for electrically heated home
Heating Reduction	=	Assumed percentage reduction in heating energy due to Wi-Fi thermostat
HF	=	Household factor, to adjust for non-single-family households
ISR	=	In-service rate, or fraction of units that get installed
Fe	=	Furnace fan energy consumption as a percentage of annual fuel consumption
%AC	=	Fraction of customers with thermostat-controlled air conditioning
FLHcool	=	estimate of household annual full load cooling hours
Capacity	=	Size of AC unit
Cooling_Reduction	=	Assumed percentage reduction in cooling energy due to Wi-Fi thermostat

EER = Energy Efficiency Ratio of existing cooling system

Cooling_ DemandReduction = Assumed percentage reduction in cooling demand due to Wi-Fi thermostat

Coincidence Factor = Cooling coincidence factor

Table 349 lists the assumptions and source of each assumption for the Wi-Fi thermostat measure savings calculations.

Table 349. *Ex Post* Variable Assumptions for Wi-Fi Thermostats

INPUT	VALUE	SOURCE
SEER	12	IL TRM v11.0
Elec_Heating_Consumption	Varies by location	IL TRM v11.0 in conjunction with IN TRM v06.01.2023
HF	1	IL TRM v11.0
ISR	N/A	Embedded in 2023 Billing Analysis results
Fe	3.14%	IL TRM v11.0
FLHcool	Varies by location	IN TRM v (2.2)
Capacity, HP Cool Capacity, HP Heat Capacity, AC	34,516 BTU 23,849 BTU 33,481 BTU	Avg of known 2018-2021 HVAC program data Avg of known 2018-2023 HVAC program data Avg of 2023 HVAC program data
Heating Reduction	6.0%	2023 NIPSCO Thermostat billing analysis
Cooling Reduction	9.6%	2023 NIPSCO Thermostat billing analysis
EER	10.5	IL TRM v11.0
Cooling Demand Reduction	16.4%	IL TRM v11.0
CF	0.44	IN TRM v (2.2)

Freeridership and Spillover Analysis

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 350).

Table 350. 2023 Residential Online Marketplace Program Intention Freeridership Assignment

FR2. RESPONSE	ASSIGNED INTENTION FREERIDERSHIP VALUE
Around the same time you purchased the kit	100%
Later but within one year	75%
Later but more than one year	0%
Not sure	25%

Table 351 shows intention freeridership score for each surveyed measure.

Table 351. 2023 Residential Online Marketplace Program Intention Freeridership Score by Measure

MEASURE	INTENTION FREERIDERSHIP SCORE (%)
Wi-Fi Thermostats	14%
EE Week Savings Kit – Smart LED Bulb	14%
EE Week Savings Kit – Desk Lamp	15%
EE Week Savings Kit – Nightlights (2)	23%
EE Week Savings Kit – Tier 2 APS	13%
EE Week Savings Kit – Add-on – 6" Recessed Downlight	13%

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 352.

Table 352. 2023 Residential Online Marketplace Program Influence Freeridership Assignment

MAXIMUM RATING	ASSIGNED INFLUENCE FREERIDERSHIP VALUE
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 353 shows *influence* freeridership score for each surveyed measure.

Table 353. 2023 Residential Online Marketplace Program Influence Freeridership Score by Measure

MEASURE	INFLUENCE FREERIDERSHIP SCORE (%)
Wi-Fi Thermostats	3%
EE Week Savings Kit – Smart LED Bulb	2%
EE Week Savings Kit – Desk Lamp	4%
EE Week Savings Kit – Nightlights (2)	4%
EE Week Savings Kit – Tier 2 APS	4%
EE Week Savings Kit – Add-on – 6" Recessed Downlight	2%

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 354 lists the intention, influence, and final freeridership scores for the 2023 Residential OLM program.

Table 354. 2023 Residential Online Marketplace Program Freeridership Score

MEASURE	INTENTION SCORE	INFLUENCE SCORE	FREERIDERSHIP SCORE
Wi-Fi Thermostats	14%	3%	9%
EE Week Savings Kit – Smart LED Bulb	14%	2%	8%

MEASURE	INTENTION SCORE	INFLUENCE SCORE	FREERIDERSHIP SCORE
EE Week Savings Kit – Desk Lamp	15%	4%	10%
EE Week Savings Kit – Nightlights (2)	23%	4%	14%
EE Week Savings Kit – Tier 2 APS	13%	4%	9%
EE Week Savings Kit – Add-on – 6" Recessed Downlight	13%	2%	7%

Participant Spillover

The evaluation team estimated participant spillover measure savings using specific information about participants, determined through the evaluation, using 2023 NIPSCO evaluation results and the IL TRM v.11 as a baseline reference.[77] 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 355.

Table 355. 2023 Residential Online Marketplace Program Participant Spillover Results

MEASURE	SPILLOVER SAVINGS (MMBTU)	PARTICIPANT PROGRAM SAVINGS (MMBTU)	PARTICIPANT SPILLOVER
Total Program	11.6	231.3	5%

[a] Program savings include *ex post* therms savings in MMBtu calculation

[77] Nonparticipant spillover evaluation activities were not conducted for the 2023 program year.

Participant Survey Demographics and Home Characteristics

The following table contains details on the demographic characteristics of survey respondents.

Table 356. 2023 Residential Online Marketplace Participant Survey Demographics

DEMOGRAPHICS	PERCENTAGE
Home Ownership (n=208)	
Own	92%
Rent	8%
Type of Residence (n=208)	
Single-family detached home	87%
Multifamily apartment or condo building (with 3 or more units)	5%
Attached house (townhouse, row house, or twin)	5%
Mobile or manufactured home	1%
Other	1%
Years Lived in Current Home (n=210)	
One year or less	6%
2-3 years	12%
4-5 years	12%
6-10 years	18%
More than 10 years	50%
Prefer not to answer	1%
Number of People in the Home (n=199)	
One	25%
Two	40%
Three	16%
Four	12%
Five or more	7%
Year Home Built (n=198)	
Before 1900	3%
1900 to 1939	11%
1940 to 1959	16%
1960 to 1979	24%
1980 to 1989	8%
1990 to 1999	16%
2000 to 2004	6%
2005 or later	18%
Year Born (n=200)	
1900 to 1939	1%

DEMOGRAPHICS	PERCENTAGE
1940 to 1959	38%
1960 to 1979	41%
1980 to 1989	13%
1990 to 1999	8%
2005 or later	1%
Race/Ethnicity (n=192)*	
White	84%
American Indian or Alaska Native	1%
Asian	1%
Hispanic, Latino, or Spanish origin	7%
Black or African American	6%
Native Hawaiian or Other Pacific Islander	1%
Middle Eastern or North African	0%
Other	1%
Languages Spoken at Home (n=208)*	
English	95%
Spanish	3%
Other	2%
Annual Income (n=208)	
Under $25,000	7%
$25,000 to under $35,000	11%
$35,000 to under $50,000	10%
$50,000 to under $75,000	20%
$75,000 to under $100,000	24%
$100,000 to under $150,000	16%
Over $150,000	12%

Source: Participant survey. Questions K2-K5, K10-K14: “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 are currently living in your home year-round?” “When was your home built?” “In what year were you born?” “Which categories describe you?” “What language(s) do you primarily speak at home?” “Which of the following best represents your annual household income from all sources in 2023 before taxes?.” *This was a multiple response question.

Appendix 12. Commercial and Industrial (C&I) Programs

C&I Measure Algorithms and Assumptions

This appendix contains the assumptions used in electric savings, demand reduction, and gas savings algorithms for the sampled measures within the C&I programs. The team examined each assumption behind the algorithms to capture savings and compared it against the Illinois TRM v11.0, 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 357 lists the sources and assumptions of the *ex post* per-measure savings for sampled measures.

Table 357. C&I Sampled Measures

MEASURE	*EX POST* SOURCE	REVIEWED ASSUMPTIONS
Lighting Replacement	TRM IL v11.0 Vol II	New and baseline wattages, hours of use, waste heat factors, coincidence factors
Lighting Power Density Reduction	TRM IL v11.0 Vol II	Square footage, baseline allowed watts, installed watts, operating hours, waste heating factors
Lighting Controls	TRM IL v11.0 Vol II	New and baseline wattages, hours of use, waste heat factors, coincidence factors
Refrigeration ECM Freezer/ Refrigerator Motors	TRM IL v11.0 Vol II	Savings per motor, hours of use
HVAC – Heating / Cooling Equipment Replacement	TRM IL v11.0 Vol II	Full load heating and cooling hours, equipment capacities, equipment efficiencies
HVAC – VFDs Pumps and Fans	TRM IL v11.0 Vol II	Motor size, motor efficiency, average equipment speed, operating hours, power consumption under baseline and VFD control
HVAC – Programmable Thermostats	TRM IL v11.0 Vol II	Equipment heating and cooling capacities, equipment heating and cooling efficiencies, equivalent full load hours
HVAC – Turn over Furnaces	Custom Energy Models	Methodology for calculating shell heat loss, infiltration heat loss, stratification rates, setback controls, equipment efficiencies.
HVAC – Pipe Insulation	TRM IL v11.0 Vol II	New and baseline R-values, pipe diameter, water heater recovery efficiency
HVAC – Steam Trap Replacement	WI TRM v2023	Steam pressure, trap orifice diameter
Air Compressors - VFD	TRM IL v11.0 Vol II	Equipment capacity, equipment performance, average CFM load, operating hours
Air Compressors – System Leak Repair	WI TRM v2023	CFM reduction, CFM brake horsepower, hours of use
Kitchen Equipment	TRM IL v11.0 Vol II	Pounds of food cooked per day, equipment efficiency, idle energy rate, production capacity, preheat time, preheat energy

MEASURE	*EX POST* SOURCE	REVIEWED ASSUMPTIONS
Water Heating	TRM IL v11.0 Vol II	Gallons per day of plant, equipment efficiency, equipment hot water temperature setpoint

Lighting – Replacement

The evaluation team used the following equations from the IL TRM v11.0 vol 2, pg. 635 to calculate electric energy and peak demand savings, as well as natural gas energy penalties, for all LED bulbs. Note that exterior installed bulbs and fixtures do not have waste heat penalties applied, as they have no impact on heating and cooling.

$$\Delta kWh = \Delta kWh_{Elec} + ((1 - FS_{Gas}) * \Delta kWh_{Heating\ Penalty})$$

$$\Delta kWh_{Elec} = \frac{(W_{base} - W_{LED}) * (Hours) * (WHF_e)}{1{,}000}$$

Heating Penalty for electrically heated spaces:

$$\Delta kWh_{Heating\ Penalty} = \frac{(W_{base} - W_{LED}) * (Hours) * (-IFkWh)}{1{,}000}$$

Heating Penalty for fossil fuel heated spaces, or if unknown:

$$\Delta therms = FS_{GAS} * \frac{(W_{base} - W_{LED}) * (Hours) * (-IFTherms_{\square})}{1{,}000}$$

Demand Savings:

$$\Delta kW_{\square} = \frac{(W_{base} - W_{LED}) * Coincidence\ Factor * (WHF_d)}{1{,}000}$$

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	=	Waste heat factor for energy to account for HVAC interactions with lighting
WHF_d	=	Waste heat factor for demand to account for HVAC interactions with lighting
$IFKWH_{ELEC\ HEAT}$	=	Waste heat factor for energy to account for HVAC interactions with lighting
$IFTherms_{GAS\ HEAT}$	=	Waste heat factor for demand 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 358 lists the input assumptions and source of each assumption for the lighting replacement measure savings calculations.

Table 358. *Ex Post* Variable Assumptions

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 v11.0 or posted operating hours of business
WHF_e	Varies	IL TRM v11.0, dependent on building type, location, and HVAC system type
WHF_d	Varies	IL TRM v11.0 dependent on building type, location, and HVAC system type
WHF_g	Varies	IL TRM v11.0, dependent on building type, location, and HVAC system type
Coincidence Factor	Varies	IL TRM v11.0, 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 359 lists the input assumptions and source of each assumption for the lighting power density reduction measure savings calculations.

Table 359. *Ex Post* Variable Assumptions

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 v11.0 or actual operating hours of building
WHF_e	Varies	IL TRM v11.0, based on location, building type, and HVAC system type
WHF_d	Varies	IL TRM v11.0 based on location, building type, and HVAC system type
WHF_g	Varies	IL TRM v11.0, based on location, building type, and HVAC system type
CF	Varies	IL TRM v11.0 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 360 lists the input assumptions and source of each assumption for the lighting occupancy sensor measure savings calculations.

Table 360. *Ex Post* Variable Assumptions

INPUT	VALUE	SOURCE
$kW_{controlled}$	Varies	Based on actual wattage controlled per sensor
Hours	Varies	IL TRM v11.0 or posted operating hours of business
ESF	Varies	IL TRM v11.0, dependent on control type
WHF_e	Varies	IL TRM v11.0, dependent on building type, location, and HVAC system type
WHF_d	Varies	IL TRM v11.0, dependent on building type, location, and HVAC system type
WHF_g	Varies	IL TRM v11.0, dependent on building type, location, and HVAC system type
CF	Varies	IL TRM v11.0, dependent on building type

Refrigeration – ECM Freezer/Refrigeration Motors

The evaluation team used the following equations to calculate electric and natural gas energy savings for ECM Freezer and Refrigerator motors in refrigeration systems from the IL TRM v11.0.

$$kWh\ savings = Savings\ per\ motor * Qty\ motors$$

$$kW\ reduction = \frac{kWh\ Savings}{Hours} * Qty\ motors * CF$$

Where:

Savings per motor = Deemed savings within IL TRM v11.0, based on rating of motor

Hours = Full load hours per year, 8760 deemed value

CF = Summer peak Coincident factor, 1.0 deemed value

Table 361 lists the input assumptions and source of each assumption for the lighting occupancy sensor measure savings calculations.

Table 361. *Ex Post* Variable Assumptions

INPUT	VALUE	SOURCE
Savings per motor	Varies	Based on actual specification, or deemed values within TRM
Hours	Varies	IL TRM v11.0 or posted operating hours of business
CF	Varies	IL TRM v11.0, dependent on building type

HVAC – Heating/Cooling Equipment Replacement

The evaluation team used the following equations to calculate electric and natural gas energy savings for HVAC hydronic units from the IL TRM v11.0.

$$kWh\ savings_{cool} = TONS * \left(\frac{3.516}{IPLV_{base}} - \frac{3.516}{IPLV_{EE}}\right) * EFLH_{cool}$$

$$kW\ reduction = TONS * \left(\frac{3.516}{COP_{base}} - \frac{3.516}{COP_{EE}}\right) * CF$$

$$therm\ savings = Btuh_{heat} * \left(\frac{1}{EFF_{base}} - \frac{1}{EFF_{EE}}\right) * \frac{EFLH_{heat}}{100{,}000}$$

Where:

TONS = Actual cooling capacity of chiller/ packaged unit / AHU / Split system, tons

$IPLV_{base}$ = Integrated part load value efficiency of the baseline equipment, 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

COP_{EE} = Actual coefficient of performance of installed equipment

CF = Summer coincidence factor, from TRM

$Btuh_{heat}$ = Actual capacity of the boiler/ furnace installed, Btu/hr

EFF_{base} = Baseline heating efficiency, based on equipment type

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 362 lists the assumptions and source of each assumption for the HVAC hydronic unit measure savings calculations.

Table 362. *Ex Post* Variable Assumptions

INPUT	VALUE	SOURCE
TONS	Varies	Equipment specifications
$IPLV_{base}$	Varies	IL TRM v11.0 vol II
$IPLV_{EE}$	Varies	Equipment specifications
$EFLH_{cool}$	Varies	IL TRM v11.0 vol II
COP_{base}	Varies	IL TRM v11.0 vol II
COP_{EE}	Varies	Equipment specifications
CF	Varies	IL TRM v11.0 vol II
$Btuh_{heat}$	Varies	Equipment specifications
EFF_{base}	Varies	IL TRM v11.0 vol II
EFF_{EE}	Varies	Equipment specifications
$EFLH_{heat}$	Varies	IL TRM v11.0 vol II

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.

$$kWh\ savings = \ ESF * \left(\frac{BHP}{EFFi}\right) * HOURS$$

$$kW\ reduction = \left(\frac{BHP}{EFF_i}\right) * DSF$$

Where:

BHP = System Brake horsepower of installed equipment, hp

EFFi = Motor efficiency, installed. 93% if unknown.

HOURS = Operating hours of equipment, from facility interviews or logged data, hrs./yr. TRM provides defaults by space type.

ESF = Energy Savings factor, provided by TRM

DSF = Demand Savings factor varies by VFD application, provided by TRM

Table 363 lists the assumptions and source of each assumption for the VFD pumps and fans measure savings calculations.

Table 363. *Ex Post* Variable Assumptions

INPUT	VALUE	SOURCE
BHP	Varies	Equipment specifications
EFFi	Varies	Actual, 93% if unknown
ESF	Varies	IL TRM v11.0 deemed set of values by space type
DSF	Varies	IL TRM v11.0 deemed set of values by space type
HOURS	Varies	Facility staff interviews logged run time if known. Or IL TRM v11.0 deemed values if not known

HVAC – Programmable Thermostats

The evaluation team used the following equations from Illinois TRM v11.0 Vol II 4.4.48 pg. 521, 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 v11.0 Pg. 523
$Kbtu/Hr_{cool}$	=	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 364 lists the input assumptions and source of each assumption for the smart thermostat measure savings calculations.

Table 364. *Ex Post* Variable Assumptions

INPUT	VALUE	SOURCE
$\%Elec_{Heat}$	0 for gas heating 1 for electric heating	Illinois TRM v11.0 Vol III pg. 522
$kBTU/Hr_{Heat}$	87	87, defined by WI TRM 2020 Pg. 250 for small sized commercial packaged system
$HSPF_{Base}$	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 v11.0 Pg. 523
F_e	7.7%	IL TRM v11.0 Pg. 523
$Kbtu/Hr_{cool}$	61 or 0	IL TRM v11.0 Pg. 523 for AC, 0 for no AC installed or gas only customer
SEER	13	IL TRM v11.0 Pg. 523, If unknown actual, use code base
$EFLH_{Cool}$	711	IN TRM 2015 Pg. 230, SB Location, Other
Cooling_Reduction	17.7%	IL TRM v11.0 Pg. 523
BAF	0.8	IL TRM v11.0 Pg. 524

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 365 lists the assumptions and source of each assumption for the HVAC furnace measure savings calculations.

Table 365. *Ex Post* Variable Assumptions

INPUT	VALUE	SOURCE
T_{SET}	Varies	Temperature setpoint during occupied and setback operation from equipment control screens

INPUT	VALUE	SOURCE
Schedule	Varies	Operating hours for occupied and setback operation from equipment control screens
Baseline Stratification Factor	0.8 °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 convert Btu to therm

Table 366 lists the assumptions and source of each assumption for the HVAC pipe insulation savings calculations.

Table 366. *Ex Post* Variable Assumptions

INPUT	VALUE	SOURCE
Btu_{base}	Varies	IL TRM v11.0 vol II. Calculated based on process fluid temperature, pipe diameter, insulation material, and insulation thickness
Btu_{EE}	Varies	IL TRM v11.0 vol II.. 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 from the WI TRM v2023 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 367 lists the assumptions and source of each assumption for the steam trap replacement measure savings calculations.

Table 367. *Ex Post* Variable Assumptions

INPUT	VALUE	SOURCE
P_{Abs}	Varies	From project specific operating pressure
D	Varies	From steam trap specifications
h_{fg}	Varies	WI TRM v2023, From steam tables, dependent on P_{Abs}
DF	32%	WI TRM v2023
EFF	Varies	Assumed 80% unless information on the actual heating efficiency of the boiler system is available

Kitchen Equipment

The evaluation team used the IL TRM v11.0 Vol II to calculate savings for all kitchen equipment measures. Most measures relate to purchasing ENERGY STAR certified efficient equipment, and result in deemed savings per unit purchased.

Compressed Air – VFD

VFD air compressor project savings were calculated from IL TRM v11.0 Vol II.

$$kWh\ savings = 0.9 * HP_{Compressor} * Hours * (CF_b - CF_e)$$

Where:

0.9	=	nominal hp to full load kW conversion factor
HP Compressor	=	Compressor motor nominal HP
Hours	=	Compressor total hours of operation depending on shift
CF_b	=	Baseline compressor factor
CFe	=	Efficient compressor factor
CF	=	Summer coincidence factor, given by TRM

Table 368 lists the assumptions and source of each assumption for the steam trap replacement measure savings calculations.

Table 368. *Ex Post* Variable Assumptions

INPUT	VALUE	SOURCE
Hp compressor	Varies	From project specific equipment data
Hours	Varies	Compressor total run hours of operation, depending on shift, given by IL TRM v11.0
CF_b	Varies	WI TRM v2023, From steam tables, dependent on P_{Abs}
CFe	0.705 0.658	Depending on unit size. Former for < 40 HP, latter for 50-200 HP
CF	Varies	Given by IL TRM v11.0

Compressed Air – System Leak Repair

Compressed air system leak repair project savings were calculated from the WI TRM v2023 measure. "unknown" hours from IL TRM for compressed air measures. Deemed savings are average from WI TRM and MEMD 2023.

$$kWh\ Savings = CFM\ Reduction * 365 * HOU * (\frac{CFM}{BHP}) * \frac{TD}{100{,}000}$$

Where:

CFM Reduction = 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 369 lists the assumptions and source of each assumption for the water heater measure savings calculations.

Table 369. *Ex Post* Variable Assumptions

INPUT	VALUE	SOURCE
GPD	Varies	IL TRM v11.0
EFFbase	80%	IL TRM v11.0
EFFEE	Varies	Equipment specifications
TD	Varies	Hot water setpoint is actual temperature the water heater operates at.

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.

$$therm\ savings = GPD * 365 * 8.3 * (\frac{1}{EFF_{base}} - \frac{1}{EFF_{EE}}) * \frac{TD}{100{,}000}$$

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 370 lists the assumptions and source of each assumption for the water heater measure savings calculations.

Table 370. *Ex Post* Variable Assumptions

INPUT	VALUE	SOURCE
GPD	Varies	IL TRM v11.0
EFFbase	80%	IL TRM v11.0
EFFEE	Varies	Equipment specifications
TD	Varies	Hot water setpoint is actual temperature the water heater operates at.

Appendix 13. C&I 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 C&I Online Marketplace program. The evaluation team examined each assumption behind the algorithms to capture savings and compared it against the IL v11.0 TRM, as well as other state and industry approaches.[78] 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
- Showerhead
- Pre-Rinse Spray Valve
- LED Bulbs
- Switch/Outlet Gaskets
- Smart Thermostat
- Pipe Insulation
- Foam Foil
- Door Sweep
- Air Purifier
- Hot Water Temperature Card

Advanced Power Strip Tier 1

The evaluation team used the following equations from the IL TRM v11.0 p. 851 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.

weeks/year = number of weeks per year = 52.2.

[78] Illinois Energy Efficiency Stakeholder Advisory Group. 2023 Illinois Statewide Technical Reference Manual for Energy Efficiency Version 11.0. Volume 2: Commercial and Industrial Measures. September 22, 2022.

ISR = in-service rate. The IL TRM v11.0 specifies ISRs for kit and direct install distributions, however 0.83 was used in the *ex ante* calculation with reference to the NIPSCO C&I Marketplace EM&V survey findings from PY 2022.

Table 371 lists the assumptions and source of each assumption for advanced power strip tier 1 measure savings calculations.

Table 371. *Ex Post* Variable Assumption for Advanced Power Strip Tier 1

INPUT	VALUE	SOURCE
kWwkday	0.0315	IL TRM v11.0 pg. 852
kWwkend	0.00617	IL TRM v11.0 pg. 852
hrswkday	106	IL TRM v11.0 pg. 852
hrswkend	62	IL TRM v10.0 pg. 852
hrswkdayopen	50	IL TRM v10.0 pg. 852
hrswkendopen	0	IL TRM v10.0 pg. 852
weeks/year	52.2	IL TRM v10.0 pg. 852
ISR	82%	2023 NIPSCO C&I Online Marketplace Survey

Kitchen and Bathroom Faucet Aerators, Pre Rinse Spray Valves

The evaluation team used the following equations from IL TRM v11.0 p. 187 to calculate electric energy, peak demand, and natural gas energy savings for low-flow kitchen and bathroom faucet aerators. Note that Pre Rinse Spray valve savings were calculated from the same equation, but are captured within a different measure, IL TRM v11.0 pg. 141.

$$\Delta kWh = ISR * \%ElectricDHW * \frac{GPM_{base} - GPM_{low\ flow}}{GPM_{base}} * Usage * EPG\ electric$$

$$\Delta kW = (kWh/Hours) * CF$$

$$\Delta therms = ISR * \%GasDHW * \left(GPM_{base} - \frac{GPM_{low\ flow}}{GPM_{base}}\right) * Usage * EPG\ gas$$

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 42% electric and 58% gas. *Ex post* utilized 48% electric and 52% 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 42% electric and 58% gas. *Ex post* utilized 48% electric and 52% gas.

GPM_{base} = gallons per minute of baseline faucet aerator or valve

$GPM_{low\text{-}flow}$ = gallons per minute of low-flow faucet aerator or valve

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 372 lists the assumptions and source of each assumption for kitchen and bathroom faucet aerator measure savings calculations.

Table 372. *Ex Post* Variable Assumption for Kitchen and Bathroom Faucet Aerators, Pre Rinse Spray Valve

INPUT	VALUE	SOURCE
GPM_{base} (Kitchen)	2.2	WI TRM 2023 (to provide differentiation between base and eff)
GPM_{base} (Bathroom)	1.39	IL TRM v11.0 pg. 188
GPM_{base} (Pre Rinse Valve)	1.23	IL TRM v11.0 pg. 141
$GPM_{low\text{-}flow}$ (Kitchen)	1.5	Specification for product distributed
$GPM_{low\text{-}flow}$ (Bathroom)	1.0	Specification for product distributed
$GPM_{low\text{-}flow}$ (Pre Rinse Valve)	0.68	IL TRM v11.0 pg. 141
ISR (Bathroom, Water Saver Kit)	88%	2023 NIPSCO C&I Online Marketplace Survey
ISR (Bathroom, Office Kit)	34%	2023 NIPSCO C&I Online Marketplace Survey
ISR (Kitchen, Water Saver Kit)	42%	2023 NIPSCO C&I Online Marketplace Survey
ISR (Kitchen, Office Kit)	34%	2023 NIPSCO C&I Online Marketplace Survey
ISR (Pre Rinse, Water Saver Kit)	33%	2023 NIPSCO C&I Online Marketplace Survey
% Electric DHW	48%	2023 NIPSCO C&I Online Marketplace Population
% Gas DHW	52%	2023 NIPSCO C&I Online Marketplace Population
Usage (Office)	2,500 gallons/yr.	IL TRM v11.0 pg. 189
Usage (Other, Water Saver Kit)	5,000 gallons/yr.	IL TRM v11.0 pg. 189

INPUT	VALUE	SOURCE
Usage (Pre Rinse, Water Saver Kit)	4,247 gallons/yr.	IL TRM v11.0 pg. 141. Calculated from 312 days per year usage, 1.3 hours per day usage (avg of small and medium business sizes)
EPG Electric (Kitchen)	0.105	IL TRM v11.0 pg. 189
EPG Electric (Bathroom)	0.088	IL TRM v11.0 pg. 189
EPG Gas (Kitchen) Therm/gal	0.0053	IL TRM v11.0 pg. 192
EPG Gas (Bathroom) Therm/gal	0.0044	IL TRM v11.0 pg. 192
Hours (Office)	20.41	IL TRM v11.0 pg. 191
Hours (Other, Water Saver Kit)	40.82	IL TRM v11.0 pg. 191
Hours/Day (Pre Rinse Spray Valve)	1.3	IL TRM v11.0 pg. 141. usage (avg hours of use per day of small and medium business sizes)
CF (Office)	0.0064	IL TRM v11.0 pg. 192
CF (Other, Water Saver Kit)	0.0128	IL TRM v11.0 pg. 192

Low-Flow Showerhead

The evaluation team used the following equations from IL TRM v11.0 Vol 2, p. 195 to calculate electric energy, peak demand, and natural gas energy savings for low flow showerheads:

$$\Delta kWh = ISR * \%ElecDHW * ((GPM_{base} * L\_Base) - (GPM_{Low} * L_{Low}) * NSPD * 365.25) * \ EPG\ Elec$$

$$\Delta kW = (kWh/Hours) * CF$$

$$\Delta therms = ISR * \%GasDHW * ((GPM_{base} * L\_Base) - (GPM_{Low} * L_{Low}) * NSPD * 365.25) * \ EPG\ Gas$$

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 42% electric and 58% gas. *Ex post* utilized 48% electric and 52% 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 42% electric and 58% gas. *Ex post* utilized 48% electric and 52% gas.

GPM_{base} = gallons per minute of baseline showerhead, 2.5 gpm

$GPM_{low\text{-}flow}$ = gallons per minute of low-flow showerhead, actual

L_base = Shower length in minutes with baseline showerhead, 8.2 min

L_low = Shower length in minutes with low flow showerhead, 8.2 min

NSPD = Estimated number of showers taken per day for one showerhead, 3

365.25	=	Average days per year
EPG Electric	=	energy per gallon of mixed water used by showerhead, 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 showerhead, 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 showerhead use, dependent on space type.
CF	=	Coincidence factor, 0.0278

Table 373 lists the assumptions and source of each assumption for kitchen and bathroom faucet aerator measure savings calculations.

Table 373. *Ex Post* Variable Assumption for Kitchen and Bathroom Faucet Aerators, Pre Rinse Spray Valve

INPUT	VALUE	SOURCE
GPM_{base}	2.5	IL TRM v11.0 Vol 2, p. 195
$GPM_{low\text{-}flow}$	1.5	IL TRM v11.0 Vol 2, p. 195
L_Base and L_Low	8.2 minutes	IL TRM v11.0 Vol 2, p. 195
ISR	10%	2023 NIPSCO C&I Online Marketplace Survey
% Electric DHW	48%	2023 NIPSCO C&I Online Marketplace Population
% Gas DHW	52%	2023 NIPSCO C&I Online Marketplace Population
NSPD	3 shower/day	IL TRM v11.0 Vol 2, p. 195
EPG Electric	0.125	IL TRM v11.0 Vol 2, p. 195
EPG Gas	0.006254	IL TRM v11.0 Vol 2, p. 195
Hours	253.38	IL TRM v11.0 Vol 2, p. 195
Hours/Day (Pre Rinse Spray Valve)	1.3	IL TRM v11.0 pg. 141. usage (avg hours of use per day of small and medium business sizes)
CF	0.0278	IL TRM v11.0 Vol 2, p. 195

LED Bulbs, LED Exit Sign and LED Desk Lamp

The evaluation team used the following equations from the IL TRM v11 vol 2, pg. 635 to calculate electric energy and peak demand savings, as well as natural gas energy penalties, for all LED bulbs. Note that exterior installed bulbs and fixtures do not have waste heat penalties applied, as they have no impact on heating and cooling.

$$\Delta kWh = \Delta kWh_{Elec} + ((1 - FS_{Gas}) * \Delta kWh_{Heating\ Penalty})$$

$$\Delta kWh_{Elec} = \frac{(W_{base} - W_{LED}) * (ISR * Hours) * (WHF_e)}{1{,}000}$$

Heating Penalty for electrically heated spaces:

$$\Delta kWh_{Heating\ Penalty} = \frac{(W_{base} - W_{LED}) * (ISR * Hours) * (-IFkWh)}{1{,}000}$$

Heating Penalty for fossil fuel heated spaces, or if unknown:

$$\Delta therms = FS_{GAS} * \frac{(W_{base} - W_{LED}) * (ISR * Hours) * (-IFTherms_{\square})}{1{,}000}$$

Demand Savings:

$$\Delta kW_{\square} = \frac{(W_{base} - W_{LED}) * Coincidence\ Factor * ISR * (WHF_d)}{1{,}000}$$

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	=	Waste heat factor for energy to account for HVAC interactions with lighting
WHF_d	=	Waste heat factor for demand to account for HVAC interactions with lighting
$IFKWH_{ELEC\ HEAT}$	=	Waste heat factor for energy to account for HVAC interactions with lighting
$IFTherms_{GAS\ HEAT}$	=	Waste heat factor for demand 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 374 lists the input assumptions and source of each assumption for the LED measure savings calculations.

Table 374. *Ex Post* Variable Assumptions for LEDS

INPUT	VALUE	SOURCE
FS_{Gas}	89%	2023 NIPSCO C&I Online Marketplace population data
W_{base} for Desk	25	IL TRM v11.0
W_{base} for Exit Sign Retrofit	7	IL TRM v11.0
W_{base} for LED Tube Pack	28.2	IL TRM v11.0
W_{base} for 2X4 Edge Lit LED Flat Panel, 45W (85W Equivalent)	84.5	IL TRM v11.0

INPUT	VALUE	SOURCE
W_{base} for 2X2 Edge Lit LED Flat Panel, 30W (57W Equivalent)	57	IL TRM v11.0
W_{base} for Wall Pack 29W (57W Equivalent)	113.6	IL TRM v11.0
W_{base} for Wall Pack 55W (120W Equivalent)	198.9	IL TRM v11.0
W_{base} for Wall Pack 80W (180W Equivalent)	284.1	IL TRM v11.0
W_{base} for 4-Pack 14W LED T8 Type A Tube 4000k AL+PC	28.2	IL TRM v11.0
W_{base} for LED Corn Bulb (36W) Replace 100W MH	113.6	IL TRM v11.0
W_{base} for LED Corn Bulb (54W) Replace 175W MH	198.9	IL TRM v11.0
W_{base} for LED Corn Bulb (100W) Replace 250W MH	284.1	IL TRM v11.0
W_{LED} for Desk	3.5	Actual installed wattage
W_{LED} for Exit Sign Retrofit	2.4	Actual installed wattage
W_{LED} for LED Tube Pack	16	Actual installed wattage
W_{LED} for 2X4 Edge Lit LED Flat Panel, 45W (85W Equivalent)	45	Actual installed wattage
W_{LED} for 2X2 Edge Lit LED Flat Panel, 30W (57W Equivalent)	30	Actual installed wattage
W_{LED} for Wall Pack 29W (57W Equivalent)	29	Actual installed wattage
W_{LED} for Wall Pack 55W (120W Equivalent)	55	Actual installed wattage
W_{LED} for Wall Pack 80W (180W Equivalent)	80	Actual installed wattage
W_{LED} for 4-Pack 14W LED T8 Type A Tube 4000k AL+PC	14	Actual installed wattage
W_{LED} for LED Corn Bulb (36W) Replace 100W MH	36	Actual installed wattage
W_{LED} for LED Corn Bulb (54W) Replace 175W MH	54	Actual installed wattage
W_{LED} for LED Corn Bulb (100W) Replace 250W MH	100	Actual installed wattage
Hours (Office)	3088	IL TRM v11.0
Hours (Exit signs)	8760	IL TRM v11.0
Hours (Unknown)	3379	IL TRM v11.0
Hours (Exterior installed)	4304	IL TRM v11.0
$WHF_{e\ Electric\ AC}$	1.1	IL TRM v11.0

INPUT	VALUE	SOURCE
	1.08	Sequentially Office, unknown
$WHF_{d\ demand\ AC}$	1.26	IL TRM v11.0
	1.3	Sequentially Office, unknown
$WHF_{e\ Electric\ Heat}$	1	IL TRM v11.0
	0.93	Sequentially Office, unknown
$WHF_{g\ Gas\ Heat}$	-0.01	IL TRM v11.0
	-0.015	Sequentially Office, unknown
Coincidence Factor (Desk Lamp, Office)	0.52	IL TRM v11.0
Coincidence Factor (Exit Signs)	1.0	IL TRM v11.0
Coincidence Factor (Interior hardwired overhead, office)	0.67	IL TRM v11.0
Coincidence Factor (Exterior bulbs)	0	IL TRM v11.0
ISR (Linear LED), and all pack LEDs	82.5%	IL TRM v11.0. 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	98%	IL TRM v11.0. 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)	33%	2022 NIPSCO C&I Online Marketplace customer survey
ISR (Desk Lamp)	69%	2022 NIPSCO C&I Online Marketplace customer survey

Smart Thermostat

The evaluation team used the following equations from IL TRM v11.0 Vol II 4.4.48 pg. 521, 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 v11.0 Pg. 523

$Kbtu/Hr_{cool}$ = 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 375 lists the input assumptions and source of each assumption for the smart thermostat measure savings calculations.

Table 375. *Ex Post* Variable Assumptions for Smart Thermostats

INPUT	VALUE	SOURCE
$\%Elec_{Heat}$	0 for gas heating 1 for electric heating	IL TRM v11.0 Vol III pg. 522
$kBTU/Hr_{Heat}$	87	87, defined by WI TRM 2020 Pg. 250 for small sized commercial packaged system
$HSPF_{Base}$	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 v11.0 Pg. 523
F_e	7.7%	IL TRM v11.0 Pg. 523
$Kbtu/Hr_{cool}$	61 or 0	IL TRM v11.0 Pg. 523 for AC, 0 for no AC installed or gas only customer
SEER	13	IL TRM v11.0 Pg. 523, If unknown actual, use code base
$EFLH_{Cool}$	711	IN TRM 2015 Pg. 230, SB Location, Other
Cooling_Reduction	17.7%	IL TRM v11.0 Pg. 523
BAF	0.8	IL TRM v11.0 Pg. 524

Switch/Outlet Gaskets

The team used the following deemed values shown in Table 376 from IL TRM v11.0 Vol III 5.6.1 Res Air Sealing measure p. 367 to calculate energy savings for this product.

Table 376. *Ex Post* Deemed Values for Switch/Outlet Gaskets

INPUT	VALUE	SOURCE
ISR	0.38	2023 NIPSCO C&I Online Marketplace Survey
Deemed kWh Savings Per Unit	1.2	IL TRM v11.0 Vol III 5.6.1 p. 367
Deemed kW Savings Per Unit	0.00006	IL TRM v11.0 Vol III 5.6.1 p. 367
Deemed therms Savings Per Unit	0.47	IL TRM v11.0 Vol III 5.6.1 p. 367

Air Purifier

The team used the following equation from IL TRM v11.0 p. 6 to calculate electric energy savings and peak demand savings for air purifiers:

$$\Delta kWh = kWh\_base - kWh\_eff$$

$$kWh\_base = hours * SmokeCADR_{base}/(SmokeCADR_{perwatt_{base}} * 1000)) + (8760 - hours) * PartialOnModePower\_base/1000)$$

$$kWh\_eff = hours * SmokeCADR_{Eff}/(SmokeCADR_{perwatt_{Eff}} * 1000)) + (8760 - hours) * PartialOnModePower\_eff/1000)$$

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

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 377 lists the input assumptions and source of each assumption for the air purifier measure savings calculations.

Table 377. *Ex Post* Variable Assumptions for Air Purifiers

INPUT	VALUE	SOURCE
SmokeCADR_base	254 Watts (Small) 376 Watts (Med) 470 Watts (Large)	ENERGY STAR product qualification comparison
SmokeCADR_eff	190.57 Watts (Small) 282 Watts (Med) 352.55 Watts (Large)	Actual unit specification
SmokeCADR_per_watt_base	1.64 (Small) 1.83 (Med) 1.94 (Large)	IL TRM v11.0 for CADR range
SmokeCADR_per_watt_eff	1.9 (Small) 3.1 (Med) 3.9 (Large)	Actual unit specification
PartialOnModePower_base	2.0	IL TRM v11.0
PartialOnModePower_eff	0.21 (Small) 0.48 (Med) 1.25 (Large)	Actual
Hours	5840	IL TRM v11.0
CF	0.667	IL TRM v11.0

Pipe Insulation

The team used the following deemed values shown in Table 378 from IL TRM v11.0 Vol III p. 313 to calculate energy savings for this product.

Table 378. *Ex Post* Deemed Values for Pipe Insulation

INPUT	VALUE	SOURCE
ISR (Kits)	0.42	2023 NIPSCO C&I Online Marketplace Survey
ISR (Non Kit Distribution)	0.95	IL TRM v11.0 Vol II p. 313
Total linear feet	5 Feet	Actual 15 feet, but given wrapping, effective linear feet assumed to be approximately 5 feet
Deemed (Therms/Yr./Ft)	5.02	IL TRM v11.0 Vol II p. 313
% Gas DHW	52%	2023 NIPSCO C&I Online Marketplace Population

Foam Foil

The team used the following deemed values shown in Table 379 from IL TRM v11.0 Vol I 4.4.43 Packaged RTU Sealing measure p. 476 to calculate energy savings for this product.

Table 379. *Ex Post* Deemed Values for Foam Foil

INPUT	VALUE	SOURCE
ISR	1.0	Non-Kit distribution, engineering assumption
kBtu/Hr capacity of RTU	150	Assumption of typical commercial small business sized equipment
Efficiency of baseline unit	80%	TRM v11.0 Vol I 4.4.43
EFLH Heat	979	TRM v11.0 Vol I 4.4.43, Chicago
Deemed Savings % based on space type	1.91%	TRM v11.0 Vol I 4.4.43, using Retail Department Store, Chicago

Door Sweep

The team used the following deemed values shown in Table 380 from IL TRM v11.0 Vol II 5.6.1 Res Air Sealing measure p. 367 to calculate energy savings for this product.

Table 380. *Ex Post* Deemed Values for Door Sweep

INPUT	VALUE	SOURCE
ISR	0.95	Non-Kit distribution, engineering assumption
Deemed therms Savings Per Unit	9.13	IL TRM v11.0 Vol II 5.6.1 p. 367

Hot Water Temperature Card

The team used the following deemed values shown in Table 381 from IL TRM v11.0 Vol III 5.4.6 Water Heat Temperature Setback measure p. 276 to calculate energy savings for this product.

Table 381. *Ex Post* Deemed Values for Hot Water Temperature Card

INPUT	VALUE	SOURCE
ISR	10%	IL TRM v11.0 Vol III 5.4.6. Pg 276. Value is incorporated into the deemed savings value rather than applied separately
Deemed therms Savings Per Unit for Kit Programs	0.130	IL TRM v11.0 Vol III 5.4.6. Pg 276.

Freeridership and Spillover Analysis

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 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 382).

Table 382. 2023 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 383 shows *intention* freeridership score for each surveyed measure.

Table 383. 2023 C&I Online Marketplace Program Intention Freeridership by Measure

MEASURE	INTENTION FREERIDERSHIP SCORE
Desk Lamp (n=46)	28%
Pre-rinse Spray Valve (n=16)	19%
Fixed Showerhead (n=9)	25%
Bathroom Aerator (n=25)	14%
Kitchen Aerator (n=24)	21%
Hot Water Temp card (n=25)	7%
Pipe Insulation (n=17)	44%
Advanced Power Strip (n=47)	43%
Fridge Thermometer (n=29)	38%

MEASURE	INTENTION FREERIDERSHIP SCORE
Switch/Outlet Gaskets (n=29)	26%
LED Exit Sign Retrofit (Red) (n=28)	35%

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 384.

Table 384. 2023 C&I Online Marketplace Program Influence 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 385 shows *influence* freeridership score for each surveyed measure.

Table 385. 2023 C&I Online Marketplace Program Influence Freeridership by Measure

MEASURE	INFLUENCE FREERIDERSHIP SCORE
Desk Lamp (n=46)	3%
Pre-rinse Spray Valve (n=16)	1%
Fixed Showerhead (n=9)	3%
Bathroom Aerator (n=25)	2%
Kitchen Aerator (n=24)	6%
Hot Water Temp card (n=25)	2%
Pipe Insulation (n=17)	1%
Advanced Power Strip (n=47)	3%
Fridge Thermometer (n=29)	2%
Switch/Outlet Gaskets (n=29)	1%
LED Exit Sign Retrofit (Red) (n=28)	4%

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 386 lists the *intention*, *influence*, and final freeridership scores for the 2023 C&I Online Marketplace program.

Table 386. 2023 C&I Online Marketplace Program Freeridership Score by Measure

MEASURE	INTENTION SCORE	INFLUENCE SCORE	FINAL SCORE
Desk Lamp (n=46)	28%	3%	16%
Pre-rinse Spray Valve (n=16)	19%	1%	10%
Fixed Showerhead (n=9)	25%	3%	14%
Bathroom Aerator (n=25)	14%	2%	8%
Kitchen Aerator (n=24)	21%	6%	14%
Hot Water Temp card (n=25)	7%	2%	5%
Pipe Insulation (n=17)	44%	1%	23%
Advanced Power Strip (n=47)	43%	3%	23%
Fridge Thermometer (n=29)	38%	2%	20%
Switch/Outlet Gaskets (n=29)	26%	1%	14%
LED Exit Sign Retrofit (Red) (n=28)	35%	4%	20%

Participant Spillover

The evaluation team estimated participant spillover measure savings using specific information about participants collected through surveys and using the IL TRM v11.0 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. [79] The participant spillover estimate for the 2023 C&I Online Marketplace program is 0%, rounded to the nearest whole percent, shown in Table 387.

Table 387. 2023 C&I Online Marketplace Program Participant Spillover Results

MEASURE	SPILLOVER SAVINGS (MMBTU)	PARTICIPANT PROGRAM SAVINGS (MMBTU)	PARTICIPANT SPILLOVER
Total Program	2.6	3,148.9	0%

[79] The spillover measures attributed to the program are LEDs that did not receive a program rebate.