ILLUME

PROJECT:

2021 DSM Portfolio Evaluation Report

June 15, 2022

PROJECT SPONSOR:

NIPSCO

PREPARED BY:

ILLUME Advising, LLC

With subcontractors:

The Cadmus Group, LLC

Optimal Energy, Inc.

ACKNOWLEDGMENTS

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

For this effort, we would like to acknowledge, first and foremost, Robbie Sears, Jennifer Staciwa, Alison Becker, Ryan Tedeschi, Susan Bantz, Greg Berning, Michele Abrell, and Matthew Kearns. We would also like to recognize the dedicated work of The Cadmus Group and Optimal Energy. Finally, we would like to acknowledge the ILLUME team members Lisa Obear, Laura Schauer, and Becca Cevilla.

PREPARED FOR:

NIPSCO
801 East 86th Avenue
Merrillville, IN 46410

PREPARED BY:

ILLUME Advising, LLC
440 Science Drive, Suite 202
Madison, WI 53711

CONTACT:

Lisa LeBeau Obear
Managing Director, ILLUME Advising, LLC
lisa@illumeadvising.com

Laura Schauer
Vice President, ILLUME Advising, LLC
laura@illumeadvising.com

Table of Contents

PORTFOLIO PERFORMANCE AND INSIGHTS 7
SAVINGS ACHIEVEMENTS 10
SUMMARY OF RECOMMENDATIONS 23
1. PROGRAM OFFERINGS 33
2. EVALUATION OBJECTIVES AND METHODOLOGY 36
3. ENERGY EFFICIENCY (HVAC) REBATES PROGRAM 45
PROGRAM DESIGN AND DELIVERY 45
PROGRAM PERFORMANCE 46
EVALUATION METHODOLOGY 47
IMPACT EVALUATION 48
PROCESS EVALUATION 60
CONCLUSIONS AND RECOMMENDATIONS 61
4. RESIDENTIAL LIGHTING PROGRAM 65
5. HOME ENERGY ASSESSMENT (HEA) PROGRAM 74
PROGRAM DESIGN AND DELIVERY 74
PROGRAM PERFORMANCE 76
EVALUATION METHODOLOGY 77
IMPACT EVALUATION 77
PROCESS EVALUATION 95
CONCLUSIONS AND RECOMMENDATIONS 114
6. INCOME-QUALIFIED WEATHERIZATION (IQW) PROGRAM 117
PROGRAM DESIGN AND DELIVERY 117
PROGRAM PERFORMANCE 118
EVALUATION METHODOLOGY 120
IMPACT EVALUATION 120
PROCESS EVALUATION 131
CONCLUSIONS AND RECOMMENDATIONS 143
7. MULTIFAMILY DIRECT INSTALL (MFDI) PROGRAM 147
PROGRAM DESIGN AND DELIVERY 147
PROGRAM PERFORMANCE 148
EVALUATION METHODOLOGY 149
IMPACT EVALUATION 149
CONCLUSIONS AND RECOMMENDATIONS 154
8. APPLIANCE RECYCLING PROGRAM 155
PROGRAM DESIGN AND DELIVERY 155
PROGRAM PERFORMANCE 156
EVALUATION METHODOLOGY 157
IMPACT EVALUATION 157
PROCESS EVALUATION 165
CONCLUSIONS AND RECOMMENDATIONS 166
9. BEHAVIORAL PROGRAM 168
PROGRAM DESIGN AND DELIVERY 168

PROGRAM PERFORMANCE 169
EVALUATION METHODOLOGY 170
IMPACT EVALUATION 170
PROCESS EVALUATION 175
CONCLUSIONS AND RECOMMENDATIONS 187
10. RESIDENTIAL NEW CONSTRUCTION PROGRAM 189
PROGRAM DESIGN AND DELIVERY 189
PROGRAM PERFORMANCE 190
EVALUATION METHODOLOGY 191
IMPACT EVALUATION 191
PROCESS EVALUATION 199
CONCLUSIONS AND RECOMMENDATIONS 200
11. SCHOOL EDUCATION PROGRAM 203
PROGRAM PERFORMANCE 204
EVALUATION METHODOLOGY 205
IMPACT EVALUATION 205
PROCESS EVALUATION 216
CONCLUSIONS AND RECOMMENDATIONS 221
12. HOMELIFE ENERGY EFFICIENCY CALCULATOR PROGRAM 223
PROGRAM DESIGN AND DELIVERY 223
PROGRAM PERFORMANCE 223
EVALUATION METHODOLOGY 224
IMPACT EVALUATION 225
PROCESS EVALUATION 238
CONCLUSIONS AND RECOMMENDATIONS 244
13. EMPLOYEE EDUCATION PROGRAM 246
PROGRAM DESIGN AND DELIVERY 246
PROGRAM PERFORMANCE 246
EVALUATION METHODOLOGY 248
IMPACT EVALUATION 248
CONCLUSIONS AND RECOMMENDATIONS 258
14. RESIDENTIAL ONLINE MARKETPLACE PROGRAM 259
PROGRAM DESIGN AND DELIVERY 259
PROGRAM PERFORMANCE 260
EVALUATION METHODOLOGY 261
IMPACT EVALUATION 261
PROCESS EVALUATION 287
CONCLUSIONS AND RECOMMENDATIONS 302
15. COMMERCIAL AND INDUSTRIAL (C&I) PROGRAMS 306
PROGRAM DESIGN AND DELIVERY 306
PROGRAM PERFORMANCE 307
EVALUATION METHODOLOGY 310
IMPACT EVALUATION 310
PROCESS EVALUATION 337

CONCLUSIONS AND RECOMMENDATIONS 354
16. COMMERCIAL AND INDUSTRIAL (C&I) ONLINE MARKETPLACE PROGRAM 358
PROGRAM DESIGN AND DELIVERY 358
PROGRAM PERFORMANCE.. 359
EVALUATION METHODOLOGY.. 360
IMPACT EVALUATION 361
PROCESS EVALUATION 376
CONCLUSIONS AND RECOMMENDATIONS 387
APPENDIX.. 392
APPENDIX 1: ENERGY EFFICIENCY (HVAC) REBATES PROGRAM 393
APPENDIX 2: RESIDENTIAL LIGHTING PROGRAM.. 410
APPENDIX 3: HOME ENERGY ASSESSMENT (HEA) PROGRAM 415
APPENDIX 4: INCOME-QUALIFIED WEATHERIZATION (IQW) PROGRAM 434
APPENDIX 5: MULTIFAMILY DIRECT INSTALL (MFDI) PROGRAM 445
APPENDIX 6: APPLIANCE RECYCLING PROGRAM 449
APPENDIX 7: BEHAVIORAL PROGRAM 455
APPENDIX 8: RESIDENTIAL NEW CONSTRUCTION PROGRAM.. 456
APPENDIX 9: SCHOOL EDUCATION PROGRAM 460
APPENDIX 10: HOMELIFE CALCULATOR PROGRAM.. 468
APPENDIX 11: EMPLOYEE EDUCATION PROGRAM 480
APPENDIX 12: RESIDENTIAL ONLINE MARKETPLACE (OLM) PROGRAM 488
APPENDIX 13: COMMERCIAL AND INDUSTRIAL (C&I) PROGRAM.. 502
APPENDIX 14: COMMERCIAL AND INDUSTRIAL (C&I) ONLINE MARKETPLACE PROGRAM 541

LIST OF ACRONYMS AND ABBREVIATIONS

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

EXECUTIVE SUMMARY

NIPSCO's demand-side management (DSM) portfolio contains twelve residential programs and five 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 108,179,999 kWh *ex post* gross electric energy savings, 15,929 kW *ex post* gross peak demand reduction, and 4,537,993 therms *ex post* gross natural gas energy savings. Considering *ex post* gross savings, the residential portfolio exceeded all electric energy, peak demand reduction, and natural gas energy goals for 2021. The C&I portfolio did not meet its electric energy, peak demand reduction, and natural gas energy goals.

PORTFOLIO PERFORMANCE AND INSIGHTS

Thousands of residential and C&I customers participated in NIPSCO's DSM programs in 2021. NIPSCO's portfolio included similar programs as offered in 2020. Adapting to the COVID-19 pandemic, several programs continued to adjust their program design or delivery to accommodate changing customer needs, and several programs resumed operation in mid-late 2021 after being paused during 2020. Additionally, NIPSCO fully launched both the Residential and C&I Online Marketplaces in 2021.

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

The next two pages summarize savings impacts, spending, and key accomplishments for the residential and C&I portfolios. As the summaries show, NIPSCO's residential programs performed well against 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 Optimal.

RESIDENTIAL SECTOR

- The Residential portfolio had a relatively successful year in 2021, despite challenges raised by the COVID-19 pandemic.
- Overall, electric portfolio performance was driven by the Behavioral and Lighting programs. Gas program performance was driven by the Behavioral and HVAC Rebates programs.
- Realization rates varied by program; net-to-gross factors remained relatively consistent across time.

	Electric Savings (KWH)	Peak Demand Reduction (KW)	Natural Gas Savings (Therms)
Goal	50,917,243	5,838	3,068,743
Ex Ante	46,916,992	4,180	4,039,863
Audited	46,915,871	4,179	4,039,313
Verified	45,152,096	3,916	4,009,270
Ex Post Gross	51,409,843	7,521	3,348,171
Ex Post Net	36,920,714	5,106	2,853,372

	Electric	Peak Demand	Natural Gas
Ex Post Gross Achieved to Gross Goal	101%	129%	109%
Realization Rate	110%	180%	83%

Budget

Electric and Peak Demand	
Budget	8,321,941
Expenditures	6,407,695

Spent 77%

Natural Gas	
Budget	3,939,873
Expenditures	3,285,100

Spent 83%

COMMERCIAL & INDUSTRIAL SECTOR

- 2021 was a challenging year for the C&I portfolio, with the COVID-19 pandemic continuing to impact C&I customers. The C&I portfolio did not meet it's goals across all fuel types.
- However, the evaluation team found realization rates close to 100% across most programs, indicating alignment between the implementation and evaluation teams in estimating savings.
- Net-to-gross factors also remained relatively consistent across time.

	Electric Savings (KWH)	Peak Demand Reduction (KW)	Natural Gas Savings (Therms)
Goal	108,890,133	20,105	1,768,951
Ex Ante	54,784,265	7,545	1,198,716
Audited	54,848,913	7,527	1,196,973
Verified	54,518,526	7,473	1,192,521
Ex Post Gross	56,770,157	8,408	1,189,821
Ex Post Net	45,397,490	6,590	878,218

	Electric	Peak Demand	Natural Gas
Ex Post Gross Achieved to Gross Goal	52%	42%	67%
Realization Rate	104%	111%	99%

Budget

Electric and Peak Demand	
Budget	13,395,378
Expenditures	6,789,290

Spent 51%

Natural Gas	
Budget	2,350,931
Expenditures	1,599,052

Spent 68%

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 2021 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 2021 goals, program performance varied widely across individual programs. Some of this variation was due to several programs remaining on pause in early to mid-2021 due to the COVID-19 pandemic and resulting social distancing requirements, which made some existing program designs difficult, if not impossible, to implement. In 2020, programs that required face-to-face interaction, such as the Appliance Recycling program and the Direct Install programs, were either put on hold or adjusted to allow for safe interactions with customers, and many of these adjustments continued into 2021.

Other challenges—such as business disruptions due to COVID-19—continued to affect the C&I programs, which resulted in lower-than-expected savings. Finally, NIPSCO introduced two new programs in late 2020 – both a Residential and C&I Marketplace. Both programs launched at the end of 2020 and ramped up considerably in 2021.

TABLE 1. 2021 PORTFOLIO ELECTRIC GOAL ACHIEVEMENT

PROGRAM	ELECTRICITY			DEMAND		
	GROSS ELECTRIC SAVINGS GOAL (KWH)	*EX POST* GROSS ELECTRIC SAVINGS (KWH)	SHARE OF ELECTRIC GOAL ACHIEVED (%)	GROSS PEAK DEMAND REDUCTION GOAL (KW)	*EX POST* GROSS PEAK DEMAND REDUCTION (KW)	SHARE OF PEAK DEMAND GOAL ACHIEVED (%)
Residential Programs						
HVAC Rebates	2,013,129	989,191	49%	1,910	1,125	59%
Lighting	16,502,239	19,839,757	120%	2,215	2,702	122%
Home Energy Analysis	314,172	154,248	49%	72	37	52%
Appliance Recycling	2,267,260	1,471,964	65%	534	231	43%
School Education	2,236,025	2,066,563	92%	200	163	82%
Multifamily Direct Install	850,863	137,099	16%	106	12	11%
Behavioral	22,795,943	24,951,917	109%	0	2,848	n/a
New Construction	926,394	161,476	17%	248	71	28%
Home Life EE Calculator	243,176	40,332	17%	25	4	14%
Employee Education	230,067	5,443	2%	23	1	3%
IQW	591,708	71,946	12%	131	18	14%
Online Marketplace	1,946,267	1,519,906	78%	375	309	82%
Total Residential	**50,917,243**	**51,409,843**	101%	**5,838**	**7,521**	129%
Commercial & Industrial Programs						

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 (%)
Prescriptive	43,020,090	26,246,826	61%	12,722	4,132	32%
Custom	43,399,212	13,043,674	30%	4,569	1,123	25%
New Construction	14,240,000	12,460,474	88%	1,475	2,174	147%
Small Business Direct Install	3,712,917	2,133,268	57%	384	244	64%
Online Marketplace	4,517,914	2,885,914	64%	955	734	77%
Total Commercial & Industrial	**108,890,133**	**56,770,157**	**52%**	**20,105**	**8,408**	**42%**
Total 2021 Portfolio	159,807,376	108,179,999	68%	25,943	15,929	61%

TABLE 2. 2021 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			
HVAC Rebates	1,357,006	925,519	68%
Lighting	n/a	n/a	n/a
Home Energy Analysis	30,389	14,176	47%
Appliance Recycling	n/a	n/a	n/a
School Education	94,648	91,824	97%
Multifamily Direct Install	58,933	0[a]	0%
Behavioral	948,398	2,001,404	211%
New Construction	319,653	254,563	80%
Home Life EE Calculator	13,656	1,894	14%
Employee Education	14,273	293	2%
IQW	120,785	16,044	13%
Online Marketplace	111,003	42,454	38%
Total Residential	**3,068,743**	**3,348,171**	**109%**
Commercial & Industrial Programs			
Prescriptive	125,000	23,677	19%
Custom	895,104	624,668	70%
New Construction	557,588	533,233	96%
Small Business Direct Install	158,763	4,266	3%
Online Marketplace	32,496	3,978	12%
Total Commercial & Industrial	**1,768,951**	**1,189,821**	**67%**
Total 2021 Portfolio	4,837,694	4,537,993	94%

[a]There was only one MFDI project and they did not have natural gas service.

TABLE 3 THROUGH

Table 5 show the electric energy, peak demand reduction, and natural gas energy savings achieved by each program in the 2021 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 106% of electric energy, 136% of demand, and 87% of therms savings. Program-level realization rates varied for reasons described in the individual chapters.

TABLE 3. 2021 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							
HVAC Rebates	1,245,292	1,245,189	1,245,189	989,191	79%	60%	594,237
Lighting	12,057,992	12,057,992	11,066,689	19,839,757	165%	36%	7,201,787
Home Energy Analysis	167,701	167,701	146,559	154,248	92%	72%	110,970
Appliance Recycling	1,861,998	1,861,816	1,861,816	1,471,964	79%	56%	827,293
School Education	2,239,641	2,239,584	2,261,820	2,066,563	92%	88%	1,817,653
Multifamily Direct Install	160,078	160,078	132,826	137,099	86%	100%	137,099
Behavioral	24,951,917	24,951,917	24,951,917	24,951,917	100%	100%	24,951,917
New Construction	443,672	443,672	443,672	161,476	36%	54%	87,197
Home Life EE Calculator	60,674	60,674	55,408	40,332	66%	93%	37,631
Employee Education	8,181	8,181	7,484	5,443	67%	93%	5,079
IQW	81,230	81,230	74,690	71,946	88%	100%	71,946
Online Marketplace	3,638,617	3,637,837	2,904,027	1,519,906	42%	71%	1,077,907
Total Residential	46,916,992	46,915,871	45,152,096	51,409,843	110%	72%	36,920,714
C&I Programs							
Prescriptive	24,520,710	24,520,613	24,520,710	26,246,826	107%	85%	22,309,802
Custom	13,028,454	13,028,454	12,864,586	13,043,674	100%	90%	11,739,307
New Construction	12,091,408	12,156,151	12,155,674	12,460,474	103%	54%	6,728,656
Small Business Direct Install	2,114,881	2,114,880	2,114,892	2,133,268	101%	94%	2,005,272
Online Marketplace	3,028,813	3,028,816	2,862,663	2,885,914	95%	91%	2,614,453
Total C&I	54,784,265	54,848,913	54,518,526	56,770,157	104%	80%	45,397,490
Total 2021 Portfolio	101,701,257	101,764,785	99,670,622	108,179,999	106%	76%	82,318,204

TABLE 4. 2021 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							
HVAC Rebates	1,216	1,215	1,215	1,125	93%	60%	674
Lighting	1,631	1,631	1,496	2,702	166%	36%	981
Home Energy Analysis	41	41	37	37	91%	79%	29
Appliance Recycling	294	294	294	231	78%	56%	130
School Education	200	204	218	163	81%	82%	134
Multifamily Direct Install	12	12	11	12	98%	100%	12
Behavioral	-	-	-	2,848	n/a	100%	2,848
New Construction	124	124	124	71	57%	54%	38
Home Life EE Calculator	6	6	5	4	58%	92%	3
Employee Education	1	1	1	1	97%	98%	1
IQW	22	22	20	18	83%	100%	18
Online Marketplace	633	629	495	309	49%	77%	237
Total Residential	**4,180**	**4,179**	**3,916**	**7,521**	**180%**	**68%**	**5,106**
Commercial & Industrial Programs							
Prescriptive	3,758	3,706	3,706	4,132	110%	85%	3,513
Custom	979	983	974	1,123	115%	90%	1,011
New Construction	1,998	2,005	2,005	2,174	109%	54%	1,174
Small Business Direct Install	186	186	186	244	131%	94%	230
Online Marketplace	623	647	602	734	118%	90%	663
Total Commercial & Industrial	7,545	7,527	7,473	8,408	111%	78%	6,590
Total 2021 Portfolio	11,725	11,706	11,389	15,929	136%	73%	11,696

TABLE 5. 2021 PORTFOLIO NATURAL GAS SAVINGS

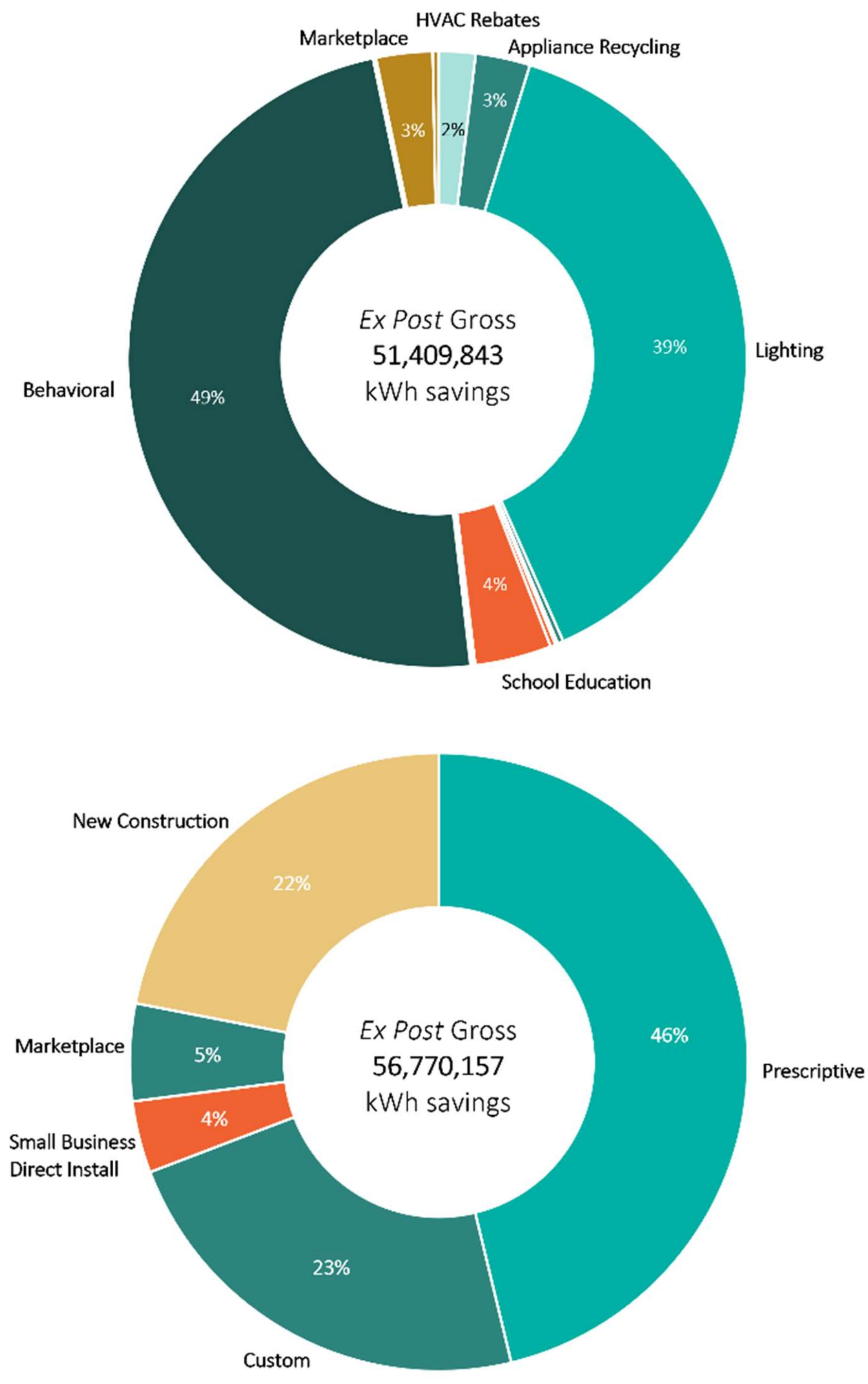
PROGRAM	REPORTED NATURAL GAS SAVINGS (THERMS)			EVALUATED NATURAL GAS SAVINGS (THERMS)			
	EX ANTE	AUDITED	VERIFIED	*EX POST* GROSS	REALIZATION RATE (%)	NTG RATIO (%)	*EX POST* NET
Residential Programs							
HVAC Rebates	1,500,190	1,500,190	1,500,190	925,519	62%	59%	549,368
Lighting	n/a	n/a	n/a	n/a	n/a	n/a	n/a
Home Energy Analysis	13,633	13,633	13,392	14,176	104%	89%	12,634
Appliance Recycling	n/a	n/a	n/a	n/a	n/a	n/a	n/a
School Education	94,956	94,995	91,763	91,824	97%	104%	95,502
Multifamily Direct Install	-	-	-	-	n/a	n/a	-
Behavioral	2,001,404	2,001,404	2,001,404	2,001,404	100%	100%	2,001,404
New Construction	289,669	289,669	289,669	254,563	88%	54%	137,464
Home Life EE Calculator	4,118	4,118	3,393	1,894	46%	100%	1,892
Employee Education	639	639	528	293	46%	100%	293
IQW	16,225	16,225	15,264	16,044	99%	100%	16,044
Online Marketplace	119,028	118,439	93,667	42,454	36%	91%	38,770
Total Residential	4,039,863	4,039,313	4,009,270	3,348,171	83%	85%	2,853,372
Commercial & Industrial Programs							
Prescriptive	23,283	23,286	23,286	23,677	102%	85%	20,125
Custom	629,183	629,183	624,668	624,668	99%	90%	562,201
New Construction	538,412	536,609	536,606	533,233	99%	54%	287,946
Small Business Direct Install	4,266	4,266	4,266	4,266	100%	94%	4,010
Online Marketplace	3,571	3,628	3,694	3,978	111%	99%	3,935
Total C&I	1,198,716	1,196,973	1,192,521	1,189,821	99%	74%	878,218
Total 2021 Portfolio	5,238,579	5,236,286	5,201,790	4,537,993	87%	82%	3,731,589

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 49% of total electric energy (kilowatt-hour) savings. The Lighting program accounted for the next largest share (39%). The Behavioral program also accounted for the largest share of peak demand reduction (kilowatts) for the Residential portfolio, contributing 38% of total peak demand reduction, followed by the Lighting program at 36%.

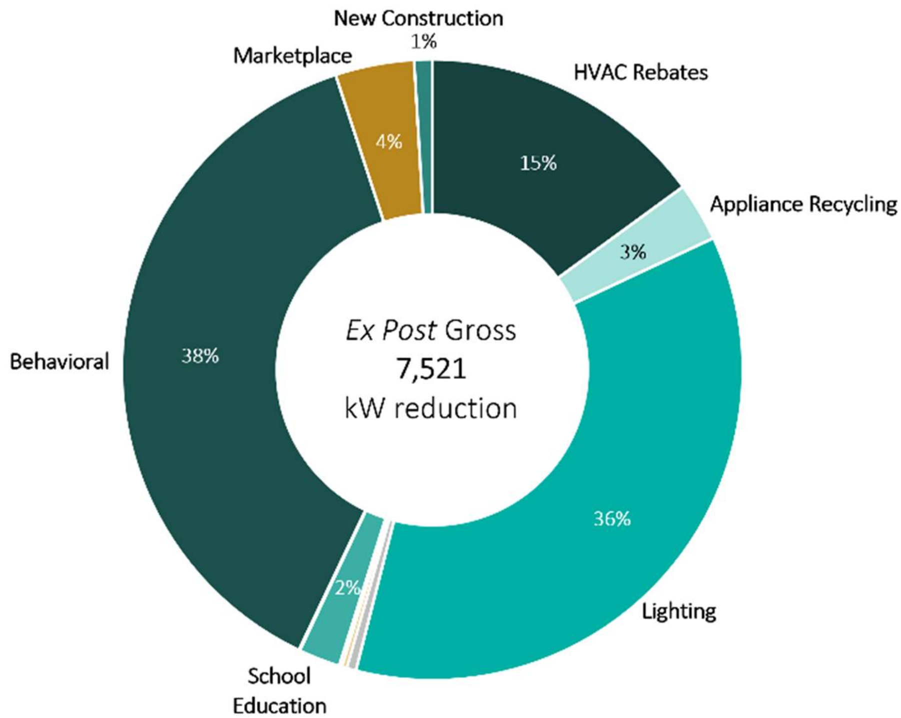
In the C&I sector, the Prescriptive program contributed the largest share of electric energy savings, with 46% of the total C&I portfolio electric energy (kilowatt-hour) savings, with the Custom program contributing 23% and the New Construction program contributing 22%. The Prescriptive and New Construction programs contributed the largest shares of peak demand reduction (kilowatts) to the C&I portfolio, accounting for 49% and 26% of peak demand reduction, respectively.

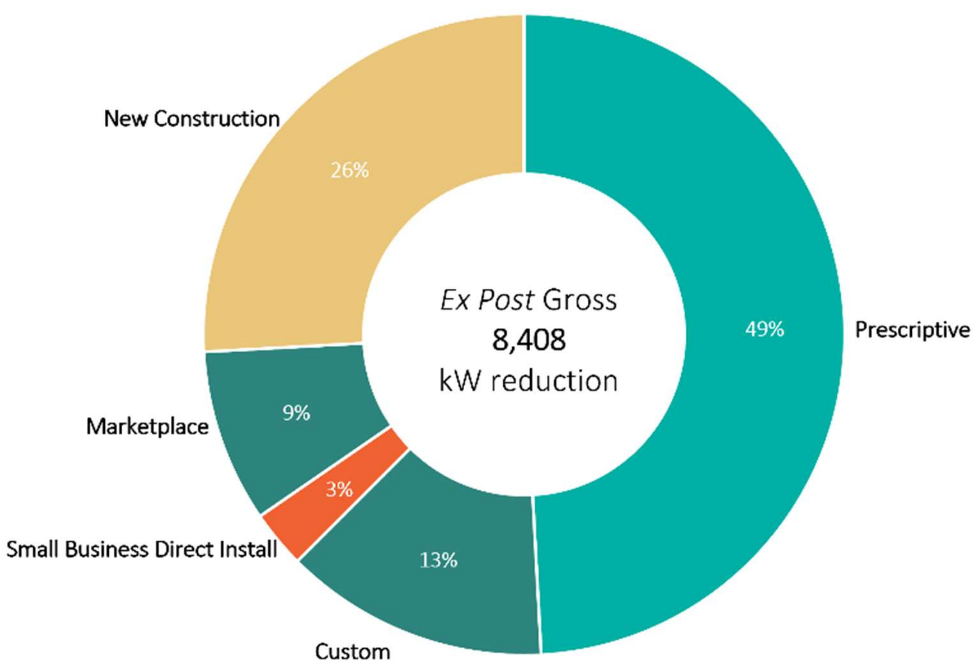
FIGURE 1. PROGRAM CONTRIBUTIONS TO PORTFOLIO ELECTRIC SAVINGS (KWH) BY *EX POST* GROSS [a]



[a] Six residential programs are not labeled due to savings of less than 1% of the total portfolio in 2021. This includes HEA, MFDI, Homelife, Employee Education, IQW, and New Construction.

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

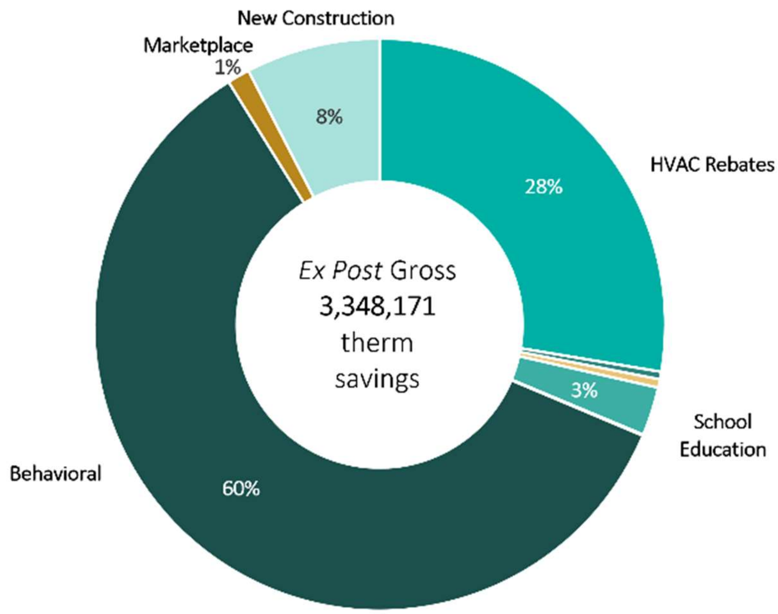


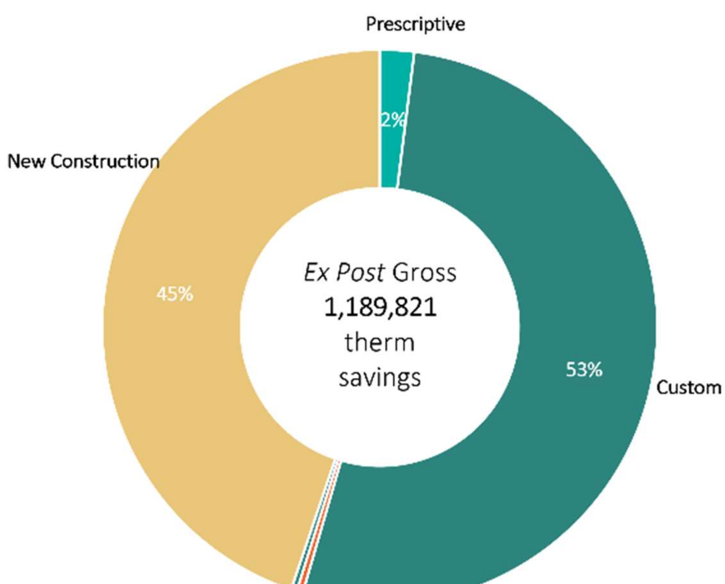


[a] Five residential programs are not labeled due to savings of less than 1% of the total portfolio in 2021. This includes HEA, MFDI, Homelife, Employee Education, and IQW.

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 60% of the Residential portfolio savings. The HVAC Rebates program was the second largest contributor to the Residential program's natural gas savings total (28%). The Custom program contributed 53% of the natural gas energy savings for the C&I sector, the most of any of the C&I programs, followed by New Construction at 45%.

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





[a] Five residential programs are not labeled due to savings of less than 1% of the total portfolio in 2021. This includes HEA, MFDI, Homelife, Employee Education, and IQW.

[b] Two C&I programs, the Online Marketplace and SBDI, are not labeled due to savings of less than 1% of the total portfolio in 2021.

BUDGET

AS SHOWN IN TABLE 6 AND

Table 7, NIPSCO spent 61% of its electric budget and 78% of its natural gas budget for the 2021 portfolio.

TABLE 6. 2021 ELECTRIC PORTFOLIO BUDGET AND SPENDING

PROGRAM	BUDGET ($)	ACTUAL SPEND ($)	BUDGET SPENT (%)	SHARE OF ELECTRIC GOAL ACHIEVED (%)	SHARE OF PEAK DEMAND GOAL ACHIEVED (%)
Residential Programs					
HVAC Rebates	818,770.76	473,230.09	58%	49%	59%
Lighting	3,358,322.92	2,257,257.33	67%	120%	122%
Home Energy Assessment	124,772.27	72,377.35	58%	49%	52%
Appliance Recycling	304,881.85	245,315.20	80%	65%	43%
School Education	447,022.69	432,310.37	97%	92%	82%
Multifamily Direct Install	324,406.40	50,641.73	16%	16%	11%
Behavioral	1,712,177.13	1,653,222.94	97%	109%	n/a
New Construction	436,336.85	212,882.10	49%	17%	28%
Home Life EE Calculator	39,195.84	11,299.10	29%	17%	14%
Employee Education	36,877.97	3,045.89	8%	2%	3%
IQW	411,713.91	60,246.02	15%	12%	12%
Online Marketplace	307,461.93	935,866.79	304%	78%	82%
Total Residential	**8,321,940.51**	**6,407,694.91**	**77%**	**101%**	**129%**
Commercial & Industrial Programs					
Prescriptive	5,561,262.57	2,953,264.36	53%	61%	32%
Custom	5,307,143.71	1,849,246.44	35%	30%	25%
New Construction	1,673,802.72	1,328,487.32	79%	88%	147%
Small Business Direct Install	559,456.09	433,584.41	78%	57%	64%
Online Marketplace	293,713.02	224,707.44	77%	64%	77%
Total Commercial & Industrial	**13,395,378.11**	**6,789,289.97**	**51%**	**52%**	**42%**
Total 2021 Portfolio	21,717,318.62	13,196,984.88	61%	68%	61%

Source: 2021 DSM Scorecard.
Note: Totals may not properly sum due to rounding

TABLE 7. 2021 NATURAL GAS PORTFOLIO BUDGET AND SPENDING

PROGRAM	BUDGET ($)	ACTUAL SPEND ($)	BUDGET SPENT (%)	SHARE OF NATURAL GAS GOAL ACHIEVED (%)
Residential Programs				
HVAC Rebates	1,897,553.47	2,039,423.64	107%	68%
Lighting	n/a	n/a	n/a	n/a
Home Energy Analysis	185,077.21	92,465.04	50%	45%
Appliance Recycling	n/a	n/a	n/a	n/a
School Education	345,077.06	332,980.48	96%	97%
Multifamily Direct Install	104,354.43	4,982.56	5%	0%
Behavioral	321,426.56	309,314.51	96%	211%
New Construction	168,369.67	232,894.02	138%	80%
Home Life EE Calculator	33,632.17	10,489.08	31%	14%
Employee Education	34,722.38	3,019.20	9%	2%
IQW	717,070.57	123,794.07	17%	12%
Online Marketplace	132,589.25	135,736.98	102%	38%
Total Residential	**3,939,872.79**	**3,285,099.59**	**83%**	**109%**
Commercial & Industrial Programs				
Prescriptive	126,324.56	34,126.33	27%	19%
Custom	1,218,548.00	835,184.93	69%	70%
New Construction	759,072.09	710,631.01	94%	96%
Small Business Direct Install	230,527.36	13,568.99	6%	3%
Online Marketplace	16,458.50	5,540.38	34%	12%
Total Commercial & Industrial	**2,350,930.50**	**1,599,051.64**	**68%**	**67%**
Total 2021 Portfolio	6,290,803.29	4,884,151.23	78%	94%

Source: 2021 DSM Scorecard.
Note: Totals may not properly sum due to rounding

SUMMARY OF RECOMMENDATIONS

Based on the 2021 evaluation findings, the evaluation team proposes several recommendations intended to improve program uptake, processes, and performance within NIPSCO's DSM portfolio. This section includes a summary of these recommendations. Please refer to the individual program chapters for more details on recommendations and detailed findings that support these recommendations.

ENERGY EFFICIENCY (HVAC) REBATES PROGRAM

- NIPSCO and TRC should update the program *ex ante* savings estimates to reflect the most recent evaluated results.
- Consistent with the 2020 report, the evaluation team recommends that results from the 2020 billing analysis for EFLH and thermostat savings should be considered in planning. In future years the evaluation team recommends that the billing analysis findings of 47 therms savings (HSF = 7.1%) are applied instead of the 35 therms assumed for this evaluation, as these may be more representative of behavior not impacted by COVID-19.
- In the next cycle, conduct an in-depth study into the EE measures to learn more about how satisfied participants are, and to calculate the updated evaluation metrics (i.e., ISR, NTG, spillover, and freeridership values). If future participant levels allow for a survey, the evaluation team recommends that ductless heat pumps, dehumidifiers, electric clothes dryers, and air purifiers are examined more closely in 2022 (or 2023 if needed) evaluation, to develop NIPSCO-specific impact metrics.
- If NIPSCO and TRC are concerned about this year-to-year inconsistency, the implementation team could adjust how *ex post* savings estimates are applied to future program years. First, one option is to calculate savings using custom calculations, more like the evaluation methods, which would allow the program to more closely estimate savings based on the specific breakdown of measures installed in that year. Alternately, the evaluation team could work with TRC to develop blended savings estimates (aka, an average savings value using three years of data instead of just one). It is likely that future *ex post* gross savings estimates calculated by the evaluation team would still fluctuate around this number, but this could mitigate the swings somewhat. The evaluation team can support in developing these estimates based on the past several years of evaluations.
- Air conditioners: Apply actual SEER, EER, and capacity to savings, or use average values from the 2021 program data (average SEER = 15.7, average EER = 14.1, average capacity = 34,056 Btuh).
- Air conditioner tune-ups: Apply actual SEER, EER, and capacity to savings, or use average values from the 2021 program data (average SEER = 15.6, average EER = 14, average capacity = 32,088 Btuh).
- Boilers: Apply average program data capacity (119,922 MMBtu) and average AFUE (94.9%).
- Boiler tune-ups: Apply average capacity from boiler tune-up measures (92,500 Btuh).
- Water heaters: Apply a baseline UEF of 0.704 and efficient UEF of 0.951 for instant water heaters and 0.722 for storage.

- New 2021 program measures (i.e., ductless mini splits, electric clothes driers, and air purifiers): Apply averages from the 2021 program data. After next year's evaluation, the evaluation team will have more historic context to update these values.
- Work with the evaluation and implementation teams to determine the frequency and importance of exploring estimating savings for dual installations of furnaces and heat pumps.
- Consider collecting data on the heat pump that is installed. This could be done in multiple ways, given logistical needs. First, the corresponding heat pump information could be collected and included in the tracking data. A section may need to be added to the rebate application for furnaces (or heat pumps, if more logical). Second, a flag could be added to the tracking data, and rebate application, which says whether there was a dual installation.
- Consider creating a unique measure type for heat pumps and furnaces that are installed in conjunction with one another. Calculate a new deemed savings value and incentive level for these measures.
- Encourage program staff to collect non-required fields. And, when possible, include fields for the following within the tracking database, rather than in the program documentation:
    - HVAC characteristics such as SEER, EER, HSPF, and cooling/heating capacities are included in the tracking data for air conditioners, AC tune ups, air source heat pumps, and ductless heat pumps.
    - When including the cooling capacity, provide it in units of Btuh instead of tons for more accuracy.
    - Water heater uniform energy factor (UEF) in the tracking data.
    - With the new ENERGY STAR measures, include the clean air delivery rate (CADR) and combined energy factor (CEF) for air purifiers and clothes dryers, respectively.

RESIDENTIAL LIGHTING PROGRAM

- Monitor the DOE's EISA outcome and incorporate effective changes in program design. Review inclusion of specialty and reflector LEDs as part of the upcoming Indiana Technical Reference Manual (TRM) update process to provide guidance for any future savings for these measures in upstream programs.

HOME ENERGY ASSESSMENT PROGRAM

- Conduct a more robust program evaluation in the next cycle to update evaluation metrics, such as in-service rates and net-to-gross if there is an increase in program participation.
- Continue monitoring program satisfaction. NIPSCO changed program subcontractors for Program Year 2022, after noting implementation difficulties. Respondents to the program evaluation survey received services with the prior subcontractor. NIPSCO should continue monitoring satisfaction to look for improvement with the new program subcontractor.
- Increase administrative support for the assessment team and participants. Providing a checklist for the assessment team to complete could help avoid gaps in the participation process. Additional follow-up to participants can ensure they are not waiting for outreach or confused about next steps.

- Work toward a higher rate of report delivery for in-person participants by having the assessment team email the report while they are onsite and verify customer receipt by having them open the report on their computer or other device. The assessment team can also re-send the report when they follow up with the customer, so the customer remembers the report.
- Consider adding an air sealing measure to maximize savings, like the IQW program. NIPSCO could also consider expanding the assessment options to increase savings and provide a more thorough visit option and include a blower door test with this visit type.
- Consider reviewing or increasing the educational aspect of both the direct install measures and the kit measures to ensure customers are aware of the energy-saving aspects of the measures, especially for water-saving measures. In-person participants may want water measures if they understand that they reduce water heating costs not just water use, and virtual participants may require further instruction on how to install measures.
- Clarify which measures each customer will qualify for and ensure energy advisors are trained to offer and install all applicable measures to each customer.
- Consider having the assessment team track reasons for not installing measures by adding checkboxes on the assessment form such as "customer already has efficient equipment", "customer faucets not compatible with aerators", "customer refused measure", etc. With this additional data, NIPSCO and the evaluation team can better determine how to improve the acceptance rate, if needed.
- Consider focusing efforts on the in-person visit. The HEA program could keep the virtual visit option available and keep relevant infrastructure updated as a backup option and for risk mitigation.
- Monitor the DOE's EISA outcome and incorporate effective changes in program design. Review inclusion of specialty and reflector LEDs as part of the upcoming Indiana Technical Reference Manual (TRM) update process to provide guidance for any future savings for these measures in upstream programs.
- If kits continue to be offered through HEA, continue to reference HomeLife for ISRs and water heater saturation numbers in the *ex ante* assumptions, unless there is enough participation to measure for HEA more robustly using surveys.

INCOME-QUALIFIED WEATHERIZATION PROGRAM

- Conduct a more robust program evaluation in 2022 to update evaluation metrics, such as in-service rates and net-to-gross if there is an increase in program participation.
- Continue monitoring program satisfaction. NIPSCO changed program subcontractors for Program Year 2022, after noting implementation difficulties. Respondents to the program evaluation survey received services with the prior subcontractor. NIPSCO should continue monitoring satisfaction to look for improvement with the new program subcontractor.
- Consider additional communication to customers who are participating or waiting for follow-up. The assessment team could inform the customer of the timeline during the assessment, and clearly outline the next steps for the customer during the assessment and in the report. NIPSCO can reach out a week after

the assessment to address any remaining questions. If any delays arise, NIPSCO could provide updated timing information to customers.

- Work toward a higher rate of report delivery by having the assessment team email the report while they are onsite and verify customer receipt by having them open the report on their computer or other device. The assessment team can also re-send the report when they follow up with the customer, so the customer remembers the report.
- During the assessment visit, clarify which measures each customer is qualified for, and ensure auditors are trained to offer and install all applicable measures to each customer.
- Consider having the assessment team track reasons for not installing measures by adding checkboxes on the assessment form, such as "customer already has efficient equipment," "customer faucets not compatible with aerators," "customer refused measure," etc. With this additional data, NIPSCO and the evaluation team can better determine how to improve the measure acceptance rate.
- Provide clear information about next steps for each follow-up measure (when installation does not occur during the assessment). This could include pamphlets with qualification and contact information, an estimated timeline for how long the delivery will take for each measure, or a page in the report detailing similar information.
- Monitor the DOE's EISA outcome and incorporate effective changes in program design. Review inclusion of specialty and reflector LEDs as part of the upcoming Indiana Technical Reference Manual (TRM) update process to provide guidance for any future savings for these measures in upstream programs.
- Provide *ex ante* methodology and assumptions for all ENERGY STAR refrigerator measures, including Efficient and Existing Unit Energy Consumption (UEC), Temperature Adjustment Factor (TAF), and Load Shape Adjustment Factor (LSAF).

MULTIFAMILY DIRECT INSTALL

- Conduct a more robust program evaluation in 2022 to update evaluation metrics, such as in-service rates and net-to-gross if there is an increase in program participation.
- Use the provided *ex post* gross savings values for future program year *ex ante* values, which more accurately represent baseline and participant characteristics.

APPLIANCE RECYCLING PROGRAM

- NIPSCO and TRC should update the program *ex ante* savings estimates to reflect the most recent evaluated results.
- Re-evaluate this program in the next program cycle to re-assess customer experiences and update evaluation metrics (such as part-use factor, ISR, and NTG). If future participant levels allow for a survey, the evaluation team recommends that dehumidifiers and room ACs be examined more closely in the 2022 (or 2023 if needed) evaluation to develop NIPSCO-specific impact metrics.

- Collect, document, and clearly label in the program tracking data the pints of water per day capacity of the dehumidifier units recycled to provide inputs for the evaluated savings calculations.
- As the program continues, adds new measures, and navigates the program landscape with COVID-19, continue to monitor appliances ages and other program metrics.

BEHAVIORAL PROGRAM

- The program may be able to achieve additional savings by acquiring more email addresses, to send emails to a higher proportion of participants. For example, the program can send messaging asking for email addresses (within printed reports or separately). This messaging would go to participants for which the program does not have valid email addresses.
- The program may be able to achieve additional savings by further informing customers about any new features and uses of the new web portal. Monitor specific customer interactions to better understand what they use on the web portal. If engagement continues at the current login rates and with the same seasonal patterns, consider ways to drive more traffic to the site to increase engagement and achieve additional savings. Consider messaging during the launches of new participant waves to educate participants about the ongoing nature of the program and drive them to click through emails and engage with the portal on a consistent basis.
- Conduct deeper cross-program participation process research with the next uplift analysis in future evaluations to understand if cross program promotion drives engagement and savings.
- Consider two options for Wave 2 savings in 2022: a) group Wave 2 with another wave during evaluation or b) consider filling Wave 2 with new randomly assigned treatment and control group customers. Increasing the sample size will increase the statistical power and hedge the risk of random variation in the modeling results (the risk that the program would see negative savings when there are positive savings or positive savings when there are negative savings). Consider similar approaches for other waves that did not achieve statistically significant savings in 2020.

RESIDENTIAL NEW CONSTRUCTION PROGRAM

- Use *ex post* savings values from the second half of 2021 for planning purposes going forward. Lower savings due to the 2020 Indiana Residential Code may have an adverse effect on the cost-effectiveness of the program and should be monitored.
- Consider having the evaluation team perform modeling of other high efficiency electric appliances, like 15+ SEER heating and cooling systems and heat pump water heaters, possibly creating a "Platinum Plus" tier for builders who install high efficiency appliances.
- Enforce program eligibility requirements to maximize program savings. For instance, in the second half sample of six homes receiving an electric incentive, only four of those were compliant with the program requirement that "All Central AC systems must be rated 15 SEER or greater to qualify for the electric service

incentive."[2] The other two installed 13 SEER units, which is code minimum and would deliver zero electric savings. Requiring 15+ SEER ACs could increase electric savings by at least 20% over 13 SEER. A higher efficiency Central AC requirement will become even more important in 2023 and beyond, when the federal code jumps from 13 to 14 SEER minimum efficiency.

- In the next evaluation cycle, a survey should be conducted with builders to gather NIPSCO-specific metrics, satisfaction, and process findings. For example, the evaluation team adopted efficient lighting installed percentages from CenterPoint Indiana's 2020 Evaluation; future evaluations should conduct research to gather NIPSCO-specific home characteristics that are not in the HERs reports. Additionally, NTG should be re-assessed to better understand the new program design's influence on builder decision-making and the impact of the more stringent building code on freeridership.
- Explore software-based solutions that would allow the program to have more insight into program performance in real time.
- Explore HERS certificate submission to also include estimated kWh, kW, therms savings.
- Consider a mid-year evaluation "lite" to model a sample of homes and see if there are any major changes.
- Ramp up outreach efforts to builders and HERS raters to ensure they are aware of the program incentives and eligibility requirements.
- Track raw HERS scores upon application, instead of tracking just the broader HERS category. This will allow for more granular analysis of where population at large is landing on HERS scores.
- Consider right-sizing program goals to reflect more realistic participation numbers.

SCHOOL EDUCATION PROGRAM

- Given that most respondents appear to be very engaged in the program, leverage enthusiasm to build program participation across other NIPSCO offerings.
- Continue to promote other NIPSCO programs by including marketing materials along with the kits.
- As applicable, adjust savings assumptions for future years to align with *ex post* gross savings approaches and findings.
- Monitor the DOE's EISA outcome and incorporate effective changes in program design. Review inclusion of specialty and reflector LEDs as part of the upcoming Indiana Technical Reference Manual (TRM) update process to provide guidance for any future savings for these measures in upstream programs.

[2] Accessed April 6, 2022. https://www.nipsco.com/partner-with-us/builders-and-developers/residential-new-construction-program

HOMELIFE ENERGY EFFICIENCY CALCULATOR PROGRAM

- Given the furnace whistle's performance, continue with the plan to discontinue offering it in future program cycles. It should be noted that the IL TRM v9.0 (2020) has removed this measure, citing evaluation results indicating it is not effective.
- Monitor the DOE's EISA outcome and incorporate effective changes in program design. Review inclusion of specialty and reflector LEDs as part of the upcoming Indiana Technical Reference Manual (TRM) update process to provide guidance for any future savings for these measures in upstream programs.
- Investigate whether there are opportunities to improve the customer experience with kit showerheads. Respondents who did not install the measure reported it did not fit or they did not install it; there may be an opportunity to clarify installation instructions.
- Consider revisiting the outreach approach to understand why customers have low recall of receiving the personalized recommendations. There may be an opportunity to revise the mode of delivery, or the language in recommendations email so that customers are more receptive to it.
- Given that most respondents appear to be engaged in the program and implementing energy efficient improvements afterwards, leverage enthusiasm to build program participation across other NIPSCO offerings. This could involve providing more explicit pathways to participate in other programs (i.e., having outreach staff follow up, or providing program collateral to participants).
- Additionally, most program participants (55%) had an annual household income under $75,000, with one-third (35%) under $50,000. Depending on family size and other factors, some of these customers may be eligible to participate in IQW. The HomeLife Calculator could be a funnel or bridge program to direct eligible customers to IQW; this program could be marketed and directed to both low- and moderate-income customers via community outreach channels (such as food banks, community action agencies, etc.).

EMPLOYEE EDUCATION PROGRAM

- There were no recommendations for the Employee Education program in 2021.

RESIDENTIAL ONLINE MARKETPLACE

- In subsequent evaluation years that include lighting measures, NIPSCO should use the baseline watts calculated from the 2021 NIPSCO Residential OLM survey for LEDs and smart LEDs which will influence more accurate planning and savings.
- Monitor the DOE's EISA outcome and incorporate effective changes in program design. Review inclusion of specialty and reflector LEDs as part of the upcoming Indiana Technical Reference Manual (TRM) update process to provide guidance for any future savings for these measures in upstream programs.
- Inputs and deemed savings values from the 2020 billing analysis should be applied to all Wi-Fi thermostats.

- If thermostats continue to have a lower in-service rate, further research should be conducted to assess reasons that thermostats were not installed. Data could be collected through additional survey questions or through qualitative interviews.
- For standalone measures with sufficient participation in 2022, NIPSCO should consider fielding another participant survey to collect information to calculate ISRs for these measures. The evaluation team recommends fielding a mixed-mode phone and online survey to achieve a sufficient response rate.
- NIPSCO should exercise caution in widespread distribution of smart plugs unless documented savings can be substantiated. Savings could be substantiated if the measure is added to a TRM or by verifying parameters through a participant survey. The evaluation team recommends a participant survey if sufficient participation for this measure is achieved in 2022, either through the Online Marketplace or through a pilot program.
- Ensure accurate recording of energy type for all measures such that energy type does not contradict what is recorded in the measure description. If needed, create a separate field in the tracking data that only documents the fuel service from NIPSCO so savings can be accurately assigned.
- Where it makes sense, NIPSCO should continue to use social media to promote LTO products on the Online Marketplace while considering the risks of products achieving much higher participation than expected.
- Use email messages to re-engage Online Marketplace participants with the Online Marketplace programs or other NIPSCO offerings. Free measures, such as the Home Office/Back-to-School kit could also include materials promoting other NIPSCO programs. If possible, NIPSCO could include LTOs for other programs, such as bonus rebates or offers in these types of marketing communications.

COMMERCIAL AND INDUSTRIAL PROGRAMS

- For New Construction and Prescriptive programs, closely monitor savings and participation trends throughout 2022 to determine if this trend will persist and identify whether program strategies, such as bonus incentives to trade allies, could help boost participation throughout the year.
- The SBDI program experienced lower than anticipated participation year over year. Small businesses experience unique challenges, which were likely exacerbated by COVID-19. A market study focused on SBDI may be valuable to identify participation and savings potential, reasons for lower than targeted savings, and opportunities to boost participation.
- To be consistent across the portfolio, NIPSCO should calculate WHFs for all C&I programs going forward in *ex ante* savings calculations, so these factors can be included in cost-effectiveness and future planning. To do this, NIPSCO should take the following steps:
    1. Add extra inputs into the applicable section of the application tool to determine how each area is heated or cooled, per Appendix B of the 2015 Indiana TRM (v2.2). There is a “space conditioning type” variable in the “Project Information” tab of the application, but some areas may be conditioned differently (i.e., warehouses with an attached office area).
    2. Add functionality to the application to look up the electricity, demand, and natural gas WHFs based on the project site location and the method of heating and cooling.

3. Modify kWh, kW, and therm calculation methodologies in the application Excel tool to include these WHFs.
4. Track fuel type by customer to accurately capture applicable WHFs for electric-only versus dual fuel customers.

- For Custom applications, do not rely on a single deemed value. Modify the application tool as follows:
  - Add inputs for average operating speed and baseline control and use these inputs to determine controlled load factors for the baseline and VFD motors.
  - Add a field for application (heating, cooling, ventilation, process, and other). Generally, the CF will be zero for cooling because the motors are fully loaded and zero for heating applications because the motors will be off during the utility peak period.
  - Accept operating hours for the motor.
  - Use other TRM hybrid calculators for support
- Develop an M&V protocol to ensure measures projected to result in large or uncertain savings have adequate collected data to support savings claims. Possible inclusions for the protocols have been discussed in the body of the report.
- While increasing incentives addresses the main barrier to energy efficiency, increasing the incentives alone will not fully address the barriers customers face. To fully address those barriers, providing more comprehensive technical and engineering support, particularly to Custom and SBDI program participants, will provide more tools to participants to overcome energy efficiency barriers.
- Leverage past participants when considering marketing campaigns, particularly participants who only participated with one measure type.

COMMERCIAL AND INDUSTRIAL ONLINE MARKETPLACE

- Continue to expand outreach methods and strategies to attract new customers to the program. 90% of the survey respondents indicated that email was their preferred means of communication. Most participants indicated that saving energy and money on utility bills were the most important drivers for them. Targeting this type of content by email campaign could be a successful program participation driver.
- Continue to evolve the kits to match the needs of potential customers to the Online Marketplace. Satisfaction, significance and ISR values appear to demonstrate that the basic lighting components included in the kits were the most desirable and resulted in the highest installation rates.
- Monitor EISA regulatory changes to baseline lighting wattage as it evolves. The baseline efficiency calculation may need modification to reflect the increasing prevalence of LED technology, thereby reducing the electric energy savings and demand reduction achieved by LED lighting installation in future years.
- Continue to leverage email in the current marketing strategy to bring more participants to the program.
- Consider whether this program could serve as a funnel to the SBDI program, given the overlap in customer bases.

- Clarify in program literature which types of businesses are eligible for the C&I Online Marketplace program and who the program target audience is. If small businesses are the target audience, direct the marketing strategy toward this group.
- Continue to offer LEDs in all kits, as the A shape bulb and BR30 bulb had a high customer-reported ISR.
- Consider adding a lamp to kits that do not currently have one, or adding additional lamps to the office kit, as the LED desk lamps had a very high customer-reported ISR.
- Offer lighting-only kits as a standalone ordering option rather than an add-on option, so that customers only interested in the basic light bulbs have a targeted option to order. Low ISRs for specialty lighting and non-lighting products suggest that customers that were primarily driven to order the kits for the lighting products might have less need or desire for the specialty lighting and non-lighting products.
- Continue to evolve the kits to match the needs of potential customers to the Online Marketplace. ISR and significance drivers will need to be monitored annually to determine the success of each kit component and should inform any modifications made to the kits.
- Continue to offer the occupancy sensor power strip in the office and retail kit. Consider including one in the restaurant kit, as well as adding additional units to the office and retail kits, as the customer reported ISR for this product was very high. 53% of survey respondents indicated the power strip was very significant in their decision to purchase the kit.
- Consider removing or reducing the amount of LED exit signs and candelabra shaped bulbs from the kits, as the customer reported ISRs and significance ratings were much lower for those measures.
- Use customer-provided water heater fuel type instead of the fixed fuel saturation ratio when calculating savings for the pre-rinse spray valve, bathroom aerators, and kitchen aerators. This will require expanding the measure categories to capture the two fuel options. An example of this is shown in the Conclusions and Recommendations section of the Commercial and Industrial Online Marketplace chapter.
- Use customer-provided space heat fuel type instead of the fixed fuel saturation ratio when calculating waste heat factors and total savings for the lighting fixtures. This will require expanding the measure categories to capture the fuel and equipment options. Groupings and assumptions can be made regarding location, building types and equipment types to minimize the additional measure categories needed. An example of this is shown in the Conclusions and Recommendations section of the Commercial and Industrial Online Marketplace chapter.

1. PROGRAM OFFERINGS

NIPSCO's DSM portfolio consists of 17 programs distributed across the Residential and C&I sectors. NIPSCO administers these programs with the support of a third-party implementer, TRC Company (formerly Lockheed Martin Energy). The 2021 program year marked the last year of a three-year program cycle. A brief description of each program's offering follows:

- The HVAC 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, and heat pumps. In 2021, NIPSCO added three new measures to the program: dehumidifiers, electric clothes dryers, and air purifiers.

- The Residential Lighting program provides upstream discounts on LED lamps and LED lighting fixtures. NIPSCO works with retailers and manufacturers to offer reduced prices at the point of sale.

- The Home Energy Assessment program provides no-cost, in-home energy assessments to residential customers. During an assessment, an energy assessor 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 assessor 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. Continuing from 2020, this program also provided virtual assessments and kits to customers due to COVID-19.

- The Appliance Recycling program provides removal and recycling services to electric customers who reduce energy consumption through recycling unneeded refrigerators and freezers. Annually, participants may recycle up to two working secondary refrigerators or freezers, sized 10 to 30 cubic feet, by scheduling a pick-up of the units. In 2021, NIPSCO added two new measures to the program: window air conditioners and dehumidifiers.

- 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 Multi-Family Direct Install (MFDI) program provides property owners and managers of multi-family 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 assessor first analyzes the efficiency of heating and cooling systems and insulation levels in the home. Depending on opportunities in the home, the assessor 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 assessor 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. This program changed its design mid-2021 to respond to a change in the statewide building code.

- The Homelife Energy Efficiency Calculator program offers residential customers a free online 'do-it-yourself' audit to help customers learn about their home's energy use and provide recommendations on how to save energy. Eligible participants also receive a free energy savings kit with various measures including LEDs, water saving devices, and furnace whistles.

- The Employee Education program provides education and an optional direct install kit to employees of NIPSCO C&I customers. The program offers in-house and virtual energy efficiency training seminars, employee energy efficiency kits, and education materials to inform residential customers of opportunities and methods to proactively manage their energy consumption.

- The Residential Online Marketplace provides an online retail platform for customers to buy energy saving equipment, such as lightbulbs, thermostats, advanced power strips, and water-saving devices. Through the Online Marketplace, NIPSCO also provided free energy-saving kits marketed as Back-To-School, each containing a customized mix of measures such as lighting and water saving devices. This program was new in late 2020 and ramped up in 2021.

- 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 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. In late December 2021, the program also began offering Lighting Add-On kits, for which the customer paid shipping, plus tax. This program was new in late 2020 and ramped up in 2021.

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 program and 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, 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 2021 DSM Scorecard.
- Audited savings: Annual gross savings after alignment or reconciliation with the program tracking data.
- Verified savings: Annual gross savings after alignment with the program tracking data (i.e., Audited savings), and adjustments related to ISRs.
- Evaluated *ex post* savings: Annual gross savings with all previous adjustments (i.e., Verified savings), and adjusted to include the best available inputs and methodology available at the time of the evaluation.
- Realization rate (percentage): the percentage of savings the program realized, calculated using the following equation:

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

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

PROCESS EVALUATION APPROACH

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

RESEARCH ACTIVITIES

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

Table 9 details the activities that informed the process evaluations.

TABLE 8. 2021 IMPACT EVALUATION ACTIVITIES

PROGRAM	DATABASE REVIEW	ENGINEERING ANALYSIS	VERIFICATION/SITE VISITS	NTG ESTIMATION	GATHER IMPACT INPUTS VIA PARTICIPANT SURVEYS	OTHER
HVAC Rebates	✓	✓				
Lighting	✓	✓		✓ (Literature Review)		
HEA	✓	✓		✓	✓	
Appliance Recycling	✓	✓				
School Education	✓	✓		✓	✓	
MFDI	✓	✓				
Behavioral	✓	✓				
New Construction	✓	✓				
Homelife Calculator	✓	✓		✓	✓	
Employee Education	✓	✓				
IQW	✓	✓			✓	
Residential Online Marketplace				✓	✓	
Prescriptive	✓	✓	✓	✓	✓	
Custom	✓	✓	✓	✓	✓	
New Construction	✓	✓	✓	✓	✓	
SBDI	✓	✓	✓	✓	✓	
C&I Online Marketplace	✓	✓	✓	✓	✓	

TABLE 9. 2021 PROCESS EVALUATION ACTIVITIES

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

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 Indiana TRM (v2.2), 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 Indiana TRM (v2.2), 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. Due to COVID-19 impacts, the evaluation team did not perform any onsite activities, including metering, in the 2021 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 2021, a second time in fall 2021, and a third time in early 2022, to identify high-saving projects and draw these projects into a sample for recruitment. Virtual verifications were completed between Spring 2021 and February 2022.

TABLE 10. 2021 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	32	2	7%	15%
C&I Custom	35	18	21%	33%
C&I New Construction	24	11	45%	43%
C&I SBDI	28	1	24%	94%
C&I Total Programs	**119**	**32**	**20%**	**38%**

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

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

PROGRAM STAFF INTERVIEWS AND DISCUSSIONS

The evaluation team set up overarching meetings with NIPSCO implementation staff to understand how the programs were designed and delivered, what worked well in 2021, and what could be improved. The interviews covered wide-ranging topics such as program design and administration, communication and data tracking processes, marketing strategies, trade ally and participant interactions, and challenges and successes.

PARTICIPANT SURVEYS

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

SAMPLING

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

TABLE 11. SURVEY POPULATION AND SAMPLE SIZES

PROGRAM	RESPONDENT GROUP	SURVEYS OR INTERVIEWS	POPULATION (COUNT OF UNIQUE ELIGIBLE CUSTOMERS)	TARGET COMPLETES	ACHIEVED COMPLETES
RESIDENTIAL					
HEA	Participants	Surveys	753	Census	193
IQW	Participants	Surveys	283	Census	70
School Education	Parents	Surveys	979	Census	122
HomeLife Calculator	Participants	Surveys	275	Census	40
Residential Online Marketplace	Participants	Surveys	9,379	210	153
C&I					
Prescriptive	Participants	Surveys	541	Census	57
Custom	Participants	Surveys	234	Census	27
New Construction	Participants	Surveys	72	Census	8
SBDI	Participants	Surveys	117	Census	8
C&I Online Marketplace	Participants	Surveys	202	Census	54

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 2021, 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 the 2018 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 Indiana TRM (v2.2) and EM&V *ex post* savings analyses as a baseline reference. The sum of the estimated spillover savings, divided by savings achieved through the program for each relevant measure, yielded spillover savings as a percentage of total savings, which the evaluation team then extrapolated to the population of program participants.

INTENTION/INFLUENCE METHOD FOR SELF-REPORTS

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

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

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

- Customers were categorized as 0% freeriders if they were not aware of a program (i.e., efficient) measure and had no plans to install that measure prior to hearing about the program. Customers also were categorized as 0% freeriders if they knew about the program but had no plans to install an efficient, program-promoted measure.
- Customers were categorized as 100% freeriders if they would have installed the measure in the program's absence or if they had already installed the measure before learning about the program.
- Customers received a partial freeridership score if they planned to install the measure and the program altered their decision. This effect may have included the installation's timing, the number of measures installed, or the efficiency levels of measures installed. For customers who were highly likely to install a measure, and for whom the program had less effect on their decisions, the evaluation team assigned a higher intention freeridership score.

The evaluation team assessed influence 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.

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

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

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

DEEMED SAVINGS METHOD

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

Additionally, for several programs, where there was not enough participation or robust enough data to calculate new NTG values from primary research, the evaluation relied on either 1) past evaluation estimates for that same program or 2) NTG values from other NIPSCO programs with similar program designs to estimate NTG for the 2021 evaluation year.

3. ENERGY EFFICIENCY (HVAC) REBATES PROGRAM

PROGRAM DESIGN AND DELIVERY

NIPSCO offers the Energy Efficiency (EE) Rebates program (also known as the HVAC 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 2021 program includes the following measure categories:

- Furnaces
- Air Conditioners
- Air Conditioner Tune-Ups
- Boilers
- Boiler Tune-Ups
- Air Source Heat Pumps
- Ductless Mini-Split Heat Pumps- Smart Wi-Fi Thermostats[3]
- Water Heaters
- ENERGY STAR® Air Purifiers
- ENERGY STAR Clothes Dryers
- ENERGY STAR Dehumidifiers

Program rebates range from $25.00 to $250.00, covering a variety of HVAC equipment and appliances, from Wi-Fi thermostats to boilers and furnaces. Rebate levels vary by equipment efficiency level and measure type.

As in previous years, 2021 participants either install measures through the contractor of their choice, or through self-installation. A licensed HVAC contractor must complete air conditioner and boiler tune-ups. Customers and contractors can fill out the application form on paper or through an online form. The online form is a PDF application that customers can download and email to TRC, the program implementer.

While NIPSCO does not have a contractor network, and does not promote any individual contractors, TRC has its own network of contractors. Customers can use the link on the NIPSCO website to find a contractor; it will link them to the TRC contractor portal. Contractors have the option to provide an instant discount on equipment or services to their customers and submit the rebate application on their behalf. If contractors do not pursue the instant discount option, participants must fill out and submit rebate forms. According to the 2020 evaluation results, contractors often help participants with the application. Customers or contractors must submit rebate applications within 60 days of installation. Program staff randomly inspect 10% of all installations each year as a means of quality control.

According to program documentation, NIPSCO advertised for the program through direct contractor outreach, bill inserts, mail, community outreach events, public relations, social media, cross-selling, and their website. According to program staff interviews, NIPSCO also advertised via point of purchase placement in retail stores for several measures, such as Wi-Fi thermostats, furnaces, and hot water heaters.

CHANGES FROM 2020 DESIGN

[3] The program abstract says Wi-Fi thermostats while the tracking data says Smart Wi-Fi programmable thermostats.

There were four changes from the 2020 program design. First, NIPSCO added a rule that equipment purchased on NIPSCO's Online Marketplace (a new program for 2021) are not eligible for a rebate through this program.

Next, NIPSCO added three new, ENERGY STAR rated measures:

- Dehumidifiers
- Electric Clothes Dryers, and
- Air Purifiers.

NIPSCO also removed a few measures due to baseline and code adjustments and changed the efficiency levels for a few measures resulting in the changes outlined in Table 12.

TABLE 12. 2020 AND 2021 ENERGY EFFICIENCY MEASURES

2020 MEASURE	2021 MEASURE
Heat pump w/ ECM	Air-source heat pump 14+ SEER Ductless mini-split heat pump 17+ SEER & 9.5+ HSPF *ECMs no longer eligible*
Natural gas furnace ≥ 95% AFUE w/ ECM	*No longer eligible*
Air conditioner installed with and without Furnace w/ECM	*No longer eligible*
Natural gas condensing water heater ≥0.80 EF	Natural gas condensing water heater 0.70+ UEF
Natural gas water heater ≥ 0.67 EF	Natural gas storage water heater 0.70+ UEF

Finally, according to the 2021 program abstract, projects are approved by NIPSCO in weekly batches. Once the batch has been approved, TRC coordinates distributing checks to customers. NIPSCO made no changes to the rebate amounts in 2021.

PROGRAM PERFORMANCE

In 2021, the NIPSCO team adjusted our timelines across programs to deliver evaluation reports earlier than in previous years. To meet the new timelines, for most programs the evaluation teams began analysis earlier, and conducted our impact analyses on 11 months of data instead of the full calendar year (January 1 to November 30, 2021). The evaluation metrics developed during this analysis (including in-service rates, realization rates, net-to-gross ratios, etc.) and included in the first draft versions of the report were applied to the full year of data as part of the final, compiled report and included in Table 111 below.

Table 13 summarizes savings for the full year of program performance, including program savings goals.

TABLE 13. 2021 HVAC PROGRAM SAVING SUMMARY – FULL YEAR 2021

METRIC	GROSS SAVINGS GOAL	*EX ANTE*	AUDITED	VERIFIED	*EX POST* GROSS	*EX POST* NET	GROSS GOAL ACHIEVEMENT
Electric Energy Savings (kWh/yr.)	2,013,129.40	1,245,291.70	1,245,189.48	1,245,189.48	989,191.22	594,236.92	49%
Peak Demand Reduction (kW)	1,909.949	1,215.649	1,215.417	1,215.417	1,125.241	674.095	59%
Natural Gas Energy Savings (therms/yr.)	1,357,006.42	1,500,190.17	1,500,190.17	1,500,190.17	925,518.76	549,368.18	68%

Table 14 summarizes savings evaluated during the program's evaluation period, which was from January 2021 to November 2021.

TABLE 14. 2021 EE REBATES PROGRAM SAVING SUMMARY – JANUARY THROUGH NOVEMBER 2021

METRIC	*EX ANTE*	AUDITED	VERIFIED	*EX POST* GROSS	*EX POST* NET
Electric Energy Savings (kWh/yr.)	1,120,439.06	1,120,336.84	1,120,336.84	882,205.68	528,960.62
Peak Demand Reduction (kW)	1,085.155	1,084.923	1,084.923	1,006.784	601.943
Natural Gas Energy Savings (therms/yr.)	1,309,914.46	1,309,914.46	1,309,914.46	808,429.32	479,852.68

Table 15 outlines the *ex post* gross and NTG adjustment factors. The evaluation team referenced the NTG adjustment factors developed during the 2020 program evaluation survey.

TABLE 15. 2021 EE REBATES PROGRAM ADJUSTMENT FACTORS

METRIC	REALIZATION RATE (%)[a]	FREERIDERSHIP	SPILLOVER	NTG (%)[b]
Electric Energy Savings (kWh/yr.)	79%	40%	<1%	60%
Peak Demand Reduction (kW)	93%	41%	<1%	60%
Natural Gas Energy Savings (therms/yr.)	62%	41%	<1%	59%

[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 and may not sum perfectly due to rounding.

The program spent 58% of its budget for electric and 107% of its budget for gas. Table 16 lists the 2021 program budget and expenditures by fuel type.

TABLE 16. 2021 EE REBATES PROGRAM EXPENDITURES

FUEL	PROGRAM BUDGET	PROGRAM EXPENDITURES	BUDGET SPENT (%)
Electric	$818,770.76	$473,230.09	58%
Natural Gas	$1,897,553.47	$2,039,423.64	107%

EVALUATION METHODOLOGY

To inform the 2021 NIPSCO 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.
- **Program staff interviews and discussions,** to understand the program process, delivery, and design.

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 our engineering calculations to NIPSCO's *ex ante* savings, basing our savings methodologies and inputs for each measure on several sources: standard engineering practices, the 2015 Indiana TRM (v2.2), 2021 Illinois TRM (v9.0) and NIPSCO's program tracking database.[4, 5] Additionally, the team used the results of a 2020 billing analysis, which measured savings resulting from the installation of Wi-Fi thermostats and equivalent full-load hours (EFLH) for installed furnaces (for full methodology of the 2020 billing analysis, please see Billing Analysis Methodology Section in Appendix 1 of the 2020 DSM Portfolio Evaluation Report).

Finally, the 2021 tracking data had some instances where rebates from 2020 overlapped into 2021 (i.e., a furnace was purchased in 2020, but not paid out until 2021). This primarily affected furnaces, central air conditioners with ECMs, heat pumps, and water heaters. In the tracking data, these measures (which we refer to as "legacy") referenced the *ex ante* deemed savings value from 2020, which differed from non-legacy measures that were installed in 2021. For any measures noted in this report as "Legacy 2020," the evaluation team has applied the *ex post* gross deemed savings value determined in the 2020 evaluation to align these measures with our 2020 approach. All non-legacy measures installed and rebated in 2021 were evaluated as described below.

AUDITED AND VERIFIED SAVINGS

In 2021, the program rebated 9,614 measures through the Energy Efficiency Rebates program. The evaluation team audited measure quantities by looking for duplicate records, ensuring measures followed program guidelines, and making sure the proper deemed savings values were applied.

When conducting the tracking data audit, the evaluation team found a few projects that did not match the program guidelines. The evaluation team removed less than 0.1% (n = 2) of all units. The evaluation team removed the following records from the tracking data:

[4] Cadmus. *Indiana Technical Reference Manual Version 2.2*. July 28, 2015.
[5] Illinois Energy Efficiency Stakeholder Advisory Group (SAG). *2021 Illinois Statewide Technical Reference Manual for Energy Efficiency Version 9.0.* September 25,2020.

- Two participants received more than one tune-up for the same equipment type. Both participants received two A/C tune-ups. Program guidelines state, "HVAC tune-ups are limited to one tune-up per equipment type, per installation address every three (3) years."

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

TABLE 17. 2021 HVAC REBATES PROGRAM AUDITED QUANTITIES

MEASURE	TRACKING DATA QUANTITY	AUDITED QUANTITY
Furnace	4,962	4,962
Furnace w/ ECM – Legacy 2020 Measure [a]	527	527
Air Conditioner (AC)	930	930
AC with and without Furnace w/ ECM – Legacy 2020 Measure [a]	106	106
AC Tune-up	291	289
Boiler	51	51
Boiler Tune-up	3	3
Air Source Heat Pump	4	4
Ductless Mini-Split Heat Pump	48	48
Heat Pump with ECM – 2020 Measure [a]	1	1
Smart Wi-Fi Thermostat	2,383	2,383
Water Heater	163	163
Water Heater – 2020 Measure [a]	19	19
Air Purifier	26	26
Clothes Dryer	9	9
Dehumidifier	91	91
Total	9,614	9,612

a. Some projects from December 2020 program were finalized in 2021. Savings for those measures are added to this 2021 evaluation with the 2020 deemed savings applied and added to the total 2021 savings. This is true for: Natural Gas Furnace 95% AFUE with ECM, Air Conditioners installed with a furnace with an ECM, Heat Pump with ECM 14.5+ SEER, Natural Gas Condensing Water Heater ≥ 0.70 UEF, Natural Gas Tankless Water Heater (whole house; 0.82 EF), Natural Gas Water Heater (0.67 EF).

In addition to removing measures, we found two natural gas furnace measures (Natural Gas Furnace - 95% AFUE with ECM - Electric and Gas Savings) that had 0.00 therms associated with the measures rather than the appropriate deemed savings value. In discussions with NIPSCO, we confirmed that these measures were installed, and the therm savings were claimed in 2020 but were not granted kWh or kW savings. These measures were included in the 2021 tracking data so the correct kWh and kW savings could be attributed to the program.

Air conditioners account for 57% of program audited electric energy savings. Air source heat pumps (AHSP) and electric clothes dryers each made up less than 1% of audited electric energy savings. Air conditioners made up 67% of audited demand reduction, with Wi-Fi thermostats making up another 20%. Furnaces (non-legacy, 2021) make up 71% of audited gas savings, with thermostats making up an additional 20%. Boilers, boiler tune-ups, and water heaters (non-legacy, 2021) amount to 1.8% of gas savings combined. Table 18 summarizes audited savings for the measure categories.

TABLE 18. 2021 EE REBATES PROGRAM SAVINGS SHARES BY MEASURE TYPE

MEASURE CATEGORY	AUDITED ELECTRIC ENERGY SAVINGS		AUDITED PEAK DEMAND REDUCTION		AUDITED NATURAL GAS ENERGY SAVINGS	
	KWH/YR.	SHARE	KW	SHARE	THERMS/YR.	SHARE
Furnace	0.00	0%	0.000	0%	929,332.98	71%
Furnace w/ ECM – Legacy 2020 Measure	115,370.00	10%	16.402	2%	98,327.25	8%
AC	635,692.20	57%	722.610	67%	0.00	0%
AC with and without Furnace w/ ECM – Legacy 2020 Measure	72,455.24	6%	82.362	8%	0.00	0%
AC Tune Up	14,770.79	1%	33.524	3%	0.00	0%
Boiler	0.00	0%	0.000	0%	15,255.02	1%
Boiler Tune Up	0.00	0%	0.000	0%	186.69	0%
ASHP – Legacy 2020 Measure	1,046.06	0%	0.365	0%	0.00	0%
ASHP	4,184.24	0%	1.460	0%	0.00	0%
Smart Thermostat	213,202.66	19%	218.962	20%	258,305.30	20%
Water Heater – Legacy 2020 Measure	0.00	0%	0.000	0%	643.74	0%
Water Heater	0.00	0%	0.000	0%	7,863.48	1%
Ductless Heat Pump	33,692.16	3%	4.800	0%	0.00	0%
Air Purifier	19,787.00	2%	2.257	0%	0.00	0%
Clothes Dryer	1,443.96	0%	0.198	0%	0.00	0%
Dehumidifier	8,692.53	1%	1.983	0%	0.00	0%
Total	1,120,336.84	100%	1,084.923	100%	1,309,914.46	100%

Note: Totals may not sum properly due to rounding.

Table 19 describes the in-service rates for each of the measure categories in the program. As is typical for programs rebating larger HVAC measures, where measures are typically not uninstalled, the installation rate for this program is 100% across all measures. For measures evaluated in 2020, the evaluation team has referenced the 2020 survey results as our ISR for the 2021 evaluation. For new measures (air purifiers, clothes dryers, dehumidifiers, and the ductless heat pump) the evaluation team has assumed a 100% ISR. Given the size and function of clothes dryers and ductless heat pumps, the evaluation team assumes that they will follow the same ISR pattern as other large appliances, like a furnace or boiler. For the new measures that are somewhat smaller and somewhat more easily uninstalled (air purifiers and dehumidifiers), the evaluation team is assuming a 100% installation rate, as we expect these ISRs to be high as well but recommend that this is confirmed in future evaluations if participant counts allow. Thermostat installation rates are also set at 100%, as any uninstallations are accounted for within the 2020 *ex post* billing analysis savings estimates.

TABLE 19. 2021 EE REBATES PROGRAM IN-SERVICE RATES RATIOS BY MEASURE

UNIT OF MEASURE	ISR
Furnace	100%
AC	100%
Tune Up	100%

UNIT OF MEASURE	ISR
Boiler	100%
ASHP	100%
Thermostat	100%
Water Heater	100%
Air Purifier	100%
Clothes Dryer	100%
Dehumidifier	100%

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

TABLE 20. 2021 EE REBATES PROGRAM AUDITED AND VERIFIED QUANTITIES

MEASURE	AUDITED QUANTITY	ISR	VERIFIED QUANTITY
Furnace	4,962	100%	4,962
Furnace w/ ECM – Legacy 2020 Measure	527	100%	527
AC	930	100%	930
AC with and without Furnace w/ ECM – Legacy 2020 Measure	106	100%	106
AC Tune-up	289	100%	289
Boiler	51	100%	51
Boiler Tune-up	3	100%	3
Air Source Heat Pump	4	100%	4
Ductless Mini-Split Heat Pump	48	100%	48
Heat Pump with ECM – 2020 Measure	1	100%	1
Smart Wi-Fi Thermostat	2,383	100%	2,383
Water Heater	163	100%	163
Water Heater – 2020 Measure	19	100%	19
Air Purifier	26	100%	26
Clothes Dryer	9	100%	9
Dehumidifier	91	100%	91
Total	9,612	N/A	9,612

EX POST GROSS SAVINGS

The evaluation team referred to the Indiana TRM (v2.2) to calculate *ex post* electric and natural gas energy savings and demand reduction for

- Furnaces
- Air Conditioners
- Boilers
- Tune Ups
- Air Source Heat Pumps
- Smart Wi-Fi Thermostats

- Water Heaters

However, some of the new measures are not in the Indiana TRM (v2.2) or the measures were outdated. For all these measures, the evaluation team referred to the Illinois TRM (v9.0). The evaluation team was missing this information for:

- Ductless Mini-Split Heat Pump

The Indiana TRM (v2.2) had outdated information for ENERGY STAR:

- Air Purifiers
- Clothes Dryers
- And Dehumidifiers

There were also inputs where the evaluation team either applied the results of a 2020 billing analysis or used a deemed savings value from the 2020 evaluation; these cases and the approach used are listed below:

- For furnaces, the evaluation team used the results of a 2020 billing analysis which updated EFLH by nearest city. The evaluation team continued to apply these values to installed furnaces for the 2021 evaluation.
- For smart Wi-Fi thermostats, the evaluation team continued to use the results of a 2020 billing analysis that provided updated gas and electric savings. In addition, the evaluation team employed measure characteristics provided in the database for variables such as capacities, efficiencies, HVAC equipment type and model, and project location.
- For the 2020 legacy measures which include furnaces with ECM's, a single ASHP measure (heat pump with ECM), ACs installed with a furnace with an ECM, and some water heater measures, the evaluation team used a deemed savings value specific to each measure that is equal to the *ex post* gross savings per measure from the 2020 evaluation.
- Finally, for boilers, air conditioners, heat pumps, thermostat cooling savings, and tune-ups, the evaluation team assigned heating and cooling hours and ground water temperatures by matching each installation's city to the closest city from the Indiana TRM (v2.2).

ENGINEERING REVIEWS

The evaluation team reviewed each of the measures, updated the assumptions if changes had been made, and recalculated savings based on the specific measure characteristics. Table 21 highlights notable differences between *ex ante* and *ex post* gross estimates. As in past evaluations, the evaluation team found that using actual measure characteristics could change the savings substantially. The implementer uses a deemed savings value for each measure; the evaluation team uses measure characteristics, like unit size or location, to create custom calculations for each installed measure. Detailed findings by measure type can be found in the Appendix.

Note that this table only includes data for 2021 measures. For all Legacy 2020 measures, the evaluation team used a deemed savings value from the 2020 program evaluation results. The 2020 Legacy Measures' sources, assumptions, and notable differences are the same as in the previous evaluation and can be found in the 2020 NIPSCO HVAC Evaluation Report.

TABLE 21. 2021 HVAC NOTABLE DIFFERENCES BETWEEN *EX ANTE* & *EX POST* GROSS

MEASURE	*EX ANTE* SOURCES AND ASSUMPTIONS	*EX POST* GROSS SOURCES AND ASSUMPTIONS	PRIMARY REASONS FOR DIFFERENCES
Furnace	*Ex ante* savings were calculated using HVAC Rebates 2018 EM&V	2020 Billing analysis results for EFLH and information in program tracking	Billing analysis EFLH were approximately 30% less than Indiana

MEASURE	*EX ANTE* SOURCES AND ASSUMPTIONS	*EX POST* GROSS SOURCES AND ASSUMPTIONS	PRIMARY REASONS FOR DIFFERENCES
	results. AFUE was assumed based on Indiana TRM (v2.2), and South Bend EFLH were used. Assumed furnace capacity of 70,000 Btuh.	data. Actual AFUE and capacity values were used to calculate *ex post* savings.	TRM (v2.2) EFLH, plus small differences due to using actual instead of assumed AFUE and capacity.
AC	*Ex ante* savings were calculated using the Indiana TRM (v2.2). Heating and circulation motor savings were included for all sites.	Indiana TRM (v2.2) and program tracking data. Assumed EER = 90% x SEER.	Differences due to using actual instead of assumed SEER, EER, and capacity. Differences between assumed EER_{ee} (12.6) and approximate actual EER_{ee} (average 14.1) produced marked differences in reported and *ex post* gross demand reduction.
AC Tune Up	*Ex ante* savings were calculated using the Indiana TRM (v2.2). Used average capacity and SEER from 2019 AC tune up data and assumed EER = 90% x SEER.	Indiana TRM (v2.2) and program tracking data. Used actual SEER and cooling capacity when available, average tracking data values when not. Varied EFLH by closest city.	Lower average cooling capacity and greater average SEER in 2021. Also used 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 2019 boiler data, TRM assumed base AFUE and South Bend EFLH, and a 2019 average AFUE of 95% for *92% AFUE* measures and 90% AFUE for *90% AFUE* measures.	Indiana TRM (v2.2) and program tracking data. Used actual capacity and AFUE. Used closest city EFLH.	Small differences due to using actual instead of assumed AFUE and capacity.
Boiler Tune Up	*Ex ante* savings were calculated using the Indiana TRM (v2.2). Appear to deviate slightly from the 50 Btuh per square foot, a 1,700 square foot average home assumed last year, based on savings calculated the assumption would be 87,215 Btuh. TRM South Bend EFLH assumed	Indiana TRM (2.2) and program tracking data. Used actual capacity and AFUE. Used closest city EFLH.	Small differences due to using actual instead of assumed AFUE and capacity.
ASHP	*Ex ante* savings seem to be calculated using the Indiana TRM (v2.2).[a]	Indiana TRM (v2.2) for cooling EFLH, furnace billing analysis for heating EFLH, and program tracking data. Used actual capacities and efficiencies.	*Ex post* and *ex ante* differ due to the use of actual capacities and efficiencies, plus updated EFLH.
Smart Wi-Fi Thermostat	*Ex ante* savings may have been calculated using Indiana TRM (v2.2) and a combination of 2016 and 2017 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.	Therm savings directly from billing analysis results. For cooling savings, Indiana TRM (v2.2) algorithm, with billing-analysis derived savings fraction. Used the closest city to get EFLH.	Billing analysis indicated gas baseline consumption and savings much lower than those assumed in the Indiana TRM (v2.2). It also revealed lower cooling savings fraction.
Water Heater	*Ex ante* deemed savings were calculated using the Indiana TRM (v2.2). Used efficient UEF of 0.936 for instant and 0.691 for storage water heaters, and a baseline UEF of 0.635.	Indiana TRM (v2.2) and program tracking data. Used actual UEF efficient and model-derived baseline UEF values.	*Ex ante* and *ex post* differ because of using actual efficient UEF values and model-derived baseline UEF values.
Ductless Heat Pump	*Ex ante* savings are calculated using the IL TRM (v8.0).	Illinois TRM (v9.0), program tracking data, and assumed same heat pump base assumptions as Indiana TRM	*Ex post* and *ex ante* differ due to the use of actual capacities and efficiencies, plus updated EFLH.

MEASURE	*EX ANTE* SOURCES AND ASSUMPTIONS	*EX POST* GROSS SOURCES AND ASSUMPTIONS	PRIMARY REASONS FOR DIFFERENCES
		(v2.2) ASHP measure. Used actual capacities and efficiencies.	
Air Purifier	*Ex ante* savings are calculated using the IL TRM (v8.0). Specifically, pulled deemed savings based on measure CADR range.	Deemed savings according to Illinois TRM (v9.0) and program tracking data. Used actual ENERGY STAR QPL reported CADR.	Deemed savings in the Illinois TRM (v9.0) are much less than what is provided in TRM (v8.0).
Clothes Dryer	*Ex ante* savings are calculated using the IL TRM (v8.0). Specifically, pulled example calculated savings.	Illinois TRM (v9.0) and program tracking data. Used actual ENERGY STAR QPL reported CEF efficient.	Small differences due to the use of CEF efficient actual and one model type being gas vs. electric.
Dehumidifier	*Ex ante* savings are calculated using the IL TRM (v8.0). Specifically, pulled ENERGY STAR deemed savings based on measure capacity.	Illinois TRM (v9.0) and program tracking data. Used actual ENERGY STAR QPL reported average capacities and L/kWh.	Illinois TRM (v9.0) savings differ from (v8.0) and the use of actual capacities and L/kWh values cause *ex post* gross to deviate from *ex ante* further.

[a] This measure category was not in the Res Measure calcs workbook.

CONCURRENTLY INSTALLED FURNACE AND HEAT PUMPS

NIPSCO requested that the evaluation team assess their current approach for providing rebates and claiming savings for situations in which a customer is installing both a furnace and heat pump at the same time. When a customer installs both a furnace and a heat pump, the customer is only allowed to receive a rebate for the furnace (and similarly, savings are only claimed for the furnace). NIPSCO does not currently claim any savings associated with the heat pump in this scenario, however, the evaluation team expects that it may be appropriate for NIPSCO to claim cooling savings associated with these heat pumps, at a minimum. On the other hand, when furnaces and heat pumps are installed together, it is expected that furnace savings in these dual-installation scenarios may be somewhat lower, as these measures are often used to provide periodic back-up heat when it is too cold for a heat pump to function. The evaluation team expects that lower savings for furnaces installed in these scenarios is already currently captured in the EFLH calculated during the 2020 billing analysis.

Currently, the tracking data does not provide us insight into how common this dual installation is because current program requirements only track the furnace that is installed. But, according to discussions with TRC, TRC estimates about 20-30 of these concurrent installations per year. Currently, evaluation team is unable to understand the frequency of these installations and the resulting potential magnitude of savings. However, the evaluation team wanted to note this as a possible area for further exploration to determine the frequency and cost-effectiveness of adjusting how these measures are rebated and how savings are claimed.

EX POST GROSS SAVINGS

Table 22 shows the *ex ante* deemed savings and *ex post* gross per-measure savings for the 2021 EE Rebates program.

TABLE 22. 2021 EE REBATES PROGRAM *EX ANTE* & *EX POST* GROSS PER-MEASURE SAVINGS VALUES

MEASURE	MEASURE TYPE	*EX ANTE* DEEMED SAVINGS			*EX POST* GROSS PER-MEASURE SAVINGS		
		KWH	KW	THERMS	KWH	KW	THERMS
Natural Gas Furnace - 95% AFUE	Furnace	0.00	0.000	187.29	0.00	0.000	129.89
Natural Gas Furnace - 95% AFUE with ECM - Gas Only	Furnace	0.00	0.000	187.29	0.00	0.000	135.07
Natural Gas Furnace - 95% AFUE with ECM - Electric and Gas Savings	Furnace	415.00	0.059	187.29	0.00	0.000	129.70

MEASURE	MEASURE TYPE	*EX ANTE* DEEMED SAVINGS			*EX POST* GROSS PER-MEASURE SAVINGS		
		KWH	KW	THERMS	KWH	KW	THERMS
Air Conditioner 15+ SEER	Air Conditioner	683.54	0.777	0.00	681.32	0.802	0.00
AC with and without Furnace w/ ECM – Legacy 2020 Measure [a]	Air Conditioner	683.54	0.777	0.00	423.20	0.798	0.00
Air Conditioner Maintenance/Tune Up	Tune Up	51.11	0.116	0.00	44.39	0.101	0.00
Natural Gas Boiler - 90% AFUE	Boiler	0.00	0.000	202.05	0.00	0.000	121.81
Natural Gas Boiler - 92% AFUE	Boiler	0.00	0.000	303.08	0.00	0.000	208.15
Boiler Tune Up	Tune Up	0.00	0.000	62.23	0.00	0.000	42.17
Heat Pump with ECM	Heat Pump	1,046.06	0.365	0.00	1,105.40	0.147	0.00
Air Source Heat Pump 14+ SEER	Heat Pump	1,046.06	0.365	0.00	757.47	0.696	0.00
Smart WiFi Programmable Thermostat - Gas Heating Only Savings	Thermostat	0.00	0.000	109.22	0.00	0.000	33.92
Smart WiFi Programmable Thermostat - Electric Cooling and Gas Heating Savings	Thermostat	168.11	0.191	109.22	101.28	0.115	32.24
Smart WiFi Programmable Thermostat - Electric Cooling Only Savings	Thermostat	168.11	0.191	0.00	104.51	0.125	0.00
Smart WiFi Programmable Thermostat - Electric Cooling and Heating Savings	Thermostat	3,369.17	0.191	0.00	1,134.12	0.125	0.00
Smart WiFi Programmable Thermostat - Electric Heating Only Savings	Thermostat	3,201.06	0.000	0.00	1,017.79	0.000	0.00
Smart WiFi Programmable Thermostat - Heat Pump Savings	Thermostat	839.23	0.229	0.00	245.50	0.120	0.00
Natural Gas Water Heater (0.67 EF)	Water Heater	0.00	0.000	15.06	0.00	0.000	13.44
Natural Gas Storage Water Heater (≥ 0.70 UEF)	Water Heater	0.00	0.000	15.06	0.00	0.000	16.99
Natural Gas Tankless Water Heater (whole house; 0.82 EF)	Water Heater	0.00	0.000	59.76	0.00	0.000	52.45
Natural Gas Tankless Water Heater (whole house; ≥ 0.94 UEF)	Water Heater	0.00	0.000	59.76	0.00	0.000	33.30
Natural Gas Condensing Water Heater (≥ 0.70 UEF)	Water Heater	0.00	0.000	15.06	0.00	0.000	23.88
Natural Gas Condensing Water Heater (0.80 EF)	Water Heater	0.00	0.000	15.06	0.00	0.000	26.68
Ductless Mini-Split Heat Pump (DMSHP) 17+ SEER & 9.5+ HSPF	Heat Pump	701.92	0.100	0.00	943.37	0.172	0.00
ENERGY STAR Air Purifier/Cleaner CADR 50-100	Air Purifier	293.00	0.033	0.00	67.00	0.008	0.00
ENERGY STAR Air Purifier/Cleaner CADR 101-150	Air Purifier	488.00	0.056	0.00	55.00	0.006	0.00
ENERGY STAR Air Purifier/Cleaner CADR 201-250	Air Purifier	877.00	0.100	0.00	328.00	0.037	0.00
ENERGY STAR Air Purifier/Cleaner CADR Over 250	Air Purifier	1,169.00	0.133	0.00	328.00	0.037	0.00
ENERGY STAR Clothes Dryer - Electric Dryers	Clothes Dryer	160.44	0.022	0.00	144.75	0.019	0.00

MEASURE	MEASURE TYPE	*EX ANTE* DEEMED SAVINGS			*EX POST* GROSS PER-MEASURE SAVINGS		
		KWH	KW	THERMS	KWH	KW	THERMS
ENERGY STAR Dehumidifier - Portable (Capacity ≤ 25 pints/day) (≥ 1.57 L/kWh)	Dehumidifier	106.37	0.024	0.00	113.29	0.026	0.00
ENERGY STAR Dehumidifier - Portable (Capacity 25 - 50 pints/day) (≥ 1.80 L/kWh)	Dehumidifier	91.80	0.021	0.00	127.76	0.029	0.00
ENERGY STAR Dehumidifier - Portable (Capacity > 50 pints/day) (≥ 3.30 L/kWh)	Dehumidifier	133.32	0.030	0.00	130.22	0.030	0.00

[a] These are air conditioners installed in 2020 with a furnace that has an ECM.

REALIZATION RATES

The following section details the measure and fuel level realization rates for the 2021 Energy Efficiency Rebates program. Table 23 shows the measure level realization rate for kWh, kW, and Therms.

TABLE 23. 2021 EE REBATES PROGRAM MEASURE LEVEL REALIZATION RATES

MEASURE	KWH RR	KW RR	THERMS RR
Furnace	-	-	69%
AC	100%	103%	-
AC Tune Up	87%	87%	-
Boiler	-	-	68%
Boiler Tune Up	-	-	68%
ASHP	72%	191%	-
Smart Wi-Fi Thermostat	57%	60%	30%
Water Heater	-	-	61%
Ductless Heat Pump	134%	172%	-
Air Purifier	31%	31%	-
Clothes Dryer	90%	88%	-
Dehumidifier	132%	132%	-

THE NEXT TABLES (

Table 24 through Table 26) show the program's *ex ante* reported savings, verified savings, and *ex post* gross savings by measure group and overall fuel-level realization rates.

TABLE 24. 2021 EE REBATES PROGRAM *EX ANTE* & *EX POST* GROSS ELECTRIC ENERGY SAVINGS

MEASURE	*EX ANTE* [a] ELECTRIC ENERGY SAVINGS (KWH/YR.)	AUDITED GROSS ELECTRIC ENERGY SAVINGS (KWH/YR.)	VERIFIED GROSS ELECTRIC ENERGY SAVINGS (KWH/YR.)	*EX POST* GROSS ELECTRIC ENERGY SAVINGS (KWH/YR.)
Furnace	0.00	0.00	0.00	0.00
Furnace w/ ECM – Legacy 2020 Measure	115,370.00	115,370.00	115,370.00	0.00
AC	635,692.20	635,692.20	635,692.20	633,625.85
AC with and without Furnace w/ ECM – Legacy 2020 Measure	72,455.24	72,455.24	72,455.24	44,858.83
AC Tune Up	14,873.01	14,770.79	14,770.79	12,828.00
Boiler	0.00	0.00	0.00	0.00
Boiler Tune Up	0.00	0.00	0.00	0.00
ASHP – Legacy 2020 Measure	1,046.06	1,046.06	1,046.06	1,105.40
ASHP	4,184.24	4,184.24	4,184.24	3,029.86
Smart Wi-Fi thermostat	213,202.66	213,202.66	213,202.66	122,569.76
Water Heater – Legacy 2020 Measure	0.00	0.00	0.00	0.00
Water Heater	0.00	0.00	0.00	0.00
Ductless Heat Pump	33,692.16	33,692.16	33,692.16	45,281.69
Air Purifier	19,787.00	19,787.00	19,787.00	6,095.00
Clothes Dryer	1,443.96	1,443.96	1,443.96	1,302.75
Dehumidifier	8,692.53	8,692.53	8,692.53	11,508.53
Total Savings	1,120,439.06	1,120,336.84	1,120,336.84	882,205.68
Total Program Realization Rate				79%

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 25. 2021 EE REBATES PROGRAM *EX ANTE* & *EX POST* GROSS PEAK DEMAND REDUCTION

MEASURE	*EX ANTE* [a] PEAK DEMAND REDUCTION (KW/YR.)	AUDITED GROSS PEAK DEMAND REDUCTION (KW/YR.)	VERIFIED GROSS PEAK DEMAND REDUCTION (KW/YR.)	*EX POST* GROSS PEAK DEMAND REDUCTION (KW/YR.)
Furnace	0.000	0.000	0.000	0.000
Furnace w/ ECM – Legacy 2020 Measure	16.402	16.402	16.402	0.000
AC	722.610	722.610	722.610	746.101
AC with and without Furnace w/ ECM – Legacy 2020 Measure	82.362	82.362	82.362	84.611
AC Tune Up	33.756	33.524	33.524	29.136
Boiler	0.000	0.000	0.000	0.000
Boiler Tune Up	0.000	0.000	0.000	0.000
ASHP – Legacy 2020 Measure	0.365	0.365	0.365	0.147
ASHP	1.460	1.460	1.460	2.786
Smart Wi-Fi thermostat	218.962	218.962	218.962	132.292
Water Heater – Legacy 2020 Measure	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.)
Water Heater	0.000	0.000	0.000	0.000
Ductless Heat Pump	4.800	4.800	4.800	8.233
Air Purifier	2.257	2.257	2.257	0.696
Clothes Dryer	0.198	0.198	0.198	0.175
Dehumidifier	1.983	1.983	1.983	2.609
Total Savings	1,085.155	1,084.923	1,084.923	1,006.784
Total Program Realization Rate				93%

Note: Totals may not sum properly due to rounding.

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

TABLE 26. 2021 EE REBATES PROGRAM *EX ANTE* & *EX POST* GROSS NATURAL GAS SAVINGS

MEASURE	*EX ANTE* [a] NATURAL GAS ENERGY SAVINGS (THERMS/YR.)	AUDITED GROSS NATURAL GAS ENERGY (THERMS/YR.)	VERIFIED GROSS NATURAL GAS ENERGY SAVINGS (THERMS/YR.)	*EX POST* GROSS NATURAL GAS ENERGY SAVINGS (THERMS/YR.)
Furnace	929,332.98	929,332.98	929,332.98	644,489.43
Furnace w/ ECM – Legacy 2020 Measure	98,327.25	98,327.25	98,327.25	69,689.03
AC	0.00	0.00	0.00	0.00
AC with and without Furnace w/ ECM – Legacy 2020 Measure	0.00	0.00	0.00	0.00
AC Tune Up	0.00	0.00	0.00	0.00
Boiler	15,255.02	15,255.02	15,255.02	10,442.93
Boiler Tune Up	186.69	186.69	186.69	126.51
ASHP – Legacy 2020 Measure	0.00	0.00	0.00	0.00
ASHP	0.00	0.00	0.00	0.00
Smart Wi-Fi thermostat	258,305.30	258,305.30	258,305.30	78,330.00
Water Heater – Legacy 2020 Measure	643.74	643.74	643.74	580.65
Water Heater	7,863.48	7,863.48	7,863.48	4,770.78
Ductless Heat Pump	0.00	0.00	0.00	0.00
Air Purifier	0.00	0.00	0.00	0.00
Clothes Dryer	0.00	0.00	0.00	0.00
Dehumidifier	0.00	0.00	0.00	0.00
Total Savings	1,309,914.46	1,309,914.46	1,309,914.46	808,429.32
Total Program Realization Rate				62%

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.

Given how the *ex post* gross savings are calculated, realization rates can vary from year to year. Table 27 shows the differences for the same measures between the 2020 and 2021 evaluations. Some measures have more consistent realization rates across years, like furnaces and thermostats, while other measures have more drastic swings like ACs, boilers, and air source heat pumps. For these measures, savings are custom calculated by the evaluation team and sensitive to the capacities and efficiency levels that happen to be installed each year.

TABLE 27. COMPARISON OF REALIZATION RATES BETWEEN 2020 AND 2021 EVALUATION

MEASURE	KWH RR		KW RR		THERMS RR	
	2020	2021	2020	2021	2020	2021
Furnace	-	-	-	-	65%	69%
AC	79%	100%	184%	103%	-	-
AC Tune Up	77%	87%	77%	87%	-	-
Boiler	-	-	-	-	132%	68%
Boiler Tune Up	-	-	-	-	110%	68%
ASHP	93%	72%	21%	191%	-	-
Smart Wi-Fi thermostat	57%	57%	66%	60%	25%	30%
Water Heater	-	-	-	-	89%	61%

EX POST NET SAVINGS

The evaluation team conducted a full program evaluation survey in the 2020 evaluation to calculate the NTG ratio. For the new measures the evaluation team calculated a weighted average for the NTG ratio; for the legacy measures, the evaluation team used the same NTG ratio from the 2020 evaluation. Table 28 shows the NTG ratios by measure.

TABLE 28. 2021 EE REBATES PROGRAM NET-TO-GROSS RATIOS BY MEASURE

MEASURE	NTG RATIO
Furnace	58%
Furnace w/ ECM – Legacy 2020 Measure	58%
AC	58%
AC with and without Furnace w/ ECM – Legacy 2020 Measure	58%
AC Tune Up	56%
Boiler	58%
Boiler Tune Up	56%
ASHP – Legacy 2020 Measure	58%
ASHP	58%
Smart Wi-Fi Thermostat	72%
Water Heater – Legacy 2020 Measure	58%
Water Heater	58%
Ductless Heat Pump	58%
Air Purifier	60%
Clothes Dryer	60%
Dehumidifier	60%

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

TABLE 29. 2021 EE REBATES PROGRAM *EX POST* NET SAVINGS

MEASURE	*EX POST* GROSS SAVINGS/REDUCTION			NTG	*EX POST* NET SAVINGS/REDUCTION		
	KWH	KW	THERMS		KWH	KW	THERMS
Furnace	0.00	0.000	644,489.43	58%	0.00	0.000	373,803.87
Furnace w/ ECM – Legacy 2020 Measure	0.00	0.000	69,689.03	58%	0.00	0.000	40,419.64
AC	633,625.85	746.101	0.00	58%	367,502.99	432.738	0.00
AC with and without Furnace w/ ECM – Legacy 2020 Measure	44,858.83	84.611	0.00	58%	26,018.12	49.074	0.00
AC Tune Up	12,828.00	29.136	0.00	56%	7,183.68	16.316	0.00
Boiler	0.00	0.000	10,442.93	58%	0.00	0.000	6,056.90
Boiler Tune Up	0.00	0.000	126.51	56%	0.00	0.000	70.84
ASHP – Legacy 2020 Measure	1,105.40	0.147	0.00	58%	641.13	0.085	0.00
ASHP	3,029.86	2.786	0.00	58%	1,757.32	1.616	0.00
Smart Thermostat	122,569.76	132.292	78,330.00	72%	88,250.23	95.250	56,397.60
Water Heater – Legacy 2020 Measure	0.00	0.000	580.65	58%	0.00	0.000	336.78
Water Heater	0.00	0.000	4,770.78	58%	0.00	0.000	2,767.05
Ductless Heat Pump	45,281.69	8.233	0.00	58%	26,263.38	4.775	0.00
Air Purifier	6,095.00	0.696	0.00	60%[a]	3,657.00	0.417	0.00
Clothes Dryer	1,302.75	0.175	0.00	60%[a]	781.65	0.105	0.00
Dehumidifier	11,508.53	2.609	0.00	60%[a]	6,905.12	1.565	0.00
Total Savings	882,205.68	1,006.784	808,429.32	59%	528,960.62	601.943	479,852.68

[a] Program weighted average NTG

PROCESS EVALUATION

In 2021, the evaluation team conducted a limited process evaluation, which focused on reviewing updated program materials, and conducting a limited secondary review of peer-utility programs to provide context around new measure offerings.

PEER UTILITY PROGRAM OFFERINGS

To provide context for the new measures and measures with updated efficiency in the program, the evaluation team reviewed five peer utilities in the Midwest (ComEd, Vectren, AES, Ameren IL, and Ameren MO) to understand how and if they offered these measures (Table 30). Four out of five other utilities also offer rebates for ENERGY STAR dehumidifiers, electric clothes dryers, and room air purifiers. The rebate amount for an ENERGY STAR dehumidifier ranged from $50 to $25. The rebate amount for an ENERGY STAR electric clothes dryer ranged from $50 to $40. Finally, the rebate amount for an ENERGY STAR room air purifier was $50 for other similar utilities. Thus, NIPSCO's rebate amount for new measures is comparable with the amount provided by peer utilities in the Midwest.

TABLE 30. COMPARISON OF REBATES FOR NEW MEASURES

MEASURE	NIPSCO	COMED	VECTREN (CENTERPOINT)	AES	AMEREN IL	AMEREN MO
Ductless Mini-Split Heat Pump 17+ SEER & 9.5+ HSPF	$250	$400 (in 2019)	-	Higher efficiency offering than NIPSCO	Higher efficiency offering than NIPSCO	-
ENERGY STAR dehumidifier (portable)	$25	$50	$35	$25	Rebated measure; amount unknown	-
ENERGY STAR electric clothes dryer	$50	$40 (with size requirement)	$50	$50	$50 (with size requirement)	-
ENERGY STAR room air purifier	$50	$50	$50	$50	Rebated measure; amount unknown	-
Air Source Heat Pump 14+ SEER	$175	Higher efficiency offering than NIPSCO	-	Higher efficiency offering than NIPSCO	Higher efficiency offering than NIPSCO	Higher efficiency offering than NIPSCO

CONCLUSIONS AND RECOMMENDATIONS

CONCLUSION 1: NIPSCO DID NOT MEET THEIR SAVINGS GOALS FOR ELECTRIC ENERGY, PEAK DEMAND, OR NATURAL GAS. THE PROGRAM HAD A 79% REALIZATION RATE FOR KWH SAVINGS, A 93% REALIZATION RATE FOR DEMAND SAVINGS, AND A 62% REALIZATION RATE FOR THERM SAVINGS.

NIPSCO did not meet their savings goals for electric energy, peak demand, or natural gas. Although *ex ante* savings for natural gas exceeded the goal, *ex post* gross savings were considerably reduced. Like last year, the gas realization rate is largely driven by the results from the 2020 billing analysis for natural gas furnaces and thermostats, which found reduced furnace EFLH and thermostat usage resulting in a reduction in savings.

In the 11 months of the program evaluation, the program saved 882,205.68 kWh, 1,006.784 kW, and 808,429.32 therms. The evaluation team used the 2020 program evaluation survey results to calculate the ISR and NTG values for the 2021 evaluation. The evaluation team recommends updating these values in the 2022 evaluation, if possible.

Recommendations:

- NIPSCO and TRC should update the program *ex ante* savings estimates to reflect the most recent evaluated results.
- Consistent with the 2020 report, the evaluation team recommends that results from the 2020 billing analysis for EFLH and thermostat savings should be considered in planning. In future years the evaluation team recommends that the billing analysis findings of 47 therms savings (HSF = 7.1%) are applied instead of the 35 therms assumed for this evaluation, as these may be more representative of behavior not impacted by COVID-19.
- In the next cycle, conduct an in-depth study into the EE measures to learn more about how satisfied participants are, and to calculate the updated evaluation metrics (i.e., ISR, NTG, spillover, and freeridership values). If future participant levels allow for a survey, the evaluation team recommends that ductless heat pumps, dehumidifiers, electric clothes dryers, and air purifiers are examined more closely in 2022 (or 2023 if needed) evaluation, to develop NIPSCO-specific impact metrics.

CONCLUSION 2: REALIZATION RATES VARIED FOR SOME MEASURES ACROSS THE 2020 AND 2021 EVALUATIONS.

The realization rates at the measure level swung between the 2020 and 2021 evaluations for some measures. The evaluation team has seen this type of swing between evaluation years consistently, due to the nature of the evaluation timelines and evaluation methods. The evaluation team uses custom calculations for each measure. As installed measure specifications change from year to year, and as sample sizes are small, the *ex post* gross savings values can vary widely.

Recommendations:

- If NIPSCO and TRC are concerned about this year-to-year inconsistency, the implementation team could adjust how *ex post* savings estimates are applied to future program years. First, one option is to calculate savings using custom calculations, more like the evaluation methods, which would allow the program to more closely estimate savings based on the specific breakdown of measures installed in that year. Alternately, the evaluation team could work with TRC to develop blended savings estimates (aka, an average savings value using three years of data instead of just one). It is likely that future *ex post* gross savings estimates calculated by the evaluation team would still fluctuate around this number, but this could mitigate the swings somewhat. The evaluation team can support in developing these estimates based on the past several years of evaluations.

CONCLUSION 3: THE EVALUATION TEAM IDENTIFIED SEVERAL MEASURE-LEVEL SAVINGS ADJUSTMENTS.

Ex ante values for several measure categories including air conditioners, air conditioner tune-ups, boilers, boiler tune-ups, thermostats, and water heaters should be updated in the next program year. This will make the program savings estimates better reflect current program participation and changes to engineering assumptions.

Recommendations:

- *Air conditioners*: Apply actual SEER, EER, and capacity to savings, or use average values from the 2021 program data (average SEER = 15.7, average EER = 14.1, average capacity = 34,056 Btuh).
- *Air conditioner tune-ups*: Apply actual SEER, EER, and capacity to savings, or use average values from the 2021 program data (average SEER = 15.6, average EER = 14, average capacity = 32,088 Btuh).
- *Boilers*: Apply average program data capacity (119,922 MMBtu) and average AFUE (94.9%).
- *Boiler tune-ups*: Apply average capacity from boiler tune-up measures (92,500 Btuh).
- *Water heaters*: Apply a baseline UEF of 0.704 and efficient UEF of 0.951 for instant water heaters and 0.722 for storage.
- *New 2021 program measures (i.e., ductless mini splits, electric clothes driers, and air purifiers):* Apply averages from the 2021 program data. After next year's evaluation, the evaluation team will have more historic context to update these values.

CONCLUSION 4: CURRENTLY, NIPSCO DOES NOT CLAIM SAVINGS FOR HEAT PUMPS WHEN THEY ARE INSTALLED IN CONJUNCTION WITH FURNACES; HOWEVER, THIS MAY BE LEAVING VIABLE ELECTRIC SAVINGS ON THE TABLE.

In conversations with NIPSCO, they indicated that in situations where a customer installs both a furnace and a heat pump, the customer is only allowed to receive a rebate for the furnace (and similarly, savings are only claimed for the furnace). While there are certainly interactions across these measures, when installed together, that must be considered when estimating savings, the evaluation team recommends that NIPSCO explores whether it is feasible to, at a minimum, claim electric cooling savings from these heat pump installations. Currently, concurrently installed heat pump measures are not tracked in the database, so the evaluation team is unable to understand the frequency of these installations and the resulting potential magnitude of savings. If desired, the evaluation team can work with NIPSCO to explore this further and better understand what savings could be claimed.

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

Recommendations:

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

CONCLUSION 5: SOME EQUIPMENT CHARACTERISTICS AND ENERGY PERFORMANCE METRICS ARE NOT INCLUDED CONSISTENTLY OR ARE DIFFICULT TO ACCESS IN THE PROGRAM TRACKING DATA THAT ARE USED AS INPUTS FOR *EX POST* GROSS SAVINGS CALCULATIONS. AS SUCH, THE EVALUATION TEAM HAS MADE ASSUMPTIONS FOR THOSE INPUTS.

There are equipment characteristics and energy performance metrics that are not available that are used to calculate savings for several measures including air conditioners, air conditioner tune ups, air source heat pumps, ductless heat pumps, water heaters, air purifiers, and clothes dryers. For example, some variables are included in the tracking data but are not consistently tracked because they are not required fields. In addition, some characteristics are captured via participant documentation. These documents, while accessible, can be cost prohibitive to access en masse. Without these values, the evaluation team must make assumptions based on engineering judgment, program averages, and ENERGY STAR and AHRI database look ups. Although it might not be possible to provide data for some of these equipment characteristics, our calculations will be more tailored to the NIPSCO territory and reflect reported measure data more accurately if the evaluation team can have as many of these characteristics as possible. The measures and missing equipment data necessary for calculated savings are detailed below.

Recommendations:

- Encourage program staff to collect non-required fields. And, when possible, include fields for the following within the tracking database, rather than in the program documentation:

- HVAC characteristics such as SEER, EER, HSPF, and cooling/heating capacities are included in the tracking data for air conditioners, AC tune ups, air source heat pumps, and ductless heat pumps.
- When including the cooling capacity, provide it in units of Btuh instead of tons for more accuracy.
- Water heater uniform energy factor (UEF) in the tracking data.
- With the new ENERGY STAR measures, include the clean air delivery rate (CADR) and combined energy factor (CEF) for air purifiers and clothes dryers, respectively.

4. RESIDENTIAL LIGHTING PROGRAM

PROGRAM DESIGN AND DELIVERY

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

In 2021, NIPSCO offered program discounts on standard, reflector, and specialty light-emitting diodes (LEDs) and LED fixtures across a wide range of applications, package sizes, and wattages. Participating retailers varied and included big-box stores, do-it-yourself stores, club stores, and discount stores.

TRC implemented the program in 2021 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 2020 DESIGN

There were no major changes to the Residential Lighting program design or delivery in 2021. The program implementation team continued to ramp down promotions of GSLs in preparation for future program designs (where GSLs will no longer be offered through the upstream program).

PROGRAM PERFORMANCE

Unlike the majority of NIPSCO program evaluations in 2021, the Residential Lighting program team was able to examine the full program year of data. The remainder of this report includes findings from an evaluation of the full year of data; the evaluation team based all evaluation metrics on 12 months of data. Throughout 2021, the Residential Lighting program discounted 624,546 light bulbs and fixtures, reporting *ex ante* program energy savings and peak demand reduction of 12,058 MWh and 1,631 kW, respectively. Table 31 summarizes savings for the full year of program performance, including program savings goals. In terms of *ex post* gross savings, the program achieved 120% of the electric energy savings goal and 122% of the peak demand reduction goal.

TABLE 31. 2021 RESIDENTIAL LIGHTING PROGRAM SAVING SUMMARY – FULL YEAR 2021

METRIC	GROSS SAVINGS GOAL	*EX ANTE*	AUDITED	VERIFIED	*EX POST* GROSS	*EX POST* NET	GROSS GOAL ACHIEVEMENT
Electric Energy Savings (kWh/yr.)	16,502,238.69	12,057,992.06	12,057,992.06	11,066,688.78	19,839,757.23	7,201,786.55	120%
Peak Demand Reduction (kW)	2,215.286	1,631.155	1,631.155	1,495.883	2,702.328	981.031	122%
Natural Gas Energy Savings (therms/yr.)	N/A	N/A	N/A	N/A	N/A	N/A	N/A

Table 32 outlines the *ex post* gross and net-to-gross (NTG) adjustment factors. The methodology the evaluation team used to develop net-to-gross (NTG) factors for 2021 is described in detail in the *Ex Post* Net Savings section of this chapter.

TABLE 32. 2021 RESIDENTIAL LIGHTING PROGRAM ADJUSTMENT FACTORS

METRIC	REALIZATION RATE (%)[a]	FREERIDERSHIP	SPILLOVER	NTG (%)[b]
Electric Energy Savings (kWh/yr.)	165%	64%	0%	36%
Peak Demand Reduction (kW)	166%	64%	0%	36%
Natural Gas Energy Savings (therms/yr.)	N/A	N/A	N/A	N/A

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

Table 33 lists the Residential Lighting program budget and expenditures. In 2021, the program spent 67% of its electric budget.

TABLE 33. 2021 RESIDENTIAL LIGHTING PROGRAM EXPENDITURES

FUEL	PROGRAM BUDGET	PROGRAM EXPENDITURES	BUDGET SPENT (%)
Electric	$3,358,322.92	$2,257,257.33	67%
Natural Gas	N/A	N/A	N/A

EVALUATION METHODOLOGY

To inform the 2021 Residential Lighting evaluation, the evaluation team completed the following research activities:

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

IMPACT EVALUATION

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

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

AUDITED AND VERIFIED SAVINGS

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

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

The current *ex ante* value assumes an in-service rate (ISR) of 100%, per the Indiana TRM (v2.2). The evaluation team estimated ISRs using first-year ISRs from the 2015 Opinion Dynamics Market Effects Study, the most current research available from Indiana.[6,7] To adjust the ISR to take into account carryover savings from delayed installation of program lamps, the evaluation team used the Uniform Methods Project’s (UMP’s) recommended Discount Future Savings method, which indicated that most bulbs placed in storage (up to 97%) were installed within four years (including the initial program year), with 24% of bulbs left over from year one installed in year two, 24% in year three, and so on.[8] However, given expected baseline lighting changes anticipated to be applied as part of Energy Independence and Security Act (EISA) 2007, all standard LEDs are anticipated to effectively function as baseline lamps. Therefore, the evaluation team did not extend baseline savings beyond 2022, which would be considered Year Two in the UMP-recommended method. Using the first year ISRs from the 2015 Opinion Dynamics study and this UMP method, the evaluation team calculated an adjusted lifetime ISR of 89% for all lamps, thus accounting for carryover savings. LED fixtures retained a 100% ISR, as in keeping with prior evaluation years. Table 34 lists the ISRs for all program-installed measures.

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

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

[8] 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)

TABLE 34. 2021 RESIDENTIAL LIGHTING PROGRAM IN-SERVICE RATES RATIOS BY MEASURE

MEASURE	ISR
LED Fixture	100%
LED General Service	89%
LED Reflector	89%
LED Specialty	89%

Table 35 summarizes the tracking data quantity, audited quantity, applied ISRs and resulting verified quantity per measure. To calculate the verified measure quantity, the evaluation team multiplied the audited measure quantity by the ISR.

TABLE 35. 2021 RESIDENTIAL LIGHTING PROGRAM AUDITED AND VERIFIED QUANTITIES

MEASURE	UNIT OF MEASURE	AUDITED QUANTITY	ISR	VERIFIED QUANTITY
LED Fixture	Fixture	65,412	100%	65,412
LED General Service	Lamp	283,474	89%	252,292
LED Reflector	Lamp	131,561	89%	117,089
LED Specialty	Lamp	144,099	89%	128,248
Totals		624,546	90%	563,041

EX POST GROSS SAVINGS

METHODOLOGY

The evaluation team determined the program's *ex post* gross energy savings and demand reduction through an engineering analysis. Like the *ex ante* calculations, algorithms included hours of use (HOU), interactive effects, coincident factor (CF) for demand reduction from the Indiana TRM (v2.2), and the recommended baseline watts approach prescribed in the most recent version of the UMP Residential Lighting Evaluation Protocol. The evaluation team used a range of data sources to ensure it used the most recent and accurate savings assumptions. Appendix 2 contains the detailed equations the evaluation team used to calculate 2021 energy savings and demand reduction for the program and provides a summary table of savings assumptions, their sources, and how they compare to the *ex ante* assumptions.

2021 *EX POST* GROSS SAVINGS

Table 36 shows the *ex ante* deemed savings and *ex post* gross per-measure savings for 2021 Residential Lighting program measures. The overall realization rate for the program is 165% for energy savings and 166% 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 calculations use the post-2020 EISA requirements to establish baseline wattage; however, the 2020 backstop portion of EISA has not yet been implemented and halogen lamps continue to be available in the market.[9] The evaluation team therefore used the UMP-recommended ENERGY STAR lumens binning approach, with halogen lamps serving as the baseline comparison lamps, to determine baseline wattages for each program lamp consistent

[9] The backstop was not enforced by the Trump administration U.S. Department of Energy, and new rules are not yet in force under the Biden administration.

with previous evaluation years. This difference in calculation resulted in substantially higher *ex post* per-unit savings for most lamps.[10] The evaluation team recognizes that that market conditions affect savings and account for those market conditions through the NTG portion of the evaluation (as discussed later).

TABLE 36. 2021 RESIDENTIAL LIGHTING PROGRAM *EX ANTE* AND *EX POST* GROSS PER-MEASURE SAVINGS VALUES

MEASURE	UNIT OF MEASURE	*EX ANTE* DEEMED SAVINGS			*EX POST* GROSS PER-MEASURE SAVINGS		
		KWH	KW	THERMS	KWH	KW	THERMS
LED Fixture	Fixture	46.57	0.006	N/A	31.23	0.004	N/A
LED General Service	Lamp	11.48	0.001	N/A	28.57	0.004	N/A
LED Reflector	Lamp	27.34	0.004	N/A	42.20	0.006	N/A
LED Specialty	Lamp	15.00	0.002	N/A	28.77	0.004	N/A

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

TABLE 37. 2021 RESIDENTIAL LIGHTING PROGRAM NOTABLE DIFFERENCES BETWEEN *EX ANTE* AND *EX POST* GROSS ESTIMATES

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

WASTE HEAT FACTOR - THERM PENALTIES

In program years prior to 2020, the evaluation team did not calculate waste heat factor therm penalties for the Residential Lighting program, as this program is electric-only. In discussions with NIPSCO, starting with the 2020 evaluation year, the evaluation team began addressing waste heat factor therm penalties by calculating and applying them within the electric program cost-effectiveness analysis. The team will not include therm penalties in EM&V reported program savings or performance and will apply this approach consistently to all NIPSCO programs where therm penalties are generated due to LED lighting measures. The evaluation team believes this approach is appropriate, as it accounts for the penalty on the electric side, where it is generated, and will allow our team to show gas program and measure performance more clearly, where applicable. NIPSCO plans to take a similar, consistent approach to account for waste heat factors across programs in their planning process. Table 38 shows the therm penalty calculated for the Residential Lighting program.

[10] For lamps with lumen output that exceeds those found in standard residential lighting and are outside the bins presented in Appendix 2, the evaluation team passed through claimed savings for those lamps with stated baselines. Very few of these lamps are present in program data.

TABLE 38. 2021 RESIDENTIAL LIGHTING PROGRAM WASTE HEAT FACTOR THERM PENALTY

MEASURE	EVALUATED *EX POST* SAVINGS (THERMS)
LED Fixture	(41,736)
LED General Service	(165,485)
LED Reflector	(113,415)
LED Specialty	(84,692)
Total	(405,328)

It should be noted that electric waste heat factors, including cooling credits and electric heating penalties, are currently reported within the kilowatt-hour and kilowatt savings for the overall program, as described in Appendix 2. 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, verified savings, and *ex post* gross savings.

TABLE 39. 2021 RESIDENTIAL LIGHTING PROGRAM *EX ANTE* AND *EX POST* GROSS ELECTRIC ENERGY SAVINGS

MEASURE	*EX ANTE* [a] ELECTRIC ENERGY SAVINGS (KWH/YR.)	AUDITED GROSS ELECTRIC ENERGY SAVINGS (KWH/YR.)	VERIFIED GROSS ELECTRIC ENERGY SAVINGS (KWH/YR.)	*EX POST* GROSS ELECTRIC ENERGY SAVINGS (KWH/YR.)
LED Fixture	3,046,144.05	3,046,144.05	3,046,144.05	2,042,890.22
LED General Service	3,252,909.06	3,252,909.06	2,895,089.06	8,100,049.70
LED Reflector	3,597,405.70	3,597,405.70	3,201,691.07	5,551,375.13
LED Specialty	2,161,533.25	2,161,533.25	1,923,764.59	4,145,442.19
Total Savings	12,057,992.06	12,057,992.06	11,066,688.78	19,839,757.23
Total Program Realization Rate				165%

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 40. 2021 RESIDENTIAL LIGHTING PROGRAM *EX ANTE* AND *EX POST* GROSS PEAK DEMAND REDUCTION

MEASURE	*EX ANTE* [a] PEAK DEMAND REDUCTION (KW/YR.)	AUDITED GROSS PEAK DEMAND REDUCTION (KW/YR.)	VERIFIED GROSS PEAK DEMAND REDUCTION (KW/YR.)	*EX POST* GROSS PEAK DEMAND REDUCTION (KW/YR.)
LED Fixture	401.413	401.413	401.413	278.421
LED General Service	412.484	412.484	367.111	1,102.524
LED Reflector	521.077	521.077	463.759	755.659
LED Specialty	296.181	296.181	263.601	565.724
Total Savings	1,631.155	1,631.155	1,495.883	2,702.328
Total Program Realization Rate				166%

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

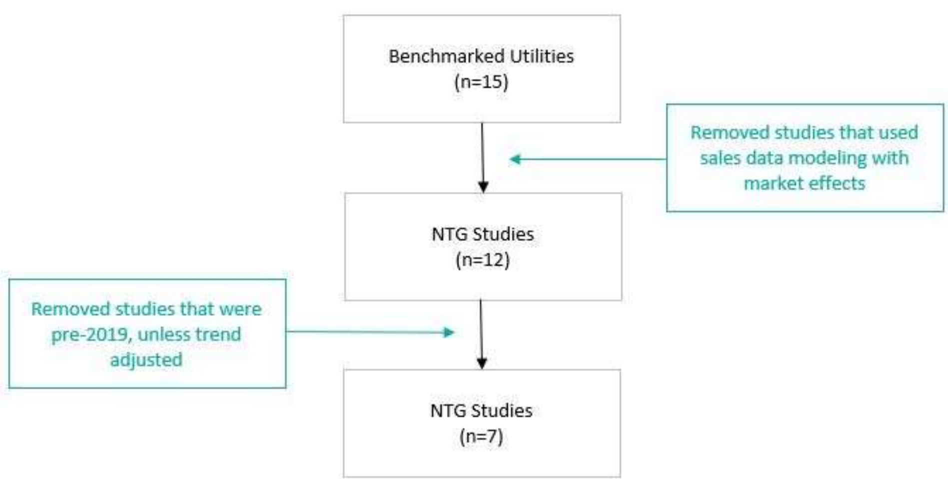
For 2021, the evaluation team reviewed publicly available evaluation results to identify the NTG values used by 15 utilities across the United States (including three Indiana utilities: AES Indiana, NIPSCO, and CenterPoint). The team collected the most recent data available to most accurately capture current market conditions for LEDs, starting with evaluation results that were applied to residential upstream lighting evaluation results between 2019 and 2021. The evaluation team removed results from several of the surveyed utilities from the benchmarking for NIPSCO for two main reasons.

First, the evaluation team removed utilities with studies that entailed sales data modeling with market effects since the Indiana framework does not allow utilities to claim market effects. The team was not able to collect disaggregated NTG estimates for three utilities and removed them from the population.

Second, market conditions changed dramatically between 2019 and 2020, with LEDs becoming the dominant technology among all common residential bulb styles, particularly reflectors.[11] Studies published analyzing 2020 lighting sales data showed LED market shares largely converged and showed little difference between states with long-running utility-sponsored programs and states with no history of utility-sponsored programs. As such, the team also removed studies known to include data collected prior to 2019, unless the studies included trend adjustments. Trend adjustments are prospective applications that use historic data but that apply values for future years that consider market trends. This step eliminated five utilities from the population, including the three Indiana utilities.

Figure 4 is an attrition diagram illustrating the evaluation team's methodology.

FIGURE 4. BENCHMARKED UTILITY ATTRITION DIAGRAM



[11] Cadmus. December 2020. *General Service Lamps: Stocking and Shelving Survey Final Report (Report Number 21-20)*. Prepared for the New York State Energy Research and Development Authority. https://www.nyserda.ny.gov/-/media/Files/Publications/Research/Other-Technical-Reports/21-20-General-Service-Lamps--Stocking-and-Shelving-Survey.pdf

Table 41 lists the remaining utilities and NTG values the evaluation team used to calculate NTG averages for each LED lamp type. The team applied the average NTG to NIPSCO's 2021 program sales data.

TABLE 41. 2021 RESIDENTIAL LIGHTING PROGRAM NET-TO-GROSS RATIOS BY MEASURE

LIST OF SURVEYED UTILITIES	GENERAL SERVICE	REFLECTOR	GLOBE/ CANDELABRA	FIXTURES/ INTEGRATED CAN	METHODOLOGY
Mid-Atlantic	0.19	0.19	0.19	0.19	Sales data modeling
Midwest 1	0.48	N/A	0.59	N/A	Sales data modeling
Midwest 2	0.40	N/A	0.50	N/A	Multiple methods, including sales data modeling
Midwest 3	0.20	0.02	0.31	N/A	Sales data modeling
Northeast 1	0.33	0.33	0.33	0.33	Sales data modeling and consensus panel
Northeast 2	0.25	0.35	0.35	0.35	Benchmarking
Northeast 3	0.68	0.68	0.68	0.68	Multiple methods, including sales data modeling
Average	0.36	0.31	0.42	0.39	

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

Table 42 lists the resulting net electric savings, demand reduction, and natural gas savings.

TABLE 42. 2021 RESIDENTIAL LIGHTING PROGRAM *EX POST* NET SAVINGS

MEASURE	*EX POST* GROSS SAVINGS/REDUCTION			NTG	*EX POST* NET SAVINGS/REDUCTION		
	KWH	KW	THERMS		KWH	KW	THERMS
LED Fixture	2,042,890.22	278.421	N/A	39%	791,619.96	107.888	N/A
LED General Service	8,100,049.70	1,102.524	N/A	36%	2,921,803.64	397.696	N/A
LED Reflector	5,551,375.13	755.659	N/A	31%	1,743,131.79	237.277	N/A
LED Specialty	4,145,442.19	565.724	N/A	42%	1,745,231.16	238.170	N/A
Total Savings	19,839,757.23	2,702.328	N/A	36%	7,201,786.55	981.031	N/A

CONCLUSIONS AND RECOMMENDATIONS

CONCLUSION 1: WHILE THE PROGRAM PERFORMED WELL IN 2021, ANTICIPATED REGULATORY CHANGES REDUCE EXPECTED GROSS SAVINGS IN 2022 AND BEYOND.

In December of 2021, the DOE's Office of Energy Efficiency and Renewable Energy again proposed a rule to codify the 45 lumen per-watt standard, with a comment period open through January 27, 2022.[12] The rule is expected to be finalized in 2022 and implemented in early 2023. The proposed rule is anticipated to fully implement EISA for all medium screw-base lamps and require applicable reflector and specialty lamps to follow the same efficiency standards as general service lamps. The new, stricter minimum efficiency standard of 45 lumens per watt means

[12] Federal Register. Last updated December 13, 2021. "Energy Conservation Program: Backstop Requirements for General Service Lamps." https://www.federalregister.gov/documents/2021/12/13/2021-26807/energy-conservation-program-backstop-requirement-for-general-service-lamps

that, likely in the next one to two calendar years, the sale of incandescent or halogen lamps would be prohibited. The exact timing of the impact on NIPSCO's energy efficiency programs is dependent on several yet-unknown factors, such as whether a sell-through period will be allowed. However, based on this regulatory change, in the next 1-2 years the evaluation team anticipates that the baseline comparison lamp for medium screw-base lighting will likely be LEDs, given the absence of incandescent, halogen, and compact fluorescent lamp alternatives after the new lumen standard has been implemented. The evaluation team, therefore, is alerting all Indiana utilities of the risk that there may not be significant gross electric or demand savings for upstream medium screw-base lighting measures, including reflector and specialty lamp forms, potentially beginning as soon as 2023. The evaluation team expects that the DOE will provide more guidance in the next few months and will discuss these implications with NIPSCO once more information is known.

This regulatory change also impacts 2021 savings for carryover lamps. Since nearly all LEDs covered by program incentives may not receive savings credit in 2023 and beyond, the evaluation team included only one year of carryover savings in this year's gross savings assumptions. Based on prior Indiana research, 86% of LED lamps are expected to be installed in the first year after purchase. Using the UMP protocol, which states that approximately 24% of stored lamps will be installed in the first year following purchase, the evaluation team applied an adjusted in-service rate of 89% for all lamp types sold through the program in 2021.

Recommendations:

Monitor the DOE's EISA outcome and incorporate effective changes in program design. Review inclusion of specialty and reflector LEDs as part of the upcoming Indiana Technical Reference Manual (TRM) update process to provide guidance for any future savings for these measures in upstream programs.

5. HOME ENERGY ASSESSMENT (HEA) PROGRAM

PROGRAM DESIGN AND DELIVERY

Through the Home Energy Assessment (HEA) program in 2021, NIPSCO provided both in-person Comprehensive Home Assessments (CHA) with direct installations of energy efficiency measures, and virtual energy assessments with home energy efficiency kits that included energy efficient products for self-installation. 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.

Customers are eligible for an in-person assessment if their home is more than five years old, they have not had a NIPSCO-sponsored in-person energy assessment in the past three years, and they have not had a NIPSCO-sponsored virtual energy assessment in the past year. To be eligible for a virtual assessment and kit, the customer must not have received a NIPSCO-sponsored energy efficiency kit in the past three years.

TRC administers the HEA 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 to implement the HEA program. These subcontractors perform the in-home assessments and direct installation of measures. TRC trains the subcontractors to ensure work quality and customer service meet program standards.

During 2021, TRC recruited participants through a variety of marketing efforts which used methods such as bill inserts, direct mail, word-of-mouth, advertising through local newspapers, newsletters, and web ads, promoting the program through community outreach, and developing content for the NIPSCO website and social media sites. They also marketed HEA by leaving door hangtags for residents of no-show appointments and at adjacent homes and placing a yard sign in the front yard of participating homes while the assessment was performed.

Interested customers can enroll in the HEA program by calling the NIPSCO Residential Energy Efficiency program hotline or signing up through the website. Subcontractors are also encouraged to discuss the program and schedule assessments for customers while performing other work for them. Due to COVID-19, customers were only offered virtual energy assessments at the beginning of 2021. Starting in June 2021, NIPSCO began offering in-person assessments, at which point interested customers were able to choose between an in-person and virtual energy assessment.

IN-PERSON ASSESSMENTS

During an in-person assessment, an energy advisor analyzes the efficiency of the heating and cooling systems and insulation levels in the home and installs energy-saving lighting, water conservation, and other energy-saving measures. The assessment concludes with the energy advisor providing a report of findings and energy-saving recommendations.

Depending on the conditions and current equipment in the home, the energy advisor installs any or all the following measures during the assessment:

- LED Bulbs (Up to 22 A-Line, Globe, and/or Candelabra Bulbs)
- Kitchen Faucet Aerator (Up to one)
- Bathroom Faucet Aerators (Up to two)
- Low Flow Showerheads (Up to two showerheads total)
- Low Flow Showerheads with Shower Start (Up to two showerheads total)
- Shower Start (Up to two)
- Filter Whistle
- Pipe Wrap (Up to 10 feet)
- Water Heater Wrap (Electric Only) (Up to one)
- Duct Sealing (Up to $150)

Qualifying program participants can also receive an instant discount of up to $700 on attic insulation installed through any insulation contractor of their choice. Participants contact and schedule the installation directly with the insulation contractor they select.

At the end of the assessment, the energy advisor provides an assessment report responding to any participants' concerns that led to their participation, information about the home's existing conditions and measures installed, as well as recommendations specific to the home. 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 customers understand the information provided and the next steps they can take.

VIRTUAL ASSESSMENTS

During a virtual assessment, the energy advisor completes the virtual assessments with participants via an online video call or phone call, depending on the customer's preference. The advisors ask participants questions about their home, including the types of energy-using equipment they have. If using video, customers walk around their home to show the advisor the different types of equipment they have as well as other characteristics of their home.

After completing the virtual assessment, the advisor compiles a report containing the information gathered during the virtual assessment, along with recommendations for how the customer can save energy in their home. The advisor discusses the findings with the customer and reviews instructions for installing and using the items they receive in their energy saving kit. After the virtual assessment is completed, the assessment report (like the one provided during the in-person assessment) is emailed to the customer. TRC then mails the customer an energy-saving kit with the following items, depending on their fuel type:

- Gas-Only Kit:
  - 2 Bathroom Faucet Aerators (1.0 gpm or less)
  - 2 Kitchen Faucet Aerators (1.5 gpm or less)
  - 2 Low flow Showerheads
  - 1 HVAC Filter Whistle
- Dual Fuel and Electric-Only Kit:
  - 4 LED Bulbs (ENERGY STAR certified 9W A-Line)
  - 1 LED Nightlight
  - 1 Bathroom Faucet Aerator (1.0 gpm or less)
  - 1 Kitchen Faucet Aerator (1.5 gpm or less)
  - 1 Low flow Showerhead
  - 1 HVAC Filter Whistle

CHANGES FROM 2020 DESIGN

Due to the COVID-19 pandemic, NIPSCO put the in-person HEA program on hold in March 2020 and instead began offering virtual assessments through the HEA program in September 2020. As previously described, NIPSCO continued offering virtual assessments in 2021, but reintroduced in-person assessments in June 2021. At that point, NIPSCO gave customers the option to choose either an in-person or virtual assessment for the remainder of 2021.

PROGRAM PERFORMANCE

In 2021, the NIPSCO team adjusted our timelines across programs to deliver evaluation reports earlier than in previous years. In order to meet the new timelines, for most programs the evaluation teams began analysis earlier, and conducted our impact analyses on 11 months of data instead of the full calendar year (January 1 to November 30, 2021).[13] The evaluation metrics developed during this analysis (including in-service rates, realization rates, net-to-gross ratios, etc.) and included in the first draft versions of the report were applied to the full year of data as part of the final, compiled report and included in Table 1 below.

Table 43 summarizes savings for the full year of program performance, including program savings goals.

TABLE 43. 2021 HEA PROGRAM SAVING SUMMARY – FULL YEAR 2021

METRIC	GROSS SAVINGS GOAL	*EX ANTE*	AUDITED	VERIFIED	*EX POST* GROSS	*EX POST* NET	GROSS GOAL ACHIEVEMENT
Electric Energy Savings (kWh/yr.)	314,171.66	167,701.08	167,700.69	146,558.78	154,248.19	110,969.55	49%
Peak Demand Reduction (kW)	71.522	40.760	40.770	36.968	36.986	29.310	52%
Natural Gas Energy Savings (therms/yr.)	30,389.24	13,633.01	13,633.25	13,392.30	14,176.22	12,634.01	47%

Table 44 summarizes savings evaluated during the program's evaluation period, which was from January 2021 to November 2021.

TABLE 44. 2021 HEA PROGRAM SAVING SUMMARY – JANUARY THROUGH NOVEMBER 2021

METRIC	*EX ANTE*	AUDITED	VERIFIED	*EX POST* GROSS	*EX POST* NET
Electric Energy Savings (kWh/yr.)	102,992.60	102,992.21	87,011.04	89,093.05	65,176.11
Peak Demand Reduction (kW)	20.146	20.156	17.718	17.319	13.618
Natural Gas Energy Savings (therms/yr.)	6,085.47	6,085.71	6,166.07	6,003.02	5,496.73

As documented in Table 44, audited savings aligned closely with the claimed *ex ante* savings; the small discrepancy stems from a rounding issue, which is described in more detail in the Audited and Verified Savings section. Verified savings were somewhat lower than claimed values due to in-service rates (ISR) of select measures. The engineering

[13] Note that all measure-level tables include measures from the full year, with the quantity listed as zero in cases where the measure appeared in the tracking data only in December 2021.

analysis completed for the *ex post* gross analysis further decreased the electric energy, peak demand, and natural gas energy savings values. Finally, the net-to-gross (NTG) analysis reduced *ex post* net results due to the calculated NTG values.

Table 45 outlines the realization rates and net energy adjustment factors resulting from the evaluation.

TABLE 45. 2021 HEA ADJUSTMENT FACTORS

METRIC	REALIZATION RATE (%)[a]	FREERIDERSHIP	SPILLOVER	NTG (%)[b]
Electric Energy Savings (kWh/yr.)	87%	27%	0%	73%
Peak Demand Reduction (kW)	86%	21%	0%	79%
Natural Gas Energy Savings (therms/yr.)	99%	8%	0%	92%

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

Both electric and natural gas spending was below the planned program budget for Program Year 2021 due to limited program participation (Table 46).

TABLE 46. 2021 HEA PROGRAM EXPENDITURES

FUEL	PROGRAM BUDGET	PROGRAM EXPENDITURES	BUDGET SPENT (%)
Electric	$124,772.27	$72,377.35	58%
Natural Gas	$185,077.21	$92,465.04	50%

EVALUATION METHODOLOGY

To inform the 2021 NIPSCO impact and process evaluation, the evaluation team completed the following research activities:

- **Program staff interviews and discussions**, to understand program design and delivery.
- **Documentation and materials review**, to provide context on program implementation.
- **Tracking data analysis**, to audit and verify the accuracy of program participation data.
- **Engineering analysis**, to review program savings assumptions and algorithms for reasonableness and accuracy.
- **Telephone and web survey of HEA participants**, to understand source of awareness, reasons for participation, experience with IQW, satisfaction with the program, program impacts on customers, and to inform the NTG analysis.

IMPACT EVALUATION

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

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

For all measure types, the evaluation team conducted an audit of the tracking data to identify potential issues, estimated and applied in-service rates (ISRs) to determine verified savings, conducted an engineering analysis to estimate *ex post* gross savings, and calculated freeridership rates to determine *ex post* net savings.

AUDITED AND VERIFIED SAVINGS

AUDITED 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.

The evaluation team reviewed the kit savings documentation (based on kit savings listed for the Employee Education program in NIPSCO's Program Design file) which contained measure-level and kit-level savings. Importantly, NIPSCO includes installation rates from past EM&V efforts in their *ex ante* assumptions for the kit program. The program documentation included discount rates to adjust savings for both installation practices and water heater fuel saturation.

Upon review of the savings, measure-level savings values in the tracking data aligned with NIPSCO's kit savings documentation. However, program tracking data savings are reported at the kit-level with a rounded total kit value, and NIPSCO's Measure Calculation file savings are reported at the measure-level with un-rounded per measure values. This difference in the unit of analysis resulted in rounding errors, meaning that the sum of total audited measure savings was off slightly from the tracking data savings. These rounding errors are noted where applicable in the remainder of this report.

VERIFIED SAVINGS

IN-SERVICE RATES

The analysis treated in-service rates (ISRs) for direct install and kit measures differently:

- To calculate the verified measure quantity for direct install measures, the evaluation team multiplied the audited measure quantity by the installation rate.
- Kit measure *ex ante* savings account for deemed ISRs. Therefore, instead of adjusting the verified quantity based on the ISR for kit measures, the evaluation team calculated per-unit verified savings using the updated ISR and kept the verified quantity the same as the audited quantity.

The evaluation team established ISRs for all HEA measures using a combination of results from the 2019, 2020, and 2021 participant surveys. We used the 2021 HEA survey for nearly all direct install measures and relied on results from the 2020 HomeLife survey for kit measures. Consistent with the method established in the 2015 evaluation and used in subsequent evaluations, the evaluation team used the percentage of customers in 2021 who recalled receiving an assessment report as the ISR for the energy assessment recommendations measures. Table 47 lists the ISRs for all program measures.

TABLE 47. 2021 HEA PROGRAM IN-SERVICE RATES RATIOS BY MEASURE

MEASURE	ISR	SOURCE
LED Bulbs	93%	2021 HEA Survey
Bathroom Aerator	95%	2021 HEA Survey
Kitchen Aerator	86%	2021 HEA Survey
Showerhead	88%	2021 HEA Survey
Pipe Wrap	88%	2021 HEA Survey
Duct Sealing	100%	2021 HEA Survey, with investigation of 2021 project documentation
Insulation	100%	2021 HEA Survey
Filter Whistle	100%	2019 HEA Evaluation
Assessment Recommendations	68%	2021 HEA Survey
Virtual Assessment Recommendations	78%	2021 HEA Survey
LED (9W) - Kit	80%[a]	2020 HomeLife Survey
Nightlight - Kit	85%	2020 HomeLife Survey
Bathroom Aerator - Kit	33%	2020 HomeLife Survey
Kitchen Aerator - Kit	44%	2020 HomeLife Survey
Showerhead - Kit	43%	2020 HomeLife Survey
Filter Whistle - Kit	30%	2020 HomeLife Survey

[a] The LED kit measure ISR also includes an update to the carryover savings.

The evaluation team calculated ISRs with 2021 survey data for all measures to determine if there were issues that required additional investigation but did not identify any concerns. For ISRs recommended in this evaluation, the evaluation team carefully reviewed the 2021 survey data to assess whether calculating ISRs from these data were appropriate based on the sample sizes by measure. 2021 ISRs were calculated and applied for all measures except filter whistles and kit measures, where sample sizes were small. The evaluation team referenced ISRs from the 2019 evaluation for filter whistles, and from the 2020 evaluation of HomeLife for kit measures.

The ISRs fell below 100% for two reasons: (1) respondents reported that a measure was not installed, or that a lower quantity than the program claimed was installed, and/or (2) respondents reported removing items after the program installed them. The ISRs for assessment recommendations are based on the number of survey respondents who indicated they received an assessment report.

For duct sealing, the evaluation team reviewed program documentation for 6 projects where 2021 survey respondents said measures were not installed. The evaluation team verified all projects were completed, resulting in an ISR of 100% for duct sealing.

TABLE 48 SUMMARIZES THE AUDITED QUANTITY, APPLIED INSTALLATION RATES, AND RESULTING VERIFIED QUANTITY PER MEASURE FOR ALL DIRECT INSTALL (NON-KIT) MEASURES. THE TABLE EXCLUDES KIT QUANTITIES. AS NOTED ABOVE, KITS EMBED ISRS WITHIN *EX ANTE* CALCULATIONS (

Table 49 documents the *ex ante* and evaluated ISRs for the kit contents). Therefore, it is not possible to cleanly apply ISRs to quantity to show the verified quantity. Further, the tracking data reports at the kit-level versus individual kit components. In total, the program distributed 146 kits (107 dual fuel, five electric-only, and 34 gas only).

TABLE 48. 2021 HEA PROGRAM AUDITED AND VERIFIED QUANTITIES - DIRECT INSTALL MEASURES

MEASURE	UNIT OF MEASURE	AUDITED QUANTITY	ISR	VERIFIED QUANTITY
A-Line LEDs - Dual Fuel	Lamp	1,639	93%	1,520
A-Line LEDs - Electric	Lamp	65	93%	60
Candelabra LEDs - Dual Fuel	Lamp	443	93%	411
Candelabra LEDs - Electric	Lamp	11	93%	10
Globe LEDs - Dual Fuel	Lamp	233	93%	216
Globe LEDs - Electric	Lamp	12	93%	11
Bathroom Aerator 1.0 gpm - Electric	Aerator	3	95%	3
Bathroom Aerator 1.0 gpm - Gas	Aerator	38	95%	36
Kitchen Aerator 1.5 gpm - Electric	Aerator	3	86%	3
Kitchen Aerator 1.5 gpm - Gas	Aerator	27	86%	23
Low Flow Showerhead 1.5 gpm - Electric	Showerhead	4	88%	4
Low Flow Showerhead 1.5 gpm - Gas	Showerhead	61	88%	54
Low Flow Showerhead with Shower Start - Electric	Showerhead with Shower Start	2	88%	2
Low Flow Showerhead with Shower Start - Gas	Showerhead with Shower Start	11	88%	10
Shower Start Only - Gas	Shower Start	7	88%	6
Pipe Wrap - Electric	Per Foot	11	88%	10
Pipe Wrap - Gas	Per Foot	151	88%	134
Filter Whistle - Electric Cooling and Gas Heating	Whistle	1	100%	1
Filter Whistle - Gas Heating Only Savings	Whistle	0	100%	0
Duct Sealing Package - Electric Cooling and Gas Heating	Home	27	100%	27
Duct Sealing Package - Electric Cooling Only	Home	1	100%	1
Duct Sealing Package - Gas Heating	Home	14	100%	14
Attic Insulation (Uninsulated Hatch) - Gas Heating Only Savings	Per ksf	0	100%	0
Attic Insulation (Uninsulated Hatch) - Electric Cooling and Gas Heating	Per ksf	1	100%	1
Assessment Recommendations - Dual Fuel	Home	215	68%	146
Assessment Recommendations - Electric	Home	9	68%	6
Assessment Recommendations - Gas	Home	66	68%	45
Virtual Assessment Recommendations - Dual Fuel	Home	110	78%	86
Virtual Assessment Recommendations - Electric	Home	6	78%	5

MEASURE	UNIT OF MEASURE	AUDITED QUANTITY	ISR	VERIFIED QUANTITY
Virtual Assessment Recommendations - Gas	Home	34	78%	27
Total		3,205	90%	2,870

TABLE 49. 2021 HEA PROGRAM *EX ANTE* AND EVALUATED ISRS - KIT MEASURES

MEASURE	*EX ANTE* ISR (EMBEDDED IN *EX ANTE* SAVINGS)	EVALUATED ISR (FROM 2020 HOMELIFE SURVEY)
LED (9W) - Kit	93%	80%[a]
Nightlight - Kit	89%	85%
Bathroom Aerator - Kit	38%	33%
Kitchen Aerator - Kit	46%	44%
Showerhead - Kit	43%	43%
Filter Whistle - Kit	37%	30%

[a] The LED kit measure ISR also includes an update to the carryover savings.

KITS

Table 50 summarizes the per unit audited and verified savings values for kits with ISRs applied. As noted above, audited savings already include ISR and water heater saturation adjustments, and these were updated using the current calculated ISRs and water heater saturation adjustment factors.

TABLE 50. 2021 HEA AUDITED AND VERIFIED PER UNIT SAVINGS - KIT MEASURES

MEASURE	AUDITED ISRS	VERIFIED ISRS[a]	AUDITED KWH SAVINGS	VERIFIED KWH SAVINGS	AUDITED KW REDUCTION	VERIFIED KW REDUCTION	AUDITED THERM SAVINGS	VERIFIED THERM SAVINGS
LED (9W) - Dual Fuel Kit	93%	80%	33.37	28.71	0.004	0.003	(0.68)	(0.59)
LED (9W) - Electric Only Kit	93%	80%	33.29	28.64	0.004	0.003	0.00	0.00
Nightlight - Dual Fuel Kit	89%	85%	4.74	4.52	0.000	0.000	0.00	0.00
Nightlight - Electric Only Kit	89%	85%	4.74	4.52	0.000	0.000	0.00	0.00
Bathroom Aerator - Dual Fuel Kit	38%	33%	4.52	1.07	0.0003	0.0001	0.66	0.74
Bathroom Aerator - Electric Only Kit	38%	33%	4.58	10.84	0.0003	0.001	0.00	0.00
Bathroom Aerator - Gas Only Kit	38%	33%	0.00	0.00	0.000	0.000	0.66	0.69
Kitchen Aerator - Dual Fuel Kit	46%	44%	33.55	8.75	0.001	0.0002	4.90	6.03
Kitchen Aerator - Electric Only Kit	46%	44%	33.93	88.51	0.001	0.002	0.00	0.00
Kitchen Aerator - Gas Only Kit	46%	44%	0.00	0.00	0.000	0.000	4.93	5.68
Showerhead - Dual Fuel Kit	43%	43%	53.66	14.63	0.002	0.0004	7.83	10.09
Showerhead - Electric Only Kit	43%	43%	54.15	147.68	0.002	0.004	0.00	0.00
Showerhead - Gas Only Kit	43%	43%	0.00	0.00	0.000	0.000	7.87	9.49
Filter Whistle - Dual Fuel Kit	37%	30%	25.69	21.01	0.009	0.007	2.48	2.03
Filter Whistle - Electric Only Kit	37%	30%	25.69	21.01	0.009	0.007	0.00	0.00
Filter Whistle - Gas Only Kit	37%	30%	0.00	0.00	0.000	0.000	2.48	2.03

[a] From 2020 HomeLife Survey

In addition to ISRs, verified savings for kit measures account for adjustments to water heater fuel types, which affected all water saving devices. The evaluation team determined the water heater fuel saturation rates from the 2021 HEA program tracking data. In Table 51, results indicate discrepancies between *ex ante* and verified electric and natural gas domestic water heating saturation rates of varying magnitudes for the three kit types.

TABLE 51. 2021 HEA PROGRAM WATER HEATER FUEL SATURATION

KIT TYPE	REPORTED *EX ANTE* SATURATION RATE		VERIFIED SATURATION RATE	
	ELECTRIC	GAS	ELECTRIC	GAS
Dual Fuel	22%	73%	6%	94%
Electric Only	22%	73%	60%	40%
Gas Only	22%	73%	12%	88%

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) for variable assumptions to calculate *ex post* gross electric energy savings, demand reduction, and natural gas savings. Where data were unavailable in the Indiana TRM (v2.2), the evaluation team used data from the 2021 Pennsylvania TRM, the Uniform Methods Project (UMP), the 2019 NIPSCO Evaluation, Measurement, and Verification (EM&V) results, and Comprehensive Home Assessments (CHA) data from the 2019 NIPSCO program. The evaluation team revised assumptions for savings estimates applicable to the NIPSCO service territory, as needed. Appendix 3 contains more details on the specific algorithms, variable assumptions, and references for all program measure *ex post* gross calculations.

EX POST GROSS SAVINGS

Table 52. 2021 HEA Program *Ex Ante* & *Ex Post* Gross Per-Measure Savings Values shows the *ex ante* deemed savings and *ex post* gross per-measure savings for 2021 HEA program measures.

TABLE 52. 2021 HEA PROGRAM *EX ANTE* & *EX POST* GROSS PER-MEASURE SAVINGS VALUES

MEASURE	UNIT OF MEASURE	*EX ANTE* DEEMED PER-MEASURE SAVINGS			*EX POST* GROSS PER-MEASURE SAVINGS		
		KWH	KW	THERMS	KWH	KW	THERMS
A-Line LEDs - Dual Fuel	Lamp	28.52	0.004	(0.58)	28.51	0.004	0.00
A-Line LEDs - Electric	Lamp	28.52	0.004	0.00	28.40	0.004	0.00
Candelabra LEDs - Dual Fuel	Lamp	20.13	0.003	(0.41)	29.35	0.004	0.00
Candelabra LEDs - Electric	Lamp	20.13	0.003	0.00	29.36	0.004	0.00
Globe LEDs - Dual Fuel	Lamp	19.29	0.003	(0.39)	28.51	0.004	0.00
Globe LEDs - Electric	Lamp	19.29	0.003	0.00	28.52	0.004	0.00
Bathroom Aerator 1.0 gpm - Electric	Aerator	34.00	0.003	0.00	33.80	0.003	0.00
Bathroom Aerator 1.0 gpm - Gas	Aerator	0.00	0.000	1.50	0.00	0.000	1.50
Kitchen Aerator 1.5 gpm - Electric	Aerator	180.95	0.008	0.00	183.13	0.008	0.00
Kitchen Aerator 1.5 gpm - Gas	Aerator	0.00	0.000	7.96	0.00	0.000	7.95
Low Flow Showerhead 1.5 gpm - Electric	Showerhead	285.65	0.017	0.00	260.66	0.017	0.00
Low Flow Showerhead 1.5 gpm - Gas	Showerhead	0.00	0.000	12.57	0.00	0.000	11.55

MEASURE	UNIT OF MEASURE	*EX ANTE* DEEMED PER-MEASURE SAVINGS			*EX POST* GROSS PER-MEASURE SAVINGS		
		KWH	KW	THERMS	KWH	KW	THERMS
Low Flow Showerhead with Shower Start - Electric	Showerhead with Shower Start	329.10	0.062	0.00	316.84	0.021	0.00
Low Flow Showerhead with Shower Start - Gas	Showerhead with Shower Start	0.00	0.000	14.48	0.00	0.000	13.39
Shower Start Only - Gas	Shower Start	0.00	0.000	3.35	0.00	0.000	3.36
Pipe Wrap - Electric	Per Foot	25.33	0.003	0.00	25.33	0.003	0.00
Pipe Wrap - Gas	Per Foot	0.00	0.000	1.13	0.00	0.000	1.13
Filter Whistle - Electric Cooling and Gas Heating	Whistle	16.25	0.026	6.76	24.37	0.028	2.75
Filter Whistle - Gas Heating Only Savings	Whistle	0.00	0.000	6.76	0.00	0.000	2.75
Duct Sealing Package - Electric Cooling and Gas Heating	Home	60.82	0.138	56.40	61.39	0.138	56.43
Duct Sealing Package - Electric Cooling Only	Home	49.02	0.112	0.00	49.48	0.112	0.00
Duct Sealing Package - Gas Heating	Home	0.00	0.000	56.40	0.00	0.000	56.43
Attic Insulation (Uninsulated Hatch) - Gas Heating Only Savings	Per ksf	0.00	0.000	213.37	0.00	0.000	207.00
Attic Insulation (Uninsulated Hatch) - Electric Cooling and Gas Heating	Per ksf	236.05	0.116	206.75	236.00	0.102	207.00
Assessment Recommendations - Dual Fuel	Home	21.24	0.012	2.70	21.24	0.012	2.70
Assessment Recommendations - Electric	Home	21.28	0.012	0.00	21.28	0.012	0.00
Assessment Recommendations - Gas	Home	0.00	0.000	2.70	0.00	0.000	2.70
Virtual Assessment Recommendations - Dual Fuel	Home	21.24	0.012	2.70	21.24	0.012	2.70
Virtual Assessment Recommendations - Electric	Home	21.28	0.012	0.00	21.28	0.012	0.00
Virtual Assessment Recommendations - Gas	Home	0.00	0.000	2.70	0.00	0.000	2.70
LED (9W) - Dual Fuel Kit	Lamp	33.37	0.004	(0.68)	22.34	0.002	0.00
LED (9W) - Electric Only Kit	Lamp	33.29	0.004	0.00	22.21	0.002	0.00
Nightlight - Dual Fuel Kit	Nightlight	4.74	0.000	0.00	2.55	0.000	0.00
Nightlight - Electric Only Kit	Nightlight	4.74	0.000	0.00	2.55	0.000	0.00
Bathroom Aerator - Dual Fuel Kit	Aerator	4.52	0.000	0.66	0.58	0.0001	0.43
Bathroom Aerator - Electric Only Kit	Aerator	4.58	0.000	0.00	6.37	0.001	0.00
Bathroom Aerator - Gas Only Kit	Aerator	0.00	0.000	0.66	0.00	0.000	0.42
Kitchen Aerator - Dual Fuel Kit	Aerator	33.55	0.001	4.90	4.45	0.0002	3.30
Kitchen Aerator - Electric Only Kit	Aerator	33.93	0.001	0.00	48.75	0.002	0.00
Kitchen Aerator - Gas Only Kit	Aerator	0.00	0.000	4.93	0.00	0.000	3.17
Showerhead - Dual Fuel Kit	Showerhead	53.66	0.002	7.83	7.53	0.0004	5.58

MEASURE	UNIT OF MEASURE	*EX ANTE* DEEMED PER-MEASURE SAVINGS			*EX POST* GROSS PER-MEASURE SAVINGS		
		KWH	KW	THERMS	KWH	KW	THERMS
Showerhead - Electric Only Kit	Showerhead	54.15	0.002	0.00	82.05	0.004	0.00
Showerhead - Gas Only Kit	Showerhead	0.00	0.000	7.87	0.00	0.000	5.34
Filter Whistle - Dual Fuel Kit	Whistle	25.69	0.009	2.48	30.97	0.003	0.00
Filter Whistle - Electric Only Kit	Whistle	25.69	0.009	0.00	28.60	0.002	0.00
Filter Whistle - Gas Only Kit	Whistle	0.00	0.000	2.48	0.00	0.000	0.00

Through the engineering review, the evaluation team uncovered a few major differences between *ex ante* and *ex post* gross savings for all measures. The measures with large differences between *ex ante* and *ex gross* savings were LEDs and filter whistles. These differences were primarily driven by the following overarching factors:

- For LED candelabra and globe measures, the baseline wattages used in *ex ante* calculations were found to be incorrect. The correct baseline wattages were higher and led to around a 50% increase in realization rate. Previously, the assigned baseline wattages for candelabras and globes assumed they were covered by the Energy Independence and Security Act (EISA). However, candelabras and globes are exempt from this legislation, and therefore their baseline wattages should be higher to reflect that. This understated savings by almost 50% for all candelabra and globe measures.
- The *ex ante* filter whistle savings used values for efficiency improvement and coincidence factor from the Illinois TRM, and the most recent version of the Illinois TRM (v9) removed its filter whistle measure. The *ex post* calculations were updated to use values from the 2021 Pennsylvania TRM.

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

- The evaluation team calculated *ex post* gross savings for most of the measures using the Indiana TRM (v2.2). The planning and reporting assumptions NIPSCO used to calculate *ex ante* savings referenced the Indiana TRM (v2.2) and the 2019 EM&V results, and sometimes included an average of the savings values provided in each source.
- The evaluation team used the installation zip code to match each customer to the closest city from the Indiana TRM (v2.2)—for example, South Bend and Fort Wayne—to more precisely account for variations in climate for measures including LED bulbs, faucet aerators, low flow showerheads, duct sealing, and attic insulation.

Table 53 describes the differences between *ex ante* and *ex post* gross estimates by measure.

TABLE 53. 2019 HEA 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, ISR, and hours per TRM. WHF values assume weighted average from South Bend per TRM tables.	*Ex post* savings are based on the Indiana TRM (v2.2), the UMP, and program tracking data. Baseline wattages come from UMP. WHF use TRM weighted average values assigned with zip code mapping.	Differences in baseline wattage and WHF assumptions.
Low Flow Showerhead	*Ex ante* savings are based on the Indiana TRM (v2.2). GPM_{base} and	*Ex post* savings are based on the Indiana TRM (v2.2) and participant	Different assumptions for water temperatures and showers per day.

MEASURE	*EX ANTE* SOURCES AND ASSUMPTIONS	*EX POST* GROSS SOURCES AND ASSUMPTIONS	PRIMARY REASONS FOR DIFFERENCES
	GPM_{low}, people per home, faucets per home, and cold-water temperature assumes South Bend per TRM tables.	information in program tracking data assumed single-family housing; cold-water inlet temperature based on customer location, actual rating for GPM_{low} of 1.5, and showers per day taken from 2021 NIPSCO survey data.	
Filter Whistle	*Ex ante* savings calculations are based on the 2021 PA TRM using coincidence factor and efficiency improvement values from the IL TRM v9.0.	2021 PA TRM values	Different values for coincidence factor and efficiency improvements, IL TRM (v9) does not have a filter whistle measure.
Kits - Kitchen and bathroom aerators, Low flow showerheads	Indiana TRM (v2.2) and 2019 EM&V	Indiana TRM (v2.2) and participant tracking data for water heater fuel type	The *ex ante* analysis applies a water heater saturation percentage across all participants based on the 2019 EM&V, whereas *ex post* incorporates actual water heater fuel type.
Kits - 9W LED	Indiana TRM (v2.2) and 2019 EM&V	Indiana TRM (v2.2); 2021 HomeLife Calculator survey for baseline wattages*	The ex *ante* analysis applies the UMP baseline wattage. The *ex post* analysis applies a blended baseline wattage based on results of the 2021 HomeLife Calculator program survey. The *ex post* therm penalties for LEDs are reported separately (discussed below).
Kits – Nightlight	Indiana TRM (v2.2) and 2019 EM&V	Indiana TRM (v2.2) and 2021 HomeLife Calculator survey*	The *ex ante* analysis applied the 2019 incandescent replacement factor (IRF) to account for the number of LED nightlights replacing incandescent nightlights. The *ex post* analysis updates the IRF with the 2021 HomeLife survey value.
Kits - Filter whistle	Illinois TRM v8.0	2021 Pennsylvania TRM and participant tracking data for presence of central air conditioning	The *ex ante* analysis assigns cooling system savings to all combo and electric kit participants and full therm savings to all combo and gas kit participants. The *ex post* analysis refers to participant tracking data for the presence of air conditioning, and the evaluation team's review of available literature reveals a lack of defensible evidence for assigning therm savings at this time.

*The evaluation team referenced the Homelife Calculator Program survey information where the HEA Program survey did not include the related questions for kits.

WASTE HEAT FACTOR – THERM PENALTIES

Consistent with the 2020 evaluation year, the evaluation team is not including therm penalties when calculating evaluated savings for the 2021 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.

The *ex ante* savings for all kit programs include therm penalties. 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. In total, the therm penalty for cost-effectiveness analysis is -1,453.58 therms (Table 54. 2021 HEA Program Waste heat factor therm penalty).

TABLE 54. 2021 HEA PROGRAM WASTE HEAT FACTOR THERM PENALTY

MEASURE	WASTE HEAT FACTOR THERM PENALTY
A-Line LEDs - Dual Fuel	(885.76)
Candelabra LEDs - Dual Fuel	(246.45)
Globe LEDs - Dual Fuel	(125.92)
LED (9W) - Combo Kit	(195.45)

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

REALIZATION RATES

The next three tables (Table 55 through Table 57) show the program's *ex ante* reported savings, verified savings, and *ex post* gross savings. The main driver for all three realization rates was the LED measures. The baseline wattages used in the *ex ante* calculations for the reported candelabra and globe measures were much lower than those used in the *ex post* calculations. Previously, candelabras and globes had assigned baseline wattages assuming they were covered by EISA. However, candelabras and globes are exempt from this legislation, and therefore the evaluation team used higher baseline wattages to reflect that. This understated savings by almost 50% for all candelabra and globe measures.

TABLE 55. 2021 HEA 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.)
A-Line LEDs - Dual Fuel	-	46,744.28	43,353.50	43,338.66
A-Line LEDs - Electric	-	1,853.80	1,719.33	1,711.89
Candelabra LEDs - Dual Fuel	-	8,917.59	8,270.72	12,058.83
Candelabra LEDs - Electric	-	221.43	205.37	299.53
Globe LEDs - Dual Fuel	-	4,494.57	4,168.54	6,160.66
Globe LEDs - Electric	-	231.48	214.69	317.43
Bathroom Aerator 1.0 gpm - Electric	-	102.00	96.90	96.33
Bathroom Aerator 1.0 gpm - Gas	-	0.00	0.00	0.00
Kitchen Aerator 1.5 gpm - Electric	-	542.85	468.83	474.47
Kitchen Aerator 1.5 gpm - Gas	-	0.00	0.00	0.00
Low Flow Showerhead 1.5 gpm - Electric	-	1,142.60	1,004.10	916.26
Low Flow Showerhead 1.5 gpm - Gas	-	0.00	0.00	0.00
Low Flow Showerhead with Shower Start - Electric	-	658.20	578.42	556.88
Low Flow Showerhead with Shower Start - Gas	-	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.)
Shower Start Only - Gas	-	0.00	0.00	0.00
Pipe Wrap - Electric	-	278.63	246.48	246.52
Pipe Wrap - Gas	-	0.00	0.00	0.00
Filter Whistle - Electric Cooling and Gas Heating	-	16.25	16.25	24.37
Filter Whistle - Gas Heating Only Savings	-	0.00	0.00	0.00
Duct Sealing Package - Electric Cooling and Gas Heating	-	1,642.14	1,642.14	1,657.60
Duct Sealing Package - Electric Cooling Only	-	49.02	49.02	49.48
Duct Sealing Package - Gas Heating	-	0.00	0.00	0.00
Attic Insulation (Uninsulated Hatch) - Gas Heating Only Savings	-	0.00	0.00	0.00
Attic Insulation (Uninsulated Hatch) - Electric Cooling and Gas Heating	-	241.95	241.95	241.90
Assessment Recommendations - Dual Fuel	-	4,566.60	3,102.95	3,102.95
Assessment Recommendations - Electric	-	191.52	130.14	130.14
Assessment Recommendations - Gas	-	0.00	0.00	0.00
Virtual Assessment Recommendations - Dual Fuel	-	2,336.40	1,831.23	1,831.23
Virtual Assessment Recommendations - Electric	-	127.68	100.07	100.07
Virtual Assessment Recommendations - Gas	-	0.00	0.00	0.00
LED (9W) - Dual Fuel Kit	-	14,282.37	12,285.91	9,561.03
LED (9W) - Electric Only Kit	-	665.81	572.74	444.16
Nightlight - Dual Fuel Kit	-	506.79	483.69	272.85
Nightlight - Electric Only Kit	-	23.68	22.60	12.75
Bathroom Aerator - Dual Fuel Kit	-	483.19	114.44	61.96
Bathroom Aerator - Electric Only Kit	-	22.89	54.22	31.86
Bathroom Aerator - Gas Only Kit	-	0.00	0.00	0.00
Kitchen Aerator - Dual Fuel Kit	-	3,590.02	936.53	476.57
Kitchen Aerator - Electric Only Kit	-	169.64	442.55	243.73
Kitchen Aerator - Gas Only Kit	-	0.00	0.00	0.00
Showerhead - Dual Fuel Kit	-	5,741.23	1,565.79	805.44
Showerhead - Electric Only Kit	-	270.74	738.39	410.24
Showerhead - Gas Only Kit	-	0.00	0.00	0.00
Filter Whistle - Dual Fuel Kit	-	2,748.41	2,248.50	3,314.25
Filter Whistle - Electric Only Kit	-	128.43	105.07	142.98
Filter Whistle - Gas Only Kit	-	0.00	0.00	0.00
Total Savings	102,992.60	102,992.21	87,011.04	89,093.05
Total Program Realization Rate				87%

Note: Totals may not sum properly due to rounding.

[a] Program tracking data is summed at the kit-level (not measure level). Therefore, *ex ante* savings are only reported at the summary level, due to rounding errors.

TABLE 56. 2021 HEA 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.)
A-Line LEDs - Dual Fuel	-	6.556	6.080	5.901
A-Line LEDs - Electric	-	0.260	0.241	0.234
Candelabra LEDs - Dual Fuel	-	1.329	1.233	1.642
Candelabra LEDs - Electric	-	0.033	0.031	0.041
Globe LEDs - Dual Fuel	-	0.699	0.648	0.839
Globe LEDs - Electric	-	0.036	0.033	0.043
Bathroom Aerator 1.0 gpm - Electric	-	0.009	0.009	0.009
Bathroom Aerator 1.0 gpm - Gas	-	0.000	0.000	0.000
Kitchen Aerator 1.5 gpm - Electric	-	0.024	0.021	0.022
Kitchen Aerator 1.5 gpm - Gas	-	0.000	0.000	0.000
Low Flow Showerhead 1.5 gpm - Electric	-	0.068	0.060	0.059
Low Flow Showerhead 1.5 gpm - Gas	-	0.000	0.000	0.000
Low Flow Showerhead with Shower Start - Electric	-	0.124	0.109	0.037
Low Flow Showerhead with Shower Start - Gas	-	0.000	0.000	0.000
Shower Start Only - Gas	-	0.000	0.000	0.000
Pipe Wrap - Electric	-	0.033	0.029	0.028
Pipe Wrap - Gas	-	0.000	0.000	0.000
Filter Whistle - Electric Cooling and Gas Heating	-	0.026	0.026	0.028
Filter Whistle - Gas Heating Only Savings	-	0.000	0.000	0.000
Duct Sealing Package - Electric Cooling and Gas Heating	-	3.726	3.726	3.734
Duct Sealing Package - Electric Cooling Only	-	0.112	0.112	0.112
Duct Sealing Package - Gas Heating	-	0.000	0.000	0.000
Attic Insulation (Uninsulated Hatch) - Gas Heating Only Savings	-	0.000	0.000	0.000
Attic Insulation (Uninsulated Hatch) - Electric Cooling and Gas Heating	-	0.119	0.119	0.105
Assessment Recommendations - Dual Fuel	-	2.580	1.753	1.753
Assessment Recommendations - Electric	-	0.108	0.073	0.073
Assessment Recommendations - Gas	-	0.000	0.000	0.000
Virtual Assessment Recommendations - Dual Fuel	-	1.320	1.035	1.035
Virtual Assessment Recommendations - Electric	-	0.072	0.056	0.056
Virtual Assessment Recommendations - Gas	-	0.000	0.000	0.000
LED (9W) - Dual Fuel Kit	-	1.545	1.329	1.035
LED (9W) - Electric Only Kit	-	0.072	0.062	0.048
Nightlight - Dual Fuel Kit	-	0.000	0.000	0.000
Nightlight - Electric Only Kit	-	0.000	0.000	0.000
Bathroom Aerator - Dual Fuel Kit	-	0.029	0.007	0.006
Bathroom Aerator - Electric Only Kit	-	0.001	0.003	0.003

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.)
Bathroom Aerator - Gas Only Kit	-	0.000	0.000	0.000
Kitchen Aerator - Dual Fuel Kit	-	0.089	0.023	0.020
Kitchen Aerator - Electric Only Kit	-	0.004	0.011	0.011
Kitchen Aerator - Gas Only Kit	-	0.000	0.000	0.000
Showerhead - Dual Fuel Kit	-	0.171	0.047	0.044
Showerhead - Electric Only Kit	-	0.008	0.022	0.022
Showerhead - Gas Only Kit	-	0.000	0.000	0.000
Filter Whistle - Dual Fuel Kit	-	0.957	0.783	0.366
Filter Whistle - Electric Only Kit	-	0.045	0.037	0.011
Filter Whistle - Gas Only Kit	-	0.000	0.000	0.000
Total Savings	20.146	20.156	17.718	17.319
Total Program Realization Rate				86%

Note: Totals may not sum properly due to rounding.

[a] Program tracking data is summed at the kit-level (not measure level). Therefore, *ex ante* savings are only reported at the summary level, due to rounding errors.

TABLE 57. 2021 HEA PROGRAM *EX ANTE* AND *EX POST* GROSS NATURAL GAS ENERGY SAVINGS

MEASURE	*EX ANTE* [a] NATURAL GAS ENERGY SAVINGS (THERMS/YR.)	AUDITED GROSS NATURAL GAS ENERGY (THERMS/YR.)	VERIFIED GROSS NATURAL GAS ENERGY SAVINGS (THERMS/YR.)	*EX POST* GROSS NATURAL GAS ENERGY SAVINGS (THERMS/YR.)
A-Line LEDs - Dual Fuel	-	(950.62)	(881.66)	0.00
A-Line LEDs - Electric	-	0.00	0.00	0.00
Candelabra LEDs - Dual Fuel	-	(181.63)	(168.45)	0.00
Candelabra LEDs - Electric	-	0.00	0.00	0.00
Globe LEDs - Dual Fuel	-	(90.87)	(84.28)	0.00
Globe LEDs - Electric	-	0.00	0.00	0.00
Bathroom Aerator 1.0 gpm - Electric	-	0.00	0.00	0.00
Bathroom Aerator 1.0 gpm - Gas	-	57.00	54.15	54.31
Kitchen Aerator 1.5 gpm - Electric	-	0.00	0.00	0.00
Kitchen Aerator 1.5 gpm - Gas	-	214.92	185.61	185.46
Low Flow Showerhead 1.5 gpm - Electric	-	0.00	0.00	0.00
Low Flow Showerhead 1.5 gpm - Gas	-	766.77	673.83	618.93
Low Flow Showerhead with Shower Start - Electric	-	0.00	0.00	0.00
Low Flow Showerhead with Shower Start - Gas	-	159.28	139.97	129.41
Shower Start Only - Gas	-	23.45	20.61	20.70
Pipe Wrap - Electric	-	0.00	0.00	0.00
Pipe Wrap - Gas	-	170.63	150.94	150.87
Filter Whistle - Electric Cooling and Gas Heating	-	6.76	6.76	2.75

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.)
Filter Whistle - Gas Heating Only Savings	-	0.00	0.00	0.00
Duct Sealing Package - Electric Cooling and Gas Heating	-	1,522.80	1,522.80	1,523.61
Duct Sealing Package - Electric Cooling Only	-	0.00	0.00	0.00
Duct Sealing Package - Gas Heating	-	789.60	789.60	790.02
Attic Insulation (Uninsulated Hatch) - Gas Heating Only Savings	-	0.00	0.00	0.00
Attic Insulation (Uninsulated Hatch) - Electric Cooling and Gas Heating	-	211.92	211.92	212.18
Assessment Recommendations - Dual Fuel	-	580.50	394.44	394.44
Assessment Recommendations - Electric	-	0.00	0.00	0.00
Assessment Recommendations - Gas	-	178.20	121.08	121.08
Virtual Assessment Recommendations - Dual Fuel	-	297.00	232.78	232.78
Virtual Assessment Recommendations - Electric	-	0.00	0.00	0.00
Virtual Assessment Recommendations - Gas	-	91.80	71.95	71.95
LED (9W) - Dual Fuel Kit	-	(291.85)	(251.05)	0.00
LED (9W) - Electric Only Kit	-	0.00	0.00	0.00
Nightlight - Dual Fuel Kit	-	0.00	0.00	0.00
Nightlight - Electric Only Kit	-	0.00	0.00	0.00
Bathroom Aerator - Dual Fuel Kit	-	70.54	78.88	45.90
Bathroom Aerator - Electric Only Kit	-	0.00	0.00	0.00
Bathroom Aerator - Gas Only Kit	-	45.14	47.26	28.24
Kitchen Aerator - Dual Fuel Kit	-	524.11	645.53	353.04
Kitchen Aerator - Electric Only Kit	-	0.00	0.00	0.00
Kitchen Aerator - Gas Only Kit	-	167.47	193.11	107.88
Showerhead - Dual Fuel Kit	-	838.16	1,079.27	596.66
Showerhead - Electric Only Kit	-	0.00	0.00	0.00
Showerhead - Gas Only Kit	-	535.11	645.06	362.79
Filter Whistle - Dual Fuel Kit	-	265.24	217.00	0.00
Filter Whistle - Electric Only Kit	-	0.00	0.00	0.00
Filter Whistle - Gas Only Kit	-	84.28	68.95	0.00
Total Savings	6,085.47	6,085.71	6,166.07	6,003.02
Total Program Realization Rate				99%

Note: Totals may not sum properly due to rounding.

[a] Program tracking data is summed at the kit-level (not measure level). Therefore, *ex ante* savings are only reported at the summary level, due to rounding errors.

EX POST NET SAVINGS

The evaluation team based NTG ratios for most direct install measures on self-reported responses to participant survey questions. NTG ratios for select direct install measures were deemed or referenced results from previous

NIPSCO evaluations for reasons discussed below. Given the limited number of participants who received kits, the evaluation team based NTG ratios for kit measures on results from the 2020 HomeLife participant survey.

The 2021 participant survey net-to-gross questions for direct install measures asked what customers would have done in the absence of the program, and the influence the program had on their decision to install the energy-efficient measures. 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.

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 (consistent with methods used in the 2015 – 2020 evaluations).

Most surveyed participants reported they were not planning to make energy efficiency upgrades in absence of the program, while those planning upgrades said they would not have done so right away, resulting in NTG ratios ranging from 67% to 98% for these measures (Table 58).

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

- Filter whistle: Program participation for filter whistles in 2021 (n=1) was not sufficient to achieve adequate sample sizes. Because of the direct install nature of the program, the team deemed the NTG ratio at 100% for the 2021 program year.
- Attic insulation: There were too few survey responses from participants that received attic insulation (n=1) to be confident in the results. The team deemed the NTG ratio at 80% for the attic insulation which is consistent with previous evaluation results (2018 – 2020).
- Assessment recommendations/Virtual assessment recommendations: As in previous evaluations (2015 – 2020), 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.

Table 58 shows the NTG ratios by measure.

TABLE 58. 2021 HEA PROGRAM NTG RATIOS BY MEASURE

MEASURE	NTG	SOURCE
LED Bulbs	67%	2021 HEA Survey
Bathroom Aerator	92%	2021 HEA Survey
Kitchen Aerator	88%	2021 HEA Survey
Showerhead	98%	2021 HEA Survey
Pipe Wrap	94%	2021 HEA Survey
Filter Whistle	100%	Deemed
Duct Sealing	86%	2021 HEA Survey
Attic Insulation	80%	Deemed
Assessment Recommendations	100%	Deemed

MEASURE	NTG	SOURCE
Virtual Assessment Recommendations	100%	Deemed
LED (9W) - Kit	80%	2020 HomeLife Survey
Nightlight - Kit	87%	2020 HomeLife Survey
Bathroom Aerator - Kit	93%	2020 HomeLife Survey
Kitchen Aerator - Kit	95%	2020 HomeLife Survey
Showerhead - Kit	94%	2020 HomeLife Survey
Filter Whistle - Kit	100%	2020 HomeLife Survey

Table 59 presents the resulting net electric savings, demand reduction, and natural gas savings.

TABLE 59. 2021 HEA PROGRAM *EX POST* NET SAVINGS

MEASURE	*EX POST* GROSS SAVINGS/REDUCTION			NTG	*EX POST* NET SAVINGS/REDUCTION		
	KWH	KW	THERMS		KWH	KW	THERMS
A-Line LEDs - Dual Fuel	43,338.66	5.901	0.00	67%	28,846.78	3.928	0.00
A-Line LEDs - Electric	1,711.89	0.234	0.00	67%	1,139.46	0.156	0.00
Candelabra LEDs - Dual Fuel	12,058.83	1.642	0.00	67%	8,026.52	1.093	0.00
Candelabra LEDs - Electric	299.53	0.041	0.00	67%	199.37	0.027	0.00
Globe LEDs - Dual Fuel	6,160.66	0.839	0.00	67%	4,100.62	0.558	0.00
Globe LEDs - Electric	317.43	0.043	0.00	67%	211.28	0.029	0.00
Bathroom Aerator 1.0 gpm - Electric	96.33	0.009	0.00	92%	88.31	0.008	0.00
Bathroom Aerator 1.0 gpm - Gas	0.00	0.000	54.31	92%	0.00	0.000	49.78
Kitchen Aerator 1.5 gpm - Electric	474.47	0.022	0.00	88%	418.65	0.019	0.00
Kitchen Aerator 1.5 gpm - Gas	0.00	0.000	185.46	88%	0.00	0.000	163.64
Low Flow Showerhead 1.5 gpm - Electric	916.26	0.059	0.00	98%	895.43	0.058	0.00
Low Flow Showerhead 1.5 gpm - Gas	0.00	0.000	618.93	98%	0.00	0.000	604.86
Low Flow Showerhead with Shower Start - Electric	556.88	0.037	0.00	98%	544.22	0.036	0.00
Low Flow Showerhead with Shower Start - Gas	0.00	0.000	129.41	98%	0.00	0.000	126.47
Shower Start Only - Gas	0.00	0.000	20.70	98%	0.00	0.000	20.23
Pipe Wrap - Electric	246.52	0.028	0.00	94%	232.02	0.026	0.00
Pipe Wrap - Gas	0.00	0.000	150.87	94%	0.00	0.000	142.00
Filter Whistle - Electric Cooling and Gas Heating	24.37	0.028	2.75	100%	24.37	0.028	2.75
Filter Whistle - Gas Heating Only Savings	0.00	0.000	0.00	100%	0.00	0.000	0.00
Duct Sealing Package - Electric Cooling and Gas Heating	1,657.60	3.734	1,523.61	86%	1,424.50	3.209	1,309.35
Duct Sealing Package - Electric Cooling Only	49.48	0.112	0.00	86%	42.53	0.096	0.00
Duct Sealing Package - Gas Heating	0.00	0.000	790.02	86%	0.00	0.000	678.92
Attic Insulation (Uninsulated Hatch) - Gas Heating Only Savings	0.00	0.000	0.00	80%	0.00	0.000	0.00

MEASURE	*EX POST* GROSS SAVINGS/REDUCTION			NTG	*EX POST* NET SAVINGS/REDUCTION		
	KWH	KW	THERMS		KWH	KW	THERMS
Attic Insulation (Uninsulated Hatch) - Electric Cooling and Gas Heating	241.90	0.105	212.18	80%	193.52	0.084	169.74
Assessment Recommendations - Dual Fuel	3,102.95	1.753	394.44	100%	3,102.95	1.753	394.44
Assessment Recommendations - Electric	130.14	0.073	0.00	100%	130.14	0.073	0.00
Assessment Recommendations - Gas	0.00	0.000	121.08	100%	0.00	0.000	121.08
Virtual Assessment Recommendations - Dual Fuel	1,831.23	1.035	232.78	100%	1,831.23	1.035	232.78
Virtual Assessment Recommendations - Electric	100.07	0.056	0.00	100%	100.07	0.056	0.00
Virtual Assessment Recommendations - Gas	0.00	0.000	71.95	100%	0.00	0.000	71.95
LED (9W) - Dual Fuel Kit	9,561.03	1.035	0.00	80%	7,648.82	0.828	0.00
LED (9W) - Electric Only Kit	444.16	0.048	0.00	80%	355.33	0.039	0.00
Nightlight - Dual Fuel Kit	272.85	0.000	0.00	87%	237.38	0.000	0.00
Nightlight - Electric Only Kit	12.75	0.000	0.00	87%	11.09	0.000	0.00
Bathroom Aerator - Dual Fuel Kit	61.96	0.006	45.90	93%	57.62	0.006	42.69
Bathroom Aerator - Electric Only Kit	31.86	0.003	0.00	93%	29.63	0.003	0.00
Bathroom Aerator - Gas Only Kit	0.00	0.000	28.24	93%	0.00	0.000	26.27
Kitchen Aerator - Dual Fuel Kit	476.57	0.020	353.04	95%	452.74	0.019	335.39
Kitchen Aerator - Electric Only Kit	243.73	0.011	0.00	95%	231.55	0.011	0.00
Kitchen Aerator - Gas Only Kit	0.00	0.000	107.88	95%	0.00	0.000	102.49
Showerhead - Dual Fuel Kit	805.44	0.044	596.66	94%	757.12	0.041	560.86
Showerhead - Electric Only Kit	410.24	0.022	0.00	94%	385.63	0.021	0.00
Showerhead - Gas Only Kit	0.00	0.000	362.79	94%	0.00	0.000	341.02
Filter Whistle - Dual Fuel Kit	3,314.25	0.366	0.00	100%	3,314.25	0.366	0.00
Filter Whistle - Electric Only Kit	142.98	0.011	0.00	100%	142.98	0.011	0.00
Filter Whistle - Gas Only Kit	0.00	0.000	0.00	100%	0.00	0.000	0.00
Total Savings	89,093.05	17.319	6,003.02		65,176.11	13.618	5,496.73

Note: Totals may not sum properly due to rounding.

Table 60 shows the program-level NTG ratio for each fuel which ranged from 73% for electric energy savings (kWh) to 92% for natural gas energy savings (therms).

TABLE 60. 2021 HEA NTG 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.)	102,992.60	89,093.05	73%	65,176.11
Peak Demand Reduction (kW)	20.146	17.319	79%	13.618
Natural Gas Energy Savings (therms/yr.)	6,085.47	6,003.02	92%	5,496.73

PROCESS EVALUATION

This section describes the evaluation team's process evaluation findings derived from surveying virtual and in-person HEA program participants.

The evaluation team sought to answer the following process-related research questions through these research activities:

- How do participants become aware of the program? Has it changed over time?
- What drives participation in the program? Why were participants motivated to get a home energy assessment?
- What was the customer's experience with the audit like? Did experience vary based on whether it was an in-person or virtual audit?
- Do customers prefer the in-person or virtual audits? Does preference vary by any customer characteristics?
- How easy was it to schedule the audit and answer the questions? Did this vary based on audit type?
- How do contractors provide findings and recommendations from the audit to the participant? How do they discuss and provide the report?
- How do customers decide to move on and install additional measures? What is their experience like?
- What are participant perceptions of the virtual audit? What was the most helpful aspect of it? Least helpful?
- How useful are the information and recommendations provided through the program?
- What energy-savings actions do participants take because of the assessment, if any? Did they participate in any other programs?
- What are customer experiences with the kit measures? Do customers install the measures? Do customers remove the measures? If so, why?
- What are customer experiences with the direct install measures? Are customers satisfied with the quality of work provided by the contractors?
- How satisfied were participants with the program, including the participation process, virtual audit experience, and satisfaction with equipment received?
- How satisfied are customers with NIPSCO?
- Do participants have any recommendations for program improvement?
- Do virtual audit participants differ from those who get in-person audits? From other kit programs?

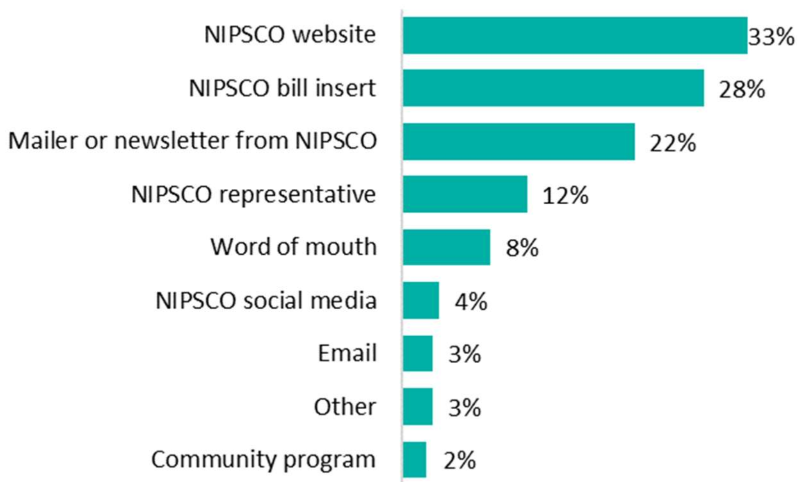
PARTICIPANT FEEDBACK

The evaluation team invited the census of 753 HEA program participants to complete a survey about their experience with the program and received 193 responses. The team fielded the survey via phone (62%) and web (38%) in January 2022. The following sections describe the survey respondent feedback related to source of program awareness, reasons for participation, experience with the in-home and virtual assessments, satisfaction with the program and measures, and suggestions for program improvement.

ENERGY EFFICIENCY AWARENESS AND MARKETING

Respondents most frequently learned about HEA directly from NIPSCO (77%) through both digital and non-digital sources, including the website, bill insert, mailer/newsletter, a NIPSCO representative, or social media (Figure 5). Respondents most learned of the program through the NIPSCO website (33%), which was also the most common way of learning about the program in 2019. Respondents also frequently learned of the program through a NIPSCO bill insert (28%) and receiving a mailer or newsletter from NIPSCO (22%).

FIGURE 5. HOW RESPONDENTS LEARNED ABOUT THE HEA PROGRAM

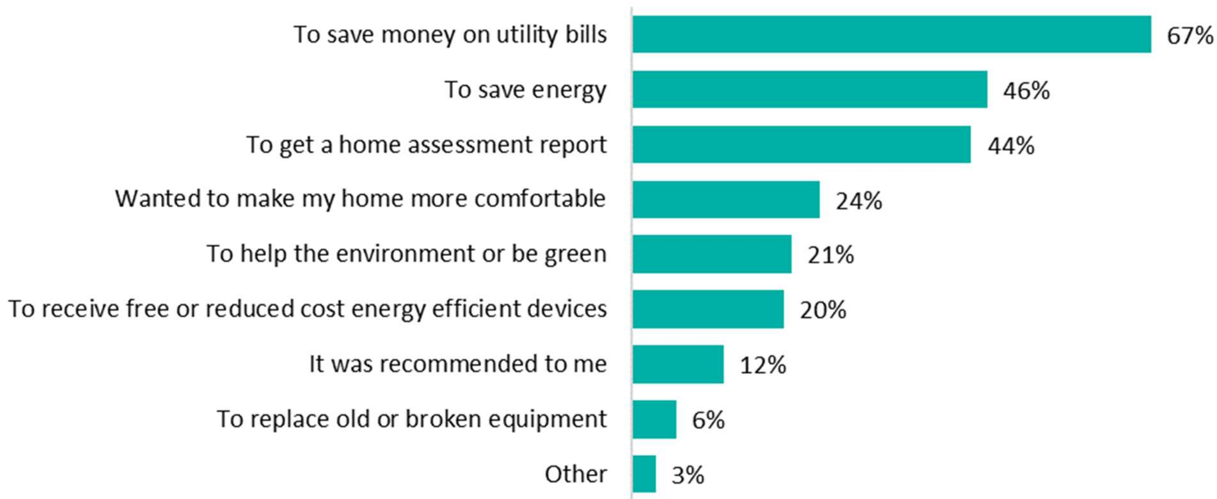


Source: Participant survey. Question: “How did you learn about NIPSCO’s HEA program?” (Multiple responses allowed) (n=193)

PARTICIPATION DRIVERS

As shown in Figure 6, respondents indicated they most often participated in the HEA program to save money on utility bills (67%), to save energy (46%), and to get a home assessment report (44%). These were also the top three participation drivers in 2019 and 2020.

FIGURE 6. REASONS FOR PARTICIPATING IN THE HEA PROGRAM



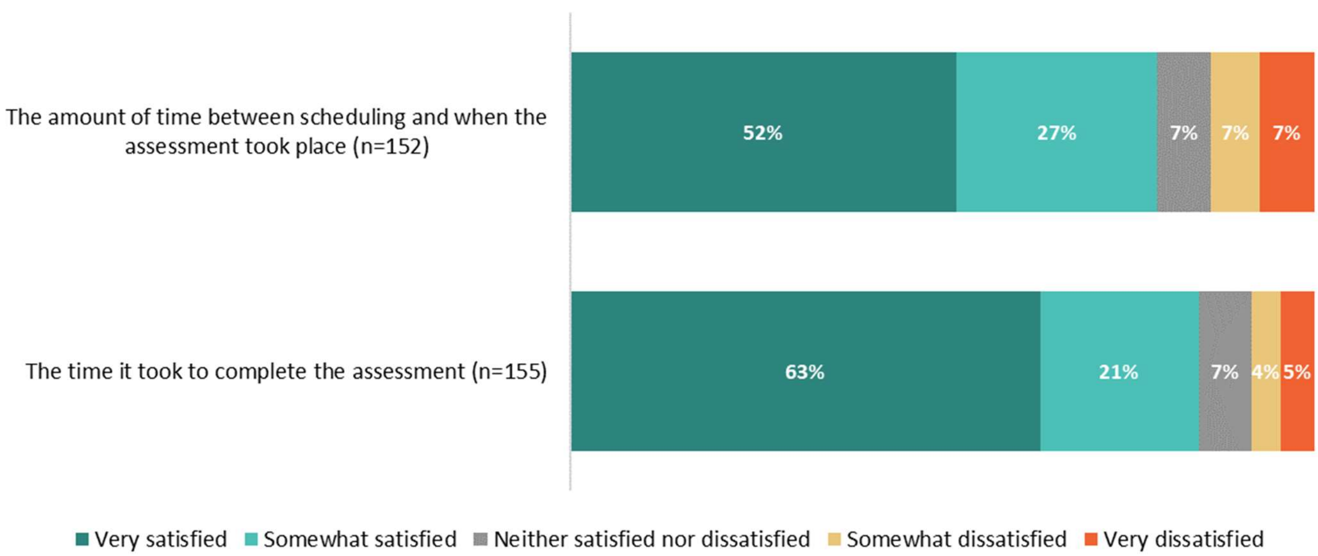
Source: Participant survey. Question: "Why did you decide to participate in NIPSCO's HEA program?" (n=193)

IN-PERSON ASSESSMENT

ASSESSMENT EXPERIENCE

The evaluation team completed surveys with 156 HEA participants who received an in-person assessment. Most of these respondents were satisfied with the time between scheduling and when the assessment took place (79%) and with the time it took to complete the assessment (84%) (Figure 7). However, some dissatisfied respondents explained they experienced long waits between scheduling and the assessment. In addition, most respondents (91%) found the scheduling process to be very or somewhat easy.

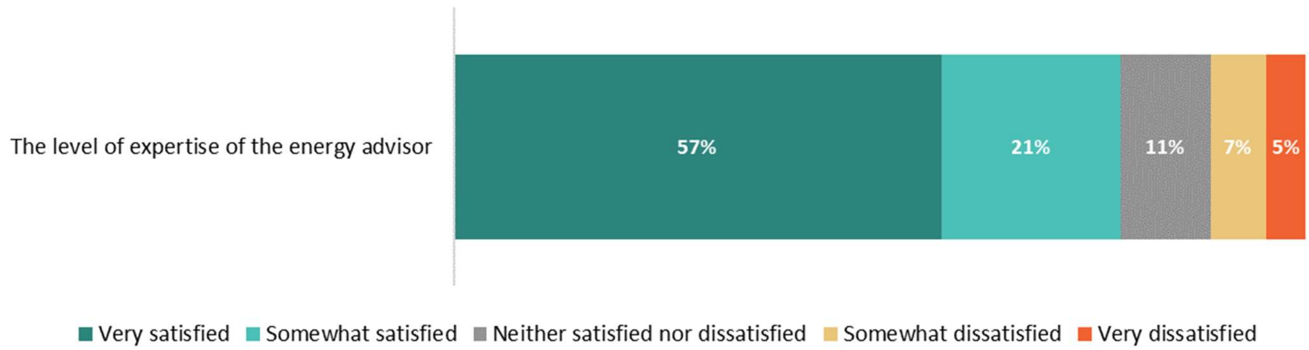
FIGURE 7. IN-PERSON ASSESSMENT EXPERIENCE SATISFACTION



Source: Participant survey. Question: "How satisfied were you with each of the following? The amount of time between scheduling and when the assessment took place. The time it took to complete the assessment. The in-person assessment overall."

Most respondents (78%) were very or somewhat satisfied with the expertise of their energy advisor (Figure 8). Satisfied respondents described the energy advisors as informative, knowledgeable, and professional, and one shared that *"I enjoyed working with the assessor."* Many respondents (61%) had specific questions for the energy advisor during the assessment, and of those respondents, 69% reported that their energy advisor was able to answer their questions. Additionally, 74% of respondents reported that their energy advisor provided helpful information about their home or equipment.

FIGURE 8. SATISFACTION WITH IN-PERSON ENERGY ADVISOR EXPERTISE

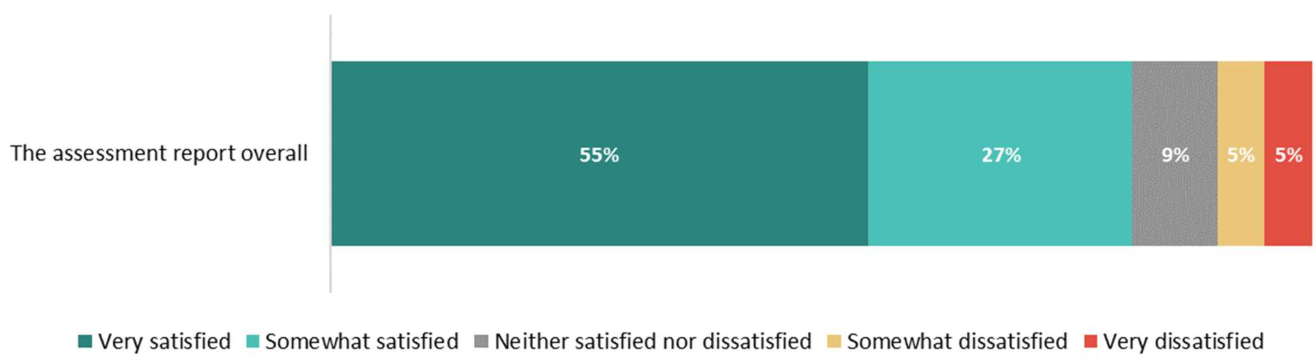


Source: Participant survey. Question: "How satisfied were you with each of the following? The level of expertise of the energy advisor." (n=152)

ASSESSMENT REPORT AND FINDINGS

Per the program description, participants should receive a report via email during the assessment as applicable (if the participants have email addresses) or a physical copy in the mail after the assessment is complete. About three-fourths of the respondents who received an in-person assessment (73%) reported receiving a report including findings and recommendations, and most respondents (88%) reported their energy advisor discussed the findings and recommendations with them. Respondents who received the report were satisfied with it overall (Figure 9). Reasons for dissatisfaction with the report included lack of specificity, low usefulness, that blower test results were listed but not performed, and that the advisors did not review the report with the customer.

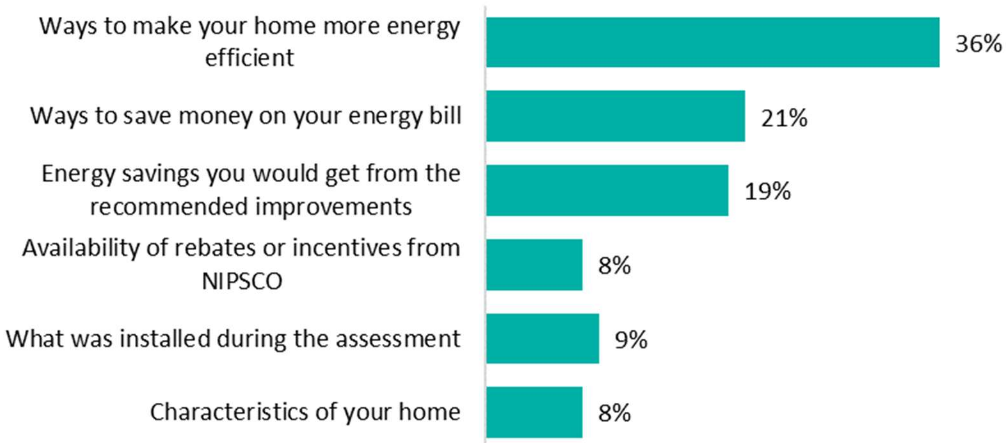
FIGURE 9. SATISFACTION WITH IN-PERSON ASSESSMENT REPORT



Source: Participant survey. Question: "How satisfied were you with each of the following? The assessment report overall." (n=104)

Most respondents (90%) who received a report felt the information provided in the report was very or somewhat easy to understand. Many respondents (67%) found the information provided by the program to be somewhat or very useful, while one-fourth of respondents (25%) found the information provided by the program to be not very or not at all useful. Respondents shared that the most useful information in the report were ways to make their homes more energy efficient, ways to save money on their energy bills, and energy savings they would get from the recommended improvements (Figure 10).

FIGURE 10. IN-PERSON USEFULNESS RATING OF INFORMATION IN THE REPORT



Source: Participant survey. Questions “What information in the report did you find most useful?” (n=78)

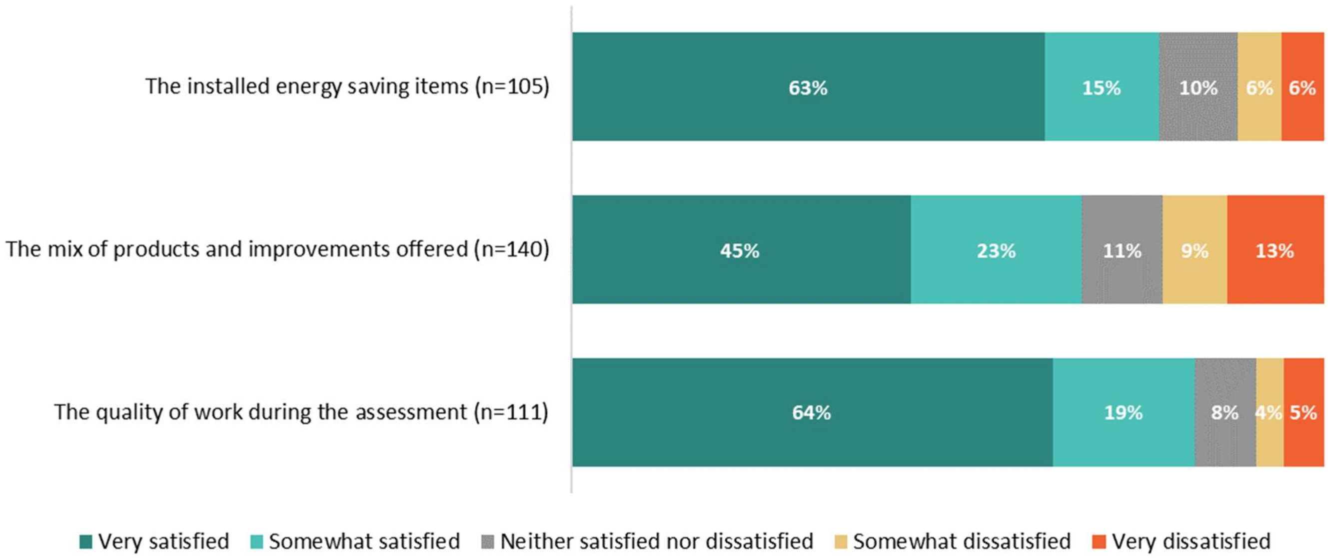
Respondents who had suggestions to improve the information provided in the assessment or the report (n=55) shared that they wanted a more thorough assessment including thermal imaging, more suggestions of measures to update besides light bulbs, and follow up after the assessment including outreach from the program and the assessment report. One respondent who did not receive the report noted aspects of the program where they wanted more communication:

> *“The assessor from TRC came in September. I took off of work to show him the house. He went through everything and noted that our appliances were newer and did a very surface inspection in the furnace room. Didn’t even inspect the crawl space. He said we should receive a comprehensive report in a couple of weeks. Never received anything. Called NIPSCO to ask for the report, they seemed confused and said they would look into it. To this day, we have yet to see the assessment report for the inspection we took off work for.”*

DIRECT INSTALL MEASURES

According to the program tracking data, 76% of respondents who received an in-person energy assessment also received direct install measures in their home during the assessment. As shown in Figure 11, respondents were generally satisfied with the energy saving items they received, as well as the quality of work performed during the assessment. About two-thirds of respondents (68%) were somewhat or very satisfied with the mix of products and improvements offered, with 21% reporting they were somewhat or very dissatisfied. Dissatisfied respondents shared they were not happy with the quality of products they received or that they only received LEDs. One noted the assessment team *“only provided a few products that did not hold up for long, so we had to replace them.”*

FIGURE 11. IN-PERSON SATISFACTION WITH DIRECT INSTALL MEASURES



Source: Participant survey. Question: "How satisfied are you with the [equipment] installed?" "How satisfied were you with each of the following? The energy saving items that were directly installed in your home."

Regarding specific measures, most respondents were very or somewhat satisfied with the LEDs (90%) and the duct sealing (94%). While fewer respondents received other measures, most were very or somewhat satisfied with them, with percentages ranging from 80% to 89% for bathroom aerators, showerheads, pipe wrap, and kitchen aerators.

Few respondents reported removing LEDs, bathroom aerators, showerheads, or kitchen aerators. The reasons for removing LEDs were not consistent: one respondent shared the bulbs stopped working, one said they were too bright, one said they were not bright enough, and one said they flickered. One respondent removed the bathroom aerator because it stopped working, and the respondents that removed the other water saving measures (one kitchen aerator and one showerhead) did not like the water pressure.

Some respondents did not have certain measures installed and shared information on why they did not receive them. The top reason respondents did not receive LEDs and water saving measures was because they already had them or did not need them. Two respondents noted the assessment team provided LEDs but did not install them. About one-third of the respondents who did not receive water saving measures reported that the technicians did not offer them (showerheads (36%), bathroom faucet aerators (34%), and kitchen faucet aerators (31%)). Table 61 provides additional detail on the reasons for not receiving measures.

TABLE 61. REASONS DIRECT INSTALL MEASURES WERE NOT RECEIVED

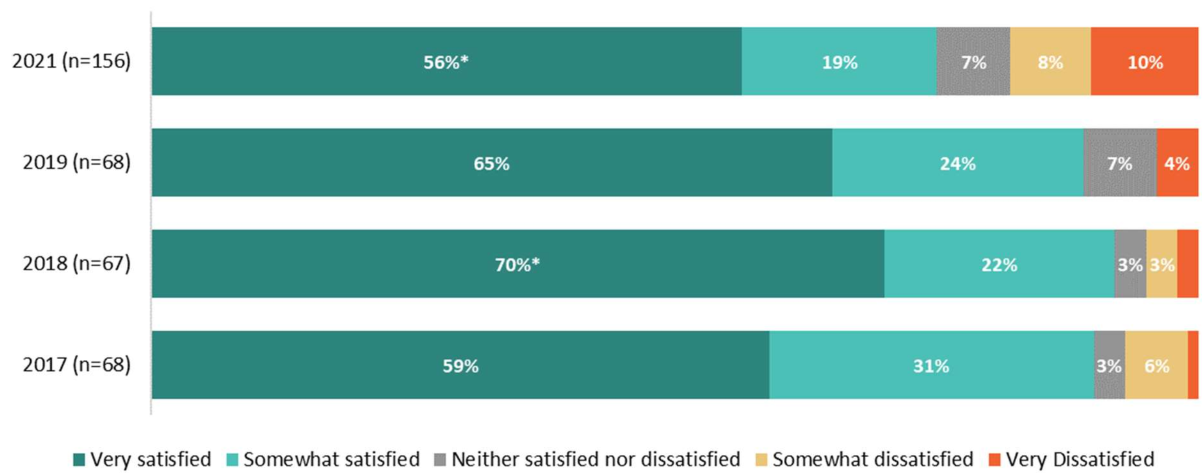
REASON	LEDS (N=28)	SHOWERHEADS (N=84)	BATHROOM FAUCET AERATORS (N=89)	KITCHEN FAUCET AERATORS (N=82)
Already had one/didn't need one	67%	37%	45%	45%
Don't like them	-	2%	-	-
Didn't fit on fixture	-	6%	16%	14%
Didn't match current fixture color	-	2%	1%	1%
Wasn't offered one	11%	36%	34%	31%
Concerned about change in water pressure	N/A	7%	2%	1%
Other	26%	12%	10%	10%

Source: Participant survey. Question: "Why didn't you have [equipment] installed?" (Multiple answers allowed)

SATISFACTION

Many respondents (75%) were very or somewhat satisfied with the in-person energy assessment overall. However, the percentage of respondents who were very or somewhat satisfied was lower in 2021 than in 2017 to 2019, and the percentage of respondents who were very or somewhat dissatisfied was significantly higher in 2021. Figure 12 shows the satisfaction ratings respondents gave to the in-person energy assessment overall.

FIGURE 12. SATISFACTION WITH IN-PERSON ENERGY ASSESSMENT



Source: Participant survey. Question: "How satisfied were you with each of the following? The in-person assessment overall."

Note: * indicates differences between 2018 and 2021 is significant at p≤0.10 (90% confidence).

Respondents who were satisfied with the assessment appreciated the information provided, the measures, and the energy advisor. Dissatisfied customers identified aspects of the in-person assessment which led to lower satisfaction. One respondent shared the program did not meet their expectation of what the assessment would include:

"Maybe my expectations were too high, but I expected to spend the allotted 2-3 hours getting an actual assessment and suggestions on where I am losing energy. What I got was a 20-minute breeze through, a handful of LED bulbs and instructed to wait for the assessment

email/letter which I never got." Some dissatisfied customers elaborated that the assessment was not as thorough as expected, they did not receive expected follow up, or that they only received LEDs and no other measures.

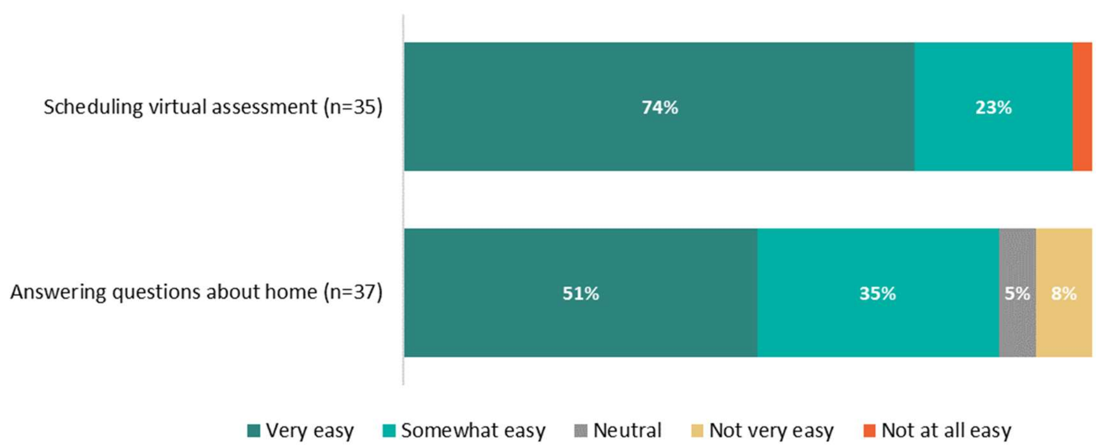
VIRTUAL ASSESSMENT EXPERIENCE

ASSESSMENT EXPERIENCE

The evaluation team completed surveys with 37 HEA participants who received a virtual assessment. Due to the small number of virtual HEA respondents, survey results should be interpreted cautiously. They represent the experiences of a small number of participants and may not accurately reflect opinions and experiences across all participants and customers. We report results as percentages for consistency with the in-person assessment results, but caution that with 37 respondents, a small number of respondents can result in a large change in percentage.

Nearly all respondents (97%) who received virtual assessments reported it was very or somewhat easy to schedule their virtual assessment, which was like ratings given by respondents who received in-person assessments. Most respondents (86%) felt it was somewhat or very easy to answer questions the energy advisor asked about their home during the virtual assessment (Figure 13).

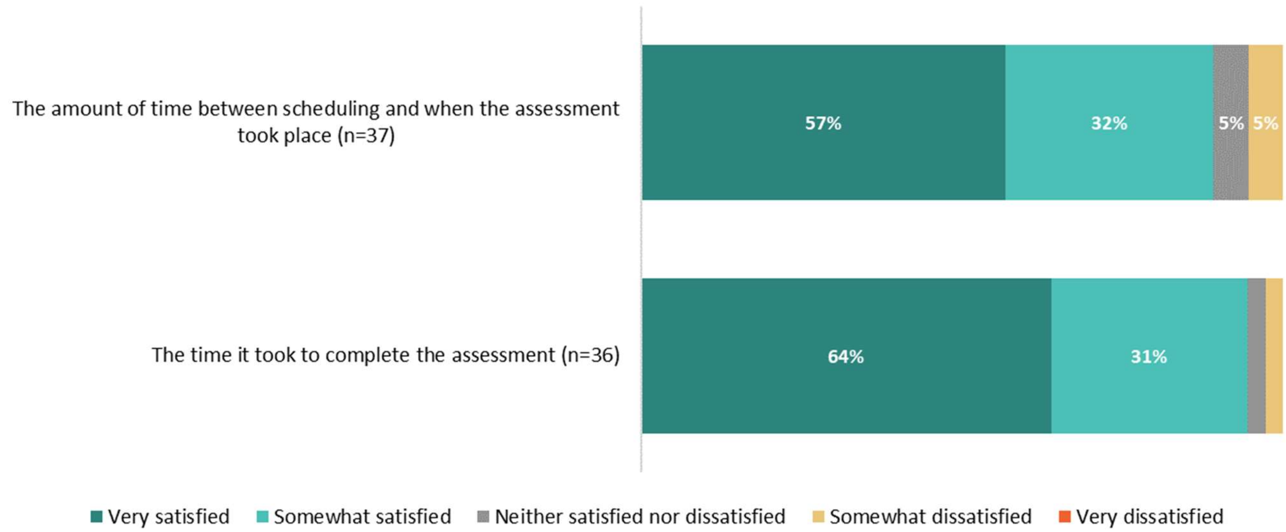
FIGURE 13. EASE OF VIRTUAL ASSESSMENT PROCESS



Source: Participant survey. Questions: "How easy was it to schedule your virtual energy assessment?" "How easy was it to answer the questions about your home during your virtual assessment?"

Respondents were highly satisfied with the meeting software used to conduct the video call for the assessment: 91% of virtual respondents were at least somewhat satisfied with the meeting software and no one reported a negative experience. Virtual assessment respondents were also highly satisfied with the amount of time between scheduling and when the assessment took place, and with the time it took to complete the assessment (Figure 14). Additionally, most respondents (70%) were satisfied with the virtual assessment overall.

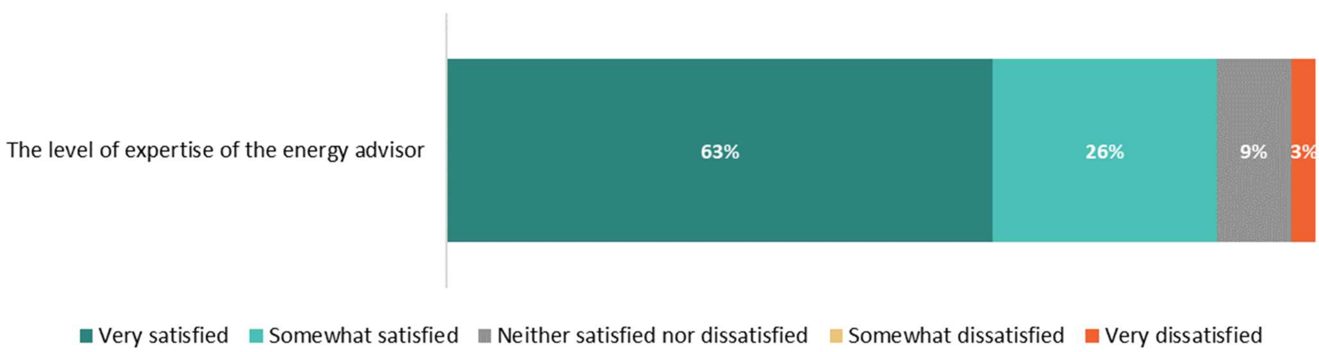
FIGURE 14. VIRTUAL ASSESSMENT EXPERIENCE SATISFACTION



Source: Participant survey. Question: "How satisfied were you with each of the following? The amount of time between scheduling and when the assessment took place. The time it took to complete the assessment. The virtual assessment overall."

As seen in Figure 15, most respondents (89%) were very or somewhat satisfied with the expertise of their energy advisor. One satisfied respondent shared high praise that *"the gentleman was outstanding."* Of the virtual assessment respondents who had specific questions for the energy advisor (31%), all of them who elaborated reported that the energy advisor was able to answer their questions. Additionally, 81% of respondents reported that their energy advisor provided helpful information about their home or equipment.

FIGURE 15. SATISFACTION WITH VIRTUAL ENERGY ADVISOR EXPERTISE

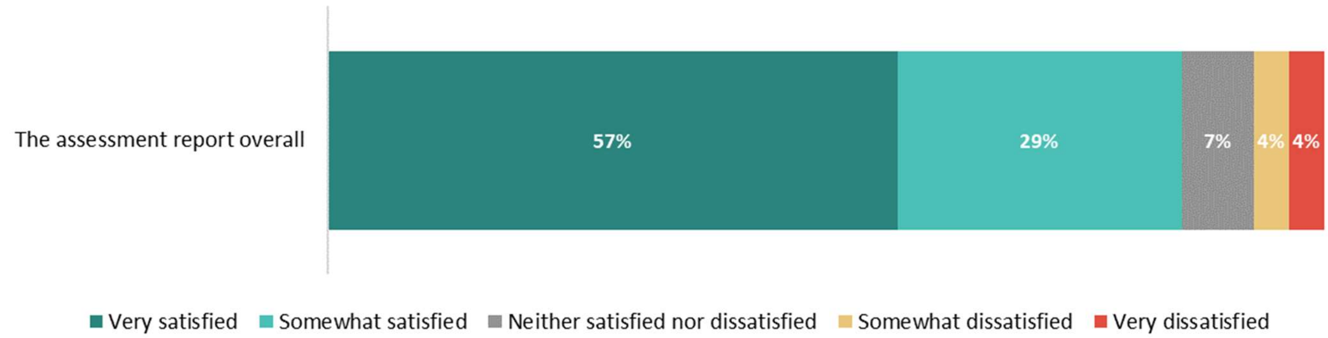


Source: Participant survey. Question: "How satisfied were you with each of the following? The level of expertise of the energy advisor." (n=35)

ASSESSMENT REPORT AND FINDINGS

Nearly all the virtual assessment respondents (91%) reported receiving the report with findings and recommendations. Virtual assessment respondents significantly more often reported receiving the report with findings and recommendations compared to in-person respondents (73%). Almost all respondents (97%) reported that their energy advisor discussed the findings and recommendations with them. Respondents who received the report were satisfied with the report overall (Figure 16).

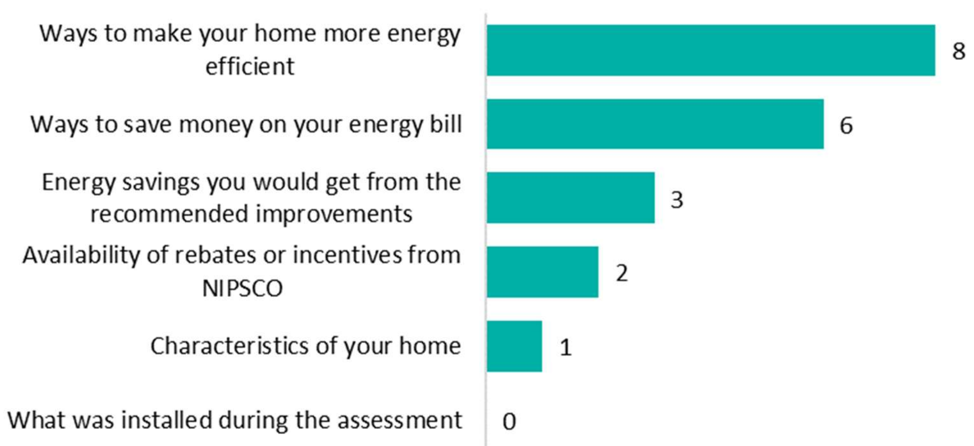
FIGURE 16. SATISFACTION WITH VIRTUAL ASSESSMENT REPORT



Source: Participant survey. Question: “How satisfied were you with each of the following? The assessment report overall.” (n=28)

Most virtual respondents (62%) found the information provided by the program to be somewhat or very useful. Virtual respondents who were dissatisfied with the information provided explained that they already knew the information provided, had already implemented the recommended changes, or felt the information was too basic. Respondents felt the most useful information in the report were the ways to make their homes more energy efficient and the ways to save money on their energy bills (Figure 17).

FIGURE 17. MOST USEFUL INFORMATION IN THE REPORT



Source: Participant survey. Questions: “What information in the report did you find most useful?” (n=20)

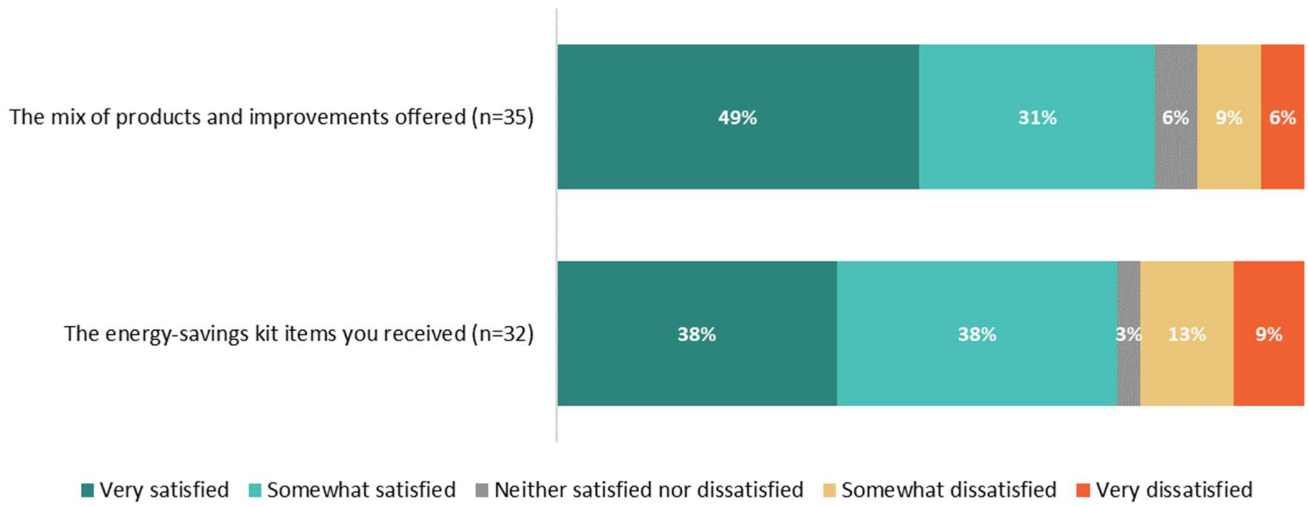
KIT MEASURES

Most respondents (90%) said the energy advisor reviewed the energy-saving kit eligibility, items, and instructions with them. When asked about the energy-saving items they received in the kit, 88% of kit recipients confirmed the items they received matched the program records.[14] Of the 30 respondents who confirmed the energy saving items in the kit were correct, 89% reported installing at least one of the items in their kits.

Of the respondents who installed none of the measures, when asked why they did not install them, one respondent noted they had *"no sense of urgency or need to install some of the items. I was worried about the heat saving rather than the water saving."* Measures that kit respondents had trouble installing included faucet aerators (n=4) and a showerhead (n=1).

Most kit recipients were satisfied with the mix of home energy-savings products and efficiency improvements offered and most were also satisfied with the energy-savings kit items they received (Figure 18). However, 22% of virtual respondents were dissatisfied with the items in the kit they received and explained the items did not fit or were not useful.

FIGURE 18. SATISFACTION WITH KIT MEASURES



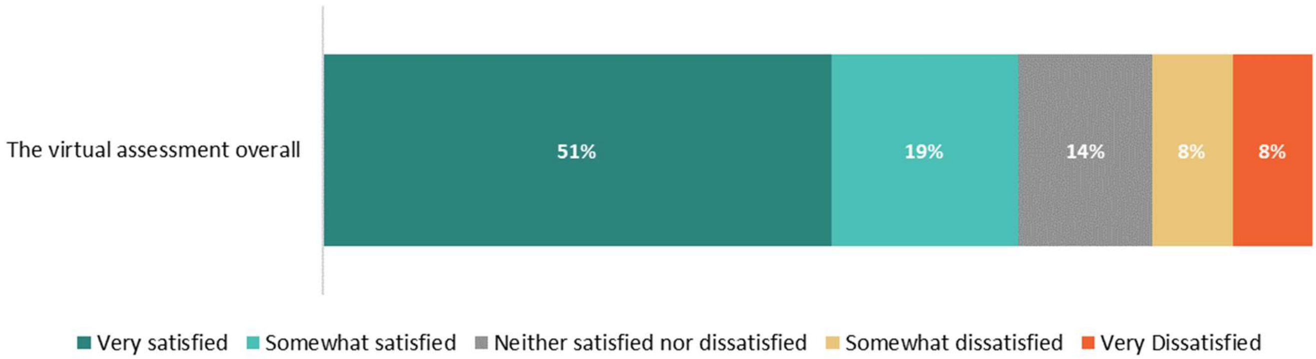
Source: Participant survey. Question: "How satisfied were you with each of the following? The mix of home energy-savings products and efficiency improvements offered. The energy-savings kit items you received."

SATISFACTION

Many respondents (70%) were very or somewhat satisfied with the virtual assessment overall, while some (16%) were somewhat or very dissatisfied (Figure 19). Satisfied respondents were happy with the convenience and helpfulness of the assessment, and one respondent elaborated they *"got useful information and energy saving products."* Respondents said they appreciated the convenience of the virtual visit and the energy saving products, and that the visit was helpful. One respondent noted that HEA is a *"great program and helpful with energy savings."* Dissatisfied respondents wanted a more thorough assessment, products that save more energy, and information that is not *"base level."* One respondent explained why the assessment was not as thorough as they expected: "*I was hoping that the evaluation would take a much better look at the mechanical systems in the house and offer suggestions that could make them and the house more efficient."* The percentages of satisfied and dissatisfied virtual respondents are like those of the in-person respondents, regarding the assessment overall.

[14] Three respondents were unsure if the items listed matched their kits, and four respondents noted that at least one of the items in the kit was incorrect. None of them elaborated on which items were incorrect and were terminated from the survey per survey logic.

FIGURE 19. SATISFACTION WITH THE VIRTUAL ENERGY ASSESSMENT[15]



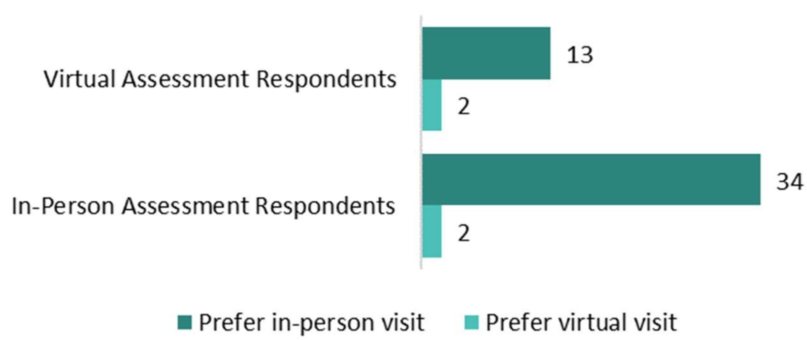
Source: Participant survey. Question: "How satisfied were you with each of the following? The virtual assessment overall." (n=37)

PREFERENCE FOR ASSESSMENT TYPE

About one-half (53%) of HEA respondents who participated in either an in-person or a virtual visit shared that the program offered them a choice in the type of assessment, while the other half (47%) reported they did not have a choice. There were no significant differences between visit types and customers who had a choice in assessment type. The majority (90%) of respondents who reported that they had a choice in assessment type felt that they had enough information to decide which assessment option was right for them.

Most virtual assessment respondents who reported they were not offered a choice in assessment type would have preferred an in-person assessment (Figure 20). All but one of these virtual respondents (n=17) would have allowed an auditor to enter the home at the time they received the virtual assessment. One in-person assessment respondent noted that virtual would have been more convenient.

FIGURE 20. PREFERENCE FOR ASSESSMENT TYPE



Source: Participant survey. Question: "If the option were provided, would you have preferred to receive an in-person energy assessment where an advisor came to your home?" "If you had a choice of assessment type, would you have preferred a virtual assessment?"

[15] The evaluation team is not comparing 2021 virtual respondent satisfaction to 2020 satisfaction, since the number of respondents from the 2020 virtual program is too low to draw a meaningful comparison.

Of the respondents who chose an in-person assessment (n=54), most did so because they wanted a more in-depth assessment (86%). Of those who chose a virtual assessment (n=13), respondents indicated they chose this option because they were more comfortable with a contact-free option (n=7), it was more convenient (n=3), it was less of a time commitment (n=3), it was easier to schedule (n=2), or because it was the only option due to COVID-19 (n=2). Some virtual respondents (n=11) noted the COVID-19 pandemic was either somewhat or very important in their decision to get a virtual assessment.

One in-person respondent who elaborated on their reason for selecting an in-person visit shared they *"did not feel virtual would be sufficient like the in-person was, not sure how it could be."* A somewhat satisfied virtual respondent said of their visit, "*I would say it would have maybe been better in person."* Three virtual respondents suggested that in-person visits are more helpful and recommended that visit type over virtual. When sharing recommendations to improve the program, one virtual respondent suggested focusing on in-person visits:

> *"When safe (due to COVID-19) only do in-person visits. It is so much easier to understand, and I think the information is better grasped when both people are looking at the same thing while it is being explained."*

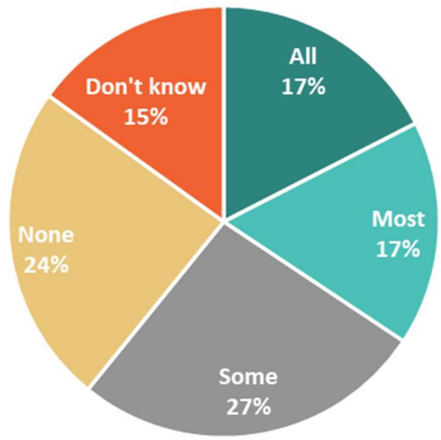
Virtual assessment recipients had lower incomes and were more likely to participate in income-qualified programs (Low-Income Home Energy Assistance, Temporary Assistance for Needy Families, Supplemental Security Income, or Social Security Disability Insurance). Virtual visit respondents (30%) significantly more often reported household income under $35,000 than in-person respondents (15%). Respondents who participated in in-person visits (76%) were significantly more likely not to qualify for any programs than virtual respondents (53%). However, these differences in income likely do not suggest differences in preference. Instead, this is likely a result of the Income-Qualified Weatherization (IQW) program being paused in the first half of 2021 due to COVID-19, during which time customers eligible for IQW were referred to the HEA virtual assessment.

RECOMMENDED IMPROVEMENTS AND ADDITIONAL PROGRAM PARTICIPATION

POST-ASSESSMENT IMPROVEMENTS

Many virtual and in-person respondents (61%) made at least some of the energy-saving improvements recommended in the assessment report they received (Figure 21). Less than a quarter of respondents (24%) reported they did not make any of the improvements.

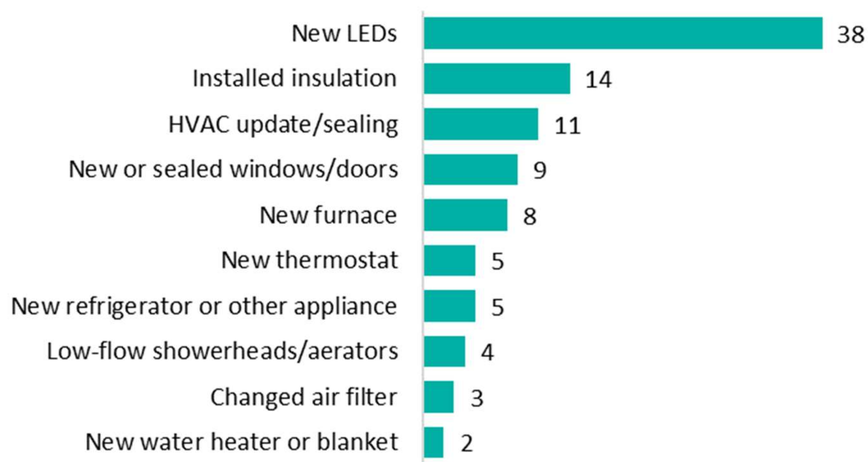
FIGURE 21. FOLLOW THROUGH ON RECOMMENDED IMPROVEMENTS



Source: Participant survey. Question: “After participating in NIPSCO’s Home Energy Assessment program, would you say you have made all, most, some, or none of the energy-saving recommendations made in the assessment report you received?” (n=166)

The improvements respondents made included installing measures, most commonly LEDs, and making behavioral changes (Figure 22).

FIGURE 22. INSTALLED RECOMMENDED MEASURES[16]



Participant survey. Questions: “What improvements did you make?”

Of the 101 respondents who implemented changes after the assessment, approximately 10% indicated that they implemented behavioral changes to reduce energy use. These changes included adjusting their water heater (n=2)

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

and thermostat (n=4) setpoint temperatures, as well as less common behaviors like airing out a damp basement, using their furnace fan more frequently, and using the dishwasher power save mode.

Of the respondents who made no improvements (n=40), some said the recommendations were not relevant (n=11), some were still planning on it (n=8), some were too busy (n=6), and a few wrote in that they either were waiting for old equipment to break, or they did not receive the report and recommendations.

ADDITIONAL PROGRAM PARTICIPATION

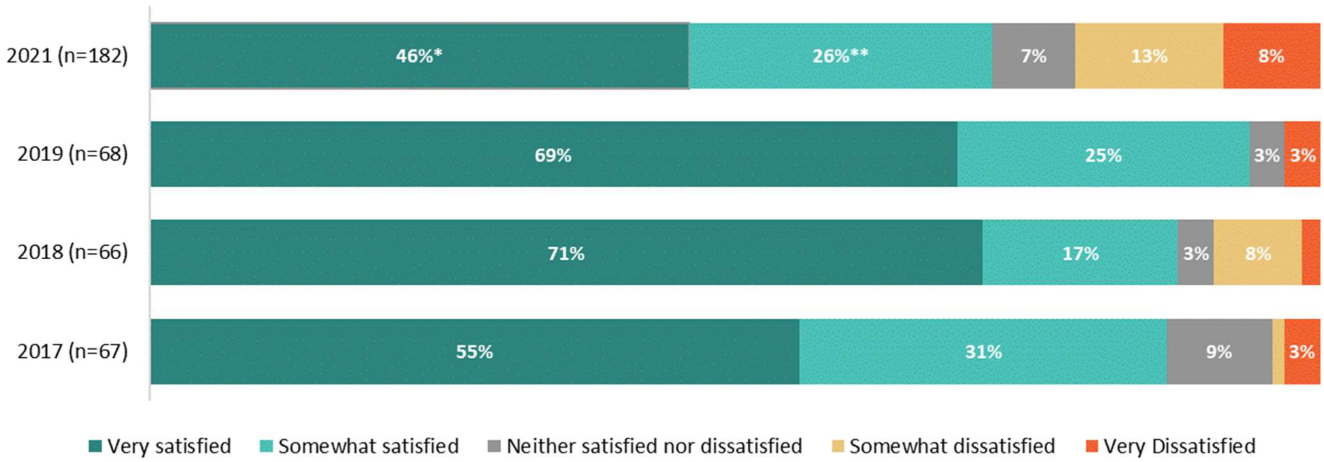
Most HEA respondents (79%) were not aware that NIPSCO offers other programs. The remaining respondents were most often aware of the Energy Efficiency Rebate program (10%), the Appliance Recycling program (9%), and the Home Energy Report program (6%). Only four respondents participated in other NIPSCO energy efficiency programs, and all reported their participation was through the Energy Efficiency Rebate program. Only two of these respondents made additional improvements or installed products after participating in HEA that they did not receive a rebate for.

SATISFACTION

SATISFACTION WITH PROGRAM

Nearly three-quarters of respondents (72%) said they were very or somewhat satisfied with the HEA program overall. The percentage of respondents who were very or somewhat satisfied overall is statistically significantly lower than program years 2017, 2018, and 2019 (Figure 23). There were no significant differences in satisfaction or dissatisfaction between the virtual and in-person respondents for 2021. Due to the low number of respondents, we excluded 2020 survey results.

FIGURE 23. SATISFACTION WITH THE HEA PROGRAM[17]



Note: * indicates difference between 2021 and the 2018 and 2019 program years is significant at p≤0.10 (90% confidence).
** indicates difference between combined very and somewhat satisfied categories in 2021 and all other program years is significant at p≤0.10 (90% confidence).
Source: Participant survey. Questions: "How satisfied are you with NIPSCO's HEA program?"

Respondents who were satisfied with the program noted they appreciated the helpfulness of the program, the quality of the information provided, the experience of saving energy and money, the advisors, and the energy-saving products including LEDs and aerators. Dissatisfied customers said they did not receive the report, had a lack of follow up from contractors or the program, wanted a blower door test, were not seeing bill savings, or did not receive new or useful information.

Very or Somewhat Satisfied

"Love the kitchen faucet aerator and chandelier LED lights and other LED lights installed. The advisor was very knowledgeable."

"I liked the assessment, but I am unable to get in contact with the company that did the assessment. I'd like to get some insulation replaced in my attic."

Neither Satisfied nor Dissatisfied

"They tried to ship it as one size fits all but that's not true."

Somewhat or Very Dissatisfied

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

"I don't feel it was a thorough inspection."

"The TRC representative that conducted the energy assessment said we should receive a comprehensive report in a couple of weeks. Never received anything. Called NIPSCO to ask for the report, they seemed confused and said they would look into it. To this day, we have yet to see the assessment report for the inspection we took off work for."

SUGGESTIONS FOR IMPROVEMENT

Approximately one third of respondents (35%) provided suggestions for program improvement. Some in-person and virtual respondents (n=21) wanted a more thorough assessment, including improved expertise and specificity from the advisors so they could answer more technical questions about the home. They requested the program use other testing techniques such as using infrared cameras to identify leaks and blower door tests. In addition, respondents wanted specific information on appliance energy use and some specific measures like mini-split systems.

Eight in-person respondents shared they wanted a copy of the report because they never received one. Relatedly, eight in-person and virtual respondents specifically requested better follow-up with customers. For some respondents, this survey was the first follow-up they received from NIPSCO since they participated in the assessment.

"A more thorough energy audit should be made available at a cost but subsidized. I understand that not everyone might want it, but if I were given the option of purchasing a full-service audit with a blower door test, I would jump at the opportunity because I would learn a lot more about where my greatest energy loss is coming from in my 120-year-old home. Many of the other issues were not necessarily new to me, though still helpful to hear."

"Make a checklist for the assessment. So that it is something to know what to expect. If something is missed its easier to be aware of that."

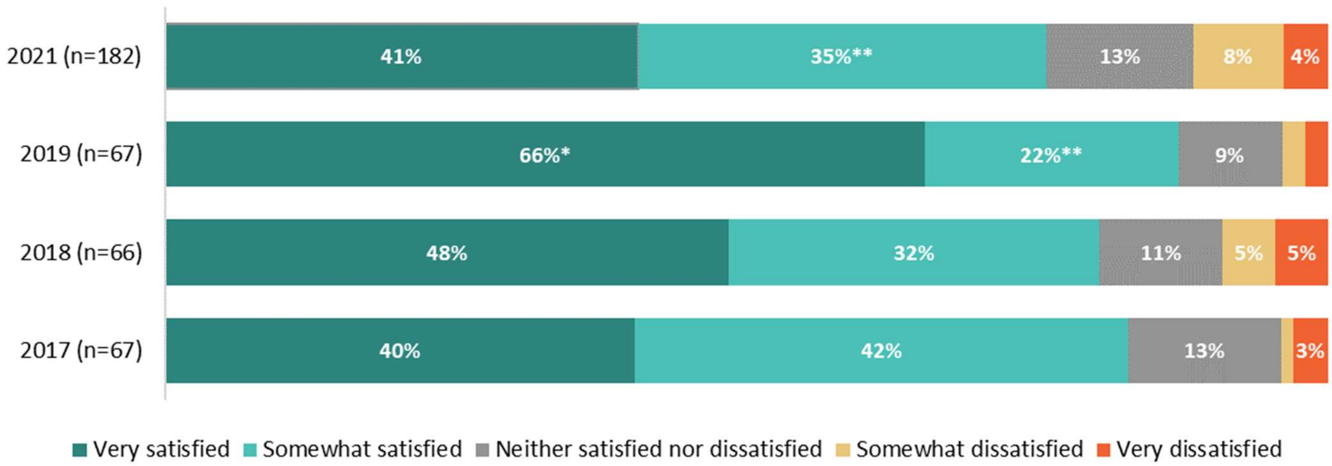
"Making things more flexible for those doing the work so it is not so rigid. The worker can have more ability to make the judgement on how long he would need."

"Make sure you get the report... Give it to the person in hand before they leave and not by email."

SATISFACTION WITH NIPSCO

Respondents were satisfied with NIPSCO as their utility service provider, with 76% of respondents either very or somewhat satisfied (Figure 24). In 2019, the percentage of very satisfied respondents was significantly higher than prior years and 2021. The percentage of combined respondents who were very or somewhat satisfied was significantly higher in 2019 than in 2021. Due the small number of respondents in 2020, the evaluation team did not include 2020 in this comparison. The evaluation team did not collect comments related to respondent satisfaction with NIPSCO as their utility service provider, and the reasons for satisfaction and dissatisfaction could be due to a variety of factors.

FIGURE 24. SATISFACTION WITH NIPSCO[18]



Note: * indicates differences between 2019 and 2017, 2018, and 2021 that are significant at p≤0.10 (90% confidence).
** indicates differences of very and somewhat satisfied respondents combined between 2019 and 2021 that are significant at p≤0.10 (90% confidence).
Source: Participant survey. Question: "How satisfied are you with NIPSCO overall as your utility service provider?

RESPONDENT DEMOGRAPHICS

As shown in Table 62, most HEA program respondents own (98%) a single-family home (88%), and about half have lived in their home for 5 years or less (48%). Home characteristics did not differ significantly by visit type.

TABLE 62. HEA PROGRAM RESPONDENT HOME CHARACTERISTICS

DEMOGRAPHICS	PERCENTAGE
Home Ownership (n=181)	
Own	98%
Rent	1%
Other	1%
Type of Residence (n=182)	
Single-family detached home	88%
Multifamily apartment or condo building (with 4 or more units)	2%
Attached house (townhouse, row house, or twin)	7%
Mobile or manufactured home	3%
Years Lived in Current Home (n=180)	
One year or less	15%
2-3 years	26%
4-5 years	7%
6-10 years	12%

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

DEMOGRAPHICS	PERCENTAGE
More than 10 years	40%
Number of People in the Home (n=177)	
One	25%
Two	41%
Three	15%
Four	10%
Five or more	8%
Square Feet of Home (n=161)	
0 – 1,499	22%
1,500 – 2,999	63%
3,000+	16%
Year Home Built (n=172)	
Before 1900	4%
1900 to 1939	15%
1940 to 1959	13%
1960 to 1979	21%
1980 to 1989	11%
1990 to 1999	15%
2000 to 2004	11%
2005 or later	10%

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

Most respondents who participated in the HEA program (82%) reported household incomes at or above $35,000, and 48% reported household incomes at or above $75,000. Just over half of respondents (54%) have either a four-year college degree or a graduate or professional degree. Respondents born in or after 1980 were significantly more likely to have a virtual visit (50%) rather than an in-person visit (16%), showing that the virtual visit is reaching younger participants (Table 63).

TABLE 63. HEA PROGRAM RESPONDENT DEMOGRAPHICS

DEMOGRAPHICS	PERCENTAGE
Annual Household Income (n=137)	
Under $25,000	7%
$25,000 to under $35,000	11%
$35,000 to under $50,000	14%
$50,000 to under $75,000	20%
$75,000 to under $100,000	15%
$100,000 to under $150,000	19%
Over $150,000	14%
Year Respondent was Born (n=167)	
1900 to 1939	5%

DEMOGRAPHICS	PERCENTAGE
1940 to 1959	42%
1960 to 1979	31%
1980 to 1989	14%
1990 to 1999	7%
Education Level Completed (n=171)	
Some high school or less	1%
High school graduate or equivalent	15%
Some college, no degree	16%
Technical college degree or certificate	5%
Two-year college degree	9%
Four-year college degree	27%
Graduate or professional degree	26%

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

CONCLUSIONS AND RECOMMENDATIONS

CONCLUSION 1: THE PROGRAM DID NOT MEET SAVINGS GOALS IN 2021.

Due to the limited participation in this program in 2021, the program fell short of its savings goals. This was largely because participation was impacted by COVID-19.

Recommendations:

- Conduct a more robust program evaluation in the next cycle to update evaluation metrics, such as in-service rates and net-to-gross if there is an increase in program participation.

CONCLUSION 2: MOST RESPONDENTS WERE SATISFIED WITH THE HEA PROGRAM, BUT OVERALL SATISFACTION IS LOWER THAN PREVIOUS PROGRAM YEARS.

While most respondents (72%) were somewhat or very satisfied with the HEA program, the percentage of respondents who were satisfied with the program overall is significantly lower than program years 2017, 2018, and 2019. Satisfied respondents noted they appreciated the expertise of the advisor, the report, and the energy savings. Dissatisfied respondents experienced a range of issues including not receiving the report, wanting follow-up from the program, not receiving new or useful information, lack of received measures, and wanting a more thorough assessment. The program implementer changed to a new subcontractor in 2022, who has focused on improving customer satisfaction.

Recommendations:

- Continue monitoring program satisfaction. NIPSCO changed program subcontractors for Program Year 2022, after noting implementation difficulties. Respondents to the program evaluation survey received services with the prior subcontractor. NIPSCO should continue monitoring satisfaction to look for improvement with the new program subcontractor.

- Increase administrative support for the assessment team and participants. Providing a checklist for the assessment team to complete could help avoid gaps in the participation process. Additional follow-up to participants can ensure they are not waiting for outreach or confused about next steps.
- Work toward a higher rate of report delivery for in-person participants by having the assessment team email the report while they are onsite and verify customer receipt by having them open the report on their computer or other device. The assessment team can also re-send the report when they follow up with the customer, so the customer remembers the report.
- Consider adding an air sealing measure to maximize savings, like the IQW program. NIPSCO could also consider expanding the assessment options to increase savings and provide a more thorough visit option and include a blower door test with this visit type.

CONCLUSION 3: SOME RESPONDENTS WERE DISSATISFIED WITH THE MEASURES. IN-PERSON RESPONDENTS SOMETIMES DID NOT RECEIVE WATER MEASURES, AND LEDS WERE SOMETIMES PROVIDED RATHER THAN INSTALLED.

Similar portions of in-person and virtual respondents felt very or somewhat dissatisfied with the measures. Twenty-one percent of respondents who participated in an in-person visit felt dissatisfied with the direct install measures and 22% of respondents who participated in a virtual visit felt dissatisfied with the energy saving kit items.

The top reason in-person respondents did not receive measures including LEDs and water saving measures was that they already had them or did not need them, and some respondents shared that the technicians sometimes did not offer the water measures. In some cases, respondents noted that the assessment team provided LEDs but did not install them. Additionally, a few virtual respondents had trouble installing water measures. The program implementer changed to a new subcontractor in 2022, who is focused on installing all applicable measures and has improved the overall number of measures installed per project compared to 2021.

Recommendations:

- Consider reviewing or increasing the educational aspect of both the direct install measures and the kit measures to ensure customers are aware of the energy-saving aspects of the measures, especially for water-saving measures. In-person participants may want water measures if they understand that they reduce water heating costs not just water use, and virtual participants may require further instruction on how to install measures.
- Clarify which measures each customer will qualify for and ensure energy advisors are trained to offer and install all applicable measures to each customer.
- Consider having the assessment team track reasons for not installing measures by adding checkboxes on the assessment form such as “customer already has efficient equipment,” “customer faucets not compatible with aerators,” “customer refused measure,” etc. With this additional data, NIPSCO and the evaluation team can better determine how to improve the acceptance rate, if needed.

CONCLUSION 4: RESPONDENTS PREFERRED THE IN-PERSON VISIT OPTION.

Most virtual assessment respondents who reported they were not offered a choice in assessment type would have preferred to receive an in-person assessment. Respondent satisfaction with the assessment did not vary significantly by visit type. Customers who had a choice of visit type and selected a virtual visit represented a range of household sizes, incomes, ages, and education levels.

Recommendations:

- Consider focusing efforts on the in-person visit. The HEA program could keep the virtual visit option available and keep relevant infrastructure updated as a backup option and for risk mitigation.

CONCLUSION 5: ANTICIPATED REGULATORY CHANGES WILL LIKELY REDUCE EXPECTED GROSS SAVINGS FOR LIGHTING MEASURES IN FUTURE PROGRAM YEARS.

As discussed in the Residential Lighting chapter, upcoming federal lighting standard changes will likely affect all NIPSCO programs that offer lighting measures to residential customers. The DOE's Office of Energy Efficiency and Renewable Energy again proposed a rule to codify the 45 lumen per-watt standard, with a comment period open through January 27, 2022.[19] The rule is expected to be finalized in 2022 and implemented in early 2023, although the timing is not yet certain and will rely on several factors (such as allowed sell-through periods).

In anticipation of this change, the evaluation team has reduced carryover savings for all LED lightbulbs to one year. Additionally, for non-upstream program designs (like kit offerings and direct-install programs) there may be additional considerations that impact how long these programs may remain viable, as these different delivery types may more frequently "early replace" incandescent or halogen bulbs that otherwise would have remained installed (which is now currently reflected in the in-situ baseline approach). The evaluation team expects that the DOE will provide more guidance in the next few months and will discuss these implications with NIPSCO once more information is known.

Recommendations:

- Monitor the DOE's EISA outcome and incorporate effective changes in program design. Review inclusion of specialty and reflector LEDs as part of the upcoming Indiana Technical Reference Manual (TRM) update process to provide guidance for any future savings for these measures in upstream programs.

CONCLUSION 6: WATER HEATER SATURATION VARIED WIDELY ACROSS DIFFERENT CUSTOMER NIPSCO FUEL SERVICE TYPES.

The evaluation team found very different water heater saturation depending on the NIPSCO fuel type of the customer. The evaluation team used these values to calculate 2021 savings; however, sample sizes for some groups were small and may not be reliable values to use for future planning.

Recommendations:

- If kits continue to be offered through HEA, continue to reference HomeLife for ISRs and water heater saturation numbers in the *ex ante* assumptions, unless there is enough participation to measure for HEA more robustly using surveys.

[19] Federal Register. Last updated December 13, 2021. "Energy Conservation Program: Backstop Requirements for General Service Lamps." https://www.federalregister.gov/documents/2021/12/13/2021-26807/energy-conservation-program-backstop-requirement-for-general-service-lamps

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). The program is open to income-qualified residential natural gas and/or electric customers living in homes that have not participated in the Home Energy Assessment (HEA) or IQW programs in the past three years. Customers are income-qualified if their total household income is at or below 200% of current federal poverty guidelines. Additionally, customers qualify if they receive one of the following: Low-income Home Energy Assistance (LIHEAP or EAP), Temporary Assistance for Needy Families (TANF), or Supplemental Security Income (SSI).

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 to implement the IQW program. These subcontractors perform the in-home assessments and direct installation of measures. TRC trains the subcontractors to ensure work quality and customer service meet program standards.

During 2021, TRC recruited participants through a variety of broadly focused marketing efforts which advertised using methods such as word-of-mouth, promoting the program through community outreach, and developing content for the NIPSCO website and social media sites. They also marketed the IQW program specifically by leaving door hangtags for residents of no-show appointments and placing a yard sign in the front yard of participating homes while the assessment is performed.

The IQW program also leverages the HEA program as a referral source; TRC screens customers interested in the HEA program for income eligibility and refers customers identified as income eligible to IQW. Interested customers enroll in the IQW program by calling the NIPSCO Residential Energy Efficiency program hotline or through the website.

Depending on the conditions and current equipment in the home, the energy advisor installs any or all the following measures during the assessment:

- LED Bulbs (up to 22 A-line, globe, and/or candelabra bulbs)
- Programmable Thermostat
- Kitchen Faucet Aerator
- Bathroom Faucet Aerators (up to two)
- Low Flow Showerheads, Low Flow Showerheads with Shower Start, Shower Start Valves (up to two total, any combination)
- Filter Whistle
- Pipe Wrap (up to 10 feet)

- Water Heater Wrap (electric only)
- Duct Sealing

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

- Refrigerator Replacement: 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.
- Air sealing: Program participants can receive an incentive toward air sealing in their homes if they can achieve at least a 20% infiltration reduction.
- Attic insulation: Qualifying program participants can also receive up to 1,000 square feet of attic insulation installed later at no cost. To receive attic insulation through the program, the existing attic insulation level must be less than R-11 and increased to R-38 or greater.

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

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

CHANGES FROM 2020 DESIGN

The IQW program largely did not operate in 2020 due to the COVID-19 pandemic. Low-income customers instead had the option to receive a virtual assessment and energy-saving kit through the Virtual HEA program. In 2021, the program began offering services again in the second half of the year and operated largely the same as it did previously, although participation was limited. In addition, instead of using a network of trade allies to complete direct installations, TRC worked with subcontractors to complete the work.

PROGRAM PERFORMANCE

In 2021, the NIPSCO team adjusted our timelines across programs to deliver evaluation reports earlier than in previous years. In order to meet the new timelines, for most programs the evaluation teams began analysis earlier, and conducted our impact analyses on 11 months of data instead of the full calendar year (January 1 to November 30, 2021).[20] The evaluation metrics developed during this analysis (including in-service rates, realization rates, net-

[20] Note that all measure-level tables include measures from the full year, with the quantity listed as zero in cases where the measure appeared in the tracking data only in December 2021.

to-gross ratios, etc.) and included in the first draft versions of the report were applied to the full year of data as part of the final, compiled report and included in Table 64 below.

Table 64 summarizes savings for the full year of program performance, including program savings goals.

TABLE 64. 2021 IQW PROGRAM SAVING SUMMARY – FULL YEAR 2021

METRIC	GROSS SAVINGS GOAL	*EX ANTE*	AUDITED	VERIFIED	*EX POST* GROSS	*EX POST* NET	GROSS GOAL ACHIEVEMENT
Electric Energy Savings (kWh/yr.)	591,708.47	81,230.34	81,230.34	74,690.05	71,945.95	71,945.95	12%
Peak Demand Reduction (kW)	131.175	21.909	21.909	20.322	18.244	18.244	14%
Natural Gas Energy Savings (therms/yr.)	120,785.14	16,225.48	16,225.48	15,263.85	16,044.14	16,044.14	12%

Table 65 summarizes savings evaluated during the program's evaluation period, which was from January 2021 to November 2021.

TABLE 65. 2021 IQW PROGRAM SAVING SUMMARY – JANUARY THROUGH NOVEMBER 2021

METRIC	*EX ANTE*	AUDITED	VERIFIED	*EX POST* GROSS	*EX POST* NET
Electric Energy Savings (kWh/yr.)	46,357.98	46,357.98	42,528.92	41,633.81	41,633.81
Peak Demand Reduction (kW)	11.051	11.051	10.084	9.438	9.438
Natural Gas Energy Savings (therms/yr.)	3,463.60	3,463.60	3,010.41	3,353.13	3,353.13

As documented in Table 65, audited savings aligned with the claimed *ex ante* savings; the evaluation team did not identify any issues through the tracking system analysis that warranted adjustments to either the savings or quantity. Verified savings were somewhat lower than claimed values due to in-service rates (ISR) of select measures. The engineering analysis completed for the *ex post* gross analysis further decreased the electric energy, peak demand, and natural gas energy savings values.

Table 66 outlines the realization rates and net energy adjustment factors resulting from the evaluation. Note that net-to-gross (NTG) is deemed at 100%, as is common practice for income-qualified programs.

TABLE 66. 2021 IQW ADJUSTMENT FACTORS

METRIC	REALIZATION RATE (%)[a]	FREERIDERSHIP	SPILLOVER	NTG (%)[b]
Electric Energy Savings (kWh/yr.)	90%	0%	0%	100%
Peak Demand Reduction (kW)	85%	0%	0%	100%
Natural Gas Energy Savings (therms/yr.)	97%	0%	0%	100%

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

Both electric and natural gas spending was below the planned program budget for Program Year 2021 due to limited program participation (Table 67).

TABLE 67. 2021 IQW PROGRAM EXPENDITURES

FUEL	PROGRAM BUDGET	PROGRAM EXPENDITURES	BUDGET SPENT (%)
Electric	$411,713.91	$60,246.02	15%
Natural Gas	$717,070.57	$123,794.07	17%

EVALUATION METHODOLOGY

To inform the 2021 NIPSCO impact and process evaluation, the evaluation team completed the following research activities:

- **Utility and implementation staff interviews and discussions**, to understand program design and delivery
- **Documentation and materials review**, to provide context on program implementation
- **Tracking data analysis**, to audit and verify the accuracy of program participation data
- **Engineering analysis**, to review program savings assumptions and algorithms for reasonableness and accuracy
- **Telephone and web survey of IQW participants**, to understand source of awareness, reasons for participation, experience with IQW, satisfaction with the program, and program impacts on customers

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?
- Is the program on track to meet its participation and savings goals?

For all measure types, the evaluation team conducted an audit of the tracking data to identify potential issues, estimated and applied in-service rates (ISRs) to determine verified savings, and conducted an engineering analysis to estimate *ex post* gross savings.

AUDITED AND VERIFIED SAVINGS

AUDITED 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.

VERIFIED SAVINGS

The evaluation team established ISRs for all IQW measures using a combination of results from the 2019 and 2021 participant surveys. Consistent with the method established in the 2015 evaluation and used in subsequent evaluations, the evaluation team used the percentage of customers in 2021 who recalled receiving an assessment report as the ISR for the energy assessment recommendations measure. Table 68 lists the ISRs and their sources for all program-installed measures.

TABLE 68. 2021 IQW PROGRAM IN-SERVICE RATES RATIOS BY MEASURE

MEASURE	ISR	SOURCE
LED	93%	2021 IQW Survey
Bathroom Aerator	85%	2019 IQW Survey
Kitchen Aerator	91%	2019 IQW Survey
Low Flow Showerhead	89%	2019 IQW Survey
Pipe Wrap	90%	2019 IQW Survey
Programmable Thermostat	70%	2019 IQW Survey
Filter Whistle	87%	2019 IQW Survey
Air Sealing	100%	2019 IQW Survey, with investigation of 2021 project documentation
Duct Sealing	100%	2019 IQW Survey, with investigation of 2021 project documentation
Attic Insulation	100%	2019 IQW Survey, with investigation of 2021 project documentation
Refrigerator	97%	2019 IQW Survey
Assessment Recommendations	62%	2021 IQW Survey

The evaluation team calculated ISRs with 2021 survey data for all measures to determine if there were issues that required additional investigation but did not identify any concerns. For ISRs recommended in this evaluation, the evaluation team carefully reviewed the 2021 survey data to assess whether calculating ISRs from these data were appropriate based on the sample sizes by measure. The number of survey respondents by measure varied widely, and due to lower participation in 2021, most measures (including water-saving devices, thermostats, and weatherization measures) had small sample sizes below 15 total completes. 2021 ISRs were calculated and applied only for LEDs and the assessment recommendations, where sample sizes were larger. For all other measures, the evaluation team referenced ISRs from the 2019 evaluation of IQW.

The ISRs fall below 100% for two reasons: (1) respondents report that a measure was not installed, or that a lower quantity than the program claimed was installed, and/or (2) respondents report removing items after the program installed them. The ISR for assessment recommendations is based on the number of survey respondents who indicated they received an assessment report.

For weatherization-related direct installation measures, the evaluation team reviewed program documentation in cases where 2021 survey respondents said measures were not installed. The evaluation team reviewed one air sealing, one attic insulation, and four duct sealing projects where this was the case and verified all to confirm the 2019 ISRs were appropriate to use. As a result of this investigation, we also increased the duct sealing ISR to 100%, up from 99% in 2019.

The ISR across all measures installed through the IQW program was relatively high, at 89%. Table 69 summarizes the tracking data quantity, audited quantity, applied installation rates, and resulting verified quantity per measure. To calculate the verified measure quantity, the evaluation team multiplied the audited measure quantity by the installation rate.

TABLE 69. 2021 IQW PROGRAM AUDITED AND VERIFIED QUANTITIES

MEASURE	UNIT OF MEASURE	AUDITED QUANTITY	ISR	VERIFIED QUANTITY
A-Line LEDs - Dual Fuel	Lamp	889	93%	825
A-Line LEDs - Electric	Lamp	23	93%	21
Candelabra LEDs - Dual Fuel	Lamp	145	93%	135
Candelabra LEDs - Electric	Lamp	9	93%	8
Globe LEDs - Dual Fuel	Lamp	101	93%	94
Globe LEDs - Electric	Lamp	9	93%	8
Bathroom Aerator - Electric	Aerator	2	85%	2
Bathroom Aerator - Gas	Aerator	26	85%	22
Kitchen Aerator 1.5 gpm - Electric	Aerator	0	91%	0
Kitchen Aerator - Gas	Aerator	25	91%	23
Low Flow Showerhead - Electric	Showerhead	2	89%	2
Low Flow Showerhead - Gas	Showerhead	32	89%	28
Low Flow Showerhead with Shower Start - Electric	Showerhead with Shower Start	2	89%	2
Low Flow Showerhead with Shower Start - Gas	Showerhead with Shower Start	14	89%	12
Shower Start - Gas	Shower Start	3	89%	3
Pipe Wrap - Gas	Per Foot	55	90%	50
Programmable Thermostat - Electric Cooling and Gas Heating	Thermostat	5	70%	4
Programmable Thermostat - Gas Heating	Thermostat	5	70%	4
Filter Whistle - Electric Cooling and Gas Heating	Whistle	1	87%	1
Filter Whistle - Electric Heating Savings	Whistle	0	87%	0
Air Sealing - Electric Cooling and Gas Heating Savings	Home	0	100%	0
Air Sealing - Electric Cooling Only Savings	Home	0	100%	0
Air Sealing - Gas Heating Only Savings	Home	0	100%	0
Duct Sealing Package - Electric Cooling and Gas Heating	Home	24	100%	24
Duct Sealing Package - Gas Heating	Home	8	100%	8
Attic Insulation (Uninsulated Hatch) - Gas Heating Only Savings	Per ksf	0	100%	0
Attic Insulation (Uninsulated Hatch) - Electric Cooling and Gas Heating Savings	Per ksf	0	100%	0
ENERGY STAR Refrigerator replace non-ENERGY STAR refrigerator (Old Model Year: <1993, New Capacity: 18 CF) (Home Depot Frigidaire FFTR1835V)	Unit	2	97%	2
ENERGY STAR Refrigerator replace non-ENERGY STAR refrigerator (Old Model Year: 1993-2010, New Capacity: 18 CF) (Home Depot Frigidaire FFTR1835V)	Unit	7	97%	7
ENERGY STAR Refrigerator replace non-ENERGY STAR refrigerator (Old Model Year: 1993-2010, New Capacity: 20 CF) (Best Buy Whirlpool WRT311FZD)	Unit	1	97%	1

MEASURE	UNIT OF MEASURE	AUDITED QUANTITY	ISR	VERIFIED QUANTITY
ENERGY STAR Refrigerator replace non-ENERGY STAR refrigerator (Old Model Year: 1993-2010, New Capacity: 20 CF) (Home Depot Frigidaire FFTR2021T)	Unit	5	97%	5
Assessment Recommendations - Dual Fuel	Home	118	62%	74
Assessment Recommendations - Electric	Home	3	62%	2
Assessment Recommendations - Gas	Home	33	62%	21
		1,549	89%	1,385

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) for variable assumptions to calculate *ex post* gross electric energy savings, demand reduction, and natural gas savings. Where data were unavailable in the Indiana TRM (v2.2), the evaluation team used data from the 2021 Pennsylvania TRM, the Uniform Methods Project (UMP), and the 2020 NIPSCO Evaluation, Measurement, and Verification (EM&V) Report. The evaluation team revised assumptions for savings estimates applicable to the NIPSCO service territory, as needed. Appendix 4 contains more details on the specific algorithms, variable assumptions, and references for the program measure *ex post* gross calculations.

EX POST GROSS SAVINGS

Table 70 shows the *ex ante* deemed savings and *ex post* gross per-measure savings for 2021 IQW program measures.

TABLE 70. 2021 IQW PROGRAM *EX ANTE* & *EX POST* GROSS PER-MEASURE SAVINGS VALUES

MEASURE	UNIT OF MEASURE	*EX ANTE* DEEMED SAVINGS			*EX POST* GROSS PER-MEASURE SAVINGS		
		KWH	KW	THERMS	KWH	KW	THERMS
A-Line LEDs - Dual Fuel	Lamp	28.52	0.004	(0.58)	28.51	0.004	0.00
A-Line LEDs - Electric	Lamp	28.52	0.004	0.00	28.44	0.004	0.00
Candelabra LEDs - Dual Fuel	Lamp	20.13	0.003	(0.41)	29.36	0.004	0.00
Candelabra LEDs - Electric	Lamp	20.13	0.003	0.00	29.19	0.004	0.00
Globe LEDs - Dual Fuel	Lamp	19.29	0.003	(0.39)	28.52	0.004	0.00
Globe LEDs - Electric	Lamp	19.29	0.003	0.00	28.52	0.004	0.00
Bathroom Aerator - Electric	Aerator	34.00	0.003	0.00	33.80	0.003	0.00
Bathroom Aerator - Gas	Aerator	0.00	0.000	1.50	0.00	0.000	1.49
Kitchen Aerator 1.5 gpm - Electric	Aerator	180.95	0.008	0.00	180.95	0.008	0.00
Kitchen Aerator - Gas	Aerator	0.00	0.000	7.96	0.00	0.000	7.92
Low Flow Showerhead - Electric	Showerhead	377.84	0.017	0.00	260.66	0.017	0.00
Low Flow Showerhead - Gas	Showerhead	0.00	0.000	16.62	0.00	0.000	11.47

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 - Electric	Showerhead with Shower Start	435.31	0.235	0.00	304.28	0.020	0.00
Low Flow Showerhead with Shower Start - Gas	Showerhead with Shower Start	0.00	0.000	19.15	0.00	0.000	13.39
Shower Start - Gas	Shower Start	0.00	0.000	4.43	0.00	0.000	3.36
Pipe Wrap - Gas	Per Foot	0.00	0.000	1.13	0.00	0.000	1.13
Programmable Thermostat - Electric Cooling and Gas Heating	Thermostat	99.88	0.000	74.66	100.69	0.000	75.07
Programmable Thermostat - Gas Heating	Thermostat	0.00	0.000	74.66	0.00	0.000	73.58
Filter Whistle - Electric Cooling and Gas Heating	Whistle	16.25	0.026	6.76	24.37	0.028	2.75
Filter Whistle - Electric Heating Savings	Whistle	53.80	0.000	0.00	53.80	0.000	0.00
Air Sealing - Electric Cooling and Gas Heating Savings	Home	83.76	0.043	98.54	83.76	0.043	98.54
Air Sealing - Electric Cooling Only Savings	Home	80.93	0.126	0.00	80.93	0.126	0.00
Air Sealing - Gas Heating Only Savings	Home	0.00	0.000	113.19	0.00	0.000	113.19
Duct Sealing Package - Electric Cooling and Gas Heating	Home	60.82	0.138	56.40	61.39	0.138	56.43
Duct Sealing Package - Gas Heating	Home	0.00	0.000	56.40	0.00	0.000	56.43
Attic Insulation (Uninsulated Hatch) - Gas Heating Only Savings	Per ksf	0.00	0.000	213.37	0.00	0.000	213.37
Attic Insulation (Uninsulated Hatch) - Electric Cooling and Gas Heating Savings	Per ksf	236.05	0.116	206.75	236.05	0.116	206.75
ENERGY STAR Refrigerator replace non-ENERGY STAR refrigerator (Old Model Year: <1993, New Capacity: 18 CF) (Home Depot Frigidaire FFTR1835V)	Unit	1,487.33	0.218	0.00	1,286.00	0.189	0.00
ENERGY STAR Refrigerator replace non-ENERGY STAR refrigerator (Old Model Year: 1993-2010, New Capacity: 18 CF) (Home Depot Frigidaire FFTR1835V)	Unit	439.87	0.065	0.00	280.00	0.041	0.00
ENERGY STAR Refrigerator replace non-ENERGY STAR refrigerator (Old Model Year: 1993-2010, New Capacity: 20 CF) (Best Buy Whirlpool WRT311FZD)	Unit	473.62	0.070	0.00	254.00	0.037	0.00
ENERGY STAR Refrigerator replace non-ENERGY STAR refrigerator (Old Model Year: 1993-2010, New Capacity: 20 CF) (Home Depot Frigidaire FFTR2021T)	Unit	473.62	0.070	0.00	260.00	0.038	0.00
Assessment Recommendations - Dual Fuel	Home	21.16	0.012	2.69	21.16	0.012	2.69
Assessment Recommendations - Electric	Home	21.28	0.012	0.00	21.28	0.012	0.00
Assessment Recommendations - Gas	Home	0.00	0.000	2.70	0.00	0.000	2.70

Through the engineering review, the evaluation team uncovered a few major differences between *ex ante* and *ex post* gross savings for all measures. The measures with large differences between *ex ante* and *ex post* gross savings were LEDs, filter whistles, and refrigerator replacements. These differences were primarily driven by the following overarching factors:

- For LED candelabra and globe measures, the baseline wattages used in *ex ante* calculations were found to be incorrect. The correct baseline wattages were higher and led to around a 50% increase in realization rate. Previously, the assigned baseline wattages for candelabras and globes assumed they were covered by the Energy Independence and Security Act (EISA). However, candelabras and globes are exempt from this legislation, and therefore their baseline wattages should be higher to reflect that. This understated savings by almost 50% for all candelabra and globe measures.
- The *ex ante* filter whistle savings used values for efficiency improvement and coincidence factor from the Illinois TRM, and the most recent version of the Illinois TRM (v9) removed its filter whistle measure. The *ex post* calculations were updated to use values from the 2021 Pennsylvania TRM.
- The *ex ante* savings for refrigerator replacement are deemed values from TRC, based on 2020 *ex post* savings. The 2021 *ex post* values were calculated using algorithms and baseline values from the IN TRM (v2.2), as well as the actual rated efficient Unit Energy Consumption (UEC) values for each model of refrigerator.

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

- The evaluation team calculated *ex post* gross savings for most of the measures using the Indiana TRM (v2.2). The planning and reporting assumptions NIPSCO used to calculate *ex ante* savings referenced the Indiana TRM (v2.2) and the 2020 EM&V results, and sometimes included an average of the savings values provided in each source.
- The evaluation team used the installation zip code to match each customer to the closest city from the Indiana TRM (v2.2)—for example, South Bend and Fort Wayne—to more precisely account for variations in climate for measures including LED bulbs, faucet aerators, low flow showerheads, duct sealing, and attic insulation.

Table 71 summarizes the notable differences between *ex ante* and *ex post* gross estimates by measure.

TABLE 71. 2021 IQW NOTABLE DIFFERENCES BETWEEN *EX ANTE* & *EX POST* GROSS

MEASURE	*EX ANTE* SOURCES AND ASSUMPTIONS	*EX POST* GROSS SOURCES AND ASSUMPTIONS	PRIMARY REASONS FOR DIFFERENCES
LED	*Ex ante* savings are based on the Indiana TRM (v2.2). Baseline wattage, ISR, and hours per TRM. WHF values assume weighted average from South Bend per TRM tables.	*Ex post* savings are based on the Indiana TRM (v2.2), the UMP, and program tracking data. Baseline wattage value per UMP. WHF use TRM weighted average values assigned with zip code mapping.	Differences in baseline wattage and WHF assumptions.
Low Flow Showerhead	*Ex ante* savings are based on the Indiana TRM (v2.2). GPM_{base} and GPM_{low}, people per home, faucets per home, and cold-water temperature assumes South Bend per TRM tables.	*Ex post* savings are based on the Indiana TRM (v2.2) and participant information in program tracking data assumed single family housing; cold-water inlet temperature based on customer location, actual rating for GPM_{low} of 1.5, and showers per day taken from 2021 IQW survey data.	Different assumptions for water temperatures and showers per day.

MEASURE	*EX ANTE* SOURCES AND ASSUMPTIONS	*EX POST* GROSS SOURCES AND ASSUMPTIONS	PRIMARY REASONS FOR DIFFERENCES
Filter Whistle	*Ex ante* savings calculations are based on the 2021 PA TRM using coincidence factor and efficiency improvement values from the IL TRM v8.0.	*Ex post* savings are based solely on the 2021 PA TRM.	Different values for coincidence factor and efficiency improvements, IL TRM (v9) does not have a filter whistle measure.
Refrigerator Replacement	*Ex ante* savings are deemed based on 2020 *ex post* evaluated savings.	*Ex post* savings are based on the IN TRM (v2.2) algorithm, using the rated UEC value of each model of refrigerator.	*Ex ante* savings are deemed, whereas *ex post* savings are based on the IN TRM (v2.2).

WASTE HEAT FACTOR – THERM PENALTIES

Consistent with the 2020 evaluation year, the evaluation team is not including therm penalties when calculating evaluated savings for the 2021 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 results and measure performance more clearly.

The *ex ante* savings for all dual fuel LED measures include therm penalties. 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. In total, the therm penalty for cost-effectiveness analysis is -615.89 therms (Table 72).

TABLE 72. 2021 IQW PROGRAM WASTE HEAT FACTOR THERM PENALTY

MEASURE	WASTE HEAT FACTOR THERM PENALTY
A-Line LEDs - Dual Fuel	(480.60)
Candelabra LEDs - Dual Fuel	(80.69)
Globe LEDs - Dual Fuel	(54.60)

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

REALIZATION RATES

The next three tables (Table 73 through Table 75) show the program's *ex ante* reported savings, verified savings, and *ex post* gross savings. The main driver for all three realization rates was the LED measures. The baseline wattages used in the *ex ante* calculations for the reported candelabra and globe measures were much lower than those used in the *ex post* calculations. Previously, candelabras and globes had assigned baseline wattages assuming they were covered by EISA. However, candelabras and globes are exempt from this legislation, and therefore the evaluation team used higher baseline wattages to reflect that. This understated savings by almost 50% for all candelabra and globe measures.

Refrigerator replacements were less impactful, but still a large driver of electric energy and demand reduction realization rates. The difference between *ex ante* and *ex post* realization rates came from a switch from deemed savings based on TRC data to savings calculated using the IN TRM (v2.2) algorithms.

TABLE 73. 2021 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.)
A-Line LEDs - Dual Fuel	25,354.28	25,354.28	23,523.14	23,513.92
A-Line LEDs - Electric	655.96	655.96	608.59	606.90
Candelabra LEDs - Dual Fuel	2,918.85	2,918.85	2,708.04	3,949.75
Candelabra LEDs - Electric	181.17	181.17	168.09	243.75
Globe LEDs - Dual Fuel	1,948.29	1,948.29	1,807.58	2,672.60
Globe LEDs - Electric	173.61	173.61	161.07	238.15
Bathroom Aerator - Electric	68.00	68.00	57.80	57.46
Bathroom Aerator - Gas	0.00	0.00	0.00	0.00
Kitchen Aerator 1.5 gpm - Electric	0.00	0.00	0.00	0.00
Kitchen Aerator - Gas	0.00	0.00	0.00	0.00
Low Flow Showerhead - Electric	755.68	755.68	672.56	463.97
Low Flow Showerhead - Gas	0.00	0.00	0.00	0.00
Low Flow Showerhead with Shower Start - Electric	870.62	870.62	774.85	541.62
Low Flow Showerhead with Shower Start - Gas	0.00	0.00	0.00	0.00
Shower Start - Gas	0.00	0.00	0.00	0.00
Pipe Wrap - Gas	0.00	0.00	0.00	0.00
Programmable Thermostat - Electric Cooling and Gas Heating	499.40	499.40	349.58	352.43
Programmable Thermostat - Gas Heating	0.00	0.00	0.00	0.00
Filter Whistle - Electric Cooling and Gas Heating	16.25	16.25	14.14	21.20
Filter Whistle - Electric Heating Savings	0.00	0.00	0.00	0.00
Air Sealing - Electric Cooling and Gas Heating Savings	0.00	0.00	0.00	0.00
Air Sealing - Electric Cooling Only Savings	0.00	0.00	0.00	0.00
Air Sealing - Gas Heating Only Savings	0.00	0.00	0.00	0.00
Duct Sealing Package - Electric Cooling and Gas Heating	1,459.68	1,459.68	1,459.68	1,473.42
Duct Sealing Package - Gas Heating	0.00	0.00	0.00	0.00
Attic Insulation (Uninsulated Hatch) - Gas Heating Only Savings	0.00	0.00	0.00	0.00
Attic Insulation (Uninsulated Hatch) - Electric Cooling and Gas Heating Savings	0.00	0.00	0.00	0.00
ENERGY STAR Refrigerator replace non-ENERGY STAR refrigerator (Old Model Year: <1993, New Capacity: 18 CF) (Home Depot Frigidaire FFTR1835V)	2,974.66	2,974.66	2,885.42	2,494.84

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.)
ENERGY STAR Refrigerator replace non-ENERGY STAR refrigerator (Old Model Year: 1993-2010, New Capacity: 18 CF) (Home Depot Frigidaire FFTR1835V)	3,079.09	3,079.09	2,986.72	1,901.20
ENERGY STAR Refrigerator replace non-ENERGY STAR refrigerator (Old Model Year: 1993-2010, New Capacity: 20 CF) (Best Buy Whirlpool WRT311FZD)	473.62	473.62	459.41	246.38
ENERGY STAR Refrigerator replace non-ENERGY STAR refrigerator (Old Model Year: 1993-2010, New Capacity: 20 CF) (Home Depot Frigidaire FFTR2021T)	2,368.10	2,368.10	2,297.06	1,261.00
Assessment Recommendations - Dual Fuel	2,496.88	2,496.88	1,555.43	1,555.43
Assessment Recommendations - Electric	63.84	63.84	39.77	39.77
Assessment Recommendations - Gas	0.00	0.00	0.00	0.00
Total Savings	46,357.98	46,357.98	42,528.92	41,633.81
Total Program Realization Rate				90%

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 74. 2021 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.)
A-Line LEDs - Dual Fuel	3.556	3.556	3.299	3.202
A-Line LEDs - Electric	0.092	0.092	0.085	0.083
Candelabra LEDs - Dual Fuel	0.435	0.435	0.404	0.538
Candelabra LEDs - Electric	0.027	0.027	0.025	0.033
Globe LEDs - Dual Fuel	0.303	0.303	0.281	0.364
Globe LEDs - Electric	0.027	0.027	0.025	0.032
Bathroom Aerator - Electric	0.006	0.006	0.005	0.005
Bathroom Aerator - Gas	0.000	0.000	0.000	0.000
Kitchen Aerator 1.5 gpm - Electric	0.000	0.000	0.000	0.000
Kitchen Aerator - Gas	0.000	0.000	0.000	0.000
Low Flow Showerhead - Electric	0.034	0.034	0.030	0.030
Low Flow Showerhead - Gas	0.000	0.000	0.000	0.000
Low Flow Showerhead with Shower Start - Electric	0.470	0.470	0.418	0.036

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 Shower Start - Gas	0.000	0.000	0.000	0.000
Shower Start - Gas	0.000	0.000	0.000	0.000
Pipe Wrap - Gas	0.000	0.000	0.000	0.000
Programmable Thermostat - Electric Cooling and Gas Heating	0.000	0.000	0.000	0.000
Programmable Thermostat - Gas Heating	0.000	0.000	0.000	0.000
Filter Whistle - Electric Cooling and Gas Heating	0.026	0.026	0.023	0.024
Filter Whistle - Electric Heating Savings	0.000	0.000	0.000	0.000
Air Sealing - Electric Cooling and Gas Heating Savings	0.000	0.000	0.000	0.000
Air Sealing - Electric Cooling Only Savings	0.000	0.000	0.000	0.000
Air Sealing - Gas Heating Only Savings	0.000	0.000	0.000	0.000
Duct Sealing Package - Electric Cooling and Gas Heating	3.312	3.312	3.312	3.319
Duct Sealing Package - Gas Heating	0.000	0.000	0.000	0.000
Attic Insulation (Uninsulated Hatch) - Gas Heating Only Savings	0.000	0.000	0.000	0.000
Attic Insulation (Uninsulated Hatch) - Electric Cooling and Gas Heating Savings	0.000	0.000	0.000	0.000
ENERGY STAR Refrigerator replace non-ENERGY STAR refrigerator (Old Model Year: <1993, New Capacity: 18 CF) (Home Depot Frigidaire FFTR1835V)	0.436	0.436	0.423	0.366
ENERGY STAR Refrigerator replace non-ENERGY STAR refrigerator (Old Model Year: 1993-2010, New Capacity: 18 CF) (Home Depot Frigidaire FFTR1835V)	0.455	0.455	0.441	0.279
ENERGY STAR Refrigerator replace non-ENERGY STAR refrigerator (Old Model Year: 1993-2010, New Capacity: 20 CF) (Best Buy Whirlpool WRT311FZD)	0.070	0.070	0.068	0.036
ENERGY STAR Refrigerator replace non-ENERGY STAR refrigerator (Old Model Year: 1993-2010, New Capacity: 20 CF) (Home Depot Frigidaire FFTR2021T)	0.350	0.350	0.340	0.185
Assessment Recommendations - Dual Fuel	1.416	1.416	0.882	0.882
Assessment Recommendations - Electric	0.036	0.036	0.022	0.022
Assessment Recommendations - Gas	0.000	0.000	0.000	0.000
Total Savings	11.051	11.051	10.084	9.438
Total Program Realization Rate				85%

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 75. 2021 IQW 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.)
A-Line LEDs - Dual Fuel	(515.62)	(515.62)	(478.38)	0.00
A-Line LEDs - Electric	0.00	0.00	0.00	0.00
Candelabra LEDs - Dual Fuel	(59.45)	(59.45)	(55.16)	0.00
Candelabra LEDs - Electric	0.00	0.00	0.00	0.00
Globe LEDs - Dual Fuel	(39.39)	(39.39)	(36.55)	0.00
Globe LEDs - Electric	0.00	0.00	0.00	0.00
Bathroom Aerator - Electric	0.00	0.00	0.00	0.00
Bathroom Aerator - Gas	39.00	39.00	33.15	32.87
Kitchen Aerator 1.5 gpm - Electric	0.00	0.00	0.00	0.00
Kitchen Aerator - Gas	199.00	199.00	181.09	180.26
Low Flow Showerhead - Electric	0.00	0.00	0.00	0.00
Low Flow Showerhead - Gas	531.84	531.84	473.34	326.61
Low Flow Showerhead with Shower Start - Electric	0.00	0.00	0.00	0.00
Low Flow Showerhead with Shower Start - Gas	268.10	268.10	238.61	166.81
Shower Start - Gas	13.29	13.29	11.83	8.98
Pipe Wrap - Gas	62.15	62.15	55.94	55.91
Programmable Thermostat - Electric Cooling and Gas Heating	373.30	373.30	261.31	262.76
Programmable Thermostat - Gas Heating	373.30	373.30	261.31	257.53
Filter Whistle - Electric Cooling and Gas Heating	6.76	6.76	5.88	2.40
Filter Whistle - Electric Heating Savings	0.00	0.00	0.00	0.00
Air Sealing - Electric Cooling and Gas Heating Savings	0.00	0.00	0.00	0.00
Air Sealing - Electric Cooling Only Savings	0.00	0.00	0.00	0.00
Air Sealing - Gas Heating Only Savings	0.00	0.00	0.00	0.00
Duct Sealing Package - Electric Cooling and Gas Heating	1,353.60	1,353.60	1,353.60	1,354.32
Duct Sealing Package - Gas Heating	451.20	451.20	451.20	451.44
Attic Insulation (Uninsulated Hatch) - Gas Heating Only Savings	0.00	0.00	0.00	0.00
Attic Insulation (Uninsulated Hatch) - Electric Cooling and Gas Heating Savings	0.00	0.00	0.00	0.00
ENERGY STAR Refrigerator replace non-ENERGY STAR refrigerator (Old Model Year: <1993, New Capacity: 18 CF) (Home Depot Frigidaire FFTR1835V)	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) (Home Depot Frigidaire FFTR1835V)	0.00	0.00	0.00	0.00

MEASURE	*EX ANTE* [a] NATURAL GAS ENERGY SAVINGS (THERMS/YR.)	AUDITED GROSS NATURAL GAS ENERGY (THERMS/YR.)	VERIFIED GROSS NATURAL GAS ENERGY SAVINGS (THERMS/YR.)	*EX POST* GROSS NATURAL GAS ENERGY SAVINGS (THERMS/YR.)
ENERGY STAR Refrigerator replace non-ENERGY STAR refrigerator (Old Model Year: 1993-2010, New Capacity: 20 CF) (Best Buy Whirlpool WRT311FZD)	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) (Home Depot Frigidaire FFTR2021T)	0.00	0.00	0.00	0.00
Assessment Recommendations - Dual Fuel	317.42	317.42	197.74	197.74
Assessment Recommendations - Electric	0.00	0.00	0.00	0.00
Assessment Recommendations - Gas	89.10	89.10	55.50	55.50
Total Savings	3,463.60	3,463.60	3,010.41	3,353.13
Total Program Realization Rate				97%

Note: Totals may not sum properly due to rounding.

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

PROCESS EVALUATION

This section describes the evaluation team's process evaluation findings, derived from surveying IQW program participants. These process evaluation activities sought to answer the following key research questions for the program:

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

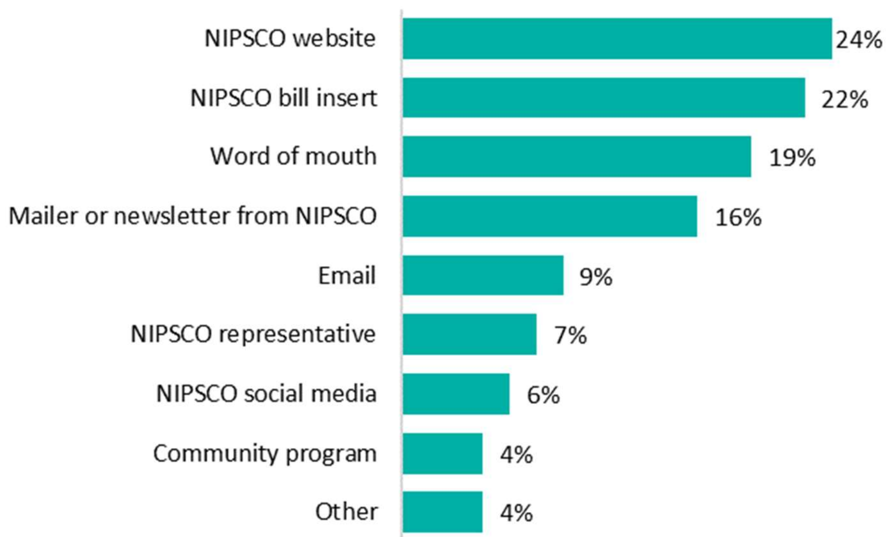
PARTICIPANT FEEDBACK

The evaluation team invited the census of 283 program participants to complete the survey and received 70 responses. The team fielded the survey via phone (66%) and web (34%) in January 2022. The following sections describe the survey respondent feedback related to source of awareness, reasons for participation, experience with the in-home assessment, satisfaction with the program and measures, and suggestions for program improvement.

ENERGY EFFICIENCY AWARENESS AND MARKETING

Respondents most frequently learned about IQW directly from NIPSCO (61%) through both digital and non-digital sources, including the website, bill insert, mailer/newsletter, a NIPSCO representative, or social media (Figure 25). Word of mouth was another common source of program awareness, like previous program years (2019 and 2018), but in those years this was the most common source of awareness.

FIGURE 25. HOW PARTICIPANTS LEARNED ABOUT THE IQW PROGRAM

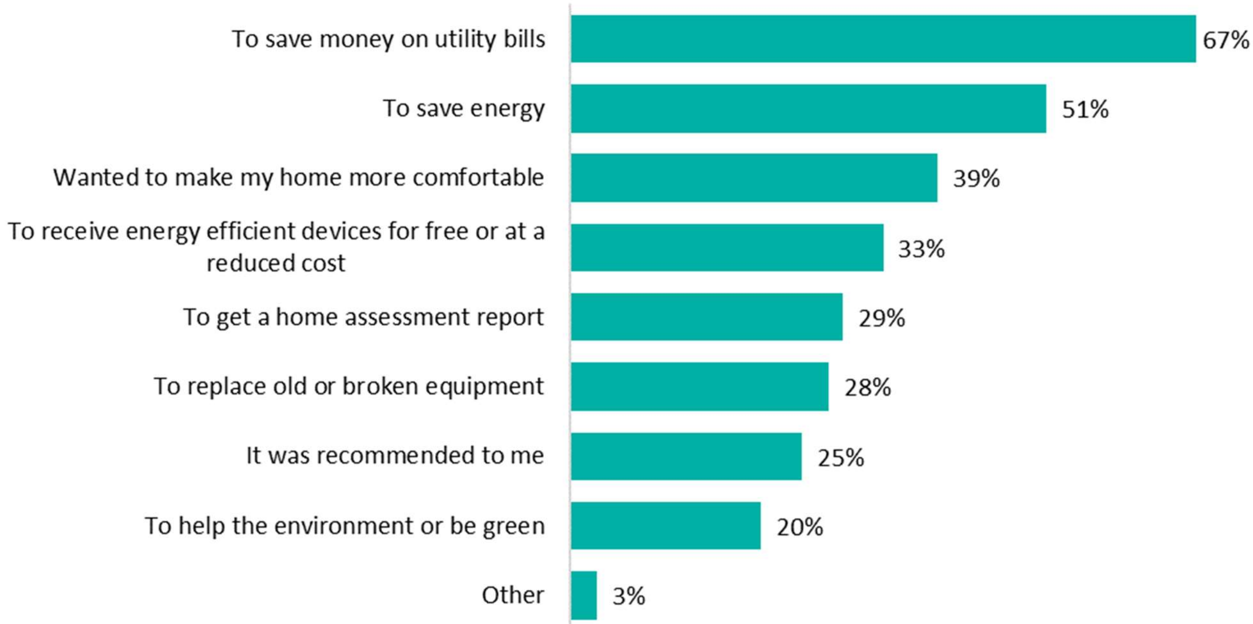


Source: Participant survey. Question: "How did you learn about NIPSCO's IQW program?" (Multiple responses allowed) (n=70)

PARTICIPATION DRIVERS

Respondents indicated that they most often participated in the IQW program to save money on utility bills (67%), which has been the top participation driver for the last four program years. The other reasons respondents mentioned most often included saving energy (51%) and making their home more comfortable (39%) (Figure 26).

FIGURE 26. TOP REASONS FOR PARTICIPATING IN IQW PROGRAM

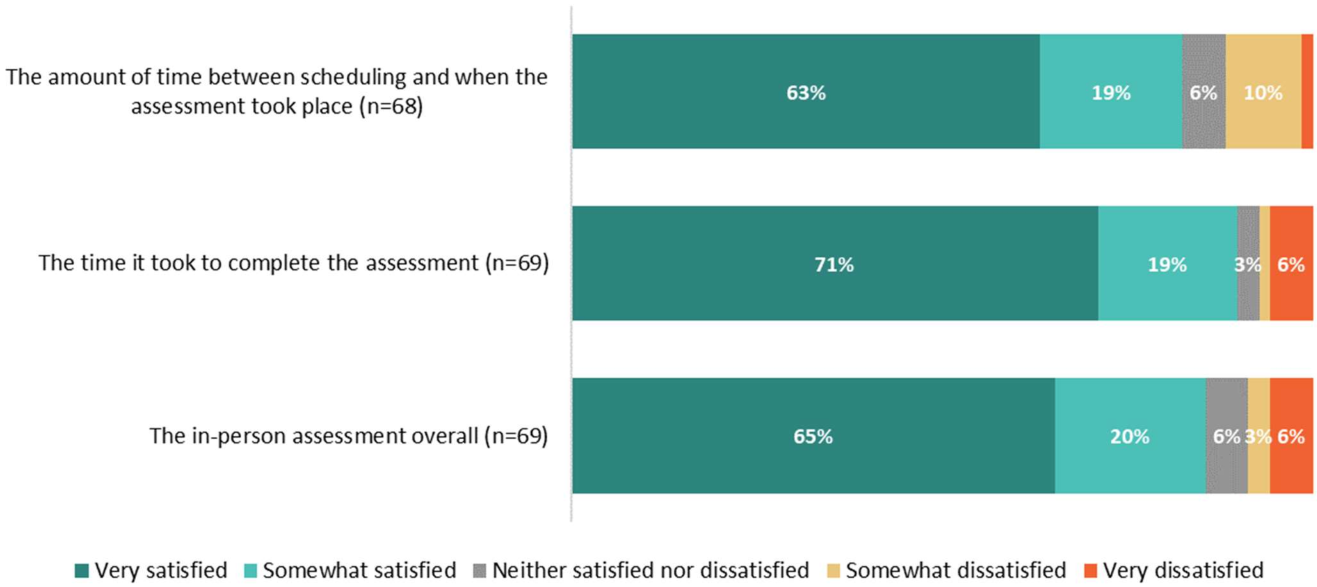


Source: Participant survey. Question: "Why did you decide to participate in NIPSCO's IQW program?" (Multiple responses allowed) (n=70)

ASSESSMENT EXPERIENCE

Most respondents were satisfied with their assessment overall and the timing of the process. A majority (85%) of respondents were very or somewhat satisfied with the assessment overall. Respondents were also highly satisfied with the time between scheduling and when the assessment took place and with the time it took to complete the assessment (Figure 27). In addition, most respondents (88%) found the scheduling process to be somewhat to very easy.

FIGURE 27. ASSESSMENT EXPERIENCE SATISFACTION



Source: Participant survey. Question: "How satisfied were you with each of the following? The amount of time between scheduling and when the assessment took place. The time it took to complete the assessment. The in-person assessment overall."

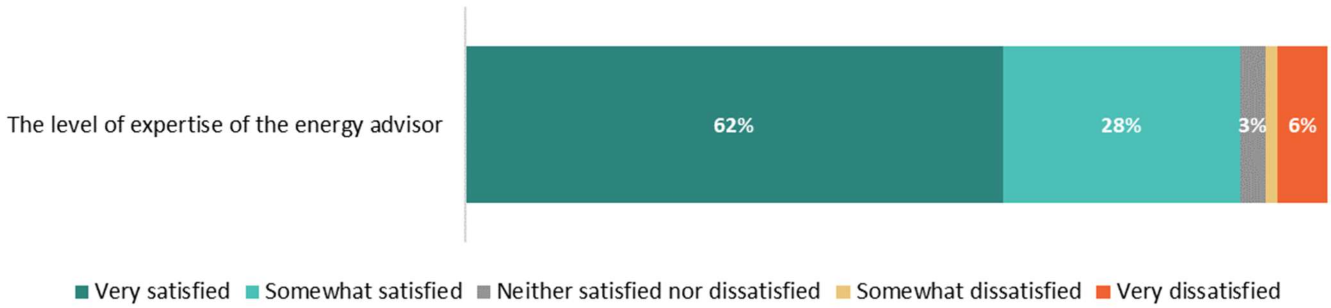
Respondents who were very satisfied explained that the energy advisors were *"considerate," "professional,"* and *"friendly and helpful."* Dissatisfaction with the program was generally not related to the assessment itself, but a lack of communication or follow-through:

> *"The two guys who did the assessment were polite and thorough; but they got dates wrong and ultimately nothing happened. I was clearly led to believe some of the issues they found would be addressed, or an offer of assistance would be forth coming."*

Most respondents (87%) felt their energy advisor provided helpful information about their home or equipment. About one-half of respondents (52%) had specific questions for their energy advisor during their in-person visits. Of these respondents who had specific questions, 79% reported their energy advisor was able to answer those questions. As seen in Figure 28, most respondents (90%) were very or somewhat satisfied with the expertise of their energy advisor. A respondent explained their high satisfaction:

> *"I was very comfortable with the person who performed the home assessment. He took his time and explained and answered my questions thoroughly."*

FIGURE 28. SATISFACTION WITH ENERGY ADVISOR EXPERTISE

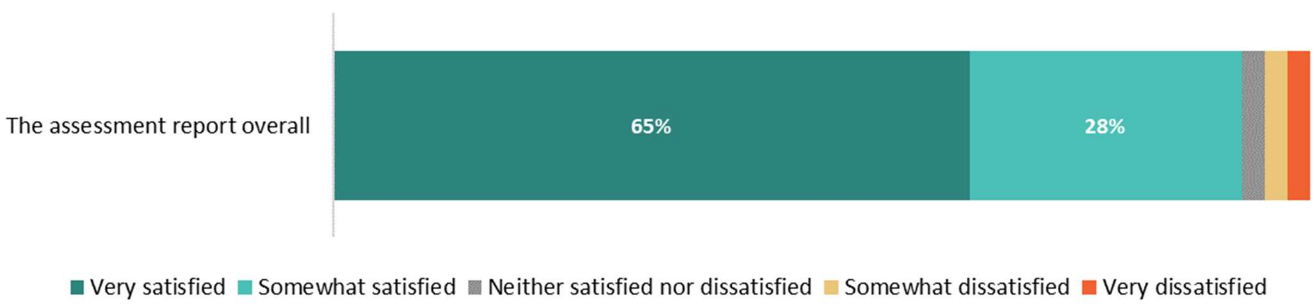


Source: Participant survey. Question: "How satisfied were you with each of the following? The level of expertise of the energy advisor." (n=69)

ASSESSMENT REPORT AND FINDINGS

Per the program description, participants should receive a report via email during the assessment as applicable (if the participants have email addresses) or a physical copy in the mail after the assessment is complete. About three-fourths of respondents (72%) reported receiving a report including findings and recommendations, and most respondents (83%) reported their energy advisor discussed the findings and recommendations with them. The percentage of respondents who received a report was consistent with 2019 (72%) and 2018 (70%). As seen in Figure 29, respondents who received the report were highly satisfied with it.

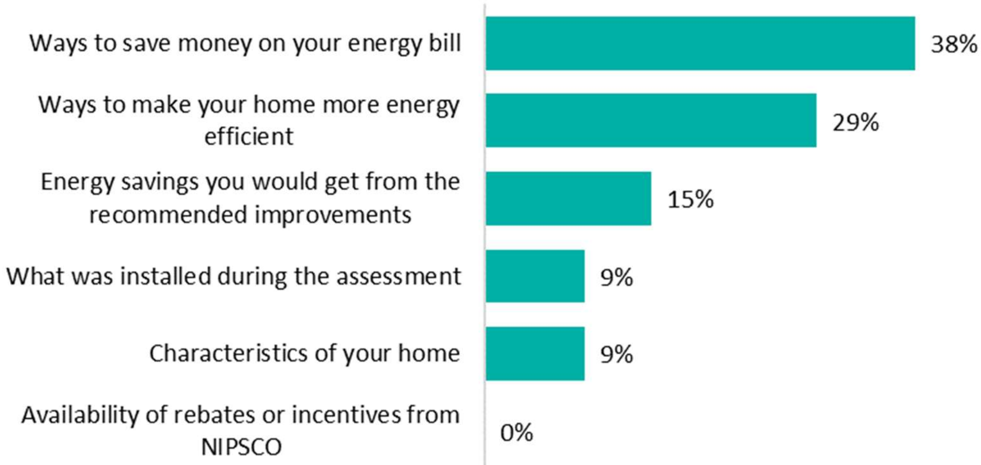
FIGURE 29. SATISFACTION WITH ASSESSMENT REPORT



Source: Participant survey. Question: "How satisfied were you with each of the following? The assessment report overall." (n=43)

Most respondents who received a report (79%) felt the information included was at least somewhat easy to understand, and only 7% of respondents felt that the information was not very or not at all easy to understand. About three-fourths of the respondents who recalled receiving the report (74%) found the information provided by the program to be somewhat or very useful. Respondents reported that the most useful information in the report included ways to save money on electricity bills (38%) and ways to make their homes more energy efficient (29%) (Figure 30). No respondents found the information about the availability of rebates or incentives to be the most useful part of the report.

FIGURE 30. USEFULNESS OF REPORT INFORMATION

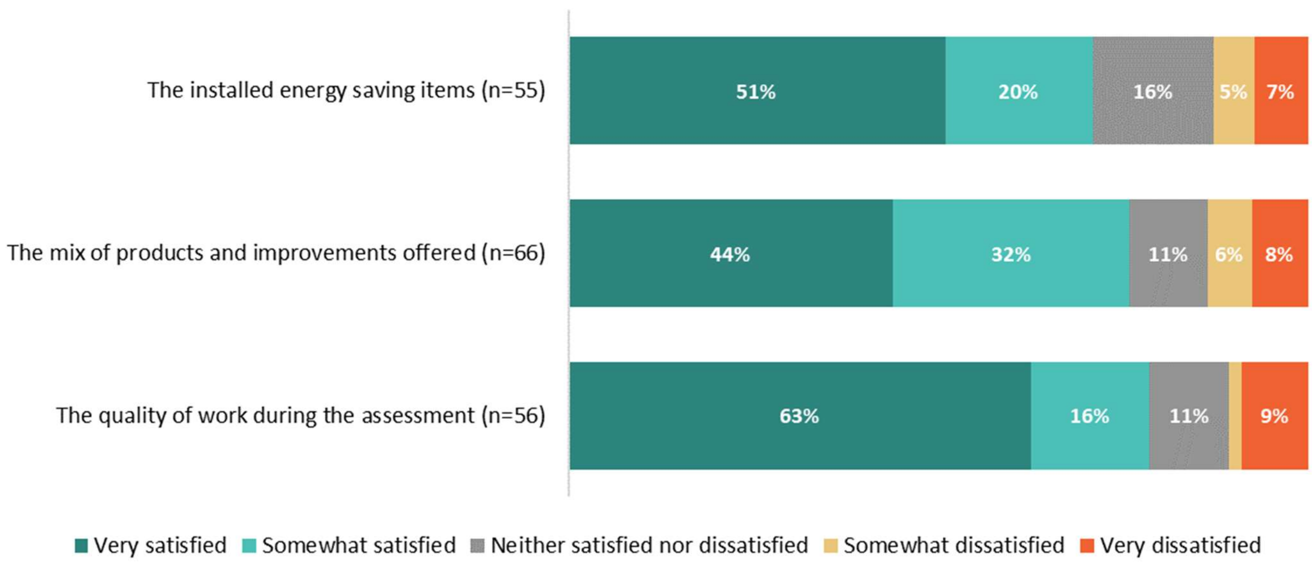


Source: Participant survey. Question: "What information in the report did you find most useful?" (n=34)

DIRECT INSTALL MEASURES

According to the program tracking data, 87% of respondents received direct install measures in their home during the assessment. Respondents who received direct install measures or services were generally satisfied with the installed energy saving items, the mix of products and improvements offered, and the quality of work performed during the assessment (Figure 31).

FIGURE 31. SATISFACTION WITH DIRECT INSTALL MEASURES



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

Many respondents (60%) received LEDs and almost all of them (97%) were somewhat or very satisfied with them. Few respondents received measures besides the LEDs. Of those who received other items, all respondents were very satisfied with the bathroom faucet aerators (n=4), low flow showerheads (n=9), and programmable thermostats (n=5). Respondents were very or somewhat satisfied with air sealing (n=10), attic insulation (n=11), pipe wrap (n=6), and kitchen faucet aerators (n=4). Respondents who received duct sealing reported being satisfied (n=4) or neither satisfied nor dissatisfied (n=3).

Though tracking data notes that 15 program participants received refrigerators, only one survey respondent received a refrigerator and shared that they were somewhat satisfied with the appliance. However, it took months to receive a working product, and the respondent provided more insight on difficulties with the process:

> *"We had to have it replaced twice. The first one didn't work at all. The second one only worked 1 1/2 months. Dealt with no fridge 2 1/2 months. After 4-5 techs came out, they gave us a credit to go to Home Depot and buy a new one, through Frigidaire."*

Note that this is only one response and should be interpreted cautiously. Five other respondents commented that they wanted to receive a refrigerator but did not, elaborating that the refrigerator qualification was confusing or that they had not heard back about receiving a new appliance. The program implementer indicated a new workflow was created in April of 2022; customers now receive an email with confirmation that their refrigerator order was placed and includes details about next steps and contact information in case customers have follow up questions.

Very few respondents removed measures the technicians installed, and their comments did not indicate any significant issues with the products. Some respondents did not receive certain measures. Many of the respondents who reported they did not receive showerheads (43%), bathroom faucet aerators (49%), and kitchen faucet aerators (49%), reported that the auditors did not offer them these measures. About half of the respondents who did not receive LEDs shared they did not need them or already had all LEDs, and about half (45%) of the respondents who did not receive showerheads shared the same reason. In some cases (n=3), respondents noted that the assessment team provided LEDs but did not install them. Table 76 provides additional detail on the reasons for not receiving measures.

TABLE 76. REASONS MEASURES WERE NOT RECEIVED

REASON	LED BULBS (n=18*)	SHOWERHEADS (n=48)	BATHROOM FAUCET AERATORS (n=50)	KITCHEN FAUCET AERATORS (n=47)
Wasn't offered one	18%	43%	49%	49%
Already had / didn't need	47%	45%	26%	32%
Didn't fit on fixture	6%	6%	21%	11%
Don't like them	-	2%	-	-
Didn't match current fixture color	-	-	-	-
Concerned about change in water pressure	N/A	-	-	-
Concerned about light quality, brightness, or color	-	N/A	N/A	N/A
Other	35%	6%	11%	9%

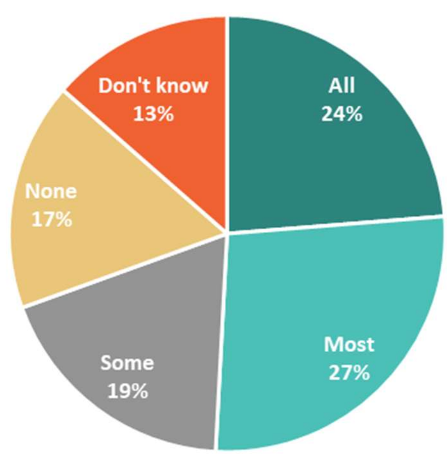
Source: Participant survey. Question: "Why didn't you have [equipment] installed?" (Multiple answers allowed)
*Low number of respondents, results should be interpreted qualitatively

RECOMMENDED IMPROVEMENTS AND ADDITIONAL PROGRAM PARTICIPATION

POST-ASSESSMENT IMPROVEMENTS

Most respondents who recalled receiving an assessment report (69%) made at least some of the energy-saving improvements recommended in the report (Figure 32). This is statistically significantly higher than in 2019, when 50% of respondents made at least some improvements after the assessment. In 2021, only 17% did not make any of the improvements.

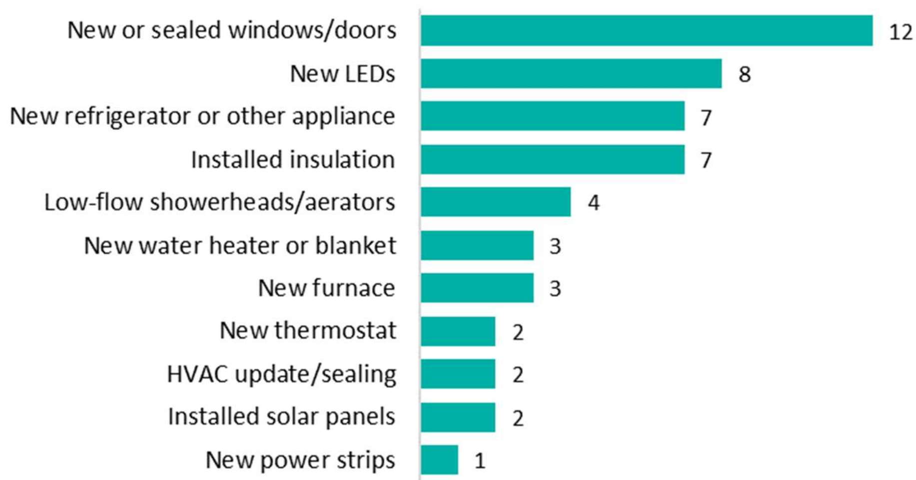
FIGURE 32. FOLLOW THROUGH ON RECOMMENDED IMPROVEMENTS



Source: Participant survey. Question: "After participating in NIPSCO's Income-Qualified Weatherization program, would you say you have made all, most, some, or none of the energy-saving recommendations made in the assessment report you received?" (n=59)

The improvements respondents made included installing measures (Figure 33) and making behavioral changes. Respondents most often added door or window sealing or replaced their doors or windows. Other common improvements included installing LEDs, appliances, and insulation.

FIGURE 33. INSTALLED RECOMMENDED MEASURES



Participant survey. Question: "What improvements did you make?"

Seven respondents implemented behavioral changes to reduce energy use. These changes included adjusting their water heater (n=1) or thermostat (n=6) setpoint temperatures. Of the respondents who made no improvements, some said it was too expensive (n=3), but most said they were waiting on a call back or that the program dropped the communication (n=6).

ADDITIONAL PROGRAM PARTICIPATION

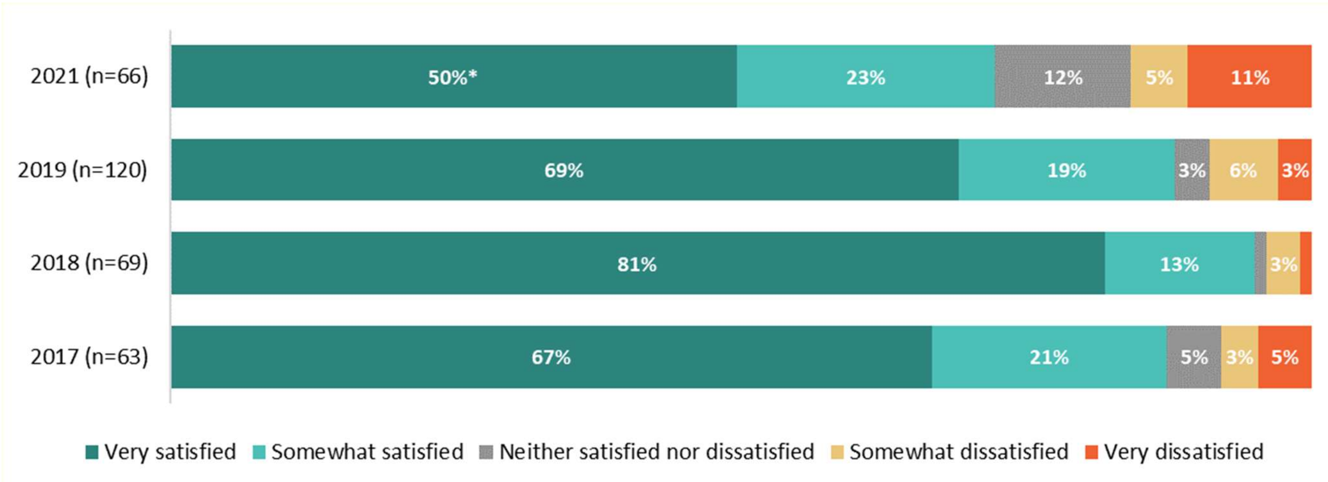
Most respondents (73%) were not aware that NIPSCO offers other programs. Of the 17 respondents who were aware of other programs, they were most often aware of the Appliance Recycling program (n=10) and the Energy Efficiency Rebate program (n=8). Only two respondents had participated in other NIPSCO energy efficiency programs: the Appliance Recycling program (n=1) and the Lighting Discounts program (n=1). Neither of these two respondents made additional improvements or installed products for which they did not receive a rebate. The percentage of respondents who were not aware NIPSCO offers other energy efficiency programs was also high in 2019 (84%) and 2018 (77%).

SATISFACTION

SATISFACTION WITH PROGRAM

Most respondents (73%) were very or somewhat satisfied with the IQW program. However, as shown in Figure 34, the percentage of very satisfied respondents decreased significantly from 2019. The percentage of very satisfied respondents also decreased significantly from 2018 to 2019, creating a downward trend.

FIGURE 34. SATISFACTION WITH THE IQW PROGRAM



Note: * Indicates difference between 2021 and all other years is significant at p≤0.10 (90% confidence).

Source: Participant survey. Question: "How satisfied are you with NIPSCO's Income-Qualified Weatherization program?"

Satisfied respondents noted they were generally happy with the service provided, specifically the products, technician expertise, follow-through of program representatives, information provided, and the financial savings associated with the program.

> *"They did everything. They addressed all the things that I needed and let me know things that needed energy saving. They caulked all the windows and asked about other aerators. Very satisfied and it was helpful. I used 11% less compared to last year."*

Dissatisfied respondents explained the program did not communicate enough, specifically not following up after the initial assessment. Some respondents thought the initial assessment would include the installation of measures, which did not occur, leading to lower satisfaction. Some of these respondents received just a few of (or none of) the direct install measures they expected to receive. Dissatisfied respondents who needed more follow-up elaborated that they were waiting for a call back that never came or took initiative and called multiple times but did not receive a reply. One respondent who was neither satisfied nor dissatisfied with the program explained the team "*never followed back up*," and said the process evaluation survey was the first outreach they received post-assessment.

Three dissatisfied respondents also noted specific confusion about qualification for the refrigerator measure, and the one respondent who received a refrigerator noted they *"had to call a bunch of times for that to happen."* One customer who wanted more specific information from the program shared:

> *"When I first registered, I thought that [the program] would assist us with the upgrades and changes in that initial assessment. I didn't know what was going to happen next. I was not qualified for the fridge program. They didn't let me know what was going to happen after that."*

SUGGESTIONS FOR IMPROVEMENT

Approximately one-third of respondents (33%) provided suggestions for program improvement. Some respondents (n=11) shared that they want clearer communication of the process and more information about qualification. Relatedly, six respondents specifically recommended better follow-up with customers.

> *"Besides the communication, a better assessment outline of what is going to happen after that, to let other people know and have them aware where they fall in the program after the process is over. I never would have known the program was complete because of lack of communication."*

Respondents who provided suggestions generally wished there was more program information provided, did not think qualifying measures were clearly communicated, and wanted additional communication after the assessment.

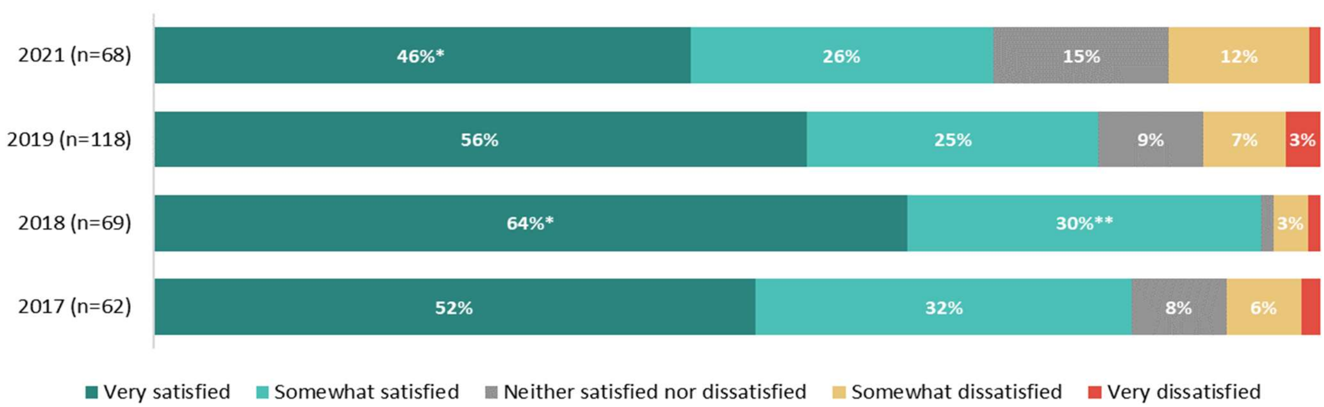
Comments specifically mentioned the insulation measure, indicating they had not heard back from the program about the measure (n=4), or they received conflicting information about qualification (n=2).

> *"The insulation thing really got my hopes up for no reason because it sounded like it was going to happen at my in-person meeting, and I got the runaround for months."*
>
> *"When the assessor came to my home, he told me the insulation in parts of my ceiling were very low and that someone would be calling me back to schedule having insulation blown in… [Then] I was told they wouldn't be doing it because I had just over the limit of insulation."*

SATISFACTION WITH NIPSCO

Most respondents (72%) were somewhat or very satisfied with NIPSCO in 2021 (Figure 35). Specifically, 46% of respondents said they were very satisfied with NIPSCO. This was lower than the percentage of very satisfied participants in 2017 through 2019. The evaluation team did not collect comments related to respondent satisfaction with NIPSCO as their utility service provider, and the reasons for satisfaction and dissatisfaction could be due to a variety of factors.

FIGURE 35. SATISFACTION WITH NIPSCO



Note: * indicates difference between 2018 and 2021 is significant at p≤0.10 (90% confidence).

Note: ** indicates differences between 2018 overall satisfaction and all other program years are significant at p≤0.10 (90% confidence).

Source: Participant survey. Question: "How satisfied are you with NIPSCO overall as your utility service provider?

RESPONDENT DEMOGRAPHICS

Overall, in 2021 the IQW program reached majority low-income, single-family homeowners (Table 77). Most respondents own (99%) single-family homes (87%) under 3,000 feet (95%), which were built before 1980 (79%). Over one-third of respondents (38%) have lived in their home for more than 10 years.

TABLE 77. IQW PROGRAM RESPONDENT HOME CHARACTERISTICS

DEMOGRAPHICS	PERCENTAGE
Home Ownership (n=69)	
Own	99%
Rent	1%
Type of Residence (n=69)	
Single-family detached home	87%
Multifamily apartment or condo building (with 4 or more units)	1%
Attached house (townhouse, row house, or twin)	6%
Mobile or manufactured home	6%
Years Lived in Current Home (n=69)	
One year or less	10%
2-3 years	19%
4-5 years	14%
6-10 years	19%
More than 10 years	38%
Number of People in the Home (n=67)	
One	33%
Two	33%
Three	9%
Four	9%
Five or more	16%
Square Feet of Home (n=58)	
0 – 1,499	52%
1,500 – 2,999	43%
3,000+	5%
Year Home Built (n=62)	
Before 1900	3%
1900 to 1939	13%
1940 to 1959	34%
1960 to 1979	29%
1980 to 1989	2%
1990 to 1999	6%
2000 to 2004	3%
2005 or later	10%

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

Most respondents (83%) reported household incomes under $35,000 and many qualified for services such as Low-Income Home Energy Assistance, Temporary Assistance for Needy Families, Supplemental Security Income, and Social Security Disability Insurance. Of the respondents that provided information about their household qualification for these assistance programs, only 39% shared that their household did not qualify for any of the programs. Less than one-half of respondents (41%) have a technical college degree/certificate or higher (Table 78).

TABLE 78. IQW PROGRAM RESPONDENT DEMOGRAPHICS

DEMOGRAPHICS	PERCENTAGE
Annual Household Income (n=59)	
Under $25,000	46%
$25,000 to under $35,000	37%
$35,000 to under $50,000	10%
$50,000 to under $75,000	3%
$75,000 to under $100,000	2%
$100,000 to under $150,000	2%
Year Respondent was Born (n=66)	
1900 to 1939	2%
1940 to 1959	38%
1960 to 1979	44%
1980 to 1989	12%
1990 to 1999	5%
Education Level Completed (n=66)	
Some high school or less	6%
High school graduate or equivalent	18%
Some college, no degree	35%
Technical college degree or certificate	8%
Two-year college degree	15%
Four-year college degree	12%
Graduate or professional degree	6%

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

CONCLUSIONS AND RECOMMENDATIONS

CONCLUSION 1: THE PROGRAM DID NOT MEET SAVINGS GOALS IN 2021.

Due to the limited participation in this program in 2021, the program fell short of its savings goals. This was largely because IQW was on hold for the first half of 2021 due to the COVID-19 pandemic.

Recommendations:

- Conduct a more robust program evaluation in 2022 to update evaluation metrics, such as in-service rates and net-to-gross if there is an increase in program participation.

CONCLUSION 2: MOST RESPONDENTS WERE SATISFIED WITH THE PROGRAM, BUT SATISFACTION DECREASED FROM 2018 TO PRESENT.

Most respondents (73%) were satisfied with the program. This success stems from the service, information, and products provided, technician expertise, follow-through of program representatives, and financial savings. Satisfied respondents felt the program overall is supporting income-qualified customers and providing an assessment and installation service.

Dissatisfied respondents (15%) cited a variety of reasons for their dissatisfaction. Respondents want clearer process communication and more information about qualification, and better follow-up. They were confused about the qualification for additional measures including the refrigerator and insulation. The program implementer changed to a new subcontractor in 2022, who has focused on improving customer satisfaction.

Recommendations:

- Continue monitoring program satisfaction. NIPSCO changed program subcontractors for Program Year 2022, after noting implementation difficulties. Respondents to the program evaluation survey received services with the prior subcontractor. NIPSCO should continue monitoring satisfaction to look for improvement with the new program subcontractor.
- Consider additional communication to customers who are participating or waiting for follow-up. The assessment team could inform the customer of the timeline during the assessment, and clearly outline the next steps for the customer during the assessment and in the report. NIPSCO can reach out a week after the assessment to address any remaining questions. If any delays arise, NIPSCO could provide updated timing information to customers.

CONCLUSION 3: OVER 25% OF RESPONDENTS WHO RECEIVED AN ASSESSMENT DID NOT RECALL RECEIVING THE ASSESSMENT REPORT, INDICATING SOME CUSTOMERS ARE MISSING AN IMPORTANT EDUCATIONAL ASPECT OF THE PROGRAM.

Most respondents (72%) received a report including findings and recommendations, per the program description, leaving 28% who did not recall receiving a report. This percentage was consistent with the 2019 (72%) and 2018 (70%) program years. Per the program design, the energy advisor creates the report on a tablet device, emails it to the customer if they have an email address or follows up with a physical copy if the customer does not have an email. The program implementer changed to a new subcontractor in 2022, who developed a new process to ensure all participants receive both an emailed and a mailed report.

Recommendations:

- Work toward a higher rate of report delivery by having the assessment team email the report while they are onsite and verify customer receipt by having them open the report on their computer or other device. The assessment team can also re-send the report when they follow up with the customer, so the customer remembers the report.

CONCLUSION 4: WHILE MOST RESPONDENTS RECEIVED LEDS, MANY RESPONDENTS REPORTED THEY WERE NOT OFFERED AERATORS AND SHOWERHEADS, AND SOME WERE UNCLEAR ON QUALIFICATION FOR OTHER MEASURES.

Most respondents received direct install measures during their assessment visit, but few received measures besides LEDs. Many respondents who did not receive water-saving measures reported that the auditors did not offer these measures: 43% for showerheads, 49% for bathroom faucet aerators, and 49% for kitchen faucet aerators. In some cases, respondents noted that the assessment team provided LEDs but did not install them. The program implementer changed to a new subcontractor in 2022, who is focused on installing all applicable measures and has improved the overall number of measures installed per project compared to 2021.

In addition, some respondents thought the assessment would include installation of some measures which did not occur, while others indicated confusion about qualification for the refrigerator and insulation measures. While some customers may have already had efficient equipment, survey responses suggest that customers are not clear on why they did not receive certain measures during the assessment visit.

Recommendations:

- During the assessment visit, clarify which measures each customer is qualified for, and ensure auditors are trained to offer and install all applicable measures to each customer.
- Consider having the assessment team track reasons for not installing measures by adding checkboxes on the assessment form, such as "customer already has efficient equipment", "customer faucets not compatible with aerators", "customer refused measure", etc. With this additional data, NIPSCO and the evaluation team can better determine how to improve the measure acceptance rate.
- Provide clear information about next steps for each follow-up measure (when installation does not occur during the assessment). This could include pamphlets with qualification and contact information, an estimated timeline for how long the delivery will take for each measure, or a page in the report detailing similar information.

CONCLUSION 5: ANTICIPATED REGULATORY CHANGES WILL LIKELY REDUCE EXPECTED GROSS SAVINGS FOR LIGHTING MEASURES IN FUTURE PROGRAM YEARS.

As discussed in the Residential Lighting chapter, upcoming federal lighting standard changes will likely affect all NIPSCO programs that offer lighting measures to residential customers. The DOE's Office of Energy Efficiency and Renewable Energy again proposed a rule to codify the 45 lumen per-watt standard, with a comment period open through January 27, 2022.[21] The rule is expected to be finalized in 2022 and implemented in early 2023, although the timing is not yet certain and will rely on several factors (such as allowed sell-through periods).

For non-upstream program designs (like kit offerings and direct-install programs) there may be additional considerations that impact how long these programs may remain viable, as these different delivery types may more

[21] Federal Register. Last updated December 13, 2021. "Energy Conservation Program: Backstop Requirements for General Service Lamps." https://www.federalregister.gov/documents/2021/12/13/2021-26807/energy-conservation-program-backstop-requirement-for-general-service-lamps

frequently “early replace” incandescent or halogen bulbs that otherwise would have remained installed. The evaluation team expects that the DOE will provide more guidance in the next few months and will discuss these implications with NIPSCO once more information is known.

Recommendations:

- Monitor the DOE’s EISA outcome and incorporate effective changes in program design. Review inclusion of specialty and reflector LEDs as part of the upcoming Indiana Technical Reference Manual (TRM) update process to provide guidance for any future savings for these measures in upstream programs.

CONCLUSION 6: *EX ANTE* ENERGY STAR REFRIGERATOR SAVINGS USED A DEEMED VALUE INSTEAD OF TAKING INDIVIDUAL MODELS INTO ACCOUNT.

Previously, the *ex ante* calculation for ENERGY STAR refrigerators was simply deemed, with no indication of what inputs are being used. In future years, listing assumed values and their sources is recommended.

Recommendations:

- Provide *ex ante* methodology and assumptions for all ENERGY STAR refrigerator measures, including Efficient and Existing Unit Energy Consumption (UEC), Temperature Adjustment Factor (TAF), and Load Shape Adjustment Factor (LSAF).

7. MULTIFAMILY DIRECT INSTALL (MFDI) PROGRAM

PROGRAM DESIGN AND DELIVERY

The Multifamily Direct Install (MFDI) program provides NIPSCO an opportunity to engage multifamily buildings within its territory and benefit more renters as a result. TRC administers the MFDI program on behalf of NIPSCO, including program design and management, processing contractor payments, quality assurance and quality control (QA/QC), and technical training. TRC partners with a subcontractor who specializes in residential unit energy assessments and direct install visits to implement the MFDI Program. This subcontractor is responsible for the direct installation of program measures in eligible multifamily units.

The MFDI program provides property owners and building managers of multifamily buildings with a full building energy assessment at no cost, providing an energy assessment for both commercially metered common areas and residentially metered tenant units. 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.

Customers can enroll in the program by calling NIPSCO's Residential Energy Efficiency Program hotline or through direct outreach by TRC staff.

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

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

The subcontractor works with property management to gain access to the residential units. Installations may last multiple days, depending on the number of units in the building and building management availability. If the subcontractor can come to an agreement with the property manager, they will also install SBDI measures in commercially metered common areas during the same visit.

CHANGES FROM 2020 DESIGN

The program did not operate in 2020 due to the COVID-19 pandemic. In 2021, the program began offering services again in the second half of the year and operated largely the same as it did in 2019, although participation was limited. However, instead of using a network of trade allies to complete direct installations, TRC worked with an assessment and direct install subcontractor to complete the work.

PROGRAM PERFORMANCE

In 2021, the NIPSCO team adjusted our timelines across programs to deliver evaluation reports earlier than in previous years. To meet the new timelines, for most programs the evaluation teams began analysis earlier, and conducted our impact analyses on 11 months of data instead of the full calendar year (January 1 to November 30, 2021). For the majority of NIPSCO program evaluations, the evaluation metrics developed during this analysis (including in-service rates (ISRs), realization rates, net-to-gross ratios (NTG), etc.) and included in the first draft versions of the report were applied to the full year of data as part of the final, compiled report.

The only program participation for the MFDI program occurred in November 2021; there was no participation in the MFDI program in December 2021. Therefore, the evaluation effectively included the full program year of data. The remainder of this report includes an evaluation of the full year of data and all evaluation metrics have been developed based on this.

The MFDI program fell short of its goals in 2021. According to TRC, this was largely due to property management companies not wanting to move forward with improvements due to COVID-19. In some cases, local management was interested in participating, but could not get approval from the property owner due to circumstances related to COVID-19.

Table 79 summarizes savings for the full year of program performance, including program savings goals.

TABLE 79. 2021 MFDI PROGRAM SAVING SUMMARY – FULL YEAR 2021

METRIC	GROSS SAVINGS GOAL	*EX ANTE*	AUDITED	VERIFIED	*EX POST* GROSS	*EX POST* NET	GROSS GOAL ACHIEVEMENT
Electric Energy Savings (kWh/yr.)	850,862.81	160,077.86	160,077.86	132,826.32	137,098.93	137,098.93	16%
Peak Demand Reduction (kW)	105.668	12.364	12.364	10.935	12.070	12.070	11%
Natural Gas Energy Savings (therms/yr.)	58,932.72	0.00	0.00	0.00	0.00	0.00	0%

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

The analysis and adjustments resulted in electric energy savings and demand reduction realization rates of 86% and 98%, respectively. Adjustment factors could not be calculated for natural gas energy savings because the single participating building does not have gas service and, therefore, did not install any gas-saving measures. Table 80 outlines the realization rates and net energy adjustment factors resulting from the evaluation. Note that net-to-gross is deemed at 100%, due to the direct install nature of the program and limited number of unique property managers.

TABLE 80. 2021 MFDI ADJUSTMENT FACTORS

METRIC	REALIZATION RATE (%)[a]	FREERIDERSHIP	SPILLOVER	NTG (%)[b]
Electric Energy Savings (kWh/yr.)	86%	0%	0%	100%
Peak Demand Reduction (kW)	98%	0%	0%	100%
Natural Gas Energy Savings (therms/yr.)	N/A	N/A	N/A	N/A

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

Both electric and natural gas spending was below planned expenditures due to limited program participation (Table 81).

TABLE 81. 2021 MFDI PROGRAM EXPENDITURES

FUEL	PROGRAM BUDGET	PROGRAM EXPENDITURES	BUDGET SPENT (%)
Electric	$324,406.40	$50,641.73	16%
Natural Gas	$104,354.43	$4,982.56	5%

EVALUATION METHODOLOGY

To inform the 2021 NIPSCO impact evaluation, the evaluation team completed the following research activities:

- Utility and implementation staff interviews and discussions, to understand program design and delivery
- Documentation and materials review, to provide context on program implementation
- Tracking data analysis, to audit and verify the accuracy of program participation data
- Engineering analysis, to review 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?
- Is the program on track to meet its participation and savings goals?

For all measure types, the evaluation team compared its engineering calculations to NIPSCO's *ex ante* savings, basing its savings methodologies and inputs for each measure on several sources: standard engineering practices, the 2015 Indiana TRM (v2.2), ENERGY STAR Qualified products list (QPL), the National Renewable Energy Laboratory (NREL) Residential Lighting Evaluation Protocol, and NIPSCO's program tracking database.[22]

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.

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

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 82 lists the ISRs for all program-installed measures and their source. Due to the limited participation in 2021, all ISRs were sourced from the 2019 evaluation. The 2019 evaluation referenced the 2018 IPL (now AES) Multifamily Direct Install program evaluation for ISRs where researched ISRs were available (bathroom aerators, kitchen aerators, and low flow showerheads). For LEDs we used a deemed ISR value of 100%.

TABLE 82. 2021 MFDI PROGRAM IN-SERVICE RATES RATIOS BY MEASURE

MEASURE	ISR	SOURCE
LED Bulbs	100%	Deemed
Bathroom Aerator	91%	2018 IPL Evaluation
Kitchen Aerator	80%	2018 IPL Evaluation
Low Flow Showerhead	75%	2018 IPL Evaluation

Table 83 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 83. 2021 MFDI PROGRAM AUDITED & VERIFIED QUANTITIES

MEASURE	UNIT OF MEASURE	AUDITED QUANTITY	ISR	VERIFIED QUANTITY
A-Line LEDs - Electric	Lamp	506	100%	506
Candelabra LEDs - Electric	Lamp	76	100%	76
Globe LEDs - Electric	Lamp	1,200	100%	1,200
Bathroom Aerator 1.0 gpm - Electric	Aerator	277	91%	252
Kitchen Aerator 1.5 gpm - Electric	Aerator	164	80%	131
Low Flow Showerhead 1.5 gpm - Electric	Showerhead	257	75%	193
		2,480	95%	2,358

EX POST **GROSS SAVINGS**

ENGINEERING REVIEWS

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

EX POST GROSS SAVINGS

Table 84 shows the *ex ante* deemed savings and *ex post* gross per-measure savings for 2021 MFDI program measures.

TABLE 84. 2021 MFDI PROGRAM *EX ANTE* & *EX POST* GROSS PER-MEASURE SAVINGS VALUES

MEASURE	UNIT OF MEASURE	*EX ANTE* DEEMED SAVINGS			*EX POST* GROSS PER-MEASURE SAVINGS		
		KWH	KW	THERMS	KWH	KW	THERMS
A-Line LEDs - Electric	Lamp	28.52	0.004	0.00	28.52	0.004	0.00
Candelabra LEDs - Electric	Lamp	20.13	0.003	0.00	29.36	0.004	0.00
Globe LEDs - Electric	Lamp	19.29	0.003	0.00	28.52	0.004	0.00
Bathroom Aerator 1.0 gpm - Electric	Aerator	34.00	0.003	0.00	33.43	0.003	0.00
Kitchen Aerator 1.5 gpm - Electric	Aerator	180.95	0.008	0.00	124.84	0.008	0.00
Low Flow Showerhead 1.5 gpm - Electric	Showerhead	318.58	0.017	0.00	318.58	0.017	0.00

Table 85 highlights notable differences between *ex ante* and *ex post* gross estimates, which are primarily driven by:

- Differences in Indiana TRM (v2.2) input assumptions used by *ex ante* and *ex post* gross savings.
- Differences in baseline lighting assumptions used by *ex ante* and *ex post* gross savings.

TABLE 85. 2021 MFDI 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
LED	*Ex ante* savings are based on the Indiana TRM (v2.2) and use post-EISA baseline wattages from the NREL Residential Lighting Protocol	Indiana TRM (v2.2) algorithm and WHFs. LED wattage in program tracking data. Baseline wattage value per NREL Residential Lighting Protocol based on average lumens per bulb type from ENERGY STAR QPL analysis.	kWh and kW savings increase from *ex ante* for globes and candelabras; primary reason for the difference is due to different base wattages. Globes and candelabras are exempt from post-EISA baseline and should have a baseline wattage of 40 watts. *Ex ante* savings assumed a post-EISA baseline wattage of 29 watts.
Kitchen aerator	Indiana TRM (v2.2). Average per household occupancy of 2.64 (SFH).	Indiana TRM (v2.2) and information in program tracking data. Average per household occupancy of 1.83 (MFDI).	kW savings align with *ex ante*, but the kWh savings decreases substantially. This is due to an *ex ante* 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). Inlet water temperature of 57.1°F. 2.04 faucets per home (SFH).	Indiana TRM (v2.2) and information in program tracking data. Average per household occupancy of 1.83 (MFH assumptions in TRM). Inlet water temperature of 57.4°F (South Bend assumption in TRM). 1.43 faucets per home (MFH assumptions in TRM).	Although RR are close to 100%, there are some notable differences in inputs used which cause the deviations from 100%. This is due to an *ex ante* assumption using SFH occupancy of 2.64 and 2.04 faucets per home with a water inlet temp of 57.1°F, while evaluated assumed an MFDI average per household occupancy of 1.83 and 1.43 faucets per home (referencing the MFH assumptions in the TRM) with a water inlet temperature of 57.4°F.
Low flow showerhead	*Ex ante* savings are based on Indiana TRM (v2.2). TRM multifamily assumed people per home, showerheads per home, GPM_{base}, actual GPM_{low}, and cold-water temperature for South Bend per TRM tables.	*Ex post* savings are based on Indiana TRM (v2.2); cold water inlet temperature based on customer location which aligned with South Bend per TRM tables, actual rating for GPM_{low} of 1.5, TRM multifamily assumed people per home, showerheads per home, and $GPM_{base.}$	No notable differences. Small differences in kW which are a result of rounding.

REALIZATION RATES

The next two tables (Table 86 and Table 87) show the program's *ex ante* reported savings, verified savings, and *ex post* gross savings. The program achieved electric energy, and peak demand reduction realization rates of 86% and 98%, respectively. There were no *ex ante* or *ex post* gross therms savings for 2021 because there was no dual fuel customer participation.

Although *ex post* gross electric energy savings for candelabra and globe LEDs were substantially higher than *ex ante*, at 146% and 148%, respectively, the combination of lower *ex post* gross per measure savings for bathroom aerators, kitchen aerators, and low flow showerheads, with ISRs of 91%, 80%, and 75%, respectively, resulted in a total program realization rate of 86%.

Similarly, *ex post* gross peak demand reduction for candelabra and globe LEDs were substantially higher than *ex ante,* at 133% and 129%, respectively, but the lower ISRs for bathroom aerators, kitchen aerators, and showerheads, resulted in a total program peak demand reduction realization rate of 98%.

TABLE 86. 2021 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.)
A-Line LEDs - Electric	14,431.12	14,431.12	14,431.12	14,431.75
Candelabra LEDs - Electric	1,529.88	1,529.88	1,529.88	2,231.37
Globe LEDs - Electric	23,148.00	23,148.00	23,148.00	34,225.49
Bathroom Aerator 1.0 gpm - Electric	9,418.00	9,418.00	8,570.38	8,425.56
Kitchen Aerator 1.5 gpm - Electric	29,675.80	29,675.80	23,740.64	16,378.77
Low Flow Showerhead 1.5 gpm - Electric	81,875.06	81,875.06	61,406.30	61,406.01
Total Savings	160,077.86	160,077.86	132,826.32	137,098.93
Total Program Realization Rate				86%

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 87. 2021 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.)
A-Line LEDs - Electric	2.024	2.024	2.024	1.964
Candelabra LEDs - Electric	0.228	0.228	0.228	0.304
Globe LEDs - Electric	3.600	3.600	3.600	4.659
Bathroom Aerator 1.0 gpm - Electric	0.831	0.831	0.756	0.812
Kitchen Aerator 1.5 gpm - Electric	1.312	1.312	1.050	1.079
Low Flow Showerhead 1.5 gpm - Electric	4.369	4.369	3.277	3.253
Total Savings	12.364	12.364	10.935	12.070
Total Program Realization Rate				98%

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 2021, performing a full NTG analysis for this program was not possible for this evaluation. Since the program is a direct-install program with no cost to participants, the evaluation team utilized a 100% NTG value for all MFDI program measures in 2021, as it did in 2019 (Table 88).

TABLE 88. 2021 MFDI PROGRAM NET-TO-GROSS RATIOS BY MEASURE

MEASURE	NTG
A-Line LEDs - Electric	100%
Candelabra LEDs - Electric	100%
Globe LEDs - Electric	100%
Bathroom Aerator 1.0 gpm - Electric	100%
Kitchen Aerator 1.5 gpm - Electric	100%
Low Flow Showerhead 1.5 gpm - Electric	100%

Table 89 presents the resulting net electric savings, demand reductions, and natural gas savings. Table 90 includes program-level NTG results by fuel type, and with a NTG ratio of 100%, the *ex post* net savings are identical to the *ex post* gross savings.

TABLE 89. 2021 MFDI PROGRAM *EX POST* NET SAVINGS

MEASURE	*EX POST* GROSS SAVINGS/REDUCTION			NTG	*EX POST* NET SAVINGS/REDUCTION		
	KWH	KW	THERMS		KWH	KW	THERMS
A-Line LEDs - Electric	14,431.75	1.964	0.00	100%	14,431.75	1.964	0.00
Candelabra LEDs - Electric	2,231.37	0.304	0.00	100%	2,231.37	0.304	0.00
Globe LEDs - Electric	34,225.49	4.659	0.00	100%	34,225.49	4.659	0.00
Bathroom Aerator 1.0 gpm - Electric	8,425.56	0.812	0.00	100%	8,425.56	0.812	0.00
Kitchen Aerator 1.5 gpm - Electric	16,378.77	1.079	0.00	100%	16,378.77	1.079	0.00
Low Flow Showerhead 1.5 gpm - Electric	61,406.01	3.253	0.00	100%	61,406.01	3.253	0.00
Total Savings	137,098.93	12.070	0.00		137,098.93	12.070	0.00

TABLE 90. 2021 MFDI NET-TO-GROSS RESULTS BY FUEL TYPE

SAVINGS TYPE	*EX ANTE* GROSS SAVINGS	*EX POST* GROSS SAVINGS	NTG RATIO (%)	*EX POST* NET SAVINGS
Electric Energy Savings (kWh/yr.)	160,077.86	137,098.93	100%	137,098.93
Peak Demand Reduction (kW)	12.364	12.070	100%	12.070
Natural Gas Energy Savings (therms/yr.)	0.00	0.00	N/A	0.00

CONCLUSIONS AND RECOMMENDATIONS

CONCLUSION 1: THE PROGRAM DID NOT MEET SAVINGS GOALS IN 2021.

Due to the limited participation in this program in 2021, the program fell short of its savings goals. According to TRC this was largely due to hesitancy on the part of property managers and owners to participate in the program during the COVID-19 pandemic.

Recommendations:

- Conduct a more robust program evaluation in 2022 to update evaluation metrics, such as in-service rates and net-to-gross if there is an increase in program participation.

CONCLUSION 2: REALIZATION RATES VARIED DUE TO DIFFERENCES IN ALGORITHMS AND ASSUMPTIONS BETWEEN *EX ANTE* AND *EX POST* GROSS SAVINGS.

While participation in the program was low this year, the evaluation team examined the *ex ante* assumptions. Program-level realization rates ranged from 86% for electric energy savings to 98% for demand reduction, with variation across measures. The primary reason for the difference in *ex ante* and *ex post* LED savings is the different baseline wattage assumptions. In the case of the water savings measures, the *ex ante* savings relied on input assumptions from the Indiana TRM (v2.2) for single-family homes while *ex post* calculations used the Indiana TRM (v2.2) inputs recommended for multifamily households. In addition, ISRs for water savings measures ranged from 75% to 91%, based on results from the 2018 IPL evaluation.

Recommendations:

Use the provided *ex post* gross savings values for future program year *ex ante* values, which more accurately represent baseline and participant characteristics.

8. APPLIANCE RECYCLING PROGRAM

PROGRAM DESIGN AND DELIVERY

NIPSCO offers the Appliance Recycling program to incent customers to remove their inefficient secondary refrigerators, freezers, window air conditioners, and dehumidifiers. Recycling these secondary units can provide long term energy savings by removing the inefficient appliances from the grid. The program implementer picks up appliances and recycles them in an environmentally friendly manner. Customers receive a $50 rebate for refrigerators or freezers and a $15 rebate for window air conditioners or dehumidifiers. In the 2021 program year, the program recycled 1,376 appliances. Table 91 describes the number of each appliance type that the program recycled; in addition to the 1,376 appliances recycled during the 2021 program year, these counts include 25 records that were included in the tracking data that were a correction to the 2020 program data. These corrections removed savings for records where the appliance was not actually removed in 2020.

TABLE 91. 2021 APPLIANCE RECYCLING PROGRAM *EX ANTE* RECYCLED UNITS

APPLIANCE TYPE	NUMBER RECYCLED
Dehumidifier	70
Freezer	234
Refrigerator	1021
Room AC	51
Freezer - 2020 Adjusted	4
Refrigerator - 2020 Adjusted	21

In 2021, NIPSCO began working with ARCA as the Appliance Recycling implementer. ARCA schedules and picks up appliances, conducts the recycling functions, and processes the rebates for the NIPSCO Appliance Recycling program. In addition, the pick-up crew leaves behind marketing collateral for other NIPSCO programs. ARCA provides in-home appliance pick-up as well as a curbside pick-up option. NIPSCO introduced the curbside option in 2020 due to the COVID-19 pandemic and it has remained as an option for customers throughout 2021.

The following describes the steps a customer takes to participate in the program.

1) After customers learn about the Appliance Recycling program, they can participate by scheduling a pick-up with ARCA through NIPSCO's website or over the phone.
2) Customers can schedule a pick-up date and time after ARCA confirms their eligibility for the program.
3) ARCA's pick-up crew calls customers the day before their pick-up to provide a two-to-four-hour pick-up window; on the morning of the pick-up ARCA calls customers to confirm again.[23]
4) While on site, ARCA pick-up crew members maintain a social distance of at least six feet, when possible, wear face masks and gloves, and use hand sanitizer due to the COVID-19 pandemic. If it is a curbside pick-up, the customer must place the appliance on the porch, sidewalk, driveway, or open garage.

[23] The text in the Program Abstract indicates a two-hour window while the process flow diagram indicates a four-hour window.

5) The pick-up crew confirms the appliances' eligibility (i.e., whether they are plugged in, operational, and the correct size) and then collects the unit's information, including their assessment of the appliance's age and other characteristics.
6) ARCA then permanently disables the appliance and removes it for transport to the processing centers. ARCA sends pick-up tracking data to TRC and then NIPSCO monthly.
7) Customers receive their rebate checks within six weeks of pick-up.

NIPSCO marketed the program to customers in many ways in 2021, including through bill and check inserts, emails, the NIPSCO website, NIPSCO's social media, and cross-promotion through other programs such as the kit programs. According to program staff interviews, NIPSCO promoted the program through a month-long Oldest Fridge or Freezer contest, encouraging customers to participate by offering a prize for the person who recycled the oldest refrigerator or freezer through the program. Program staff said this increased recycling in October and November. NIPSCO announced the winner in late 2021 and posted it on their website and social media channels.

CHANGES FROM 2020 DESIGN

There were three changes to the Appliance Recycling program in 2021. First, NIPSCO added two new measures to the program: window air conditioners and dehumidifiers. Like the refrigerators and freezers, these units must be removed from the wall and placed next to an outlet to confirm they are working. A customer can recycle a window air conditioner or dehumidifier without also recycling a refrigerator or freezer.

Second, the program abstract outlines that a customer will receive their rebate within six weeks, which is two weeks shorter than the rebate timing for the 2020 program.

Finally, as previously stated, the program changed implementers this year. ARCA implemented the Appliance Recycling program in 2021, whereas Recleim implemented the program in 2020. The NIPSCO team said that the transition to ARCA has gone well.

PROGRAM PERFORMANCE

In 2021, the NIPSCO team adjusted evaluation timelines across programs to deliver evaluation reports earlier than in previous years. To meet the new timelines, for most programs the evaluation teams began analysis earlier, and conducted impact analyses on 11 months of data instead of the full calendar year (January 1 to November 30, 2021). The evaluation metrics utilized during this analysis (including in-service rates, realization rates, net-to-gross ratios, etc.) and included in the first draft versions of the report were applied to the full year of data as part of the final, compiled report and included in Table 92 below.

Table 92 summarizes savings for the full year of program performance, including program savings goals.

TABLE 92. 2021 APPLIANCE RECYCLING PROGRAM SAVINGS SUMMARY – FULL YEAR 2021

METRIC	GROSS SAVINGS GOAL	*EX ANTE*	AUDITED	VERIFIED	*EX POST* GROSS	*EX POST* NET	GROSS GOAL ACHIEVEMENT
Electric Energy Savings (kWh/yr)	2,267,260.00	1,861,997.82	1,861,815.68	1,861,815.68	1,471,963.85	827,292.79	65%
Peak Demand Reduction (kW)	533.826	294.015	293.755	293.755	230.739	129.678	43%

Table 93 summarizes savings evaluated during the program's evaluation period, which was from January 2021 to November 2021.

TABLE 93. 2021 APPLIANCE RECYCLING PROGRAM SAVINGS SUMMARY – JAN THROUGH NOV 2021

METRIC	*EX ANTE*	AUDITED	VERIFIED	*EX POST* GROSS	*EX POST* NET
Electric Energy Savings (kWh/yr.)	1,444,456.14	1,444,274.00	1,444,274.00	1,139,046.46	634,938.48
Peak Demand Reduction (kW)	228.958	228.698	228.698	179.154	99.863

Table 94 outlines the *ex post* gross and NTG adjustment factors that the evaluation team calculated in 2020 and is using for this evaluation. The program realization rate for electric energy savings was 79% and peak demand reduction was 78%. The evaluation team continued to use the NTG and ISR rates from the 2020 survey of program participants. The NTG ratio was 56% for electric energy and demand savings, and the ISR was 100%.

TABLE 94. 2021 APPLIANCE RECYCLING PROGRAM ADJUSTMENT FACTORS

METRIC	REALIZATION RATE (%)[a]	FREERIDERSHIP	SPILLOVER	NTG (%)[b]
Electric Energy Savings (kWh/yr.)	79%	44%	0%	56%
Peak Demand Reduction (kW)	78%	44%	0%	56%

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

During the full 2021 program year, the program spent 80% of its annual budget. Table 95 lists the 2021 program budget and expenditures for the full program year.

TABLE 95. 2021 APPLIANCE RECYCLING PROGRAM EXPENDITURES

FUEL	PROGRAM BUDGET	PROGRAM EXPENDITURES	BUDGET SPENT (%)
Electric	$304,881.85	$245,315.20	80%

EVALUATION METHODOLOGY

To inform the 2021 NIPSCO impact and process evaluation, the evaluation team completed the following research activities:

- **Program staff interviews and discussions**, to understand program design and delivery.
- **Documentation and materials review,** to provide context on program implementation.
- **Tracking data analysis,** to audit and verify the accuracy of program participation data.
- **Engineering analysis**, to review program savings assumptions and algorithms for reasonableness and accuracy.

IMPACT EVALUATION

This section details each step of the impact evaluation and its associated electric energy savings and peak demand reduction. The research questions addressed in the impact analysis are below.

- 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?

The evaluation team compared its engineering calculations to NIPSCO's *ex ante* savings, basing its savings methodologies and inputs for program measures on several sources: the 2015 Indiana TRM (v2.2), the *Uniform Methods Project* (UMP), and the Mid-Atlantic TRM (v10). [24,25,26]

AUDITED AND VERIFIED SAVINGS

The evaluation team reviewed the program tracking data provided by TRC and audited the program savings and recycled appliances by looking for duplicate records, misapplied deemed savings calculations, and program participants or appliances that did not meet the program requirements.

The 2021 program tracking data included 1,401 records. According to program tracking data, the program recycled 1,376 appliances in the 2021 Program Year. TRC included a correction to the 2020 program tracking data in this years' data.[27] Twenty-five units (21 refrigerators and four freezers) were included in the data with a negative savings value to remove savings that were previously accounted for in the 2020 tracking data. These are listed as "2020 Adjusted" throughout the report and are included in all total savings estimates. Table 96 shows the *ex ante* measure count for the Appliance Recycling program.

TABLE 96. 2021 APPLIANCE RECYCLING PROGRAM *EX ANTE* COUNT

MEASURE	*EX ANTE* COUNT
Refrigerator	1,021
Freezer	234
Dehumidifier	70
Room AC	51
2021 PROGRAM TOTAL	1,376
Refrigerator – 2020 Adjusted	21
Freezer – 2020 Adjusted	4
2020 ADJUSTED TOTAL	25

The evaluation team found that less than 1% (n = 1) of recycled appliances were outside of the program requirements. One participant recycled three window air conditioners; the program states a participant can only recycle two of the same unit type. In addition to removing a unit that was outside of the program requirements, the evaluation team found one other data inconsistency in the tracking data. The tracking data measure variable ("measure.group") incorrectly labeled some appliances as freezers. The evaluation team created a new measure variable based on a unique identifier "measure.name." TRC explained that this variable discrepancy was due to a switch in subcontractors mid-year which affected their data tracking. According to TRC, using "measure.name" was the best way to capture the true measure recycled.

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

[25] National Renewable Energy Laboratory. October 2017. *Chapter 7: Refrigerator Recycling Evaluation Protocol. Uniform Methods Project: Methods for Determining Energy Efficiency Savings for Specific Measures*. https://www.nrel.gov/docs/fy17osti/68563.pdf

[26] Northeast Energy Efficiency Partnerships. May 2020. *Maryland/Mid-Atlantic Technical Reference Manual Version 10*. https://neep.org/sites/default/files/media-files/trmv10.pdf

[27] The evaluated count reported here does not match what was reported in the scorecard. In the raw tracking data, a variable that tracked the number of units installed had all correction measures with a negative unit count. When summing this variable in the tracking data the value matches the scorecard. Instead of summing the number of units, the evaluation team counted the number of rows in the tracking data by measure type to calculate the *ex ante* count.

Table 97 summarizes the tracking data quantity, audited quantity, applied installation rates, and resulting verified quantity per measure. To calculate the verified measure quantity, the evaluation team multiplied the audited measure quantity by the in-service rate (ISR). The team deemed the ISR at 100% for refrigerators and freezers, using the 2020 participant survey. The team also deemed the ISR at 100% for the new program measures. Given that these measures follow the same program model as the recycled refrigerators and freezers, the evaluation team believes it is appropriate to assume a 100% ISR for the window air conditioners and dehumidifiers. If necessary, the evaluation team will adjust this value after the 2022 program evaluation.

TABLE 97. 2021 APPLIANCE RECYCLING PROGRAM *EX ANTE* THROUGH VERIFIED QUANTITIES

MEASURE	TRACKING DATA QUANTITY	AUDITED QUANTITY	ISR	VERIFIED QUANTITY
Refrigerator	1,021	1,021	100%	1,021
Freezer	234	234	100%	234
Dehumidifier	70	70	100%	70
Window AC	51	50	100%	50
2021 PROGRAM TOTAL	1,376	1,375	N/A	1,375
Refrigerator – 2020 Adjusted	21	21	100%	21
Freezer – 2020 Adjusted	4	4	100%	4
TOTAL 2020 ADJUSTMENT	25	25	N/A	25

EX POST GROSS SAVINGS

The evaluation team calculated *ex post* gross per-measure savings for program measures using algorithms and variable assumptions from the UMP (refrigerator and freezer recycling), the Indiana TRM (v2.2) (refrigerator, freezer, and room AC recycling), and the Mid-Atlantic TRM (v10) (dehumidifier recycling). As described above, dehumidifier and room AC measures were added to this program in 2021, to increase program participation and savings with additional options for measures to recycle. Most program *ex post gross* savings continued to be driven by refrigerator and freezer recycling, with room ACs and dehumidifiers making up a relatively small proportion of savings and participation, as shown in Table 98.

TABLE 98. 2021 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	74%	81%
Freezers	17%	15%
Dehumidifier	5%	3%
Window Air Conditioner	4%	1%

The UMP models for refrigerator and freezer savings calculations contain the same variables as those used in the Indiana TRM (v2.2) but include models for appliance recycling using data from six different utilities and models for freezer recycling using data from three different utilities. Collectively, the in-situ dataset offered a wide distribution of appliance ages, sizes, configurations, usage scenarios (primary or secondary), and climate conditions. Because NIPSCO evaluations have never conducted utility-specific in situ metering, these in situ data provided an ideal secondary source for determining the independent variable coefficients to be used in the energy savings algorithm specified in the Indiana TRM (V2.2) to determine the energy savings for refrigerators and freezers recycled during the 2021 Program Year. The UMP protocol methods focus on energy savings, but do not include other parameter assessments, such as a peak CF for calculating demand reduction. The evaluation team calculated demand reduction for recycled refrigerators and freezers using the Indiana TRM (v2.2) algorithm.

The evaluation team estimated gross and net impact components on a per-unit basis and for the program overall. For the *ex post* gross analysis for refrigerators and freezers, the evaluation team used 2020 participant survey results for the part-use factor, the unit age, the percent of refrigerators that were used as a primary unit, and the percent of units that were in unconditioned spaces. More information is provided below (Table 99) and in Appendix 8 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 99. 2021 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	2021 Tracking Data
Part-use factor	Accounting for units not in use for the entire year	2020 Participant Survey
Average gross per-unit energy savings	Based on per-unit energy consumption and part-use factors	2021 Tracking Data and 2020 Participant Survey

Appendix 8 presents the algorithms, variable assumptions, and specific references for all program measure *ex post* calculations. It also contains detailed descriptions that explain the differences between *ex ante* and *ex post* savings.

EX POST GROSS SAVINGS

Table 100 shows the *ex ante* deemed savings and *ex post* gross per-measure savings for 2021 Appliance Recycling measures. As in previous years, program evaluation findings from two years prior (i.e., 2019 findings) informed the *ex ante* savings used in 2021 for recycled refrigerators and freezers. The sections below explore differences in refrigerators and freezers between these program years in more detail. As dehumidifiers and room ACs are new measures this year, the evaluation team is unable to make comparisons to any past results.

TABLE 100. 2021 APPLIANCE RECYCLING 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	KWH	KW
Refrigerators	Recycled appliance	1,184.00	0.174	922.00	0.135
Freezers	Recycled appliance	857.00	0.126	740.00	0.109
Dehumidifier	Recycled appliance	711.00	0.173	533.60	0.121
Window Air Conditioner	Recycled appliance	182.14	0.260	175.55	0.205
Refrigerator – 2020 Adjusted	Recycled appliance	(1,009.00)	(0.150)	(901.00)	(0.134)
Freezer – 2020 Adjusted	Recycled appliance	(704.00)	(0.100)	(671.00)	(0.100)

Upon the evaluation team's review of program tracking data, there were some notable differences in refrigerator and freezer characteristics between 2019 and 2021 that affected the savings. These differences include:

- decreases in average age,
- decreased proportion of appliances manufactured before 1990,
- and increased part-use estimate, or, appliance runtime, for freezers.

As shown in the graphics below, all of the above metrics (except freezer part-use) result in lower savings in 2021 than in 2019, the basis for the *ex ante* savings in 2019. The report discusses this issue further in subsequent sections. Table 101, Figure 36, Figure 37, Figure 38, and Figure 39 highlight notable differences between *ex ante* and *ex post* gross estimates between 2019 and 2021.

TABLE 101. APPLIANCE RECYCLING PROGRAM DIFFERENCES BETWEEN PROGRAM YEARS

PROGRAM YEAR	PROPORTION OF PRE-1990 REFRIGERATORS	PROPORTION OF PRE-1990 FREEZERS	PROPORTION OF PRIMARY UNIT REFRIGERATORS RECYCLED	PROPORTION OF SIDE-BY-SIDE REFRIGERATORS	PROPORTION OF CHEST FREEZERS	PART-USE VALUE - REFRIGERATORS	PART-USE VALUE - FREEZERS
2019	57%	64%	54%[a]	28%	27%	0.90[a]	0.83[a]
2020	2%[b]	13%[c]	58%	25%	23%	0.89	0.90
2021	8%	30%	58%[d]	27%	34%	0.89[d]	0.90[d]

a. Using the 2018 survey results.

b. Based on tracking data ages multiplied by refrigerator age adjustment factor of 0.63 from 2020 survey results.

c. Based on tracking data ages multiplied by freezer age adjustment factor of 0.71 from 2020 survey results.

d. Using the 2020 survey results.

FIGURE 36. PROPORTION OF APPLIANCES MANUFACTURED BEFORE 1990 (2019 – 2020)

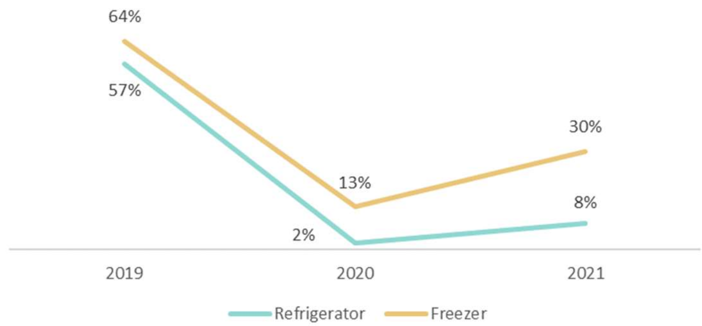


FIGURE 38. PROPORTION OF APPLIANCE CONFIGURATION (2019 – 2020)

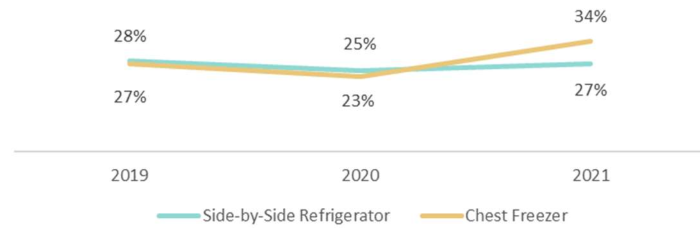


FIGURE 37. PROPORTION OF REFRIGERATORS THAT WERE PRIMARY UNIT (2019 -2021)

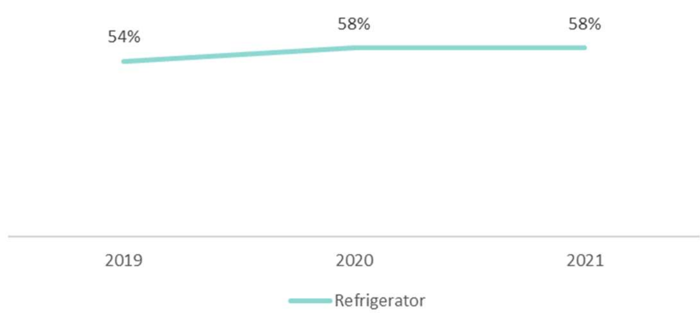


FIGURE 39. PART-USE FACTOR OF APPLIANCES (2019 – 2021)

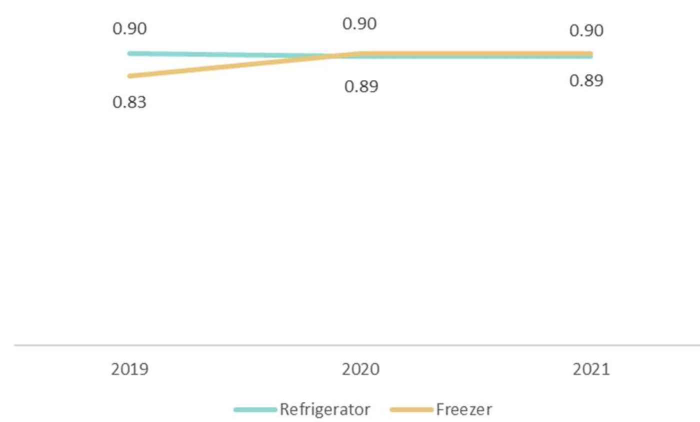


Table 102 highlights notable differences between variables used in the *ex ante* and *ex post* gross estimates.

TABLE 102. 2021 APPLIANCE RECYCLING PROGRAM DIFFERENCES BETWEEN *EX ANTE* AND *EX POST* GROSS

MEASURE	*EX ANTE* SOURCES AND ASSUMPTIONS	*EX POST* GROSS SOURCES AND ASSUMPTIONS	PRIMARY REASONS FOR DIFFERENCES
Refrigerators	*Ex ante* savings are based on the 2019 evaluation results.	DOE's UMP evaluation protocol for energy savings. The UMP protocol methods focus on energy savings, but do not include other parameter assessments, such as a peak CF for calculating demand reduction. The evaluation team calculated demand reduction using the Indiana TRM (v2.2) algorithm.	Decreases in average age, proportion manufactured before 1990, unit volume size, part-use estimate. [a]
Freezers	*Ex ante* savings are based on the 2019 evaluation results.	Since the UMP does not include specifications for freezers, the evaluation team created an analogous freezer model using metering data from three different utilities. The evaluation team calculated demand reduction using the Indiana TRM (v2.2) algorithm.	Decreases in average age, proportion manufactured before 1990, unit volume size.
Dehumidifier	*Ex ante* savings are based on Pennsylvania TRM (2021) algorithms and assumptions.	The Indiana TRM (v2.2) does not include dehumidifier recycling; therefore, the evaluation team used the default algorithms and assumptions from the Mid-Atlantic TRM (v10) to calculate *ex post* per-measure savings for recycled dehumidifiers.	The Mid-Atlantic TRM (v10) used for *ex post* savings includes a replacement rate while *ex ante* savings based on deemed values from Pennsylvania TRM (2021) does not include a replacement rate. The evaluation team believes a replacement rate is applicable to dehumidifier recycling gross energy savings and demand reduction estimation.
Window Air Conditioner	*Ex ante* savings are based on Illinois TRM (v8.0) algorithms and assumptions.	The evaluation team used Indiana TRM (v2.2) algorithms and assumptions to calculate *ex post* per-measure savings.	The Indiana TRM (v2.2) used for *ex post* savings includes a replacement rate while *ex ante* savings based on deemed values from Illinois TRM (v8.0) does not include a replacement rate.

a. Based on 2020 survey results.

REALIZATION RATES

The next two tables show the program's *ex ante* reported savings, audited savings, verified savings, and *ex post* gross savings.

TABLE 103. 2021 APPLIANCE RECYCLING 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.) [a]	VERIFIED GROSS ELECTRIC ENERGY SAVINGS (kWh/yr.)	*EX POST* GROSS ELECTRIC ENERGY SAVINGS (kWh/yr.)
Refrigerators	1,208,864.00	1,208,864.00	1,208,864.00	941,362.00
Freezers	200,538.00	200,538.00	200,538.00	173,160.00
Dehumidifier	49,770.00	49,770.00	49,770.00	37,352.00
Window Air Conditioner	9,289.14	9,107.00	9,107.00	8,777.46
Refrigerator – 2020 Adjusted	(21,189.00)	(21,189.00)	(21,189.00)	(18,921.00)
Freezer – 2020 Adjusted	(2,816.00)	(2,816.00)	(2,816.00)	(2,684.00)
Total Savings	1,444,456.14	1,444,274.00	1,444,274.00	1,139,046.46
Total Program Realization Rate				79%

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 104. 2021 APPLIANCE RECYCLING 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.) [a]	VERIFIED GROSS PEAK DEMAND REDUCTION (KW/YR.)	*EX POST* GROSS PEAK DEMAND REDUCTION (KW/YR.)
Refrigerators	177.654	177.654	177.654	138.226
Freezers	29.484	29.484	29.484	25.418
Dehumidifier	12.110	12.110	12.110	8.468
Window Air Conditioner	13.260	13.000	13.000	10.246
Refrigerator – 2020 Adjusted	(3.150)	(3.150)	(3.150)	(2.806)
Freezer – 2020 Adjusted	(0.400)	(0.400)	(0.400)	(0.398)
Total Savings	228.958	228.698	228.698	179.154
Total Program Realization Rate				78%

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 2020 evaluation results for the NTG ratio for both refrigerators and freezers. In 2020, the evaluation team found that there was a NTG of 52% for refrigerators and 76% for freezers. Using a savings weighted average of 2021 recycled refrigerator and freezers NTG estimates, the evaluation team found a total program NTG of 56% for energy savings and 56% for demand reduction. The evaluation team applied the total program NTG values as the NTG for the new measures (dehumidifiers and room ACs). Table 105 shows the NTG ratios by measure.

TABLE 105. 2021 APPLIANCE RECYCLING PROGRAM NET-TO-GROSS RATIOS BY MEASURE

MEASURE	NTG
Refrigerators	52%
Freezers	76%
Dehumidifier	56%
Window Air Conditioner	56%
Refrigerator – 2020 Adjusted	52%
Freezer – 2020 Adjusted	76%

Table 106 presents the resulting net electric energy savings and peak demand reduction by measure.

TABLE 106. 2021 APPLIANCE RECYCLING PROGRAM *EX POST* NET SAVINGS

MEASURE	*EX POST* GROSS SAVINGS/REDUCTION KWH	*EX POST* GROSS SAVINGS/REDUCTION KW	NTG	*EX POST* NET SAVINGS/REDUCTION KWH	*EX POST* NET SAVINGS/REDUCTION KW
Refrigerators	941,362.00	138.226	52%	489,508.24	71.878
Freezers	173,160.00	25.418	76%	131,601.60	19.318
Dehumidifier	37,352.00	8.468	56%	20,815.82	4.719
Window Air Conditioner	8,777.46	10.246	56%	4,891.57	5.710
Refrigerator – 2020 Adjusted	(18,921.00)	(2.806)	52%	(9,838.92)	(1.459)
Freezer – 2020 Adjusted	(2,684.00)	(0.398)	76%	(2,039.84)	(0.303)
Total Savings	1,139,046.46	179.154	56%	634,938.48	99.863

Table 107 presents the resulting net electric energy savings and peak demand reduction.

TABLE 107. 2021 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.)	1,444,456.14	1,139,046.46	56%	634,938.48
Peak Demand Reduction (kW)	228.958	179.154	56%	99.863

PROCESS EVALUATION

This section details each task of the process evaluation, including an analysis of the age of appliances and a high-level comparison of NIPSCO to other Appliance Recycling programs in the Midwest.

APPLIANCE AGE

In the past two evaluations (2019 and 2020), the evaluation team identified that the average appliance age documented in the program tracking data for both refrigerators and freezers had increased considerably when compared to prior years. In 2020, the evaluation team conducted a survey with participating customers to capture their self-reported appliance age, as well as context around how confident they were in that estimation. As shown in Table 108, the evaluation team reviewed the refrigerator and freezer ages in the 2021 tracking data and found that the values were closely aligned with the 2018 averages and the 2020 survey results.

TABLE 108. AVERAGE REPORTED AND TRACKING DATA AGES BY PROGRAM YEAR

	SURVEY RESPONSES (PY 2019)	TRACKING DATA (PY 2019)	SURVEY RESPONSES (PY 2020)	TRACKING DATA (PY 2020)	TRACKING DATA (PY 2021)
Refrigerator	18	33	17	27	21
Freezer	22	35	22	30	27

Source: Tracking data and 2020 participant survey. Survey question asked of 2019 and 2020 participants in 2020: “About how old was [UNIT.COLOR] [UNIT.MAKE] refrigerator you recycled (in years)?” & “About how old was [UNIT.COLOR] [UNIT.MAKE] freezer you recycled (in years)?”

COMPARISON TO OTHER APPLIANCE RECYCLING PROGRAMS

To provide context and comparison to how these programs are offered elsewhere, the evaluation team conducted a high-level scan of five peer utility offerings for appliance recycling programs. For an overview, see Table 109. Four out of five similar utilities that our team reviewed also recycle window air conditioners, and three out of five also recycle dehumidifiers. The rebate amount for window air conditioners ranged from $10 to $25. The rebate amount for dehumidifiers ranged from $5 to $20. This shows that NIPSCO's rebate amounts are comparable to other utilities. Four out of five utilities offered contact-free pick-up options. Of the four other utilities offering pick-ups for additional measures, all required a refrigerator or freezer to pick-up a window air conditioner or dehumidifier. This is different from NIPSCO's Appliance Recycling program which does not require a refrigerator or freezer to pick-up a window air conditioner or dehumidifier.

TABLE 109. DESCRIPTION OF PEER UTILITY APPLIANCE RECYCLING PROGRAMS

	WINDOW AIR CONDITIONERS REBATE	DEHUMIDIFIER REBATE	COMBINED WITH REFRIGERATOR/FREEZER PICK-UP?	IN-HOME VS. CURBSIDE
NIPSCO	$15	$15	No	Both
ComEd*	-	-	-	-
Vectren (CenterPoint)	$25	-	Yes	Both
AES Indiana	$20	$20	Yes	Both
Ameren MO	$10	$5	Yes	Only contact-free
PPL	$10	$10	Yes	Both

*ComEd offered a $25 rebate at an event in 2019 to recycle room AC or dehumidifiers but the program ended
Ameren MO: customer also receives a free Efficient Energy kit; website says this program ends Dec 2021
PPL: hosts events for customers to pre-register to drop off room AC and dehumidifiers for free and mails a $10 rebate

CONCLUSIONS AND RECOMMENDATIONS

CONCLUSION 1: THE PROGRAM FELL SHORT OF ITS SAVINGS AND DEMAND REDUCTION GOALS. THE PROGRAM REACHED A KWH REALIZATION RATE OF 79% AND DEMAND REALIZATION RATE OF 78%.

In the eleven months of program tracking data evaluated, the program saved 1,139,046 kWh and 179 kW. The evaluation team used the 2020 program evaluation survey results to calculate the part-use factor, ISR, and NTG values for the 2021 evaluation. Given that the program added two new measures this year, the evaluation team assumed the same ISR, NTG, spillover, and freeridership free ridership values for these measures.

Recommendations:

- NIPSCO and TRC should update the program *ex ante* savings estimates to reflect the most recent evaluated results.
- Re-evaluate this program in the next program cycle to re-assess customer experiences and update evaluation metrics (such as part-use factor, ISR, and NTG). If future participant levels allow for a survey, the

evaluation team recommends that dehumidifiers and room ACs be examined more closely in the 2022 (or 2023 if needed) evaluation to develop NIPSCO-specific impact metrics.

- Collect, document, and clearly label in the program tracking data the pints of water per day capacity of the dehumidifier units recycled to provide inputs for the evaluated savings calculations.

CONCLUSION 2: THE AVERAGE RECYCLED REFRIGERATOR AND FREEZER AGES ARE CLOSER TO THE 2018 AVERAGES AND PAST EVALUATIONS. IN ADDITION, THE TRANSITION FROM THE PAST IMPLEMENTER TO ARCA HAS GONE WELL.

In the past evaluations the evaluation team has found that there was a discrepancy in the implementer-reported appliance ages, survey-reported appliance ages, and past evaluation results. This year, after switching to a new implementer, the evaluation team saw that the average appliance ages were more in line with past survey results.

Recommendations:

- As the program continues, adds new measures, and navigates the program landscape with COVID-19, continue to monitor appliances ages and other program metrics.

9. BEHAVIORAL PROGRAM

PROGRAM DESIGN AND DELIVERY

First launched in 2011, the Behavioral program provides paper and electronic Home Energy Reports (HERs) to select NIPSCO customers. HERs detail the customer's energy usage—including their historical consumption data as well as a comparison to other households—and provide low-cost and no-cost tips to save energy. Customers participating in the program with a valid email address also receive a monthly electronic HER and access to the program-affiliated web portal to review their energy consumption and see additional energy saving tips. HERs also promote and encourage participation in other NIPSCO energy efficiency programs.

The program uses a randomized control trial (RCT) design whereby customers are randomly assigned to a treatment or control group. Customers in the treatment group receive an HER while customers in the control group do not receive an HER. The customer population is divided into ten waves based on when a customer began receiving the HER (Table 110). The initial five waves have respective natural gas and electric populations, known as cohorts. The program launched a sixth wave of gas only customers in September 2017, a seventh wave of electric only customers in May 2018, and eighth, ninth, and tenth waves with gas and electric customers in April 2019, April 2020, and April 2021. Treatment group participants in all ten waves received paper reports; those with a valid email address on file received email reports and had access to the web portal in 2021. The number of reports a treatment group participant received varied by their fuel type and by availability of a valid email address.

TABLE 110. 2021 CUSTOMER COUNTS BY WAVE

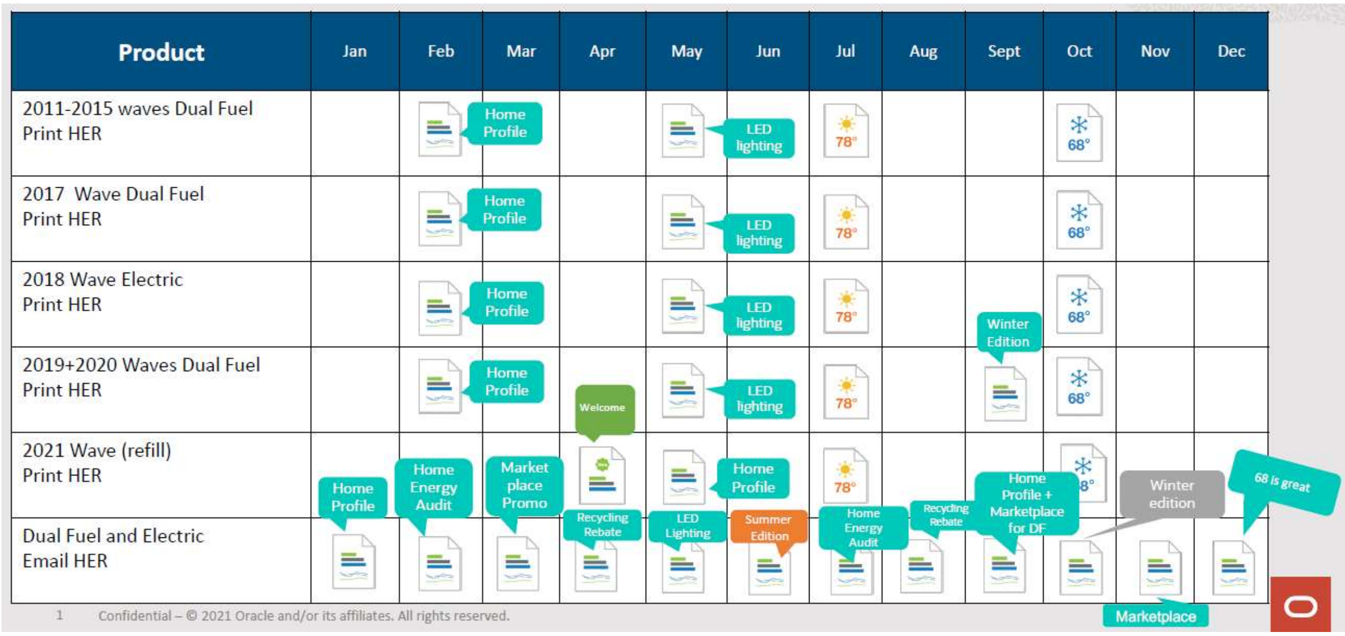
		NUMBER OF ELECTRIC CUSTOMERS		NUMBER OF GAS CUSTOMERS	
WAVE	FUEL	TREATMENT	CONTROL	TREATMENT	CONTROL
Wave 1 (first report March 2011)	Dual	80,325	26,646	80,077	26,568
Wave 2 (first report June 2012)	Dual	6,023	6,106	6,016	6,081
Wave 3 (first report July 2014)	Dual	26,085	5,903	26,100	5,915
Wave 4 (first report March 2015)	Dual	19,054	4,937	18,962	4,900
Wave 5 (first report June 2017)	Dual	21,099	6,890	21,086	6,908
Wave 6 (first report September 2017)	Natural Gas	-	-	37,934	9,082
Wave 7 (first report in May 2018)	Electric	16,188	7,658	-	-
Wave 8 (first report April 2019)	Dual	20,837	10,173	20,864	10,193
Wave 9 (first report April 2020)	Dual	15,027	7,489	15,022	7,495
Wave 10 (first report April 2021)	Dual	22,383	11,027	22,380	11,031
TOTAL		227,021	86,829	248,441	88,173

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 2021, except Wave 10, which started in April 2021, and is reported for April 2021.
Source: ILLUME analysis of data provided by Oracle

CHANGES FROM 2020 DESIGN

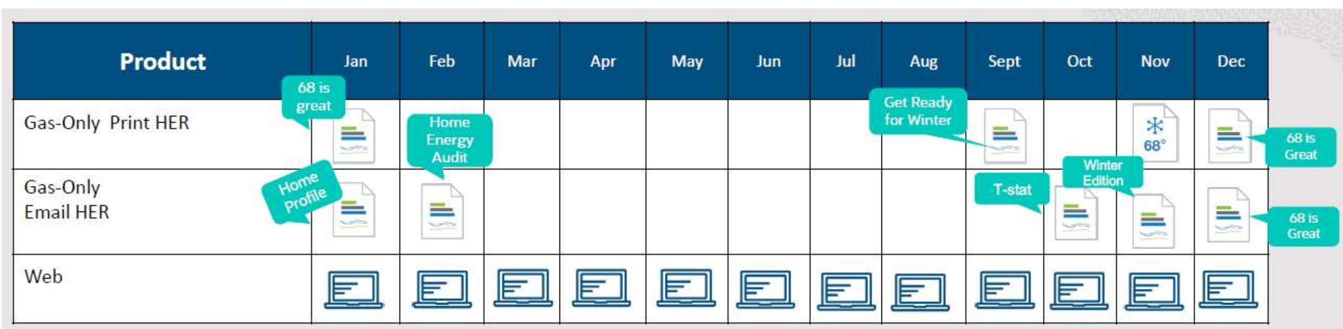
There were three primary changes from 2020 to 2021. First, in 2020, the Behavioral program introduced a new dual fuel wave. The program also replaced the appliance quiz from May 2020 with an LED lighting-focused report for electric and dual fuel customers, via print and email, as shown in Figure 40. The email HERs also channeled to home energy audits and recycling rebates, as shown in Figure 41.

FIGURE 40. 2021 PROGRAM DESIGN - ELECTRIC AND DUAL FUEL CUSTOMERS



Source: Oracle

FIGURE 41. 2021 PROGRAM DESIGN – GAS ONLY CUSTOMERS



Source: Oracle

PROGRAM PERFORMANCE

For the 2021 evaluation year, the Behavioral evaluation team was able to examine the full program year of data because the data were available by the time of initial reporting. The remainder of this report includes an evaluation of the full year of data and all evaluation metrics have been developed based on this.

Table 111 presents a savings summary for the program, including goals. The program achieved 109% of its electric gross savings goal and 211% of its natural gas gross savings goal (aggregate of all ten waves). The 2021 electric gross savings goal was 5% higher than the goal in 2020 and the 2021 natural gas gross savings goal was 11% lower than the goal in 2020. NIPSCO did not have a demand reduction goal for the program and did not track *ex ante* demand reduction.

Note that the experimental design and evaluation methods (comparing change in energy use over time between a treatment and control group) means that *ex post* savings are by design net savings. No additional adjustments are needed.

TABLE 111. 2021 BEHAVIORAL PROGRAM SAVING SUMMARY – FULL YEAR 2021

METRIC	GROSS SAVINGS GOAL	*EX ANTE*	*EX POST* GROSS	*EX POST* NET	GROSS GOAL ACHIEVEMENT
Electric Energy Savings (kWh/yr)	22,795,942.69	24,951,917.00	24,951,917.00	24,951,917.00	109%
Peak Demand Reduction (kW)	0.000	0.000	2,848.392	2,848.392	n/a
Natural Gas Energy Savings (therms/yr)	948,397.95	2,001,404.00	2,001,404.00	2,001,404.00	211%

Source: ILLUME analysis of data provided by NIPSCO

Table 112 outlines the *ex post* gross and NTG adjustment factors. The evaluation produces a net savings value with an NTG of 100% because the program follows a randomized study design. In this study design, participants would not receive reports in absence of the program (i.e., no freeridership) and any spillover within participants is captured in the evaluation as program savings (i.e., spillover is N/A).

TABLE 112. 2021 BEHAVIORAL PROGRAM ADJUSTMENT FACTORS

METRIC	REALIZATION RATE (%)[a]	FREERIDERSHIP	SPILLOVER	NTG (%)[b]
Electric Energy Savings (kWh/yr)	100%	0%	N/A	100%
Peak Demand Reduction (kW)	N/A	0%	N/A	100%
Natural Gas Energy Savings (therms/yr)	100%	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 31, 2021, the program spent 97% of its annual electric program budget and 96% of its annual natural gas program budget. Table 113 lists the 2021 program budget and expenditures by fuel type.

TABLE 113. 2021 BEHAVIORAL PROGRAM EXPENDITURES

FUEL	PROGRAM BUDGET	PROGRAM EXPENDITURES	BUDGET SPENT (%)
Electric	$1,712,177.13	$1,653,222.94	97%
Natural Gas	$321,426.56	$309,314.51	96%

Source: ILLUME analysis of data provided by NIPSCO

EVALUATION METHODOLOGY

To inform the 2021 NIPSCO impact and process evaluation, the evaluation team completed the following research activities:

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

IMPACT EVALUATION

The evaluation team recommends evaluating savings via billing analysis every other year. As this was last completed in 2020, the team conducted a desk review of NIPSCO's Behavioral program in 2021 and recommends reassessing in 2022, as portfolio priorities allow. For 2021, the primary researchable question the evaluation team sought to answer was:

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

For the impact analysis, the evaluation team collected 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 2021 across waves. In summary, the evaluation team successfully corroborated the *ex ante* savings. The analysis found savings that were slightly lower (for natural gas) or slightly higher (for electric) than the *ex ante* savings.

CORROBORATE IMPLEMENTER PROVIDED SAVINGS

The implementer provided monthly savings for each wave. ILLUME corroborated this data field by comparing the implementer's estimated savings to a simple difference between control and treatment average daily usage. The percent savings based on a simple difference was 0.2 percentage points higher for electric and 0.3 percentage points higher for gas than the implementer's modeled monthly savings. This small degree of difference validates the implementer provided data.

Table 114 lists the differences for all waves. Wave 10 electric savings are negative for both calculation methods. First year 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. It will be important to monitor any continued negative savings in the next evaluation year.

TABLE 114. 2021 DIFFERENCES BETWEEN CONTROL AND TREATMENT USAGE

WAVE	ELECTRIC SIMPLE DIFFERENCE (%)	ELECTRIC *EX POST* SAVINGS (%)	GAS SIMPLE DIFFERENCE (%)	GAS *EX POST* SAVINGS (%)
Wave 1 (first report March 2011)	5.4%	2.1%	0.7%	0.9%
Wave 2 (first report June 2012)	0.2%	1.0%	0.8%	0.6%
Wave 3 (first report July 2014)	1.3%	1.6%	1.2%	0.7%
Wave 4 (first report March 2015)	0.9%	0.9%	1.7%	1.1%
Wave 5 (first report June 2017)	1.1%	0.5%	1.9%	1.3%
Wave 6 (first report September 2017)	-	-	2.0%	1.3%
Wave 7 (first report in May 2018)	0.9%	1.0%	-	-
Wave 8 (first report April 2019)	0.1%	0.3%	1.0%	0.8%
Wave 9 (first report April 2020)	0.7%	0.8%	-0.6%	0.7%
Wave 10 (first report April 2021)	-0.6%	-0.3%	2.0%	0.3%
AVERAGE	1.1%	0.9%	1.2%	0.9%

Source: ILLUME analysis of data provided by NIPSCO

COMPARE IMPLEMENTER PROVIDED SAVINGS TO *EX ANTE*

ILLUME verified the *ex ante* savings by comparing the implementer provided savings to the 2021 scorecard, as shown in Table 115. In summary, ILLUME found differences in savings of about 1% of the *ex ante* savings for both electric and natural gas, and as a result, does not recommend an *ex post* adjustment.

NIPSCO currently does not calculate *ex ante* demand savings for the Behavior 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 above. The total demand reduction is calculated at 2,848 kW.

TABLE 115. 2021 BEHAVIORAL PROGRAM *EX ANTE* AND ILLUME'S SUMMED SAVINGS VALUES

	KWH	KW	THERMS
Ex Ante Savings	24,951,917.00	N/A	2,001,404.00
ILLUME Desk Review: Summed Savings	25,237,776.49	2,848.392	1,984,479.30

Source: ILLUME analysis of data provided by Oracle and NIPSCO

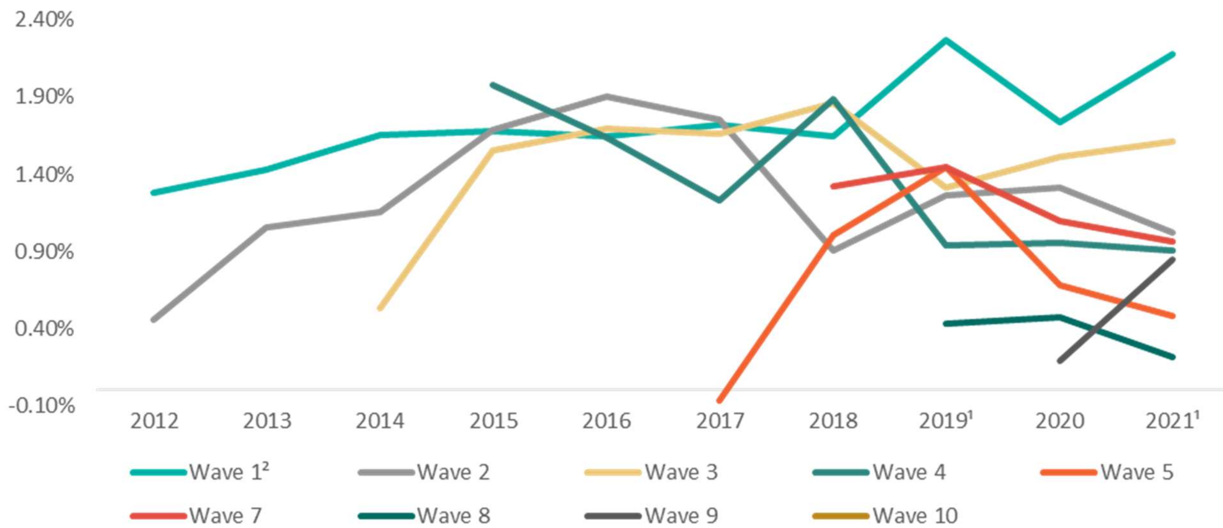
COMPARE SAVINGS YEAR OVER YEAR

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.[28] Within that context, the household savings percentage of each wave falls within these expectations (see

[28] 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 42 and Figure 43), except for Wave 4 and Wave 5, where savings may be declining earlier than expected. However, there could be an uptick in savings after a decline, as seen in Wave 2, and these waves have stable or increasing gas savings. As such, it will be valuable to look at Wave 4 and Wave 5 in future years to see if electric savings increase again. The following figures show average household-level electric savings as a percentage of usage for all ten Behavioral program waves from 2012 to 2021.

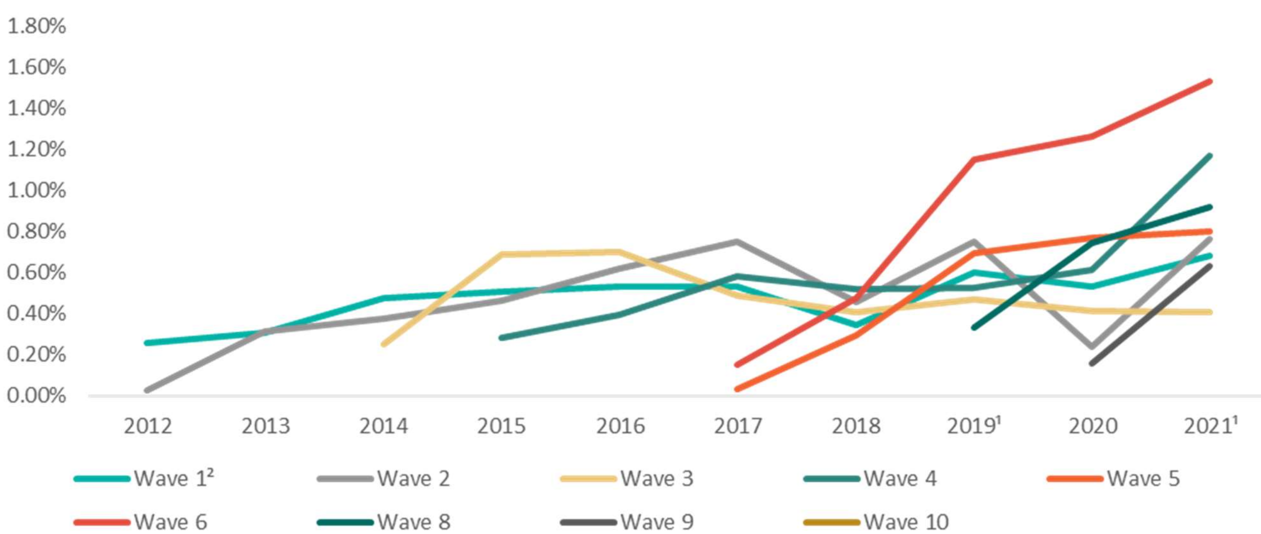
FIGURE 42. HOUSEHOLD-LEVEL PERCENTAGE SAVINGS OF ELECTRICITY FOR BEHAVIORAL PROGRAM PARTICIPANTS, BY WAVE AND YEAR



Source: ILLUME analysis of data provided by Oracle and NIPSCO

[1] The 2019 and 2021 results are based on Oracle's percent savings estimates as they were not modeled as part of this evaluation.
[2] Wave 1 results are presented as weighted averages of the eHER and non-eHER waves.

FIGURE 43. 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 and 2021 results are based on Oracle's percent savings estimates as they were not modeled as part of this evaluation.
[2] Wave 1 results are presented as weighted averages of the eHer and non-eHer waves.

PROCESS EVALUATION

The evaluation team sought to answer the following key researchable questions as part of the 2021 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 use changed from last program year?
- Do the tips and marketing messaging align with NIPSCO's channeling goals and with changing consumer habits?
- How have the savings changed over time and what might that indicate for future savings?

ILLUME performed the 2021 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 HER

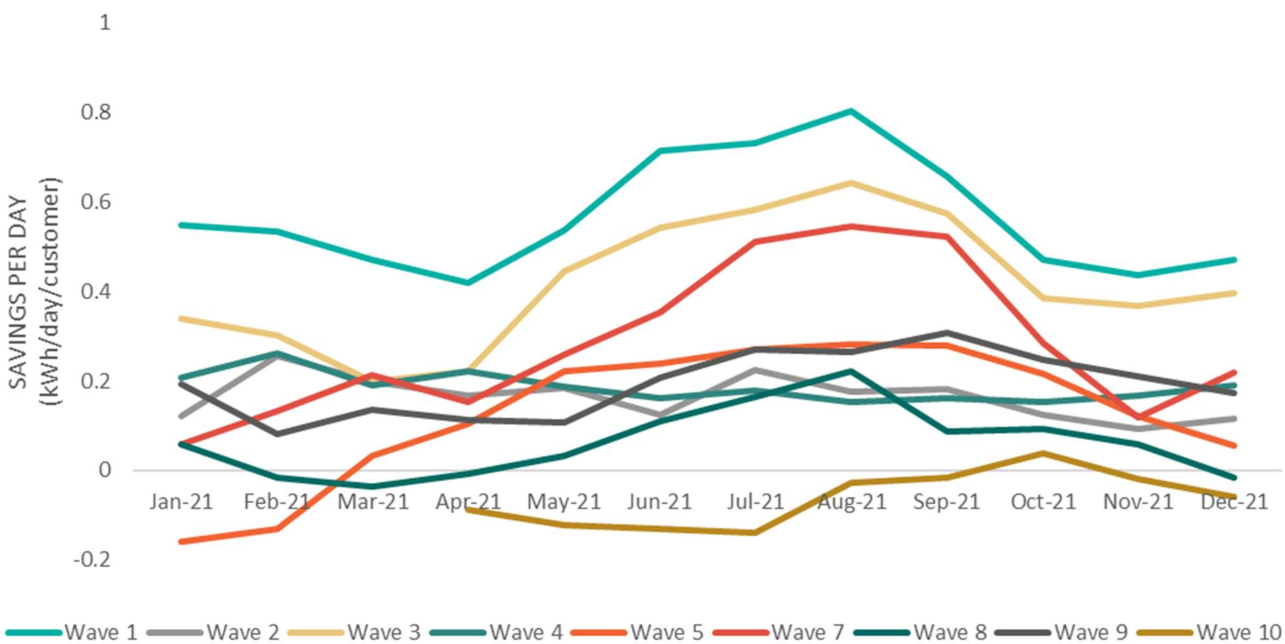
The following sections describe results related to trends in savings over time and between waves, customer counts during 2021, email engagement, and web portal engagement.

SAVINGS TRENDS

The evaluation team reviewed monthly savings for each wave to identify interesting trends over time and between waves. In summary, the program savings in 2021 were steady, clearly identifiable and there were no signs that savings will decline substantially in 2022.

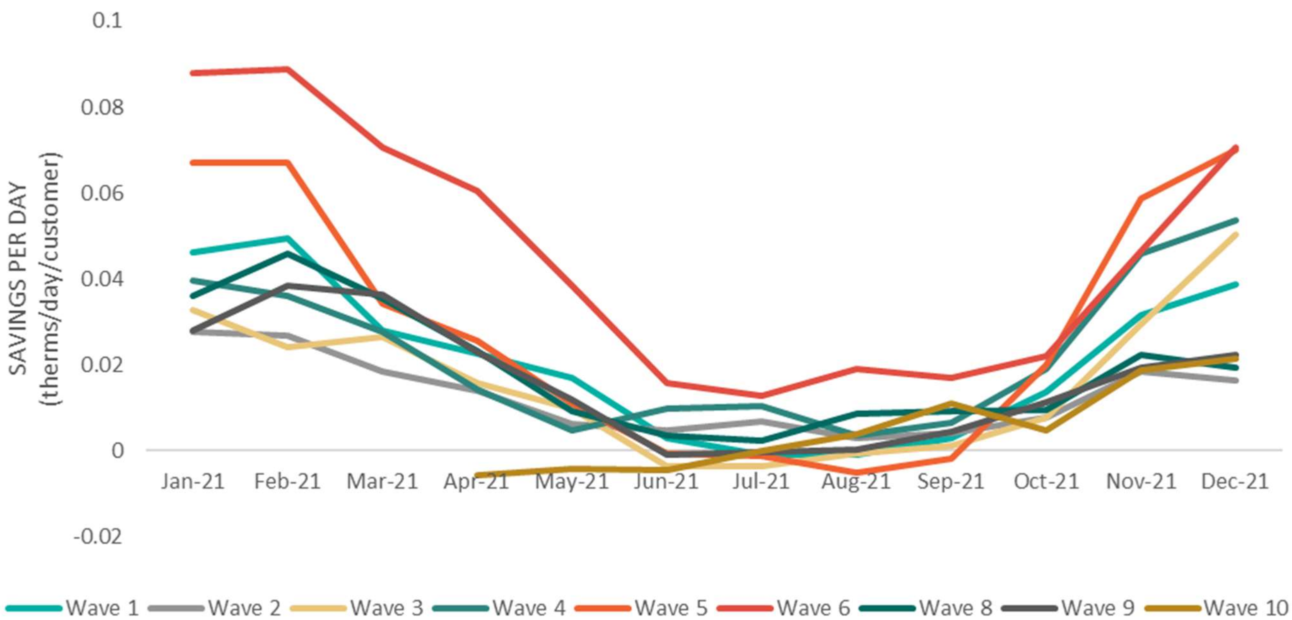
As shown in Figure 44, electric savings were relatively consistent throughout 2021, although highest in the summer across most waves. Wave 1 had the highest average household savings and Wave 10 (the new wave launched in 2021) showed fall savings, but otherwise low savings in 2021. Savings for new waves typically build up over time. As such, it will be valuable to watch the electric savings for Wave 10 in 2022.

FIGURE 44. AVERAGE DAILY ELECTRIC SAVINGS BY WAVE AND MONTH



As shown in Figure 45, natural gas savings demonstrate the typical heating load shape with higher savings in the winter and lower savings in the summer. Wave 6 (a gas only wave) follows that general shape, but with higher summer savings than other waves. Wave 10 (the new wave launched in 2021) shows relatively low savings until later in the summer. The delayed savings for Wave 10 is partially due to seasonality and the typical delayed effect of HER in new waves, where savings start to build over time.

FIGURE 45. AVERAGE DAILY GAS SAVINGS BY WAVE AND MONTH



CUSTOMER COUNT TRENDS

In 2021, NIPSCO's Behavioral program lost 10% (electric) and 9% (gas) treatment participants on average, which was the same as in 2020. Available data suggests these participants left the program by moving during 2021, rather than by opting out. Based on Oracle's data, a wave-average of only 0.06% of participants left the program voluntarily by opting out this year.

As shown in Table 116, customers in more recent waves are moving at a higher rate than older waves, thus leaving the program. Wave 2 is an older wave with a small number of participants. The savings results for this wave's gas savings were not statistically significant in 2020.

TABLE 116. JANUARY AND DECEMBER 2021 CUSTOMER COUNTS BY WAVE AND FUEL TYPE

WAVE	ELECTRIC			GAS		
	NUMBER OF PARTICIPANTS JANUARY 2021	NUMBER OF PARTICIPANTS DECEMBER 2021	DECLINE RATE (%)	NUMBER OF PARTICIPANTS JANUARY 2021	NUMBER OF PARTICIPANTS DECEMBER 2021	DECLINE RATE (%)
Wave 1 (first report March 2011)	80,325	76,243	5%	80,077	75,978	5%
Wave 2 (first report June 2012)	6,023	5,580	7%	6,016	5,566	7%
Wave 3 (first report July 2014)	26,085	24,356	7%	26,100	24,354	7%

WAVE	ELECTRIC			GAS		
	NUMBER OF PARTICIPANTS JANUARY 2021	NUMBER OF PARTICIPANTS DECEMBER 2021	DECLINE RATE (%)	NUMBER OF PARTICIPANTS JANUARY 2021	NUMBER OF PARTICIPANTS DECEMBER 2021	DECLINE RATE (%)
Wave 4 (first report March 2015)	19,054	17,574	8%	18,962	17,470	8%
Wave 5 (first report June 2017)	21,099	19,247	9%	21,086	19,220	9%
Wave 6 (first report September 2017)	-	-	-	37,934	35,655	6%
Wave 7 (first report in May 2018)	16,188	14,773	9%	-	-	-
Wave 8 (first report April 2019)	20,837	18,348	12%	20,864	18,385	12%
Wave 9 (first report April 2020)	15,027	12,721	15%	15,022	12,733	15%
Wave 10 (first report April 2021)[a]	22,383	19,070	15%	22,380	19,106	15%
AVERAGE	-	-	10%	-	-	9%

Source: ILLUME analysis of data provided by Oracle and NIPSCO
[a]Wave 10 started in April 2021. Its participants in the start date column are its participants as of April 2021.

EMAIL HER ENGAGEMENT

Behavioral programs drive savings by influencing customer behavior through paper and electronic messaging. As such, metrics around email engagement (e.g., open rates) may correlate with savings and provide an indication of program engagement. As shown in Table 117, all participants received 5.4 emails throughout the year on average. More recent waves received more emails.

TABLE 117. EMAIL ENGAGEMENT BY WAVE

WAVE	EMAILS SENT PER CUSTOMER[a]
Wave 1 (first report March 2011)	4.1
Wave 2 (first report June 2012)	3.4
Wave 3 (first report July 2014)	6.1
Wave 4 (first report March 2015)	5.4
Wave 5 (first report June 2017)	7.0
Wave 6 (first report September 2017)	2.0
Wave 7 (first report in May 2018)	4.7
Wave 8 (first report April 2019)	7.5
Wave 9 (first report April 2020)	8.3
Wave 10 (first report April 2021)	5.9
AVERAGE	5.4

Source: ILLUME analysis of email analytics data provided by Oracle
[a]Emails sent per customer is defined as the total number of emails sent for each wave over the year, divided by the average number of treatment customers for each wave over the year.

AS SHOWN IN

Table 118, NIPSCO's Behavioral program participants opened 41% of program emails in 2021 on average over the year. Participants opened between 39% and 48% of program emails each month in 2021. 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 rate was in December. Participants may have opened more program emails in December than other months because of high winter gas bills. One notable finding is that while those who received emails had high open rates, a relatively low amount (24% of customers on average across waves) received emails each month.

TABLE 118. EMAIL ENGAGEMENT BY MONTH AND YEAR

MONTH	CUSTOMERS RECEIVING EMAILS (%)[a]	EMAILS SUCCESSFULLY RECEIVED (% OF SENT)	EMAILS OPENED (% OF RECEIVED)	EMAILS CLICKED THROUGH (% OF OPENED)
Jan. 2021	24%	99%	41%	3%
Feb. 2021	27%	99%	41%	3%
Mar. 2021	21%	99%	40%	7%
Apr. 2021	19%	99%	39%	3%
May 2021	24%	99%	41%	2%
Jun. 2021	24%	97%	41%	2%
Jul. 2021	23%	99%	40%	2%
Aug. 2021	24%	99%	39%	5%
Sep. 2021	23%	99%	40%	6%
Oct. 2021	25%	99%	43%	3%
Nov. 2021	27%	99%	44%	3%
Dec. 2021	23%	99%	48%	2%
2021 AVERAGE	24%	99%	41%	3%
2020 AVERAGE	N/A[b]	99%	N/A[c]	1%[d]
2019 AVERAGE	19%	99%	39%	1%[d]

Source: ILLUME analysis of email analytics data provided by Oracle

[a]Customers receiving emails is defined as the total number of emails sent divided by the total number of gas and electric treatment customers across waves in each month.
[b]The team calculated the number of customers differently using billing data for the 2020 program year and the result is not comparable to 2019 or 2021.
[c]The team did not have data for have emails opened by month in the 2020 program year.
[d]In prior years emails clicked through was presented as a percentage of total customers. This year it is presented as a percentage of opened emails.

WEB PORTAL ENGAGEMENT

Like the 2020 program year evaluation findings, very few of NIPSCO's Behavioral program participants are engaging with the online portal; participants who do engage with it appear to value the portal. On average, 0.01% of NIPSCO's Behavioral program participants log into the web portal each month, but when they do, they stay on the site for an average of nine minutes (see Table 119). Due to the low number of log ins, it is unlikely that the portal is currently driving additional savings.

TABLE 119. WEB PORTAL ANALYTICS BY MONTH

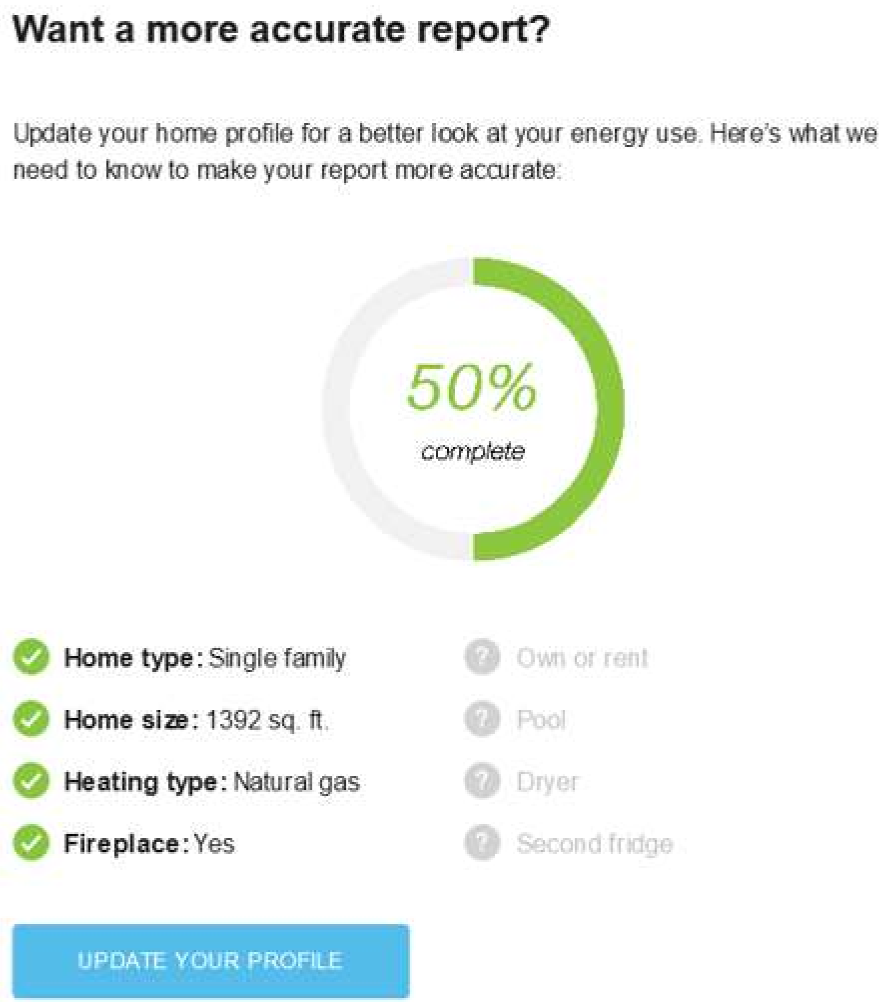
MONTH	UNIQUE PARTICIPANT LOG INS (%)	AVERAGE TIME ON PORTAL (MINUTES)
Jan. 2021	0.01%	7
Feb. 2021	0.01%	10
Mar. 2021	0.01%	10
Apr. 2021	0.01%	6
May 2021	0.01%	7
Jun. 2021	0.01%	12
Jul. 2021	0.00%	9
Aug. 2021	0.01%	10
Sep. 2021	0.01%	12
Oct. 2021	0.01%	10
Nov. 2021	0.01%	9
Dec. 2021	0.01%	11
AVERAGE	0.01%	9

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

REPORT CHANGES

In 2018, the evaluation team surveyed Behavioral program participants and received feedback that customers wanted a way to improve the accuracy of their reports. In the last three program years, some reports included specific messaging for customers to improve the accuracy of their reports by updating their Home Profiles on the web portal (see Figure 46). While few participants are logging into the portal regularly, this messaging may be helpful for the participants who are interested in improving the accuracy of their reports.

FIGURE 46. HER MESSAGING SAMPLE: REPORT ACCURACY

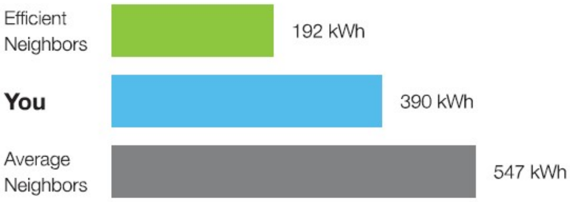


CHANNELING

NIPSCO's Behavioral program used similar messaging in 2021 compared to prior program years with regards to other Energy Efficiency programs. The following figures demonstrate that messaging. Figure 47 is a sample print HER channeling to NIPSCO's discount lighting program. Figure 48 is a sample eHER also promoting the lighting program with a link to NIPSCO's residential online marketplace. There were similar messages in print and email HERs for NIPSCO's appliance recycling program and a short-term promotion for wi-fi thermostats. Figure 49 is a sample print HER and highlights NIPSCO's Home Energy Assessment program. Figure 50 is a sample eHER that offers a virtual home energy assessment. Based on the small uplift effect in 2020 and similar channeling messaging, it is likely that the efficacy of NIPSCO's Behavioral program's channeling efforts is like past years.

FIGURE 47. HER MESSAGING SAMPLE: GENERAL CHANNELING (PRINT VERSION)

Here's how you compare to neighbors



Feb 5, 2021 - Mar 8, 2021

This is based on 100 similar homes within approx. 9 mi. Efficient neighbors are the 20% who use the least amount of electricity.
See back for details.*

Great
Good
Using more than average

103% **more electricity**
than efficient neighbors

Easy upgrade

Make your home glow

Whether you want your rooms warm and cozy or bright and airy, there's an efficient LED bulb for you.

LEDs use up to 75% less energy and last six times longer than incandescent bulbs. Plus, they come in all different moods and styles, so you'll have well-lit rooms that save you more.

Get NIPSCO-discounted pricing on qualified LED bulbs at **nipsco.com/lighting** or call **800-721-7385.**

Tips from efficient neighbors

Unplug electronics when they're not in use

Hang laundry to dry
Save up to $60 per year

Turn over

FIGURE 48. HER MESSAGING SAMPLE: GENERAL CHANNELING (EMAIL VERSION)

NIPSCO

Acct # *********09-9

Save more on LEDs with this limited-time offer

See what the NIPSCO Marketplace has to offer

With the NIPSCO Marketplace, you could receive instant rebates and discounts on a wide variety of energy-efficient products.

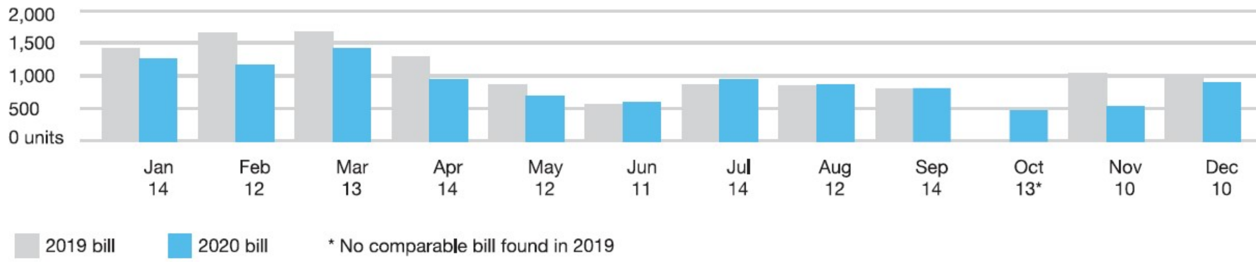
And, for a limited time only, you can get an extra discount on multi-packs of BR30 LEDs. Make sure to get yours soon, because this offer is only available from March 18 to April 30.

GO TO MARKETPLACE

FIGURE 49. HER MESSAGING SAMPLE: HOME ENERGY ASSESSMENT CHANNELING (PRINT VERSION)

Track your progress

This bill, you used 11% less energy than last year.



Save on your next bill

Seal leaky ducts

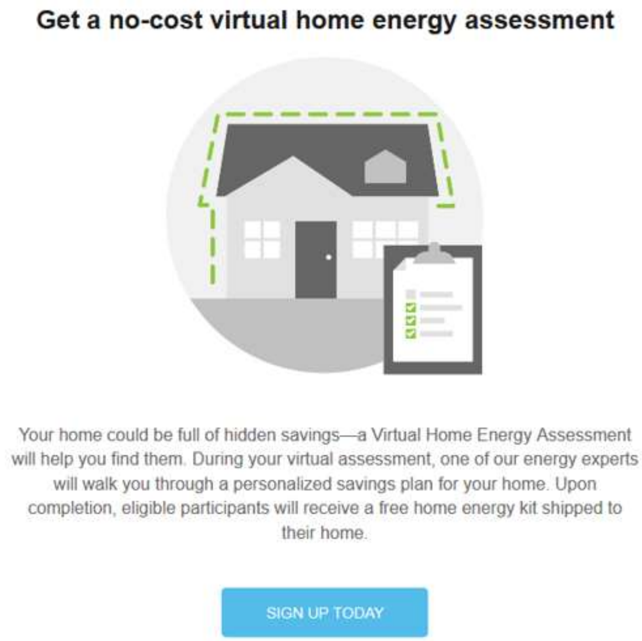
Ducts carry air from your heating and AC systems to each room of your home. When ducts have leaks, they can lose up to 30% of heated or cooled air before it reaches living spaces.

Delaying duct repair is like leaving the window open while the heat or air conditioning is running.

You can check for obvious holes throughout your duct system and seal them with mastic. For a longer-term solution, have a professional test, seal, and insulate ducts.

Consider having a Home Energy Assessment performed on your home. Visit NIPSCO.com/SaveEnergy to learn more.

FIGURE 50. HER MESSAGING SAMPLE: HOME ENERGY ASSESSMENT CHANNELING (EMAIL VERSION)



CONCLUSIONS AND RECOMMENDATIONS

CONCLUSION 1: THE BEHAVIORAL PROGRAM IS CONSISTENTLY EXCEEDING PLANNING ESTIMATES.

In the past three program years the gross goal achievements have consistently exceeded planned program goals. The gross goal achievement for electricity ranged from 109% in 2021 to 149% in 2019. Similarly for natural gas, the gross goal achievement ranged from 156% in 2018 to 211% in 2021. The savings of eight of the nine natural gas waves increased from 2020 to 2021. Electric savings were relatively consistent across the year, although highest in the summer across most waves. Natural gas savings demonstrated the typical heating load shape, with higher savings in the winter and lower savings in the summer. There are no signs that savings will decline substantially in 2022.

CONCLUSION 2: PARTICIPANTS ARE ENGAGING WITH PROGRAM EMAILS, BUT ONLY 24% OF PARTICIPANTS RECEIVE EMAILS EACH MONTH.

In 2021 only 24% of participants received emails on average each month. The number of emails received by wave varied from two for Wave 6 to eight for Wave 9 over the course of the year. Participants opened 41% of electronic HERs on average in 2021 but click-through rates did not increase, averaging 1% again this year.

Recommendations:

- The program may be able to achieve additional savings by acquiring more email addresses, to send emails to a higher proportion of participants. For example, the program can send messaging asking for email addresses (within printed reports or separately). This messaging would go to participants for which the program does not have valid email addresses.

CONCLUSION 3: SIMILAR TO 2020, FEW PARTICIPANTS ARE ENGAGING WITH THE WEB PORTAL, BUT THOSE WHO DO SPEND CONSIDERABLE TIME ON IT.

On average, 0.01% of NIPSCO's Behavioral program participants log into the web portal each month, but when they do, they stay on the site for an average of 9 minutes. Due to the low number of log ins, it is unlikely that the portal is currently driving savings. However, based on the average length of time that customers stay on the website, the customers who log in appear to engage with the web portal.

Recommendations:

- The program may be able to achieve additional savings by further informing customers about any new features and uses of the new web portal. Monitor specific customer interactions to better understand what they use on the web portal. If engagement continues at the current login rates and with the same seasonal patterns, consider ways to drive more traffic to the site to increase engagement and achieve additional savings. Consider messaging during the launches of new participant waves to educate participants about the ongoing nature of the program and drive them to click through emails and engage with the portal on a consistent basis.
- Conduct deeper cross-program participation process research with the next uplift analysis in future evaluations to understand if cross program promotion drives engagement and savings.

CONCLUSION 4: PARTICIPANT COUNTS ARE DECLINING AS CUSTOMERS MOVE.

In 2021, NIPSCO's Behavioral program lost 10% (electric) and 9% (gas) treatment participants on average. Available data suggests that these participants left the program because they moved during 2021; they did not opt out. Based on Oracle's data, a wave-average of only 0.06% of participants left the program voluntarily by opting out this year. Customer decline rates, which impact statistical significance, are consistent year over year, typically less than 10% for older waves and more than 10% for newer waves. This issue primarily affects Wave 2, where there were fewer than 6,000 treatment participants by the end of 2021, and the gas savings were not statistically significant in 2020.

Recommendations:

- Consider two options for Wave 2 savings in 2022: a) group Wave 2 with another wave during evaluation or b) consider filling Wave 2 with new randomly assigned treatment and control group customers. Increasing the sample size will increase the statistical power and hedge the risk of random variation in the modeling results (the risk that the program would see negative savings when there are positive savings or positive savings when there are negative savings). Consider similar approaches for other waves that did not achieve statistically significant savings in 2020.

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 a higher efficiency standard than the 2020 Indiana Residential Code, as defined by the Residential Energy Services Network (RESNET) Home Energy Rating System (HERS) Index. Incentives are paid directly to home builders, or HERS rating companies, that submit incentive applications. Participating homes must have NIPSCO residential electric and/or natural gas service. Only detached single-family, duplex, or multifamily homes are eligible to participate.

Homes that only receive one fuel service from NIPSCO (either electric only or gas only) are only eligible for incentives for that respective fuel type. Homes with both NIPSCO natural gas and electric service are eligible for both incentives. Incentives are tiered by the HERS Index score range. Homes with lower HERS Index scores receive higher incentives, as these homes are more energy efficient.

NIPSCO markets the program to builders and HERS raters directly and through industry organizations, such as builder associations. NIPSCO does not currently market homes directly to prospective homebuyers. The Residential New Construction program was newly introduced in 2019.

CHANGES FROM 2020 DESIGN

In July 2021, the Residential New Construction program shifted HERS tiers to align with the new 2020 Indiana Residential Code. The code changes increased the minimum energy efficiency requirements for new homes in Indiana, which effectively raised the baseline from which savings were measured. Because the 2020 building code change rendered incremental electric savings difficult to achieve, the incentive structure was flipped mid-year to offer the larger incentive to natural gas customers instead of electric customers, but the overall incentive for a combined-fuel customer remained unchanged. Table 120 outlines program tiers and incentives for the first half of the year and the second half of the year. Most of the participants in 2021 received the natural gas incentives (970 natural gas versus 405 electric participants).

TABLE 120. PROGRAM INCENTIVES

HERS INDEX SCORE	ELECTRIC INCENTIVE	NATURAL GAS INCENTIVE
Platinum ≤ 56 (Jan-Jun 2021)	$450	$60
Gold 57-65 (Jan-Jun 2021)	$400	$50
Silver 66-75 (Jan-Jun 2021)	$350	$40
Platinum <=56 (July-Dec 2021)	$60	$450
Gold 57-58 (July-Dec 2021)	$50	$400
Silver 59-62 (July-Dec 2021)	$40	$350

Due to the midyear program changes, it is unclear how the COVID-19 pandemic affected program participation.

PROGRAM PERFORMANCE

Unlike the majority of NIPSCO program evaluations in 2021, the Residential New Construction program evaluation team was able to examine the full program year of data. The remainder of this report includes findings from an evaluation of the full year of data; the evaluation team based all evaluation metrics on 12 months of data. Throughout 2021, the program processed 1,375 rebates, 405 electric incentives and 970 gas incentives, reporting *ex ante* program electric energy savings of 444 MWh and peak demand reduction of 124 kW. The program also reported *ex ante* natural gas energy savings of 289,669 therms. For *ex post* gross savings, the program achieved 17% of the electric energy savings goal, 28% of the peak demand reduction goal, and 80% of the natural gas savings goal. As noted above, NIPSCO made a mid-year program design change; the effect of this on program savings will be discussed further in this report.

The Residential New Construction Program significantly underachieved its electric energy targets and its electric demand targets. Additionally, the program fell short of its natural gas savings targets. The driver of the low electric realization rates was that the code change in 2020 drastically reduced claimable electric savings. *Ex post* gross therm savings were much more closely aligned with *ex ante* assumptions, but the program did not quite meet its gas savings goal, likely driven by lower program participation in the second half of the year. Table 121 summarizes savings for the program, including program savings goals.

TABLE 121. 2021 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.)	926,393.74	443,671.68	443,671.68	443,671.68	161,476.35	87,197.23	17%
Peak Demand Reduction (kW)	247.673	124.005	124.005	124.005	70.500	38.070	28%
Natural Gas Energy Savings (therms/yr.)	319,652.57	289,669.28	289,669.28	289,669.28	254,562.88	137,463.95	80%

Table 122 outlines the *ex post* gross and net-to-gross (NTG) adjustment factors. Realization rates for electric savings were low, while the realization rates for natural gas measures were higher.

TABLE 122. 2021 RESIDENTIAL NEW CONSTRUCTION PROGRAM ADJUSTMENT FACTORS

METRIC	REALIZATION RATE[a]	FREERIDERSHIP	SPILLOVER	NTG[b]
Electric Energy Savings (kWh/yr.)	36%	46%	0%	54%
Peak Demand Reduction (kW)	57%	46%	0%	54%
Natural Gas Energy Savings (therms/yr.)	88%	46%	0%	54%

[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 123 lists the 2021 program budget and expenditures by fuel type.

TABLE 123. 2021 RESIDENTIAL NEW CONSTRUCTION PROGRAM EXPENDITURES

FUEL	PROGRAM BUDGET	PROGRAM EXPENDITURES	BUDGET SPENT
Electric	$436,336.85	$212,882.10	49%
Natural Gas	$168,369.67	$232,894.02	138%

EVALUATION METHODOLOGY

To inform the 2021 Residential New Construction evaluation, the evaluation team completed the following research activities:

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

IMPACT EVALUATION

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

- 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 did the new 2020 Indiana Residential Code affect savings?
- Are there any opportunities to improve program data tracking?
- Is the program on track to meet its participation and savings goals?

AUDITED AND VERIFIED SAVINGS

To audit energy savings and demand reduction, the evaluation team conducted a careful review of the program tracking data, creating multiple data summaries, and checking measure identifiers for duplicates. The team sampled 62 projects from the second half of the year and confirmed the HERS documentation verifying the rebate amount, HERS scores, and program tier. The evaluation team found no inconsistencies in the data and applied an in-service rate (ISR) of 100% to all tiers for both the first half of the year projects and the second half of the year projects.

Table 124 summarizes the audited quantity, applied installation rates, and resulting verified quantity per measure. To calculate the verified measure quantity, the evaluation team multiplied the audited measure quantity by the in-service rate.

TABLE 124. 2021 RESIDENTIAL NEW CONSTRUCTION PROGRAM AUDITED AND VERIFIED QUANTITIES

MEASURE	UNIT OF MEASURE	AUDITED QUANTITY	ISR	VERIFIED QUANTITY
Silver 66-75 (Jan-Jun 2021) Electric	Home	71	100%	71
Silver 66-75 (Jan-Jun 2021) Natural Gas	Home	102	100%	102
Gold 57-65 (Jan-Jun 2021) Electric	Home	281	100%	281
Gold 57-65 (Jan-Jun 2021) Natural Gas	Home	531	100%	531
Platinum <=56 (Jan-Jun 2021) Electric	Home	41	100%	41
Platinum <=56 (Jan-Jun 2021) Natural Gas	Home	89	100%	89
Silver 59-62 (July-Dec 2021) Electric	Home	2	100%	2
Silver 59-62 (July-Dec 2021) Natural Gas	Home	148	100%	148
Gold 57-58 (July-Dec 2021) Electric	Home	1	100%	1
Gold 57-58 (July-Dec 2021) Natural Gas	Home	51	100%	51
Platinum <=56 (July-Dec 2021) Electric	Home	9	100%	9
Platinum <=56 (July-Dec 2021) Natural Gas	Home	49	100%	49
		1,375	100%	1,375

EX POST GROSS SAVINGS

RESIDENTIAL CODE CHANGE

Indiana adopted the 2020 Indiana Residential Code in December of 2019. These code changes increased the minimum energy efficiency requirements in Indiana, which effectively raises the baseline from which savings were measured.

For the 2020 program evaluation, the evaluation team did not yet reference the 2020 Indiana Residential code for baselines. Homes are built to the standards in effect at the time the building permit was issued. As building permits are issued before the construction process starts, homes submitted to the program in 2020 were likely permitted before the code change was in effect. This was supported by builder surveys conducted for the 2020 evaluation, which indicated that they had not yet made changes to their building practices to align with the code change. Since the code change likely did not significantly impact 2020 program homes, the gross baseline of the 2010 energy code was used to calculate gross savings.

Beginning in program year 2021, this code change did affect the program baseline, as it is likely most homes built will have had their permits issued post-code change. NIPSCO put these code changes into effect for the Residential New Construction program in July of 2021. Because the program had not yet adjusted participation requirements for the first half of the year, participating homes from January through June had significantly reduced *ex post* gross savings due to this baseline shift (discussed in more detail below).

Table 125 below details some key information about this mid-year program design change, including how the pre- and post-change measures are described in the data and the assumed baselines for both *ex ante* and *ex post* gross savings estimates.

TABLE 125. 2021 RESIDENTIAL NEW CONSTRUCTION PROGRAM ASSUMED BASELINES

MEASURE DESCRIPTION	TIMEFRAME OF PARTICIPATION	NUMBER OF REBATES ISSUED IN 2021	*EX ANTE* CODE ASSUMED FOR BASELINE	*EX POST* CODE ASSUMED FOR BASELINE
Silver 66-75 (Jan-Jun 2021) Electric	January-June 2021	71	IN 2010	IN 2020
Silver 66-75 (Jan-Jun 2021) Natural Gas	January-June 2021	102	IN 2010	IN 2020
Gold 57-65 (Jan-Jun 2021) Electric	January-June 2021	281	IN 2010	IN 2020
Gold 57-65 (Jan-Jun 2021) Natural Gas	January-June 2021	531	IN 2010	IN 2020
Platinum <=56 (Jan-Jun 2021) Electric	January-June 2021	41	IN 2010	IN 2020
Platinum <=56 (Jan-Jun 2021) Natural Gas	January-June 2021	89	IN 2010	IN 2020
Subtotal	January-June 2021	1,115		
Silver 59-62 (July-Dec 2021) Electric	July-December 2021	2	IN 2020	IN 2020
Silver 59-62 (July-Dec 2021) Natural Gas	July-December 2021	148	IN 2020	IN 2020
Gold 57-58 (July-Dec 2021) Electric	July-December 2021	1	IN 2020	IN 2020
Gold 57-58 (July-Dec 2021) Natural Gas	July-December 2021	51	IN 2020	IN 2020
Platinum <=56 (July-Dec 2021) Electric	July-December 2021	9	IN 2020	IN 2020
Platinum <=56 (July-Dec 2021) Natural Gas	July-December 2021	49	IN 2020	IN 2020
Subtotal	July-December 2021	260		

METHODOLOGY

For the 2021 *ex post* evaluation, the evaluation team modeled savings in the REM/Rate (version 16.0.6) software utilizing prototype home characteristics based on a sample of HERS certificates from program participant homes. 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, using HERS certificates to develop inputs for the models. Because Silver, Gold, and Platinum rated homes can have a myriad of different home characteristics within each grouping, it is preferable to group prototypes by the actual home characteristics rather than rating. The team modeled homes that reflect how the homes are constructed, given the available information, to generate an overall analysis of the population of homes. The overall weighted realization rate, based on the random sample, ensures correct overall adjustments.

For the program participants in the first half of 2021, the evaluation team determined *ex post* savings per tier from 2020 participant data, utilizing a baseline of the 2020 Indiana Residential Code, and a sample of 197 participants, and applied those *ex post* savings to each HERS tier. For participating homes in the first half of 2021, the evaluation team decided to reference 2020 participant data, because there were no other changes in the program design for that period.

For the participant population in the second half of 2021, the evaluation team again modeled home energy savings relative to the requirements of the 2020 Indiana Residential Code, this time developing prototype models for a sample of 62 second half 2021 participants. These projects had a slightly different tier structure, and they were most recently built, under the modified program structure.

Appendix 10 provides a full description of the methods used to calculate gross energy savings.

EX POST GROSS SAVINGS

The biggest difference between the 2020 and 2021 Residential New Construction program evaluations is that the savings for 2021 incorporates the 2020 Indiana Residential Code as the baseline for savings calculations. As such, increasing the baseline performance level decreased opportunities for the as-built homes to achieve energy savings above the more stringent code.

The evaluation team used the more stringent code standard for the prototype models for the *ex post* for all of 2021, while the *ex ante* savings for the first half of 2021 did not incorporate the new code standard as a baseline. Because participation in the first half of the year was over four times the participation in the second half of the year, first half of the year savings had a proportionately adverse effect on the overall program realization rate.

The other difference between estimates of *ex ante* and *ex post* electricity and natural gas savings resulted from different methodologies used by the program implementer and the evaluation team to estimate measure savings. While the evaluation team used program as-built home characteristics to model savings for homes, the implementer calculated electric energy and demand deemed savings by modeling the consumption of baseline homes using inputs from a regional program and then calculated savings based on the HERS score of the program home. This difference in methods of modeling homes using characteristics from different data sources, such as a home's square footage, likely resulted in the discrepancy in *ex ante* and *ex post* savings.

As a response to this code change, NIPSCO implemented a midyear program change to the HERS scores for the tiers. The minimum silver and gold HERS score to qualify for the tiers were more stringent, which resulted in additional savings per home in the *ex post* calculated for the second half of 2021.

Table 126 shows the *ex ante* deemed savings and *ex post* gross per-measure savings for the 2021 Residential New Construction program measures.

TABLE 126. 2021 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 66-75 (Jan-Jun 2021) Electric	Home	1,092.51	0.219	0.00	386.01	0.125	0.00
Silver 66-75 (Jan-Jun 2021) Natural Gas	Home	0.00	0.000	308.40	0.00	0.000	238.80
Gold 57-65 (Jan-Jun 2021) Electric	Home	1,115.52	0.319	0.00	394.14	0.182	0.00
Gold 57-65 (Jan-Jun 2021) Natural Gas	Home	0.00	0.000	314.94	0.00	0.000	243.86
Platinum <=56 (Jan-Jun 2021) Electric	Home	1,227.87	0.329	0.00	433.84	0.187	0.00
Platinum <=56 (Jan-Jun 2021) Natural Gas	Home	0.00	0.000	346.62	0.00	0.000	268.39
Silver 59-62 (July-Dec 2021) Electric	Home	191.64	0.444	0.00	460.63	0.240	0.00
Silver 59-62 (July-Dec 2021) Natural Gas	Home	0.00	0.000	235.00	0.00	0.000	300.26
Gold 57-58 (July-Dec 2021) Electric	Home	191.64	0.444	0.00	460.63	0.240	0.00
Gold 57-58 (July-Dec 2021) Natural Gas	Home	0.00	0.000	247.21	0.00	0.000	315.86
Platinum <=56 (July-Dec 2021) Electric	Home	191.64	0.444	0.00	460.63	0.240	0.00
Platinum <=56 (July-Dec 2021) Natural Gas	Home	0.00	0.000	260.05	0.00	0.000	332.27

Table 127 highlights notable differences between *ex ante* and *ex post* gross estimates.

TABLE 127. 2021 RESIDENTIAL NEW CONSTRUCTION DIFFERENCES BETWEEN *EX ANTE* AND *EX POST* GROSS

MEASURE	*EX ANTE* SOURCES AND ASSUMPTIONS	*EX POST* GROSS SOURCES AND ASSUMPTIONS	PRIMARY REASONS FOR DIFFERENCES
Jan-June 2021 projects Silver, Gold, and Platinum Star Savings	First half savings per home did not incorporate new code baseline. Natural gas modeling assumptions are unknown. Electric savings modeled based on HERS scores and benchmarked savings.	As-built home characteristics from 2020 program; a random sample of home HERS certificates (n=122 for natural gas homes, n=80 for electric homes) modeled in REM/Rate version 16.0.6 (12 prototype homes). 2020 Indiana Residential Code used for baseline.	2020 Indiana Residential Code used for baseline for *ex post* while *ex ante* did not incorporate baseline for first half of year.
July-Dec 2021 projects Silver, Gold, and Platinum Star Savings	Second half savings per home did incorporate new code baseline. Natural gas and electric savings are modeled based on HERS scores and benchmarked savings.	As-built home characteristics from 2021 program; a random sample of home HERS certificates (n=62 for natural gas homes, n=6 for electric homes) modeled in REM/Rate version 16.0.6 (8 prototype homes). 2020 Indiana Residential Code used for baseline.	A very high percentage of installed high-efficiency lighting contributed to higher *ex post* electric savings; and the square footage of 2021 second half homes was almost 20% larger than 2020 natural gas homes, resulting in proportionally higher natural gas savings.

REALIZATION RATES

Table 128 through Table 130 show the program's *ex ante* reported savings, verified savings, and *ex post* gross savings. The realization rates were low for electric energy and peak demand savings, at 36% and 57%, respectively. The realization rate for natural gas savings was 88%.

The low realization rates for electric energy and peak demand savings are primarily driven by the new stringent energy code reducing savings for program homes in the first half of the year. which applied higher *ex ante* values. The 2020 Indiana Residential Code increased some mandatory efficiency requirements, including increased insulation levels, building envelope air tightness, and increasing the percentage of high-efficiency lighting from 50% to 90%.

Drivers of realization rates by fuel type are:

- Electric energy and demand savings.
    - Savings were primarily driven by the marginal difference between the new 90% efficient lighting requirement and the estimation that program-participating homes are now almost exclusively installing LED lighting.[29]
    - Two of the six sampled homes receiving an electric incentive in the second half of 2021 installed code-minimum central air conditioners (SEER 13), which delivered zero electric savings. The program does currently state a requirement that: "All Central AC systems must be rated 15 SEER or greater to qualify for the electric service incentive," which if enforced for all participants, is an opportunity to meaningfully increase electric savings going forward.[30]
- Natural gas savings:
    - The *ex post* prototype models yielded much of their therm savings in the heating end use category. The HERS program leaves flexibility in efficient heating systems or the building envelope, such that when more efficient than code choices are made, therm savings are achieved.

The *ex ante* savings for the first half of the year were not based on the more stringent code, which resulted in low realization rates. The second half of the year *ex ante* savings were more closely aligned with realistic electric savings that can be achieved per the new 2020 Indiana Residential Code, and potentially even underestimated compared to *ex post* gross evaluation findings across fuels. However, because participation in the first half of the year was over 4 times that of participation in the second half of the year, the first-half realization rates had a proportionately adverse effect on the overall program realization rate for 2021. The evaluation team expects future program realization rates to align with the second half of the year findings more closely, assuming *ex ante* assumptions stay similar.

[29] The models were updated with benchmarked efficient lighting data from the 2020 published CenterPoint Indiana program evaluation (discussed in more detail in the Appendix). This study showed that 100% of interior, 99% of garage, and 99% of exterior lightbulbs in homes built through the program were efficient.

[30] Accessed April 6, 2022. https://www.nipsco.com/partner-with-us/builders-and-developers/residential-new-construction-program

TABLE 128. 2021 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 66-75 (Jan-Jun 2021) Electric	77,568.21	77,568.21	77,568.21	27,406.97
Silver 66-75 (Jan-Jun 2021) Natural Gas	0.00	0.00	0.00	0.00
Gold 57-65 (Jan-Jun 2021) Electric	313,461.12	313,461.12	313,461.12	110,754.39
Gold 57-65 (Jan-Jun 2021) Natural Gas	0.00	0.00	0.00	0.00
Platinum <=56 (Jan-Jun 2021) Electric	50,342.67	50,342.67	50,342.67	17,787.44
Platinum <=56 (Jan-Jun 2021) Natural Gas	0.00	0.00	0.00	0.00
Sub Total (Jan-Jun 2021) Savings	**441,372.00**	**441,372.00**	**441,372.00**	**155,948.81**
Sub Total (Jan-Jun 2021) Program Realization Rate				**35%**
Silver 59-62 (July-Dec 2021) Electric	383.28	383.28	383.28	921.26
Silver 59-62 (July-Dec 2021) Natural Gas	0.00	0.00	0.00	0.00
Gold 57-58 (July-Dec 2021) Electric	191.64	191.64	191.64	460.63
Gold 57-58 (July-Dec 2021) Natural Gas	0.00	0.00	0.00	0.00
Platinum <=56 (July-Dec 2021) Electric	1,724.76	1,724.76	1,724.76	4,145.66
Platinum <=56 (July-Dec 2021) Natural Gas	0.00	0.00	0.00	0.00
Sub Total Savings (July-Dec 2021) Savings	**2,299.68**	**2,299.68**	**2,299.68**	**5,527.55**
Sub Total (July-Dec 2021) Program Realization Rate				**240%**
Total Savings	443,671.68	443,671.68	443,671.68	161,476.35
Total Program Realization Rate				36%

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 129. 2021 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 66-75 (Jan-Jun 2021) Electric	15.549	15.549	15.549	8.859
Silver 66-75 (Jan-Jun 2021) Natural Gas	0.000	0.000	0.000	0.000
Gold 57-65 (Jan-Jun 2021) Electric	89.639	89.639	89.639	51.072
Gold 57-65 (Jan-Jun 2021) Natural Gas	0.000	0.000	0.000	0.000
Platinum <=56 (Jan-Jun 2021) Electric	13.489	13.489	13.489	7.685
Platinum <=56 (Jan-Jun 2021) Natural Gas	0.000	0.000	0.000	0.000
Subtotal (Jan-Jun 2021) Savings	**118.677**	**118.677**	**118.677**	**67.616**
Subtotal (Jan-Jun 2021) Program Realization Rate				**57%**
Silver 59-62 (July-Dec 2021) Electric	0.888	0.888	0.888	0.481
Silver 59-62 (July-Dec 2021) Natural Gas	0.000	0.000	0.000	0.000
Gold 57-58 (July-Dec 2021) Electric	0.444	0.444	0.444	0.240
Gold 57-58 (July-Dec 2021) Natural Gas	0.000	0.000	0.000	0.000
Platinum <=56 (July-Dec 2021) Electric	3.996	3.996	3.996	2.163
Platinum <=56 (July-Dec 2021) Natural Gas	0.000	0.000	0.000	0.000
Subtotal Savings (July-Dec 2021) Savings	**5.328**	**5.328**	**5.328**	**2.884**
Subtotal (July-Dec 2021) Program Realization Rate				**54%**
Total Savings	124.005	124.005	124.005	70.500
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.

TABLE 130. 2021 RESIDENTIAL NEW CONSTRUCTION PROGRAM *EX ANTE* AND *EX POST* GROSS NATURAL GAS ENERGY SAVINGS

MEASURE	*EX ANTE*[a] NATURAL GAS ENERGY SAVINGS (THERMS/YR.)	AUDITED GROSS NATURAL GAS ENERGY (THERMS/YR.)	VERIFIED GROSS NATURAL GAS ENERGY SAVINGS (THERMS/YR.)	*EX POST* GROSS NATURAL GAS ENERGY SAVINGS (THERMS/YR.)
Silver 66-75 (Jan-Jun 2021) Electric	0.00	0.00	0.00	0.00
Silver 66-75 (Jan-Jun 2021) Natural Gas	31,456.80	31,456.80	31,456.80	24,357.20
Gold 57-65 (Jan-Jun 2021) Electric	0.00	0.00	0.00	0.00
Gold 57-65 (Jan-Jun 2021) Natural Gas	167,233.14	167,233.14	167,233.14	129,489.69
Platinum <=56 (Jan-Jun 2021) Electric	0.00	0.00	0.00	0.00
Platinum <=56 (Jan-Jun 2021) Natural Gas	30,849.18	30,849.18	30,849.18	23,886.72
Subtotal (Jan-Jun 2021) Savings	**229,539.12**	**229,539.12**	**229,539.12**	**177,733.61**
Subtotal (Jan-Jun 2021) Program Realization Rate				**77%**
Silver 59-62 (July-Dec 2021) Electric	0.00	0.00	0.00	0.00
Silver 59-62 (July-Dec 2021) Natural Gas	34,780.00	34,780.00	34,780.00	44,438.96
Gold 57-58 (July-Dec 2021) Electric	0.00	0.00	0.00	0.00
Gold 57-58 (July-Dec 2021) Natural Gas	12,607.71	12,607.71	12,607.71	16,109.07
Platinum <=56 (July-Dec 2021) Electric	0.00	0.00	0.00	0.00
Platinum <=56 (July-Dec 2021) Natural Gas	12,742.45	12,742.45	12,742.45	16,281.23
Subtotal Savings (July-Dec 2021) Savings	**60,130.16**	**60,130.16**	**60,130.16**	**76,829.27**
Subtotal (July-Dec 2021) Program Realization Rate				**128%**
Total Savings	289,669.28	289,669.28	289,669.28	254,562.88
Total Program Realization Rate				88%

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 2020 New Construction program evaluation to inform 2021 NTG ratios. Because 2021 had a midyear program design change, the evaluation team recommended postponing a new participant survey until the 2022 program evaluation cycle, which would result in a more robust 2022 NTG program evaluation. This assessment will be important to understand the impact of the new program design on builder decision making. Table 131 shows the 2021 NTG ratios by measure.

TABLE 131. 2021 RESIDENTIAL NEW CONSTRUCTION PROGRAM NTG RATIOS BY MEASURE

MEASURE	NTG
Silver 66-75 (Jan-Jun 2021) Electric	54%
Silver 66-75 (Jan-Jun 2021) Natural Gas	54%
Gold 57-65 (Jan-Jun 2021) Electric	54%
Gold 57-65 (Jan-Jun 2021) Natural Gas	54%
Platinum <=56 (Jan-Jun 2021) Electric	54%
Platinum <=56 (Jan-Jun 2021) Natural Gas	54%
Silver 59-62 (July-Dec 2021) Electric	54%
Silver 59-62 (July-Dec 2021) Natural Gas	54%
Gold 57-58 (July-Dec 2021) Electric	54%
Gold 57-58 (July-Dec 2021) Natural Gas	54%
Platinum <=56 (July-Dec 2021) Electric	54%
Platinum <=56 (July-Dec 2021) Natural Gas	54%

Table 132 presents the resulting net electric savings, demand reduction, and natural gas savings.

TABLE 132. 2021 RESIDENTIAL NEW CONSTRUCTION PROGRAM *EX POST* NET SAVINGS

MEASURE	*EX POST* GROSS SAVINGS			NTG	*EX POST* NET SAVINGS		
	KWH	KW	THERMS		KWH	KW	THERMS
Silver 66-75 (Jan-Jun 2021) Electric	27,406.97	8.859	0.00	54%	14,799.76	4.784	0.00
Silver 66-75 (Jan-Jun 2021) Natural Gas	0.00	0.000	24,357.20	54%	0.00	0.000	13,152.89
Gold Star 57-65 (Jan-Jun 2021) Electric	110,754.39	51.072	0.00	54%	59,807.37	27.579	0.00
Gold Star 57-65 (Jan-Jun 2021) Natural Gas	0.00	0.000	129,489.69	54%	0.00	0.000	69,924.43
Platinum <=56 (Jan-Jun 2021) Electric	17,787.44	7.685	0.00	54%	9,605.22	4.150	0.00
Platinum <=56 (Jan-Jun 2021) Natural Gas	0.00	0.000	23,886.72	54%	0.00	0.000	12,898.83
Silver 59-62 (July-Dec 2021) Electric	921.26	0.481	0.00	54%	497.48	0.260	0.00
Silver 59-62 (July-Dec 2021) Natural Gas	0.00	0.000	44,438.96	54%	0.00	0.000	23,997.04
Gold 57-58 (July-Dec 2021) Electric	460.63	0.240	0.00	54%	248.74	0.130	0.00
Gold 57-58 (July-Dec 2021) Natural Gas	0.00	0.000	16,109.07	54%	0.00	0.000	8,698.90
Platinum <=56 (July-Dec 2021) Electric	4,145.66	2.163	0.00	54%	2,238.66	1.168	0.00
Platinum <=56 (July-Dec 2021) Natural Gas	0.00	0.000	16,281.23	54%	0.00	0.000	8,791.87
Total Savings	161,476.35	70.500	254,562.88	54%	87,197.23	38.070	137,463.95

Table 133 shows the NTG for each fuel type. The 2021 program evaluation used 2020 freeridership values and NTG ratios (Table 134).

TABLE 133. 2021 RESIDENTIAL NEW CONSTRUCTION NTG 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.)	443,671.68	161,476.35	54%	87,197.23
Peak Demand Reduction (kW)	124.005	70.500	54%	38.070
Natural Gas Energy Savings (therms/yr.)	289,669.28	254,562.88	54%	137,463.95

TABLE 134. 2021 RESIDENTIAL NEW CONSTRUCTION PROGRAM-LEVEL NTG

RESPONSES	FREERIDERSHIP	SPILLOVER	NTG RATIO
N/A	46%	N/A	54%

PROCESS EVALUATION

In 2021, the evaluation team conducted a very limited process evaluation. The evaluation team conducted a phone call with the implementer, TRC, where the impact of program design changes on 2021 participation was discussed, as well as any possible COVID impacts on the program.

PROGRAM DESIGN CHANGE

Program staff indicated they had not heard any negative feedback from builders regarding the midyear program design change. A big reason for the lack of negative feedback was that the overall incentive for a combination customer (natural gas and electric incentive) remained unchanged. The incentive value switched from the electric to the natural gas side. A significant percentage of the projects in the second half of the year were either natural gas or combined gas and electric customers.

COVID IMPACT

Whereas several 2021 efficiency programs experienced negative impacts due to COVID, program implementer staff saw an uptick in housing permits, housing starts, and housing completions monthly over the course of 2021. There were consistent month-over-previous-month increases to housing starts, including 11% in October 2021. The implementer attributes the success of ongoing program participation to HERS raters. With the COVID-19 pandemic, there has been a trend for some employees to work from home and move away from major cities, which increased housing starts in 2021 and will likely continue.

CONCLUSIONS AND RECOMMENDATIONS

CONCLUSION 1: HOMES HAD SIGNIFICANTLY MORE NATURAL GAS SAVINGS THAN ELECTRIC ENERGY AND PEAK DEMAND SAVINGS.

Based on *ex post* model results, the evaluation team estimated that *ex post* natural gas therm savings, when converted to its kWh equivalent, were approximately 46 times the evaluated electricity kWh savings. *Ex post* electric savings, both energy and peak demand, were significantly lower than *ex ante* savings. The realization rate for kWh was 36% and the realization rate for kW was 57%, while the therm savings realization rate was 88%.

Recommendations:

- Use *ex post* savings values from the second half of 2021 for planning purposes going forward. Lower savings due to the 2020 Indiana Residential Code may have an adverse effect on the cost-effectiveness of the program and should be monitored.
- Consider having the evaluation team perform modeling of other high efficiency electric appliances, like 15+ SEER heating and cooling systems and heat pump water heaters, possibly creating a "Platinum Plus" tier for builders who install high efficiency appliances.
- Enforce program eligibility requirements to maximize program savings. For instance, in the second half sample of 6 homes receiving an electric incentive, only 4 of those were compliant with the program requirement that "All Central AC systems must be rated 15 SEER or greater to qualify for the electric service incentive."[31] The other two installed 13 SEER units, which is code minimum and would deliver zero electric savings. Requiring 15+ SEER ACs could increase electric savings by at least 20% over 13 SEER. A higher efficiency Central AC requirement will become even more important in 2023 and beyond, when the federal code jumps from 13 to 14 SEER minimum efficiency.

[31] Accessed April 6, 2022. https://www.nipsco.com/partner-with-us/builders-and-developers/residential-new-construction-program

CONCLUSION 2: A ROBUST PROCESS AND NET-TO-GROSS EVALUATION SHOULD BE CONDUCTED IN 2022.

Due to the code change and midyear program design change, the evaluation team did not assess process or net-to-gross metrics for the 2021 evaluation. The evaluation team recommends a full process and impact evaluation in 2022, as priorities allow, to assess a full year of program performance under the new design.

Recommendations:

- In the next evaluation cycle, a survey should be conducted with builders to gather NIPSCO-specific metrics, satisfaction, and process findings. For example, the evaluation team adopted efficient lighting installed percentages from CenterPoint Indiana's 2020 Evaluation; future evaluations should conduct research to gather NIPSCO-specific home characteristics that are not in the HERs reports. Additionally, NTG should be re-assessed to better understand the new program design's influence on builder decision-making and the impact of the more stringent building code on freeridership.

CONCLUSION 3: THE ADOPTION OF THE 2020 INDIANA RESIDENTIAL CODE SIGNIFICANTLY REDUCED PROGRAM SAVINGS IN 2021, BUT GOING FORWARD, SOFTWARE IS ALREADY IN PLACE FOR SAVINGS TO BE MORE ACCURATELY ESTIMATED IN REAL TIME.

The new energy code raises the baseline for the program by requiring all homes to install more efficient lighting and insulation and build tighter homes and duct systems.

Builders working in conjunction with HERS raters are typically using rating software packages such as REM/Rate and Ekotrope to confirm homes are meeting program requirements. Both software options can calculate energy savings for each home that is built. The program implementer could leverage these data and capability to increase the accuracy of estimates of energy savings prior to evaluation. Both software options offer state-specific reports and even program-specific reports (e.g., PPL Electric Utilities in Pennsylvania, First Energy in Ohio, and EMPower in Maryland) that calculate energy and demand savings for each home submitted to the program, allowing program implementers to track program progress.

Recommendations:

- Explore software-based solutions that would allow the program to have more insight into program performance in real time.
- Explore HERS certificate submission to also include estimated kWh, kW, therms savings.
- Consider a mid-year evaluation "lite" to model a sample of homes and see if there are any major changes.

CONCLUSION 4: DESPITE INCREASED HOUSING STARTS IN 2021, PROGRAM PARTICIPATION DROPPED SIGNIFICANTLY WITH THE MID-YEAR PROGRAM CHANGE.

Participation in the second six months of the year was only 19% of total participation. This is likely due almost exclusively to the significant shift in HERS score required to qualify for an incentive under the new building code.

Where previously homes could earn a silver incentive with a score of 75, homes under the modified program must achieve a 62 or lower to qualify for an incentive.

Recommendations:

- Ramp up outreach efforts to builders and HERS raters to ensure they are aware of the program incentives and eligibility requirements.
- Track raw HERS scores upon application, instead of tracking just the broader HERS category. This will allow for more granular analysis of where population at large is landing on HERS scores.
- Consider right-sizing program goals to reflect more realistic participation numbers.

11. SCHOOL EDUCATION PROGRAM

The School Education program is designed to produce cost-effective electric and gas savings by influencing fifth grade students and their families to focus on the efficient use of electricity and gas. It provides classroom instruction, posters, and activities aligned with national and state learning standards and energy education kits filled with energy saving products and advice. Students participate in an energy education presentation at school, learning about basic energy concepts through class lessons and activities. Students also receive an energy education kit of quality, high-efficiency products and are instructed to install the energy-efficient products at home with their families, as well as complete a worksheet. The experience at home completes the learning cycle started at school.

TRC was the program implementer and managed the overall program and acted as a liaison between NIPSCO and program subcontractors. To deliver the program, TRC contracted with National Energy Foundation (NEF). NEF was responsible for several key program components, including:

- Maintaining a program website
- Marketing and outreach
- Creating educational collateral and kit materials
- Engaging teachers and explaining to them how to use the program's educational materials in their classrooms
- Distributing kits to students
- Reporting on the number of kits shipped
- Collecting student responses to the Home Energy Worksheet (HEW)
- Dispersing teacher mini grants when students returned the target percentage of HEWs

NEF distributed the kits and curriculum materials to teachers who formally committed to participate in the program. They distributed two types of kits:

1. Combo kits for schools in NIPSCO's natural gas and electric territory.
2. Gas-only kits for schools in NIPSCO's natural gas territory, but not in NIPSCO's electric territory.

The kits contained the following energy-saving measures, along with the other educational materials and activities:

- Gas Only Kits Measures
  - 2 Low Flow Showerheads
  - 1 Kitchen Aerator (1.5 gpm or less)
  - 2 Bathroom Aerators (1.0 gpm or less)
  - 1 HVAC Filter Whistle
  - 1 Digital Thermometer
  - 1 Water Flow Test Bag
  - 1 Plumber's Tape
- Combo Kits Measures
  - 4 ENERGY STAR® Certified 9W A-Line LED Bulbs
  - 1 Low Flow Showerhead
  - 1 Kitchen Aerator (1.5 gpm or less)
  - 1 Bathroom Aerator (1.0 gpm or less)
  - 1 LED Nightlight
  - 1 HVAC Filter Whistle
  - 1 Digital Thermometer
  - 1 Water Flow Test Bag
  - 1 Plumber's Tape

In general, program participation is driven by direct outreach to schools that have participated in the program in prior years. The implementation team also used community outreach, direct mail, and social media to promote the School Education program.

PROGRAM PERFORMANCE

In 2021, the NIPSCO team adjusted our timelines across programs to deliver evaluation reports earlier than in previous years. To meet the new timeline requirements, for most programs the evaluation teams began analysis earlier, and conducted our impact analyses on 11 months of data instead of the full calendar year (January 1 to November 30, 2021). The evaluation metrics developed during this analysis (including in-service rates, realization rates, net-to-gross ratios, etc.) and included in the first draft versions of the report were applied to the full year of data as part of the final, compiled report and included in Table 135 below.

Table 135 summarizes savings for the full year of program performance, including program savings goals.

TABLE 135. 2021 SCHOOL EDUCATION PROGRAM SAVINGS SUMMARY – FULL YEAR 2021

METRIC	GROSS SAVINGS GOAL	*EX ANTE*	AUDITED	VERIFIED	*EX POST* GROSS	*EX POST* NET	GROSS GOAL ACHIEVEMENT
Electric Energy Savings (kWh/yr.)	2,236,025.00	2,239,640.70	2,239,584.30	2,261,819.78	2,066,563.10	1,817,652.54	92%
Peak Demand Reduction (kW)	199.750	200.073	203.975	217.813	162.802	133.532	82%
Natural Gas Energy Savings (therms/yr.)	94,647.50	94,956.19	94,995.21	91,762.71	91,824.05	95,501.94	97%

Table 136 summarizes savings evaluated during the program's evaluation period, which was from January 2021 to November 2021. As of November 2021, the program fell short of meeting electric, peak demand, and gas savings goals. The baseline wattage for LEDs was lower than in previous evaluation years, which is likely the largest contributor to this shortfall.

TABLE 136. 2021 SCHOOL EDUCATION PROGRAM SAVINGS SUMMARY – JAN THROUGH NOV 2021

METRIC	*EX ANTE*	AUDITED	VERIFIED	*EX POST* GROSS	*EX POST* NET
Electric Energy Savings (kWh/yr.)	1,588,053.50	1,588,013.51	1,603,779.94	1,465,330.02	1,288,835.96
Peak Demand Reduction (kW)	141.865	144.632	154.444	115.437	94.683
Natural Gas Energy Savings (therms/yr.)	64,339.95	64,367.34	62,357.31	62,899.33	65,413.53

Table 137 summarizes *ex post* gross values and NTG adjustment factors.

TABLE 137. 2021 SCHOOL EDUCATION PROGRAM ADJUSTMENT FACTORS

METRIC	REALIZATION RATE (%) [a]	FREERIDERSHIP	SPILLOVER	NTG (%) [b]
Electric Energy Savings (kWh/yr.)	92%	21%	9%	88%
Peak Demand Reduction (kW)	81%	27%	9%	82%
Natural Gas Energy Savings (therms/yr.)	98%	5%	9%	104%

[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 2021. As is outlined in Table 138, the program spent 97% of its allocated electric budget and 96% of its allocated natural gas budget.

TABLE 138. 2021 SCHOOL EDUCATION PROGRAM EXPENDITURES

FUEL	PROGRAM BUDGET	PROGRAM EXPENDITURES	BUDGET SPENT (%)
Electric	$447,022.69	$432,310.37	97%
Natural Gas	$345,077.06	$332,980.48	96%

EVALUATION METHODOLOGY

To inform the 2021 NIPSCO impact and process evaluation, the evaluation team completed the following research activities:

- **Program staff interviews and discussions,** to understand the program design and delivery.
- **Documentation and materials review,** to provide context on program implementation.
- **Phone survey with parents/guardians of students who received energy saving kits and educational materials in their classrooms.** This survey informed the net-to-gross analysis and process feedback for the program.
- **Engineering analysis**, to review program savings assumptions and algorithms for reasonableness and accuracy.

Each section of this chapter provides further detail on the methodology of each evaluation activity.

IMPACT EVALUATION

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

- What assumptions were used to develop deemed savings estimates? Are there any updates that should be made?
- What are *ex post* program savings? Do these suggest any needed updates to program design, delivery, or savings assumptions?
- What are installation rates for kit measures? Are there certain measures that are installed most often? Least often?
- How effective was the program in influencing participant decision making? What are the program's spillover and freeridership estimates (net savings)?

For all measure types, the evaluation team compared its engineering calculations to NIPSCO's *ex ante* savings, basing its savings methodologies and inputs for each measure on several sources: standard engineering practices, the 2015 Indiana TRM (v2.2), and NIPSCO's program tracking database.[32]

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

AUDITED SAVINGS

To audit program savings, the evaluation team performed the following reviews to verify alignment with the program's scorecard:

- **Audited Kits Quantity.** Reviewed program tracking data provided by the implementer and audited the number of kits distributed.
- **Confirm Measure-Level Savings Calculations.** Reviewed per-measure and per-kit savings in the documentation provided by NIPSCO.
- **Savings Estimate Review.** Confirmed program-level total savings.

AUDITED QUANTITY OF KITS

NIPSCO reported a total of 8,345 combo kits distributed through the School Education program. Note that gas kits were not included in this evaluation, as they were not present in the January – November 2021 tracking data. These reported scorecard values were checked against the program tracking data and, as Table 139 illustrates, the values aligned.

TABLE 139. 2021 SCHOOL EDUCATION PROGRAM AUDITED KIT QUANTITY

KIT TYPE	SCORECARD	TRACKING DATA
Combo Kits	8,345	8,345

CONFIRMATION OF MEASURE-LEVEL SAVINGS

The evaluation team reviewed the kit savings documentation in the 2021 Program Design file, which contained measure-level and kit-level savings. Importantly, NIPSCO included installation rates from past EM&V efforts in their *ex ante* assumptions for the kit program. The measure calculations included discount rates to adjust savings for both installation practices and water heater fuel saturation.

Upon review of this document, measure-level savings values in the tracking data aligned with NIPSCO's kit savings documentation. However, program tracking data savings are reported at the kit-level with a rounded total kit value, and NIPSCO's Program Design file savings are reported at the measure-level with un-rounded per measure values. This difference in the unit of analysis resulted in rounding errors, meaning that the sum of total measure savings was off slightly from the tracking data savings. These rounding errors will be noted where applicable in the remainder of this report.

SAVINGS ESTIMATE REVIEW

In addition, the evaluation team reviewed measure-level and total savings values. The savings values from the program tracking data were summed and compared to the savings values reported in the scorecard. The savings values align across all savings types (Table 140).

TABLE 140. 2021 SCHOOL EDUCATION PROGRAM TOTAL SAVINGS REVIEW

UNIT OF ENERGY SAVINGS	SCORECARD	TRACKING DATA
kWh	1,588,053.50	1,588,053.50
kW	141.865	141.865
therms	64,339.95	64,339.95

VERIFIED SAVINGS

The evaluation team calculated in-service rates (ISRs) for the School Education program using self-reported parent survey data and the Home Energy Worksheet (HEW) data.

Parents whose children participated in the School Education program were asked to fill out HEWs, which collect information on home characteristics, energy behavior, and initial measure installation rates. The HEWs are voluntary; not all parents complete them. HEWs are completed very shortly after kit distribution and likely do not reflect long-term installation rates as participants may install or uninstall measures as time passes. Thus, the primary data source for in-service rates was the parent survey, fielded through this evaluation, where respondents were asked to self-report if measures were installed at the time of the survey.

Using the same approach as last year, the evaluation team examined if survey ISRs were representative of the broader population of customers who completed the HEW, by comparing HEW in-service rates for the full HEW population (n = 4,700), to the subsample of those who completed the survey (n = 122).

As Table 141 illustrates, relative to the full HEW population, the sample of customers who responded to the parent survey generally had higher in-service rates even at the time of the HEW; apart from bathroom and kitchen aerators, which had slightly lower in-service rates. This may be driven by response bias, wherein these respondents are more engaged with the program and thus more likely to participate in the follow-up parent survey. In short, it may be the case that the evaluation team primarily surveyed engaged participants, who were most likely to install the kit measures.

TABLE 141. 2021 SCHOOL EDUCATION PROGRAM IN-SERVICE RATES: HEW & EM&V SURVEY

MEASURE	FULL HEW POPULATION ISR (n = 4,700)	PARENTS WHO COMPLETED THE HEW AND THE EM&V SURVEY (n = 122)	
		HEW ISR	EM&V ISR
LED (9W) - Combo Kit	36%	42%	77%
Nightlight - Combo Kit	71%	82%	81%
Bathroom Aerator - Combo Kit	24%	23%	26%
Kitchen Aerator - Combo Kit	23%	20%	30%
Low Flow Showerhead - Combo Kit	26%	26%	30%
Filter Whistle - Combo Kit	29%	31%	22%

To account for this potential response bias when calculating ISRs for the program, the evaluation team adjusted ISRs to align with likely installation 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 = 122). 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 142).

Like 2020, furnace whistles experienced the highest removal rate. Nearly one-third of HEW participants had the filter whistle measure installed when they filled out the HEW and less than one-fourth (22%) of survey respondents said the filter whistle was still installed at the time of the EM&V survey. Other measures, most notably LEDs, experienced higher rates of installation as time passed between filling out the HEW and completing the EM&V survey.

Finally, to account for LED lamps currently stored for future use, the evaluation team calculated carryover savings for the LEDs included in the kit. The evaluation team used the UMP-recommended "Discount Future Savings" method (National Renewable Energy Laboratory/UMP Chapter 21, 2015) to calculate carryover savings. This method assumes most bulbs placed in storage (up to 97%) are installed within four years (including the initial program year), with 24% of bulbs left over from year one installed in year two, 24% in year three, and so on. However, given upcoming expected baseline lighting changes anticipated to be applied by EISA 2007, all standard LEDs are anticipated to function as baseline lamps within the next several years. Thus, the evaluation team did not extend LED carryover savings beyond 2022 (Year two in the UMP-recommended method). This is consistent with how NIPSCO program evaluations treated carryover savings for the 2021 evaluation year. This resulted in a final ISR for LEDs of 73%.

TABLE 142. 2021 SCHOOL EDUCATION PROGRAM MEASURE-LEVEL ADJUSTED ISRS

MEASURE	PARENTS WHO COMPLETED THE HEW AND THE EM&V SURVEY (n = 122)		RELATIVE CHANGE IN ISR	FULL HEW POPULATION ISR (n = 4,700)	FINAL ADJUSTED ISR
	HEW ISR	EM&V ISR			
LED (9W) - Combo Kit	42%	77%	184%	36%	73%[a]
Nightlight - Combo Kit	82%	81%	99%	71%	70%
Bathroom Aerator - Combo Kit	23%	26%	117%	24%	28%
Kitchen Aerator - Combo Kit	20%	30%	150%	23%	35%
Low Flow Showerhead - Combo Kit	26%	30%	113%	26%	30%
Filter Whistle - Combo Kit	31%	22%	69%	29%	20%

[a] The final LED ISR includes the addition of carryover savings. The adjusted ISR without carryover savings was 66%.

WATER HEATER SATURATION

The evaluation team also adjusted the *ex ante* electric and natural gas saturation rates for water-saving measures by analyzing data from the 2021 HEW results (Table 143). Results indicated a slight discrepancy between *ex ante* and verified electric and natural gas domestic water heating saturation rates.

TABLE 143. 2021 SCHOOL EDUCATION PROGRAM WATER HEATER FUEL SATURATION

SAVINGS TYPE	ELECTRIC WATER HEATING SATURATION RATE (%)	NATURAL GAS WATER HEATING SATURATION RATE (%)
Reported *ex ante*	22%	73%
Verified [a]	23%	62%

[a] Electric and natural gas saturation rates do not total 100% because 7% of respondents selected "Other" and 9% selected "Propane" on the HEW.

Table 144 summarizes the per unit audited and verified savings values with ISRs applied. In addition to ISRs, the evaluation team applied water heating saturation adjustment factors to all water saving devices. As noted above, *ex ante* savings already include ISR and water heater saturation adjustments, and these were updated using the current calculated ISRs and water heater saturation adjustment factors.

TABLE 144. 2021 SCHOOL EDUCATION *EX ANTE* AND VERIFIED PER UNIT MEASURE SAVINGS

MEASURE	ISRS	*EX ANTE* KWH SAVINGS [a]	VERIFIED KWH SAVINGS	*EX ANTE* KW REDUCTION	VERIFIED KW REDUCTION	*EX ANTE* THERM SAVINGS	VERIFIED THERM SAVINGS
LED (9W) - Combo Kit	73%	28.71	26.20	0.003	0.003	(0.59)	(0.54)
Nightlight - Combo Kit	70%	3.58	3.72	0.000	0.000	0.00	0.00
Bathroom Aerator - Combo Kit	28%	2.99	3.50	0.000	0.000	0.44	0.42
Kitchen Aerator - Combo Kit	35%	21.27	26.84	0.001	0.001	3.11	3.18
Low Flow Showerhead - Combo Kit	30%	38.86	39.32	0.001	0.001	5.67	4.66
Filter Whistle - Combo Kit	20%	8.75	14.01	0.003	0.005	0.84	1.35

[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. The following section provides the *ex post* gross analysis results.

ENGINEERING REVIEWS

The evaluation team referred to the Indiana TRM (v2.2) and the 2021 Pennsylvania TRM to calculate *ex post* gross electric energy savings, demand reduction, and natural gas savings. Where NIPSCO customer-specific information was available, such as for persons per home and water heater fuel saturation, the evaluation team revised input assumptions. Appendix 9 contains details on the specific algorithms, variable assumptions, and references for all program measure *ex post* gross calculations.

Through the engineering review, the evaluation team found differences between *ex ante* and *ex post* gross savings. These differences were primarily driven by the following factors:

- The evaluation team applied updated ISRs, persons per household, bathroom faucets and showerheads per household, and water heater saturation rates based on the 2021 HEW and parent survey.
- The evaluation team referred to the 2021 Pennsylvania TRM for the filter whistle *ex post* savings.
- The evaluation team updated the incandescent replacement factor (IRF) based on the 2021 survey.

The following sections summarize the team's findings and recommendations based on the engineering review.

EX POST GROSS SAVINGS

Ex post savings reflect the engineering adjustments made to the verified measure savings. The evaluation team calculated *ex post* electric energy, peak demand, and natural gas energy savings for each measure kit using algorithms from the Indiana TRM (v2.2) and the 2021 Pennsylvania TRM. The evaluation team leveraged the 2021 HEW and survey results to estimate people per household, in-service rates, and water heating fuel type saturation, 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 the 2021 School Education program measures. *Ex post* savings calculations differed from *ex ante* analysis for the following overarching reasons:

- LED: Updated baseline wattage and ISR values for LEDs. The 2021 *ex ante* analysis applies the UMP baseline wattage of 43 watts, whereas the *ex post* analysis applies a blended baseline, calculated using 2021 survey results, of 38.4 watts. The 2021 survey results, used to calculate the *ex post* baseline, are provided in Appendix 9*,* and a discussion of therm penalties generated by LED lighting is provided below.
- Nightlight: Updated ISR and incandescent replacement factor values in the *ex post* analysis decrease energy savings, compared to *ex ante*.
- Filter whistle: Evaluation methodology. The evaluation team referred to the 2021 Pennsylvania TRM to calculate filter whistle electric savings, which assigns electric energy and demand savings to the blower motor energy reduction because dirty filters increase electricity consumption for the circulating fan. The *ex ante* approach referenced the Illinois TRM (v8), which assigns electric energy, demand, and therm savings. The evaluation team does not assign therm savings for the filter whistle measure because, in our best judgment, any therm savings will be minimal, and a review of available literature reveals a lack of defensible evidence for assigning therm savings at this time. Notably, the filter whistle is a provisional measure in Illinois TRM (v8) and was subsequently removed from Illinois TRM (v9) due to "evaluation results showing filter alarms being ineffectual at indicating a dirty filter."[33]
- Low flow faucet aerators and showerheads: Updated water heating fuel saturation values, ISRs, and household characteristics. The evaluation team applied updated water heating fuel saturation percentages and ISRs based on 2021 HEW results. As reported in Table 143, the verified natural gas water heater saturation rate is lower than *ex ante*, 62% and 73%, respectively, and the verified electric water heater saturation rate is higher than *ex ante*, 28% and 22%, respectively. Additionally, the average number of people per home reported in the 2021 HEW was lower compared to the 2020 HEW average. The lower natural gas water heater saturation rate, combined with fewer people per home, drove down the *ex post* therm savings and increased *ex post* energy and demand savings for the aerator and showerhead measures.

[33] Illinois Energy Efficiency Stakeholder Advisory Group. September 25, 2020. 2021 Illinois Statewide Technical Reference Manual for Energy Efficiency Version 9.0. "Volume 3: Residential Measures.".

TABLE 145. 2021 SCHOOL EDUCATION PROGRAM *EX ANTE* & *EX POST* GROSS PER-MEASURE SAVINGS VALUES

MEASURE	QTY PER KIT	*EX ANTE* DEEMED SAVINGS [a]			*EX POST* GROSS PER-MEASURE SAVINGS		
		KWH	KW	THERMS	KWH	KW	THERMS
LED (9W) - Combo Kit	4	114.84	0.012	(2.35)	90.62	0.010	0.00
Nightlight - Combo Kit	1	3.58	0.000	0.00	1.34	0.000	0.00
Bathroom Aerator – Combo Kit	1	2.99	0.000	0.44	3.19	0.000	0.38
Kitchen Aerator – Combo Kit	1	21.27	0.001	3.11	26.03	0.001	3.09
Low Flow Showerhead - Combo Kit	1	38.86	0.001	5.67	34.33	0.001	4.07
Filter Whistle - Combo Kit	1	8.75	0.003	0.84	20.09	0.002	0.00
Total Combo Kit Savings		190.30	0.017	7.71	175.59	0.014	7.54

[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. 2021 SCHOOL EDUCATION NOTABLE DIFFERENCES BETWEEN *EX ANTE* & *EX POST* GROSS

MEASURE(S)	*EX ANTE* SOURCES AND ASSUMPTIONS	*EX POST* GROSS SOURCES AND ASSUMPTIONS	PRIMARY REASONS FOR DIFFERENCES
Kitchen Aerators Bathroom Aerators Low flow Showerheads	Indiana TRM (v2.2) and 2019 EMV	Indiana TRM (v2.2), with 2021 HEW updates for people, faucets, and showerheads per household.	The *ex post* analysis incorporates 2021 survey-derived, NIPSCO-specific values for people, faucets, and showerheads per household. The *ex post* analysis also includes updated water heating fuel saturation percentages based on 2021 HEWs.
9W LED	Indiana TRM (v2.2) and 2019 EMV	Indiana TRM (v2.2); 2021 School Kit program survey for baseline wattages	The *ex ante* analysis applies the UMP baseline wattage. The *ex post* analysis applies a blended baseline wattage based on results of the 2021 School Education program survey. The *ex post* therm penalties for LEDs are reported separately (discussed below).
LED Nightlight	Indiana TRM (v2.2) and 2019 EMV	Indiana TRM (v2.2); 2021 School Kit program survey for IRF	The *ex ante* analysis applies the 2019 incandescent replacement factor (IRF) to account for LED nightlights replacing incandescent nightlights. For the *ex post* analysis, the evaluation team updated the IRF, which was considerably lower than the 2019 value (0.14 compared to 0.39).
Filter Whistle	Illinois TRM (v8)	2021 Pennsylvania TRM and Indiana TRM (v2.2)	The *ex ante* analysis assigns cooling system savings to all combo and electric kit participants and full therm savings to all combo and gas kit participants. The *ex post* analysis refers to the Indiana TRM (v2.2) for the percentage of households with central air conditioning, and the evaluation team's review of available literature reveals a lack of defensible evidence for assigning therm savings currently.

WASTE HEAT FACTOR – THERM PENALTIES

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

The *ex ante* savings for all kit programs include therm penalties. 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. In total, the therm penalty for cost-effectiveness analysis is – 21,788.09 therms (Table 147).

TABLE 147. 2021 SCHOOL EDUCATION PROGRAM WASTE HEAT FACTOR THERM PENALTY

MEASURE	WASTE HEAT FACTOR THERM PENALTY
LED (9W) - Combo Kit	(21,788.09)

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 148 through Table 150) show the program's *ex ante* reported savings, verified savings, and *ex post* gross savings.

TABLE 148. 2021 SCHOOL EDUCATION PROGRAM *EX ANTE* & *EX POST* GROSS ELECTRIC ENERGY SAVINGS

MEASURE	*EX ANTE* [a] ELECTRIC ENERGY SAVINGS (KWH/YR.)	AUDITED GROSS ELECTRIC ENERGY SAVINGS (KWH/YR.)	VERIFIED GROSS ELECTRIC ENERGY SAVINGS (KWH/YR.)	*EX POST* GROSS ELECTRIC ENERGY SAVINGS (KWH/YR.)
LED (9W) - Combo Kit	-	958,371.84	874,514.31	756,197.67
Nightlight - Combo Kit	-	29,875.10	31,066.24	11,151.98
Bathroom Aerator - Combo Kit	-	24,965.85	29,232.74	26,614.17
Kitchen Aerator - Combo Kit	-	177,505.80	223,968.92	217,218.49
Low Flow Showerhead - Combo Kit	-	324,286.01	328,089.96	286,514.99
Filter Whistle - Combo Kit	-	73,008.91	116,907.78	167,632.73
Total Savings	1,588,053.50	1,588,013.51	1,603,779.94	1,465,330.02
Total Program Realization Rate				92%

Note: Totals may not sum properly due to rounding.
[a] Program tracking data is summed at the kit-level (not measure level). Therefore, *ex ante* savings are only reported at the summary level, due to rounding errors.

TABLE 149. 2021 SCHOOL EDUCATION PROGRAM *EX ANTE* & *EX POST* GROSS PEAK DEMAND REDUCTION

MEASURE	*EX ANTE* [a] PEAK DEMAND REDUCTION (KW/YR.)	AUDITED GROSS PEAK DEMAND REDUCTION (KW/YR.)	VERIFIED GROSS PEAK DEMAND REDUCTION (KW/YR.)	*EX POST* GROSS PEAK DEMAND REDUCTION (KW/YR.)
LED (9W) - Combo Kit	-	103.668	94.597	81.799

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.)
Nightlight - Combo Kit	-	0.000	0.000	0.000
Bathroom Aerator - Combo Kit	-	1.488	1.743	1.731
Kitchen Aerator - Combo Kit	-	4.403	5.555	5.524
Low Flow Showerhead - Combo Kit	-	9.649	9.762	9.718
Filter Whistle - Combo Kit	-	25.423	42.786	16.666
Total Savings	141.865	144.632	154.444	115.437
Total Program Realization Rate				81%

Note: Totals may not sum properly due to rounding.
[a] Program tracking data is summed at the kit-level (not measure level). Therefore, *ex ante* savings are only reported at the summary level, due to rounding errors.

TABLE 150. 2021 SCHOOL EDUCATION PROGRAM *EX ANTE* & *EX POST* GROSS NATURAL GAS ENERGY SAVINGS

MEASURE	*EX ANTE* [a] NATURAL GAS ENERGY SAVINGS (THERMS/YR.)	AUDITED GROSS NATURAL GAS ENERGY (THERMS/YR.)	VERIFIED GROSS NATURAL GAS ENERGY SAVINGS (THERMS/YR.)	*EX POST* GROSS NATURAL GAS ENERGY SAVINGS (THERMS/YR.)
LED (9W) - Combo Kit	-	(19,579.64)	(17,866.42)	0.00
Nightlight - Combo Kit	-	0.00	0.00	0.00
Bathroom Aerator - Combo Kit	-	3,644.75	3,467.01	3,156.45
Kitchen Aerator - Combo Kit	-	25,913.99	26,562.75	25,762.15
Low Flow Showerhead - Combo Kit	-	47,342.36	38,911.53	33,980.73
Filter Whistle - Combo Kit	-	7,045.88	11,282.44	0.00
Total Savings	64,339.95	64,367.34	62,357.31	62,899.33
Total Program Realization Rate				98%

Note: Totals may not sum properly due to rounding.
[a] Program tracking data is summed at the kit-level (not measure level). Therefore, *ex ante* savings are only reported at the summary level, due to rounding errors.

EX POST NET SAVINGS

The evaluation team calculated freeridership and participant spillover using the survey data collected from 2021 respondents. The evaluation team found varying levels of freeridership by measure. While spillover savings were very high in 2020 (52%), they reduced to 9% in 2021, which aligns with prior evaluation years. Table 151 shows the NTG ratios by measure.

TABLE 151. 2021 SCHOOL EDUCATION PROGRAM NET-TO-GROSS RATIOS BY MEASURE

MEASURE	NTG
LED (9W) - Combo Kit	72%
Nightlight - Combo Kit	96%
Bathroom Aerator - Combo Kit	104%
Kitchen Aerator - Combo Kit	103%
Low Flow Showerhead - Combo Kit	105%
Filter Whistle - Combo Kit	108%

FREERIDERSHIP

The evaluation team calculated measure-level freeridership values for each participant using the following survey questions:

- FR1. If you had not received the kit, would you have purchased a [MEASURE] on your own?
- FR2. "Would you have purchased the [MEASURE]…around the same time you received the kit, later but within one year, or later but more than one year?"

Respondents who gave a response of "No" to FR1 were assigned a freeridership score of 0%. Those who said "Yes" were asked FR2 and assigned a freeridership score based on the timing of their decision (Table 152). In addition to these questions, participants who installed LED measures were also asked to quantify the quantity of lightbulbs they would have installed without the program. A full flowchart of the LED freeridership approach is included in the Appendix 9.

TABLE 152. 2020 SCHOOL EDUCATION PROGRAM FREERIDERSHIP ASSIGNMENT

FR2. RESPONSE OPTION	ASSIGNED FREERIDERSHIP VALUE
Around the same time you received the kit	100%
Later but within one year	50%
More than one year later	0%
Not sure	25%

As Table 153 illustrates, freeridership rates were low, apart from LEDs (37%).

TABLE 153. 2021 SCHOOL EDUCATION PROGRAM FREERIDERSHIP BY MEASURE

MEASURE	ASSIGNED FREERIDERSHIP VALUE
LED (9W) - Combo Kit	37%
Nightlight - Combo Kit	14%
Bathroom Aerator - Combo Kit	5%
Kitchen Aerator - Combo Kit	6%

Low Flow Showerhead - Combo Kit	4%
Filter Whistle - Combo Kit	1%

SPILLOVER

The evaluation team estimated participant spillover using survey responses and the Indiana TRM (v2.2) and program measure calculations as a baseline reference. If survey respondents met the following criteria, based on self-reported EM&V survey responses, they qualified as a spillover participant:

1. Installed an additional energy efficient measure(s) after participating in the School Education program
2. Deemed participation in the School Education program to be "very influential" in their decision to install an additional energy efficient measure
3. Did not receive a rebate for the additional measure

Three survey respondents installed a total of three additional energy efficient measures totaling 12.27 MMBtu in spillover savings. Program participation spillover was calculated by dividing the sum of additional spillover savings by the total gross savings achieved by all surveyed program respondents (Table 154).

TABLE 154. 2021 SCHOOL EDUCATION PROGRAM SPILLOVER

SPILLOVER SAVINGS (MMBtu)	SURVEY RESPONDENT PROGRAM SAVINGS (MMBtu)	PARTICIPANT SPILLOVER (%)
12.27	142.44	9%

While participant spillover was unusually high in 2020 – 52% – the 2021 spillover rate of 9% aligns with what the evaluation team has found in previous evaluation years. For example, spillover was 6% in 2018 and 19% in 2019. The evaluation team hypothesized that program spillover may have been considerably higher in 2020 due to participants' increased time spent at home, due to the COVID-19 pandemic. As restrictions have eased in 2021, it is reasonable to expect that participants may be spending less time at home and may be less focused on home improvement projects than they were in 2020.

NET-TO-GROSS

Table 155 presents the resulting net electric savings, demand reduction, and natural gas savings.

TABLE 155. 2021 SCHOOL EDUCATION PROGRAM *EX POST* NET SAVINGS

MEASURE	*EX POST* GROSS SAVINGS/REDUCTION			NTG	*EX POST* NET SAVINGS/REDUCTION		
	KWH	KW	THERMS		KWH	KW	THERMS
LED (9W) - Combo Kit	756,197.67	81.799	0.00	72%	545,294.14	58.985	0.00
Nightlight - Combo Kit	11,151.98	0.000	0.00	96%	10,650.14	0.000	0.00
Bathroom Aerator - Combo Kit	26,614.17	1.731	3,156.45	104%	27,700.03	1.801	3,285.23
Kitchen Aerator - Combo Kit	217,218.49	5.524	25,762.15	103%	223,865.38	5.693	26,550.47
Low Flow Showerhead - Combo Kit	286,514.99	9.718	33,980.73	105%	299,981.19	10.174	35,577.82
Filter Whistle - Combo Kit	167,632.73	16.666	0.00	108%	181,345.08	18.029	0.00
Total Savings	1,465,330.02	115.437	62,899.33	98%	1,288,835.96	94.683	65,413.53

Table 156 shows the net-to-gross ratios and associated net savings for each fuel.

TABLE 156. 2021 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.)	1,588,053.50	1,465,330.02	88%	1,288,835.96
Peak Demand Reduction (kW)	141.865	115.437	82%	94.683
Natural Gas Energy Savings (therms/yr.)	64,339.95	62,899.33	104%	65,413.53

PROCESS EVALUATION

The evaluation team completed 122 surveys by phone, with parents who participated in the School Education program, to answer the following research questions:

- Are there any updates that should be made to the assumptions used to develop deemed savings estimates? What are installation rates for kit measures?
    - Are there certain measures that are installed most often? Least often?
    - What are the barriers to parents installing equipment from the kit?
- How effective was the program in influencing participant decision making? What are the program's spillover and freeridership estimates (net savings)?
- How satisfied are parents with the equipment included in the kit?
- What are parents' perspectives on the program materials? What are the barriers to parents engaging with program materials?
- Do customers learn about other programs? Do they engage in any additional energy behaviors? Do families move on to participate in other programs? If so, which?
- Does the program experience vary by demographics?

PARTICIPANT FEEDBACK

The evaluation team surveyed 122 parents who participated in the program. The following sections describe the results related to measures within the Energy Efficiency Kits, program satisfaction, and additional programs respondents participated in.

MEASURE INSTALLATION AND SATISFACTION

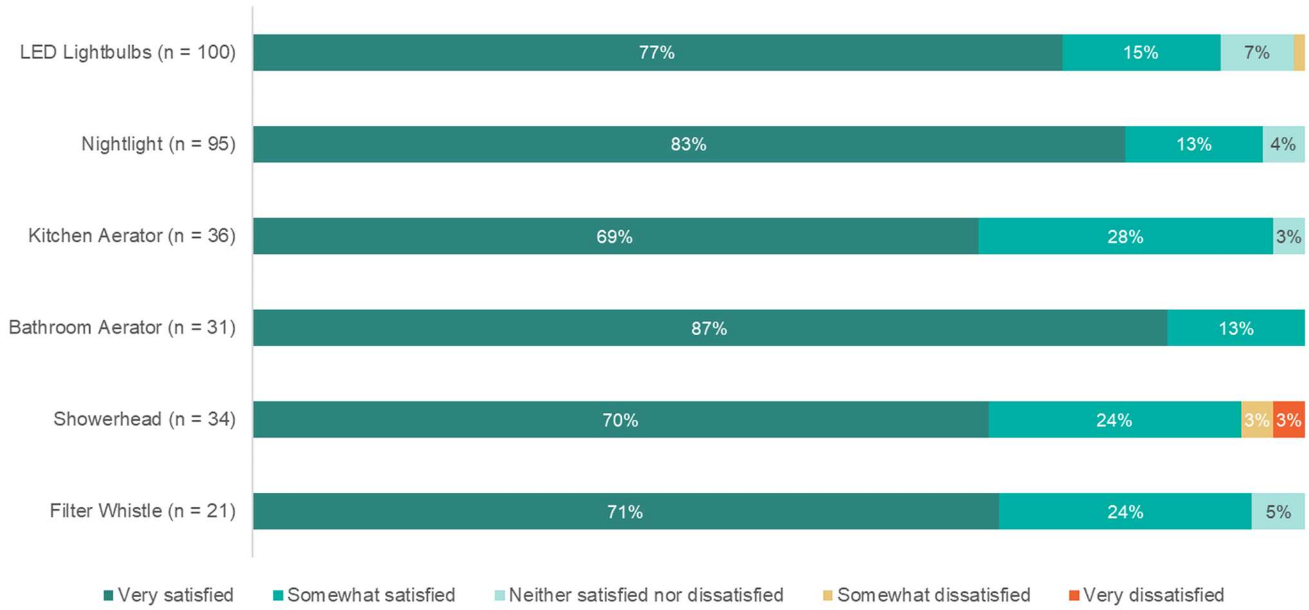
As discussed in the Verified section, installation rates varied by measure. Most respondents reported they have installed LEDs and nightlights at the time we fielded the survey. By contrast, respondents reported lower installation rates for the kitchen aerator and showerhead (30% for each) and bath aerator (26%). Most commonly, respondents who said their water-saving measures were not installed, said they already had the measure installed, it did not fit, or they did not know how to install it.

Notably, as we discuss in the impact section, filter whistles had the lowest installation rates. When asked why the measure was not installed, respondents most mentioned they did not understand its purpose. Other respondents said they forgot about the measure, had not yet installed it, or it did not work for their living situation (e.g., they rent, or their HVAC equipment was not compatible with the filter whistle).

Overall, respondents were satisfied with the kit measures, as shown in Figure 51. Notably, not a single respondent was dissatisfied with the LED lightbulbs, the LED nightlight, or the kitchen faucet aerator.

Despite low installation rates, respondents who installed the filter whistle felt positive about the measure. Nearly three-quarters of respondents (71%) said they were very satisfied with the filter whistle. However, almost all respondents (96%) said they would not have purchased the filter whistle on their own if they had not received it in the kit.

FIGURE 51. 2021 SCHOOL EDUCATION PROGRAM MEASURE SATISFACTION

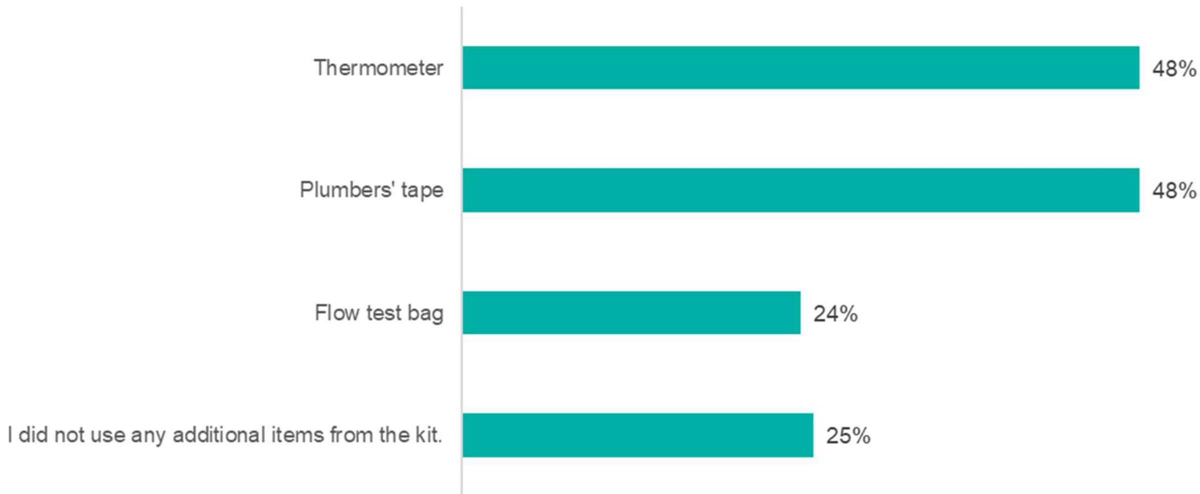


Source: Parent survey. Question: "How satisfied are you with the [MEASURE] overall? Would you say you are…"

ADDITIONAL MEASURES

Of the additional measures included in the kit, the thermometer and plumber's tape were the most widely used by respondents, at around 48% each (Figure 52). Around a quarter of respondents (24%) used the flow test bag and a quarter of respondents (25%) did not use any additional measures.

FIGURE 52. USE OF ADDITIONAL MEASURES IN SCHOOL EDUCATION KITS[34]



Source: Parent survey. Question: "Which of the following other items from the kit did you use, if any?"

Most respondents (84%) found the additional measures to be very useful. Some respondents found them to be somewhat useful (9%) and a few not useful (7%). Several respondents mentioned the usefulness of the thermometer and plumber's tape:

- "They were useful, the thermometer showed that my fridge wasn't as cold as it should have been."
- "Very useful, thermometer was able to help me see if my refrigerator had consistent temperature."
- "We've already used the tape for the faucet aerator, and are using the thermometer for the refrigerator and check the water temp."
- "Very satisfied that I didn't have to pay for these items out of pocket and am learning what they can do around my home."

PARTICIPATION IN ADDITIONAL PROGRAMS

Just three respondents reported participating in additional NIPSCO programs, since receiving the energy kit. These respondents gave the following answers when asked which programs they participated in:

- "Energy assistance that helps pay your bill."
- "Program called township to help lower bills."
- "Rebate on smart thermostat."

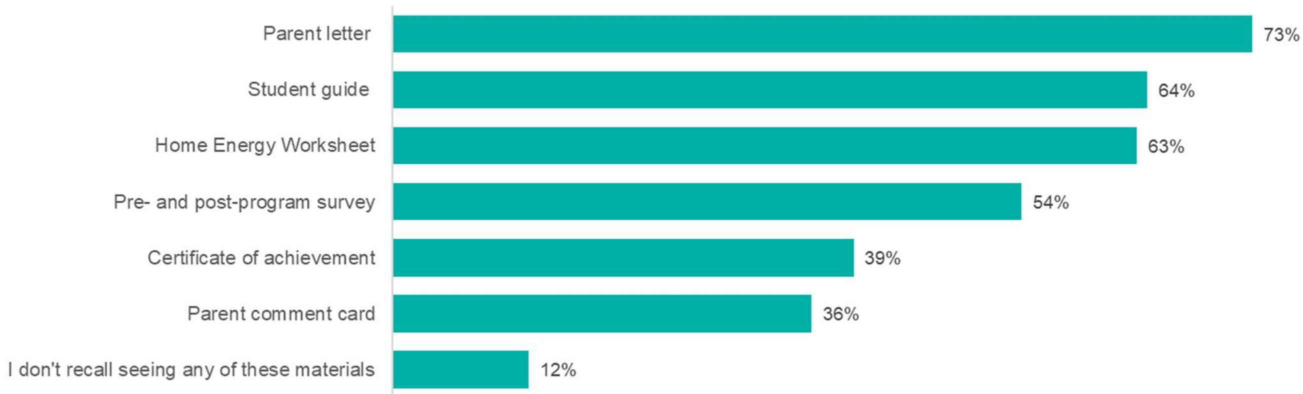
These respondents either heard about the programs through word of mouth (n=2) or through NIPSCO customer service (n=1).

[34] This was a multiple response question (N=166 responses). The response option "I did not use any additional items from the kit" was an exclusive answer.

PROGRAM ENGAGEMENT

Respondent's recollection of the various program materials they received through the program varied (Figure 53). Most respondents recalled receiving the parent letter (73%) and the student guide (64%). Just over one-half of respondents recalled the pre- and post-program survey (54%).

FIGURE 53. 2021 SCHOOL EDUCATION PROGRAM ENGAGEMENT[35]



Source: Parent survey. Question: "Which materials do you recall seeing along with the kit? Do you recall seeing…?"

Of the 99 respondents who recalled seeing program materials, 79% spoke with their child about the energy efficiency tips and facts they learned about in school. Conversations with children largely centered around the energy and cost savings benefits of the kit measures. Several parents noted how excited and engaged their children were with the program:

- "My daughter came back excited about what she learned but I don't recall the specifics about what she said."
- "She talked about turning off water in between brushing teeth and shutting off lights when not in a room.
- "Talking about not running water while brushing teeth and better stuff for the dishwasher so you don't have to rinse all the dishes."

Of the 75 respondents who spoke with their child about energy efficiency tips, about one-half (49%) modified their behavior based on these tips.

SATISFACTION

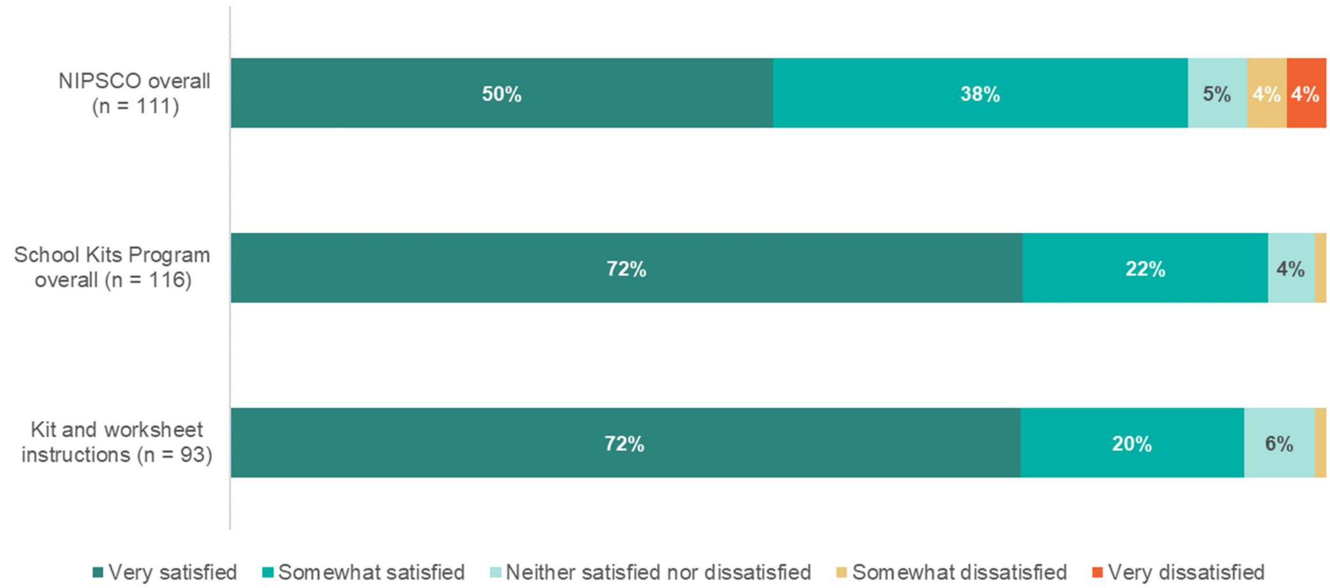
OVERALL PROGRAM SATISFACTION

As Figure 54 illustrates, overall satisfaction with both the School Education program and NIPSCO was high. Most respondents (94%) reported being very or somewhat satisfied with the program and 92% said they were very or

[35] This was a multiple response question (N=112 respondents). The response option "I don't recall seeing any of these materials" was an exclusive answer, and 13 respondents selected this option.

somewhat satisfied with the kit and worksheet instructions. No respondents said they were dissatisfied with the School Education program or the kit and worksheet instructions.

FIGURE 54. 2021 SCHOOL EDUCATION PROGRAM: SATISFACTION WITH PROGRAM AND UTILITY



Source: Parent survey. Question: “How satisfied are you with the X overall? Would you say you are…?”

SUGGESTIONS FOR IMPROVING THE SCHOOL EDUCATION PROGRAM

Of the 36 respondents who answered the question on how to improve the School Education program, eight said that they had no recommendations. Others suggested several ways to improve the School Education program, including:

- Offering different products than the ones currently in the kit (e.g., weatherization, measures for doors and windows) (n=6)
- Adding more of the products in the kit (e.g., more LED light bulbs) (n=4)
- Distributing the kits at school differently (e.g., not restricting the kits to homeowners, only giving kits to families in need) (n=4)
- More information/instruction for parents as to what the products are and how to install them (n=2)

SATISFACTION WITH NIPSCO

Overall, 88% of respondents were somewhat or very satisfied with NIPSCO as their energy service provider. Only eight percent of respondents expressed dissatisfaction. If respondents were dissatisfied with NIPSCO as their energy service provider (n=12), it was typically due to the cost, either as it is currently, or the increasing rates (n=9):

- “They raised the surcharges, delivery fees and so now we are paying double what we used to and I'm not happy with that.”

- “Right now, our bills are pretty expensive for me because it's an older home that wasn't built very energy efficient and the costs have gone up.”
- “Because they overcharge, I keep my heat at 67 and for some reason my bills are getting higher and higher every year. That is all.”

PARTICIPANT SURVEY DEMOGRAPHICS

RESPONDENT DEMOGRAPHICS

Forty-eight percent of respondents have college degrees (technical college-graduate) and 55% are between 32 and 42 years old. Respondents tend to be longer-term occupants of their homes. Nearly one third of respondents (28%) have lived in their homes for more than 10 years. Just 13% have lived in their home for one year or less.

HOME CHARACTERISTICS

Almost all respondents (91%) live in a single-family home and 70% own their home. Many respondents (41%) live in homes built before 1980. Most respondents (85%) have just one kitchen sink; 14% have two. Nearly half of respondents (45%) have two showers in their home, 30% have one, and 21% have three showers.

The following is a snapshot of self-reported home characteristics of School Education program participants:

- Heating equipment: 82% heat their homes with a furnace.
- Cooling equipment: 81% have central air conditioning and 14% use AC room/window units.

CONCLUSIONS AND RECOMMENDATIONS

CONCLUSION 1: RESPONDENTS WERE SATISFIED OVERALL WITH NIPSCO, THE SCHOOL EDUCATION PROGRAM, AND THE MEASURES OFFERED THROUGH THE PROGRAM.

Satisfaction was high around NIPSCO as a utility, the School Education program, and the program components (i.e., kit and worksheet instructions). Most respondents (72%) were very satisfied with both the School Education program, and the kit and worksheet instructions; almost all respondents were at least somewhat satisfied with the program (94%). Satisfaction with NIPSCO overall was also high, as 88% of respondents reported they were very or somewhat satisfied with the utility.

CONCLUSION 2: CROSS-PROGRAM PARTICIPATION WAS VERY LOW.

Like last year, just one respondent reported participating in another NIPSCO program aside from the School Education program.

Recommendations:

- Given that most respondents appear to be very engaged in the program, leverage enthusiasm to build program participation across other NIPSCO offerings.
- Continue to promote other NIPSCO programs by including marketing materials along with the kits.

CONCLUSION 3: LEDS SAW A LOWER REALIZATION RATE THIS YEAR DUE TO THE USE OF AN IN-SITU BASELINE.

While realization rates were relatively close to 100% across fuel types, a few measures had more significant changes. LEDs saw a somewhat lower realization rate this year as our team moved to using an in-situ baseline. Nightlights also saw lower realization rates.

Recommendations:

- As applicable, adjust savings assumptions for future years to align with *ex post* gross savings approaches and findings.

CONCLUSION 4: ANTICIPATED REGULATORY CHANGES WILL LIKELY REDUCE EXPECTED GROSS SAVINGS FOR LIGHTING MEASURES IN FUTURE PROGRAM YEARS.

As discussed in the Residential Lighting chapter, upcoming federal lighting standard changes will likely affect all NIPSCO programs that offer lighting measures to residential customers. The DOE's Office of Energy Efficiency and Renewable Energy again proposed a rule to codify the 45 lumen per-watt standard, with a comment period open through January 27, 2022.[36] The rule is expected to be finalized in 2022 and implemented in early 2023, although the timing is not yet certain and will rely on several factors (such as allowed sell-through periods).

In anticipation of this change, the evaluation team has reduced carryover savings for all LED lightbulbs to one year. Additionally, for non-upstream program designs (like kit offerings and direct-install programs) there may be additional considerations that impact how long these programs may remain viable, as these different delivery types may more frequently "early replace" incandescent or halogen bulbs that otherwise would have remained installed (which is now currently reflected in the in-situ baseline approach). The evaluation team expects that the DOE will provide more guidance in the next few months and will discuss potential implications with NIPSCO, once more information is known.

Recommendations:

- Monitor the DOE's EISA outcome and incorporate effective changes in program design. Review inclusion of specialty and reflector LEDs as part of the upcoming Indiana Technical Reference Manual (TRM) update process to provide guidance for any future savings for these measures in upstream programs.

CONCLUSION 5: IN-SERVICE RATES LARGELY REMAINED CONSISTENT FROM 2020, THOUGH LEDS WERE SLIGHTLY LOWER AND FILTER WHISTLES WERE SLIGHTLY HIGHER.

In general, in-service rates were consistent with prior years. LED in-service rates are slightly lower this year, primarily due to the evaluation team assigning limited carryover savings pending baseline changes that will likely be in place within the next several years. Filter whistles in-service rates continue to be low, though they were slightly higher than the past evaluation year.

[36] Federal Register. Last updated December 13, 2021. "Energy Conservation Program: Backstop Requirements for General Service Lamps." https://www.federalregister.gov/documents/2021/12/13/2021-26807/energy-conservation-program-backstop-requirement-for-general-service-lamps

12. HOMELIFE ENERGY EFFICIENCY CALCULATOR PROGRAM

PROGRAM DESIGN AND DELIVERY

The HomeLife Energy Efficiency Calculator (HomeLife Calculator) program offers residential customers a free online 'do-it-yourself' home audit and a free energy savings kit to carry out this audit. The intent of this tool is to 1) identify low-cost/no-cost measures that a NIPSCO residential customer can easily implement to manage their gas and electric consumption; 2) allow eligible customers to request a free home energy kit; 3) educate customers about the variety of programs available to them through the NIPSCO's residential energy efficiency portfolio. This program is implemented by TRC.

The online calculator is available to individuals with a NIPSCO account number who log onto NIPSCO's website. To receive a kit, customers must be an active electric and/or gas NIPSCO customer. The calculator provides tips on low-to-no cost improvements that will save customers energy and money and provides an analysis of their energy consumption along with recommendations to improve the efficiency of their homes. In addition, the tips shared with customers, as well as the customers' usage analysis, are based on customer responses to the calculator's survey questions.

All customers – combo, electric-only, and gas-only – are eligible to receive a kit. Electric-only customers receive the combo kit, but NIPSCO does not claim savings for the gas measures. Gas-only customers receive a kit that has additional water saving devices:

- Measures in Combo and Electric Only Kits
  - One Kitchen Faucet Aerator (1.5 Gpm)
  - One Bathroom Faucet Aerator (1.0 Gpm)
  - One Low Flow Showerhead (1.5 Gpm)
  - Four 9-Watt LEDs
  - One 0.5-Watt LED Night-Light
  - One Furnace Filter Whistle
- Measures in Gas Only Kits
  - One Kitchen Faucet Aerator (1.5 Gpm)
  - Two-Bathroom Faucet Aerators (1.0 Gpm)
  - Two Low Flow Showerheads (1.5 Gpm)
  - One Furnace Filter Whistle

PROGRAM PERFORMANCE

In 2021, the NIPSCO team adjusted our timelines across programs to deliver evaluation reports earlier than in previous years. To meet the new timelines, for most programs the evaluation teams began analysis earlier, and conducted our impact analyses on 11 months of data instead of the full calendar year (January 1 to November 30, 2021). The evaluation metrics developed during this analysis (including in-service rates, realization rates, net-to-gross ratios, etc.) and included in the first draft versions of the report were applied to the full year of data as part of the final, compiled report and included in Table 157 below.

TABLE 157. 2021 HOMELIFE CALCULATOR PROGRAM SAVING SUMMARY – FULL YEAR 2021

METRIC	GROSS SAVINGS GOAL	*EX ANTE*	AUDITED	VERIFIED	*EX POST* GROSS	*EX POST* NET	GROSS GOAL ACHIEVEMENT
Electric Energy Savings (kWh/yr.)	243,176.10	60,673.63	60,674.15	55,407.85	40,331.50	37,631.31	17%
Peak Demand Reduction (kW)	24.700	6.162	6.186	5.156	3.555	3.257	14%
Natural Gas Energy Savings (therms/yr.)	13,655.90	4,118.28	4,118.25	3,392.54	1,894.20	1,892.22	14%

Table 158 summarizes savings evaluated during the program's evaluation period, which was from January 2021 to November 2021.

TABLE 158. 2021 HOMELIFE CALCULATOR PROGRAM SAVING SUMMARY – JANUARY THROUGH NOVEMBER 2021

METRIC	*EX ANTE*	AUDITED	VERIFIED	*EX POST* GROSS	*EX POST* NET
Electric Energy Savings (kWh/yr.)	59,137.81	59,138.32	54,005.40	39,310.52	36,678.70
Peak Demand Reduction (kW)	6.006	6.029	5.026	3.465	3.174
Natural Gas Energy Savings (therms/yr.)	3,989.48	3,989.45	3,286.38	1,835.56	1,833.64

Table 159 outlines the *ex post* gross and NTG adjustment factors. While spillover values are lower than 2020 (59%), they continue be high for this program in 2021.

TABLE 159. 2021 HOMELIFE CALCULATOR PROGRAM ADJUSTMENT FACTORS

METRIC	REALIZATION RATE (%)[a]	FREERIDERSHIP	SPILLOVER	NTG (%)[b]
Electric Energy Savings (kWh/yr.)	66%	16%	9%	93%
Peak Demand Reduction (kW)	58%	17%	9%	92%
Natural Gas Energy Savings (therms/yr.)	46%	9%	9%	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.

As Table 160 indicates, The HomeLife Calculator program spent 29% and 31% of the allocated budget for electric and gas savings respectively.

TABLE 160. 2021 HOMELIFE CALCULATOR PROGRAM EXPENDITURES

FUEL	PROGRAM BUDGET	PROGRAM EXPENDITURES	BUDGET SPENT (%)
Electric	$39,195.84	$11,299.10	29%
Natural Gas	$33,632.17	$ 10,489.08	31%

EVALUATION METHODOLOGY

To inform the 2021 NIPSCO impact and process evaluation, the evaluation team completed the following research activities:

- **Program staff interviews and discussions,** to understand the program design and delivery.
- **Documentation and materials review,** to provide context on program design and implementation.

- **Engineering analysis**, to review program savings assumptions and algorithms for reasonableness and accuracy.
- **Phone and web surveys with HomeLife Calculator program participants**, to provide insight on the customer experience and processes, and to inform savings estimates.

IMPACT EVALUATION

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

- What assumptions were used to develop deemed savings estimates? Are there any updates that should be made?
- What are *ex post* program savings? Do these suggest any needed updates to program design, delivery, or savings assumptions?
- What are installation rates for kit measures? Are there certain measures that are installed most often? Least often?

For all measure types, the evaluation team compared its engineering calculations to NIPSCO's *ex ante* savings, basing its savings methodologies and inputs for each measure on several sources: standard engineering practices, the 2015 Indiana TRM (v2.2), and NIPSCO's program tracking database.[37]

This section details each step of the impact evaluation and its associated electric energy savings, peak demand reduction, and natural gas savings.

AUDITED SAVINGS

To audit program savings, the evaluation team performed the following reviews to verify alignment with the program's scorecard:

1. **Audited Kits Quantity.** Reviewed program tracking data provided by the implementer and audited the number of kits distributed.
2. **Confirm Measure-Level Savings Calculations.** Reviewed per-measure and per-kit savings in the documentation provided by NIPSCO.
3. **Savings Estimate Review.** Confirmed program-level total savings.

AUDITED QUANTITY OF KITS

NIPSCO reported a total of 212 combo kits, 48 gas-only kits, and 19 electric-only kits distributed through the HomeLife Calculator Program. These reported scorecard values were checked against the program tracking data. The audit of the tracking data mirrored the totals reported by NIPSCO ().

Table 161).

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

TABLE 161. 2021 HOMELIFE CALCULATOR PROGRAM AUDITED KIT QUANTITY

KIT TYPE	SCORECARD	TRACKING DATA
Combo Kits	212	212
Gas Only Kits	48	48
Electric Only Kits	19	19
Total	279	279

CONFIRM MEASURE-LEVEL SAVING

The evaluation team reviewed the kit savings documentation which contained measure-level and kit-level savings. Importantly, NIPSCO included installation rates from past EM&V efforts in their *ex ante* assumptions for the kit program. The program documentation included rates to adjust savings for both installation practices and water heater fuel saturation.

Upon review of this document, measure-level savings values in the tracking data aligned with NIPSCO's kit savings documentation. However, program tracking data savings were reported at the kit-level with a rounded total kit value, and NIPSCO's measure calculation file savings were reported at the measure-level with un-rounded per measure values. This difference in the unit of analysis resulted in rounding errors, meaning that the sum of total measure savings was slightly off from the tracking data savings. These rounding errors will be noted where applicable in the remainder of this report.

SAVINGS ESTIMATE REVIEW

Measure-level and total savings values were also reviewed. Savings values in the program tracking data were summed and compared to savings values reported in the scorecard. The savings values align (Table 162).

TABLE 162. 2021 HOMELIFE CALCULATOR PROGRAM SAVINGS ESTIMATES

UNIT OF ENERGY SAVINGS	SCORECARD	TRACKING DATA
KWH	59,137.81	59,137.81
KW	6.006	6.006
Therms	3,989.48	3,989.48

VERIFIED SAVINGS

The evaluation team took a census of all available customers for the Homelife Calculator Program and confirmed installation of all measures. In 2021, the evaluation team was able to complete a total of 40 surveys with participants, taking a census of all available participants. Upon review, the evaluation team combined ISRs from 2020 and 2021 to calculate a simple weighted and blended average by measure (Table 163). We recommend using this blended value for 2021 results and for future planning. While the results across years were similar, when available using a blended value for ISRs mitigates any swings that may result from response biases each year due to small population and respondent sizes.

TABLE 163. 2021 HOMELIFE CALCULATOR PROGRAM MEASURE-LEVEL BLENDED ISRS

MEASURE	2020 ISR	2020 N OF VALID RESPONDENTS	2021 ISR	2021 N OF VALID RESPONDENTS	WEIGHTED BLENDED AVERAGE
LED	80%[a]	46	81%	33	80%
Nightlight	85%	47	91%	33	87%
Bathroom Aerator	33%	46	41%	30	36%
Kitchen Aerator	44%	50	56%	39	49%
Showerhead	43%	49	41%	32	42%
Furnace Whistle	30%	43	19%	31	25%

[a] The 2020 LED installation rate was adjusted for this calculation to only include one year of carryover savings to be consistent with the 2021 calculation (discussed more below).

Installation rates for the HomeLife Calculator Program were somewhat higher across the board relative to the current Schools installation rates. This is expected given differences in program design, as customers may explicitly opt in to the Homelife program because they want to receive a kit (whereas Schools participants receive a kit without requesting it). Consistent with the Schools evaluation, lighting measures had the highest installation rates, with most of those measures installed at the time of the survey. Furnace whistles had the lowest installation rates. Most measures had relatively consistent installation rates with what was assumed in the *ex ante* savings, with the exception of furnace whistles and nightlights, where installation rates were somewhat higher.

Finally, to account for LED lamps currently stored for future use, carryover savings were calculated for the LEDs included in the kit. The evaluation team used the UMP-recommended “Discount Future Savings” method (National Renewable Energy Laboratory/UMP Chapter 21, 2015) to calculate carryover savings. This method assumes most bulbs placed in storage (up to 97%) are installed within four years (including the initial program year), with 24% of bulbs left over from Year one installed in Year two, 24% in Year three, and so on. However, given expected baseline lighting changes mandated by EISA 2007, all standard LEDs are anticipated to function as baseline lamps. Thus, the evaluation team did not extend GSL baseline savings beyond 2022, Year Two in the UMP-recommended method. This resulted in a final ISR for LEDs of 80%.

Table 164 lists the final ISRs for all program-installed measures.

TABLE 164. 2021 HOMELIFE CALCULATOR PROGRAM FINAL IN-SERVICE RATES BY MEASURE (BLENDED 2020-2021)

MEASURE	ISR
LED - Combo Kit (Dual Fuel)	80%
LED - Electric Only Kit	80%
Night Light - Combo Kit (Dual Fuel)	87%
Night Light - Electric Only Kit	87%
Bath Aerator - Combo Kit (Dual Fuel)	36%
Bath Aerator - Gas Only Kit	36%
Bath Aerator - Electric Only Kit	36%
Kitchen Aerator - Combo Kit (Dual Fuel)	49%
Kitchen Aerator - Gas Only Kit	49%
Kitchen Aerator - Electric Only Kit	49%
Showerhead - Combo Kit (Dual Fuel)	42%
Showerhead - Gas Only Kit	42%
Showerhead - Electric Only Kit	42%
Filter Whistle - Combo Kit (Dual Fuel)	25%
Filter Whistle - Gas Only Kit	25%
Filter Whistle - Electric Only Kit	25%

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 2021 HEW results from the School Education Program, which provides a large sample of customers who report their water heater fuel, shown in Table 165. Results indicate a slight discrepancy between *ex ante* and verified electric and natural gas domestic water heating saturation rates. However, these slightly lower 2021 values are consistent with what was found in the 2020 program evaluation (which was 64% natural gas saturation).

TABLE 165. 2021 HOMELIFE CALCULATOR PROGRAM WATER HEATER FUEL SATURATION[38]

SAVINGS TYPE	ELECTRIC WATER HEATING SATURATION RATE (%)	NATURAL GAS WATER HEATING SATURATION RATE (%)
Reported *ex ante*	22%	73%
Verified[a]	23%	62%

[a] Electric and natural gas saturation rates do not total 100% because 7% of respondents selected "Other" and 9% selected "Propane" on the HEW.

Table 166 summarizes the *ex ante* and verified savings per measure.

[38] Calculated from School Education Program sample

TABLE 166. 2021 HOMELIFE CALCULATOR PROGRAM *EX ANTE* AND VERIFIED PER-UNIT MEASURE SAVINGS

MEASURE	ISRS	*EX ANTE* KWH SAVINGS[a]	VERIFIED KWH SAVINGS	*EX ANTE* KW REDUCTION	VERIFIED KW REDUCTION	*EX ANTE* THERM SAVINGS	VERIFIED THERM SAVINGS
LED - Combo Kit (Dual Fuel)	80%	33.34	28.68	0.004	0.003	(0.68)	(0.59)
LED - Electric Only Kit	80%	33.22	28.58	0.004	0.003	0.00	0.00
Night Light - Combo Kit (Dual Fuel)	87%	4.74	4.65	0.000	0.000	0.00	0.00
Night Light - Electric Only Kit	87%	4.74	4.65	0.000	0.000	0.00	0.00
Bath Aerator - Combo Kit (Dual Fuel)	36%	4.55	4.48	0.000	0.000	0.66	0.53
Bath Aerator - Gas Only Kit	36%	0.00	0.00	0.000	0.000	0.66	0.53
Bath Aerator - Electric Only Kit	36%	4.61	4.54	0.000	0.000	0.00	0.00
Kitchen Aerator - Combo Kit (Dual Fuel)	49%	33.74	37.37	0.001	0.001	4.93	4.45
Kitchen Aerator - Gas Only Kit	49%	0.00	0.00	0.000	0.000	5.01	4.52
Kitchen Aerator - Electric Only Kit	49%	34.12	37.79	0.001	0.001	0.00	0.00
Showerhead - Combo Kit (Dual Fuel)	42%	53.90	54.74	0.002	0.002	7.87	6.51
Showerhead - Gas Only Kit	42%	0.00	0.00	0.000	0.000	7.98	6.60
Showerhead – Electric Only Kit	42%	54.39	55.23	0.002	0.002	0.00	0.00
Filter Whistle - Combo Kit (Dual Fuel)	25%	25.69	17.79	0.009	0.007	2.48	1.72
Filter Whistle - Gas Only Kit	25%	0.00	0.00	0.000	0.000	2.48	1.72
Filter Whistle - Electric Only Kit	25%	25.69	17.79	0.009	0.007	0.00	0.00

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

EX POST GROSS SAVINGS

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

ENGINEERING REVIEWS

The evaluation team referred to the Indiana TRM (v2.2) and the 2021 Pennsyl-vania TRM to calculate *ex post* gross electric energy savings, demand reduction, and natural gas savings. Appendix 10 contains details on the specific algorithms, variable assumptions, and references for all program measure *ex post* gross calculations.

Through the engineering review, the evaluation team found differences between *ex ante* and *ex post* gross savings. These differences were primarily driven by the following overarching factors:

- The evaluation team did not assign a therm penalty to the LED measures and calculated these separately for use in cost-effectiveness analyses.
- The evaluation team used geolocation for each customer address in the database then matched each address with 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 faucet aerators, showerheads, and LED bulbs.
- The evaluation team referred the 2021 Pennsylvania TRM for the *ex post* savings for the filter whistle measure.

- The evaluation team used updated installation rate, water heater saturation, and other algorithm inputs (such as people-per-home) which adjusted savings across measures.

The following sections summarize the team's findings and recommendations based on the engineering review.

EX POST GROSS SAVINGS

Ex post savings reflect the engineering adjustments made to verified measure savings. The evaluation team calculated *ex post* electric energy, peak demand, and natural gas energy savings for each measure kit using algorithms and inputs from the Indiana TRM (v2.2), the 2021 Pennsylvania TRM, as well as customer location to account for weather effects. The evaluation team leveraged Homelife Calculator participant survey information for faucet and showerheads per home, and the parent worksheet from the School Education program to estimate heating system and water heater fuel type saturation values, then used this information to inform *ex post* gross savings calculations. *Ex post* savings calculations differed from *ex ante* analysis as follows:

- LEDs: Updated baseline wattage and ISR values for LEDs. The 2021 *ex ante* analysis applies the UMP baseline wattage of 43 watts, whereas the *ex post* analysis applies a blended baseline, calculated using 2021 Homelife survey results, of 35.5 watts. The 2021 survey results used to calculate the *ex post* baseline are provided in Appendix 10, and a discussion of therm penalties generated by LED lighting is provided below.
- Nightlight: Updated ISR and incandescent replacement factor values in the *ex post* analysis decrease energy savings compared to *ex ante*.
- Filter whistle: The evaluation team referred to the 2021 Pennsylvania TRM to calculate filter whistle electric savings, which assigns electric energy and demand savings to the blower motor energy reduction because dirty filters increase electricity consumption for the circulating fan. The *ex ante* approach referenced the Illinois TRM (v8), which assigns electric energy, demand, and therm savings. The evaluation team does not give therm savings for the filter whistle measure because, in our best judgment, any therm savings will be minimal, and a review of available literature reveals a lack of defensible evidence for assigning therm savings at this time. Notably, the filter whistle is a provisional measure in Illinois TRM (v8) and subsequently removed from Illinois TRM (v9) due to "evaluation results showing filter alarms being ineffectual at indicating a dirty filter."[39]
- Low flow faucet aerators and showerheads: Updated values for people per home water heating fuel saturation values, and ISRs. The evaluation team updated people per home to the Indiana TRM (v2.2) deemed value of 2.64, versus the *ex ante* value of 4.86, to more reasonably reflect demographics across all households, and applied updated water heating fuel saturation percentages and ISRs based on 2021 HEW results. As reported in Table 143, the verified natural gas water heater saturation rate is lower than *ex ante*, 62% and 73%, respectively.

Table 167 shows the *ex ante* deemed savings and *ex post* gross per-measure savings for 2021 Homelife program measures.

[39] Illinois Energy Efficiency Stakeholder Advisory Group. September 25, 2020. 2021 Illinois Statewide Technical Reference Manual for Energy Efficiency Version 9.0. "Volume 3: Residential Measures."

TABLE 167. 2021 HOMELIFE CALCULATOR PROGRAM *EX ANTE* & *EX POST* GROSS PER-MEASURE SAVINGS VALUES

MEASURE	UNITS PER KIT	*EX ANTE* DEEMED SAVINGS			*EX POST* GROSS SAVINGS		
		KWH	KW	THERMS	KWH	KW	THERMS
LED - Combo Kit (Dual Fuel)	4	133.36	0.014	(2.73)	89.36	0.010	0.00
LED - Electric Only Kit	4	132.89	0.014	0.00	89.23	0.010	0.00
Night Light - Combo Kit (Dual Fuel)	1	4.74	0.000	0.00	2.61	0.000	0.00
Night Light - Electric Only Kit	1	4.74	0.000	0.00	2.61	0.000	0.00
Bath Aerator - Combo Kit (Dual Fuel)	1	4.55	0.000	0.66	2.59	0.000	0.31
Bath Aerator - Gas Only Kit	2	0.00	0.000	1.33	0.00	0.000	0.64
Bath Aerator - Electric Only Kit	1	4.61	0.000	0.00	2.61	0.000	0.00
Kitchen Aerator - Combo Kit (Dual Fuel)	1	33.74	0.001	4.93	20.34	0.001	2.41
Kitchen Aerator - Gas Only Kit	1	0.00	0.000	5.01	0.00	0.000	2.48
Kitchen Aerator - Electric Only Kit	1	34.12	0.001	0.00	20.46	0.001	0.00
Showerhead - Combo Kit (Dual Fuel)	1	53.90	0.002	7.87	30.15	0.002	3.58
Showerhead - Gas Only Kit	2	0.00	0.000	15.95	0.00	0.000	7.32
Showerhead - Electric Only Kit	1	54.39	0.002	0.00	30.30	0.002	0.00
Filter Whistle - Combo Kit (Dual Fuel)	1	25.69	0.009	2.48	25.11	0.002	0.00
Filter Whistle - Gas Only Kit	1	0.00	0.000	2.48	0.00	0.000	0.00
Filter Whistle - Electric Only Kit	1	25.69	0.009	0.00	25.11	0.002	0.00
Total per Combo Kit		255.97	0.026	13.21	170.16	0.015	6.30
Total per Electric-Only Kit		256.43	0.026	0.00	170.31	0.015	0.00
Total per Gas-Only Kit		0.00	0.000	24.77	0.00	0.000	10.43

Table 168 highlights notable differences between *ex ante* and *ex post* gross estimates.

TABLE 168. 2021 HOMELIFE CALCULATOR 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
Kitchen Aerator, Bathroom Aerator, and Low Flow Showerheads	Indiana TRM (v2.2) and 2019 EMV	Indiana TRM (v2.2) and information in program tracking data. Cold water inlet temperature averaged across current participant location, and water heater saturation and ISRs from 2021 survey information.	The evaluation team used the Indiana TRM (v2.2) assumption for the number of people per home, updated the hot water heating saturation based on 2021 survey information, and applied inlet water temperature based on current participant type and location. The *ex post* reduction in people per home, to the Indiana TRM (v2.2) deemed value, is the primary driver for the difference between *ex ante* and *ex post* savings values.

MEASURE	*EX ANTE* SOURCES AND ASSUMPTIONS	*EX POST* GROSS SOURCES AND ASSUMPTIONS	PRIMARY REASONS FOR DIFFERENCES
9W LED	Indiana TRM (v2.2) and 2019 EMV	Indiana TRM (v2.2); 2021 Home Life survey for baseline wattages	The updated *ex post* baseline wattage is the primary driver for the difference between *ex ante* and *ex post* savings values. The evaluation team updated the baseline wattage to a blended value based on 2021 HomeLife survey information. The *ex ante* analysis applies the UMP baseline wattage.
Night Light	Indiana TRM (v2.2) and 2019 EMV	Indiana TRM (v2.2) and 2021 HomeLife survey information for incandescent replacement	The *ex ante* analysis applies the 2019 incandescent replacement factor (IRF) to account for LED nightlights replacing incandescent nightlights. For the *ex post* analysis, the evaluation team updated the IRF based on information from the 2021 HomeLife survey.
Filter Whistle	Illinois TRM (v8)	2021 Pennsylvania TRM and Indiana TRM (v2.2)	The *ex ante* analysis assigns cooling system savings to all combo and electric kit participants and full therm savings to all combo and gas kit participants. The *ex post* analysis refers to the Indiana TRM (v2.2) for the percentage of households with central air conditioning, and the evaluation team's review of available literature reveals a lack of defensible evidence for assigning therm savings at this time.

WASTE HEAT FACTOR – THERM PENALTIES

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

The *ex ante* savings for all kit programs include therm penalties. 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. In total, the therm penalty for cost-effectiveness analysis is – 387.24 therms (Table 169).

TABLE 169. 2021 HOMELIFE CALCULATOR WASTE HEAT FACTOR THERM PENALTY

MEASURE	WASTE HEAT FACTOR THERM PENALTY
LED (9W) - Combo Kit	(387.24)

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

REALIZATION RATES

The next three tables (Table 170 through Table 172) show the program's *ex ante* reported savings, verified savings, and *ex post* gross savings. In general, the primary drivers affecting the overall savings are updates to the baseline wattage for the LED measure and the IRF for nightlight measure based on information from the 2021 HomeLife survey, and the number of people per home for the water savings device measures based on the Indiana TRM (v2.2). The *ex post* assumption for people per home, based on the Indiana TRM (v2.2), is 54% lower than the *ex ante* assumption, which is based on results from the 2019 School Kit program HEW.

TABLE 170. 2021 HOMELIFE CALCULATOR PROGRAM *EX ANTE* & *EX POST* GROSS ELECTRIC ENERGY SAVINGS

MEASURE	*EX ANTE*[a] ELECTRIC ENERGY SAVINGS (KWH/YR.)	AUDITED GROSS ELECTRIC ENERGY SAVINGS (KWH/YR.)	VERIFIED GROSS ELECTRIC ENERGY SAVINGS (KWH/YR.)	*EX POST* GROSS ELECTRIC ENERGY SAVINGS (KWH/YR.)
LED - Combo Kit (Dual Fuel)	-	28,272.22	24,320.19	18,944.24
LED - Electric Only Kit	-	2,524.91	2,171.97	1,695.32
Night Light - Combo Kit (Dual Fuel)	-	1,004.11	986.24	553.32
Night Light - Electric Only Kit	-	89.99	88.39	49.59
Bath Aerator - Combo Kit (Dual Fuel)	-	964.05	948.92	549.18
Bath Aerator - Gas Only Kit	-	0.00	0.00	0.00
Bath Aerator - Electric Only Kit	-	87.60	86.23	49.57
Kitchen Aerator - Combo Kit (Dual Fuel)	-	7,152.90	7,923.49	4,312.26
Kitchen Aerator - Gas Only Kit	-	0.00	0.00	0.00
Kitchen Aerator - Electric Only Kit	-	648.22	718.06	388.71
Showerhead - Combo Kit (Dual Fuel)	-	11,427.32	11,603.84	6,392.37
Showerhead - Gas Only Kit	-	0.00	0.00	0.00
Showerhead - Electric Only Kit	-	1,033.50	1,049.46	575.61
Filter Whistle - Combo Kit (Dual Fuel)	-	5,445.45	3,770.67	5,323.27
Filter Whistle - Gas Only Kit	-	0.00	0.00	0.00
Filter Whistle - Electric Only Kit	-	488.04	337.94	477.09
Total Savings	59,137.81	59,138.32	54,005.40	39,310.52
Total Program Realization Rate				66%

Note: Totals may not sum properly due to rounding.
[a] Program tracking data is summed at the kit-level (not measure level). Therefore, *ex ante* savings are only reported at the summary level, due to rounding errors.

TABLE 171. 2021 HOMELIFE CALCULATOR PROGRAM *EX ANTE* & *EX POST* GROSS PEAK DEMAND REDUCTION

MEASURE	*EX ANTE*[a] PEAK DEMAND REDUCTION (KW/YR.)	AUDITED GROSS PEAK DEMAND REDUCTION (KW/YR.)	VERIFIED GROSS PEAK DEMAND REDUCTION (KW/YR.)	*EX POST* GROSS PEAK DEMAND REDUCTION (KW/YR.)
LED - Combo Kit (Dual Fuel)	-	3.062	2.634	2.050
LED - Electric Only Kit	-	0.274	0.236	0.184
Night Light - Combo Kit (Dual Fuel)	-	0.000	0.000	0.000
Night Light - Electric Only Kit	-	0.000	0.000	0.000
Bath Aerator - Combo Kit (Dual Fuel)	-	0.057	0.057	0.057
Bath Aerator - Gas Only Kit	-	0.000	0.000	0.000
Bath Aerator - Electric Only Kit	-	0.005	0.005	0.005
Kitchen Aerator - Combo Kit (Dual Fuel)	-	0.177	0.197	0.197
Kitchen Aerator - Gas Only Kit	-	0.000	0.000	0.000
Kitchen Aerator - Electric Only Kit	-	0.016	0.018	0.018
Showerhead - Combo Kit (Dual Fuel)	-	0.340	0.345	0.346
Showerhead - Gas Only Kit	-	0.000	0.000	0.000
Showerhead - Electric Only Kit	-	0.031	0.031	0.031
Filter Whistle - Combo Kit (Dual Fuel)	-	1.896	1.380	0.529
Filter Whistle - Gas Only Kit	-	0.000	0.000	0.000
Filter Whistle - Electric Only Kit	-	0.170	0.124	0.047
Total Savings	6.006	6.029	5.026	3.465
Total Program Realization Rate				58%

Note: Totals may not sum properly due to rounding.
[a] Program tracking data is summed at the kit-level (not measure level). Therefore, *ex ante* savings are only reported at the summary level, due to rounding errors.

TABLE 172. 2021 HOMELIFE CALCULATOR 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.)
LED - Combo Kit (Dual Fuel)	-	(578.24)	(497.41)	0.00
LED - Electric Only Kit	-	0.00	0.00	0.00
Night Light - Combo Kit (Dual Fuel)	-	0.00	0.00	0.00
Night Light - Electric Only Kit	-	0.00	0.00	0.00
Bath Aerator - Combo Kit (Dual Fuel)	-	140.74	112.88	65.13
Bath Aerators - Gas Only Kit	-	63.73	51.12	30.53
Bath Aerator - Electric Only Kit	-	0.00	0.00	0.00
Kitchen Aerator - Combo Kit (Dual Fuel)	-	1,044.25	942.55	511.43
Kitchen Aerator - Gas Only Kit	-	240.40	216.98	119.07
Kitchen Aerator - Electric Only Kit	-	0.00	0.00	0.00
Showerhead - Combo Kit (Dual Fuel)	-	1,668.27	1,380.35	758.14
Showerheads - Gas Only Kit	-	765.79	633.63	351.25
Showerhead - Electric Only Kit	-	0.00	0.00	0.00
Filter Whistle - Combo Kit (Dual Fuel)	-	525.53	363.90	0.00
Filter Whistle - Gas Only Kit	-	118.99	82.39	0.00
Filter Whistle - Electric Only Kit	-	0.00	0.00	0.00
Total Savings	3,989.48	3,989.45	3,286.38	1,835.56
Total Program Realization Rate				46%

Note: Totals may not sum properly due to rounding.
[a] Program tracking data is summed at the kit-level (not measure level). Therefore, *ex ante* savings are only reported at the summary level, due to rounding errors.

EX POST NET SAVINGS

The evaluation team calculated freeridership and participant spillover using the survey data collected from 2021 respondents. Like 2020 evaluation results, the evaluation team found varying levels of freeridership by measure. Table 173 shows the NTG ratios by measure.

TABLE 173. 2021 HOMELIFE CALCULATOR PROGRAM NET-TO-GROSS RATIOS BY MEASURE

MEASURE	NTG
LED - Combo Kit (Dual Fuel)	85%
LED - Electric Only Kit	85%
Night Light - Combo Kit (Dual Fuel)	102%
Night Light - Electric Only Kit	102%
Bath Aerator - Combo Kit (Dual Fuel)	98%
Bath Aerator - Gas Only Kit	98%
Bath Aerator - Electric Only Kit	98%
Kitchen Aerator - Combo Kit (Dual Fuel)	100%
Kitchen Aerator - Gas Only Kit	100%
Kitchen Aerator - Electric Only Kit	100%
Showerhead - Combo Kit (Dual Fuel)	100%
Showerhead - Gas Only Kit	100%
Showerhead - Electric Only Kit	100%
Filter Whistle - Combo Kit (Dual Fuel)	108%
Filter Whistle - Gas Only Kit	108%
Filter Whistle - Electric Only Kit	108%

FREERIDERSHIP

Measure-level freeridership values for each participant were calculated using the following survey questions:

- FR1. If you had not received the kit, would you have purchased a [MEASURE] on your own?
- FR2. "Would you have purchased the [MEASURE]…around the same time you received the kit, later but within one year, or later but more than one year?"

Respondents who gave a response of "No" to FR1 were assigned a freeridership score of 0%. Those who said "Yes" were asked FR2 and assigned a freeridership score based on the timing of their decision (Table 174).

TABLE 174. 2021 HOMELIFE CALCULATOR PROGRAM FREERIDERSHIP ASSIGNMENT

FR2. RESPONSE OPTION	ASSIGNED FREERIDERSHIP VALUE
Around the same time you received the kit	100%
Later but within one year	50%
More than one year later	0%
Not sure	25%

As Table 175 illustrates, freeridership rates were low, except for LEDs (24%).

TABLE 175. 2021 HOMELIFE CALCULATOR PROGRAM FREERIDERSHIP BY MEASURE

MEASURE	ASSIGNED FREERIDERSHIP VALUE
LED - Combo Kit (Dual Fuel)	24%
LED - Electric Only Kit	24%
Night Light - Combo Kit (Dual Fuel)	7%
Night Light - Electric Only Kit	7%
Bath Aerator - Combo Kit (Dual Fuel)	11%
Bath Aerators - Gas Only Kit	11%
Bath Aerator - Electric Only Kit	11%
Kitchen Aerator - Combo Kit (Dual Fuel)	9%
Kitchen Aerator - Gas Only Kit	9%
Kitchen Aerator - Electric Only Kit	9%
Showerhead - Combo Kit (Dual Fuel)	9%
Showerheads - Gas Only Kit	9%
Showerhead - Electric Only Kit	9%
Filter Whistle - Combo Kit (Dual Fuel)	1%
Filter Whistle - Gas Only Kit	1%
Filter Whistle - Electric Only Kit	1%

SPILLOVER

The evaluation team estimated participant spillover using survey responses and the Indiana TRM (v2.2) and program measure calculations as a baseline reference. If survey respondents met the following criteria, based on self-reported EM&V survey responses, they qualified as a spillover participant:

4. Installed an additional energy efficient measure(s)
5. Deemed participation in the HomeLife Calculator Program to be "very influential" in their decision to install an additional energy efficient measure
6. Did not receive a rebate for the additional measure

The evaluation team found that seven survey respondents installed a total of eight additional energy efficient measures totaling 39.84 MMBtu in spillover savings for the Homelife program this year. However, this value results in extremely high spillover savings, higher than what is typically seen for any residential program and may be skewed due to the small sample size in 2021. For 2021, the evaluation team recommends referencing the schools program evaluation spillover value due to that program's higher survey sample sizes and more robust analysis. (Table 176).

TABLE 176. 2021 HOMELIFE PROGRAM SPILLOVER (REFERENCED FROM 2021 SCHOOLS EVALUATION)

SPILLOVER SAVINGS (MMBtu)	SURVEY RESPONDENT PROGRAM SAVINGS (MMBtu)	PARTICIPANT SPILLOVER (%)
12.27	142.44	9%

NET-TO-GROSS

Table 177 presents the resulting net electric savings, demand reduction, and natural gas savings.

TABLE 177. 2021 HOMELIFE CALCULATOR PROGRAM *EX POST* NET SAVINGS

MEASURE	*EX POST* GROSS SAVINGS/REDUCTION			NTG	*EX POST* NET SAVINGS/REDUCTION		
	KWH	KW	THERMS		KWH	KW	THERMS
LED - Combo Kit (Dual Fuel)	18,944.24	2.050	0.00	85%	16,102.60	1.743	0.00
LED - Electric Only Kit	1,695.32	0.184	0.00	85%	1,441.02	0.156	0.00
Night Light - Combo Kit (Dual Fuel)	553.32	0.000	0.00	102%	564.39	0.000	0.00
Night Light - Electric Only Kit	49.59	0.000	0.00	102%	50.58	0.000	0.00
Bath Aerator - Combo Kit (Dual Fuel)	549.18	0.057	65.13	98%	538.20	0.056	63.83
Bath Aerator - Gas Only Kit	0.00	0.000	30.53	98%	0.00	0.000	29.92
Bath Aerator - Electric Only Kit	49.57	0.005	0.00	98%	48.58	0.005	0.00
Kitchen Aerator - Combo Kit (Dual Fuel)	4,312.26	0.197	511.43	100%	4,312.26	0.197	511.43
Kitchen Aerator - Gas Only Kit	0.00	0.000	119.07	100%	0.00	0.000	119.07
Kitchen Aerator - Electric Only Kit	388.71	0.018	0.00	100%	388.71	0.018	0.00
Showerhead - Combo Kit (Dual Fuel)	6,392.37	0.346	758.14	100%	6,392.37	0.346	758.14
Showerhead - Gas Only Kit	0.00	0.000	351.25	100%	0.00	0.000	351.25
Showerhead - Electric Only Kit	575.61	0.031	0.00	100%	575.61	0.031	0.00
Filter Whistle - Combo Kit (Dual Fuel)	5,323.27	0.529	0.00	108%	5,749.13	0.572	0.00
Filter Whistle - Gas Only Kit	0.00	0.000	0.00	108%	0.00	0.000	0.00
Filter Whistle - Electric Only Kit	477.09	0.047	0.00	108%	515.25	0.051	0.00
Total Savings	39,310.52	3.465	1,835.56		36,678.70	3.174	1,833.64

Note: Totals may not sum properly due to rounding.

Table 178 shows the NTG results by fuel type.

TABLE 178. 2021 HOMELIFE CALCULATOR 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.)	59,137.81	39,310.52	93%	36,678.70
Peak Demand Reduction (kW)	6.006	3.465	92%	3.174
Natural Gas Energy Savings (therms/yr.)	3,989.48	1,835.56	100%	1,833.64

PROCESS EVALUATION

The evaluation team conducted qualitative and quantitative research activities to answer the following key research questions for the program:

- What was the customer experience with the program, from sign-up through completion?
- How did customers become aware of the program?
- What were customer motivations for participation?
- How satisfied were customers with the program, including the participation process, interactions with the program implementer, and satisfaction with each piece of equipment received?

- How useful were the recommendations customers received after the assessment?
- What do participants recommend for program improvement?

PARTICIPANT SURVEY FINDINGS

The evaluation team took a census of all available program participants with contact information; 40 program participants completed surveys. The following sections describe surveyed participants' experience with the kit and program satisfaction.

PROGRAM AWARENESS AND DECISION MAKING

Like 2020, in 2021, participants learned about the program through various channels but largely from the NIPSCO website. Respondents cited the following as the top four channels for learning about the HomeLife Calculator program:

- NIPSCO website (43%)
- Word of mouth (18%)
- Email from NIPSCO (10%)
- NIPSCO social media (8%)

No respondents reported hearing about the program through a call to NIPSCO, a TV ad or a mailer from NIPSCO.

Nearly three quarters of respondents (65%) participated in the program to save money on their bills and almost half (48%) to save energy. Additional reasons for participating include:

- To receive energy efficient measures, such as LED light bulbs, at no cost (20%)
- To help the environment (13%)
- To get a home assessment report (10%)

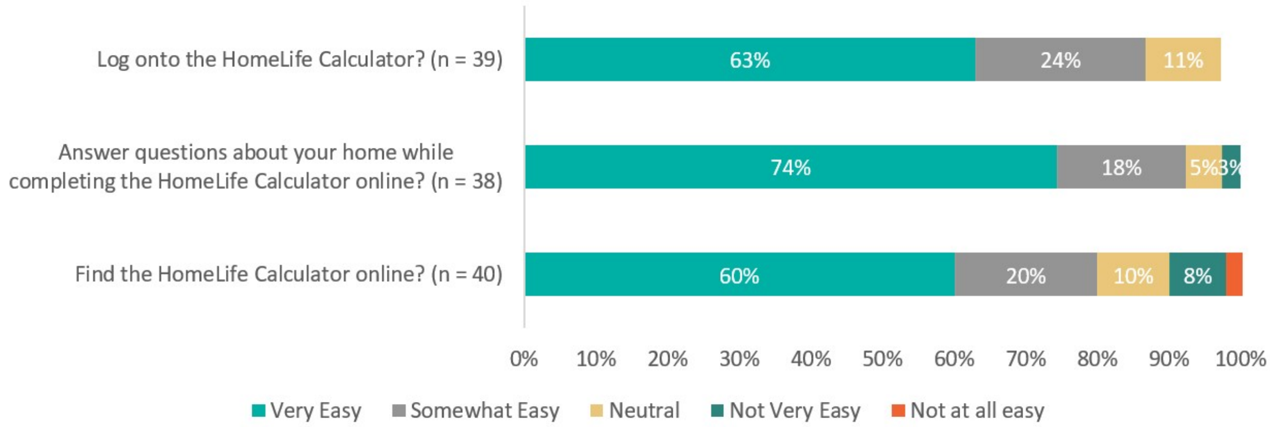
ONLINE AUDIT EXPERIENCE

Most respondents were satisfied with the overall program process (87%).[40] Of those satisfied, 80% reported being somewhat satisfied, while 7% were very satisfied.

Figure 55 shows that most respondents (80%) said it was easy to find the HomeLife calculator and just 8% said it was not. Respondents also found that logging onto the HomeLife Calculator or answering questions about their homes was easy (87% and 92%, respectively). One respondent said it was not easy to find because "I had to do multiple clicks to reach that point to even find out about it." Another respondent said: "I had to go through many pages to find the right way to get into it."

[40] The overall N for this question was 30.

FIGURE 55. 2021 HOMELIFE CALCULATOR PROGRAM: HOW EASY WAS IT TO DO THE FOLLOWING?



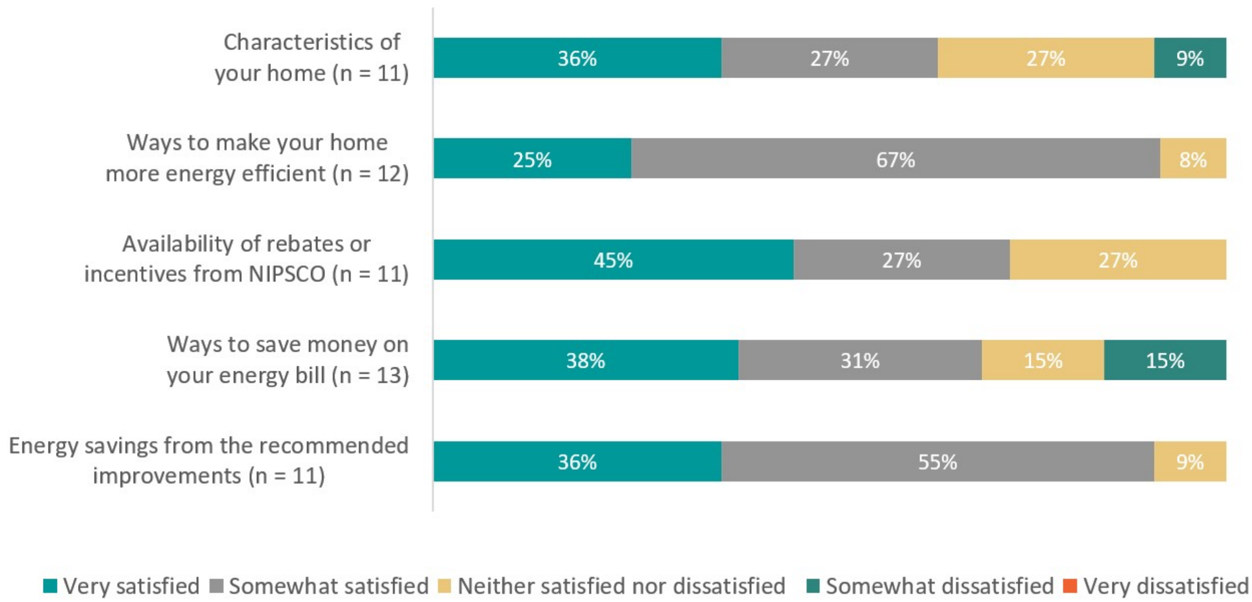
Source: HomeLife survey. Question: "How easy was it to…?"

Nearly a third of respondents (28%) recalled receiving personalized recommendations after filling out the HomeLife Calculator. However, 72% of respondents reported not receiving recommendations or did not recall if they did.[41]

Overall, respondents were satisfied with the various personalized suggestions they received after completing the online audit. In fact, not a single respondent reported being very dissatisfied with a suggestion (Figure 56). Among those respondents who expressed neutrality or dissatisfaction with recommendations about ways to save money on their energy bill, one mentioned "there wasn't anything useful in that section" and another stated "I'm not sure I'm saving money with energy costs." In relation to the availability of rebates or incentives, one dissatisfied respondent mentioned that they were dissatisfied with the time limits they have.

[41] The overall N for this question was 39.

FIGURE 56. 2021 HOMELIFE CALCULATOR PROGRAM: SATISFACTION WITH PERSONALIZED RECOMMENDATIONS

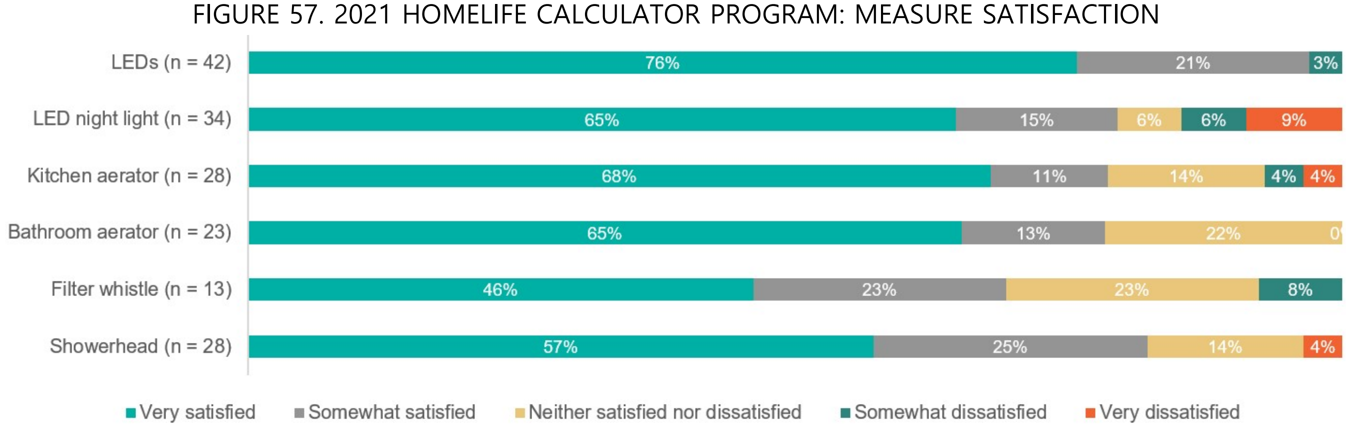


Source: HomeLife survey. Question: "How satisfied were you with how the personalized recommendations explained each of the following?"

KIT MEASURES

Generally, respondents were satisfied with all kit measures. Lighting measures (Both LEDs and LED night lights) experienced the highest satisfaction rates while the showerhead and filter whistle experienced the highest rates of dissatisfaction (FIGURE 57).

FIGURE 57. 2021 HOMELIFE CALCULATOR PROGRAM: MEASURE SATISFACTION



Source: HomeLife survey. Question: "How satisfied are you with the [...] overall?

As discussed in the Verified section, installation rates varied by measure type. Most respondents indicated that they had installed the LEDs and the nightlight at the time of the survey. Fewer respondents indicated that they had installed the showerheads or faucet aerators. Most commonly, respondents who said their water saving devices were not installed said that they either already had one of these measures installed, it did not fit their fixture, or they did not know how to install it.

Notably, as discussed in the impact section, the filter whistle experienced the lowest installation rates. When asked why it was not installed, respondents most said it was because they did not understand what it was. Other respondents said they did not take the time to install it or that it did not fit (Table 179).

TABLE 179. 2021 HOMELIFE CALCULATOR PROGRAM: REASONS FILTER WHISTLE WAS NOT INSTALLED

REASON	COUNT	PERCENT
Did not understand what it was	8	32%
Did not have the time to install it	5	20%
Not sure	4	16%
Did not fit	3	12%
Did not feel the need for it	2	8%
Other	2	8%
Did not like the whistle feature	1	4%
TOTAL	25	100%

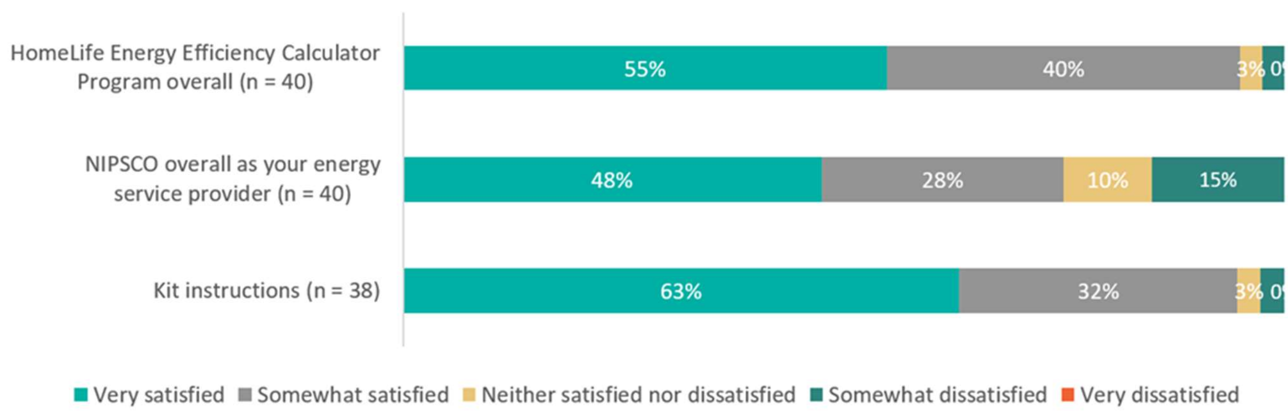
PARTICIPATION IN ADDITIONAL PROGRAMS

Just one respondent reported participating in additional NIPSCO programs since receiving the kit. However, when asked which program they participated in, the respondent said, the “bill payment assistance.” This may suggest that there is a lack of awareness of NIPSCO energy efficiency programs among respondents.

PROGRAM SATISFACTION

As shown in Figure 58, overall satisfaction with the HomeLife Calculator program was high. Most respondents (95%) reported being very or somewhat satisfied with the program overall. Just one respondent was neutral, and one respondent was somewhat dissatisfied with the program due the “the results not being relevant.”

FIGURE 58. 2021 HOMELIFE CALCULATOR PROGRAM: PROGRAM AND UTILITY SATISFACTION



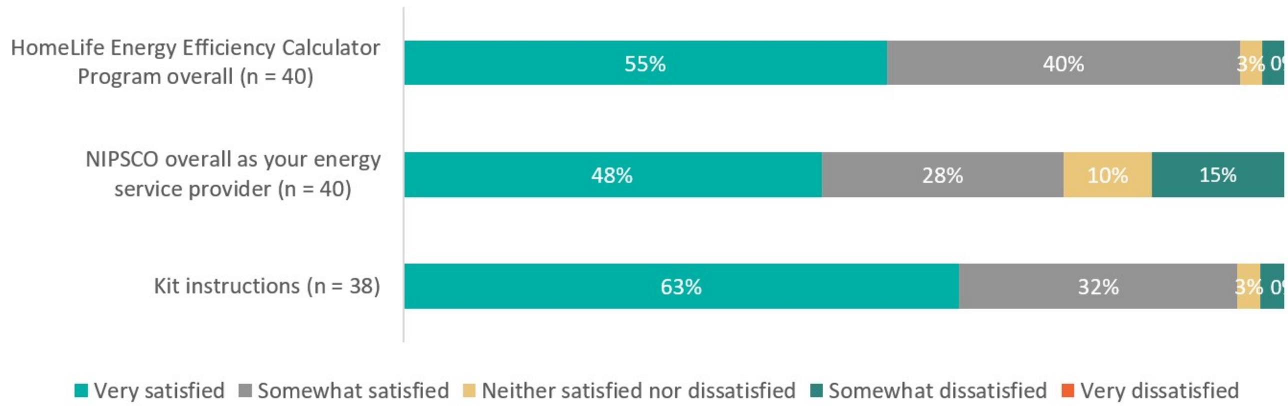
Source: HomeLife survey. Questions: “How satisfied are you with the HomeLife Energy Efficiency Calculator Program overall?”; “How satisfied are you with NIPSCO overall as your energy service provider?”

The evaluation team also asked participants about their satisfaction with the instructions that came with the kit. Most respondents (95%) were satisfied with the instructions. Only three respondents were either neutral or somewhat dissatisfied.

As shown in Figure 59, satisfaction with NIPSCO as their service provider is also high with three quarters of respondents (76%) stating that they were satisfied. The reasons for those that gave dissatisfactory or neutral ratings included:

- Energy costs are high (n=5)
- Utility is the only option (n=3)
- Utility rates keep increasing (n=1)

FIGURE 59. 2021 HOMELIFE CALCULATOR PROGRAM: PROGRAM AND UTILITY SATISFACTION



Source: HomeLife survey. Questions: “How satisfied are you with the HomeLife Energy Efficiency Calculator Program overall?”; “How satisfied are you with NIPSCO overall as your energy service provider?”

SUGGESTIONS FOR PROGRAM IMPROVEMENT

Most people did not have any suggestions for improvement for the HomeLife Calculator program (90%). The participants that had a suggestion for improvement mentioned the following:

- Increase the number of LED light bulbs in the kits from 4, to 6 or 8
- Increase program awareness to capture a broader audience
- Include door seals and draft protection in the kits

CONCLUSIONS AND RECOMMENDATIONS

CONCLUSION 1: LIKE LAST YEAR, FURNACE WHISTLES EXPERIENCED THE LOWEST INSTALLATION RATES OF ALL MEASURES. SOME PARTICIPANTS DO NOT UNDERSTAND THE PURPOSE OF THE FURNACE WHISTLE.

The evaluation team found that many respondents do not install the furnace whistle. Respondents reported some confusion with this measure, both around its purpose and *how* to install it. This likely contributes to lower installation rates.

Recommendations:

- Given this measure's performance, continue with the plan to discontinue offering it in future program cycles. It should be noted that the IL TRM v9.0 (2020) has removed this measure, citing evaluation results indicating it is not effective.

CONCLUSION 2: ANTICIPATED REGULATORY CHANGES WILL LIKELY REDUCE EXPECTED GROSS SAVINGS FOR LIGHTING MEASURES IN FUTURE PROGRAM YEARS.

As discussed in the Residential Lighting chapter, upcoming federal lighting standard changes will likely affect all NIPSCO programs that offer lighting measures to residential customers. The DOE's Office of Energy Efficiency and Renewable Energy again proposed a rule to codify the 45 lumen per-watt standard, with a comment period open through January 27, 2022. [42] The rule is expected to be finalized in 2022 and implemented in early 2023, although the timing is not yet certain and will rely on several factors (such as allowed sell-through periods).

In anticipation of this change, the evaluation team has reduced carryover savings for all LED lightbulbs to one year. Additionally, for non-upstream program designs (like kit offerings and direct-install programs) there may be additional considerations that impact how long these programs may remain viable, as these different delivery types may more frequently "early replace" incandescent or halogen bulbs that otherwise would have remained installed (which is now currently reflected in the in-situ baseline approach). The evaluation team expects that the DOE will provide more guidance in the next few months and will discuss these implications with NIPSCO once more information is known.

Recommendations:

- Monitor the DOE's EISA outcome and incorporate effective changes in program design. Review inclusion of specialty and reflector LEDs as part of the upcoming Indiana Technical Reference Manual (TRM) update process to provide guidance for any future savings for these measures in upstream programs.

[42] Federal Register. Last updated December 13, 2021. "Energy Conservation Program: Backstop Requirements for General Service Lamps." https://www.federalregister.gov/documents/2021/12/13/2021-26807/energy-conservation-program-backstop-requirement-for-general-service-lamps

CONCLUSION 3: PARTICIPANTS WERE GENERALLY SATISFIED THE HOMELIFE CALCULATOR PROGRAM, THE MEASURES INCLUDED IN THE KIT, AND NIPSCO OVERALL.

Participants reported high satisfaction with the program overall, and most respondents found the online participation process to be easy. Seventy-six percent of respondents were somewhat-to-very satisfied with NIPSCO overall as their service provider.

Additionally, more than half of respondents were "very satisfied" with all measures but the low flow showerhead. The highest satisfaction ratings were for lighting measures, LEDs, and the night light.

Recommendations:

- Investigate whether there are opportunities to improve the customer experience with kit showerheads. Respondents who did *not* install the measure reported it did not fit or they did not install it; there may be an opportunity to clarify installation instructions.

CONCLUSION 4: NEARLY THREE-QUARTERS (72%) OF RESPONDENTS DID NOT REMEMBER RECEIVING PERSONALIZED RECOMMENDATIONS AFTER COMPLETING THE AUDIT.

While a third of respondents (28%) recalled receiving personalized recommendations after filling out the HomeLife Calculator, 72% of respondents reported not receiving recommendations or did not recall if they did.

Recommendations:

- Consider revisiting the outreach approach to understand why customers have low recall of receiving the personalized recommendations. There may be an opportunity to revise the mode of delivery, or the language in recommendations email so that customers are more receptive to it.

CONCLUSION 5: CROSS-PROGRAM PARTICIPATION WAS VERY LOW; HOWEVER, A PROPORTIONALLY HIGH NUMBER OF PARTICIPANTS REPORTED ACTING ON RECOMMENDATIONS MADE DURING THE ASSESSMENT WITHOUT RECEIVING A REBATE.

Like last year, just one respondent reported participating in another NIPSCO program aside from the HomeLife Calculator Program and reported that this program was bill pay assistance. However, a high proportion of customers said they took action to save energy post-assessment and indicated that they did so because of their participation in the HomeLife Calculator program.

Recommendations:

- Given that most respondents appear to be engaged in the program and implementing energy efficient improvements afterwards, leverage enthusiasm to build program participation across other NIPSCO offerings. This could involve providing more explicit pathways to participate in other programs (i.e., having outreach staff follow up, or providing program collateral to participants).
- Additionally, most program participants (55%) had an annual household income under $75,000, with one-third (35%) under $50,000. Depending on family size and other factors, some of these customers may be eligible to participate in IQW. The HomeLife Calculator could be a funnel or bridge program to direct eligible customers to IQW; this program could be marketed and directed to both low- and moderate-income customers via community outreach channels (such as food banks, community action agencies, etc.).

13. EMPLOYEE EDUCATION PROGRAM

PROGRAM DESIGN AND DELIVERY

The Employee Education program was first offered in the 2019 program year and had 42 participants in the 2021 program year. Through this program, NIPSCO offers energy efficiency training seminars at places of employment, provides optional energy efficiency kits, and distributes educational materials to inform residential customers, through their workplace, of opportunities and methods to proactively manage their energy consumption. This program is implemented by TRC and the National Energy Foundation (NEF).

All customers—dual fuel (combo), electric-only, and gas-only—are eligible to receive a kit. Electric-only customers receive the combo kit, but NIPSCO does not claim savings for the gas measures. Gas-only customers receive a kit that has additional water saving devices.

- Measures in Combo and Electric Only Kits
    - One kitchen faucet aerator (1.5 gpm)
    - One bathroom faucet aerator (1.0 gpm)
    - One low flow showerhead (1.5 gpm)
    - Four 9-watt LEDs
    - One 0.5-watt LED nightlight
    - One furnace filter whistle
- Measures in Gas Only Kits
    - One kitchen faucet aerator (1.5 gpm)
    - Two-bathroom faucet aerators (1.0 gpm)
    - Two low flow showerheads (1.5 gpm)
    - One furnace filter whistle

In 2021, TRC marketed the Employee Education Program through a variety of marketing approaches, such as bill inserts, local chamber newsletters and events and targeted email campaigns

CHANGES FROM 2020 DESIGN

In 2021, the Employee Education program design was updated to include a virtual seminar instead of an in-person presentation. This was delivered via an on-demand or live online seminar link which could be distributed to employees. At the completion of the virtual seminar, employees were directed to an online form to determine eligibility and gather mailing information for the kit.

Despite this virtual offering, this program saw minimal participation in 2021 and will not be offered in 2022. The evaluation team conducted a high-level impact evaluation, primarily to align *ex post* per measure savings with other kit programs

PROGRAM PERFORMANCE

In 2021, the NIPSCO team adjusted our timelines across programs to deliver evaluation reports earlier than in previous years. To meet the new timelines, for most programs the evaluation teams began analysis earlier, and conducted our impact analyses on 11 months of data instead of the full calendar year (January 1 to November 30, 2021). For the majority of NIPSCO program evaluations, the evaluation metrics developed during this analysis (including in-service rates (ISRs), realization rates, net-to-gross ratios (NTG), etc.) and included in the first draft versions of the report were applied to the full year of data as part of the final, compiled report.

There was no participation in the Employee Education program in December 2021. Therefore, the evaluation effectively included the full program year of data. The remainder of this report includes an evaluation of the full year of data and all evaluation metrics have been developed based on this.

In 2021, the program distributed 42 kits: 30 combo kits, 10 gas kits, and 2 electric kits.[43] It fell short of meeting its electric, peak demand, and gas savings goals. Table 180 summarizes savings for the full year of program performance, including program savings goals.

TABLE 180. 2021 EMPLOYEE EDUCATION PROGRAM SAVING SUMMARY – FULL YEAR 2021

METRIC	GROSS SAVINGS GOAL	*EX ANTE*	AUDITED	VERIFIED	*EX POST* GROSS	*EX POST* NET	GROSS GOAL ACHIEVEMENT
Electric Energy Savings (kWh/yr.)	230,067.00	8,181.38	8,181.27	7,483.77	5,443.47	5,078.60	2%
Peak Demand Reduction (kW)	23.400	0.832	0.835	0.693	0.806	0.792	3%
Natural Gas Energy Savings (therms/yr.)	14,273.00	638.90	638.97	527.71	293.28	292.97	2%

Table 181 outlines the *ex post* gross and NTG adjustment factors. The evaluation team used the spillover and freeridership, calculated from the School Education Program, to calculate NTG adjustment factors.

TABLE 181. 2021 EMPLOYEE EDUCATION PROGRAM ADJUSTMENT FACTORS

METRIC	REALIZATION RATE (%)[a]	FREERIDERSHIP	SPILLOVER	NTG (%)[b]
Electric Energy Savings (kWh/yr.)	67%	16%	9%	93%
Peak Demand Reduction (kW)	97%	11%	9%	98%
Natural Gas Energy Savings (therms/yr.)	46%	9%	9%	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.

The Employee Education program expenditures fell short of the program budget, due to the limited participation in 2021. The implementation team spent 8% of the $36,877.97 allocated budget for electric savings and 8% of the $34,722.38 allocated budget for natural gas savings (see Table 182).

TABLE 182. 2021 EMPLOYEE EDUCATION PROGRAM EXPENDITURES

FUEL	PROGRAM BUDGET	PROGRAM EXPENDITURES	BUDGET SPENT (%)
Electric	$36,877.97	$3,045.89	8%
Natural Gas	$34,722.38	$3,019.20	9%

[43] The "Program Scorecard Notes" in the December Scorecard noted that 40 gas kits were distributed, which includes 10 gas kits and 30 combo kits.

EVALUATION METHODOLOGY

To inform the 2021 NIPSCO impact evaluation, the evaluation team completed the following research activities:

- Utility and implementation staff interviews and discussions, to understand program design and delivery.
- Documentation and materials review, to provide context on program implementation.
- Tracking data analysis, to audit and verify the accuracy of program participation data.
- Engineering analysis, to review 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 2015 Indiana TRM (v2.2), and NIPSCO's program tracking database.[44]

This section details each step of the impact evaluation and its associated electric energy savings, peak demand reduction, and natural gas savings.

AUDITED AND VERIFIED SAVINGS

To audit program savings, the evaluation team performed the following reviews to verify alignment with the program's scorecard:

1. Audited Kits Quantity. Reviewed program tracking data provided by the implementer and audited the number of kits distributed.
2. Confirm Measure-Level Savings Calculations. Reviewed per-measure and per-kit savings in the documentation provided by NIPSCO.
3. Savings Estimate Review. Confirmed program-level total savings.

AUDITED QUANTITY OF KIT

NIPSCO reported a total of 30 combo kits, ten gas-only kits, and two electric-only kits distributed through the Employee Education program. These reported scorecard values were checked against the program tracking data. The audit of the tracking data mirrored the totals reported by NIPSCO (Table 183).

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

TABLE 183. 2021 EMPLOYEE EDUCATION PROGRAM AUDITED KIT QUANTITY

KIT TYPE	SCORECARD[45]	TRACKING DATA
Combo Kits	30	30
Gas Only Kits	10	10
Electric Only Kits	2	2
Total	42	42

CONFIRMATION OF MEASURE-LEVEL SAVINGS

The evaluation team reviewed the kit savings documentation in the 2021 Program Design file, which contained measure-level and kit-level savings. Importantly, NIPSCO included installation rates from past EM&V efforts in their *ex ante* assumptions for the kit program. The measure calculations included rates to adjust savings for both installation practices and water heater fuel saturation.

Upon review of this document, measure-level savings values in the tracking data aligned with NIPSCO's kit savings documentation. However, program tracking data savings were reported at the kit-level with a rounded total kit value, and NIPSCO's Measure Calculation file savings were reported at the measure-level with un-rounded per measure values. This difference in the unit of analysis resulted in rounding errors, meaning that the sum of total measure savings was slightly off from the tracking data savings. These rounding errors will be noted where applicable in the remainder of this report.

SAVINGS ESTIMATE REVIEW

The evaluation team also reviewed measure-level and total savings values. Savings values in the program tracking data were summed and compared to savings values reported in the scorecard. The savings values align, as shown in Table 184.

TABLE 184. 2021 EMPLOYEE EDUCATION PROGRAM SAVINGS ESTIMATES

UNIT OF ENERGY SAVINGS	SCORECARD	TRACKING DATA
kWh	8,181.38	8,181.38
kW	0.832	0.832
therms	638.90	638.90

[45] As noted above, the "Program Scorecard Notes" in the December Scorecard noted that 40 gas kits were distributed, which includes 10 gas kits and 30 combo kits.

IN-SERVICE RATES

Given the small number of participants in the Employee Education program, the evaluation team applied in-service rates from the HomeLife Calculator program to the measures in the Employee Education program.[46] Table 185 lists the ISRs for the kit measures.

TABLE 185. 2021 EMPLOYEE EDUCATION PROGRAM IN-SERVICE RATES RATIOS BY MEASURE

MEASURE	ISR
LED - Combo Kit (Dual Fuel)	80%
LED - Electric Only Kit	80%
Night light - Combo Kit (Dual Fuel)	87%
Night light - Electric Only Kit	87%
Bath aerator - Combo Kit (Dual Fuel)	36%
Bath aerators - Gas Only Kit	36%
Bath aerator - Electric Only Kit	36%
Kitchen aerator - Combo Kit (Dual Fuel)	49%
Kitchen aerator - Gas Only Kit	49%
Kitchen aerator - Electric Only Kit	49%
Showerhead - Combo Kit (Dual Fuel)	42%
Showerheads - Gas Only Kit	42%
Showerhead - Electric Only Kit	42%
Filter whistle - Combo Kit (Dual Fuel)	25%
Filter whistle - Gas Only Kit	25%
Filter whistle - Electric Only Kit	25%

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 2021 Home Energy Worksheet (HEW) results from the School Education program, which provided a large sample of customers who report their water heater fuel, shown in Table 186. Results indicate a slight discrepancy between *ex ante* and verified electric and natural gas domestic water heating saturation rates.

[46] The methodology behind these ISR calculations can be found in the HomeLife Calculator program report chapter.

TABLE 186. 2021 EMPLOYEE EDUCATION PROGRAM WATER HEATER FUEL SATURATION[47]

SAVINGS TYPE	ELECTRIC WATER HEATING SATURATION RATE (%)	NATURAL GAS WATER HEATING SATURATION RATE (%)
Reported *ex ante*	22%	73%
Verified[a]	23%	62%

[a] Electric and natural gas saturation rates do not total 100% because 7% of respondents selected "Other" and 9% selected "Propane" on the HEW.

Table 187 summarizes the tracking data quantity, audited quantity, applied installation rates, and resulting verified quantity per measure. To calculate the verified measure quantity, the evaluation team multiplied the audited measure quantity by the installation rate.

TABLE 187. 2021 EMPLOYEE EDUCATION PROGRAM *EX ANTE* AND VERIFIED PER-UNIT MEASURE SAVINGS

MEASURE	ISR	*EX ANTE* KWH SAVINGS PER UNIT[a]	VERIFIED KWH SAVINGS PER UNIT	*EX ANTE* KW REDUCTION PER UNIT	VERIFIED KW REDUCTION PER UNIT	*EX ANTE* THERM SAVINGS PER UNIT	VERIFIED THERM SAVINGS PER UNIT
LED - Combo Kit (Dual Fuel)	80%	33.37	28.71	0.004	0.003	(0.68)	(0.59)
LED - Electric Only Kit	80%	33.29	28.64	0.004	0.003	0.00	0.00
Night light - Combo Kit (Dual Fuel)	87%	4.74	4.63	0.000	0.000	0.00	0.00
Night light - Electric Only Kit	87%	4.74	4.63	0.000	0.000	0.00	0.00
Bath aerator - Combo Kit (Dual Fuel)	36%	4.52	4.47	0.000	0.000	0.66	0.53
Bath aerators - Gas Only Kit	36%	0.00	0.00	0.000	0.000	0.66	0.53
Bath aerator - Electric Only Kit	36%	4.58	4.54	0.000	0.000	0.00	0.00
Kitchen aerator - Combo Kit (Dual Fuel)	49%	33.55	37.36	0.001	0.001	4.90	4.43
Kitchen aerator - Gas Only Kit	49%	0.00	0.00	0.000	0.000	4.93	4.46
Kitchen aerator - Electric Only Kit	49%	33.93	37.78	0.001	0.001	0.00	0.00
Showerhead - Combo Kit (Dual Fuel)	42%	53.66	55.04	0.002	0.002	7.83	6.53
Showerheads - Gas Only Kit	42%	0.00	0.00	0.000	0.000	7.87	6.53
Showerhead - Electric Only Kit	42%	54.15	55.29	0.002	0.002	0.00	0.00
Filter whistle - Combo Kit (Dual Fuel)	25%	25.69	17.51	0.009	0.006	2.48	1.69
Filter whistle - Gas Only Kit	25%	0.00	0.00	0.000	0.000	2.48	1.69
Filter whistle - Electric Only Kit	25%	25.69	17.51	0.009	0.006	0.00	0.00

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

EX POST GROSS SAVINGS

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

[47] Calculated from 2021 School Education program HEW results.

ENGINEERING REVIEWS

The evaluation team referred to the Indiana TRM (v2.2) and the 2021 Pennsylvania TRM to calculate *ex post* gross electric energy savings, demand reduction, and natural gas savings. Appendix 11 contains details on the specific algorithms, variable assumptions, and references for all program measures *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 did not assign a therm penalty to the LED measures, consistent with the C&I approach.
- The evaluation team used geolocation for each customer address in the database, then matched each address with 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 faucet aerators, showerheads, and LED bulbs.
- The evaluation team referred to the 2021 Pennsylvania TRM for the *ex post* savings for the filter whistle measure.

The following sections summarize the team's findings and recommendations based on the engineering review.

EX POST GROSS SAVINGS

Ex post savings reflect the engineering adjustments made to verified measure savings. The evaluation team calculated *ex post* electric energy, peak demand, and natural gas energy savings for each measure kit using algorithms and inputs from the Indiana TRM (v2.2), the 2021 Pennsylvania TRM, as well as customer location, to account for weather effects. The evaluation team leveraged Homelife Calculator participant survey information for faucet and showerheads per home, and the parent worksheet from the School Education program to estimate heating system and water heater fuel type saturation values, then used this information to inform *ex post* gross savings calculations. *Ex post* savings calculations differed from *ex ante* analysis as follows:

- LED: Updated baseline wattage and ISR values for LEDs. The 2021 *ex ante* analysis applies the UMP baseline wattage of 43 watts, whereas the *ex post* analysis applies a blended baseline, calculated using 2021 Homelife calculator survey results, of 35.5 watts. The 2021 survey results used to calculate the *ex post* baseline are provided in Appendix 11, and a discussion of therm penalties generated by LED lighting is provided below.
- Nightlight: Updated ISR and incandescent replacement factor values in the *ex post* analysis decrease energy savings compared to *ex ante*.
- Filter whistle: Evaluation methodology. The evaluation team referred to the 2021 Pennsylvania TRM to calculate filter whistle electric savings, which assigns electric energy and demand savings to the blower motor energy reduction because dirty filters increase electricity consumption for the circulating fan. The *ex ante* approach referenced the Illinois TRM (v8), which assigns electric energy, demand, and therm savings. The evaluation team does not give therm savings for the filter whistle measure because, in our best judgment, any therm savings will be minimal, and a review of available literature reveals a lack of defensible evidence for assigning therm savings at this time. Notably, the filter whistle is a provisional

measure in Illinois TRM (v8) and was subsequently removed from Illinois TRM (v9), due to "evaluation results showing filter alarms being ineffectual at indicating a dirty filter."[48]

- Low flow faucet aerators and showerheads: Updated water heating fuel saturation values and ISRs. The evaluation team applied updated water heating fuel saturation percentages and ISRs based on 2021 HEW results. As reported in Table 186. 2021 Employee Education program Water heater fuel saturation, the verified natural gas water heater saturation rate is lower than *ex ante*, 62% and 73%, respectively, and the verified electric water heater saturation rate is higher than *ex ante*, 23% and 22%, respectively.

Table 188 shows the *ex ante* deemed savings and *ex post* gross per-measure savings for 2021 Employee Education program measures.

TABLE 188. 2021 EMPLOYEE EDUCATION PROGRAM *EX ANTE* AND *EX POST* GROSS PER-MEASURE SAVINGS VALUES

MEASURE	NUMBER OF UNITS PER KIT	*EX ANTE* DEEMED PER-KIT SAVINGS[a]			*EX POST* GROSS PER-KIT SAVINGS		
		kWh	kW	therms	kWh	kW	therms
LED - Combo Kit (Dual Fuel)	4	133.48	0.014	(2.73)	89.41	0.010	0.00
LED - Electric Only Kit	4	133.16	0.014	0.00	89.41	0.010	0.00
Night light - Combo Kit (Dual Fuel)	1	4.74	0.000	0.00	2.61	0.000	0.00
Night light - Electric Only Kit	1	4.74	0.000	0.00	2.61	0.000	0.00
Bath aerator - Combo Kit (Dual Fuel)	1	4.52	0.000	0.66	2.58	0.000	0.31
Bath aerators - Gas Only Kit	2	0.00	0.000	1.33	0.00	0.000	0.64
Bath aerator - Electric Only Kit	1	4.58	0.000	0.00	2.58	0.000	0.00
Kitchen aerator - Combo Kit (Dual Fuel)	1	33.55	0.001	4.90	20.30	0.001	2.41
Kitchen aerator - Gas Only Kit	1	0.00	0.000	4.93	0.00	0.000	2.49
Kitchen aerator - Electric Only Kit	1	33.93	0.001	0.00	20.30	0.001	0.00
Showerhead - Combo Kit (Dual Fuel)	1	53.66	0.002	7.83	30.10	0.002	3.57
Showerheads - Gas Only Kit	2	0.00	0.000	15.74	0.00	0.000	7.35
Showerhead - Electric Only Kit	1	54.15	0.002	0.00	30.10	0.002	0.00
Filter whistle - Combo Kit (Dual Fuel)	1	25.69	0.009	2.48	25.11	0.013	0.00
Filter whistle - Gas Only Kit	1	0.00	0.000	2.48	0.00	0.000	0.00
Filter whistle - Electric Only Kit	1	25.69	0.009	0.00	25.11	0.013	0.00
Total Combo Kit Savings		255.63	0.026	13.14	170.11	0.025	6.28
Total Electric Only Kit Savings		256.24	0.026	0.00	170.11	0.025	0.00
Total Gas Only Kit Savings		0.00	0.000	24.47	0.00	0.000	10.48

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

Table 189 highlights notable differences between *ex ante* and *ex post* gross estimates.

[48] Illinois Energy Efficiency Stakeholder Advisory Group. September 25, 2020. 2021 Illinois Statewide Technical Reference Manual for Energy Efficiency Version 9.0. "Volume 3: Residential Measures."

TABLE 189. 2021 EMPLOYEE EDUCATION 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
Kitchen aerator, Bathroom aerator, and Low flow showerheads	Indiana TRM (v2.2) and 2019 EMV	Indiana TRM (v2.2) and information in program tracking data. Cold water inlet temperature averaged across current participant location, and water heater saturation from 2021 Schools HEW information and ISRs from 2021 HomeLife Calculator program survey information.	The evaluation team used the Indiana TRM (v2.2) assumption for the number of people per home, updated the hot water heating saturation based on 2021 survey information, and applied inlet water temperature based on current participant type and location.
9W LED	Indiana TRM (v2.2) and 2019 EMV	Indiana TRM (v2.2); 2021 HomeLife Calculator survey for baseline wattages	The evaluation team updated the baseline wattage to a blended value based on 2021 survey information. The *ex ante* analysis applies the UMP baseline wattage.
Nightlight	Indiana TRM (v2.2) and 2019 EMV	Indiana TRM (v2.2) and 2021 HomeLife Calculator survey information for incandescent replacement	The *ex ante* analysis applies the 2019 incandescent replacement factor (IRF) to account for LED nightlights replacing incandescent nightlights. For the *ex post* analysis, the evaluation team updated the IRF based on 2021 HomeLife Calculator survey information.
Filter Whistle	Illinois TRM (v8)	2021 Pennsylvania TRM and Indiana TRM (v2.2)	The *ex ante* analysis assigns cooling system savings to all combo and electric kit participants and full therm savings to all combo and gas kit participants. The *ex post* analysis refers to the Indiana TRM (v2.2) for the percentage of households with central air conditioning, and the evaluation team's review of available literature reveals a lack of defensible evidence for assigning therm savings at this time.

WASTE HEAT FACTOR – THERM PENALTIES

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

The *ex ante* savings for all kit programs include therm penalties. 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. In total, the therm penalty for cost-effectiveness analysis is – 54.80 therms (Table 190).

TABLE 190. 2021 EMPLOYEE EDUCATION WASTE HEAT FACTOR THERM PENALTY

MEASURE	WASTE HEAT FACTOR THERM PENALTY
LED (9W) - Combo Kit	(54.80)

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

REALIZATION RATES

The next three tables (Table 191 through Table 193) show the program's *ex ante* reported savings, verified savings, and *ex post* gross savings.

TABLE 191. 2021 EMPLOYEE EDUCATION PROGRAM *EX ANTE* AND *EX POST* GROSS ELECTRIC ENERGY SAVINGS

MEASURE	*EX ANTE*[a] ELECTRIC ENERGY SAVINGS (KWH/YR.)	AUDITED GROSS ELECTRIC ENERGY SAVINGS (KWH/YR.)	VERIFIED GROSS ELECTRIC ENERGY SAVINGS (kWh/yr.)	*EX POST* GROSS ELECTRIC ENERGY SAVINGS (KWH/YR.)
LED - Combo Kit (Dual Fuel)	-	4,004.40	3,444.65	2,682.28
LED - Electric Only Kit	-	266.32	229.09	178.82
Night light - Combo Kit (Dual Fuel)	-	142.09	138.80	78.30
Night light - Electric Only Kit	-	9.47	9.25	5.22
Bath aerator - Combo Kit (Dual Fuel)	-	135.47	134.18	77.50
Bath aerators - Gas Only Kit	-	0.00	0.00	0.00
Bath aerator - Electric Only Kit	-	9.16	9.07	5.17
Kitchen aerator - Combo Kit (Dual Fuel)	-	1,006.55	1,120.93	608.90
Kitchen aerator - Gas Only Kit	-	0.00	0.00	0.00
Kitchen aerator - Electric Only Kit	-	67.86	75.57	40.59
Showerhead - Combo Kit (Dual Fuel)	-	1,609.69	1,651.26	902.97
Showerheads - Gas Only Kit	-	0.00	0.00	0.00
Showerhead - Electric Only Kit	-	108.30	110.59	60.20
Filter whistle - Combo Kit (Dual Fuel)	-	770.58	525.35	753.29
Filter whistle - Gas Only Kit	-	0.00	0.00	0.00
Filter whistle - Electric Only Kit	-	51.37	35.02	50.22
Total Savings	8,181.38	8,181.27	7,483.77	5,443.47
Total Program Realization Rate				67%

Note: Totals may not sum properly due to rounding.

[a] Program tracking data is summed at the kit-level (not measure level). Therefore, *ex ante* savings are only reported at the summary level, due to rounding errors.

TABLE 192. 2021 EMPLOYEE EDUCATION PROGRAM *EX ANTE* AND *EX POST* GROSS PEAK DEMAND REDUCTION

MEASURE	*EX ANTE*[a] PEAK DEMAND REDUCTION (KW/YR.)	AUDITED GROSS PEAK DEMAND REDUCTION (KW/YR.)	VERIFIED GROSS PEAK DEMAND REDUCTION (KW/YR.)	*EX POST* GROSS PEAK DEMAND REDUCTION (KW/YR.)
LED - Combo Kit (Dual Fuel)	-	0.433	0.373	0.290
LED - Electric Only Kit	-	0.029	0.025	0.019
Night light - Combo Kit (Dual Fuel)	-	0.000	0.000	0.000
Night light - Electric Only Kit	-	0.000	0.000	0.000
Bath aerator - Combo Kit (Dual Fuel)	-	0.008	0.008	0.008
Bath aerators - Gas Only Kit	-	0.000	0.000	0.000

MEASURE	*EX ANTE*[a] PEAK DEMAND REDUCTION (KW/YR.)	AUDITED GROSS PEAK DEMAND REDUCTION (KW/YR.)	VERIFIED GROSS PEAK DEMAND REDUCTION (KW/YR.)	*EX POST* GROSS PEAK DEMAND REDUCTION (KW/YR.)
Bath aerator - Electric Only Kit	-	0.001	0.001	0.001
Kitchen aerator - Combo Kit (Dual Fuel)	-	0.025	0.028	0.028
Kitchen aerator - Gas Only Kit	-	0.000	0.000	0.000
Kitchen aerator - Electric Only Kit	-	0.002	0.002	0.002
Showerhead - Combo Kit (Dual Fuel)	-	0.048	0.049	0.049
Showerheads - Gas Only Kit	-	0.000	0.000	0.000
Showerhead - Electric Only Kit	-	0.003	0.003	0.003
Filter whistle - Combo Kit (Dual Fuel)	-	0.268	0.192	0.381
Filter whistle - Gas Only Kit	-	0.000	0.000	0.000
Filter whistle - Electric Only Kit	-	0.018	0.013	0.025
Total Savings	0.832	0.835	0.693	0.806
Total Program Realization Rate				97%

Note: Totals may not sum properly due to rounding.
[a] Program tracking data is summed at the kit-level (not measure level). Therefore, *ex ante* savings are only reported at the summary level, due to rounding errors.

TABLE 193. 2021 EMPLOYEE EDUCATION PROGRAM *EX ANTE* AND *EX POST* GROSS NATURAL GAS ENERGY SAVINGS

MEASURE	*EX ANTE*[a] NATURAL GAS ENERGY SAVINGS (THERMS/YR.)	AUDITED GROSS NATURAL GAS ENERGY (THERMS/YR.)	VERIFIED GROSS NATURAL GAS ENERGY SAVINGS (THERMS/YR.)	*EX POST* GROSS NATURAL GAS ENERGY SAVINGS (THERMS/YR.)
LED - Combo Kit (Dual Fuel)	-	(81.83)	(70.39)	0.00
LED - Electric Only Kit	-	0.00	0.00	0.00
Night light - Combo Kit (Dual Fuel)	-	0.00	0.00	0.00
Night light - Electric Only Kit	-	0.00	0.00	0.00
Bath aerator - Combo Kit (Dual Fuel)	-	19.78	15.91	9.19
Bath aerators - Gas Only Kit	-	13.28	10.68	6.40
Bath aerator - Electric Only Kit	-	0.00	0.00	0.00
Kitchen aerator - Combo Kit (Dual Fuel)	-	146.95	132.94	72.22
Kitchen aerator - Gas Only Kit	-	49.26	44.56	24.92
Kitchen aerator - Electric Only Kit	-	0.00	0.00	0.00
Showerhead - Combo Kit (Dual Fuel)	-	235.00	195.84	107.09
Showerheads - Gas Only Kit	-	157.38	130.56	73.46
Showerhead - Electric Only Kit	-	0.00	0.00	0.00
Filter whistle - Combo Kit (Dual Fuel)	-	74.37	50.70	0.00
Filter whistle - Gas Only Kit	-	24.79	16.90	0.00
Filter whistle - Electric Only Kit	-	0.00	0.00	0.00
Total Savings	638.90	638.97	527.71	293.28
Total Program Realization Rate				46%

Note: Totals may not sum properly due to rounding.
[a] Program tracking data is summed at the kit-level (not measure level). Therefore, *ex ante* savings are only reported at the summary level, due to rounding errors.

EX POST NET SAVINGS

To calculate *ex post* net savings, the evaluation team used freeridership and participant spillover from the 2021 School Education Program participant survey.[49] While participant spillover was unusually high in 2020 – 52% – the 2021 spillover rate of 9% aligns with what the evaluation team has found in previous evaluation years. Table 194 shows the NTG ratios by measure.

TABLE 194. 2021 EMPLOYEE EDUCATION PROGRAM NET-TO-GROSS RATIOS BY MEASURE

MEASURE	NTG
LED - Combo Kit (Dual Fuel)	85%
LED - Electric Only Kit	85%
Night light - Combo Kit (Dual Fuel)	102%
Night light - Electric Only Kit	102%
Bath aerator - Combo Kit (Dual Fuel)	98%
Bath aerators - Gas Only Kit	98%
Bath aerator - Electric Only Kit	98%
Kitchen aerator - Combo Kit (Dual Fuel)	100%
Kitchen aerator - Gas Only Kit	100%
Kitchen aerator - Electric Only Kit	100%
Showerhead - Combo Kit (Dual Fuel)	100%
Showerheads - Gas Only Kit	100%
Showerhead - Electric Only Kit	100%
Filter whistle - Combo Kit (Dual Fuel)	108%
Filter whistle - Gas Only Kit	108%
Filter whistle - Electric Only Kit	108%

Table 195 presents the resulting net electric savings, demand reduction, and natural gas savings.

TABLE 195. 2021 EMPLOYEE EDUCATION PROGRAM *EX POST* NET SAVINGS

MEASURE	*EX POST* GROSS SAVINGS/REDUCTION			NTG	*EX POST* NET SAVINGS/REDUCTION		
	kWh	kW	therms		kWh	kW	therms
LED - Combo Kit (Dual Fuel)	2,682.28	0.290	0.00	85%	2,279.94	0.247	0.00
LED - Electric Only Kit	178.82	0.019	0.00	85%	152.00	0.016	0.00
Night light - Combo Kit (Dual Fuel)	78.30	0.000	0.00	102%	79.87	0.000	0.00
Night light - Electric Only Kit	5.22	0.000	0.00	102%	5.32	0.000	0.00
Bath aerator - Combo Kit (Dual Fuel)	77.50	0.008	9.19	98%	75.95	0.008	9.01
Bath aerators - Gas Only Kit	0.00	0.000	6.40	98%	0.00	0.000	6.27
Bath aerator - Electric Only Kit	5.17	0.001	0.00	98%	5.06	0.001	0.00
Kitchen aerator - Combo Kit (Dual Fuel)	608.90	0.028	72.22	100%	608.90	0.028	72.22

[49] NTG calculated from the 2020 School Education Program participant survey was used for the Employee Education kit measures because the contents of the kit were the same and there was a sufficient sample to calculate NTG.

MEASURE	*EX POST* GROSS SAVINGS/REDUCTION			NTG	*EX POST* NET SAVINGS/REDUCTION		
	kWh	kW	therms		kWh	kW	therms
Kitchen aerator - Gas Only Kit	0.00	0.000	24.92	100%	0.00	0.000	24.92
Kitchen aerator - Electric Only Kit	40.59	0.002	0.00	100%	40.59	0.002	0.00
Showerhead - Combo Kit (Dual Fuel)	902.97	0.049	107.09	100%	902.97	0.049	107.09
Showerheads - Gas Only Kit	0.00	0.000	73.46	100%	0.00	0.000	73.46
Showerhead - Electric Only Kit	60.20	0.003	0.00	100%	60.20	0.003	0.00
Filter whistle - Combo Kit (Dual Fuel)	753.29	0.381	0.00	108%	813.56	0.411	0.00
Filter whistle - Gas Only Kit	0.00	0.000	0.00	108%	0.00	0.000	0.00
Filter whistle - Electric Only Kit	50.22	0.025	0.00	108%	54.24	0.027	0.00
Total Savings	5,443.47	0.806	293.28		5,078.60	0.792	292.97

Note: Totals may not sum properly due to rounding.

Table 196 shows the NTG results by fuel type.

TABLE 196. 2021 EMPLOYEE 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.)	8,181.38	5,443.47	93%	5,078.60
Peak Demand Reduction (kW)	0.832	0.806	98%	0.792
Natural Gas Energy Savings (therms/yr.)	638.90	293.28	100%	292.97

CONCLUSIONS AND RECOMMENDATIONS

CONCLUSION 1: THE PROGRAM DID NOT MEET SAVINGS GOALS IN 2021.

Due to the limited participation in this program in 2021, the program fell short of its savings goals. Despite the introduction of a virtual seminar to make it easier for businesses to participate, the program did not gain traction and will not be offered in 2022.

CONCLUSION 2: REALIZATION RATES VARIED DUE TO DIFFERENCES IN ALGORITHMS AND ASSUMPTIONS BETWEEN *EX ANTE* AND *EX POST* GROSS SAVINGS.

While participation in the program was low this year, the evaluation team examined the *ex ante* assumptions. Program-level realization rates ranged from 46% for natural gas energy savings to 97% for demand reduction, with variation across measures. The primary reason for the difference in *ex ante* and *ex post* LED savings is the different baseline wattage assumptions. In the case of the water savings measures, the evaluation team used the Indiana TRM (v2.2) assumption for the number of people per home, updated the hot water heating saturation based on 2021 survey information, and applied inlet water temperature based on current participant type and location. In addition, ISRs for water saving measures ranged from 36% to 49%, based on results from the 2021 HomeLife Calculator evaluation.

14. RESIDENTIAL ONLINE MARKETPLACE PROGRAM

PROGRAM DESIGN AND DELIVERY

The Residential Online Marketplace (OLM) program is a new program, launched at the very end of 2020 with a full ramp up in 2021. This program provides instant discounts on stand-alone energy-saving products and energy-saving kits, purchased through an online store. The program's intent is to help remove the financial barrier associated with the initial cost of these energy-efficient alternatives. This program is implemented by TRC, who partners with TechniArt to implement the online marketplace. TechniArt is responsible for building, hosting, and maintaining the 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. The energy efficient items are then shipped directly to the customer's home within five to eight days and customers may return products up to 30 days after receipt. Participants must be active NIPSCO residential customers that receive the corresponding electric and/or natural gas service for the product they are purchasing. Products purchased through the OLM are not eligible for rebates through other NIPSCO programs.

The measures offered through the Residential OLM are listed below. For certain measures, there are caps on the number of items a customer can purchase in a calendar year.

- Stand-alone Online Marketplace measures
  - Tier 1 and Tier 2 advanced power strips (limit of 4 power strips per year)
  - Bathroom aerator 1.0 gpm
  - Kitchen aerator 1.5 gpm
  - LED light bulbs (limit of 24 LED bulbs of any type per year)
  - LED indoor and outdoor string lights (limit of 4 sets of string lights per year)
  - Low flow showerhead and handheld showerhead 1.5 gpm
  - Low flow showerhead and handheld showerhead 1.5 gpm w/ ShowerStart
  - ShowerStart
  - Pipe wrap 15 ft
  - Wi-Fi thermostat (limit of 1 thermostat per year)
  - Smart plug (limit of 8 smart plugs per year)
  - Energy Star air purifier/cleaner (limit of 2 air purifiers per year)
- Bathroom kit (limit of 1 kit per year)
  - Eight LED globe bulbs
  - One low flow showerhead (1.5 gpm)
  - One bathroom aerator (1.0 gpm)
  - One LED nightlight
- Home Office/Back to School kit (limit of 1 kit per year)
  - Two smart LED bulbs
  - One tier 1 advanced power strip
  - One desk lamp

- One LED nightlight
- Optional add-on: up to two 6-packs of 9.5W BR/PAR LED reflector bulbs

In 2021, NIPSCO offered Home Office/Back to School kits to customers at no cost. Customers also had the option to receive up to two 6-packs of 9.5W BR/PAR LED reflector bulbs at no cost with the kit. The OLM also promoted certain offerings through limited time offerings (LTOs), including BR30 LEDs, Wi-Fi thermostats, Bathroom kits, and Home Office/Back to School kits. Certain products, such as the two kit products, were only available during the LTOs. Other products, such as Wi-Fi thermostats, were offered at an additional discount from the manufacturer during the LTO.

PROGRAM PERFORMANCE

In 2021, the NIPSCO team adjusted our timelines across programs to deliver evaluation reports earlier than in previous years. To meet the new timelines, for most programs, the evaluation teams began analysis earlier, and conducted our impact analyses on 11 months of data instead of the full calendar year (January 1 to November 30, 2021). The evaluation metrics developed during this analysis (including in-service rates, realization rates, net-to-gross ratios, etc.) and included in the first draft versions of the report were applied to the full year of data as part of the final, compiled report and included in Table 197 below.

Table 197 summarizes savings for the full year of program performance, including program savings goals.

TABLE 197. 2021 RESIDENTIAL ONLINE MARKETPLACE PROGRAM SAVING SUMMARY – FULL YEAR 2021

METRIC	GROSS SAVINGS GOAL	*EX ANTE*	AUDITED	VERIFIED	*EX POST* GROSS	*EX POST* NET	GROSS GOAL ACHIEVEMENT
Electric Energy Savings (kWh/yr.)	1,946,267.38	3,638,617.00	3,637,836.97	2,904,027.07	1,519,906.01	1,077,907.05	78%
Peak Demand Reduction (kW)	375.231	632.707	628.740	494.902	308.914	237.191	82%
Natural Gas Energy Savings (therms/yr.)	111,002.79	119,027.58	118,438.63	93,667.07	42,453.78	38,770.30	38%

Table 198 summarizes savings evaluated during the program's evaluation period, which was from January 2021 to November 2021.

TABLE 198. 2021 RESIDENTIAL ONLINE MARKETPLACE PROGRAM SAVING SUMMARY – JANUARY THROUGH NOVEMBER 2021

METRIC	*EX ANTE*	AUDITED	VERIFIED	*EX POST* GROSS	*EX POST* NET
Electric Energy Savings (kWh/yr.)	3,510,654.18	3,509,874.15	2,784,811.99	1,449,252.86	1,020,953.86
Peak Demand Reduction (kW)	562.968	559.013	438.935	271.609	203.925
Natural Gas Energy Savings (therms/yr.)	74,119.56	73,800.35	59,149.64	30,946.90	28,217.00

Table 199 outlines realization rates and NTG adjustment factors.

TABLE 199. 2021 RESIDENTIAL ONLINE MARKETPLACE PROGRAM ADJUSTMENT FACTORS

METRIC	REALIZATION RATE (%) [a]	FREERIDERSHIP	SPILLOVER	NTG (%) [b]
Electric Energy Savings (kWh/yr.)	41%	37%	7%	70%
Peak Demand Reduction (kW)	48%	32%	7%	75%
Natural Gas Energy Savings (therms/yr.)	42%	16%	7%	91%

[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.

In 2021, the OLM greatly exceeded its overall electric budget and slightly exceeded its natural gas budget. Table 200 lists the 2021 program budget and expenditures by fuel type. It should be noted that while the electric OLM program significantly overspent its budget, other NIPSCO residential programs underspent, and overall, the residential portfolio was underspent on its electric budget.

TABLE 200. 2021 RESIDENTIAL ONLINE MARKETPLACE PROGRAM EXPENDITURES

FUEL	PROGRAM BUDGET	PROGRAM EXPENDITURES	BUDGET SPENT (%)
Electric	$307,461.93	$935,866.79	304%
Natural Gas	$132,589.25	$135,736.98	102%

EVALUATION METHODOLOGY

To inform the 2021 NIPSCO impact and process evaluation, the evaluation team completed the following research activities:

- **Program staff interviews and discussions,** to understand the program design and delivery.
- **Documentation and materials review,** to provide context on program design and implementation.
- **Tracking data audit**, to audit and verify the accuracy of program participation data.
- **Engineering analysis**, to review program savings assumptions and algorithms for reasonableness and accuracy.
- **Mixed-mode customer survey (n=153),** to assess sources of install rates, net-to-gross, and awareness, motivations, perceptions, experience, and satisfaction with the OLM.

IMPACT EVALUATION

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

- What assumptions were used to develop deemed savings estimates? Are there any updates that should be made?
- What are *ex post* program savings? Do these suggest any needed updates to program design, delivery, or savings assumptions?
- What are 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 (net savings)?
- Is the program on track to meet its participation and savings goals?

This section details each step of the impact evaluation and its associated electric energy savings, peak demand reduction, and natural gas savings.

AUDITED AND VERIFIED SAVINGS

AUDITED SAVINGS

To audit program savings, the evaluation team performed the following reviews to verify alignment with the program's scorecard:

4. Audited Quantity. Reviewed measure quantities by looking for duplicate records, ensuring measures followed program guidelines, and making sure the proper deemed savings values were applied.
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.

AUDITED QUANTITY

According to the 2021 tracking data, the program rebated a total of 18,854 items, distributed to 9,517 customers. The evaluation team audited measure quantities by looking for duplicate records, ensuring measures followed program guidelines, and making sure the proper deemed savings values were applied.

When conducting the tracking data audit, we identified the following anomalies impacting less than 1% of all program savings:

- Six records did not have any customer information associated with them, including electric or gas ID, applicant name, applicant phone number, or applicant address. Participants must be active NIPSCO residential customers that receive the corresponding electric and/or natural gas savings to be eligible for the program. These records were removed from the analysis.

Table 201 shows the tracking data and audited quantities for each measure. As shown, excluding six records without account ID information resulted in a small adjustment to the number of LED Specialty products distributed and to the number of Wi-Fi thermostats distributed.

TABLE 201. 2021 TRACKING DATA AND AUDITED QUANTITIES

MEASURE	UNIT OF MEASURE	TRACKING DATA QUANTITY [a]	AUDITED QUANTITY
Advanced Power Strip Tier 1	Power Strip	52	52
Advanced Power Strip Tier 2	Power Strip	20	20
Air Purifier	Unit	1	1
Bathroom Aerator 1.0 gpm - Electric	Aerator	11	11
Bathroom Aerator 1.0 gpm - Gas	Aerator	66	66
Kitchen Aerator 1.5 gpm - Electric	Aerator	1	1
Kitchen Aerator 1.5 gpm - Gas	Aerator	22	22
LED Reflector	Bulb	521	521
LED Specialty	Bulb	336	318
Smart LED	Bulb	49	49
Low Flow Showerhead 1.5 gpm - Electric	Showerhead	3	3
Low Flow Showerhead 1.5 gpm - Gas	Showerhead	31	31
Low Flow Showerhead with Shower Start 1.5 gpm - Gas	Showerhead	14	14
Pipe Wrap - Electric	15 Feet	1	1
Pipe Wrap - Gas	15 Feet	19	19
Shower Start Only - Gas	Valve	10	10
Smart Plug	Plug	1	1
Wi-Fi Thermostat - Electric Cooling and Gas Heating Savings	Thermostat	821	818
Wi-Fi Thermostat - Electric Cooling and Heating Savings	Thermostat	61	61
Wi-Fi Thermostat - Electric Cooling Only Savings	Thermostat	7	7
Wi-Fi Thermostat - Electric Heating Only Savings	Thermostat	6	6
Wi-Fi Thermostat - Gas Heating Only Savings	Thermostat	199	199
Wi-Fi Thermostat - Heat Pump Savings	Thermostat	1	1
Bathroom Kit - LED Globe - Electric Water Heating	Bulb	104	104
Bathroom Kit - Low Flow Showerhead 1.5 gpm - Electric Water	Showerhead	13	13
Bathroom Kit - Bathroom Aerator 1.0 gpm - Electric Water Heating	Aerator	13	13
Bathroom Kit - LED Nightlight - Electric Water Heating	Nightlight	13	13
Bathroom Kit - LED Globe - Gas Water Heating	Bulb	2,224	2,224
Bathroom Kit - Low Flow Showerhead 1.5 gpm - Gas Water Heating	Showerhead	278	278
Bathroom Kit - Bathroom Aerator 1.0 gpm - Gas Water Heating	Aerator	278	278
Bathroom Kit - LED Nightlight - Gas Water Heating	Nightlight	278	278
Home Office/Back to School Kit - Smart LED	Bulb	15,660	15,660
Home Office/Back to School Kit - Tier 1 APS	Power Strip	7,830	7,830
Home Office/Back to School Kit - Desk Lamp	Desk Lamp	7,830	7,830
Home Office/Back to School Kit - Nightlight	Nightlight	7,830	7,830
Home Office/Back to School Kit Add-On - LED Reflector	Bulb	55,302	55,302

[a] In the tracking data, kit quantity and savings are reported at the kit-level, as opposed to the measure level. The evaluation team opted to report kit quantity and savings at the measure level to allow for better insight into the measure-level in-service rate and savings adjustments that we made. Quantities for kit measures reflect the total number of that measure distributed in all kits at the program-level The team also opted to report bulb quantities at the bulb level, instead of at the pack level, as these quantities are reported in the tracking data. This allowed savings for LED Reflector and LED Specialty bulb measure to be rolled up into measure groups, even though LED packs of varying sizes were offered. These changes are reflected throughout the report.

CONFIRM MEASURE-LEVEL SAVINGS

The evaluation team reviewed the kit savings documentation ("NIPSCO Residential 2019 – 2021 Program Design v4.3") which contained measure-level savings for stand-alone measures and measures included in kits sold through the Online Marketplace.

The evaluation team found that measure-level and kit-level savings values in the tracking data aligned with NIPSCO's savings documentation. However, in the tracking data, kit savings were reported at the kit-level and used a rounded value, while savings in the Measure Calculation file were reported both at the kit and measure-level values and used un-rounded values. Throughout the report, the evaluation team has split kit items into individual rows, to reflect in-service rates and *ex post* gross adjustments which were applied at the measure level. Splitting items into multiple rows and applying unrounded measure-level savings resulted in a rounding discrepancy, meaning that the sum of total measure savings was slightly off from the tracking data savings. These rounding discrepancies will be noted where applicable in the remainder of this report.

SAVINGS ESTIMATE REVIEW

Measure-level and total savings values were also reviewed. Savings values in the program tracking data were summed and compared to savings values reported in the scorecard. The savings values in the scorecard and unaudited tracking data aligned. There were minor discrepancies between the scorecard and the audited tracking data due to the six records removed and rounding discrepancies, as described in the previous two sections. Scorecard and audited tracking data savings are compared in the table below (Table 202).

TABLE 202. 2021 RESIDENTIAL ONLINE MARKETPLACE PROGRAM TOTAL SAVINGS REVIEW

UNIT OF ENERGY SAVINGS	SCORECARD	AUDITED TRACKING DATA
kWh	3,510,654.18	3,509,874.15
kW	562.968	559.013
Therms	74,119.56	73,800.35

VERIFIED SAVINGS

As the OLM is a new offering for NIPSCO in 2021, the evaluation team wanted to prioritize developing program-specific in-service rates for all measures with large enough participation rates. As shown in Table 201, several measures saw high participation in 2021, including some LED measures, thermostats, and both kits. In particular, the Home Office/Back to School kit dominated program participation in 2021, driven by very successful social media marketing efforts. The evaluation team reviewed program participation data from January through November of 2021 to develop a sampling plan, and surveyed customers to assess in-service rates for Wi-Fi thermostats, Bathroom kits, Home Office/Back to School kits, and add-on LED reflector bulb 6-packs.

The team received a low response rate to the initial online survey, and therefore also fielded the survey via phone to achieve a sufficient response rate. Further discussion of the survey response rate is included in the process evaluation section below. Survey in-service rates were applied to kit and thermostat measures. The survey in-service rate for advanced power strips included in kits was also applied to standalone advanced power strips. The participant survey measured a higher in-service rate for advanced power strips included in kits than the in-service rate reported in the Illinois TRM v9.0 for standalone advanced power strips. Standalone measures are generally assumed to have higher in-service rates than kit measures, since customers order standalone items specifically and not as part of a bundle. Therefore, the evaluation team determined that the kit in-service rate was more applicable in this case.

For the remaining standalone measures, there was insufficient participation in 2021 for the evaluation team to assess in-service rates through a survey. The evaluation team developed proxy in-service rates for these measures from similar NIPSCO programs, including Home Energy Assessment and Residential Lighting, or from the TRM as applicable. The evaluation team applied a 0% in-service rate to the one Smart Plug sold through the Online Marketplace, as the team was unable to find a validated source for calculating savings from this measure (Table 203).

TABLE 203. *EX ANTE* AND VERIFIED IN-SERVICE RATES (ISR) BY MEASURE

MEASURE	*EX ANTE* ISR	VERIFIED ISR	VERIFIED ISR SOURCE	n[a]
Advanced Power Strip Tier 1	100%	87%	Residential OLM participant survey	70
Advanced Power Strip Tier 2	100%	87%	Residential OLM participant survey	70
Air Purifier	100%	100%	IL TRM v9.0 - Air Purifier Deemed Savings	NA
Bathroom Aerator 1.0 gpm - Electric	95%	95%	2021 HEA participant survey	118
Bathroom Aerator 1.0 gpm - Gas	95%	95%	2021 HEA participant survey	118
Kitchen Aerator 1.5 gpm - Electric	95%	86%	2021 HEA participant survey	118
Kitchen Aerator 1.5 gpm - Gas	95%	86%	2021 HEA participant survey	118
LED Reflector	82%	89%	2021 Residential Lighting program evaluation	NA
LED Specialty	82%	89%	2021 Residential Lighting program evaluation	NA
Smart LED	98%	89%	2021 Residential Lighting program evaluation	NA
Low Flow Showerhead 1.5 gpm - Electric	95%	88%	2021 HEA participant survey	118
Low Flow Showerhead 1.5 gpm - Gas	95%	88%	2021 HEA participant survey	118
Low Flow Showerhead with Shower Start 1.5 gpm - Gas	95%	88%	2021 HEA participant survey	118
Pipe Wrap - Electric	95%	88%	2021 HEA participant survey	26
Pipe Wrap - Gas	95%	88%	2021 HEA participant survey	26
Shower Start Only - Gas	95%	88%	2021 HEA participant survey	118
Smart Plug	100%	0%	Residential OLM evaluation	NA
Wi-Fi Thermostat - Electric Cooling and Gas Heating Savings	100%	79%	Residential OLM participant survey	58
Wi-Fi Thermostat - Electric Cooling and Heating Savings	100%	79%	Residential OLM participant survey	58
Wi-Fi Thermostat - Electric Cooling Only Savings	100%	79%	Residential OLM participant survey	58
Wi-Fi Thermostat - Electric Heating Only Savings	100%	79%	Residential OLM participant survey	58
Wi-Fi Thermostat - Gas Heating Only Savings	100%	79%	Residential OLM participant survey	58
Wi-Fi Thermostat - Heat Pump Savings	100%	79%	Residential OLM participant survey	58
Bathroom Kit - LED Globe - Electric Water Heating	82%	75%	Residential OLM participant survey	25
Bathroom Kit - Low Flow Showerhead 1.5 gpm - Electric Water Heating	95%	60%	Residential OLM participant survey	25
Bathroom Kit - Bathroom Aerator 1.0 gpm - Electric Water Heating	95%	44%	Residential OLM participant survey	25
Bathroom Kit - LED Nightlight - Electric Water Heating	67%	88%	Residential OLM participant survey	25
Bathroom Kit - LED Globe - Gas Water Heating	82%	75%	Residential OLM participant survey	25

MEASURE	*EX ANTE* ISR	VERIFIED ISR	VERIFIED ISR SOURCE	n[a]
Bathroom Kit - Low Flow Showerhead 1.5 gpm - Gas Water Heating	95%	60%	Residential OLM participant survey	25
Bathroom Kit - Bathroom Aerator 1.0 gpm - Gas Water Heating	95%	44%	Residential OLM participant survey	25
Bathroom Kit - LED Nightlight - Gas Water Heating	67%	88%	Residential OLM participant survey	25
Home Office/Back to School Kit - Smart LED	98%	85%	Residential OLM participant survey	70
Home Office/Back to School Kit - Tier 1 APS	100%	87%	Residential OLM participant survey	70
Home Office/Back to School Kit - Desk Lamp	100%	81%	Residential OLM participant survey	70
Home Office/Back to School Kit - Nightlight	67%	81%	Residential OLM participant survey	70
Home Office/Back to School Kit Add-On - LED Reflector	82%	61%	Residential OLM participant survey	60

[a] The number of survey responses included in the ISR calculation.

In many cases, the evaluation team assigned lower in-service rates than those assumed in the *ex ante* calculations. The largest measure-level decrease in in-service rates occurred for water-saving measures in Bathroom kits, including low flow showerheads (35% decrease) and bathroom aerators (51% decrease). This result is not unusual, as respondents who order kits may be interested in some, but not all the items included in the kit. Furthermore, water-saving measures tend to have lower install rates than other types of measures due to challenges with measures fitting existing fixtures and concerns about water pressure (see the Process Evaluation section for more information on measure-level satisfaction, drivers of dissatisfaction, and reasons for not installing measures).

The in-service rate adjustment for Wi-Fi thermostats and add-on LED reflector bulb 6-packs had the largest impact on program savings, due to larger per-unit savings for the Wi-Fi thermostats and the large quantity of LED reflector bulk 6-packs distributed. Adjustments to the LED reflector bulb 6-pack in-service rates contributed to 73% of the decrease in electric savings, 60% of the decrease in demand savings, and 24% of the increase in natural gas savings (due to a decrease in the waste heat factor therm penalty) at the program level. Likewise, 12 out of 58 survey respondents indicated they had not installed their smart thermostat, resulting in adjustments to the Wi-Fi thermostat in-service rate which accounted for 10% of the decrease in electric savings, 30% of the decrease in demand savings and 54% of decrease in natural gas savings. It is worth noting that while no savings were granted for intent-to-install, three-quarters of respondents who had not yet installed their Wi-Fi thermostat indicated they were planning to install it in the future.

For a few measures, the evaluation team assigned higher verified than *ex ante* in-service rates. These measures included LED specialty bulbs LED reflectors, and LED nightlights in the Bathroom kit and the Home Office/Back to School kits.

To account for LED lamps currently stored for future use, carryover savings were calculated for all LED lamps, both those included in the kits and those sold through the OLM as standalone measures. To adjust the ISR to consider carryover savings from delayed installation of program lamps, the evaluation team used the Uniform Methods Project's (UMP's) recommended Discount Future Savings method, which indicated that most bulbs placed in storage (up to 97%) were installed within four years (including the initial program year), with 24% of bulbs left over from year one installed in year two, 24% in year three, and so on.[50] However, given expected baseline lighting

[50] 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)]

changes, anticipated to be applied as part of Energy Independence and Security Act (EISA) 2007, all standard LEDs are anticipated to effectively function as baseline lamps. Therefore, the evaluation team did not extend baseline savings beyond 2022, which would be considered year two in the UMP-recommended method.

- For LEDs distributed through kits, the evaluation team applied a first-year in-service rate from survey data of 68% for LED globes, 50% for LED reflectors, and 81% for smart LED light bulbs. To determine carryover savings, the team used the UMP-recommended "Discount Future Savings" method, resulting in verified kit ISRs of 75% (globes), 85% (smart LEDs) and 61% (reflectors).
- For LEDs sold as stand-alone measures, the evaluation team estimated ISRs using first year ISRs from the 2015 Opinion Dynamics Market Effects Study, the most current research available from Indiana.[51,52] Following the same UMP carryover methodology, the resulting adjusted lifetime ISR was 89% for smart, specialty and reflector LEDs. Table 204 summarizes the per unit audited and verified savings values with ISRs applied.

TABLE 204. 2021 RESIDENTIAL ONLINE MARKETPLACE *EX ANTE* AND VERIFIED PER UNIT MEASURE SAVINGS

MEASURE	UNIT OF MEASURE	*EX ANTE* PER-UNIT DEEMED SAVINGS			VERIFIED PER-UNIT SAVINGS		
		KWH	KW	THERMS	KWH	KW	THERMS
Advanced Power Strip Tier 1	Power Strip	103.00	0.012	0.00	89.61	0.010	0.00
Advanced Power Strip Tier 2	Power Strip	174.75	0.032	0.00	152.03	0.028	0.00
Air Purifier	Unit	683.00	0.078	0.00	683.00	0.078	0.00
Bathroom Aerator 1.0 gpm - Electric	Aerator	32.30	0.003	0.00	32.30	0.003	0.00
Bathroom Aerator 1.0 gpm - Gas	Aerator	0.00	0.000	1.42	0.00	0.000	1.42
Kitchen Aerator 1.5 gpm - Electric	Aerator	171.91	0.008	0.00	155.62	0.007	0.00
Kitchen Aerator 1.5 gpm - Gas	Aerator	0.00	0.000	7.56	0.00	0.000	6.85
LED Reflector	Bulb	38.14	0.005	(0.78)	41.65	0.006	(0.85)
LED Specialty	Bulb	25.77	0.003	(0.51)	28.14	0.004	(0.55)
Smart LED	Bulb	1.85	0.000	0.00	1.68	0.000	0.00
Low Flow Showerhead 1.5 gpm - Electric	Showerhead	271.37	0.016	0.00	251.37	0.015	0.00
Low Flow Showerhead 1.5 gpm - Gas	Showerhead	0.00	0.000	11.94	0.00	0.000	11.06
Low Flow Showerhead with Shower Start 1.5 gpm - Gas	Showerhead	0.00	0.000	13.76	0.00	0.000	12.74
Pipe Wrap - Electric	15 Feet	317.08	0.034	0.00	293.71	0.030	0.00
Pipe Wrap - Gas	15 Feet	0.00	0.000	14.14	0.00	0.000	13.09
Shower Start Only - Gas	Valve	0.00	0.000	3.18	0.00	0.000	2.95
Smart Plug	Plug	14.60	0.000	0.00	0.00	0.000	0.00
Wi-Fi Thermostat - Electric Cooling and Gas Heating Savings	Thermostat	168.11	0.191	109.22	132.81	0.151	86.28
Wi-Fi Thermostat - Electric Cooling and Heating Savings	Thermostat	3,369.17	0.191	0.00	2,696.95	0.151	0.00
Wi-Fi Thermostat - Electric Cooling Only Savings	Thermostat	168.11	0.191	0.00	132.81	0.151	0.00

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

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

MEASURE	UNIT OF MEASURE	*EX ANTE* PER-UNIT DEEMED SAVINGS			VERIFIED PER-UNIT SAVINGS		
		KWH	KW	THERMS	KWH	KW	THERMS
Wi-Fi Thermostat - Electric Heating Only Savings	Thermostat	3,201.06	0.000	0.00	2,528.84	0.000	0.00
Wi-Fi Thermostat - Gas Heating Only Savings	Thermostat	0.00	0.000	109.22	0.00	0.000	86.28
Wi-Fi Thermostat - Heat Pump Savings	Thermostat	839.23	0.229	0.00	705.37	0.181	0.00
Bathroom Kit - LED Globe - Electric Water Heating	Bulb	24.61	0.003	(0.50)	22.65	0.003	(0.46)
Bathroom Kit - Low Flow Showerhead 1.5 gpm - Electric Water Heating	Showerhead	271.37	0.016	0.00	171.39	0.010	0.00
Bathroom Kit - Bathroom Aerator 1.0 gpm - Electric Water Heating	Aerator	32.30	0.003	0.00	14.96	0.001	0.00
Bathroom Kit - LED Nightlight - Electric Water Heating	Nightlight	3.58	0.000	0.00	4.68	0.000	0.00
Bathroom Kit - LED Globe - Gas Water Heating	Bulb	24.61	0.003	(0.50)	22.65	0.003	(0.46)
Bathroom Kit - Low Flow Showerhead 1.5 gpm - Gas Water Heating	Showerhead	0.00	0.000	11.94	0.00	0.000	7.54
Bathroom Kit - Bathroom Aerator 1.0 gpm - Gas Water Heating	Aerator	0.00	0.000	1.42	0.00	0.000	0.66
Bathroom Kit - LED Nightlight - Gas Water Heating	Nightlight	3.58	0.000	0.00	4.68	0.000	0.00
Home Office/Back to School Kit - Smart LED	Bulb	1.88	0.000	0.00	1.63	0.000	0.00
Home Office/Back to School Kit - Tier 1 APS	Power Strip	103.00	0.012	0.00	89.61	0.010	0.00
Home Office/Back to School Kit - Desk Lamp	Desk Lamp	10.44	0.000	0.00	8.46	0.000	0.00
Home Office/Back to School Kit - Nightlight	Nightlight	3.58	0.000	0.00	4.31	0.000	0.00
Home Office/Back to School Kit Add-On - LED Reflector	Bulb	37.94	0.005	(0.73)	28.40	0.004	(0.55)

EX POST GROSS SAVINGS

The evaluation team referred to the Indiana TRM (v2.2) and the Illinois TRM v9.0 to calculate *ex post* gross electric energy savings, demand reduction, and natural gas savings. Where information specific to NIPSCO customers was available, such as for water heater fuel saturation and LED baseline wattages, the evaluation team revised input assumptions. Appendix 12 contains details on the specific algorithms, variable assumptions, and references for all program measure *ex post* gross calculations.

ENGINEERING REVIEWS

Through the engineering review, the evaluation team found differences between the *ex ante* and *ex post* gross savings. These differences were primarily driven by the following factors:

- As determined in conjunction with NIPSCO and the OSB at the beginning of the 2021 evaluation, the evaluation team used in-situ baseline wattages for all bulbs received in kits as opposed to using the baseline watts approach prescribed in the UMP.[53] This resulted in much lower savings for the LED globes included in the Bathroom kit as well as the LED Reflectors included in the Home Office/Back to School Kit add-on.

  - For the smart LED measure, both sold as standalone and included in the Home Office/Back to School kit, the *ex ante* used the Illinois TRM v8.0 connected LED lamps savings algorithm, which assumes an LED baseline. However, to remain consistent with other kit lighting measures, the evaluation team used the LED savings algorithm from the Indiana TRM (v2.2), with the in-situ baseline wattages calculated from survey results for the smart LED included in the Home Office/Back to School kit. This showed higher energy savings since the in-situ baseline wattage was much higher than the assumed LED baseline used in the *ex ante*. The evaluation team applied the UMP baseline to the LED savings algorithm from the Indiana TRM (v2.2) for standalone Smart LEDs, consistent with the approach for other standalone bulbs.

- For showerstarts, tier 1 advanced power strips, tier 2 advanced power strips, and air purifiers, *ex ante* savings were calculated using the Illinois TRM v8.0, but for *ex post* savings the evaluation team used the Illinois TRM v.9.0, which was the most recent and applicable TRM during the 2021 program year. The Illinois TRM was used because showerstarts and air purifiers are not included in the Indiana TRM v2.2, and the Indiana TRM v2.2 does not differentiate between tier 1 and tier 2 advanced power strips.
- The evaluation team used geolocation for each customer address in the database, then matched each address with 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 faucet aerators, showerheads, and LED bulbs.
- For Wi-Fi thermostats, the evaluation team used inputs from the 2020 HVAC evaluation, including variables from a billing analysis.

The following sections summarize the team's findings and recommendations based on the engineering review.

EX POST GROSS SAVINGS

Ex post savings reflect the engineering adjustments made to audited measure savings. The evaluation team calculated *ex post* electric energy, peak demand, and natural gas energy savings for each measure using algorithms and inputs from the Indiana TRM (v2.2), the Illinois TRM v9.0, customer location to account for weather effects, inputs from other NIPSCO programs, inputs from past evaluation results (including billing analysis), as well as survey data when appropriate. The evaluation team leveraged the survey results from the Residential OLM participant survey to estimate in-situ baselines for LEDs and water heater fuel type saturation, then used this information to inform *ex post* gross savings calculations. *Ex post* savings calculations differed from *ex ante* analysis as follows:

- Globe and Reflector LEDs: The evaluation team used the Indiana TRM (v2.2) algorithm to calculate energy and demand savings as well as therm penalties. However, inputs varied for baseline watts for kits, ISRs, and waste heat factors, with in-situ baseline wattages having a significant negative impact on savings.

[53] For LEDs sold as standalone measures on the NIPSCO OLM, the evaluation team used the baseline watts approach prescribed in the UMP for calculating savings. This was determined to be an appropriate approach because 1) there was no survey data collected for standalone LEDs to calculate in-situ baselines, and 2) the OLM channel for standalone LEDs closely resembles the upstream lighting channel.

- The in-situ baseline watts were calculated using the 2021 NIPSCO Residential OLM survey. The baseline delta watts for LED globes included in the Bathroom kit was 15.64 watts compared to the *ex ante* assumption of 36.00 delta watts. The delta watts for the LED reflectors, included as an optional add-on to the Home Office/Back to School kit, were 17.63 watts, compared to the *ex ante* assumption of 55.50 delta watts. With a total of 55,302 LED reflectors distributed with kits, the in-situ baseline watts had a bigger impact on *ex post* savings than other calculation assumptions (Table 205).

TABLE 205. RESIDENTIAL ONLINE MARKETPLACE PROGRAM – LED PER MEASURE SAVINGS

MEASURE	TRACKING DATA MEASURE NAME	UNITS	*EX ANTE* BASELINE WATTS	*EX POST* BASELINE WATTS	*EX POST* PER UNIT kWh	*EX POST* PER UNIT kW
LED Reflector	LED - BR/Par - 10W - 3 pack - (TCP L90P38D2530KFL) - Electric and Gas	6	90	90	59.73	0.008
LED Reflector	LED - BR/Par - 9.5W - 1 pack - (TCP LED9BR30D50K) - Electric and Gas	11	65	65	41.44	0.006
LED Reflector	LED - BR/Par - 9.5W - 12 pack - (TCP LED9BR30D27K) - Electric and Gas	228	65	65	41.41	0.006
LED Reflector	LED - BR/Par - 9.5W - 12 pack - (TCP LED9BR30D50K) - Electric and Gas	168	65	65	41.44	0.006
LED Reflector	LED - BR/Par - 9.5W - 6-pack - (TCP LED9BR30D27K) - Electric and Gas	78	65	65	41.44	0.006
LED Reflector	LED - BR/Par - 9.5W - 6-pack - (TCP LED9BR30D50K) - Electric and Gas	30	65	65	41.44	0.006
LED Specialty	LED - Decorative/Mini - 4W - 6-pack - (TCP LED5G25D27KF) - Electric and Gas	120	40	40	26.86	0.004
LED Specialty	LED - Decorative/Mini - 4W - 6-pack - (TCP LED5G25D27KF) - Electric Only	12	40	40	26.88	0.004
LED Specialty	LED - Decorative/Mini - 5W - 6-pack - (TCP LED5E12B1127K) - Electric and Gas	48	40	40	26.13	0.004
LED Specialty	LED - Decorative/Mini - 6.5W - 6-pack - (EarthTronics LGU10630D7) - Electric and Gas	66	50	50	32.48	0.004
LED Specialty	LED - Decorative/Mini - 6.5W - 6-pack - (TCP LED712VMR16V27KFL) - Electric and Gas	12	50	50	32.48	0.004
LED Specialty	LED - Filament - 4W - 6-pack - (TCP FB11D4027EC) - Electric and Gas	6	40	40	26.88	0.004
LED Specialty	LED - Filament - 4W - 6-pack - (TCP FB11D4027EE12C) - Electric and Gas	48	40	40	26.88	0.004
LED Specialty	LED - Filament - 4W - 6-pack - (TCP FG25D4027EC) - Electric and Gas	6	40	40	26.53	0.004
Smart LED	LED - Smart LED - 8W - 1 pack - (AMC L8W-BR30-CCT-RGBWiFi)	5	N/A	65	42.56	0.006
Smart LED	LED - Smart LED - 9W - 1 pack - (AMC L9W-A19-CCT-RGBWiFi)	44	N/A	60	38.08	0.005
Bathroom Kit - LED Globe - Electric Water Heating	Bathroom Kit - LED Globe (8) - Electric Water Heating	104	40	21	10.45	0.001
Bathroom Kit - LED Nightlight - Electric Water Heating	Bathroom Kit - LED Nightlight - Electric Water Heating	13	5	5	2.13	0.000
Bathroom Kit - LED Globe - Gas Water Heating	Bathroom Kit - LED Globe (8) - Gas Water Heating	2,224	40	21	10.43	0.001
Bathroom Kit - LED Nightlight - Gas Water Heating	Bathroom Kit - LED Nightlight - Gas Water Heating	278	5	5	2.12	0.000

MEASURE	TRACKING DATA MEASURE NAME	UNITS	*EX ANTE* BASELINE WATTS	*EX POST* BASELINE WATTS	*EX POST* PER UNIT kWh	*EX POST* PER UNIT kW
Home Office/Back to School Kit - Smart LEDs (2)	Home Office/Back to School Kit - Smart LEDs (2)	15,660	N/A	35	18.30	0.002
Home Office/Back to School Kit - Smart LED	Home Office/Back to School Kit - Desk Lamp	7,830	38	38	7.91	0.003
Home Office/Back to School Kit - Nightlight	Home Office/Back to School Kit - Nightlight	7,830	5	5	2.13	0.000
Home Office/ Back to School Kit Add-On - LED Reflector	Home Office/ Back to School Kit Add-On - LED Reflector	55,302	65	27	9.02	0.001

- Smart LEDs: The *ex ante* savings for smart LEDS were calculated using the Illinois TRM v8.0. This was used instead of the Indiana TRM (v2.2) because the Indiana TRM (v2.2) does not include smart LEDs as a measure. The evaluation team used the Indiana TRM (v2.2) and calculated savings using the residential ENERGY STAR lighting algorithm since the smart LED algorithm in the Illinois TRM v9.0 assumes an LED baseline. For smart LEDs distributed through kits, the calculated in-situ watts baseline was used, as several survey respondents indicated that they replaced incandescent and halogen bulbs with their smart LED. With an in-situ baseline of 35 watts, this *ex post* approach increased smart LED savings significantly. For the smart LEDs sold as a standalone product, the evaluation team also used IN TRM (v2.2) so that the algorithm was consistent for the same measures. However, since an in-situ baseline was not calculated due to a lack of survey responses, the evaluation team used the UMP protocol for baseline wattage (Table 205).
- Wi-Fi Thermostats: Both *ex ante* and *ex post* electric energy savings used the Indiana TRM (v2.2). However, while *ex ante* savings used 2019 NIPSCO EM&V values for several inputs, the evaluation team used the more recent 2020 NIPSCO EM&V report to calculate *ex post* savings. The variables taken from the 2020 NIPSCO EM&V report include cooling system capacity and heating system capacity, averaged across all HVAC units (by type). The inputs used from the 2020 billing analysis include cooling energy savings fraction and heating energy savings fraction, which the billing analysis determined were lower than the same values used in *ex ante*, totaling 8.3% and 5.4%, respectively. For gas savings, the evaluation team applied a deemed value of 35 therms from the billing analysis. This value reflects the impact of COVID-19 on Wi-Fi thermostats savings and was applied for all sites with gas heat in 2021, since we expect behavior to continue to be impacted by COVID-19. More information on this billing analysis can be found in the 2021 Residential HVAC program chapter. The Indiana TRM (v2.2) does not provide guidance on claiming demand reduction for Wi-Fi thermostat measures. Currently, savings for Wi-Fi thermostats in most TRMs and evaluations are derived via analysis of billing data, which cannot produce values for demand reduction. However, it is likely that some demand reduction for Wi-Fi thermostats does exist. The evaluation team opted to use the Illinois TRM v9.0, which accommodates this reduction. The Illinois TRM v9.0 calculates savings using standard methods for deriving baseline peak load, then applies a Wi-Fi thermostats energy savings factor (ESF) and half the coincidence factor (CF) normally used for cooling.

Table 206 shows the *ex ante* deemed savings and *ex post* gross per-measure savings for the 2021 Residential OLM program measures. *Ex ante* assumptions included ISRs in the calculation, and therefore *ex post* gross per-unit savings algorithms also include ISRs.

TABLE 206. 2021 RESIDENTIAL ONLINE MARKETPLACE PROGRAM *EX ANTE* & *EX POST* GROSS PER-MEASURES SAVINGS VALUES

MEASURE	UNIT OF MEASURE	*EX ANTE* DEEMED PER-UNIT SAVINGS			*EX POST* GROSS PER-UNIT SAVINGS		
		KWH	KW	THERMS	KWH	KW	THERMS
Advanced Power Strip Tier 1	Power Strip	103.00	0.012	0.00	63.70	0.007	0.00
Advanced Power Strip Tier 2	Power Strip	174.75	0.032	0.00	108.63	0.020	0.00
Air Purifier	Unit	683.00	0.078	0.00	95.00	0.011	0.00
Bathroom Aerator 1.0 gpm - Electric	Aerator	32.30	0.003	0.00	32.11	0.003	0.00
Bathroom Aerator 1.0 gpm - Gas	Aerator	0.00	0.000	1.42	0.00	0.000	1.37
Kitchen Aerator 1.5 gpm - Electric	Aerator	171.91	0.008	0.00	154.88	0.007	0.00
Kitchen Aerator 1.5 gpm - Gas	Aerator	0.00	0.000	7.56	0.00	0.000	6.51
LED Reflector	Bulb	38.14	0.005	(0.78)	41.63	0.006	0.00
LED Specialty	Bulb	25.77	0.003	(0.51)	28.12	0.004	0.00
Smart LED	Bulb	1.85	0.000	0.00	38.53	0.005	0.00
Low Flow Showerhead 1.5 gpm - Electric	Showerhead	271.37	0.016	0.00	225.09	0.015	0.00
Low Flow Showerhead 1.5 gpm - Gas	Showerhead	0.00	0.000	11.94	0.00	0.000	9.88
Low Flow Showerhead with Shower Start 1.5 gpm - Gas	Showerhead	0.00	0.000	13.76	0.00	0.000	12.17
Pipe Wrap - Electric	15 Feet	317.08	0.034	0.00	293.71	0.030	0.00
Pipe Wrap - Gas	15 Feet	0.00	0.000	14.14	0.00	0.000	13.09
Shower Start Only - Gas	Valve	0.00	0.000	3.18	0.00	0.000	2.23
Smart Plug	Plug	14.60	0.000	0.00	0.00	0.000	0.00
Wi-Fi Thermostat - Electric Cooling and Gas Heating Savings	Thermostat	168.11	0.191	109.22	86.64	0.098	27.76
Wi-Fi Thermostat - Electric Cooling and Heating Savings	Thermostat	3,369.17	0.191	0.00	904.86	0.098	0.00
Wi-Fi Thermostat - Electric Cooling Only Savings	Thermostat	168.11	0.191	0.00	86.65	0.098	0.00
Wi-Fi Thermostat - Electric Heating Only Savings	Thermostat	3,201.06	0.000	0.00	817.82	0.000	0.00
Wi-Fi Thermostat - Gas Heating Only Savings	Thermostat	0.00	0.000	109.22	0.00	0.000	27.76
Wi-Fi Thermostat - Heat Pump Savings	Thermostat	839.23	0.229	0.00	187.66	0.095	0.00
Bathroom Kit - LED Globe - Electric Water Heating	Bulb	24.61	0.003	(0.50)	10.45	0.001	0.00
Bathroom Kit - Low Flow Showerhead 1.5 gpm - Electric Water Heating	Showerhead	271.37	0.016	0.00	154.44	0.010	0.00
Bathroom Kit - Bathroom Aerator 1.0 gpm - Electric Water Heating	Aerator	32.30	0.003	0.00	15.02	0.001	0.00
Bathroom Kit - LED Nightlight - Electric Water Heating	Nightlight	3.58	0.000	0.00	2.13	0.000	0.00
Bathroom Kit - LED Globe - Gas Water Heating	Bulb	24.61	0.003	(0.50)	10.43	0.001	0.00
Bathroom Kit - Low Flow Showerhead 1.5 gpm - Gas Water Heating	Showerhead	0.00	0.000	11.94	0.00	0.000	5.59

MEASURE	UNIT OF MEASURE	*EX ANTE* DEEMED PER-UNIT SAVINGS			*EX POST* GROSS PER-UNIT SAVINGS		
		KWH	KW	THERMS	KWH	KW	THERMS
Bathroom Kit - Bathroom Aerator 1.0 gpm - Gas Water Heating	Aerator	0.00	0.000	1.42	0.00	0.000	0.65
Bathroom Kit - LED Nightlight - Gas Water Heating	Nightlight	3.58	0.000	0.00	2.12	0.000	0.00
Home Office/Back to School Kit - Smart LED	Bulb	1.88	0.000	0.00	18.30	0.002	0.00
Home Office/Back to School Kit - Tier 1 APS	Power Strip	103.00	0.012	0.00	49.41	0.006	0.00
Home Office/Back to School Kit - Desk Lamp	Desk Lamp	10.44	0.000	0.00	7.91	0.003	0.00
Home Office/Back to School Kit - Nightlight	Nightlight	3.58	0.000	0.00	2.13	0.000	0.00
Home Office/Back to School Kit Add-On - LED Reflector	Bulb	37.94	0.005	(0.73)	9.02	0.001	0.00

Table 207 highlights notable differences between *ex ante* and *ex post* gross estimates.

TABLE 207. 2021 RESIDENTIAL ONLINE MARKETPLACE NOTABLE DIFFERENCES BETWEEN *EX ANTE* & *EX POST* GROSS

MEASURE	*EX ANTE* SOURCES AND ASSUMPTIONS	*EX POST* GROSS SOURCES AND ASSUMPTIONS	PRIMARY REASONS FOR DIFFERENCES
Advanced Power Strip Tier 1	Illinois TRM v8.0; assumed 7-plug time of sale delta kWh and kW.	Illinois TRM v9.0; assumed 7-plug time of sale delta kWh for standalone measures and 7-plug single-family energy efficiency kit leave behind for kits.	Delta kWh and kW differs substantially for Illinois TRM v8.0 versus v9.0. *Ex ante* assumes time of sale for kits.
Advanced Power Strip Tier 2	Illinois TRM v8.0; assumed average of ERP values	Illinois TRM v9.0; confirmed infrared or infrared and occupancy sensor with model numbers	Difference in product type binning for delta kWh for Illinois TRM v8.0 versus v9.0.
Air Purifier	Illinois TRM v8.0 deemed savings	Illinois TRM v9.0 deemed savings	Delta kWh and kW differs substantially for Illinois TRM v8.0 versus v9.0. *Ex ante* incorrectly binned measure based on CADR, *ex post* confirmed CADR with ENERGYSTAR QPL and binned appropriately.
Bathroom and Kitchen Aerator	Indiana TRM (v2.2) and 2019 EMV; assumed single-family for all applicable measures and 100% water heating saturation; used EMV 2019 value for cold water inlet temperature.	Indiana TRM (v2.2); cold water inlet temperature determined by matching to closest city from tracking data; water heater saturation value from 2021 NIPSCO Residential OLM survey.	The evaluation team updated the hot water heating saturation based on the 2021 NIPSCO Residential OLM survey information, and applied inlet water temperature based on project location.
LED	Indiana TRM (v2.2) and ENERGY STAR baseline watts; assumed South Bend as closest city for all weighted average waste heat factors.	Indiana TRM (v2.2) and 2021 NIPSCO Residential OLM survey to determine in-situ baseline watts for kits. Weighted average waste heat factors determined by matching to closest city from tracking data.	The in-situ baseline watts calculated from the 2021 NIPSCO Residential OLM survey significantly reduced the baseline watts for all kit LEDs.
Smart LED	Illinois TRM v8.0 savings algorithm is used with some inputs from Indiana TRM (v2.2); assumed time of sale for hours of use and assumed South Bend as closest city for all weighted average waste heat	Indiana TRM (v2.2); calculated as a standard LED with in-situ baseline watts from 2021 NIPSCO Residential OLM survey. Weighted average waste heat factors determined by matching to closest city from tracking data.	The evaluation team determined that since an in-situ baseline watts had been calculated from the 2021 NIPSCO Residential OLM survey this measure should be treated as a standard LED since the Illinois TRM v8.0 assumes an LED baseline.

MEASURE	*EX ANTE* SOURCES AND ASSUMPTIONS	*EX POST* GROSS SOURCES AND ASSUMPTIONS	PRIMARY REASONS FOR DIFFERENCES
	factors from Indiana TRM (v2.2). Assumed 0% leakage.		
Low Flow Showerhead (with and without Showerstart)	Illinois TRM v8.0 savings algorithm with some inputs from Indiana TRM (v2.2) and EMV 2019; assumed single-family for all applicable inputs, used EMV 2019 value for cold water inlet temperature, and 100% water heating saturation.	Indiana TRM (v2.2), 2021 HEA/IQW survey, and 2019 NIPSCO survey; assumed single-family for applicable inputs, calculated showers per household per day from 2021 HEA/IQW survey, showerheads per household from 2019 NIPSCO survey. Cold water inlet temperature determined by matching to closest city from tracking data. Water heater saturation rate value from 2021 NIPSCO Residential OLM survey.	The evaluation team updated the hot water heating saturation based on the 2021 NIPSCO Residential OLM survey information, and applied inlet water temperature based on project location.
Smart Plug	Deemed value from EnergyEarth	No *ex post* savings applied.	The evaluation team determined no *ex post* savings should be applied as this measure was not found in a relevant TRM.
Wi-Fi thermostat	Indiana TRM (v2.2) savings algorithm for energy and Illinois TRM v8.0 for demand with all inputs from EMV 2019; assumed South Bend as closest city for EFLH.	Indiana TRM (v2.2) savings algorithm for electric savings, deemed value from 2020 billing analysis for gas savings, and Illinois TRM v9.0 for demand; all inputs from EMV 2020 and billing analysis; EFLH determined by matching to closest city from tracking data and used $EFLH_{heat}$ from 2020 billing analysis.	The 2020 billing analysis used by the evaluation team has a much lower cooling energy savings fraction and heating energy savings fraction, as well as a lower deemed gas savings value, and lower $EFLH_{heat}$.
LED Nightlight	Indiana TRM (v2.2); EMV 2019 for IRF	Indiana TRM (v2.2); OLM 2021 survey for IRF	The OLM 2021 survey calculated a lower IRF (18%) than was used in *ex ante* (39%)
Desk Lamp	Indiana TRM (v2.2); calculated electric savings as an LED, did not attribute demand savings or therm penalty; baseline watts and HOU from DOE assumptions.	Indiana TRM (v2.2); calculated all savings as an LED; baseline watts and HOU from DOE assumptions.	The evaluation team attributed demand savings and therm penalty as an LED measure.

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 2021 Residential OLM survey results, which provided a sample of customers who reported their water heater fuel source, shown in Table 208. 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 included a question in the participant survey to verify water heater saturation. Seventeen out of 20 survey respondents who received a *Bathroom Kit – Gas Water Heating* measure indicated they had gas water heat, yielding an 83% natural gas saturation rate. There were insufficient responses from customers who received a *Bathroom Kit – Electric Water Heating*, so the evaluation team assigned a 100% saturation rate. The evaluation team recommends that TRC continue to use customer self-report information to assign savings for water-heating measures. The drop-down menu currently includes electric, gas, oil, and other water-heating options. The evaluation team will continue to validate participant-reported water heating fuel type through the participant survey. If a discrepancy persists, the evaluation team will conduct additional research as to the source of the discrepancy.

TABLE 208. 2021 RESIDENTIAL ONLINE MARKETPLACE PROGRAM WATER HEATER FUEL SATURATION

SAVINGS TYPE	ELECTRIC WATER HEATING SATURATION RATE (%)	NATURAL GAS WATER HEATING SATURATION RATE (%)
Reported *ex ante*	100%	100%
Ex post[a]	100%	83%

[a]Electric and natural gas saturation rates do not total 100% because there were insufficient survey responses to inform electric saturation.

WASTE HEAT FACTOR - THERM PENALTIES

In 2019, and prior years, the evaluation team applied waste heat factors to lighting measures, representing kWh, kW, and therm penalties resulting from LED lighting. In discussions with NIPSCO, for the 2020 evaluation year and beyond, the evaluation team is not including therm penalties when calculating evaluated savings. However, cost-effectiveness results will include these penalties and be applied to the electric program cost-effectiveness. The evaluation team believes this approach is appropriate, as it accounts for the penalty on the electric side (where it is generated) and allows the evaluation team to show gas program performance and measure performance more clearly. NIPSCO plans to take a consistent approach to accounting for waste heat factors in their planning process.

Currently, the *ex ante* savings for all kit programs include therm penalties. These have been removed in the *ex post* analysis, and the evaluation team is reporting these below, to be used in the cost-effectiveness analysis. In total, the therm penalty for cost-effectiveness analysis is (17,333.78) therms (Table 209).

TABLE 209. 2021 RESIDENTIAL ONLINE MARKETPLACE WASTE HEAT FACTOR THERM PENALTY

MEASURE	WASTE HEAT FACTOR THERM PENALTY
LED Reflector	(443.29)
LED Specialty	(182.81)
Smart LED	(38.57)
Bathroom Kit - LED Globe - Electric Water Heating	(22.25)
Bathroom Kit - LED Globe - Gas Water Heating	(475.65)
Home Office/Back to School Kit – Smart LEDs (2)	(5,853.50)
Home Office/Back to School Kit - Desk Lamp	(126.47)
Home Office/Back to School Kit Add-On - LED Reflector	(10,191.25)
Total	(17,333.78)

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 210 through Table 212) show the program's *ex ante* reported savings, verified savings, and *ex post* gross savings.

TABLE 210. 2021 RESIDENTIAL ONLINE MARKETPLACE PROGRAM *EX ANTE* & *EX POST* GROSS ELECTRIC ENERGY SAVINGS

MEASURE	*EX ANTE*[a] ELECTRIC ENERGY SAVINGS (KWH/YR.)	AUDITED GROSS ELECTRIC ENERGY SAVINGS (KWH/YR.)	VERIFIED GROSS ELECTRIC ENERGY SAVINGS (KWH/YR.)	*EX POST* GROSS ELECTRIC ENERGY SAVINGS (KWH/YR.)
Advanced Power Strip Tier 1	-	5,356.00	4,659.72	3,312.47
Advanced Power Strip Tier 2	-	3,495.00	3,040.65	2,172.56
Air Purifier	-	683.00	683.00	95.00
Bathroom Aerator 1.0 gpm - Electric	-	355.30	355.33	353.23
Bathroom Aerator 1.0 gpm - Gas	-	0.00	0.00	0.00
Kitchen Aerator 1.5 gpm - Electric	-	171.91	155.62	154.88
Kitchen Aerator 1.5 gpm - Gas	-	0.00	0.00	0.00
LED Reflector	-	19,868.94	21,697.64	21,691.22
LED Specialty	-	8,193.72	8,947.83	8,943.66
Smart LED	-	90.87	82.20	1,888.11
Low Flow Showerhead 1.5 gpm - Electric	-	814.11	754.12	675.26
Low Flow Showerhead 1.5 gpm - Gas	-	0.00	0.00	0.00
Low Flow Showerhead with Shower Start 1.5 gpm - Gas	-	0.00	0.00	0.00
Pipe Wrap - Electric	-	317.08	293.71	293.71
Pipe Wrap - Gas	-	0.00	0.00	0.00
Shower Start Only - Gas	-	0.00	0.00	0.00
Smart Plug	-	14.60	0.00	0.00
Wi-Fi Thermostat - Electric Cooling and Gas Heating Savings	-	137,513.98	108,638.11	70,873.47
Wi-Fi Thermostat - Electric Cooling and Heating Savings	-	205,519.37	164,513.91	55,196.57
Wi-Fi Thermostat - Electric Cooling Only Savings	-	1,176.77	929.67	606.56
Wi-Fi Thermostat - Electric Heating Only Savings	-	19,206.36	15,173.02	4,906.91
Wi-Fi Thermostat - Gas Heating Only Savings	-	0.00	0.00	0.00
Wi-Fi Thermostat - Heat Pump Savings	-	839.23	705.37	187.66
Bathroom Kit - LED Globe - Electric Water Heating	-	2,559.66	2,355.52	1,086.76
Bathroom Kit - Low Flow Showerhead 1.5 gpm - Electric Water Heating	-	3,527.79	2,228.08	2,007.77
Bathroom Kit - Bathroom Aerator 1.0 gpm - Electric Water Heating	-	419.93	194.49	195.22
Bathroom Kit - LED Nightlight - Electric Water Heating	-	46.54	60.84	27.66
Bathroom Kit - LED Globe - Gas Water Heating	-	54,737.43	50,371.87	23,197.91
Bathroom Kit - Low Flow Showerhead 1.5 gpm - Gas Water Heating	-	0.00	0.00	0.00
Bathroom Kit - Bathroom Aerator 1.0 gpm - Gas Water Heating	-	0.00	0.00	0.00
Bathroom Kit - LED Nightlight - Gas Water Heating	-	995.24	1,301.04	589.45
Home Office/Back to School Kit - Smart LED	-	29,362.50	25,525.80	286,515.73
Home Office/Back to School Kit - Tier 1 APS	-	806,490.00	701,646.30	386,880.30
Home Office/Back to School Kit - Desk Lamp	-	81,745.20	66,213.61	61,903.28

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.)
Home Office/Back to School Kit - Nightlight	-	28,031.40	33,729.59	16,662.21
Home Office/Back to School Kit Add-On - LED Reflector	-	2,098,342.22	1,570,554.97	498,835.26
Total Savings	3,510,654.18	3,509,874.15	2,784,811.99	1,449,252.86
Total Program Realization Rate				41%

Note: Totals may not sum properly due to rounding.

[a] Program tracking data is summed at the kit-level (not measure level). Therefore, *ex ante* savings are only reported at the summary level, due to rounding errors.

TABLE 211. 2021 RESIDENTIAL ONLINE MARKETPLACE PROGRAM *EX ANTE* & *EX POST* GROSS PEAK DEMAND REDUCTION

MEASURE	*EX ANTE*[a] PEAK DEMAND REDUCTION (KW/YR.)	AUDITED GROSS PEAK DEMAND REDUCTION (KW/YR.)	VERIFIED GROSS PEAK DEMAND REDUCTION (KW/YR.)	*EX POST* GROSS PEAK DEMAND REDUCTION (KW/YR.)
Advanced Power Strip Tier 1	-	0.624	0.523	0.372
Advanced Power Strip Tier 2	-	0.640	0.555	0.397
Air Purifier	-	0.078	0.078	0.011
Bathroom Aerator 1.0 gpm - Electric	-	0.033	0.034	0.034
Bathroom Aerator 1.0 gpm - Gas	-	0.000	0.000	0.000
Kitchen Aerator 1.5 gpm - Electric	-	0.008	0.007	0.007
Kitchen Aerator 1.5 gpm - Gas	-	0.000	0.000	0.000
LED Reflector	-	2.703	2.953	2.953
LED Specialty	-	1.112	1.218	1.218
Smart LED	-	0.000	0.000	0.257
Low Flow Showerhead 1.5 gpm - Electric	-	0.048	0.045	0.045
Low Flow Showerhead 1.5 gpm - Gas	-	0.000	0.000	0.000
Low Flow Showerhead with Shower Start 1.5 gpm - Gas	-	0.000	0.000	0.000
Pipe Wrap - Electric	-	0.034	0.030	0.030
Pipe Wrap - Gas	-	0.000	0.000	0.000
Shower Start Only - Gas	-	0.000	0.000	0.000
Smart Plug	-	0.000	0.000	0.000
Wi-Fi Thermostat - Electric Cooling and Gas Heating Savings	-	156.238	123.230	80.401
Wi-Fi Thermostat - Electric Cooling and Heating Savings	-	11.651	9.189	5.996
Wi-Fi Thermostat - Electric Cooling Only Savings	-	1.337	1.055	0.688
Wi-Fi Thermostat - Electric Heating Only Savings	-	0.000	0.000	0.000
Wi-Fi Thermostat - Gas Heating Only Savings	-	0.000	0.000	0.000
Wi-Fi Thermostat - Heat Pump Savings	-	0.229	0.181	0.095
Bathroom Kit - LED Globe - Electric Water Heating	-	0.348	0.321	0.148
Bathroom Kit - Low Flow Showerhead 1.5 gpm - Electric Water Heating	-	0.209	0.132	0.132
Bathroom Kit - Bathroom Aerator 1.0 gpm - Electric Water Heating	-	0.040	0.019	0.019
Bathroom Kit - LED Nightlight - Electric Water Heating	-	0.000	0.000	0.000
Bathroom Kit - LED Globe - Gas Water Heating	-	7.450	6.856	3.158
Bathroom Kit - Low Flow Showerhead 1.5 gpm - Gas Water Heating	-	0.000	0.000	0.000
Bathroom Kit - Bathroom Aerator 1.0 gpm - Gas Water Heating	-	0.000	0.000	0.000
Bathroom Kit - LED Nightlight - Gas Water Heating	-	0.000	0.000	0.000
Home Office/Back to School Kit - Smart LED	-	0.000	0.000	39.000
Home Office/Back to School Kit - Tier 1 APS	-	90.502	78.737	43.415
Home Office/Back to School Kit - Desk Lamp	-	0.000	0.000	25.335

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.)
Home Office/Back to School Kit - Nightlight	-	0.000	0.000	0.000
Home Office/Back to School Kit Add-On - LED Reflector	-	285.727	213.773	67.900
Total Savings	562.968	559.013	438.935	271.609
Total Program Realization Rate				48%

Note: Totals may not sum properly due to rounding.

[a] Program tracking data is summed at the kit-level (not measure level). Therefore, *ex ante* savings are only reported at the summary level, due to rounding errors.

TABLE 212. 2021 RESIDENTIAL ONLINE MARKETPLACE PROGRAM *EX ANTE* & *EX POST* GROSS GAS ENERGY 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.)
Advanced Power Strip Tier 1	-	0.00	0.00	0.00
Advanced Power Strip Tier 2	-	0.00	0.00	0.00
Air Purifier	-	0.00	0.00	0.00
Bathroom Aerator 1.0 gpm - Electric	-	0.00	0.00	0.00
Bathroom Aerator 1.0 gpm - Gas	-	93.72	93.80	90.53
Kitchen Aerator 1.5 gpm - Electric	-	0.00	0.00	0.00
Kitchen Aerator 1.5 gpm - Gas	-	166.32	150.63	143.20
LED Reflector	-	(405.88)	(443.29)	0.00
LED Specialty	-	(161.49)	(176.22)	0.00
Smart LED	-	0.00	0.00	0.00
Low Flow Showerhead 1.5 gpm - Electric	-	0.00	0.00	0.00
Low Flow Showerhead 1.5 gpm - Gas	-	370.14	342.85	306.29
Low Flow Showerhead with Shower Start 1.5 gpm - Gas	-	192.64	178.42	170.41
Pipe Wrap - Electric	-	0.00	0.00	0.00
Pipe Wrap - Gas	-	268.66	248.80	248.80
Shower Start Only - Gas	-	31.80	29.50	22.33
Smart Plug	-	0.00	0.00	0.00
Wi-Fi Thermostat - Electric Cooling and Gas Heating Savings	-	89,341.96	70,580.22	22,706.55
Wi-Fi Thermostat - Electric Cooling and Heating Savings	-	0.00	0.00	0.00
Wi-Fi Thermostat - Electric Cooling Only Savings	-	0.00	0.00	0.00
Wi-Fi Thermostat - Electric Heating Only Savings	-	0.00	0.00	0.00
Wi-Fi Thermostat - Gas Heating Only Savings	-	21,734.78	17,170.49	5,523.97
Wi-Fi Thermostat - Heat Pump Savings	-	0.00	0.00	0.00
Bathroom Kit - LED Globe - Electric Water Heating	-	(52.29)	(48.12)	0.00

MEASURE	*EX ANTE*[a] NATURAL GAS ENERGY SAVINGS (THERMS/YR.)	AUDITED GROSS NATURAL GAS ENERGY (THERMS/YR.)	VERIFIED GROSS NATURAL GAS ENERGY SAVINGS (THERMS/YR.)	*EX POST* GROSS NATURAL GAS ENERGY SAVINGS (THERMS/YR.)
Bathroom Kit - Low Flow Showerhead 1.5 gpm - Electric Water Heating	-	0.00	0.00	0.00
Bathroom Kit - Bathroom Aerator 1.0 gpm - Electric Water Heating	-	0.00	0.00	0.00
Bathroom Kit - LED Nightlight - Electric Water Heating	-	0.00	0.00	0.00
Bathroom Kit - LED Globe - Gas Water Heating	-	(1,118.29)	(1,029.10)	0.00
Bathroom Kit - Low Flow Showerhead 1.5 gpm - Gas Water Heating	-	3,319.14	2,096.30	1,553.38
Bathroom Kit - Bathroom Aerator 1.0 gpm - Gas Water Heating	-	395.09	182.99	181.43
Bathroom Kit - LED Nightlight - Gas Water Heating	-	0.00	0.00	0.00
Home Office/Back to School Kit - Smart LED	-	0.00	0.00	0.00
Home Office/Back to School Kit - Tier 1 APS	-	0.00	0.00	0.00
Home Office/Back to School Kit - Desk Lamp	-	0.00	0.00	0.00
Home Office/Back to School Kit - Nightlight	-	0.00	0.00	0.00
Home Office/Back to School Kit Add-On - LED Reflector	-	(40,375.95)	(30,227.62)	0.00
Total Savings	74,119.56	73,800.35	59,149.64	30,946.90
Total Program Realization Rate				42%

Note: Totals may not sum properly due to rounding.

[a] Program tracking data is summed at the kit-level (not measure level). Therefore, *ex ante* savings are only reported at the summary level, due to rounding errors.

EX POST NET SAVINGS

The team estimated freeridership and spillover for select measures using survey data collected from 2021 participants. Table 213 shows the NTG ratios by measure for surveyed measures only.

TABLE 213. 2021 RESIDENTIAL ONLINE MARKETPLACE PROGRAM NET-TO-GROSS RATIOS BY MEASURE (SURVEYED MEASURES)

MEASURE	RESPONSES (n)	FREERIDERSHIP[a]	PARTICIPANT SPILLOVER	NTG
Wi-Fi Thermostats	46	15%	7%	92%
Reflector LED	48	50%	7%	57%
Smart LED	50	37%	7%	70%
LED Globe	16	24%	7%	83%
LED Night Light	68	37%	7%	70%
Showerhead	12	27%	7%	80%
Bathroom faucet aerator	8	17%	7%	90%
Smart Strip	50	25%	7%	82%
Desk Lamp	47	44%	7%	63%

[a]Freeridership score is an average weighted by verified quantity of measure installed.

For measures where respondents were not surveyed, including air purifier, smart plug, shower start, and pipe wrap measures, the evaluation team applied the overall program-level NTG ratios, developed from measures with 2021 survey respondents, weighted by *ex post* gross population savings. Table 214 shows the NTG ratio by measure for all program measures.

TABLE 214. 2021 RESIDENTIAL ONLINE MARKETPLACE PROGRAM NET-TO-GROSS RATIOS BY MEASURE

MEASURE	FREERIDERSHIP	SPILLOVER	NTG	SOURCE
Advanced Power Strip Tier 1	25%	7%	82%	Residential OMP participant survey
Advanced Power Strip Tier 2	25%	7%	82%	Residential OMP participant survey
Air Purifier	37%	7%	70%	OMP overall electric weighted average parameters
Bathroom Aerator 1.0 gpm - Electric	17%	7%	90%	Residential OMP participant survey
Bathroom Aerator 1.0 gpm - Gas	17%	7%	90%	Residential OMP participant survey
Kitchen Aerator 1.5 gpm - Electric	17%	7%	90%	Residential OMP participant survey
Kitchen Aerator 1.5 gpm - Gas	17%	7%	90%	Residential OMP participant survey
LED Reflector	50%	7%	57%	Residential OMP participant survey
LED Specialty	50%	7%	57%	Residential OMP participant survey
Smart LED	37%	7%	70%	Residential OMP participant survey
Low Flow Showerhead 1.5 gpm - Electric	27%	7%	80%	Residential OMP participant survey
Low Flow Showerhead 1.5 gpm - Gas	27%	7%	80%	Residential OMP participant survey
Low Flow Showerhead with Shower Start 1.5 gpm - Gas	27%	7%	80%	Residential OMP participant survey
Pipe Wrap - Electric	37%	7%	70%	OMP overall electric weighted average parameters
Pipe Wrap - Gas	16%	7%	91%	OMP overall gas weighted average parameters
Shower Start Only - Gas	16%	7%	91%	OMP overall gas weighted average parameters
Smart Plug	37%	7%	70%	OMP overall electric weighted average parameters
Wi-Fi Thermostat - Electric Cooling and Gas Heating Savings	15%	7%	92%	Residential OMP participant survey
Wi-Fi Thermostat - Electric Cooling and Heating Savings	15%	7%	92%	Residential OMP participant survey
Wi-Fi Thermostat - Electric Cooling Only Savings	15%	7%	92%	Residential OMP participant survey
Wi-Fi Thermostat - Electric Heating Only Savings	15%	7%	92%	Residential OMP participant survey
Wi-Fi Thermostat - Gas Heating Only Savings	15%	7%	92%	Residential OMP participant survey
Wi-Fi Thermostat - Heat Pump Savings	15%	7%	92%	Residential OMP participant survey
Bathroom Kit - LED Globe - Electric Water Heating	24%	7%	83%	Residential OMP participant survey
Bathroom Kit - Low Flow Showerhead 1.5 gpm - Electric Water Heating	27%	7%	80%	Residential OMP participant survey
Bathroom Kit - Bathroom Aerator 1.0 gpm - Electric Water Heating	17%	7%	90%	Residential OMP participant survey
Bathroom Kit - LED Nightlight - Electric Water Heating	37%	7%	70%	Residential OMP participant survey
Bathroom Kit - LED Globe - Gas Water Heating	24%	7%	83%	Residential OMP participant survey

MEASURE	FREERIDERSHIP	SPILLOVER	NTG	SOURCE
Bathroom Kit - Low Flow Showerhead 1.5 gpm - Gas Water Heating	27%	7%	80%	Residential OMP participant survey
Bathroom Kit - Bathroom Aerator 1.0 gpm - Gas Water Heating	17%	7%	90%	Residential OMP participant survey
Bathroom Kit - LED Nightlight - Gas Water Heating	37%	7%	70%	Residential OMP participant survey
Home Office/Back to School Kit - Smart LED	37%	7%	70%	Residential OMP participant survey
Home Office/Back to School Kit - Tier 1 APS	25%	7%	82%	Residential OMP participant survey
Home Office/Back to School Kit - Desk Lamp	44%	7%	63%	Residential OMP participant survey
Home Office/Back to School Kit - Nightlight	37%	7%	70%	Residential OMP participant survey
Home Office/Back to School Kit Add-On - LED Reflector	50%	7%	57%	Residential OMP participant survey

[a]Freeridership score is an average weighted by verified quantity of measure installed.

FREERIDERSHIP

INTENTION FREERIDERSHIP

Measure-level *intention* freeridership values for each participant were calculated using the following survey questions:

- FR1. If an instant discount from the NIPSCO Online Marketplace had not been available for the kit, would you have purchased a [MEASURE] on your own?
- FR2. When would you have purchased the [MEASURE] if the NIPSCO Online Marketplace and instant discount had not been available?

Respondents who gave a response of “No” to FR1 were assigned an *intention* freeridership score of 0%. Those who gave a response of “No, I already have them installed in all locations” were assigned an *intention* freeridership score of 100%. Those who said “Yes” to FR1 were asked FR2 and assigned an *intention* freeridership score based on the timing of their decision (Table 215).

TABLE 215. 2021 RESIDENTIAL ONLINE MARKETPLACE PROGRAM INTENTION FREERIDERSHIP ASSIGNMENT

FR2. RESPONSE OPTION	ASSIGNED INTENTION FREERIDERSHIP VALUE
Around the same time you purchased the kit	100%
Later but within one year	50%
Later but more than one year	0%
Not sure	25%

Table 216 shows *intention* freeridership score for each surveyed measure.

TABLE 216. 2021 RESIDENTIAL ONLINE MARKETPLACE PROGRAM INTENTION FREERIDERSHIP BY MEASURE

MEASURE	INTENTION FREERIDERSHIP SCORE (%)
Wi-Fi Thermostats (n=46)	27%
Reflector LEDs (n=48)	50%
Smart LEDs (n=50)	37%
LED Globe (n=16)	42%
LED Night Light (n=68)	40%
Showerhead (n=12)	46%
Bathroom faucet aerator (n=8)	25%
Smart Strip (n=50)	25%
Desk Lamp (n=47)	44%

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 217.

TABLE 217. 2021 RESIDENTIAL ONLINE MARKETPLACE PROGRAM INTENTION FREERIDERSHIP SCORING

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

Table 218 shows *influence* freeridership score for each surveyed measure. An *influence* freeridership score was not applied to measures that respondents received for free, it was only applied to measures with cost sharing.

TABLE 218. 2021 RESIDENTIAL ONLINE MARKETPLACE PROGRAM INFLUENCE FREERIDERSHIP SCORING

MEASURE	INFLUENCE FREERIDERSHIP SCORE (%)
Wi-Fi Thermostats (n=46)	3%
Reflector LEDs (n=48)	NA
Smart LEDs (n=50)	NA
LED Globe (n=16)	6%
LED Night Light (n=68)*	33%
Showerhead (n=12)	8%
Bathroom faucet aerator (n=8)	9%
Smart Strip (n=50)	NA
Desk Lamp (n=47)	NA

NA: Respondents received measure for free and an *influence* freeridership score was not applied.
*18 respondents received the LED night light as part of a cost sharing kit and have an *influence* freeridership score applied. 50 respondents received the LED night light for free, where an *influence* freeridership score does not apply and for purpose of reporting, the evaluation team applied an *influence* freeridership score equal to the *intention* freeridership score for these 50 respondents.

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 219 lists the intention, influence, and final freeridership scores for the 2021 Residential OLM program.

TABLE 219. 2021 RESIDENTIAL ONLINE MARKETPLACE PROGRAM FREERIDERSHIP SCORE

MEASURE	INTENTION SCORE	INFLUENCE SCORE	FREERIDERSHIP SCORE
Wi-Fi Thermostats (n=46)	27%	3%	15%
Reflector LEDs (n=48)	50%	NA	50%
Smart LEDs (n=50)	37%	NA	37%
LED Globe (n=16)	42%	6%	24%
LED Night Light (n=68)	40%	33%	37%
Showerhead (n=12)	46%	8%	27%
Bathroom faucet aerator (n=8)	25%	9%	17%
Smart Strip (n=50)	25%	NA	25%
Desk Lamp (n=47)	44%	NA	44%

NA: Respondents received measure for free and an *influence* freeridership score was not applied.

PARTICIPANT SPILLOVER

The evaluation team estimated participant spillover measure savings using specific information about participants, determined through the evaluation, using 2021 NIPSCO evaluation results, the Indiana TRM (v2.2) and the Illinois TRM v.10 as a baseline reference.[54] 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

[54] Nonparticipant spillover evaluation activities were not conducted for the 2021 program year.

achieved by all survey respondents.[55] The participant spillover estimates for the Residential OLM program, rounded to the nearest whole percent, can be seen in Table 220.

TABLE 220. 2021 RESIDENTIAL ONLINE MARKETPLACE PROGRAM PARTICIPANT SPILLOVER RESULTS

MEASURE	SPILLOVER SAVINGS (MMBtu)	PARTICIPANT PROGRAM SAVINGS (MMBtu)	PARTICIPANT SPILLOVER
Total Program	14.8	217.3	7%

RESULTING NET SAVINGS

Table 221 presents the resulting net electric savings, demand reduction, and natural gas savings.

TABLE 221. 2021 RESIDENTIAL ONLINE MARKETPLACE PROGRAM *EX POST* NET SAVINGS

MEASURE	*EX POST* GROSS SAVINGS/REDUCTION			NTG	*EX POST* NET SAVINGS/REDUCTION		
	KWH	KW	THERMS		KWH	KW	THERMS
Advanced Power Strip Tier 1	3,312.47	0.372	0.00	82%	2,716.23	0.305	0.00
Advanced Power Strip Tier 2	2,172.56	0.397	0.00	82%	1,781.50	0.325	0.00
Air Purifier	95.00	0.011	0.00	70% [a]	66.92	0.008	0.00
Bathroom Aerator 1.0 gpm - Electric	353.23	0.034	0.00	90%	317.90	0.030	0.00
Bathroom Aerator 1.0 gpm - Gas	0.00	0.000	90.53	90%	0.00	0.000	81.48
Kitchen Aerator 1.5 gpm - Electric	154.88	0.007	0.00	90%	139.39	0.006	0.00
Kitchen Aerator 1.5 gpm - Gas	0.00	0.000	143.20	90%	0.00	0.000	128.88
LED Reflector	21,691.22	2.953	0.00	57%	12,364.00	1.683	0.00
LED Specialty	8,943.66	1.218	0.00	57%	5,097.89	0.694	0.00
Smart LED	1,888.11	0.257	0.00	70%	1,321.68	0.180	0.00
Low Flow Showerhead 1.5 gpm - Electric	675.26	0.045	0.00	80%	540.21	0.036	0.00
Low Flow Showerhead 1.5 gpm - Gas	0.00	0.000	306.29	80%	0.00	0.000	245.03
Low Flow Showerhead with Shower Start 1.5 gpm - Gas	0.00	0.000	170.41	80%	0.00	0.000	136.33
Pipe Wrap - Electric	293.71	0.030	0.00	70% [a]	206.91	0.021	0.00
Pipe Wrap - Gas	0.00	0.000	248.80	91% [b]	0.00	0.000	226.85
Shower Start Only - Gas	0.00	0.000	22.33	91% [b]	0.00	0.000	20.36
Smart Plug	0.00	0.000	0.00	70% [a]	0.00	0.000	0.00
Wi-Fi Thermostat - Electric Cooling and Gas Heating Savings	70,873.47	80.401	22,706.55	92%	65,203.60	73.969	20,890.03
Wi-Fi Thermostat - Electric Cooling and Heating Savings	55,196.57	5.996	0.00	92%	50,780.85	5.516	0.00
Wi-Fi Thermostat - Electric Cooling Only Savings	606.56	0.688	0.00	92%	558.03	0.633	0.00
Wi-Fi Thermostat - Electric Heating Only Savings	4,906.91	0.000	0.00	92%	4,514.36	0.000	0.00
Wi-Fi Thermostat - Gas Heating Only Savings	0.00	0.000	5,523.97	92%	0.00	0.000	5,082.05

[55] The spillover measures attributed to the program are an energy efficient central air conditioner, ENERGY STAR refrigerator, ENERGY STAR freezer, two ENERGY STAR dehumidifiers, two ENERGY STAR air purifiers, a heat pump water heater and air sealing that did not receive a program rebate.

MEASURE	*EX POST* GROSS SAVINGS/REDUCTION			NTG	*EX POST* NET SAVINGS/REDUCTION		
	KWH	KW	THERMS		KWH	KW	THERMS
Wi-Fi Thermostat - Heat Pump Savings	187.66	0.095	0.00	92%	172.65	0.087	0.00
Bathroom Kit - LED Globe - Electric Water Heating	1,086.76	0.148	0.00	83%	902.01	0.123	0.00
Bathroom Kit - Low Flow Showerhead 1.5 gpm - Electric Water Heating	2,007.77	0.132	0.00	80%	1,606.22	0.106	0.00
Bathroom Kit - Bathroom Aerator 1.0 gpm - Electric Water Heating	195.22	0.019	0.00	90%	175.70	0.017	0.00
Bathroom Kit - LED Nightlight - Electric Water Heating	27.66	0.000	0.00	70%	19.36	0.000	0.00
Bathroom Kit - LED Globe - Gas Water Heating	23,197.91	3.158	0.00	83%	19,254.27	2.621	0.00
Bathroom Kit - Low Flow Showerhead 1.5 gpm - Gas Water Heating	0.00	0.000	1,553.38	80%	0.00	0.000	1,242.70
Bathroom Kit - Bathroom Aerator 1.0 gpm - Gas Water Heating	0.00	0.000	181.43	90%	0.00	0.000	163.29
Bathroom Kit - LED Nightlight - Gas Water Heating	589.45	0.000	0.00	70%	412.62	0.000	0.00
Home Office/Back to School Kit - Smart LED	286,515.73	39.000	0.00	70%	200,561.01	27.300	0.00
Home Office/Back to School Kit - Tier 1 APS	386,880.30	43.415	0.00	82%	317,241.85	35.600	0.00
Home Office/Back to School Kit - Desk Lamp	61,903.28	25.335	0.00	63%	38,999.07	15.961	0.00
Home Office/Back to School Kit - Nightlight	16,662.21	0.000	0.00	70%	11,663.55	0.000	0.00
Home Office/Back to School Kit Add-On - LED Reflector	498,835.26	67.900	0.00	57%	284,336.10	38.703	0.00
Total Savings	1,449,252.86	271.609	30,946.90		1,020,953.86	203.925	28,217.00

Note: Totals may not sum properly due to rounding.
[a] No surveys completed. The evaluation team applied the program-level electric energy savings NTG ratio of 70%.
[b] No surveys completed. The evaluation team applied the program-level natural gas energy savings NTG ratio of 91%.

Table 222 shows the NTG results by fuel type.

TABLE 222. 2021 RESIDENTIAL ONLINE MARKETPLACE NET-TO-GROSS RESULTS BY FUEL TYPE

SAVINGS TYPE	*EX ANTE* GROSS SAVINGS	*EX POST* GROSS SAVINGS	NTG RATIO (%)	*EX POST* NET SAVINGS
Electric Energy Savings (kWh/yr.)	3,510,654.18	1,449,252.86	70%	1,020,953.86
Peak Demand Reduction (kW)	562.968	271.609	75%	203.925
Natural Gas Energy Savings (therms/yr.)	74,119.56	30,946.90	91%	28,217.00

PROCESS EVALUATION

The evaluation team conducted quantitative research activities to answer the following key research questions for the program:

- How do participants learn about the program?
- What prompted the participant to purchase the efficient equipment from the Online Marketplace? Why did they purchase it from the Online Marketplace, as opposed to another retailer?
- What was the participant experience with the Online Marketplace website and shipping? Do they have any suggestions to improve the Online Marketplace?
- How satisfied are participants with the items they purchased from the Online Marketplace?
- How satisfied are participants with the program overall?
- What additional NIPSCO programs are participants aware of?

To answer these research questions, the evaluation team completed a mixed-mode telephone and web survey of program participants (n = 153) to understand families' experiences with the materials and kits, satisfaction with the program, and inform impacts inputs.

The evaluation team initially planned to field this survey as an online survey only. However, the initial response rate to the survey was low: 5% for Bathroom kits and less than 1% for Home Office/Back to School kits and Thermostats. Both the Home Office/Back to School kits and the thermostats were marketed primarily through social media. The evaluation team hypothesized that since NIPSCO Online Marketplace branding was less prominently featured on social media advertising, respondents did not associate the items they received with the NIPSCO Online Marketplace. Alternatively, respondents may have expended a low enough effort to receive measures that they felt it was not worth their time to take a follow up survey.

To attempt to increase the response rate, the evaluation team updated survey email invitations to reference specific measures instead of the NIPSCO Online Marketplace overall. We also removed a screening question that asked respondents if they recalled participating in the NIPSCO Online Marketplace prior to asking them about the specific measures they received. Finally, the team conducted phone surveys to give the survey administrator the opportunity to clarify, via phone with respondents, what items the evaluation team was asking about. These changes resulted in increased response rates for all measures: 11% for Bathroom kits, 5% for Thermostats, and 3% for Home Office/Back to School kits. The evaluation team recommends that mixed mode surveying be used in the future to ensure a sufficient response rate and that the survey language references the measures themselves and does not rely on recognition that items were received through the NIPSCO Online Marketplace.

PARTICIPANT SURVEY FINDINGS

The evaluation team surveyed 153 customers who participated in the program. The following sections describe the results related to program awareness, reasons for participation, experience with the OLM, satisfaction with the program, and program impacts on customers. The following is a summary of survey respondents per kit or product they received:

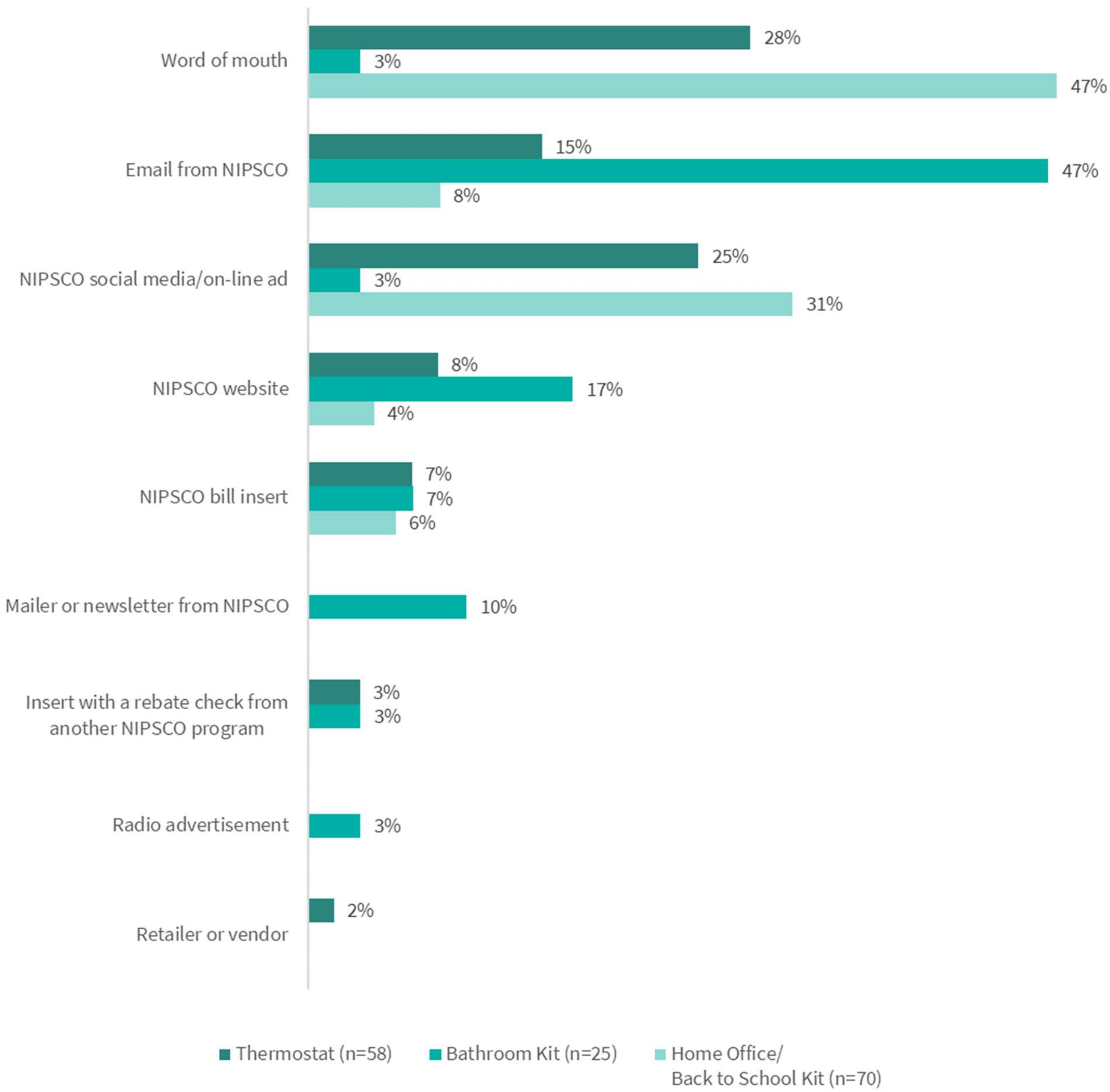
- Almost half (46%) of respondents received the Home Office/Back-to-School kit measure (n=70)
- Customers who received Wi-Fi thermostats made up 38% of respondents (n=58)
- The Bathroom kit measure received the fewest responses (n=25)

Out of the respondents who received the Home Office/Back-To-School kit (n=70), 60 of them (~85%) also received the add-on LED reflector bulb 6-packs.

PROGRAM AWARENESS

The evaluation team asked all respondents how they became aware of the NIPSCO Online Marketplace. Most Bathroom kit recipients learned about the NIPSCO Online Marketplace through emails from NIPSCO. Respondents who received the Home Office/Back-to-School kit and respondents who purchased a thermostat most often reported learning about the NIPSCO Online Marketplace through word of mouth, followed by social media or online ads from NIPSCO. Per NIPSCO, the Home Office/Back-to-School kits were advertised on Facebook, which aligns with these results. Fewer than 10% of respondents for any measure type reported learning about the Online Marketplace from NIPSCO mailers, bill inserts, rebate check inserts, radio advertisements, and retailers or vendors (FigureFigure 60. Overall Program Awareness [a]).

FIGURE 60. OVERALL PROGRAM AWARENESS [a]



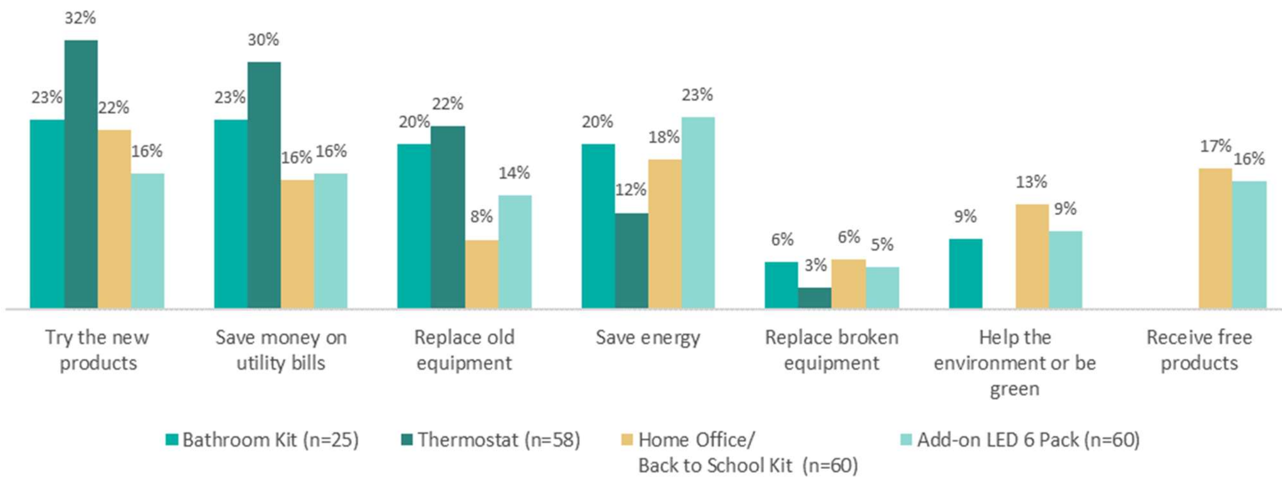
Source: Participant Survey. Question: "How did you learn about the NIPSCO Online Marketplace?"

[a] This was a multiple response question (N=153). No respondents reported hearing about the Online marketplace through the following sources: television advertisements, a contractor, or a billboard.

DECISION-MAKING

To understand the motivations behind the purchase of Online Marketplace products, the evaluation team asked respondents why they ordered the different products and kits. As shown in FigureFIGURE 61, respondents who ordered Bathroom kits and thermostats, most often said they ordered these items to try the new products (23% Bathroom kit; 32% thermostat) or to save money on utility bills (23% Bathroom kit; 30% thermostat). Notably, both these measures were purchased at a discount, as opposed to being free. For free items, including the Home Office/Back to School kit and the Add-on LED 6-pack, respondents most frequently said they ordered these items to save energy (18% Home Office/Back to School kits, 23% Add-on LED 6-pack) or because the products were free (17% Home Office/Back to School kits, 16% Add-on LED 6-pack).

FIGURE 61. MOTIVATIONS TO ORDER ONLINE MARKETPLACE PRODUCTS BY MEASURE [a]

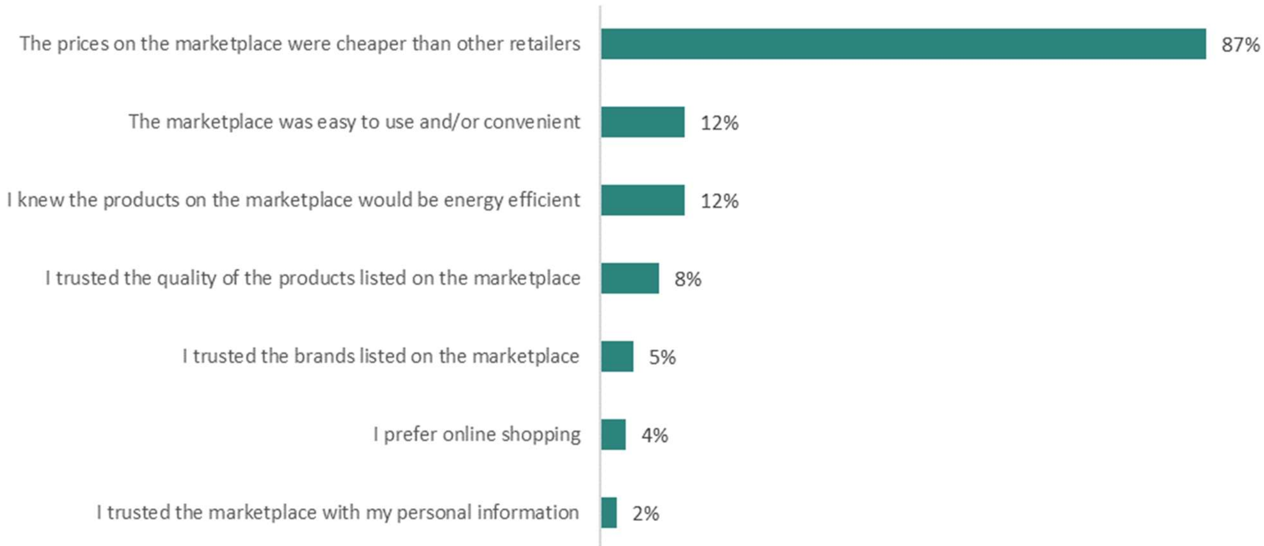


Source: Participant Survey. Question: "Why did you decide to receive the [Bathroom Kit, Thermostat, Home Office/Back-to-School Kit, Add-on LED 6-pack] from the Online Marketplace at the time you did?"

[a] This was a multiple response question (n=153). Only the Home Office/Back-to-School kit respondents, and subsequently the Add-on LED 6-pack respondents, were shown the response option "to receive the free products."

Respondents who purchased their items from the Online Marketplace, were asked why they decided to buy the products from the NIPSCO Online Marketplace, as opposed to another retailer. The vast majority (87%) of Thermostat and Bathroom kit respondents (n=83) expressed that they bought their products from the NIPSCO Online Marketplace because the prices on the Online Marketplace were cheaper than other retailers (FigureFIGURE 62). Respondents also indicated that the Online Marketplace was easy to use/and or convenient (12%) and that they knew the products purchased on the Online Marketplace would be energy efficient (12%).

FIGURE 62. OVERALL MOTIVATIONS TO PURCHASE ONLINE MARKETPLACE PRODUCTS (N=83)[a]



Source: Participant Survey. Question: "Why did you decide to buy the [Bathroom Kit, Thermostat, Home Office/Back-to-School Kit, Add-on LED 6-pack] from the NIPSCO Online Marketplace?"
[a] This was a multiple response question.

The respondents who did not cite cheaper prices as a motivation to purchase from the NIPSCO Online Marketplace (n=11 out of 83) were asked about the prices they paid for their measures on the Online Marketplace, compared to other retailers. Almost all these respondents (n=10) expressed that the prices they paid for their products were cheaper on the NIPSCO Online Marketplace than elsewhere.

Almost all customers who received the Bathroom kits or thermostats (97%) said that they would use the NIPSCO Online Marketplace again in the future to purchase products. Respondents who would not use the Online Marketplace again would buy from either house/hardware retailers (e.g., Home Depot, Menards) (n=2) or online retailers (e.g., Amazon) (n=2) instead.

ONLINE MARKETPLACE EXPERIENCE

The evaluation team asked all respondents (n=153) to provide feedback on their experience with the Online Marketplace. The following is a snapshot of themes related to their Online Marketplace experience:

- Most (82%) respondents expressed that it was very easy to purchase their energy efficient products on the NIPSCO Online Marketplace.
- Seventy-eight percent of respondents stated that the product descriptions on the NIPSCO Online Marketplace were very useful when deciding which products to buy.
- Seventy-two percent of respondents indicated that they were very satisfied with the variety of products available through the Online Marketplace.
- Most respondents (80%) received their products from the NIPSCO Online Marketplace in less than three weeks.

Several respondents (20%) had suggestions to improve the Online Marketplace (n=26). The most common suggestion (27%) was a desire for more options or a wider variety of products available on the Online Marketplace, such as smart home products or other efficiency items. These themes are described in more detail in Table 223.

TABLE 223. SUGGESTIONS TO IMPROVE THE MARKETPLACE

THEME	FREQUENCY	PERCENT	REPRESENTATIVE QUOTE
More options/variety in products on the Online Marketplace	7	27%	*"Get more. anything energy efficient or saving"*
Assistance/clarification on how the Online Marketplace works	4	15%	*"I have no clue what your marketplace actually does offer, provide more information about the services products offered by marketplace"*
Issues with specific products	3	12%	*"LED lightbulbs flicker"*
Make more light bulbs available on the Online Marketplace	3	12%	*"More LED light bulbs"*
More advertising for the Online Marketplace	3	12%	*"Advertise more than just in the bills"*
More discounts available	3	12%	*"It would be nice to be able to purchase products even if over the household quota for discounts"*
Assistance/clarification on how specific products work	2	8%	*"We had to go off of the marketplace to buy a wire for the thermostat so if there is a part that might possibly be necessary, you might want to recommend where it is being sold. That is all."*
Other	1	4%	
TOTAL	26	100%	

MEASURE, PROGRAM, AND OVERALL SATISFACTION

MEASURE SATISFACTION

Bathroom Kit

OF THE RESPONDENTS WHO RECEIVED THE BATHROOM KIT (N=25), 23 GAVE REASONS FOR NOT INSTALLING ONE OR MEASURES INCLUDED IN THE KIT. ACROSS ALL KIT MEASURES, THE MOST COMMON REASON FOR NOT INSTALLING MEASURES WAS THAT THE RESPONDENT WAS PLANNING TO INSTALL MEASURES IN THE FUTURE. OTHER REASONS INCLUDED: THE MEASURE NOT FITTING; RESPONDENTS ALREADY OWNED A SIMILAR MEASURE; OR THE RESPONDENT GAVE THE MEASURE AWAY (

Table 224). We note that all respondents reported installing or planning to install the LED globe light bulb(s) and LED night lights, so no reasons for non-installation were given for these measures.

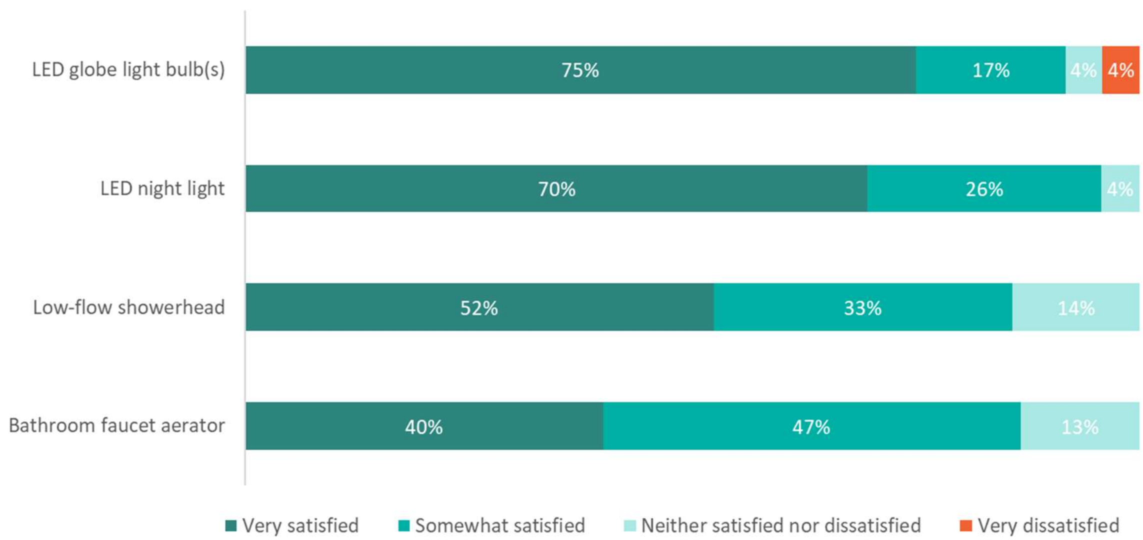
TABLE 224. REASONS NOT TO INSTALL ALL BATHROOM KIT MEASURES

KIT MEASURE	COUNT	REASON(S)
LED globe light bulb(s)	15	Plan to install the remaining LED light bulb(s) in the future (n=15)
LED night light	3	Plan to install the LED night light in the future (n=3)
Low flow showerhead	10	Plan to install the showerhead in the future (n=5); Did not try it (n=2); Didn't fit (n=1); Already had one (n=1); Gave it away (n=1); It did not work (n=1)
Bathroom faucet aerator	13	Plan to install the bathroom aerator in the future (n=7); Didn't fit (n=3); Already had one (n=2); Gave it away (n=1)

Source: Residential Online Marketplace survey. Question: "Why did you choose not to install the…?" This was a multiple response question.

Among the four products received in the Bathroom kits, customers were most satisfied with the LED globe light bulb(s) and the LED night light, with 92% and 96% of respondents stating they were somewhat to very satisfied, respectively (FIGURE 63).

FIGURE 63. SATISFACTION WITH BATHROOM KIT PRODUCTS (N=25)



Source: Participant Survey. Question: "How satisfied are you with the…?"

Customers who were neutral or dissatisfied with their Bathroom kit products had the following reasons:

- The LED globe light bulbs/night lights were not bright enough (n=3)
- The LED globe light bulbs did not work properly (n=1)
- The low flow showerhead/bathroom faucet aerator had an undesirable water pressure (n=3), or
- The bathroom faucet aerator did not fit (n=1)

Home Office/Back-to-School Kit

Seventy respondents received the Home Office/Back-to-School Kits. Of these, 62 respondents gave reasons for not installing one or more measures included in the kit. These reasons varied and are explained in more detail below (Table 225).

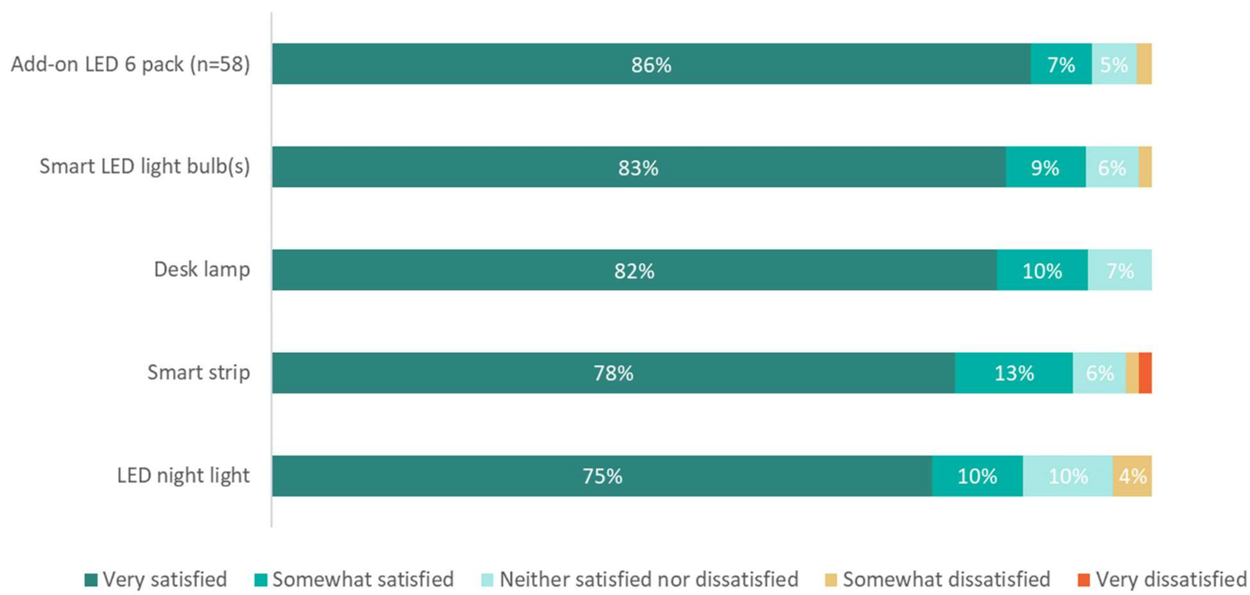
TABLE 225. REASONS NOT TO INSTALL ALL HOME OFFICE/BACK-TO-SCHOOL KIT MEASURES

KIT MEASURE	COUNT	REASON(S)
LED light bulb(s)	16	Plan to install the LED bulb(s) in the future (n=13); Gave them away (n=1); Didn't like the look of the bulbs (n=1); Do not have the necessary equipment for installation (n=1)
Smart strip	7	Plan to install the smart strip in the future (n=5); Disliked the way the smart strip works (n=1); Did not have time (n=1)
Desk lamp	12	Plan to install the desk lamp in the future (n=12); Gave it away (n=1); Not sure (n=1)
LED night light	12	Plan to install the LED night light in the future (n=10); Not bright enough (n=1); No need for the night light (n=1)
Add-on LED 6-pack	57	Plan to install the LED bulb(s) in the future (n=52); Didn't fit (n=3); Did not like the light color (n=1)

Source: Residential Online Marketplace survey. Question: "Why did you choose not to install the…?" This was a multiple response question.

Customers who received the Home Office/Back-to-School Kits were satisfied with the products provided. Smart LED light bulbs, the add-on LED 6-pack and desk lamps had the highest satisfaction ratings (FIGURE 64).

FIGURE 64. SATISFACTION WITH THE HOME OFFICE/BACK-TO-SCHOOL KIT PRODUCTS (N=68)



Source: Participant Survey. Question: "How satisfied are you with the…?"

Those customers who were less than satisfied with their Home Office/Back-to-School Kit products gave the following reasons:

- The product had not been installed yet (n=8)
- The LED light bulb(s)/smart strip/LED night light did not work properly (n=5)
- The LED night light was not bright enough (n=4)
- The smart strip was difficult to use (n=2)
- The desk lamp had an undesirable design (n=1)
- The desk lamp/LED night light had an undesirable color (n=2).

Similar reasons were given for less satisfied ratings of the LED Add-on 6-pack, such as:

- The LED Add-on 6-pack was not bright enough (n=2)
- The LED Add-on 6-pack did not work properly (n=1)
- The LED Add-on 6-pack was too bright (n=1)
- The LED Add-on 6-pack had an undesirable color (n=1).

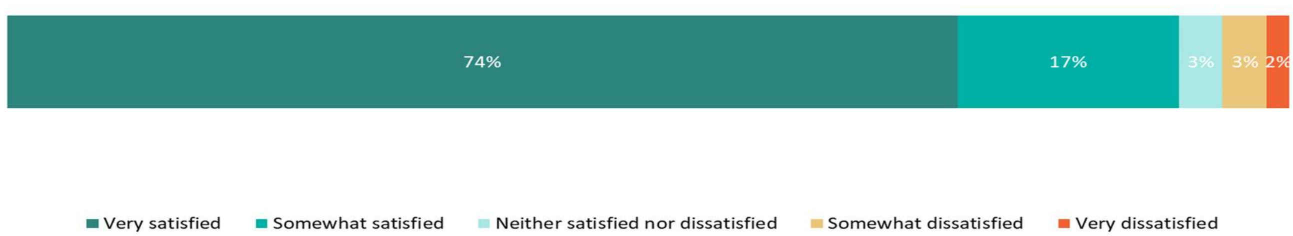
Thermostat

Fifty-eight respondents received a thermostat. Of these, 12 provided reasons for not installing their thermostat. Nine respondents said they intended to install their thermostat in the future and two were unsure. One respondent said they returned their thermostat to the Online Marketplace.

The evaluation team reviewed the dates that respondents who said they would install thermostats in the future received their thermostats, to assess whether respondents may not have had sufficient time between purchasing their thermostat and being surveyed to install the thermostat. The evaluation team found that three of nine respondents who planned to install their thermostat in the future had purchased their thermostat in December 2021, with the remainder purchasing thermostats in the April-July 2021 timeframe. Given this, the evaluation team decided not to adjust the thermostat in-service rate to account for future installs.

Customers who purchased thermostats were generally satisfied with their purchase, with 74% of respondents stating that they were "very satisfied" with the product (Figure 65).

FIGURE 65. SATISFACTION WITH THE THERMOSTAT PRODUCTS (N=58)



Source: Participant Survey. Question: "How satisfied are you with the thermostat products you purchased from the Online Marketplace overall?"

If respondents gave a less than satisfied rating for the thermostat, it was typically due to an issue with how the thermostat worked (n=3). For example, some customers noted, *"[The thermostat] loses power so I need to have an HVAC tech work on it to get it to work properly,"* and, *"It will go offline at least once a week and I have to factory reset to get it back online."* Other reasons for dissatisfaction included that the thermostat had not yet been installed (n=1).

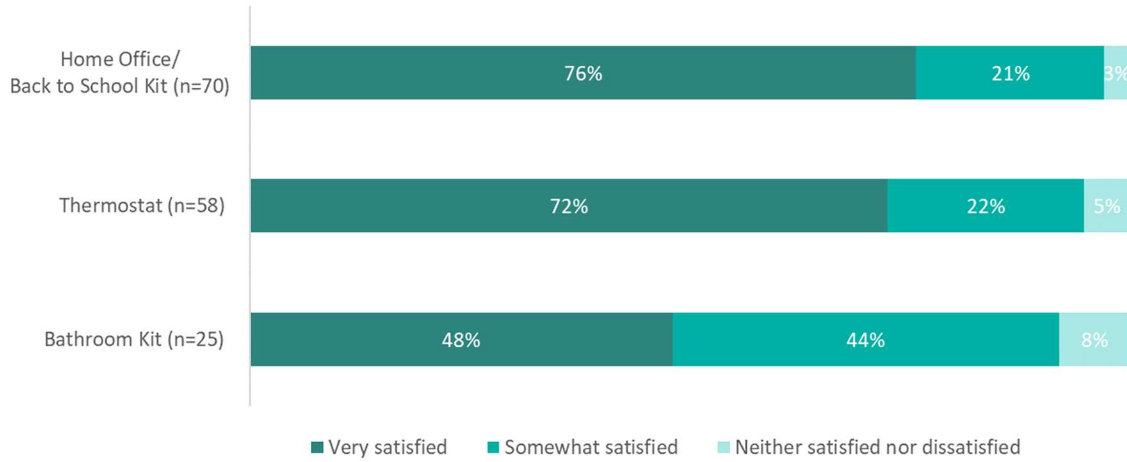
ONLINE MARKETPLACE SATISFACTION

Seventy percent of respondents reported being very satisfied with the NIPSCO Online Marketplace overall. Respondents who received a thermostat or a Home Office/Back to School kit reported being "Very Satisfied" with the Online Marketplace at higher rates than those who received a Bathroom kit.

This follows a similar trend to respondent satisfaction with kit products: 75% or more respondents provided "Very Satisfied" ratings for all Bathroom kit items, while 74% of respondents were "Very Satisfied" with thermostats. Water-saving measures in the Bathroom kit received lower scores by comparison, with 52% indicating they were

“Very Satisfied” with the low flow showerhead and 40% indicating they were “Very Satisfied” with the bathroom aerator. Although there was a slight variation in satisfaction by measure, no respondents expressed dissatisfaction with the NIPSCO Online Marketplace (Figure 66).

FIGURE 66. SATISFACTION WITH THE RESIDENTIAL ONLINE MARKETPLACE (N=153)



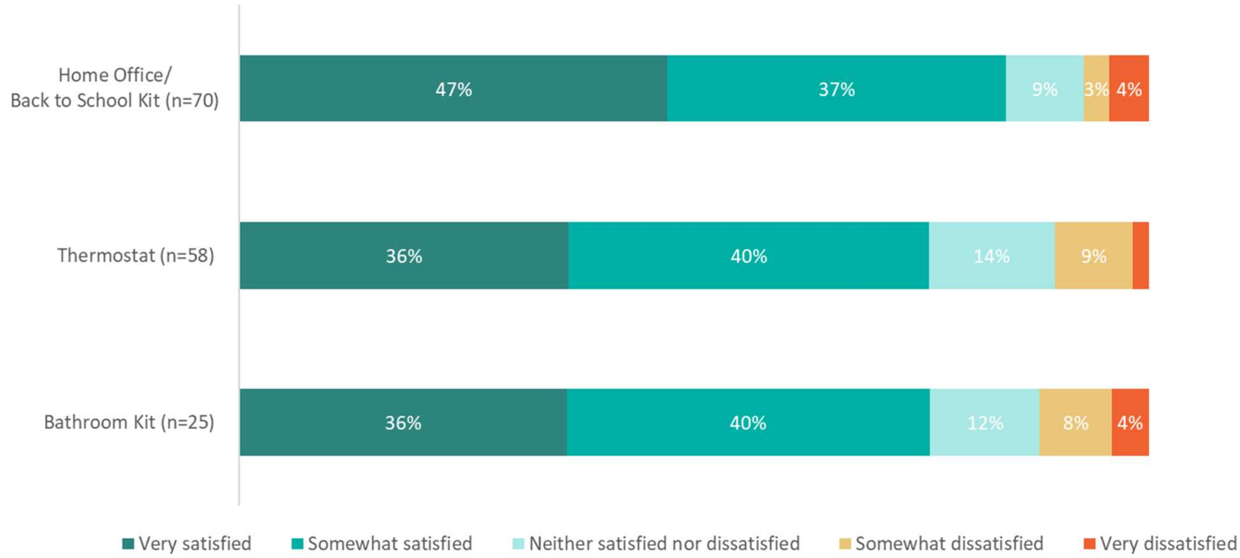
Source: Participant Survey. Question: How satisfied are you with the NIPSCO Online Marketplace overall?

Respondents who were neutral towards the Online Marketplace usually referenced a general issue (n=3). As one respondent wrote, they were not satisfied because, *“I didn't [know] what it entails and need to something to catch my eye.”* Other respondents had difficulties with the overall process (n=2), like one respondent who expressed that they felt neutral, *“Just because of the account number not being recognized and customer service making me wait to get it to work.”*

SATISFACTION WITH NIPSCO

The evaluation team also asked respondents about their satisfaction with NIPSCO as their energy service provider (Figure 67). Seventy-six percent of Bathroom kit recipients were somewhat or very satisfied with NIPSCO (n=25). Similarly, 76% of respondents who purchased thermostats were somewhat or very satisfied (n=58). Those who received Home Office/Back-to-School Kits had the highest satisfaction, with 84% of respondents stating that they were somewhat or very satisfied with NIPSCO as their energy service provider (n=70).

FIGURE 67. SATISFACTION WITH NIPSCO OVERALL (N=153)



Source: Participant Survey. Question: "How satisfied are you with NIPSCO overall as your energy service provider?"

Customers who were neutral or expressed dissatisfaction with NIPSCO (n=26) were asked why they felt that way. Reasons for neutral and dissatisfied ratings included:

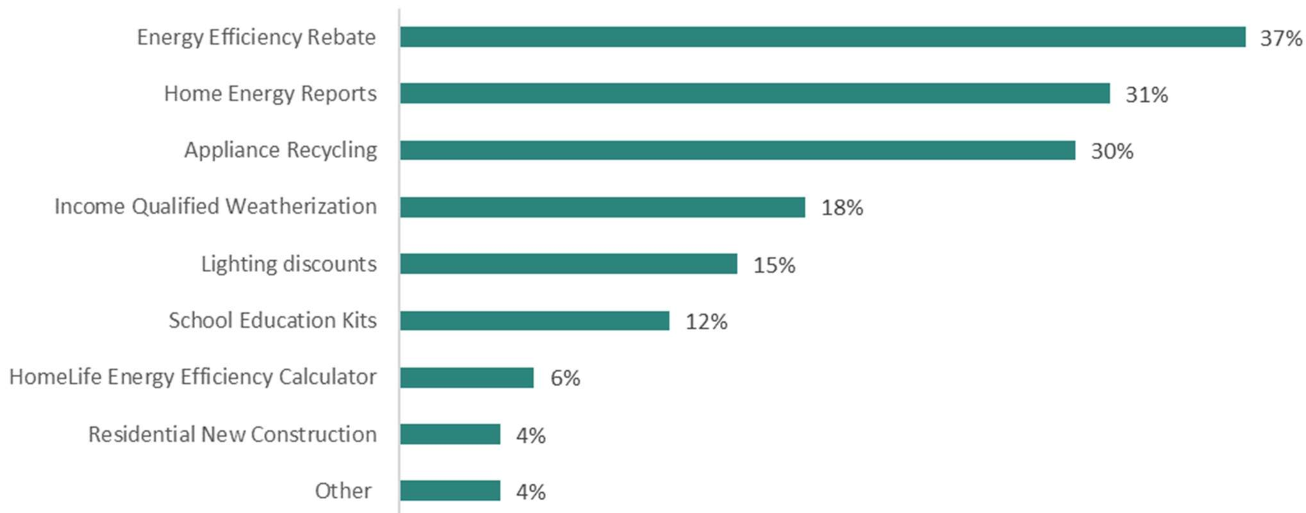
- Rates are increasing (n=10)
- Rates are currently high (n=8)
- General ambivalence (e.g., *"Haven't been too happy with my last bill but can't complain"*) (n=4)
- Customers have no choice in their utility (n=4), or
- Other, specific issues (n=2)

OTHER PROGRAM AWARENESS AND CHANNELING

When asked if customers were aware of other NIPSCO energy efficiency programs, outside of the Online Marketplace, almost half of respondents (48%) said they were, while 52% were not (n=153).

The NIPSCO programs that respondents were most aware of were Energy Efficiency Rebates (37%) and Home Energy Reports (HERs) (31%) (Figure 68). It should be noted that there were several respondents (n=10) who were aware that NIPSCO had other energy efficiency programs, but either did not know their names or knew none of the programs listed.

FIGURE 68. ADDITIONAL PROGRAM AWARENESS (N=67)



Source: Participant Survey. Question: "What energy efficiency programs are you aware of?" This was a multiple response question.

Although almost half of the respondents were aware of NIPSCO's other energy efficiency programs, 90% of respondents stated that they had not participated in any additional NIPSCO programs since buying from the Online Marketplace. Of those that did participate in an additional program after using the Online Marketplace (n=11), the most common programs were Energy Efficiency Rebates (n=3) and Lighting Discounts (n=3).

Respondents who had participated in another program were also asked where they had heard of each program. In general, respondents found out about these programs through the NISPCO website (27%) or a retailer or vendor (20%).

No respondents mentioned hearing about additional programs through materials inside the kit, radio/TV advertisements, or contractors (Table 226).

TABLE 226. ADDITIONAL PROGRAM SOURCE

RESPONSE	FREQUENCY	PERCENT
NIPSCO website	4	27%
Retailer or Vendor	3	20%
NIPSCO bill Insert	2	13%
Mailer or newsletter from NIPSCO	2	13%
Word of mouth (through friend, family, or colleague)	2	13%
Insert mailed with rebate check from another NIPSCO program	1	7%
Other	1	7%
TOTAL	15	100%

DEMOGRAPHICS

Personal Characteristics

Just under one-half of respondents (45%) have a four-year college degree or higher. Most respondents (27%) are between 33 and 42 years old, though in general, the respondents skewed younger. Respondents seem fairly split in terms of the length of time they had lived in their current residence (with most time ranges representing ~15-25% of respondents), as well as their income (with most income categories representing ~10-20% of respondents).

More than one-half of respondents (55%) are currently working or attending school outside of the home (Table 227).

TABLE 227. PERSONAL CHARACTERISTICS OF SURVEYED ONLINE MARKETPLACE PARTICIPANTS.

PERSONAL CHARACTERISTICS	COUNT	PERCENT
Number of years lived in current home		
One year or less	23	16%
2-3 years	29	20%
4-5 years	23	16%
6-10 years	31	21%
More than 10 years	40	27%
TOTAL	**146**	**100%**
Year born		
1900 to 1939	3	2%
1940 to 1959	29	20%
1960 to 1979	43	30%
1980 to 1989	38	26%
1990 to 1999	31	22%
TOTAL	**136**	**100%**
Highest level of education completed		
Some college, no degree	36	31%
Two-year college degree	28	24%
Four-year college degree	31	27%
Graduate or professional degree	21	18%
TOTAL	**116**	**100%**
Employment situation of household (MULTIPLE RESPONSE)		
Working or attending school outside of the home	99	55%
Working or attending school from home	28	16%
Retired	32	18%
Unemployed	1	1%
On medical, disability or parental leave	7	4%
Stay-at-home parent or care provider	13	7%
TOTAL	**180**	**100%**
Annual household income from all sources		
Under $25,000	15	12%
$25,000 to under $35,000	14	11%
$35,000 to under $50,000	19	15%
$50,000 to under $75,000	23	18%
$75,000 to under $100,000	30	23%
$100,000 to under $150,000	18	14%
Over $150,000	11	8%
TOTAL	**130**	**100%**

Home Characteristics

Over three quarters of respondents (78%) live in a single-family home and 87% own their home. Over one-half of respondents (51%) live in homes built before 1980. Natural gas is the primary fuel for water heating (80%) and heating homes (86%). Most respondents use a furnace to heat their homes (92%) and central air conditioning (91%) to cool their homes (Table 228).

TABLE 228. HOME CHARACTERISTICS OF SURVEYED ONLINE MARKETPLACE PARTICIPANTS.

HOME CHARACTERISTICS	COUNT	PERCENT
Type of residence		
Single-family detached home	116	78%
Multifamily apartment or condo building (with 4 or more units)	9	6%
Attached house (townhouse, row house, or twin)	16	11%
Mobile or manufactured home	8	5%
TOTAL	149	100%
Ownership of residence		
Own	130	87%
Rent	20	13%
TOTAL	150	100%
Primary fuel source for water heating		
Electricity	25	17%
Natural Gas	115	80%
Other	3	2%
TOTAL	143	100%
Primary fuel source for heating		
Electricity	17	12%
Natural Gas	124	86%
Other	4	3%
TOTAL	145	100%
Primary equipment used to heat the home		
Central boiler	8	5%
Furnace	137	92%
Baseboard Heater(s)	2	1%
Electric Wall Heater(s)	1	1%
Other	1	1%
TOTAL	149	100%
Primary cooling system in the home		
Central air conditioner	133	91%
Air source heat pump	2	1%
Room or window air conditioners	9	6%
Evaporative cooler, or swamp cooler	2	1%
TOTAL	146	100%
Year home was built		
Before 1900	4	3%
1900 to 1939	10	7%
1940 to 1959	19	14%
1960 to 1979	37	27%
1980 to 1989	14	10%
1990 to 1999	18	13%
2000 to 2004	11	8%

HOME CHARACTERISTICS	COUNT	PERCENT
2005 or later	23	17%
TOTAL	136	100%

CONCLUSIONS AND RECOMMENDATIONS

CONCLUSION 1: IN-SITU BASELINES CALCULATED FROM THE 2021 NIPSCO RESIDENTIAL OLM SURVEY OVERALL REDUCED *EX POST* LED SAVINGS.

With the *ex post* gross savings impact evaluation, the evaluation team found that the primary contributing factor to lower savings were the in-situ baseline wattages calculated from the 2021 NIPSCO Residential OLM survey and applied to all kit LEDs. *Ex ante* savings were calculated using the UMP protocol. While contributing to lower savings for LEDs, in-situ baselines are a more accurate representation of NIPSCO customer savings because they are based on customer-specific information. Calculating in-situ wattages also led the evaluation team to evaluate smart LEDs as normal LEDs since a baseline wattage was available (the Indiana TRM (v2.2) assumes an LED baseline for smart LEDs), which attributed much higher savings for smart LEDs.

Recommendations:

- In subsequent evaluation years that include lighting measures, NIPSCO should use the baseline watts calculated from the 2021 NIPSCO Residential OLM survey for LEDs and smart LEDs which will influence more accurate planning and savings.

CONCLUSION 2: ANTICIPATED REGULATORY CHANGES WILL LIKELY REDUCE EXPECTED GROSS SAVINGS FOR LIGHTING MEASURES IN FUTURE PROGRAM YEARS.

As discussed in the Residential Lighting chapter, upcoming federal lighting standard changes will likely affect all NIPSCO programs that offer lighting measures to residential customers. The DOE's Office of Energy Efficiency and Renewable Energy again proposed a rule to codify the 45 lumen per-watt standard, with a comment period open through January 27, 2022.[56] The rule is expected to be finalized in 2022 and implemented in early 2023, although the timing is not yet certain and will rely on several factors (such as allowed sell-through periods).

In anticipation of this change, the evaluation team has reduced carryover savings for all LED lightbulbs to one year. Additionally, for non-upstream program designs (like kit offerings and direct-install programs) there may be additional considerations that impact how long these programs may remain viable, as these different delivery types may more frequently "early replace" incandescent or halogen bulbs that otherwise would have remained installed (which is now currently reflected in the in-situ baseline approach). The evaluation team expects that the DOE will provide more guidance in the next few months and will discuss these implications with NIPSCO once more information is known.

[56] Federal Register. Last updated December 13, 2021. "Energy Conservation Program: Backstop Requirements for General Service Lamps." https://www.federalregister.gov/documents/2021/12/13/2021-26807/energy-conservation-program-backstop-requirement-for-general-service-lamps

Recommendations:

- Monitor the DOE's EISA outcome and incorporate effective changes in program design. Review inclusion of specialty and reflector LEDs as part of the upcoming Indiana Technical Reference Manual (TRM) update process to provide guidance for any future savings for these measures in upstream programs.

CONCLUSION 3: REALIZATION RATES FOR WI-FI THERMOSTATS WERE LOWER DUE TO THE *EX POST* ALGORITHM USING HEATING AND COOLING ENERGY SAVINGS FRACTIONS FROM THE 2020 BILLING ANALYSIS.

The inputs used from the 2020 billing analysis include 8.3% for the cooling energy savings fraction and 5.4% for the heating energy savings fraction, which are lower than the inputs used in the *ex ante.* For gas savings, a deemed value of 35 therms was used from the billing analysis. This value reflects the impact of COVID-19 on Wi-Fi thermostat savings and was applied for all sites with gas heat in 2021 since we still expect behavior to be impacted by COVID-19.

Thermostats also had a lower-than-expected in-service rate of 79%. Nine of 12 respondents indicated they were planning to install their thermostat in the future. The evaluation team reviewed the dates when survey respondents who indicated they were planning to install thermostats received their thermostats and found only three of nine respondents had received their thermostat within two months of being surveyed. Based on this, the evaluation team decided not to adjust the in-service rate calculation to account for future installs.

Recommendations:

- Inputs and deemed savings values from the 2020 billing analysis should be applied to all Wi-Fi thermostats.
- If thermostats continue to have a lower in-service rate, further research should be conducted to assess reasons that thermostats were not installed. Data could be collected through additional survey questions or through qualitative interviews.

CONCLUSION 4: NOT ALL ISRS WERE CALCULATED FROM THE 2021 NIPSCO RESIDENTIAL OLM SURVEY, THEREFORE *EX POST* SAVINGS MAY DIFFER IN FUTURE YEARS AS DIFFERENT ISRS ARE APPLIED.

ISRs were calculated for all kit and thermostat measures from the 2021 NIPSCO Residential OLM survey. However, because non-kit measure participants did not achieve high enough participation to be surveyed, survey responses were not available to calculate standalone measure ISRs. Therefore, proxy ISRs were used from similar programs.

Recommendations:

- For standalone measures with sufficient participation in 2022, NIPSCO should consider fielding another participant survey to collect information to calculate ISRs for these measures. The evaluation team recommends fielding a mixed-mode phone and online survey to achieve a sufficient response rate.

CONCLUSION 5: THE SMART PLUG MEASURE HAD VERY LOW PARTICIPATION AND WAS GRANTED ZERO *EX POST* SAVINGS BECAUSE VALID SOURCES OF SAVINGS COULD NOT BE IDENTIFIED.

The evaluation team could not identify sources to validate the assumptions used to claim savings for this measure. *Ex ante* savings referenced a manufacturer's website. However, the evaluation team was not able to validate the assumptions on the manufacturer website, such as plug load or hours of use, using a TRM or participant survey data. Given this, zero *ex post* savings were granted for the measure. The elimination of savings had negligible impact on 2021 savings because only one measure was sold through the Online Marketplace. However, NIPSCO should exercise caution in widespread distribution of smart plugs until savings are substantiated.

Recommendations:

- NIPSCO should exercise caution in widespread distribution of smart plugs unless documented savings can be substantiated. Savings could be substantiated if the measure is added to a TRM or by verifying parameters through a participant survey. The evaluation team recommends a participant survey if sufficient participation for this measure is achieved in 2022, either through the Online Marketplace or through a pilot program.

CONCLUSION 6: IN THE TRACKING DATA FOR LEDS, THE ENERGY TYPE FIELD OFTEN CONTRADICTED THE FUEL TYPE AS SPECIFIED IN THE MEASURE DESCRIPTION FOR LEDS.

Within the tracking data for this program, there is a lack of clarity on customer fuel types which impacts the evaluation's ability to correctly assign savings. The field "energy.type" does not consistently identify the customer's actual fuel service from NIPSCO. The field "material.description" describes the measure, and for certain measures like LEDS, specifies fuel service as well. For several thousand LEDs the fuel indicated in the "energy.type" field was electric, however in the "material.description" electric and gas was indicated. In the case of the LED Reflectors that were offered as an add-on to the Home Office/Back to School Kit, the material description indicated electric and gas, but the vast majority had electric only as the energy type. The evaluation team determined the energy type was likely mislabeled in these cases, and that most of these customers were dual fuel customers and therefore gave therm penalties for all LED measures. The implementation contractor confirmed that "material.description" should be used to determine customer fuel type.

Recommendations:

- Ensure accurate recording of energy type for all measures such that energy type does not contradict what is recorded in the measure description. If needed, create a separate field in the tracking data that only documents the fuel service from NIPSCO so savings can be accurately assigned.

CONCLUSION 7: WORD OF MOUTH AND SOCIAL MEDIA/ONLINE ADS WERE THE LEADING SOURCES OF AWARENESS FOR THE MEASURES PURCHASED AT THE HIGHEST RATES THROUGH THE PROGRAM.

During 2021, NIPSCO promoted several measures through limited-time-offers (LTOs) including the measures adopted at the highest rates through the program: Home Office/Back to School kits, Wi-Fi thermostats, and Bathroom kits. TRC noted that promotion of the Home Office/Back to School kits on social media was so successful that they had to shut down the LTO early, due to not having enough inventory to keep up with demand. Survey results likewise reflect that word of mouth and social media/online ads were leading sources of awareness for the Home Office/Back to School Kits, as well as Wi-Fi thermostats.

Recommendations:

- Where it makes sense, NIPSCO should continue to use social media to promote LTO products on the Online Marketplace while considering the risks of products achieving much higher participation than expected.

CONCLUSION 8: RESPONDENTS WERE SATISFIED WITH THE ONLINE MARKETPLACE OVERALL AND PROVIDED POSITIVE FEEDBACK ON THEIR EXPERIENCE.

Over 90% of respondents indicated they were “Satisfied” or “Very Satisfied” with the Online Marketplace overall, with no respondents providing dissatisfied ratings. Likewise, around three-quarters of respondents indicated it was very easy to purchase products through the Online Marketplace, that product descriptions were very useful in deciding which products to buy, and that they were very satisfied with the variety of products available. Satisfaction with the measures themselves was likewise high, with 85% or more of respondents indicating they were “Satisfied” or “Very Satisfied” with the items they received.

CONCLUSION 9: ALMOST HALF OF SURVEY RESPONDENTS WERE AWARE OF OTHER NIPSCO PROGRAMS. HOWEVER, ONLY ELEVEN RESPONDENTS HAD ACTUALLY PARTICIPATED.

Almost half of respondents were aware of other NIPSCO program offerings, with Energy Efficient Rebates, Home Energy Reports, and Appliance Recycling being the three most heard of programs. However, only eleven respondents had participated in other programs. The programs respondents had participated in included Energy Efficiency Rebates, Lighting Discounts, Home Energy Assessment, and Income Qualified Weatherization. The gap between the number of respondents who were aware of NIPSCO programs and the number who participated indicates a possible opportunity to encourage Online Marketplace participants to participate in other NIPSCO programs.

Recommendations:

- Use email messages to re-engage Online Marketplace participants with the Online Marketplace programs or other NIPSCO offerings. Free measures, such as the Home Office/Back-to-School kit could also include materials promoting other NIPSCO programs. If possible, NIPSCO could include LTOs for other programs, such as bonus rebates or offers in these types of marketing communications.

15. 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 trade allies. Trade allies are instrumental in identifying energy-saving opportunities and promoting the programs to customers. NIPSCO's major account managers also assist with implementation efforts through direct support and program assistance to customers within the service territory. The following programs are offered to nonresidential customers.

Prescriptive program. The Prescriptive program offers a set rebate for one-for-one replacements of dozens of measures including efficient lighting; pumps and drives; and heating, cooling, and refrigeration equipment.

Custom program. The Custom program offers incentives for nonprescriptive projects that involve more complex technologies or equipment changes than are covered in the one-for-one replacement offers available through the Prescriptive program. Custom incentives are based on a project's estimated electric or natural gas energy savings.

New Construction program. The New Construction program provides financial incentives to C&I new construction facilities that exceed the energy efficiency requirements of statewide building codes. Energy savings are determined using the ASHRAE 90.1 2007 standard as a baseline energy usage. The following types of projects are eligible for the program:

- New buildings
- Additions or expansions to existing buildings
- Gut rehabs for a change of purpose requiring replacement of all electrical and mechanical equipment

Small Business Direct Install (SBDI) program. The SBDI program is designed to encourage small business customers—those with peak electric demand of 200 kW or less over the past 12 months—to service or replace standard equipment with higher-efficiency equipment. Incentives available through the SBDI program are typically higher than those offered through the Prescriptive and Custom programs, and customers can also apply for Prescriptive and Custom program incentives for equipment that falls outside the scope of the SBDI program. Although not a program requirement, TRC encourages trade allies to offer walk-through assessments of facilities and support the application process, including submitting the application for payment on a participant's behalf. The program further encourages trade allies to include the rebate on their invoice, accepting the rebate on behalf of the customer, thereby reducing the total up-front cost to the customer.

Commercial Online Marketplace. This newly launched program is discussed in a separate chapter of this report.

CHANGES FROM 2020 DESIGN

2021 program design changes were limited to small adjustments in prescriptive measure savings and adjustments needed to address operations during the COVID-19 pandemic. To limit in-person contact, TRC adjusted its project verification process to allow for virtual inspections or photo submissions. TRC also focused trade ally and customer outreach on virtual webinars and phone contact, over face-to-face outreach.

PROGRAM PERFORMANCE

In 2021, the evaluation team was able to examine the full 12 months (program year) of data to capture high-impact projects that were finalized within the December window and important for the analysis. This chapter includes an evaluation of the full year of data, and the evaluation team developed all evaluation metrics based on 12 months of program production. However, to meet the new timelines for the 2021 evaluation, the team's process and net-to-gross analyses are based on 11 months of data instead of the full calendar year (January 1 to November 30, 2021).

Comparing the *ex post* gross savings with goals, the C&I portfolio fell short of its goals at the portfolio level, achieving 52% of electric energy savings, 40% of peak electric demand savings, and 68% of natural gas therm savings. The gross goal achievement varied by program and fuel type:

- The Custom program fell further short of the peak demand savings goal (25%) and electric savings goal (30%) than any other C&I program. All goals for this program were slightly increased from calendar year (CY) 2020.
- The New Construction program achieved the greatest percentage of all goals (88% of electric energy savings, 147% of peak demand savings, and 96% of natural gas savings) within the C&I portfolio. All goals for the New Construction program were increased significantly from CY 2020. Even with less than anticipated growth in CY 2021, the New Construction program increased *ex ante* savings from CY 2020 by 75%, demonstrating continued growth in this program.
- The SBDI program and Prescriptive program had the lowest therms goals amongst the four C&I portfolio programs, and both fell furthest short of the natural gas savings goals (3% and 19% respectively). The SBDI program therms savings goal is similar to CY 2020, while the Prescriptive program therms savings goal was reduced by 58% from CY 2020.

TRC attributed low participation levels to the continued long-term effects of the COVID-19 pandemic. Specifically, TRC reported that workforce and supply chain availability, along with customer hesitation to proceed with capital projects, inhibited participation. The C&I programs attracted 810 unique customer participants in CY 2021, as compared to 847 in CY 2020. TRC reported that CY 2021 projects were smaller and less impactful on energy savings on average than projects in CY 2020.

Table 229 summarizes savings for the full year of program performance, including program savings goals. Total *ex ante* savings of 51,755,453 kWh in CY 2021 fell short of CY 2020 *ex ante* savings of 61,028,238 kWh. Total *ex ante* demand reduction of 6,921 kW in CY 2021 also fell short of CY 2020 *ex ante* demand reduction of 8,286 kW. There was moderate growth in *ex ante* therms savings year over year, growing from 1,117,267 therms in CY 2020 to 1,195,145 therms in CY 2021.

TABLE 229. 2021 C&I PROGRAMS SAVING SUMMARY – FULL YEAR 2021

	GROSS SAVINGS GOAL	*EX ANTE*	AUDITED	VERIFIED	*EX POST* GROSS	*EX POST* NET	GROSS GOAL ACHIEVEMENT
Prescriptive Program							
Electric Energy Savings (kWh/yr.)	43,020,089.60	24,520,709.68	24,520,612.78	24,520,710.18	26,246,825.99	22,309,802.09	61%
Peak Demand Reduction (kW)	12,722.081	3,758.072	3,705.703	3,705.702	4,132.496	3,512.622	32%
Natural Gas Energy Savings (therms/yr.)	125,000.00	23,283.06	23,286.34	23,286.34	23,676.78	20,125.27	19%
Custom Program							
Electric Energy Savings (kWh/yr.)	43,399,212.02	13,028,454.09	13,028,453.56	12,864,585.97	13,043,674.06	11,739,306.65	30%
Peak Demand Reduction (kW)	4,568.627	979.113	982.835	974.322	1,122.879	1,010.591	25%
Natural Gas Energy Savings (therms/yr.)	895,103.73	629,183.40	629,183.40	624,667.90	624,667.90	562,201.11	70%
New Construction Program							
Electric Energy Savings (kWh/yr.)	14,240,000.00	12,091,407.50	12,156,151.08	12,155,674.01	12,460,474.16	6,728,656.04	88%
Peak Demand Reduction (kW)	1,475.098	1,998.032	2,005.404	2,005.404	2,174.299	1,174.122	147%
Natural Gas Energy Savings (therms/yr.)	557,588.42	538,411.99	536,608.53	536,605.68	533,232.99	287,945.81	96%
SBDI Program							
Electric Energy Savings (kWh/yr.)	3,712,917.17	2,114,881.32	2,114,879.82	2,114,892.32	2,133,268.29	2,005,272.20	57%
Peak Demand Reduction (kW)	383.917	186.213	186.295	186.295	244.436	229.770	64%
Natural Gas Energy Savings (therms/yr.)	158,763.00	4,266.28	4,266.28	4,266.28	4,266.28	4,010.30	3%
Total C&I Portfolio[57]							
Electric Energy Savings (kWh/yr.)	104,372,218.79	51,755,452.59	51,820,097.24	51,655,862.48	53,884,242.49	42,783,036.98	52%
Peak Demand Reduction (kW)	19,149.723	6,921.430	6,880.237	6,871.723	7,674.111	5,927.105	40%
Natural Gas Energy Savings (therms/yr.)	1,736,455.15	1,195,144.73	1,193,344.55	1,188,826.20	1,185,843.95	874,282.49	68%

Table 230 outlines the *ex post* gross and net-to-gross (NTG) adjustment factors. The evaluation team developed these by analyzing survey data collected from the 2021 C&I customer population, as described in the *Ex Post* Gross Savings section. The NTG is consistent with previous years.

[57] C&I Online Marketplace summary values have been excluded from this table of results and from the Total C&I Portfolio summary values shown. C&I Online Marketplace summary values are outlined in a separate chapter.

TABLE 230. 2021 C&I PROGRAMS ADJUSTMENT FACTORS

METRIC	REALIZATION RATE (%)[a]	FREERIDERSHIP	SPILLOVER	NTG (%)[b]
Prescriptive Program				
Electric Energy Savings (kWh/yr.)	107%	15%	0%	85%
Peak Demand Reduction (kW)	110%			
Natural Gas Energy Savings (therms/yr.)	102%			
Custom Program				
Electric Energy Savings (kWh/yr.)	100%	10%	0%	90%
Peak Demand Reduction (kW)	115%			
Natural Gas Energy Savings (therms/yr.)	99%			
New Construction Program				
Electric Energy Savings (kWh/yr.)	103%	46%	0%	54%
Peak Demand Reduction (kW)	109%			
Natural Gas Energy Savings (therms/yr.)	99%			
SBDI Program				
Electric Energy Savings (kWh/yr.)	101%	6%	0%	94%
Peak Demand Reduction (kW)	131%			
Natural Gas Energy Savings (therms/yr.)	100%			

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

According to the final 2021 year-end scorecard, NIPSCO spent 50% of its electric and 68% of its natural gas budgets. The proportion of spending aligned with performance towards savings goals. Table 231 lists the 2021 program budget and program trackable expenditures by fuel type.

TABLE 231. 2021 C&I PROGRAMS EXPENDITURES

FUEL	PROGRAM BUDGET	PROGRAM EXPENDITURES	BUDGET SPENT (%)
Prescriptive Program			
Electric	$5,561,262.57	$2,953,264.36	53%
Natural Gas	$126,324.56	$34,126.33	27%
Custom Program			
Electric	$5,307,143.71	$1,849,246.44	35%
Natural Gas	$1,218,548.00	$835,184.93	69%
New Construction Program			
Electric	$1,673,802.72	$1,328,487.32	79%
Natural Gas	$759,072.09	$710,631.01	94%
SBDI Program			
Electric	$559,456.09	$433,584.41	78%
Natural Gas	$230,527.36	$13,568.99	6%
Total C&I Programs			
Electric	$13,101,665.09	$6,564,582.54	50%
Natural Gas	$2,334,472.01	$1,593,511.26	68%

EVALUATION METHODOLOGY

To inform the impact and process evaluation of NIPSCO's 2021 C&I programs, the evaluation team completed the following research activities:

- Documentation and materials review, to provide context on program implementation
- Customer survey, to provide feedback on process issues, areas for program improvement and data on freeridership, in-service rates (ISRs), and spillover
- Engineering analysis, to audit the performance of individual projects and inform the realization rates for the C&I programs

IMPACT EVALUATION

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

- Are tracking database savings sourced with proper project documentation?
- Do claimed savings algorithms align with the 2015 Indiana Technical Reference Manual (TRM) version 2.2 (v2.2), NIPSCO's measure savings database, or other more appropriate secondary sources?[58] What assumptions were used to develop savings estimates? Are there any updates that should be made?
- What are *ex post* program savings? Do these suggest any needed updates to program design, delivery, or savings assumptions?

For all measure types, the evaluation team compared its engineering calculations to NIPSCO's *ex ante* savings, basing its savings methodologies and inputs for each measure on several sources: standard engineering practices, the 2015 Indiana TRM (v2.2), NIPSCO's measure savings database, and other secondary TRM sources.

AUDITED AND VERIFIED SAVINGS

To develop an audited measure quantity and savings, the evaluation team first checked the program tracking data for duplicates or other data quality issues. In the verified savings step, the team made minor modifications to quantities and the resulting energy savings values for sampled projects, when it found discrepancies between the measure documentation and the reported values. To determine audited and verified savings, the team used the same method of savings calculation used for the reported *ex ante* savings.

EX POST GROSS SAVINGS

The evaluation team adjusted 2021 measure savings in the *ex post* gross analysis to address discrepancies in quantity, equipment capacity, equipment efficiency, or lighting wattage, discovered during a review of project documents or at virtual site inspections. The team used the following data sources to adjust:

- Annual operating hours from online schedules, posted store schedules, logged data, or 2015 Indiana TRM (v2.2) values for the building type or equipment type.

[58] Cadmus. July 28, 2015. *Indiana Technical Reference Manual Version 2.2 (v2.2).*

- Electric waste heat factors (WHFs) and peak summer coincident factors (CFs) consistent with the 2015 Indiana TRM (v2.2).
- Methodologies or simple calculation methods from the 2015 Indiana TRM (v2.2) versus deemed values.

IMPACT SAMPLING STRATEGY

The evaluation team sampled 2021 C&I program measures for desk reviews and virtual audits. The evaluation targeted a minimum of a 90% confidence interval with ±10% precision for each C&I program across the three-year program period *(*2019 through 2021). To achieve this, the team selected a representative sample of measures from each individual program to evaluate. While results are presented at the C&I portfolio and individual program levels, to better illustrate measure-category level trends across all commercial programs, the evaluation team primarily focused on providing sufficient sampling and analysis at the program level.

The evaluation team classified measures into measure types and stratified the sample into two groups: (1) lighting measures and (2) non-lighting measures. The team further defined the measures by type within those groups, but estimated and extrapolated savings within the two broader groups.

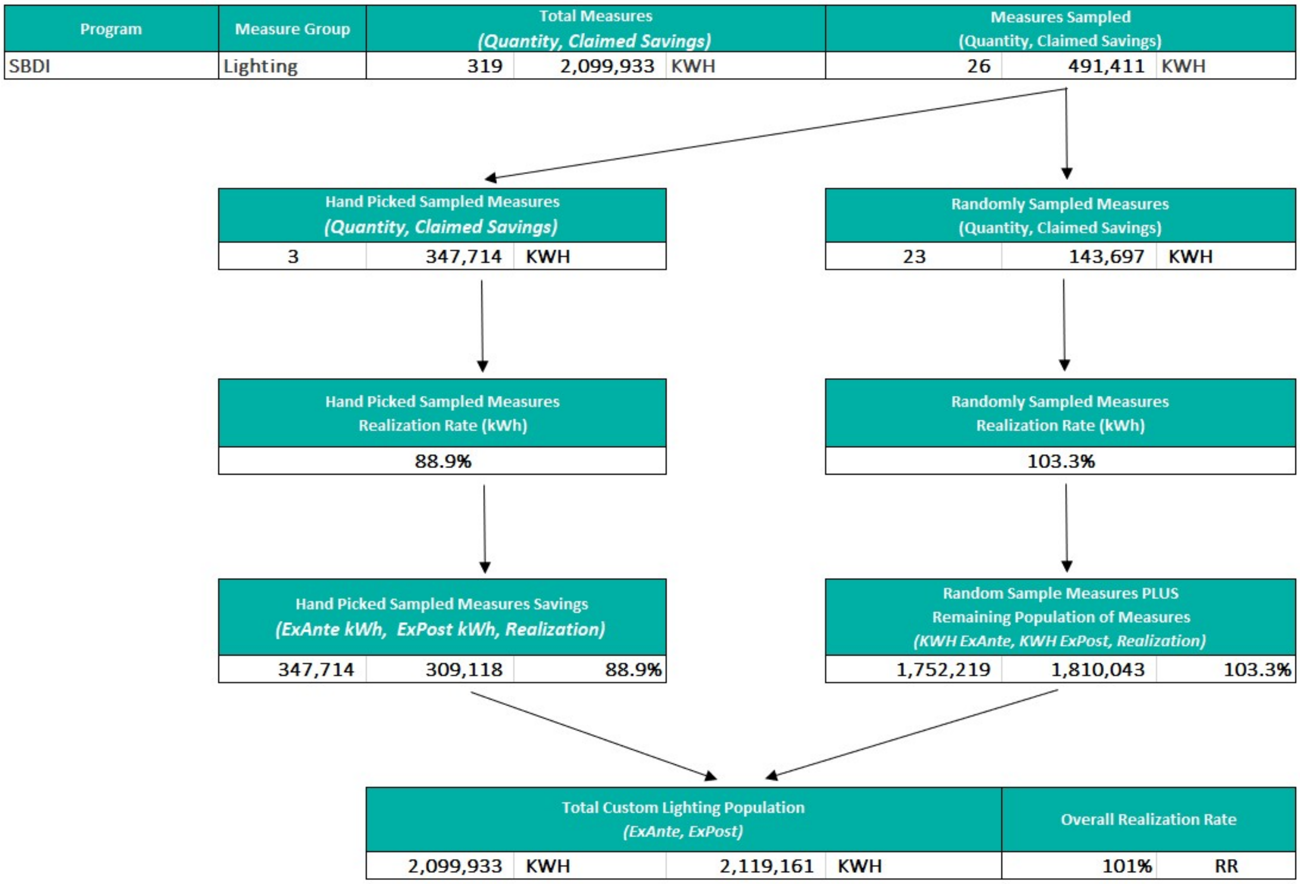
Measures were handpicked (purposive) or randomly (proportional) sampled from each program. Out of the 3,775 unique measures in the population, the evaluation sample included 119 total unique measures.[59] The evaluation team conducted an engineering review of these measures (19 through purposive sampling and 100 through proportional sampling). Of these, 87 received desk reviews only and 32 received virtual audits.

- The purposive sampling selected the largest saving measures in a program. For each program, the purposive sampling process selected measures that comprised at least 5% of the cumulative program savings and measures that comprised at least 20% of the measure category savings. Because these measures were sampled with certainty (100% of eligible highest saving measures were sampled) the results *were not* extrapolated to the population. These measures are referred to as handpicked measures.
- The proportional sampling measures were randomly selected from the population of the specific program measures, ensuring at least one measure from each measure category was sampled. Findings were extrapolated to the population of savings for the relevant measure categories. These measures are referred to as randomly sampled measures.

An outline of this methodology is shown in Figure 69, using the lighting measure category within the 2021 SBDI program to illustrate the example.

[59] Measures are defined as a measure type installed by a customer account. One measure could account for multiple pieces of equipment installed and rebated.

FIGURE 69. EXAMPLE OF 2021 C&I PROGRAMS SAMPLING METHODOLOGY (SBDI PROGRAM)



The evaluation team calculated lighting measure group realization rates from the collective realization rate of the randomly sampled measures for each program. The team then used the lighting realization rates to extrapolate to the full lighting population for each program to determine *ex post* gross savings.

Handpicked sampled measures received a realization rate specific to the individual measure, which did not factor into the extrapolation to the rest of the population. The evaluation team applied the realization rate determined for the handpicked measure, only to that individual measure, to determine the *ex post* gross savings for the measure. The team then added *ex post* gross savings from handpicked measures to *ex post* savings from the rest of the population to determine the cumulative *ex post* savings for the program.

There are many measure types in the non-lighting measure group. The team aggregated the *ex post* gross results from these measure types to create a realization rate for the non-lighting measure group and then extrapolated those rates to the complete non-lighting population for each program.

This report breaks out measures into measure types to provide transparency on results and guidance on how to best improve program savings estimates and activities; however, the sample was not designed to estimate realization rates by measure types beyond lighting and non-lighting groups by program.

Table 232 summarizes the number of evaluated measures and the proportion of *ex ante* program savings the evaluated measures represent. The 2021 C&I programs sample covered 20% of cumulative program electricity savings and 38% of gas savings. The table shows that the lighting measure category was the largest measure category in 2021, and the sample captured 19% of total lighting electricity savings. The non-lighting measure category shows all other measures combined; the cumulative non-lighting sample captured 27% of electricity savings and 38% of gas savings. While not shown in the table, the evaluation team sampled 20% of C&I programs lighting and 22% of C&I programs non-lighting kW demand savings.

TABLE 232. 2021 COMBINED C&I PROGRAMS *EX ANTE* SAMPLED MEASURES

MEASURE CATEGORY	MEASURE COUNTS				TOTAL *EX ANTE* SAVINGS			SAMPLED *EX ANTE* SAVINGS & PROPORTION OF SAVINGS SAMPLED			
	TOTAL	SAMPLED TOTAL	HAND PICKED	RANDOM	KWH	KW	THERMS	KWH	KWH	THERMS	THERMS
Lighting	**2,607**	**66**	**9**	**57**	**40,883,455.48**	**5,930.629**	**-**	**7,665,037.90**	**19%**	**-**	
Non-Lighting	**484**	**53**	**10**	**43**	**10,871,997.11**	**990.801**	**1,195,144.73**	**2,888,359.65**	**27%**	**449,297.49**	**38%**
Building Redesign	1	-	-	-	13,314.28	-	-	-	0%	-	
Compressed Air	118	14	-	14	4,779,744.53	43.497	-	804,918.16	17%	-	
Controls	15	2	1	1	1,375,091.57	79.396	8,119.00	467,275.54	34%	-	0%
HVAC	220	19	4	15	1,018,606.85	413.139	896,291.93	41,946.00	4%	256,274.49	29%
Kitchen	1	1	-	1	5,278.00	0.806	-	5,278.00	100%	-	
Motors	5	3	1	2	603,734.00	51.628	-	591,585.00	98%	-	
Other	7	1	1	-	-	-	47,558.00	-		31,450.00	66%
Process	5	2	1	1	1,041,383.00	61.500	161,251.00	370,543.00	36%	161,251.00	100%
Refrigeration	49	7	2	5	1,215,573.70	220.808	-	569,818.55	47%	-	
Ventilation	7	-	-	-	-	-	77,796.40	-		-	0%
Variable Frequency Drive (VFD)	45	2	-	2	819,271.18	120.027	-	36,995.40	5%	-	
Water Heat	11	2	-	2	-	-	4,128.40	-		322.00	8%
Total	3,091	119	19	100	51,755,452.59	6,921.430	1,195,144.73	10,553,397.55	20%	449,297.49	38%

ENGINEERING REVIEWS, REALIZATION RATES AND *EX POST* GROSS SAVINGS

The evaluation team completed engineering desk reviews on 119 measures for the 2021 C&I programs. The team sampled 113 unique customer sites (as defined by NIPSCO tracking data as site codes) as a subset of the 119 evaluated measures.

The following sections summarize the results of the engineering review by lighting and non-lighting measures. For brevity, this section summarizes reasons for adjustments, focusing on those that had the greatest impact on savings or where the evaluation team recommends adjustments in values or calculation methods. Table 233 provides more detailed discussion on the reasons for adjustment by each measure type.

LIGHTING MEASURES

All four C&I programs contain lighting measures. Table 233 documents the number of measures, savings, and sample sizes by each program. The team evaluated 66 lighting measures across the C&I programs.

TABLE 233. 2021 C&I PROGRAMS SAMPLED LIGHTING MEASURES

PROGRAM	NUMBER OF MEASURES				PROPORTION OF PROGRAM SAVINGS EVALUATED		
	TOTAL	SAMPLED TOTAL	HANDPICKED	RANDOM	KWH	KW	THERMS
Prescriptive	1,882	20	1	19	7%	6%	N/A
Custom	306	10	-	10	2%	3%	N/A
New Construction	100	10	5	5	49%	57%	N/A
SBDI	319	26	3	23	23%	16%	N/A
Total	2,607	66	9	57	19%	20%	N/A

Below details the reasons for savings adjustments, organized by interior and exterior lighting measures.

Lighting - Interior. Of the total 66 lighting measures evaluated this year, 40 measures were interior lighting measures. The evaluation team adjusted measure savings for the following types of issues:

- *Ex ante* calculations excluded waste heat factors (WHFs) for interior lighting measures that the 2015 Indiana TRM (v2.2) states should be applied (40 measures). The *ex post* gross savings integrate WHFs for kW and kWh savings. The team calculated WHF therm penalties for cost-effectiveness testing but did not include them in *ex post* gross savings. The application of WHFs have the effect of generally increasing the kW and kWh realization rates across all evaluated projects.
- There were minor operating hour changes based on reviews of the posted schedules for the buildings, interviews with the customer site contact, or reviews of the 2015 Indiana TRM (v2.2) hours for the building types.
- There were several minor data entry errors, where the wattage and quantity entries were inverted.
- There were changes to the CFs to better match the specific building type where measures were installed.
- Changes to the number of baseline fixtures, number of installed fixtures, and wattage of fixtures based on a review of invoices, counts of fixtures during the inspection, and review of lighting specification sheets.

Lighting - Exterior. The evaluation team reviewed 26 exterior lighting measures. Of these, 25 measures achieved a 100% realization rate. The team adjusted the remaining single measure due to slight differences in installed wattage specification.

Table 234 shows the complete list of lighting measure subcategories represented by the 2021 C&I population. The number of units refers to the units specified for the measure subcategory algorithms within the 2015 Indiana TRM (v2.2). Units can refer to the number of lamps, bulbs, fixtures, watts reduced, or linear feet reduced, depending on the specific measure subcategory algorithm. The number of measures refers to the count of each measure type installed as part of a completed project across all C&I programs. The team completed sampling at the measure level for each program, sampling 66 lighting measures (without consideration of the measure subcategory) from the 2,607 total lighting measures.

TABLE 234. 2021 C&I PROGRAMS LIGHTING MEASURES BY SUBCATEGORY

MEASURE SUBCATEGORY	SUM OF UNITS	SUM OF MEASURES	SUM OF SAMPLED MEASURES
Interior Lighting	165,710	1,857	41
LED < 10W Replacing Incandescent >=25W	128	9	
LED <= 12W Replacing Incandescent 25-45W	533	18	
LED <= 15W Replacing Incandescent 46-65W	4,016	127	5
LED <= 17W Replacing Incandescent 66-90W	715	55	1
LED <= 20W Replacing Incandescent >90W	430	28	
LED 2x2 Fixture Replacing T12 2 Lamp U-Tube	235	24	
LED 2x2 Fixture Replacing T8 2 Lamp U-Tube	463	43	
LED 2x4 Fixture Replacing T12 4ft 3 Lamp or 4 Lamp	2,454	65	
LED 2x4 Fixture Replacing T8 4ft 3 Lamp or 4 Lamp	10,827	117	1
LED Exit Sign Fixture with Battery Backup Replacing CFL or Incandescent Exit Sign	23	6	
LED Exit Sign Replacing CFL or Incandescent Exit Sign	143	18	
LED Fixture	3,177	64	1
LED Interior	25,845	233	9
LED Interior Replacing HID ≤ 175W	58	6	
LED Interior Replacing HID ≤ 175W Replacing HID ≤ 175W	84	10	
LED Interior Replacing HID 1000W	40	4	
LED Interior Replacing HID 176-250W	20	3	
LED Interior Replacing HID 251-400W	322	21	1
LED Interior Replacing HID 251-400W Replacing HID 251-400W	2,260	96	2
LED Interior Replacing HID176-250W Replacing HID176-250W	319	15	
LED Tube Relamp Replacing T12 Replacing T12	22,616	265	2
LED Tube Relamp Replacing T5	784	11	
LED Tube Relamp Replacing T5HO	10,246	40	
LED Tube Relamp Replacing T8 Replacing T8	66,714	317	5
Lighting System Exceeding ASHRAE 90.1-2007	5,969	100	10
Occupancy Sensor >500W Connected Load Replacing No Existing Controls	51	7	
Occupancy Sensor 100-199W Connected Load Replacing No Existing Controls	1,060	24	
Occupancy Sensor 200-500W Connected Load Replacing No Existing Controls	448	11	
Others (Please Describe)	1,451	22	1
T12 4-ft Delamping Replacing T12 Fixture	2,090	27	1
T8 Fixture - 17W Lamp(s)	260	2	
LED 2x4 Fixture Replacing 2-Lamp Fluorescent	273	10	
LED 2x2 Fixture Replacing 2-Lamp Fluorescent	316	8	
Occupancy Sensor 100-199W Connected Load Replacing No Control	20	2	
LED 1x4 Fixture Replacing 2-Lamp Fluorescent.	780	30	1
Blank, Undefined	10	2	
LED Interior Replacing HID 1000W Replacing HID 1,000W	293	14	1

MEASURE SUBCATEGORY	SUM OF UNITS	SUM OF MEASURES	SUM OF SAMPLED MEASURES
Occupancy Sensor 200-500W Connected Load Replacing No Control	15	1	
LED Tube Relamp Replacing T8	222	2	
Exterior Lighting	5,922	750	25
LED Exterior	196	49	
LED Exterior Replacing HID ≤ 175W	475	44	4
LED Exterior Replacing HID ≤ 175W Replacing HID ≤ 175W	988	118	
LED Exterior Replacing HID 1,000W	222	24	4
LED Exterior Replacing HID 1,000W Replacing HID 1,000W	461	53	1
LED Exterior Replacing HID 176-250W	188	50	4
LED Exterior Replacing HID 251-400W	495	100	8
LED Exterior Replacing HID 251-400W Replacing HID 251-400W	1,953	204	3
LED Exterior Replacing HID176-250W Replacing HID176-250W	944	108	1
Total	171,632	2,607	66

Table 235 shows the *ex ante* savings and the measure-specific realization rates from the sampled lighting measures in the 2021 C&I programs. The team only applied measure-specific realization rates from the handpicked sampled projects to those specific projects. For the lighting measure group, the team extrapolated the randomly sampled realization rates to the rest of the lighting population by program. The extrapolated lighting realization rates for all programs combined is 105% electric energy and 113% for peak demand. Later in this chapter, Table 235 shows the complete set of extrapolated realization rates by program.

TABLE 235. 2021 C&I PROGRAMS *EX ANTE* SAVINGS & REALIZATION RATES FOR SAMPLED LIGHTING MEASURES

PROGRAM	SAMPLED *EX ANTE*			REALIZATION RATES (KWH)		REALIZATION RATES (KW)	
	KWH	KW	THERMS	HANDPICKED	RANDOM	HANDPICKED	RANDOM
Prescriptive	1,648,646.82	195.640	-	108%	108%	120%	113%
Custom	102,752.44	20.751	-	N/A	109%	N/A	119%
New Construction	5,422,227.86	921.159	-	104%	103%	110%	112%
SBDI	491,410.78	29.753	-	89%	103%	118%	132%
Total	7,665,037.90	1,167.30	-	103%	105%	111%	113%

Figure 70 shows measure-level results for each project sampled. Each program is represented with a different color. The figure shows the size of the *ex ante* project savings compared with the resulting realization rate. The Prescriptive projects performed with the most consistency, while Custom projects had the most variability. The SBDI projects tended to be smaller, while the New Construction projects were generally the largest. The New Construction program had the three largest lighting projects, which realized at or just over 100% savings.

FIGURE 70. 2021 C&I PROGRAMS SAMPLED LIGHTING MEASURES *EX ANTE* IMPACT AND REALIZATION RATES

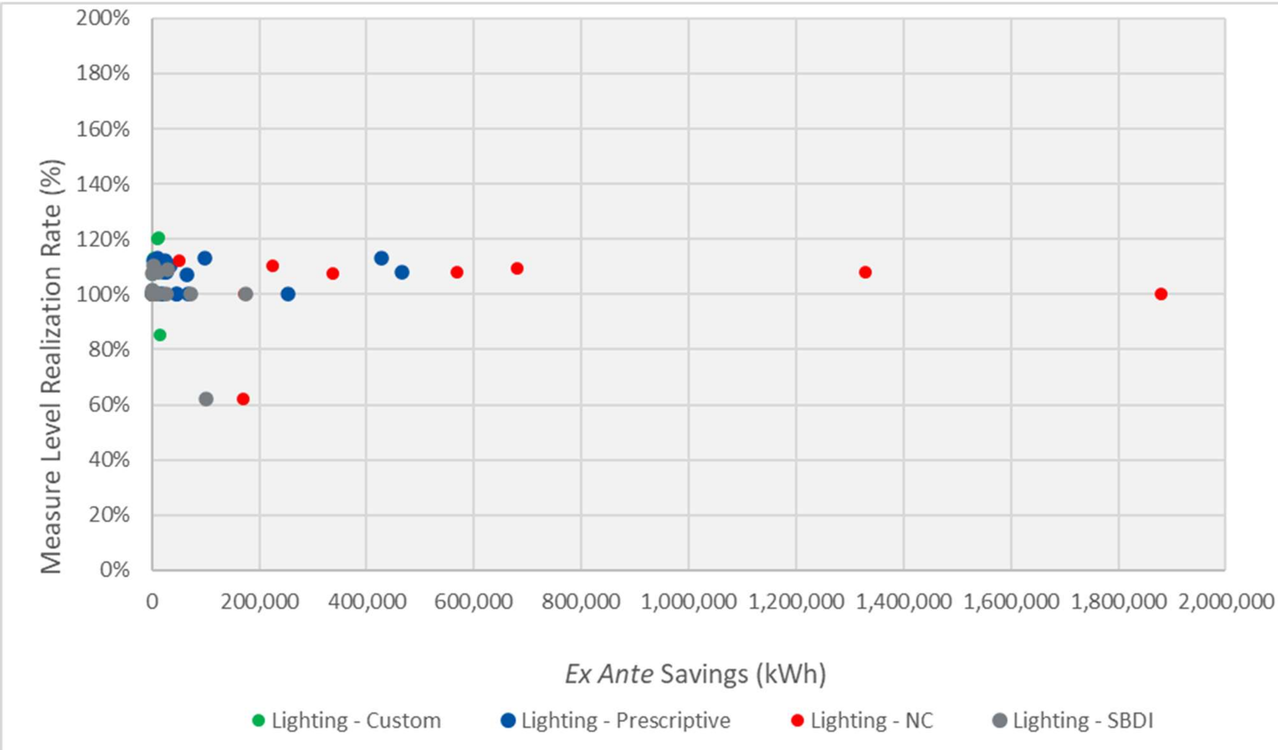


Table 236 summarizes notable differences between *ex ante* and *ex post* gross estimates from the measures sampled.

TABLE 236. 2021 C&I PROGRAMS NOTABLE DIFFERENCES BETWEEN *EX ANTE* AND *EX POST* GROSS LIGHTING MEASURES

MEASURE CATEGORY	*EX ANTE* SOURCES AND ASSUMPTIONS	*EX POST* GROSS SOURCES AND ASSUMPTIONS	PRIMARY REASONS FOR DIFFERENCES
Lighting	*Ex ante* savings were determined by the 2015 Indiana TRM (v2.2), calculated through the application Excel tool	2015 Indiana TRM (v2.2). All inputs were verified through project documentation or interviews conducted.	The electric penalties attributed to WHFs were incorporated into the *ex post* gross savings values. Interview data also demonstrated different operating hours and coincidence factors than assumed in the *ex ante* calculations in a few instances. Project documentation showed different installed wattages and misclassification of lighting type in a few instances.

WASTE HEAT FACTOR NATURAL GAS PENALTIES

In 2020, 2019, and prior years, the evaluation team applied WHFs to lighting measures, representing the heating penalties resulting from more efficient lighting. The program does not report therm WHFs in *ex ante* calculations. Electric WHF penalties are minor in comparison with therm WHF penalties and are reported within *ex post* savings.

In discussions with NIPSCO, the evaluation team did not include negative therm WHFs in *ex post* therm calculations. However, Table 237 shows the therm penalties included in cost-effectiveness calculations. This table shows the therm penalties calculated for randomly sampled and handpicked projects and the proportions of those penalties when compared to overall kWh savings. The team applied these to the remaining unsampled interior lighting projects and then summed them to come up with total therm penalty estimates for all programs. There was a 166,261-therm penalty from sampled projects (combined handpicked sample and random sample penalties). When extrapolated to the remaining population of interior Lighting measures, the total therm penalty is 899,938 therms for the entire C&I portfolio.

TABLE 237. 2021 C&I PROGRAMS WASTE HEAT FACTOR PENALTIES

PROGRAM	*EX ANTE* SAMPLED INTERIOR LIGHTING		WHF PENALTIES		REMAINING INTERIOR LIGHTING POPULATION		TOTAL INTERIOR LIGHTING POPULATION		
	RANDOMLY SAMPLED KWH	HAND PICKED KWH	RANDOMLY SAMPLED THERMS	HAND PICKED THERMS	RATIO WHF PENALTY TO KWH	*EX ANTE* KWH	EXTRAPOLATED THERM PENALTY	*EX ANTE* KWH	EXTRAPOLATED THERM PENALTY
Prescriptive	733,815.82	466,221.60	(17,600.38)	(12,084.46)	0.024	16,606,807.91	(398,309.95)	17,806,845.33	(427,994.80)
Custom	102,752.44		(2,460.86)		0.024	4,175,502.34	(102,461.59)	4,278,254.78	(104,922.45)
New Construction	1,238,481.59	4,175,043.07	(28,000.24)	(104,405.49)	0.023	3,826,612.22	(208,905.85)	9,240,136.88	(341,311.58)
SBDI	53,411.00	102,097.80	(1,709.49)		0.032	594,324.26	(23,999.38)	749,833.06	(25,708.87)
Total	2,128,460.85	4,743,362.47	(49,770.97)	(116,489.95)	0.10	25,203,246.73	(733,676.78)	32,075,070.05	(899,937.70)

NON-LIGHTING MEASURES

Non-lighting measures were present in the 2021 measure population in each of the four C&I programs. The evaluation team sampled at least one measure from most non-lighting measure groups across the four C&I programs. Only ventilation and building redesign projects were not represented in the random or handpicked samples. Table 238 lists the number of measures, savings, and sample sizes for each program. The team evaluated 53 non-lighting measures representing a range of measure types. HVAC measures constituted the greatest proportion of non-lighting measure types (n=19), followed by compressed air (n=14), and refrigeration (n=7).

TABLE 238. 2021 C&I PROGRAMS SAMPLED NON-LIGHTING MEASURES

MEASURE GROUP	PROGRAM	NUMBER OF MEASURES				PROPORTION OF PROGRAM SAVINGS EVALUATED		
		TOTAL	SAMPLED TOTAL	HAND PICKED	RANDOM	KWH	KW	THERMS
Building Redesign	Prescriptive	-	-					
	Custom	-	-					
	New Construction	1	0	-	-	0%	N/A	N/A
	SBDI	-	-					
Compressed Air	Prescriptive	2	2	-	2	100%	100%	N/A
	Custom	115	12	-	12	16%	25%	N/A
	New Construction	1	0	-	-	0%	N/A	N/A
	SBDI	-	-	-	-			
Controls	Prescriptive	-	-	-	-			
	Custom	15	2	1	1	34%	0%	0%
	New Construction	-	-	-				
	SBDI	-	-	-	-			
HVAC	Prescriptive	71	3	1	2	0%	0%	16%
	Custom	44	4	-	4	6%	31%	94%
	New Construction	102	11	3	8	1%	3%	43%
	SBDI	3	1	-	1	N/A	N/A	94%
Kitchen	Prescriptive	1	1	-	1	100%	100%	N/A
	Custom	-	-					
	New Construction	-	-					
	SBDI	-	-					
Motors	Prescriptive	-	-					
	Custom	4	2	1	1	98%	99%	N/A
	New Construction	1	1	-	1	100%	N/A	N/A
	SBDI	-	-					
Other	Prescriptive	-	-					
	Custom	7	1	1	-	N/A	N/A	66%
	New Construction	-	-					
	SBDI	-	-					
Process	Prescriptive	-	-					
	Custom	5	2	1	1	36%	0%	100%
	New Construction	-	-					
	SBDI	-	-					
Refrigeration	Prescriptive	35	3	1	2	7%	33%	N/A
	Custom	4	2	1	1	94%	92%	N/A
	New Construction	4	1	-	1	29%	0%	N/A
	SBDI	6	1	-	1	47%	47%	N/A
Ventilation	Prescriptive	-	-					
	Custom	7	0	-	-	N/A	N/A	0%
	New Construction	-	-					
	SBDI	-	-					
VFD	Prescriptive	45	2	-	2	5%	8%	N/A
	Custom	-	-					
	New Construction	-	-					
	SBDI	-	-					
Water Heat	Prescriptive	8	1	-	1	N/A	N/A	5%
	Custom	1	0	-	-	0%	0%	0%
	New Construction	2	1	-	1	N/A	N/A	63%
	SBDI	-	-					

The evaluation team adjusted savings for many of the sampled measures, which resulted in realization rates that deviated from 100%. Appendix 13 includes a complete discussion of the adjustments.

The following paragraphs summarize the reasons for the most high-impact adjustments the evaluation team made in the 2021 evaluation.

HVAC

Three HVAC measures had minor data entry errors and rounding errors that resulted in realization rates ranging from 96% to 99%. One randomly selected Prescriptive measure did not have supporting calculations provided within the documentation. The evaluation team re-created the savings calculations based on project documentation metrics and customer data, which resulted in an evaluated therm realization rate of 105%.

CONTROLS AND OTHER

A single Custom retro-commissioning project was split into two measures. The kWh and kW savings were captured under a Controls measure, and the therm savings were captured under an *Other* measure. Both were handpicked, and both were adjusted based on virtual site visit data, collected from the customer. The programming ranges of two of the retro-commissioning measures implemented were adjusted by the customer post verification to better meet the customer's conditioning needs. The adjustments made by the customer reduced the projected savings from the two implemented measures slightly. The resulting realization rate for the measures were 84% for kWh and 86% for therms.

MOTORS

One Custom measure was handpicked due to its size and impact and represented 92% of the total kWh savings amongst the five total motor measures in the C&I portfolio. The evaluation team conducted a virtual site visit with the customer, who provided the team with an application of specific power factor and motor load for the motor. The team adjusted the power factor (reduced) and motor load (reduced) in the savings calculation. The resulting kWh realization rate was 104%, and the kW demand realization rate was 112%.

The *ex ante* savings value of one randomly selected Custom measure was calculated from a deemed Michigan Energy Measure Database (MEMD) value. Since the project was a custom application of a process pump, which is typically dependent on project specific inputs, the evaluation team used several different hybrid calculators, developed by various TRMs, including Wisconsin, California and Mid Atlantic. All resulted in similar savings values. The evaluation team selected the Wisconsin TRM hybrid calculation, which resulted in the highest savings and a realization rate of 65% for the measure. The original savings estimation of this project could have benefited from baseline and post install metering or trending.

REFRIGERATION

One project was handpicked that constituted 79% of the Custom refrigeration savings and 42% of the refrigeration measure group savings across the C&I portfolio. This Custom refrigeration measure's baseline consumption was derived from engineering calculations that did not fit the equipment type installed. The 2015 Indiana TRM (v2.2) has an appropriate measure outline that more accurately estimates the consumption of this type of equipment. Additionally, there were some equipment specification errors made in the *ex ante* calculation, which the evaluation team corrected in the evaluated savings calculations. Both issues drove the evaluated baseline consumption significantly downward, resulting in a much smaller savings value for the project overall. The resulting realization rate was 34% for kWh savings and 51% for kW savings.

One handpicked LED refrigerated case lighting Prescriptive measure's *ex ante* savings were derived from a program deemed value for kWh and kW, likely originating from the Michigan MEMD. The resulting kWh savings from the deemed value aligned with the 2015 Indiana TRM (v2.2) for this measure. However, the kW demand savings value was 1,300% higher than the 2015 Indiana TRM (v2.2) savings calculation for this measure. Since this was a Prescriptive project and there is an existing measure in the 2015 Indiana TRM (v2.2), the evaluation team used the TRM values to calculate evaluated savings for this measure. The resulting realization rate was 8% for kW savings. This was a handpicked measure, and the realization rate was not extrapolated; however, the reduction of 53 kW for the Prescriptive program contributed to the overall reduction of the non-lighting kW realization rate for the program overall.

NIPSCO does not currently have an established M&V protocol that is consistently followed for large impact or custom projects. This has led to some inconsistencies in savings verification, as outlined in the custom refrigeration measure above, but more particularly in several custom CY 2020 sampled measures. Measures that are projected to have impactful savings to a program or measure category should receive more individualized attention to determine how savings will be estimated prior to project approval, and how savings will be verified after project completion. The NIPSCO M&V protocol could potentially include the following elements:

- Implement a threshold of savings, above which project details are discussed with the evaluation team and other stakeholders to deliberate and agree upon the best available savings calculation specific to the project and any known limitations.
- Implement a threshold of savings, above which final project savings verification will require one or more of the following to confirm savings:
  - Trend data collected and provided by the customer or vendor to establish an accurate picture of the baseline and post-install sequencing, operation, loading, production and run time, as applicable to the metrics involved in the project.
  - Power metering of baseline and installed equipment, as applicable to the metrics involved in the project. The duration of metering should be determined by the pattern of use of the equipment involved. Weather-dependent equipment (most HVAC) will likely require season timing to accurately capture annual performance, whereas weather-independent equipment (most process) will likely require only a couple weeks of normal operation to extrapolate annual performance.
  - To ensure receipt of the above data, fully discuss the requirements with the customer prior to issuance of offer and consider linking incentive delivery to the receipt of data.
- Develop metering guidelines to be used internally and potentially by vendors externally that outline the standard metering practices expected to be followed and the installation documentation that should be generated as part of a metering installation. Consider using the IPMVP Option C guidance as a foundation for this guideline.

Table 239 shows the *ex ante* savings and the measure-specific realization rates from the sampled non-lighting measures in the 2021 C&I programs by fuel type. The evaluation team only applied the measure-specific realization rates from the handpicked sampled projects to those specific projects. The table shows the realization rates determined for randomly sampled projects; however, the team did not extrapolate those realization rates to the rest of a given population. The evaluation team aggregated non-lighting measure types to create realization rates for each program as a full measure category and then extrapolated to the rates the complete non-lighting population for each program. The extrapolated non-lighting realization rates for all programs combined were 96% for electric savings, 93% for demand savings, and 99% for natural gas therm savings. The complete set of extrapolated realization rates are shown in Table 239.

TABLE 239. 2021 C&I PROGRAMS *EX ANTE* SAVINGS & REALIZATION RATES FOR SAMPLED NON-LIGHTING MEASURES

PROGRAM		SAMPLED *EX ANTE*			REALIZATION RATES (KWH)		REALIZATION RATES (KW)		REALIZATION RATES (THERMS)	
		KWH	KW	THERMS	HAND PICKED	RANDOM	HAND PICKED	RANDOM	HAND PICKED	RANDOM
Building Redesign	Prescriptive	-	-	-						
	Custom	-	-	-						
	New Construction	-	-	-						
	SBDI	-	-	-						
Compressed Air	Prescriptive	86,519.16	16.387	-		100%		81%		
	Custom	718,399.00	6.650	-		100%		155%		
	New Construction	-	-	-						
	SBDI	-	-	-						
Controls	Prescriptive	-	-	-						
	Custom	467,275.54	-	-	84%	101%				
	New Construction	-	-	-						
	SBDI	-	-	-						
HVAC	Prescriptive	-	-	3,179.120					100%	103%
	Custom	37,058.00	22.644	17,580.00		100%		103%		100%
	New Construction	4,888.00	11.292	231,518.09		100%		100%	99%	99%
	SBDI	-	-	3,997.28						100%
Kitchen	Prescriptive	5,278.00	0.806	-		100%		100%		
	Custom	-	-	-						
	New Construction	-	-	-						
	SBDI	-	-	-						
Motors	Prescriptive	-	-	-						
	Custom	585,415.00	50.973	-	104%	65%	112%	97%		
	New Construction	6,170.00	-	-		100%				
	SBDI	-	-	-						
Other	Prescriptive	-	-	-						
	Custom	-	-	31,450.00					86%	
	New Construction	-	-	-						
	SBDI	-	-	-						
Process	Prescriptive	-	-	-						
	Custom	370,543.00	-	161,251.00		100%			100%	
	New Construction	-	-	-						
	SBDI	-	-	-						
Refrigeration	Prescriptive	42,712.00	57.483	-	102%	100%	8%	100%		
	Custom	519,290.55	39.692	-	34%	100%	51%	109%		
	New Construction	742.00	-	-		117%				
	SBDI	7,074.00	0.966	-		100%		109%		
Ventilation	Prescriptive	-	-	-						
	Custom	-	-	-						
	New Construction	-	-	-						
	SBDI	-	-	-						
VFD	Prescriptive	36,995.40	9.707	-		100%		106%		
	Custom	-	-	-						
	New Construction	-	-	-						
	SBDI	-	-	-						
Water Heat	Prescriptive	-	-	208.00						100%
	Custom	-	-	-						
	New Construction	-	-	114.00						100%
	SBDI	-	-	-						

Figure 71 and Figure 72 illustrate the distribution of realization rates for the individually sampled projects by program and by fuel source. Most of the smaller impact measures realized 100% of savings (kWh and therms). The largest impact kWh measure (motor measure) realized nearly 100% of savings. The second largest kWh measure (refrigeration measure) had a lower realization rate. Most of the largest kWh measures fell into the process, refrigeration, controls, and motor measure categories. There was minimal deviation in therms realization, with most projects clustered at the 100% realization mark. The largest therms measure (process measure) achieved a 100% realization rate.

FIGURE 71. 2021 C&I PROGRAMS SAMPLED NON-LIGHTING ELECTRIC MEASURES

EX ANTE IMPACT AND REALIZATION RATES

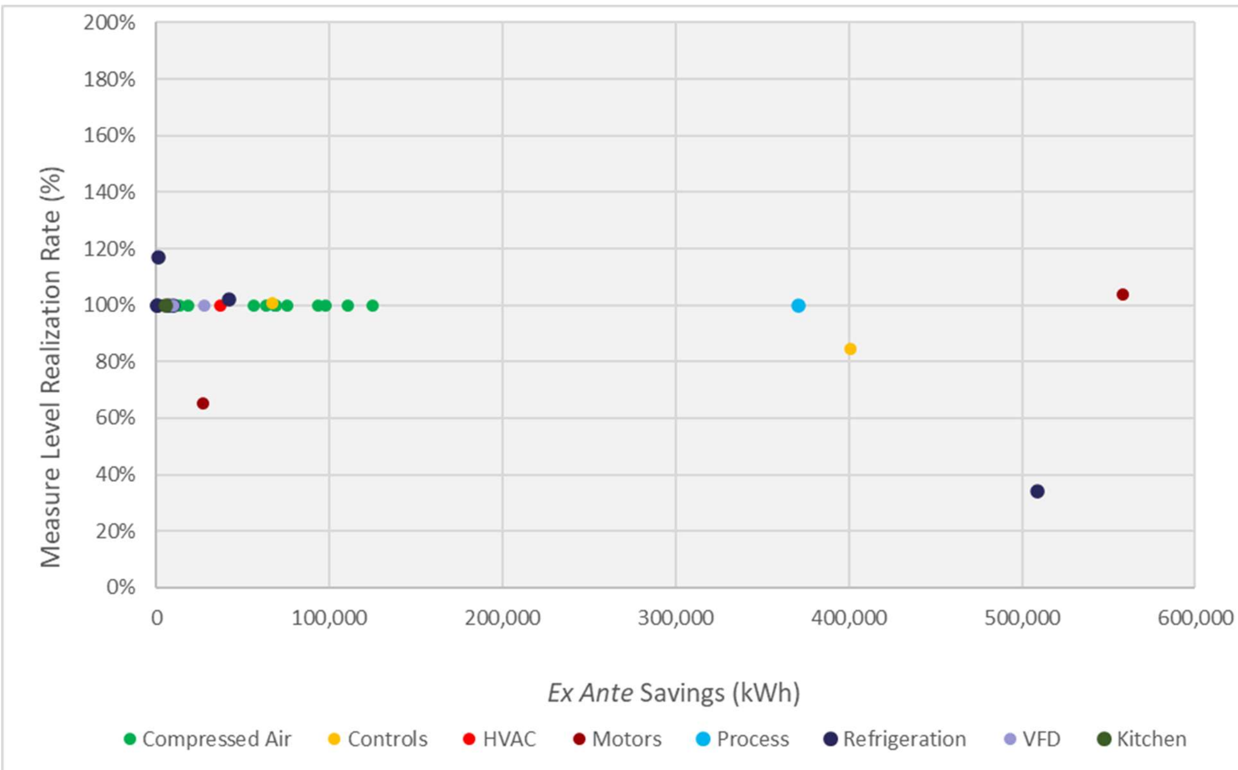


FIGURE 72. 2021 C&I PROGRAMS SAMPLED NON-LIGHTING GAS MEASURES *EX ANTE* IMPACT AND REALIZATION RATES

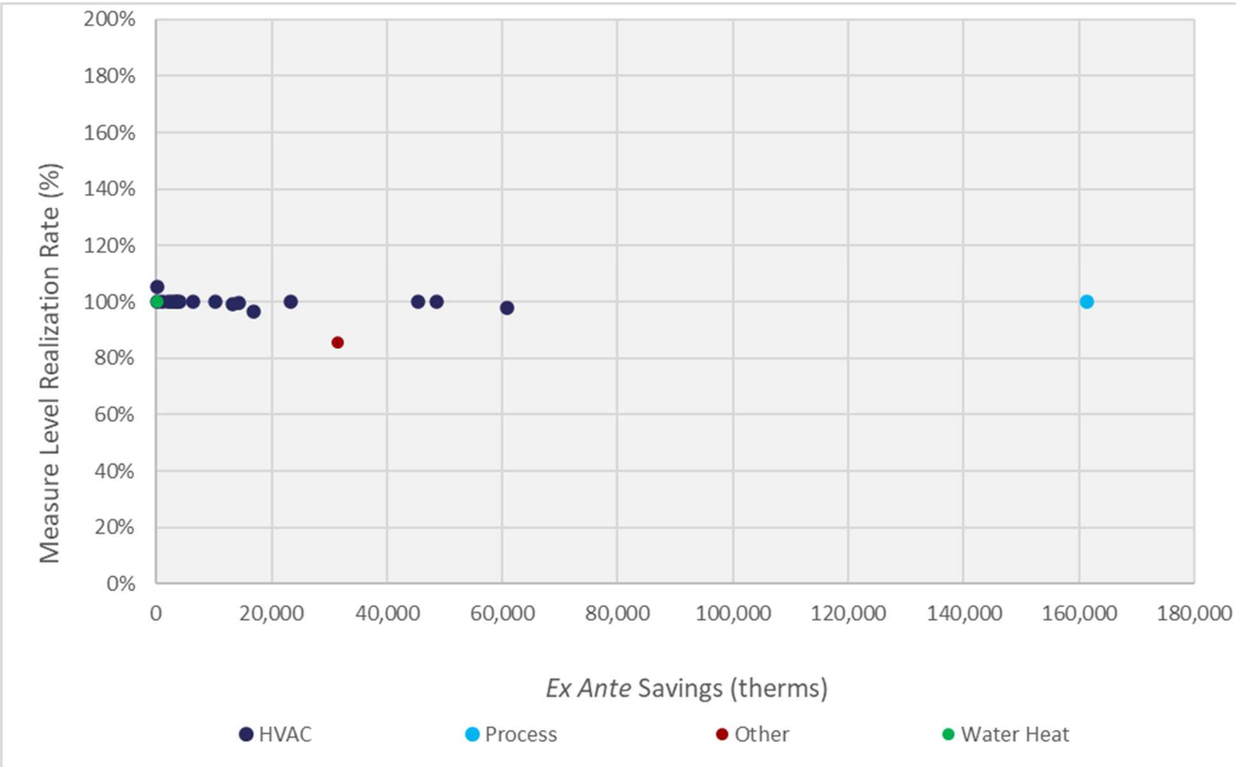


Table 240 summarizes notable differences between *ex ante* and *ex post* gross estimates from the measures sampled.

TABLE 240. 2021 C&I PROGRAMS NOTABLE DIFFERENCES BETWEEN *EX ANTE* & *EX POST* GROSS

MEASURE CATEGORY	*EX ANTE* SOURCES AND ASSUMPTIONS	*EX POST* GROSS SOURCES AND ASSUMPTIONS	PRIMARY REASONS FOR DIFFERENCES
HVAC	*Ex ante* savings were determined by the 2015 Indiana TRM (v2.2), calculated through the application Excel tool.	2015 Indiana TRM (v2.2), calculated through the application Excel tool. All inputs were verified through project documentation, virtual site visits or interviews.	Installed equipment efficiencies for energy and demand savings calculations. Missing calculations were re-created with evaluator-created furnace savings calculation spreadsheets resulting in minor differences in claimed savings. Some slight clerical errors in data entry into captures.
VFD	*Ex ante* savings were deemed through the application Excel tool	2015 Indiana TRM (v2.2). All inputs were verified through project documentation, virtual site visits or interviews. Engineering calculations with VFD curves adapted from the Bonneville Power Administration ASD Calculator and the California TRM VFD Fan Analysis workbook.	The deemed savings values do not account for operating hours or loading of the VFDs. The California TRM VFD Fan Analysis workbook results resulted in 0 kW savings due to projections of motor running at full load during mid-day. Changes to installed horsepower and hours of use based on customer data.
Refrigeration	*Ex ante* savings were determined by the 2015 Indiana TRM (v2.2), Michigan EMD, or through engineering calculations.	2015 Indiana TRM (v2.2). All inputs were verified through project documentation, virtual site visits or interviews.	Modifications to baseline case volumes, capacities composed most adjustments. Deviation from the 2015 Indiana TRM (v2.2) prescriptive calculations.

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 2015 Indiana TRM (v2.2).	2015 Indiana TRM (v2.2). All inputs were verified through project documentation, virtual site visits or interviews.	Modifications based on customer attained data to the load profile, hours of use, and pressure to custom projects only. Deviations from the 2015 Indiana TRM (v2.2) for prescriptive projects.
Motors	*Ex ante* savings were determined through engineering calculations, 2015 Indiana TRM (v2.2) and Michigan TRM	2015 Indiana TRM (v2.2), Michigan TRM and hybrid VFD calculators from other TRMs including Wisconsin and California. All inputs were verified through project documentation, virtual site visits or interviews. Customer data was requested to supplement inputs.	Modifications based on interview customer data to the measure inputs. Different hybrid VFD calculations were used to determine a more accurate savings value generated from more project specific inputs.
Controls	*Ex ante* savings were determined by 2015 Indiana TRM (v2.2) and 2021 Wisconsin TRM.	2015 Indiana TRM (v2.2) and 2021 Wisconsin TRM. All inputs were verified through project documentation, virtual site visits or interviews.	Equipment capacity did not match reported capacity. Customer collected data demonstrated retro-commissioning (RCx) programming modifications to implemented measures
Other	*Ex ante* savings were determined through engineering calculations.	2015 Indiana TRM (v2.2). All inputs were verified through project documentation, virtual site visits or interviews.	Customer collected data demonstrated RCx programming modifications to implemented measures

ADJUSTMENT SUMMARY – ALL C&I MEASURES

Table 241 provides the realization rates for lighting and non-lighting projects by each C&I program and overall. The evaluation team determined cumulative realization rates by extrapolating the random sample realization rates to the full population. The handpicked realization rate had a greater effect on the cumulative realization rate when those projects are larger and constitute a greater portion of savings. For example, for the Prescriptive non-lighting kW demand realization rate, a single handpicked refrigeration measure with a low realization rate impacted the overall realization rate more strongly than other programs.

TABLE 241. 2021 C&I PROGRAMS SAMPLE REALIZATION RATES

MEASURE CATEGORY	HANDPICKED SAMPLE REALIZATION RATE			RANDOM SAMPLE REALIZATION RATE			CUMULATIVE REALIZATION RATE		
	KWH	KW	THERMS	KWH	KW	THERMS	KWH	KW	THERMS
Prescriptive Program									
Lighting	108%	120%	N/A	108%	113%	N/A	108%	113%	N/A
Non-Lighting	102%	8%	100%	100%	90%	102%	100%	76%	102%
Custom Program									
Lighting	N/A	N/A	N/A	109%	119%	N/A	109%	119%	N/A
Non-Lighting	74%	84%	98%	99%	112%	100%	95%	104%	99%
New Construction Program									
Lighting	104%	110%	N/A	103%	112%	N/A	103%	111%	N/A
Non-Lighting	N/A	N/A	99%	101%	100%	99%	101%	100%	99%
SBDI Program									
Lighting	89%	118%	N/A	103%	132%	N/A	101%	132%	N/A
Non-Lighting	N/A	N/A	N/A	100%	109%	100%	100%	109%	100%

SUMMARY C&I PROGRAM REALIZATION RATES AND *EX POST* GROSS SAVINGS

The next three tables (Table 242 through Table 244) show the C&I program's collective *ex ante* reported savings, verified savings, and *ex post* gross savings. The lighting measure group achieved a high electric realization rate of 106%. Realization rates were generally very consistent across the non-lighting measure group, with an average rate of 96%. There was some variability in the refrigeration measure group, which resulted in a realization rate of 72%. The realization rates of all individual measure categories and overall realization rates increased from the CY 2020 evaluation.

TABLE 242. 2021 C&I PROGRAMS *EX ANTE* AND *EX POST* GROSS ELECTRIC ENERGY SAVINGS

MEASURE GROUP	*EX ANTE*[A] ELECTRIC ENERGY SAVINGS (KWH/YR.)	AUDITED GROSS ELECTRIC ENERGY SAVINGS (KWH/YR.)	VERIFIED GROSS ELECTRIC ENERGY SAVINGS (KWH/YR.)	*EX POST* GROSS ELECTRIC ENERGY SAVINGS (KWH/YR.)	REALIZATION RATE
Lighting	40,883,455.48	40,948,100.48	40,945,554.49	43,428,450.66	106%
Non-Lighting	10,871,997.11	10,871,996.77	10,710,307.99	10,455,791.83	96%
Building Redesign	13,314.28	13,314.28	13,314.28	13,457.24	101%
Compressed Air	4,779,744.53	4,779,744.53	4,779,744.53	4,747,454.60	99%
Controls	1,375,091.57	1,375,091.57	1,312,839.02	1,305,272.74	95%
HVAC	1,018,606.85	1,018,606.85	1,018,607.85	1,026,745.79	101%
Kitchen	5,278.00	5,278.00	5,278.00	5,278.02	100%
Motors	603,734.00	603,733.46	504,169.50	624,103.80	103%
Other	-	-	-	-	N/A
Process	1,041,383.00	1,041,383.00	1,041,382.72	1,033,726.60	99%
Refrigeration	1,215,573.70	1,215,573.40	1,215,700.42	880,478.71	72%
Ventilation	-	-	-	-	N/A
VFD	819,271.18	819,271.68	819,271.68	819,274.34	100%
Water Heat	-	-	-	-	N/A
Total	51,755,452.59	51,820,097.24	51,655,862.48	53,884,242.49	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.

The C&I portfolio achieved a 111% demand realization rate, primarily driven by the lighting measure group results. The lighting measure group had a realization rate of 114%, primarily driven upward by WHF adjustments (which tend to have an upward influence on demand savings). The non-lighting demand realization rates varied by sampled measures, with most measure groups achieving high realization rates. Project variability in controls, kitchen, refrigeration, and VFD measures drove the realization rates away from 100% in those measure groups. A single handpicked refrigeration measure drove down the realization rate for the refrigeration measure group, which resulted in a 63% overall demand realization rate.

TABLE 243. 2021 C&I PROGRAMS *EX ANTE* & *EX POST* GROSS PEAK DEMAND REDUCTION

MEASURE GROUP	*EX ANTE*[A] PEAK DEMAND REDUCTION (KW/YR.)	AUDITED GROSS PEAK DEMAND REDUCTION (KW/YR.)	VERIFIED GROSS PEAK DEMAND REDUCTION (KW/YR.)	*EX POST* GROSS PEAK DEMAND REDUCTION (KW/YR.)	REALIZATION RATE
Lighting	5,930.629	5,937.999	5,937.884	6,751.167	114%
Non-Lighting	990.801	942.238	933.839	922.944	93%
Building Redesign	-	-	-	-	N/A
Compressed Air	43.497	47.124	47.124	45.155	104%
Controls	79.396	79.396	79.396	88.822	112%
HVAC	413.139	413.139	413.859	414.654	100%
Kitchen	0.806	0.806	0.806	0.729	90%
Motors	51.628	51.631	42.512	57.669	112%
Other	-	-	-	-	N/A
Process	61.500	61.500	61.500	68.801	112%
Refrigeration	220.808	168.073	168.073	138.520	63%
Ventilation	-	-	-	-	N/A
VFD	120.027	120.569	120.569	108.594	90%
Water Heat	-	-	-	-	N/A
Total	6,921.430	6,880.237	6,871.723	7,674.111	111%

Note: Totals may not sum properly due to rounding.

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

Realization rates were very consistent across all measure groups in the gas fuel type. The C&I Portfolio gas realization rate of 99% is driven primarily by the HVAC measure group, which contains 75% of the *ex ante* therm savings for the C&I portfolio.

TABLE 244. 2021 C&I PROGRAMS *EX ANTE* & *EX POST* GROSS GAS ENERGY SAVINGS

MEASURE GROUP	*EX ANTE*[A] NATURAL GAS ENERGY SAVINGS (THERMS/YR.)	AUDITED GROSS NATURAL GAS ENERGY (THERMS/YR.)	VERIFIED GROSS NATURAL GAS ENERGY SAVINGS (THERMS/YR.)	*EX POST* GROSS NATURAL GAS ENERGY SAVINGS (THERMS/YR.)	REALIZATION RATE
Lighting	-	-	-	-	N/A
Non-Lighting	1,195,144.73	1,193,344.55	1,188,826.20	1,185,843.95	99%
Building Redesign	-	-	-	-	N/A
Compressed Air	-	-	-	-	N/A
Controls	8,119.00	8,119.00	8,119.00	8,119.00	100%
HVAC	896,291.93	894,491.75	894,488.90	891,436.04	99%
Kitchen	-	-	-	-	N/A
Motors	-	-	-	-	N/A
Other	47,558.00	47,558.00	43,042.50	43,042.50	91%
Process	161,251.00	161,251.00	161,251.00	161,251.00	100%
Refrigeration	-	-	-	-	N/A
Ventilation	77,796.40	77,796.40	77,796.40	77,796.40	100%
VFD	-	-	-	-	N/A
Water Heat	4,128.40	4,128.40	4,128.40	4,199.01	102%
Total	1,195,144.73	1,193,344.55	1,188,826.20	1,185,843.95	99%

Note: Totals may not sum properly due to rounding.

Table 245 shows the realization rates and *ex post* gross savings values for each program and the overall C&I portfolio. The lighting measure group represented a high proportion of electric savings for Prescriptive, New Construction, and SBDI 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 245. 2021 C&I PROGRAMS *EX POST* GROSS SAVINGS AND REALIZATION RATES

PROGRAM/ MEASURE CATEGORY	KWH			KW			THERMS		
	EX ANTE	*EX POST* GROSS	REALIZATION RATE	*EX ANTE*	*EX POST* GROSS	REALIZATION RATE	*EX ANTE*	*EX POST* GROSS	REALIZATION RATE
Prescriptive Total	24,520,709.68	26,246,825.99	107%	3,758.072	4,132.496	110%	23,283.06	23,676.78	102%
Lighting	22,905,539.11	24,630,817.08	107.5%	3,431.191	3,884.194	113.2%	-	-	N/A
Non-Lighting	1,615,170.57	1,616,008.90	100.1%	326.881	248.303	76.0%	23,283.06	23,676.78	101.7%
Custom Total	13,028,454.09	13,043,674.06	100%	979.113	1,122.879	115%	629,183.40	624,667.90	99%
Lighting	4,771,808.83	5,214,650.50	109.3%	692.367	825.587	119.2%	-	-	N/A
Non-Lighting	8,256,645.26	7,829,023.56	94.8%	286.746	297.292	103.7%	629,183.40	624,667.90	99.3%
New Construction Total	12,091,407.50	12,460,474.16	103%	1,998.032	2,174.299	109%	538,411.99	533,232.99	99%
Lighting	11,106,175.22	11,464,663.15	103.2%	1,622.901	1,799.168	110.9%	-	-	N/A
Non-Lighting	985,232.28	995,811.00	101.1%	375.131	375.131	100.0%	538,411.99	533,232.99	99.0%
SBDI Total	2,114,881.32	2,133,268.29	101%	186.213	244.436	131%	4,266.28	4,266.28	100%
Lighting	2,099,932.32	2,118,319.93	100.9%	184.170	242.218	131.5%	-	-	N/A
Non-Lighting	14,949.00	14,948.37	100.0%	2.043	2.218	108.6%	4,266.28	4,266.28	100.0%
Total C&I	51,755,452.59	53,884,242.49	104%	6,921.430	7,674.111	111%	1,195,144.73	1,185,843.95	99%

EX POST NET SAVINGS

The evaluation team calculated freeridership and participant spillover using survey data collected from 2021 participants for all four C&I programs. Table 246 shows the NTG ratios, spillover and freeridership ratios for the Prescriptive, Custom, New Construction and SBDI programs in 2021. The C&I New Construction program achieved a lower NTG value than the other C&I programs, however this value is not statistically different than the CY2019 value of 67% and the CY 2018 value of 52%. The 2021 NIPSCO NTG ratio is also like the past four researched NTG results for the ComEd Illinois Business New Construction Service Program and the Stakeholder Advisory Group (SAG) recommended NTG ratio (53%) for the 2021 ComEd Illinois Business New Construction Service Program.[60]

TABLE 246. 2021 C&I PROGRAMS NTG RESULTS

PROGRAM	FREERIDERSHIP	PARTICIPANT SPILLOVER	NTG[a]
Prescriptive	15%	0%	85%
Custom	10%	0%	90%
New Construction [b]	46%	0%	54%
SBDI	6%	0%	94%

[a] Weighted by survey sample *ex post* gross program MMBtu savings.
[b] The top four largest saving projects have a weighted average freeridership score of 48% and represent 96% of the analysis sample gross savings. When there is a small analysis sample size and the potential for large variation in gross savings for projects/respondents, there can be large swings in freeridership from one evaluation to the next.

FREERIDERSHIP

To determine freeridership, the evaluation team asked respondents questions about whether they would have installed equipment at the same efficiency level, at the same time, and in same amount, in absence of the C&I programs. By combining the previously used *intention* methodology with *influence* methodology, 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 targeted 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 247.

Appendix 15 contains the *intention* freeridership questions and scoring.

[60] *See* ComEd PROGRAMS NTG APPROACH FOR CY2021. September 30, 2020. Page 8. https://ilsag.s3.amazonaws.com/ComEd-NTG-History-and-CY2021-Recs-2020-09-30-Final.pdf

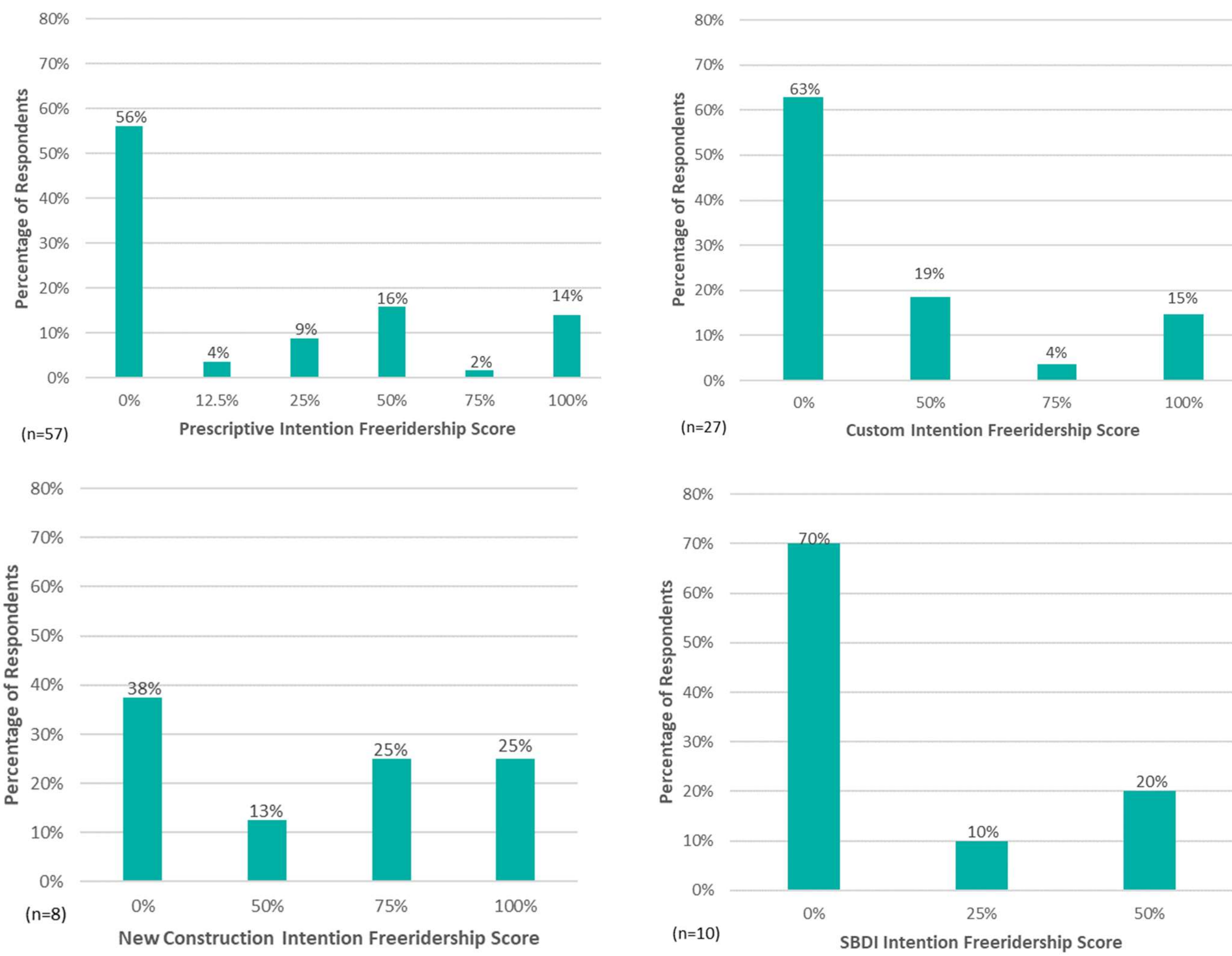
TABLE 247. 2021 C&I PROGRAMS INTENTION FREERIDERSHIP RESULTS

PROGRAM	RESPONSES	INTENTION FREERIDERSHIP SCORE[a]
Prescriptive	57	21%
Custom	27	11%
New Construction	8	86%
SBDI	10	0%

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

Figure 73 shows the distribution of individual *intention* freeridership scores.

FIGURE 73. 2021 C&I PROGRAMS DISTRIBUTION OF INTENTION FREERIDERSHIP SCORES



Source: Participant Survey. Questions: G1 to G9 and G11 were used to estimate an *intention* freeridership score.

INFLUENCE FREERIDERSHIP

The evaluation team assessed *influence* freeridership by asking participants how important various elements of the program were in their purchasing decision-making process. These questions are targeted at understanding the extent to which the design of the program 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.

Prescriptive

The incentive, per respondents, is the most influential factor in their decision, followed by the recommendation from a vendor or contractor. Table 248 shows the program elements participants rated for importance, along with a count and average rating for each factor.

TABLE 248. 2021 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%	3	5	8	6
2	75%	2	7	2	0
3	25%	9	15	10	8
4 - Very important	0%	38	22	32	14
Not applicable	50%	5	8	5	29
Average		3.6	3.1	3.3	3.1

Shown in Table 249, the evaluation team determined each respondent's *influence* freeridership rate using the maximum rating provided for any factor included in Table 248. Counts refer to the number of "maximum influence" responses for each factor, or *influence* score, response option.

TABLE 249. 2021 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	39	39
2	75%	2	87	65
3	25%	2	256	64
4 - Very important	0%	50	5,820	0
Not applicable	50%	1	773	387
Average Maximum Influence Rating - Simple Average				3.8
Average Influence Score [a]				8%

[a] The average *influence* score of 8% for the 2021 Prescriptive program was weighted by *ex post* gross MMBtu program savings.

Custom

For Custom, both the incentive and recommendation from contractors are statistically equally important in customers' decisions, and in fact, the incentive is slightly less important than for the Prescriptive program. Previous participation in another NIPSCO program and information provided by NIPSCO on saving opportunities were ranked less important to this program than any other C&I program. Table 250 shows Custom program elements participants rated for importance, along with a count and average rating for each factor.

TABLE 250. 2021 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%	3	5	2	3
2	75%	1	3	3	2
3	25%	3	6	6	4
4 - Very important	0%	18	7	13	6
Don't know	50%	0	0	0	0
Not applicable	50%	2	6	3	12
Average		3.4	2.7	3.3	2.9

Table 251 shows the summary influence freeridership results and a maximum influence rating of 3.7 for the Custom program.

TABLE 251. 2021 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%	2	134	101
3	25%	3	1,823	456
4 - Very important	0%	21	10,690	0
Average Maximum Influence Rating - Simple Average				3.7
Average Influence Score[a]				8%

[a] The average *influence* score of 8% for the 2021 Custom program was weighted by *ex post* gross MMBtu program savings.

New Construction

Again, the incentive rates are higher in importance for the New Construction program. Unlike the prior programs, participation in a previous NIPSCO program also rated equally high, although the sample sizes for whom this is applicable are low. Table 252 shows New Construction program elements participants rated for importance, along with a count and average rating for each factor.

TABLE 252. 2021 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%	0	0	1	0
2	75%	1	2	0	0
3	25%	1	1	1	2
4 - Very important	0%	6	5	5	2
Don't know	50%	0	0	1	4
Not applicable	50%	4	3	3	4
Average		3.6	3.4	3.4	3.5

Table 253 shows the summary influence freeridership results and a maximum influence rating of 3.9 for the New Construction program.

TABLE 253. 2021 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	2,136	534
4 - Very important	0%	7	6,251	0
Average Maximum Influence Rating - Simple Average				3.9
Average Influence Score[a]				6%

[a] The average *influence* score of 6% for the 2021 New Construction program was weighted by *ex post* gross MMBtu program savings.

Small Business Direct Install

Unlike the other C&I programs, recommendation from a contractor or vendor was the most important factor for customers. The incentive provided by NIPSCO ranked higher in the SBDI program than any other C&I program. Table 254 shows SBDI program elements participants rated for importance, along with a count and average rating for each factor.

TABLE 254. 2021 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	1
2	75%	1	0	0	0
3	25%	1	2	1	1
4 - Very important	0%	7	5	9	5
Don’t know	50%	0	0	0	0
Not applicable	50%	1	2	0	3
Average		3.7	3.4	3.9	3.4

Table 255 shows the summary influence freeridership results and a maximum influence rating of 3.7 for the SBDI program.

TABLE 255. 2021 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%	0	0	0
4 - Very important	0%	10	252	0
Average Maximum Influence Rating - Simple Average				4.0
Average Influence Score				0%

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:

$$Final\ Prescriptive\ Freeridership\ (15\%) = \frac{Intention\ FR\ Score\ (21\%) + Influence\ FR\ Score\ (8\%)}{2}$$

$$Final\ Custom\ Freeridership\ (10\%) = \frac{Intention\ FR\ Score\ (11\%) + Influence\ FR\ Score\ (8\%)}{2}$$

$$Final\ New\ Construction\ Freeridership\ (46\%) = \frac{Intention\ FR\ Score\ (86\%) + Influence\ FR\ Score\ (6\%)}{2}$$

$$Final\ SBDI\ Freeridership\ (6\%) = \frac{Intention\ FR\ Score\ (11\%) + Influence\ FR\ Score\ (0\%)}{2}$$

A higher freeridership score translates to more savings, which are deducted from the gross savings estimates. Table 256 lists the intention, influence, and final freeridership scores for the 2021 C&I programs.

TABLE 256. 2021 C&I PROGRAMS FREERIDERSHIP SCORE

PROGRAM	INTENTION SCORE	INFLUENCE SCORE	FREERIDERSHIP SCORE
Prescriptive	21%	8%	15%
Custom	11%	8%	10%
New Construction	86%	6%	46%
SBDI	11%	0%	6%

PARTICIPANT SPILLOVER

The evaluation team estimated participant spillover measure savings using specific information about participants determined through the evaluation, using the 2015 Indiana TRM (v2.2) 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. Only the Custom program resulted in spillover savings, which were too low compared with program savings, resulting in 0% for all programs, rounded to the nearest whole percent, as shown in Table 257.

TABLE 257. 2021 C&I PROGRAMS PARTICIPANT SPILLOVER RESULTS

PROGRAM	SPILLOVER SAVINGS (MMBTU)	PARTICIPANT PROGRAM SAVINGS (MMBTU)	PARTICIPANT SPILLOVER
Prescriptive	0	6,975.05	0%
Custom	2.96	13,789.85	0%
New Construction	0	8,387.02	0%
SBDI	0	252.15	0%

RESULTING NET SAVINGS

Table 258 through Table 261 present the resulting C&I programs net electric savings, demand reduction, and natural gas savings by program.

TABLE 258. 2021 C&I PRESCRIPTIVE *EX POST* NET SAVINGS

MEASURE CATEGORY	*EX POST* GROSS SAVINGS/REDUCTION			NTG	*EX POST* NET SAVINGS/REDUCTION		
	KWH	KW	THERMS		KWH	KW	THERMS
Compressed Air	86,519.49	14.826	-	85%	73,541.57	12.602	-
HVAC	57,102.05	12.771	19,794.90	85%	48,536.74	10.856	16,825.66
Kitchen	5,278.02	0.729	-	85%	4,486.32	0.620	-
Lighting	24,630,817.08	3,884.194	-	85%	20,936,194.52	3,301.565	-
Refrigeration	647,835.00	111.382	-	85%	550,659.75	94.675	-
VFD	819,274.34	108.594	-	85%	696,383.19	92.305	-
Water Heat	-	-	3,881.89	85%	-	-	3,299.60
Total Savings	26,246,825.99	4,132.496	23,676.78	85%	22,309,802.09	3,512.622	20,125.27

TABLE 259. 2021 C&I CUSTOM *EX POST* NET SAVINGS

MEASURE	*EX POST* GROSS SAVINGS/REDUCTION			NTG	*EX POST* NET SAVINGS/REDUCTION		
	KWH	KW	THERMS		KWH	KW	THERMS
Compressed Air	4,537,172.34	30.328	-	90%	4,083,455.11	27.296	-
Controls	1,305,272.74	88.822	8,119.00	90%	1,174,745.46	79.940	7,307.10
HVAC	119,913.87	26.947	334,321.00	90%	107,922.48	24.252	300,888.90
Lighting	5,214,650.50	825.587	-	90%	4,693,185.45	743.028	-
Motors	617,867.55	57.669	-	90%	556,080.79	51.902	-
Other	-	-	43,042.50	90%	-	-	38,738.25
Process	1,033,726.60	68.801	161,251.00	90%	930,353.94	61.921	145,125.90
Refrigeration	215,070.46	24.725	-	90%	193,563.41	22.253	-
Ventilation	-	-	77,796.40	90%	-	-	70,016.76
Water Heat	-	-	138.00	90%	-	-	124.20
Total Savings	13,043,674.06	1,122.879	624,667.90	90%	11,739,306.65	1,010.591	562,201.11

TABLE 260. 2021 C&I NEW CONSTRUCTION *EX POST* NET SAVINGS

MEASURE	*EX POST* GROSS SAVINGS/REDUCTION			NTG	*EX POST* NET SAVINGS/REDUCTION		
	KWH	KW	THERMS		KWH	KW	THERMS
Building Redesign	13,457.24	-	-	54%	7,266.91	-	-
Compressed Air	123,762.76	-	-	54%	66,831.89	-	-
HVAC	849,729.87	374.936	533,053.86	54%	458,854.13	202.465	287,849.09
Lighting	11,464,663.15	1,799.168	-	54%	6,190,918.10	971.551	-
Motors	6,236.25	-	-	54%	3,367.57	-	-
Refrigeration	2,624.88	0.195	-	54%	1,417.44	0.105	-
Water Heat	-	-	179.12	54%	-	-	96.73
Total Savings	12,460,474.16	2,174.299	533,232.99	54%	6,728,656.04	1,174.122	287,945.81

TABLE 261. 2021 C&I SBDI *EX POST* NET SAVINGS

MEASURE	*EX POST* GROSS SAVINGS/REDUCTION			NTG	*EX POST* NET SAVINGS/REDUCTION		
	KWH	KW	THERMS		KWH	KW	THERMS
HVAC	-	-	4,266.28	94%	-	-	4,010.30
Lighting	2,118,319.93	242.218	-	94%	1,991,220.73	227.685	-
Refrigeration	14,948.37	2.218	-	94%	14,051.46	2.085	-
Total Savings	2,133,268.29	244.436	4,266.28	94%	2,005,272.20	229.770	4,010.30

PROCESS EVALUATION

As part of the process evaluation, the evaluation team reviewed the program database and program materials and surveyed Custom, Prescriptive, SBDI, and New Construction program participants. The team also interviewed NIPSCO's program manager and program implementation staff to gain a better understanding of the program design and delivery process and any associated changes or challenges experienced in 2021. The evaluation team sought to answer the following process-related research questions:

- What are the most effective referral sources for C&I customers, and to what extent are those sources being leveraged by the program?
- What are the barriers and challenges to energy efficiency and program participation?
- What are the primary reasons for participation?
- Are participants satisfied with the program and its components, and what opportunities exist to improve participants' experience?
- What type of C&I customers is the program reaching? Is there a segment the program may want to target for future efforts?

PROCESS SAMPLING STRATEGY

The evaluation team took a census of all 2021 C&I program participants for this survey. The sampling frame included 2021 Prescriptive, Custom, New Construction, and SBDI program participants, drawn from data provided by TRC. If participants participated in more than one program, they were only asked about one program, which was selected using a program priority hierarchy as follows: New Construction, SBDI, Custom, and Prescriptive. The hierarchy was determined by the number of participants in each program, to maximize response rate per program and fuel representation. The evaluation team identified duplicate project/participants by phone number. In the cases where duplicates existed, the team selected the project that resulted in the greatest energy savings.

The survey asked customers about one measure installed, organized by measure category (e.g., lighting). The measure selected was read into the survey language. In the sampling process, when customers received more than one measure, the evaluation team prioritized gas-saving measures and measures with highest per-site savings as a proportion of the total project.

PARTICIPANT FEEDBACK

The evaluation team surveyed 102 customers who participated in the Prescriptive (n=57), Custom (n=27), SBDI (n=10), and New Construction (n=8) programs (out of a census of 810 participants, representing an 13% response rate).[61] The following sections describe the results related to source of awareness, motivations for and barriers to energy efficiency and program participation, satisfaction with the program, and program impacts on customers.

The previous evaluation segmented certain survey results by the type of measures that participants received through the program, broken down into lighting and non-lighting measures. Due to the relatively low number of responses from non-lighting measures (n=40) compared to lighting measures (n=164), the team segmented the survey results by program instead of measure. Table 262 lists the count of 2021 survey respondents by program and measure type.

[61] We typically show counts for any programs/results under 30 completes instead of percentages, however for the purposes of comparison we are showing percentages for all programs. Please interpret all results with small sample sizes cautiously; while the evaluation team took a census, small sample sizes can be more susceptible to introduced biases.

TABLE 262. COUNT OF SURVEY RESPONDENTS BY MEASURE TYPE

MEASURE TYPE	TYPE	PRESCRIPTIVE PROGRAM	CUSTOM PROGRAM	SBDI PROGRAM	NEW CONSTRUCTION PROGRAM	TOTAL
Interior LED Lighting	Lighting	40	9	5	5	59
Exterior LED Lighting	Lighting	14	4	5	0	23
Furnace Replacement	Non-Lighting	0	6	0	2	8
Efficient Compressed Air System	Non-Lighting	0	6	0	0	6
Efficient Furnace	Non-Lighting	2	0	0	0	2
Efficient HVAC Equipment	Non-Lighting	0	1	0	1	2
Efficient Motors and Drive	Non-Lighting	0	1	0	0	1
Variable Speed Air Compressor	Non-Lighting	1	0	0	0	1
Total		57	27	10	8	102

NIPSCO’s C&I programs reach a wide variety of industry types (Figure 113 in Appendix 13). Overall, respondents from the manufacturing industry were most frequently surveyed (24%), followed by respondents from the construction (12%) and retail/wholesale (11%) industries. SBDI respondents were most frequently from the retail/wholesale industry (30%).

The team reviewed program tracking data, which included an industry indicator, and found that the industrial and warehouse segments made up the greatest portion of the 2021 C&I programs combined electric and therm savings. In 2021, the warehouse segment made up the largest portion of the therm savings (20.3%), and the industrial sector made up the largest portion of electric savings (40.4%). To assess the distribution of savings across customer segments, the evaluation team compared 2020 to 2021 program participation by building type designation. The following segments increased their total *ex ante* electric savings from 2020 to 2021: industrial, warehouse, and grocery and convenience. The following segments increased their total therm savings over the same time: warehouse, agriculture and farming, and faith based. Table 263 shows the percentage of the total program savings achieved from 2019 to 2021 for all designated customer segments.

TABLE 263. PERCENTAGE *EX ANTE* SAVINGS ACHIEVEMENT BY CUSTOMER SEGMENT

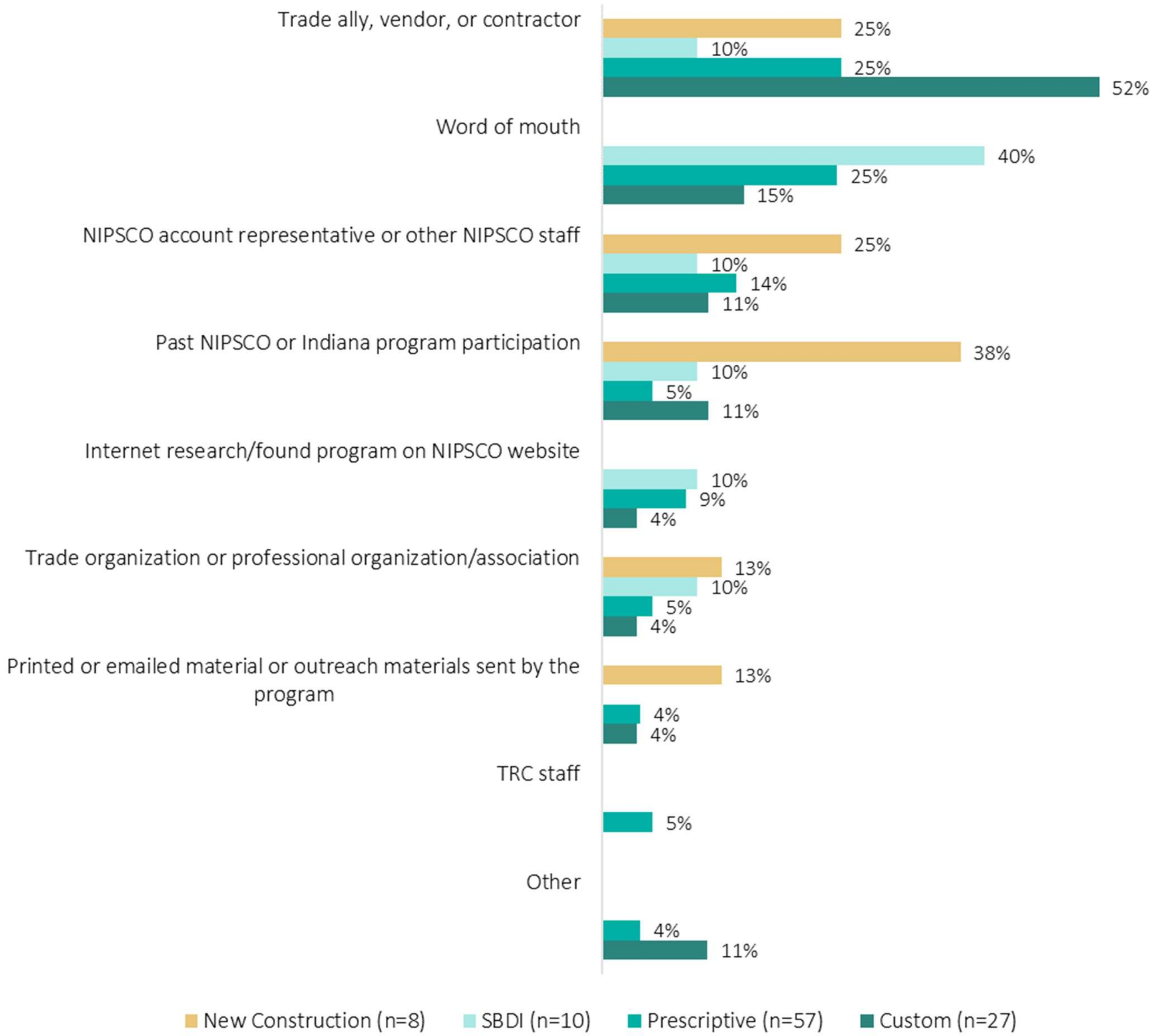
	2019		2020		2021	
CUSTOMER SEGMENT	*EX ANTE* KWH	*EX ANTE* THERMS	*EX ANTE* KWH	*EX ANTE* THERMS	*EX ANTE* KWH	*EX ANTE* THERMS
Agriculture/Farming	0.10%	0.00%	1.60%	0.00%	0.86%	5.42%
Automotive Services	3.60%	0.00%	2.60%	0.00%	2.89%	0.07%
Education	10.30%	31.40%	8.50%	14.20%	10.14%	9.68%
Entertainment/Recreation	0.80%	0.10%	3.00%	1.20%	3.10%	0.08%
Faith-Based	2.30%	2.00%	2.00%	4.00%	3.32%	4.98%
Food & Beverage Service	1.80%	0.10%	1.30%	0.00%	1.12%	0.00%
Gas Station	0.50%	0.00%	0.60%	0.00%	1.97%	0.03%
Government	5.50%	2.70%	15.70%	14.10%	4.17%	1.99%
Grocery and Convenience	3.60%	0.00%	5.30%	0.00%	8.31%	0.00%
Healthcare	2.70%	0.10%	5.20%	6.40%	3.91%	4.79%
Industrial	35.20%	33.20%	32.60%	51.50%	40.43%	51.84%
IT/Data Center	0.00%	0.00%	0.40%	0.00%	1.21%	0.03%
Lodging	0.70%	0.00%	1.60%	0.00%	1.63%	0.27%
Office	2.90%	4.00%	4.70%	0.40%	0.98%	0.06%
Parking Garage	0.30%	0.10%	0.00%	0.00%	0.48%	0.33%
Retail	21.70%	0.10%	9.20%	0.10%	6.65%	0.08%
Warehouse	5.90%	6.00%	5.60%	8.20%	8.84%	20.34%

ENERGY EFFICIENCY AWARENESS AND MARKETING

In 2021, the implementer sent 19 waves of marketing emails and newsletters (including reminder emails), hosted five webinars, and provided three trade ally orientation sessions to market the C&I programs to trade allies and nonresidential customers. Like the implementer's efforts to target office, restaurant, warehouse/manufacturing, and retail in 2020, the implementer sent industry-specific emails to grocery, healthcare, and small businesses customers in 2021.

Trade allies continued to be the primary source of program awareness in 2021; about 27% of all respondents said they learned about the program through their trade allies (in aggregate, Figure 74 shows by program). This is a decrease from 2020, when 50% of the respondents heard about the program through trade allies. Word of mouth was the second most common source of awareness for 22% of all respondents (which only included SBDI, Prescriptive, and Custom participants). Thirty-eight percent of New Construction respondents said past program participation was the primary way they learned about the program.

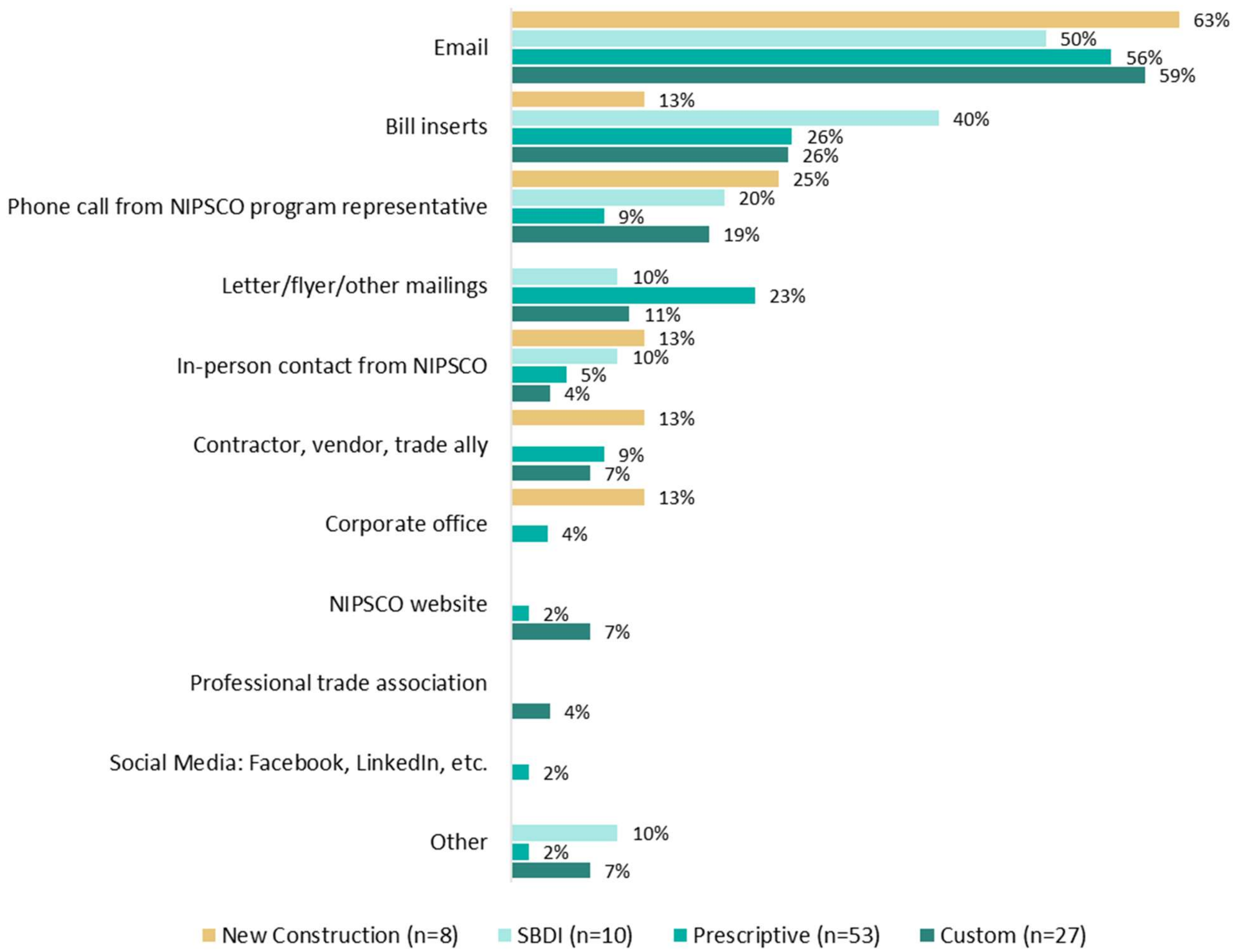
FIGURE 74. HOW PARTICIPANTS LEARNED ABOUT THE PROGRAM



Source: Survey Question B1: "How did you learn about NIPSCO's [PROGRAM] incentive program?"
Multiple responses allowed.

While trade allies and contractors were the leading source of program awareness, they were not the preferred channel from which customers desired to learn about energy efficiency opportunities (Figure 75, by program). In aggregate, 57% of respondents preferred email communication from NIPSCO to keep their organizations informed about opportunities to save energy, followed by bill inserts, phone calls, and letters/ flyers/other mailings. By comparison, in 2020, letters/flyers/other mailings were the second most preferred method of communication, while bill inserts and phone calls from NIPSCO were third and fourth, respectively.

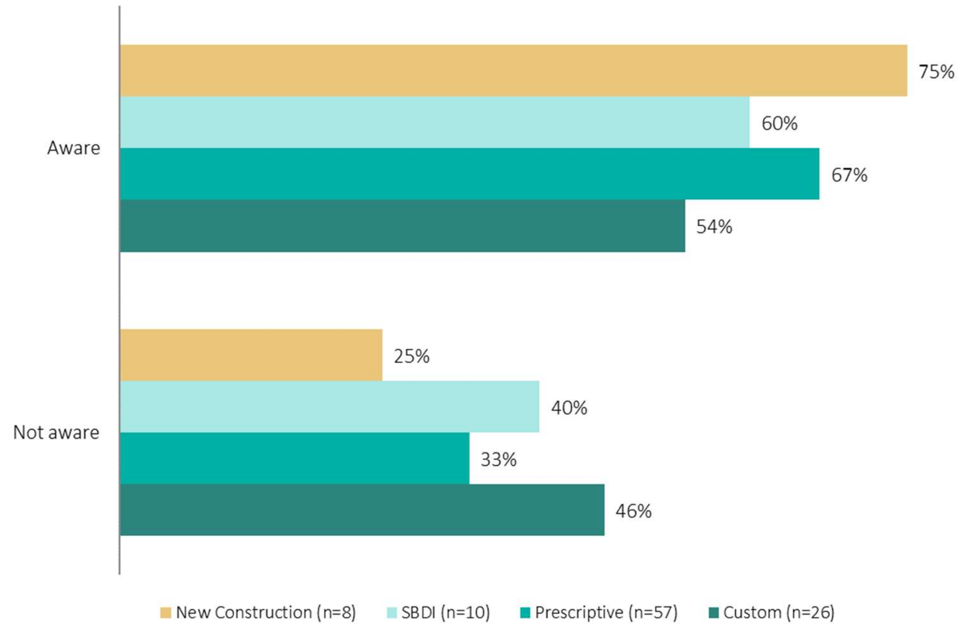
FIGURE 75. PREFERRED ENERGY EFFICIENCY COMMUNICATION CHANNEL



Source: Survey Question B4: "In your opinion, what is the best way for NIPSCO to keep organizations like yours informed about opportunities to save energy?" Multiple responses allowed.

Overall, many (63% of respondents) were aware of other NIPSCO commercial energy efficiency offerings (Figure 76, by program). This proportion is higher amongst New Construction participants, where 75% of respondents were aware of other NIPSCO commercial offerings. Among the respondents who were not aware of other NIPSCO offerings, Custom participants were the least aware, with 46% reporting they were not aware of other NIPSCO's commercial offerings. Of those who reported they were aware of other offerings, respondents were most aware of lighting measures (58%); followed by lighting controls (44%); HVAC measures (39%); and air compressor, water heating measures, and others with less than 10% each.

FIGURE 76. AWARENESS OF OTHER COMMERCIAL ENERGY EFFICIENCY OPPORTUNITIES

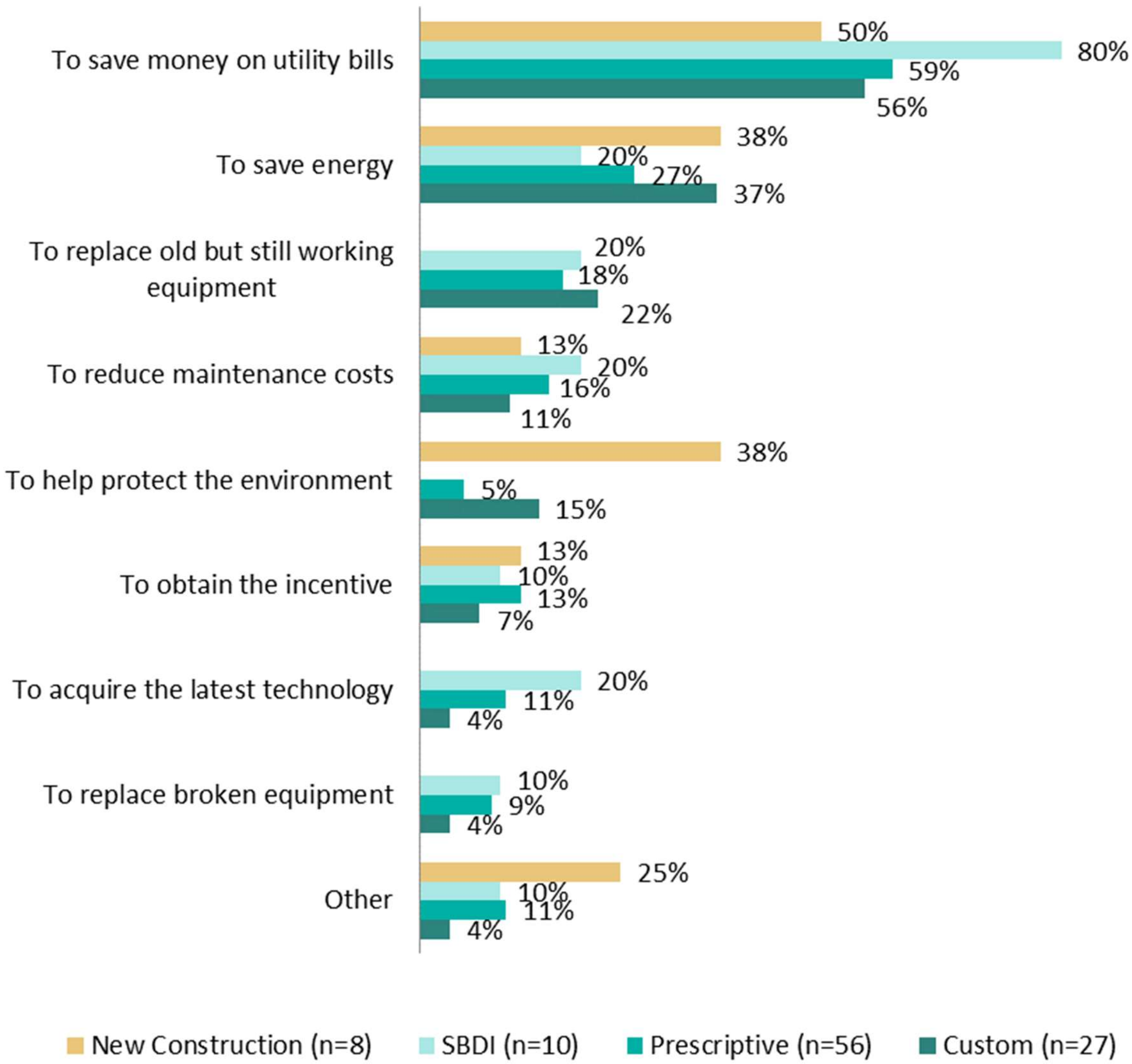


Source: Survey Question B2: "Besides the rebates, are you aware that NIPSCO offers rebates for other energy-efficient commercial and industrial equipment and services?" Single response allowed.

PARTICIPATION DRIVERS AND BARRIERS

Survey respondents expressed similar motivations for completing an energy efficiency project (Figure 77, by program). In aggregate, respondents from all programs cited saving money on utility bills (59%) as a top motivation, though SBDI respondents most frequently said saving money on utility bills (80%). For all respondents, the second most cited motivation was to save energy (30%), followed by replace old but still working equipment (18%), reduce maintenance costs (18%), and obtain the incentive (11%). The other categories, to help protect the environment, to acquire the latest technology, and to replace broken equipment were mentioned in less than 10% of all responses. However, 38% of New Construction respondents reported to help protect the environment as their primary motivation. While return on investment was the second most common motivation for the installation of energy-efficient equipment in 2020, it was only mentioned by two respondents in 2021. In both 2020 and 2021 return on the investment was mentioned under the *Other* category.

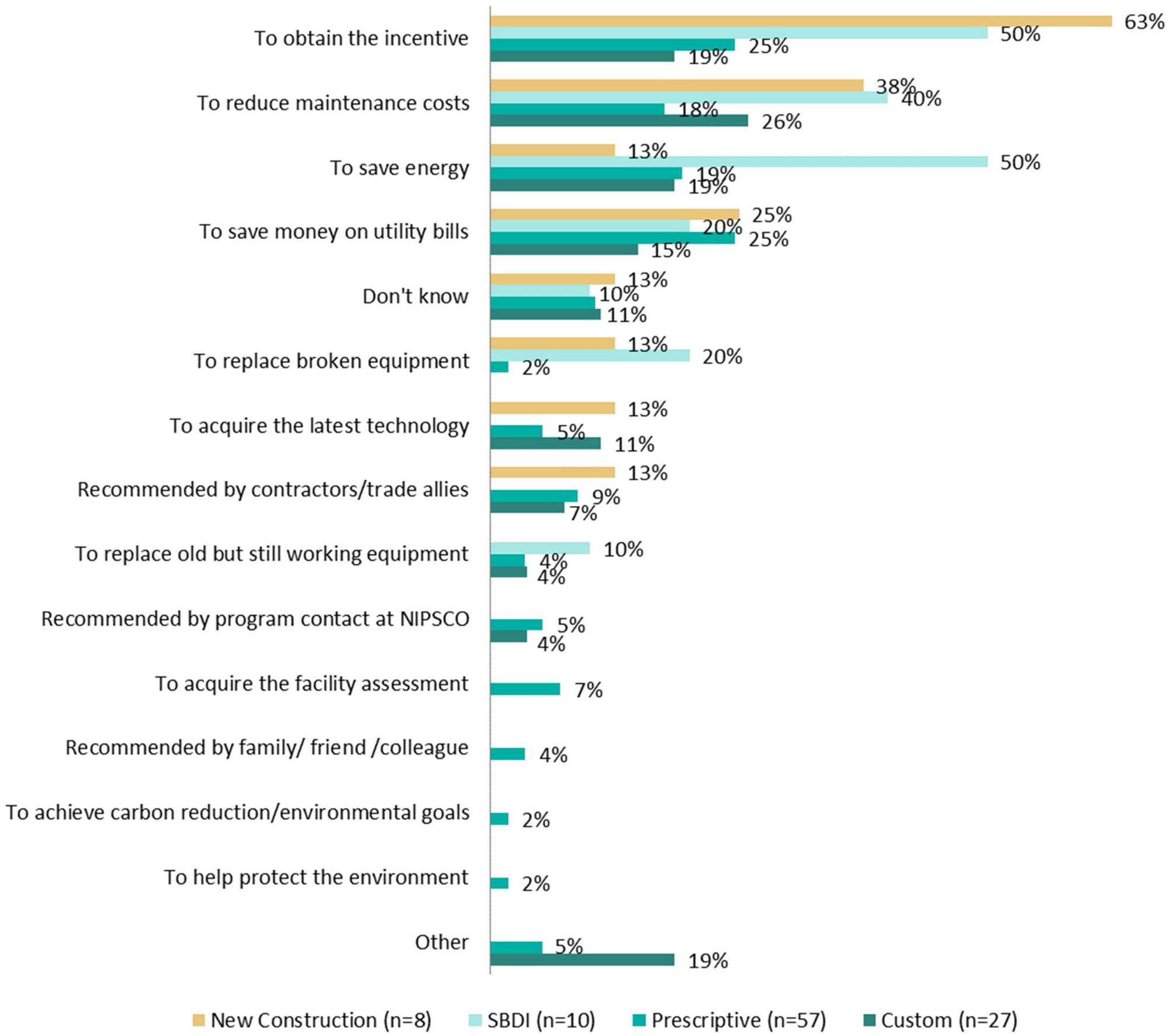
FIGURE 77. PRIMARY MOTIVATION FOR INSTALLING ENERGY-EFFICIENT EQUIPMENT



Source: Survey Question C1: "Why did you decide to invest in an energy efficiency project at your organization?" Multiple responses allowed.

When asked why they decided to participate in the NIPSCO program, respondents most often said it was to obtain the incentive (28%), followed by reducing maintenance costs (24%), followed by saving energy and contractor/trade ally recommendation (22% each). Most New Construction respondents said the incentives were their main reason for participating in the program (63%), and 50% of SBDI participants said saving energy was their main motivation to participate in the program. Figure 78 shows the full breakdown of responses.

FIGURE 78. PRIMARY REASON FOR PARTICIPATION IN THE PROGRAM

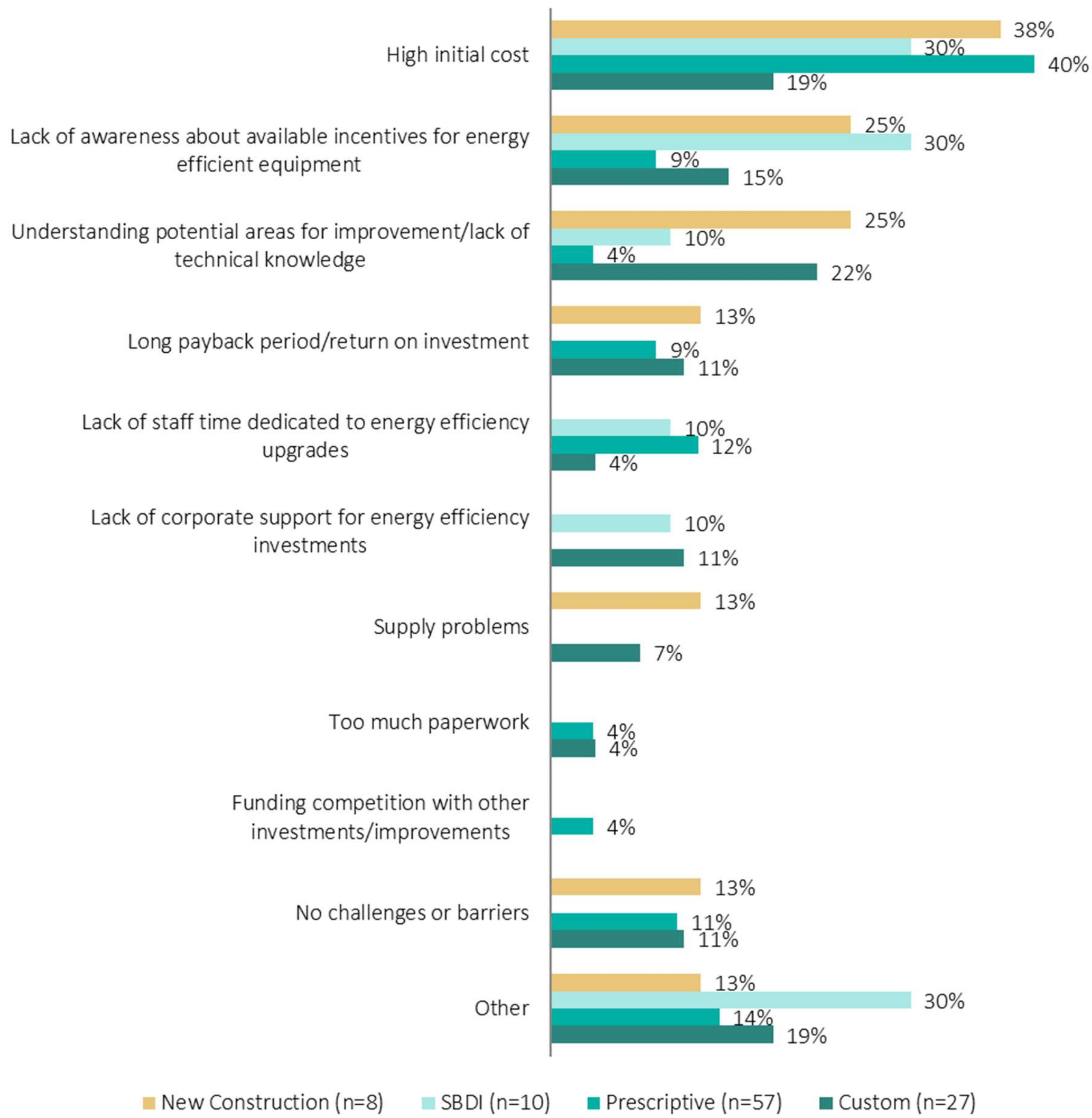


Source: Survey Question C2: "Why did you decide to participate in NIPSCO's [PROGRAM] program?"
Multiple responses allowed.

Overall, high initial cost was the primary barrier to installing energy-efficient equipment, cited by 33% of all respondents (in aggregate, Figure 79 shows by program). This was followed by lack of awereness about available incentives for energy-efficient equipment (15%) and understanding potential areas for improvement/lack of technical knowledge (11%). In addition, high initial cost was the primary barrier for New Construction (38%), SBDI (30%), and Prescriptive (40%) participants. For Custom participants, the main barrier was understanding potential areas for improvement and lack of technical knowledge (22%). Responses in the *Other* category included difficulty finding contractors and equipment (n=3) and time constraints and scheduling related barriers (n=2).

Prescriptive and Custom participants reported too much paperwork and supply problems enough times under the *Other* category that the evaluation team included it as a separate line item in Figure 79. Each factor was mentioned three times, with respondents specifically citing the "paperwork was cumbersome" and "the lack of availability of products." Because paperwork is not technically a barrier to installation, it is possible these customers used the survey as an outlet to voice their displeasure with the program paperwork.

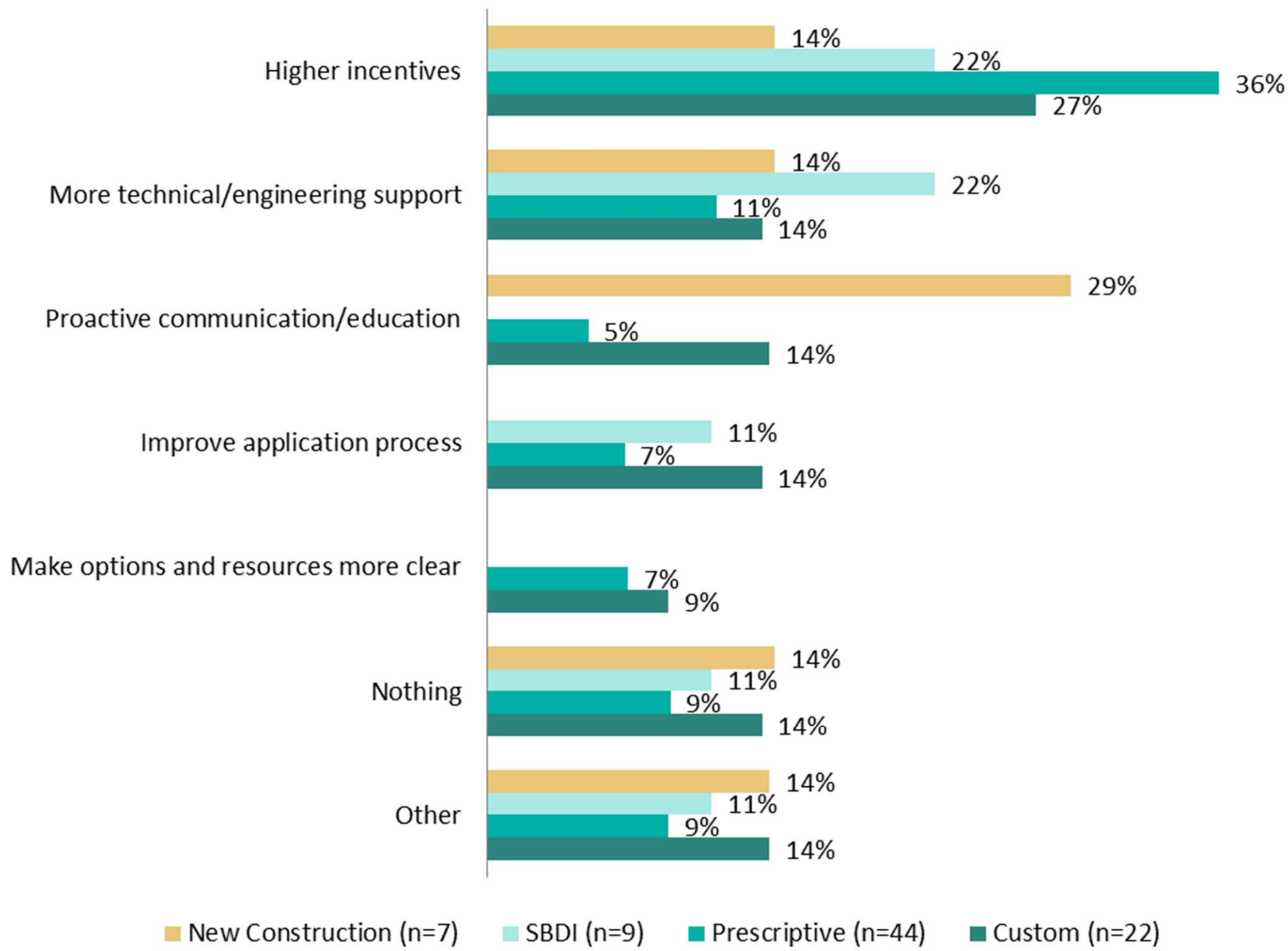
FIGURE 79. PRIMARY BARRIER TO INSTALLING ENERGY-EFFICIENT EQUIPMENT



Source: Survey Question D1: "When considering improvements to increase commercial and industrial energy efficiency, what are the most significant challenges that organizations face?" Multiple responses allowed.

In 2020, most respondents cited proactive communication/education as a way that NIPSCO could help participants to overcome energy-efficiency challenges. As shown in Figure 80 (by program), in aggregate most respondents (30%) cited higher incentives in 2021. However, proactive communication/education was still the most important factor for New Construction participants (29%). For all respondents, the second most cited way that NIPSCO can help participants to overcome energy efficiency challenges was to provide more technical/engineering support (13%), followed by proactive communication/education and improving the application process (9% each). Many respondents also mentioned that there was nothing NIPSCO could do to help organizations overcome energy efficiency challenges (11%).

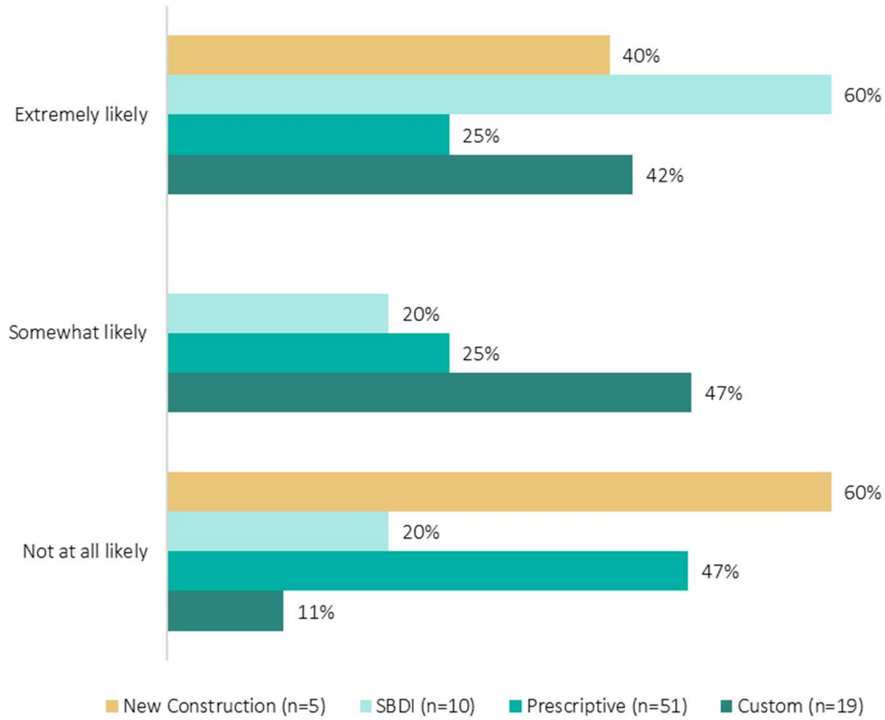
FIGURE 80. OPPORTUNITIES FOR NIPSCO TO SUPPORT ORGANIZATIONS WITH ENERGY EFFICIENCY



Source: Survey Question D2: "What could NIPSCO do to help organizations like yours overcome the challenges faced when investing in energy-efficient equipment?" Multiple responses allowed.

Most respondents who did not receive HVAC measures said they were either extremely likely (35% aggregate) or somewhat likely (29% aggregate) to replace their HVAC equipment in the next five years (Figure 81 shows by program). Thirty-seven percent of the respondents said that they were not at all likely, which includes 60% of New Construction respondents. When asked why they were not at all likely to replace their HVAC equipment in the next five years, 57% of respondents said that they would not replace their HVAC equipment because their equipment was new. This was followed by four respondents (13%) who reported their equipment was still operational, one respondent who reported they were a tenant, and another respondent who reported budget limitations. For those who said that they were likely to replace their HVAC equipment in the next five years, the team asked what the rebate would be needed for them to choose high-efficiency HVAC equipment. Most respondents said $1,000 (40%), followed by $2,000 (34%), $1,500 (9%), and $250 (2%). Some respondents did not identify a value (15%).

FIGURE 81. LIKELIHOOD TO REPLACE HVAC EQUIPMENT IN THE NEXT FIVE YEARS



Source: Survey Question D2: "Thinking now specifically about your facility´s HVAC equipment, how likely is your company to invest in replacing or upgrading any of that equipment in the next 5 years? Would you say that you are:" Single response allowed.

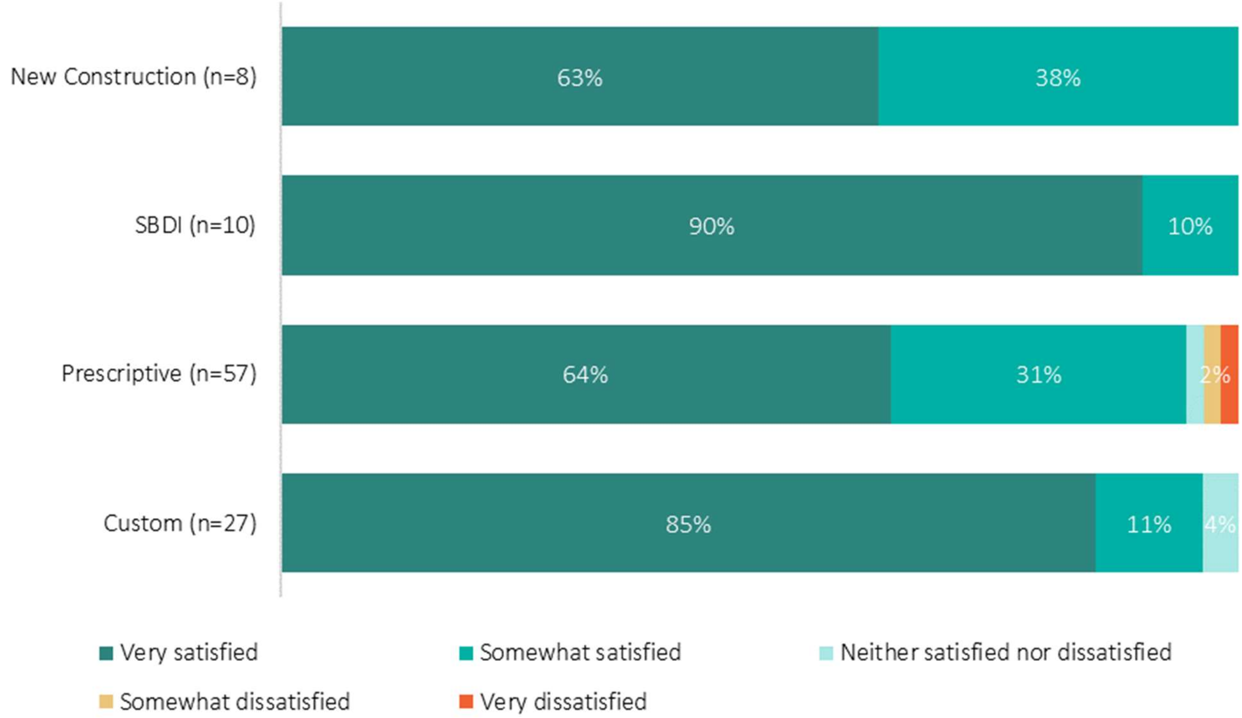
Most respondents said they still observed lingering effects of the COVID-19 pandemic in their businesses in 2021 (63%). The team asked these respondents what effects they experienced and most reported staff-related challenges, such as staff illness or death (28%), having to lay off staff (27%), or employee retention and recruitment (11%). They also experienced a decrease in business, sales, production, or operating hours (25%), supply chain disruptions (19%), complete closure for an extended period (8%), and other effects (9%). Other effects included not being able to access areas of construction, a tighter budget, and enhancing cleaning and air filtering.

PARTICIPANT SATISFACTION – OVERALL SATISFACTION

OVERALL PROGRAM SATISFACTION

Respondents expressed high levels of satisfaction with the commercial programs in 2021. Nearly all 2021 program respondents (94%) said that they were either *somewhat satisfied* or *very satisfied* with the program overall (Figure 82), a slight decrease from the overall satisfaction reported in 2020 (98%). SBDI respondents were the most satisfied, with 90% reporting to be *very satisfied*, followed by Custom respondents (85%) and New Construction respondents (63%) reporting they were *very satisfied*. The least satisfied respondents were Prescriptive participants, who reported an overall 64% *very satisfied*, 31% *somewhat satisfied*, 2% *neither satisfied nor dissatisfied*, 2% *somewhat dissatisfied*, and 2% *very dissatisfied*.

FIGURE 82. OVERALL SATISFACTION WITH PROGRAM



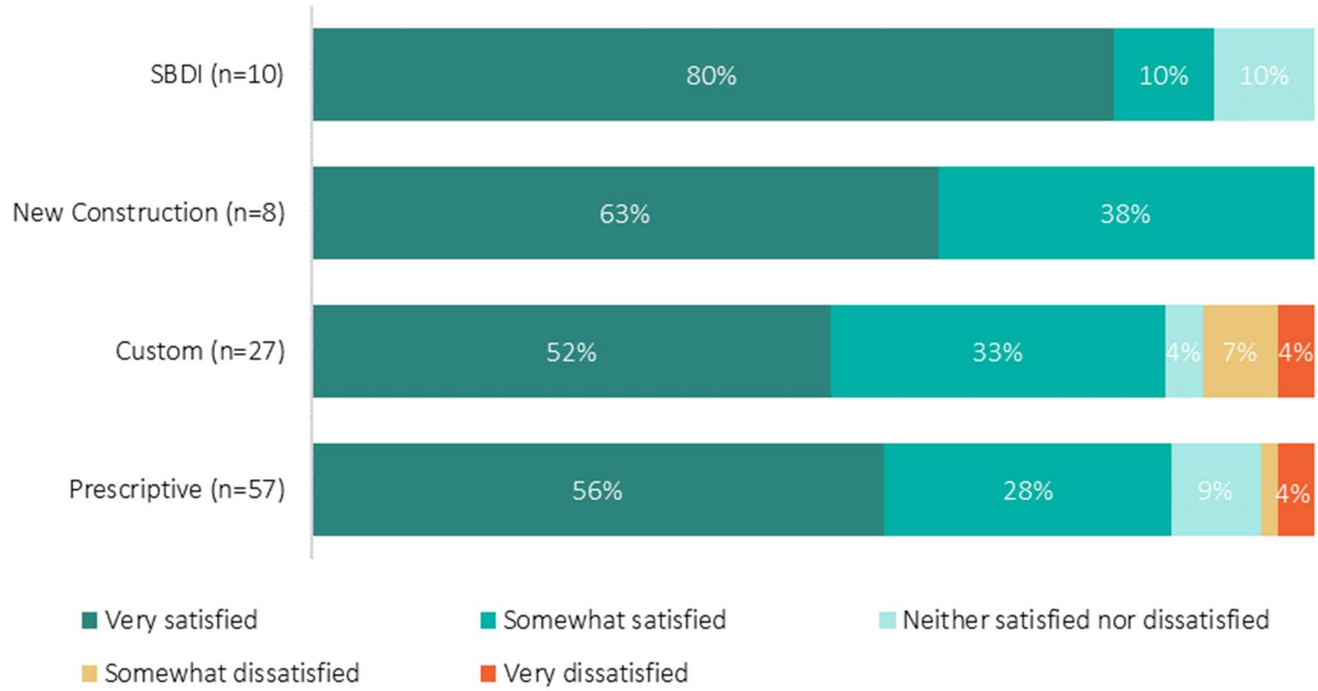
Source: Survey Question H2: "How satisfied are you with NIPSCO´s program overall? Would you say you are…:" Single response allowed.

Further, respondents who said they were *somewhat dissatisfied* or *very dissatisfied* with the program (2%), stated they were dissatisfied with the program for the following reasons:

- "We have not received any real discount on our electric bill." (n=1)
- "They [NIPSCO] are set in their ways not flexible, they don't do anything different." (n=1)

Participation satisfaction with NIPSCO as a service provider observed a decline in 2021. Eighty-six percent of respondents said they were either *somewhat satisfied* or *very satisfied* with NIPSCO overall (Figure 83). This is a statistically significant decrease from the overall satisfaction with NIPSCO reported in 2020 (95%). New Construction participants were the most satisfied with NIPSCO, with 100% respondents saying they were either *somewhat satisfied* or *very satisfied* with NIPSCO as their service provider, followed by SBDI participants (90%), Custom participants (85%), and Prescriptive participants (85%). Satisfaction with NIPSCO dropped for the two programs that were evaluated in 2020, Prescriptive and Custom. In 2020, 95% of Prescriptive respondents were *somewhat satisfied* or *very satisfied* with NIPSCO overall, this is a statistically significant difference. Custom participants satisfaction with NIPSCO also dropped, from 96% in 2020 to 85% in 2021, however this difference is not statistically significant.

FIGURE 83. OVERALL SATISFACTION WITH NIPSCO

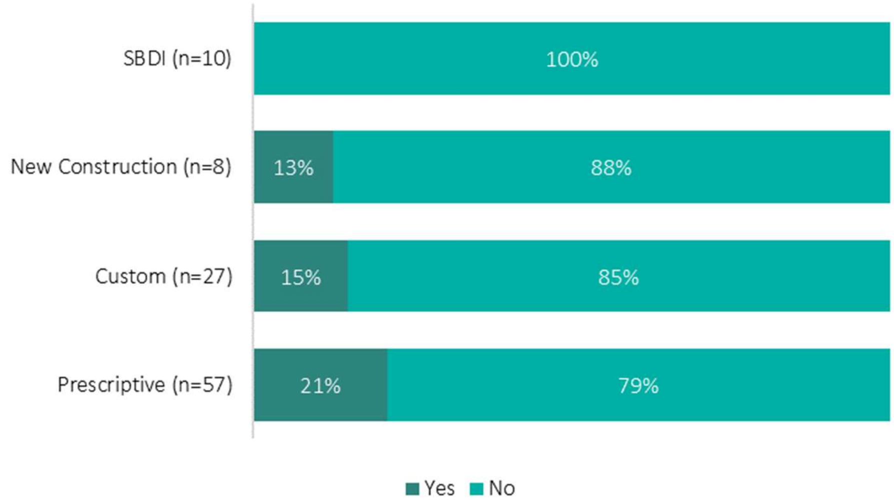


Source: Survey Question H7: "How satisfied are you with NIPSCO overall as your organization´s utility service provider? Would you say you are:" Single response allowed.

A relatively low percentage of respondents said they experienced challenges while participating in the program (17%). Figure 84 breaks down customers reporting challenges by program. Among these respondents, completing the application was the most common issue cited (24%), followed by confusion on who to contact for information or navigating the program (24%). Other challenges included the following:

- Paperwork hard to fill out. (n=3)
- "Some of the bulbs were broken and they did not replace them." (n=1)
- "We had to sometimes send information multiple times because it was lost or misplaced." (n=1)

FIGURE 84. CUSTOMERS REPORTING CHALLENGES



Source: Survey Question H4: "Did you experience any challenges participating in the program?"
Single response allowed.

Respondents who expressed that they faced challenges with the program were asked what NIPSCO could have done to help them overcome those challenges; most said simplifying the application process (47%). This was followed by providing higher incentives (18%) and providing more technical and engineering support (12%). Some respondents specifically mentioned the following items:

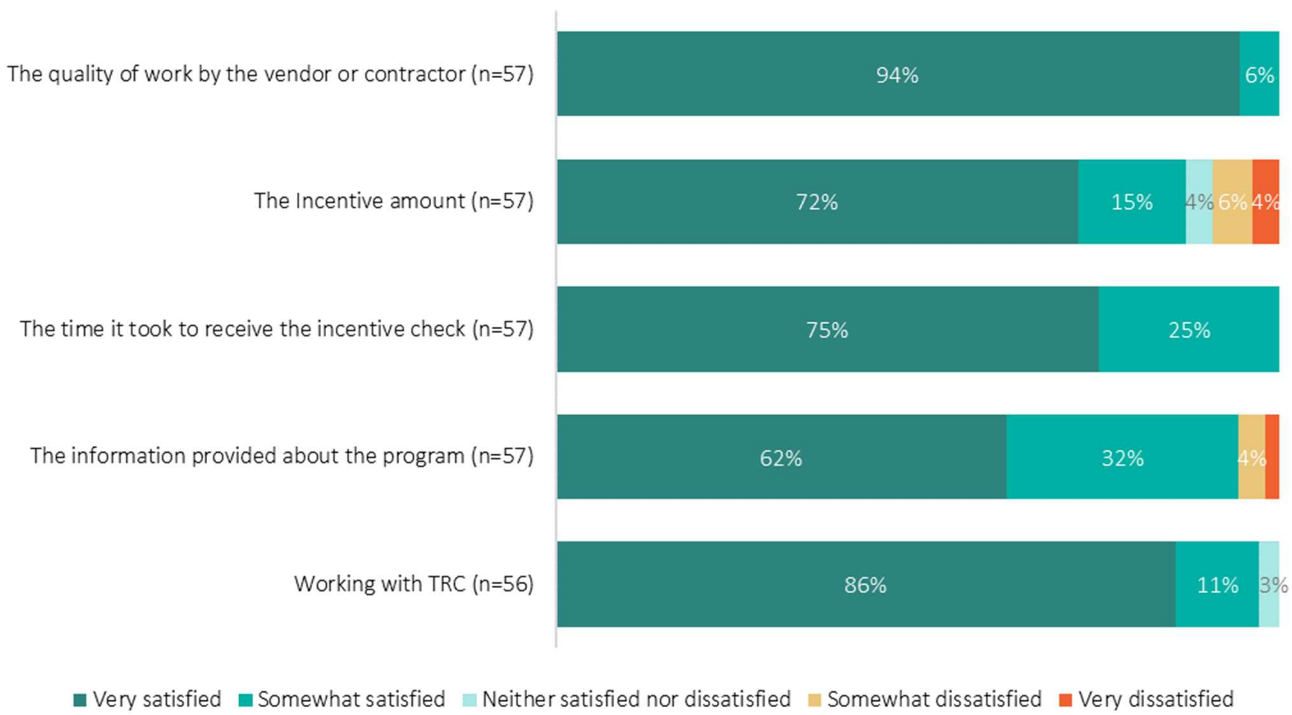
- "Have more vendors that we can work with through our bid process."
- "Keeping better track of information provided."
- "Providing more flexibility."
- "Following up."

The team also asked survey respondents whether there was anything NIPSCO could have done to improve their overall experience with the program. Most said there was nothing NIPSCO could have done (71%). The remaining respondents said NIPSCO could have provided more and better communication (12%), simplify the application process and faster application approval (3% each), and provide higher incentives and offer more technical assistance on projects (2% each).

PARTICIPANT SATISFACTION – PRESCRIPTIVE PROGRAM

Although respondents were generally satisfied with each of the Prescriptive program components, with at least 87% of respondents rating their satisfaction as either *very satisfied* or *somewhat satisfied* to each question (Figure 85), satisfaction with the program has dropped from 2020. In 2020, 79% of respondents were *very satisfied* with the Prescriptive program, whereas 64% reported to be *very satisfied* in 2021 (this difference is statistically significant). Based on the percentage of *very satisfied* or *somewhat satisfied* responses, respondents were most satisfied with the time it took to receive the incentive check (100%) and the quality of work by the vendor or contractor (100%), followed by the incentive amount itself (87%). The greatest year-over-year change in satisfaction (*somewhat satisfied* or *very satisfied*) with a component of the Prescriptive program, was satisfaction with the incentive amount, which decreased from 99% in 2020 to 87% in 2021. Respondents only cited two program components as *somewhat dissatisfied* or *very dissatisfied:* the incentive amount (10%) and information provided by the program (6%, n=3). As seen in the NTG results, the incentive amount is influential for the Prescriptive respondents (50 of 56 reported as being *very important*). While 87% of Prescriptive respondents reported to be *very satisfied* or *somewhat satisfied* with the incentive amount, 10% reported being *very dissatisfied* or *somewhat dissatisfied* with the incentive amount. Of the 12 Prescriptive participants who reported experiencing challenges in the program, two reported that higher incentives would help them to overcome those challenges. When describing their challenges, one respondent reported, "When I spend $300,000 it would be nice to for them to give the $10,000 because of the added steps we do and the quality of upgrade we do."

FIGURE 85. SATISFACTION WITH PRESCRIPTIVE PROGRAM PROCESSES

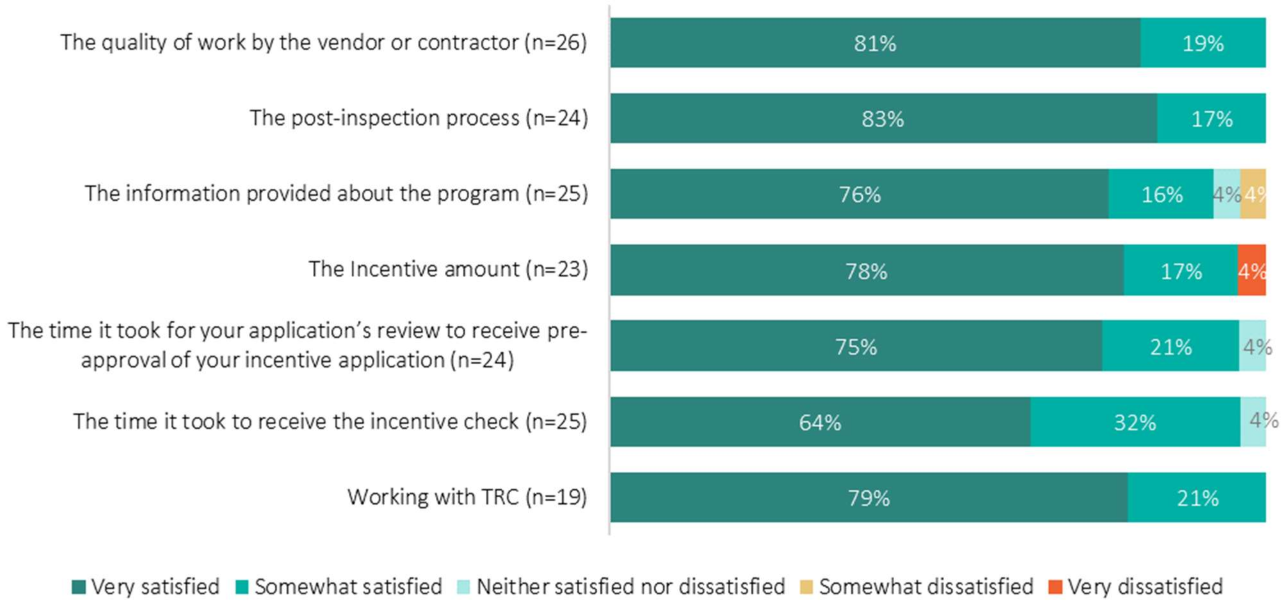


Source: Survey Question H1.1 through H1.7: "Next, I would like to ask you about some different components of the [PROGRAM] program. Please rate your level of satisfaction with each of these components as being very satisfied, somewhat satisfied, neither satisfied nor dissatisfied, somewhat dissatisfied, or very dissatisfied. If something is not applicable to you, please say so. How would you rate your satisfaction with…" Single response allowed.

PARTICIPANT SATISFACTION – CUSTOM PROGRAM

Respondents were generally satisfied with each of the Custom program processes, with at least 92% of respondents rating their satisfaction as either *very satisfied* or *somewhat satisfied* to each question (Figure 86). For three questions (satisfaction with working with TRC, satisfaction with the post-inspection process, and satisfaction with the quality of work by the vendor or contractor) 100% of respondents said they were either *very satisfied* or *somewhat satisfied*. Based on the percentage of *very dissatisfied* responses, respondents were least satisfied with the incentive amount (4%), followed by the information provided about the program, which received 4% of *somewhat dissatisfied* responses.

FIGURE 86. SATISFACTION WITH CUSTOM PROGRAM PROCESSES



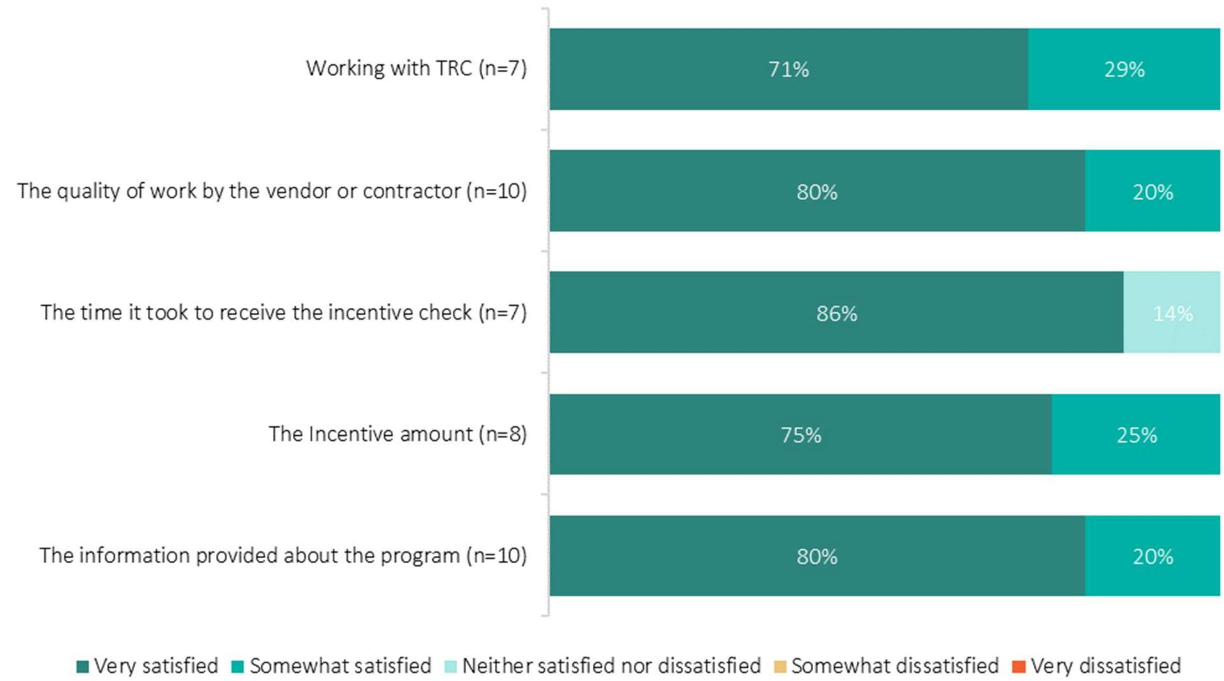
Source: Survey Question H1.1 through H1.7: "Next, I would like to ask you about some different components of the [PROGRAM] program. Please rate your level of satisfaction with each of these components as being very satisfied, somewhat satisfied, neither satisfied nor dissatisfied, somewhat dissatisfied, or very dissatisfied. If something is not applicable to you, please say so. How would you rate your satisfaction with…" Single response allowed.

PARTICIPANT SATISFACTION – SBDI PROGRAM

SBDI respondents were *very satisfied* with the program overall. In addition, SBDI respondents found the audit process *very important* for equipment selection, with 70% stating they received a walk-through audit or assessment on their facility to identify energy-saving opportunities. When asked what information they received because of the audit, respondents reported items such as getting their equipment checked (n=3). All participants found the audit process selection *very important* (86%) or *somewhat important* (14%) for their equipment selection. When asked what information they received because of the audit, three respondents said factors related to equipment check, two said cost estimation, one said the anticipated payback, and one said the education they received with the engineering study. Furthermore, 86% of respondents said the audit process was *very important* in their equipment selection and 14% said the audit was *somewhat important* in their equipment selection.

In four out of the five processes evaluated in the SBDI program—the information provided, the incentive amount, the quality of work by the vendor or contractor, and working with TRC—100% of the respondents said they were *very satisfied* or *somewhat satisfied* (Figure 87). Respondents did not report being *somewhat dissatisfied* or *very dissatisfied* with any of the processes evaluated. As noted above, for this program, sample sizes were small and should be interpreted as such.

FIGURE 87. SATISFACTION WITH SBDI PROGRAM PROCESSES



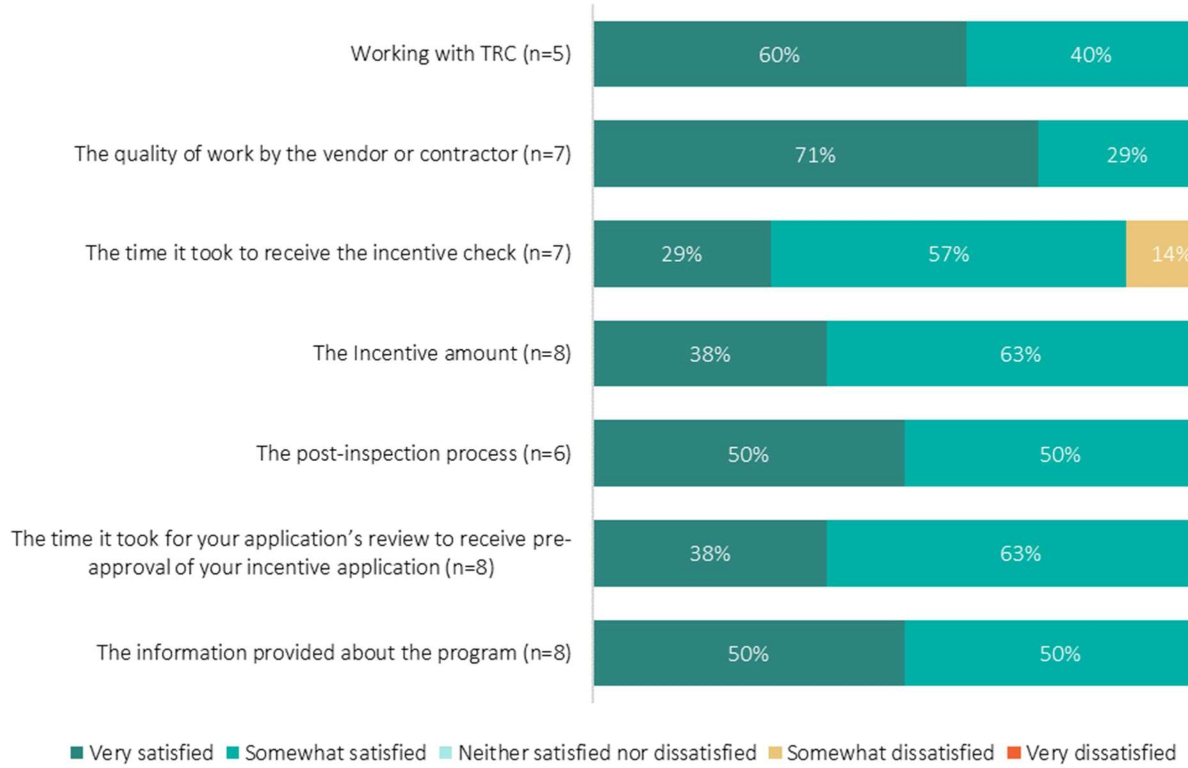
Source: Survey Question H1.1 through H1.7: "Next, I would like to ask you about some different components of the [PROGRAM] program. Please rate your level of satisfaction with each of these components as being very satisfied, somewhat satisfied, neither satisfied nor dissatisfied, somewhat dissatisfied, or very dissatisfied. If something is not applicable to you, please say so. How would you rate your satisfaction with…" Single response allowed.

PARTICIPANT SATISFACTION – NEW CONSTRUCTION PROGRAM

Most New Construction respondents joined the program before (38%) or during the project design process (25%). One respondent joined the program after the design was completed but before construction began (13%), one after construction began but before construction was completed (13%), and one after construction was completed (13%). When asked about how the program aligned with their expectations, 38% of the New Construction respondents said that it completely aligned, and 63% said that it mostly aligned with their expectations. Those who said that the program mostly aligned with their expectations offered mixed explanations of why they thought that: two said the program doing what it advertised, and one said conversations with the TRC staff were helpful. However, two respondents said they had difficulty understanding all the information they received.

New Construction respondents reported overall satisfaction with the program processes. Except for the time that it took to receive the incentive, 100% of respondents said they were *very satisfied* or *somewhat satisfied* with the program (Figure 88). One respondent (14%) was *somewhat dissatisfied* with the time it took to receive the incentive check. As noted above, for this program, sample sizes were small and should be interpreted as such.

FIGURE 88. SATISFACTION WITH NEW CONSTRUCTION PROGRAM PROCESSES



Source: Survey Question H1.1 through H1.7: "Next, I would like to ask you about some different components of the [PROGRAM] program. Please rate your level of satisfaction with each of these components as being very satisfied, somewhat satisfied, neither satisfied nor dissatisfied, somewhat dissatisfied, or very dissatisfied. If something is not applicable to you, please say so. How would you rate your satisfaction with…" Single response allowed.

CONCLUSIONS AND RECOMMENDATIONS

CONCLUSION 1: MOST PROGRAMS EXPERIENCED A DECREASE IN CUSTOMER PARTICIPATION AND ACHIEVED SAVINGS FROM 2020, AND SUBSEQUENTLY THE C&I PORTFOLIO DID NOT MEET SAVINGS GOALS.

Cumulatively, the C&I portfolio achieved 52% of its electric savings goal and 68% of its gas savings goal. To gain a better understanding of where to target incentives and marketing, the evaluation team compared participation in the 2021 C&I programs to the 2020 and 2019 programs. Specifically, the team reviewed customer participation, electric savings impact, gas saving impact, and total MMBTU savings impact and concluded the following:

- The New Construction program experienced significant growth in 2021 over 2020, increasing *ex ante* kWh savings by 75%, and building on the modest growth in 2020 from 2019.
- The Prescriptive and Custom programs achieved approximately 20% less kWh savings in 2021 as compared to 2020.
- The SBDI program achieved significantly lower gas savings in 2021 as compared to 2020. 2021 electric savings increased by 25% from 2020.

- The SBDI program had significantly lower customer participation in 2021 and 2020 compared to 2019. Customer participation count in 2021 and 2020 was the same (117 and 116 customers, respectively).
- Customer participation counts in the Prescriptive and New Construction programs fell by 10% in 2021 as compared to 2020.
- Customer participation count in the Custom program grew by 23% in 2021 as compared to 2020.

It is likely that COVID-19 affected participation, which is largely out of NIPSCO's ability to control. The data obtained from the customer survey indicated that customers are still feeling the effects of the pandemic (63%, n=64), which could be affecting customer willingness and ability to support business capital investments.

Recommendations:

- For New Construction and Prescriptive programs, closely monitor savings and participation trends throughout 2022 to determine if this trend will persist and identify whether program strategies, such as bonus incentives to trade allies, could help boost participation throughout the year.
- The SBDI program experienced lower than anticipated participation year over year. Small businesses experience unique challenges, which were likely exacerbated by COVID-19. A market study focused on SBDI may be valuable to identify participation and savings potential, reasons for lower than targeted savings, and opportunities to boost participation.

CONCLUSION 2: WASTE HEAT FACTORS WERE NOT APPLIED CONSISTENTLY ACROSS THE PORTFOLIO.

Currently, C&I programs do not capture WHF therm penalties. The 2015 Indiana TRM (v2.2), along with most other state TRMs, include WHFs to capture interactive effects that lighting upgrades have on the building HVAC systems. These waste heating effects have real effects on the energy consumption of buildings and should be included in the application calculation tool. Going forward, both NIPSCO and the evaluation team plan to address WHF therm penalties within program cost-effectiveness on the electric side.

Recommendations:

- To be consistent across the portfolio, NIPSCO should calculate WHFs for all C&I programs going forward in *ex ante* savings calculations, so these factors can be included in cost-effectiveness and future planning. To do this, NIPSCO should take the following steps:
    1. Add extra inputs into the applicable section of the application tool to determine how each area is heated or cooled, per Appendix B of the 2015 Indiana TRM (v2.2). There is a "space conditioning type" variable in the "Project Information" tab of the application, but some areas may be conditioned differently (i.e., warehouses with an attached office area).
    2. Add functionality to the application to look up the electricity, demand, and natural gas WHFs based on the project site location and the method of heating and cooling.
    3. Modify kWh, kW, and therm calculation methodologies in the application Excel tool to include these WHFs.
    4. Track fuel type by customer to accurately capture applicable WHFs for electric-only versus dual fuel customers.

CONCLUSION 3: DEEMED VALUES ARE FREQUENTLY USED FOR CUSTOM VFD MEASURES.

The energy and demand savings from VFDs are strongly tied to site-specific loading and operating hour factors. Deemed values result in high variation of energy savings, depending on the application of the VFD. As a result, a one-size-fits-all deemed factor results in a high variation in realization rates for this program. Specifically, applications like process VFD in the Custom program require some customized inputs. Smaller prescriptive VFDs, particularly applied to HVAC functions, might receive lower priority for additional inputs.

Recommendations:

- For Custom applications, do not rely on a single deemed value. Modify the application tool as follows:
    - Add inputs for average operating speed and baseline control and use these inputs to determine controlled load factors for the baseline and VFD motors.
    - Add a field for application (heating, cooling, ventilation, process, and other). Generally, the CF will be zero for cooling because the motors are fully loaded and zero for heating applications because the motors will be off during the utility peak period.
    - Accept operating hours for the motor.
    - Use other TRM hybrid calculators for support

CONCLUSION 4: NIPSCO DOES NOT HAVE ESTABLISHED M&V PROTOCOLS FOR LARGE OR CUSTOM PROJECTS, LEADING TO INCONSISTENT VERIFICATION OF SAVINGS.

Measures that are projected to have impactful savings to a program or measure group should receive more individualized attention to determine how savings will be estimated prior to project approval and verified after project completion.

Recommendations:

- Develop an M&V protocol to ensure measures projected to result in large or uncertain savings have adequate collected data to support savings claims. Possible inclusions for the protocols have been discussed in the body of the report.

CONCLUSION 5: THE MAIN BARRIER PARTICIPANTS FACED IN INSTALLING ENERGY-EFFICIENT EQUIPMENT WAS HIGH INITIAL COST, BUT OTHER FACTORS WERE ALSO IMPORTANT.

High initial cost was overall the primary barrier to participants installing energy-efficient equipment (33% in aggregate). However, for Custom participants, the primary barrier was understanding potential areas of improvement or lack of technical knowledge (22%). For SBDI participants, lack of awareness about the incentives was also a primary barrier (30%).

Recommendations:

- While increasing incentives addresses the main barrier to energy efficiency, increasing the incentives alone will not fully address the barriers customers face. To fully address those barriers, providing more comprehensive technical and engineering support, particularly to Custom and SBDI program participants, will provide more tools to participants to overcome energy efficiency barriers.

CONCLUSION 6: THERE MAY BE SIGNIFICANT POTENTIAL FOR HVAC PARTICIPANTS IN THE COMING YEARS.

Most participants who did not participate in the programs through an HVAC measure indicated they were likely to replace their HVAC equipment in the next five years (63%), and for 42% of those participants, a rebate of $1,000 or less would be enough for them to select high-efficiency equipment. This may indicate a high potential for current participants to participate in NIPSCO programs again in the future with HVAC measures.

Recommendations:

- Leverage past participants when considering marketing campaigns, particularly participants who only participated with one measure type.

16. COMMERCIAL AND INDUSTRIAL (C&I) ONLINE MARKETPLACE PROGRAM

PROGRAM DESIGN AND DELIVERY

The Commercial and Industrial (C&I) Online Marketplace program is a new offering to NIPSCO's portfolio and was launched in late December of 2020, with a full ramp up in 2021. This program provides instant discounts on energy-saving kits ordered through an online store. The intent of the program is to help remove the financial barrier associated with the initial cost of these energy-efficient alternatives. This program is implemented by TRC, who partners with TechniArt to implement the Online Marketplace. TechniArt is responsible for building, hosting, and maintaining the C&I Online Marketplace website, verifying customer accounts, handling customer orders, shipping products to customers and answering customer questions and concerns.

In 2021, NIPSCO offered kits to C&I customers at no cost. To participate, customers visit the online store website, add the kits they would like to receive to their shopping cart, and provide their account information at checkout. TechniArt then ships the kits 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 264 lists the measures offered through the C&I Online Marketplace. A single customer account can order up to five kits (any combination) in a calendar year. The Restaurant, Office and Retail kits were initially released in January 2021, the Lighting Add-On kits were added to the C&I Online Marketplace in late December 2021.

TABLE 264. 2021 C&I ONLINE MARKETPLACE KIT CONTENTS AND SUMMARY METRICS

PRODUCTS	QTY	RETAIL VALUE	EUL	*EX ANTE* KWH SAVINGS	*EX ANTE* KW SAVINGS	*EX ANTE* THERMS SAVINGS *(DUAL FUEL ONLY)*
Restaurant Kit (650000 & 650003)						
LED Filament A19 Bulb Model FA19D6027EC or LA19727DCFIL9	12	$17.40	3	1,790.27	0.381	-
LED Filament Candle E12 Bulb Model FB11D4027EE12C	6	$10.44	3	537.08	0.114	-
LED Exit Sign Retrofit Model 20715	2	$30.00	5	46.86	0.005	-
Power Pre-Rinse Spray Valve Model N2180 1.1 GPM	1	$25.00	5	42.01	-	6.23
Bathroom Aerator Model N3115P 1.0 GPM	2	$4.00	10	31.09	0.003	5.15
Kitchen Aerator Model N3115P 1.5 GPM	1	$3.00	10	35.62	0.004	6.23

PRODUCTS	QTY	RETAIL VALUE	EUL	*EX ANTE* KWH SAVINGS	*EX ANTE* KW SAVINGS	*EX ANTE* THERMS SAVINGS *(DUAL FUEL ONLY)*
Retail Kit (650001 & 650004)						
LED A19 (60W) Bulb Model L60A19D1527KUT	6	$8.70	5	553.24	0.154	-
LED Filament BR30 Bulb Model LED9BR30D50K Daylight	12	$42.36	9	1,806.15	0.503	-
LED Exit Sign Retrofit Model 20715	2	$30.00	5	48.60	0.005	-
Tier 1 Advanced Power Strip Model TS1104	1	$5.00	7	42.76	-	-
Bathroom Aerator Model N3210B-PC 1.0 GPM	2	$4.00	10	8.95	0.001	1.48
Office Kit (650002 & 650005)						
LED A19 (60W) Bulb Model L60A19D1527KUT	6	$8.70	5	571.68	0.110	-
LED Filament BR30 Bulb Model LED9BR30D50K Daylight	10	$35.30	8	1,555.31	0.300	-
LED Exit Sign Retrofit Model 20715	2	$30.00	5	47.73	0.003	-
LED Desk Lamp Model 31710	1	$1.45	12	61.09	0.012	-
Tier 1 Advanced Power Strip Model TS1104	1	$5.00	7	44.82	-	-
Bathroom Aerator Model N3210B-PC 1.0 GPM	2	$4.00	10	6.13	0.002	1.02
Kitchen Aerator Model N3115P 1.5 GPM	1	$3.00	10	7.03	0.002	1.23
LED Tube Add on Kit (650006 & 650008)						
LED T8 linear Model LT814840G9	25	$174.75	15	918.26	0.219	-
A19 LED Add on Kit (650007 & 650009)						
LED Filament A19 Bulb Model L60A19D1527KUT	24	$17.40	5	2,286.73	0.221	-

PROGRAM PERFORMANCE

In 2021, the C&I Online Marketplace program team was able to examine the full 12-month program year of data, which allowed our team to capture the impact of the two add-on lighting kits, initially distributed in November 2021. The impact evaluation, and corresponding sections in this report, included the full year of data and the evaluation team developed all metrics based on 12 months of program operation. To meet the new timelines for the evaluation reporting, the process analysis used 11 months (January 1 to November 30, 2021) of customer data instead of the full calendar year. The customer survey was issued to customers who participated in the program during that 11-month span.

The C&I Online Marketplace program fell short of its goals, achieving 64% of electric energy savings, 77% of peak demand savings, and 12% of natural gas therm savings. While the program did not meet its goals, many programs do experience a ramp up period in their first year, while awareness and engagement builds. The COVID-19 pandemic did also continue to impact businesses in 2021, which may have also impacted participation

Table 265 summarizes savings for the full year of program performance, including program savings goals.

TABLE 265. 2021 C&I ONLINE MARKETPLACE PROGRAM SAVING SUMMARY

METRIC	GROSS SAVINGS GOAL	*EX ANTE*	AUDITED	VERIFIED	*EX POST* GROSS	*EX POST* NET	GROSS GOAL ACHIEVEMENT
Electric Energy Savings (kWh/yr.)	4,517,914.09	3,028,812.58	3,028,815.93	2,862,663.27	2,885,914.04	2,614,453.06	64%
Peak Demand Reduction (kW)	955.286	623.442	646.718	601.681	734.020	663.271	77%
Natural Gas Energy Savings (therms/yr.)	32,495.85	3,571.39	3,628.10	3,694.32	3,977.52	3,935.06	12%

Table 266 outlines the *ex post* gross and net-to-gross (NTG) adjustment factors. The evaluation team developed these values by analyzing survey data collected from the 2021 C&I Online Marketplace customer population, as described in the *Ex Post* Gross Savings section.

TABLE 266. 2021 C&I ONLINE MARKETPLACE PROGRAM ADJUSTMENT FACTORS

METRIC	REALIZATION RATE[a]	FREERIDERSHIP	SPILLOVER	NTG[b]
Electric Energy Savings (kWh/yr.)	95%	10%	1%	91%
Peak Demand Reduction (kW)	118%	11%	1%	90%
Natural Gas Energy Savings (therms/yr.)	111%	2%	1%	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.

NIPSCO spent 77% of the electric program budget and 34% of the natural gas program budget. The proportion of spending aligns closely to the achievement of electric savings goals (77% of budget spent, 64% of goal savings achieved). The proportion of spending to achievement of gas goals is not as well aligned (34% of budget spent, 12% of savings goals achieved). Table 267 lists the 2021 C&I Online Marketplace program budget and expenditures by fuel type.

TABLE 267. 2021 C&I ONLINE MARKETPLACE PROGRAM EXPENDITURES

FUEL	PROGRAM BUDGET	PROGRAM EXPENDITURES	BUDGET SPENT
Electric	$293,713.02	$224,707.44	77%
Natural Gas	$16,458.50	$5,540.38	34%

EVALUATION METHODOLOGY

To inform the impact and process evaluation of the 2021 C&I Online Marketplace program, the evaluation team completed the following research activities:

- Program staff interviews and discussions, to understand program design and delivery.
- Documentation and materials review, to provide context on program design and implementation.

- **Tracking data audit**, to audit and verify the accuracy of program participation data.
- **Engineering analysis**, to audit the calculation methodology and assumptions that form the measure savings for each C&I Online Marketplace kit component, which also informs the realization rates for the kit components.
- **Participant survey**, to provide feedback on areas for program improvement and data on freeridership, in-service rate (ISR), spillover, NTG, awareness, motivations, perceptions, experience, and satisfaction with the program.

IMPACT EVALUATION

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

- What assumptions were used to develop deemed savings estimates? Are there any updates that should be made? Do claimed savings algorithms align with the 2015 Indiana Technical Reference Manual (TRM) version 2.2 (v2.2), NIPSCO's measure savings database, or other more appropriate secondary sources?[62] Are there any updates that should be made?
- What are *ex post* program savings? Do these suggest any needed updates to program design, delivery, or savings assumptions?
- What are installation rates for kit measures? Are there certain measures that are installed most often? Least often?
- How effective was the program in influencing customer decision making (net savings)?
- Is the program on track to meet its participation and savings goals?

For all measure types, the evaluation team compared its engineering calculations to NIPSCO's *ex ante* savings, basing its savings methodologies and inputs for each measure on several sources: standard engineering practices, the 2015 Indiana TRM (v2.2), NIPSCO's measure savings database, and other secondary TRM sources, including the Illinois TRM v9.0.[63]

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 kits quantity.** Reviewed program tracking data provided by the implementer and audited the number of kits distributed.
- **Confirmed measure-level savings calculations.** Reviewed per-measure and per-kit savings calculations in the documentation provided by NIPSCO.
- **Reviewed savings estimates.** Confirmed program-level total savings reported in the scorecard.

[62] Cadmus. July 28, 2015. *Indiana Technical Reference Manual Version 2.2 (v2.2).*
[63] September 25, 2020. *Illinois Statewide Technical Reference Manual for Energy Efficiency Version 9.0*

AUDITED QUANTITY OF KITS

Table 268 shows the number of reported and audited kits distributed through the C&I Online Marketplace program in 2021. The evaluation team checked reported scorecard values against the program tracking data and found that kit quantities aligned. The program rebated a total of 1,410 kits of varying types.

TABLE 268. 2021 C&I ONLINE MARKETPLACE AUDITED KIT QUANTITY

KIT TYPE	MEASURE ID	SCORECARD	TRACKING DATA
Dual Fuel Kit – Restaurant	650000	131	131
Dual Fuel Kit – Retail	650001	196	196
Dual Fuel Kit – Office	650002	432	432
Electric Only Kit – Restaurant	650003	41	41
Electric Only Kit – Retail	650004	107	107
Electric Only Kit – Office	650005	188	188
Dual Fuel Kit – Restaurant Rev 1	650006	0	0
Electric Only Kit – Restaurant Rev 1	650007	0	0
LED Tube - Add-On Pack	650008	209	209
A19 Add-On Pack	650009	106	106
Total		1,410	1,410

MEASURE AND KIT SAVINGS REVIEW

The evaluation team reviewed the measure and kit savings documentation (file titled: NIPSCO Commercial Product and Kit Quote w Calcs_REVISED), which contained measure-level and kit-level savings.[64] Importantly, NIPSCO included ISR values from other programs' past EM&V efforts in their *ex ante* assumptions for the kit program. The program documentation included rates to adjust savings for both in-service practices and water heater fuel saturation.

Upon review of this document, the evaluation team found that measure-level savings values in the tracking data mostly aligned with NIPSCO's kit savings documentation and reported kWh savings aligned with calculated values. However, the team identified a few calculation or rounding errors, described below:

- Demand savings for the A19 Add-On Pack was incorrectly reported as 0.221 kW demand savings. This value was incorrectly hardcoded in the provided calculations, but actively calculated to 0.441 kW demand savings.
- Therm savings from kitchen aerators differed between reported and calculated savings, which affected the total therm savings in the Dual Fuel Restaurant kit and Dual Fuel Office kit.
- Like other kit programs, program tracking data savings were reported at the kit-level with a rounded total kit value, and savings in NIPSCO's Measure Calculation file were reported at the measure level with unrounded per-measure values. This difference resulted in a rounding discrepancy, meaning that the sum of total measure savings was slightly off from the tracking data savings at the kit-level. The difference in kW demand reduction is within a hundredth of a decimal place (0.050 kW). The difference in kWh savings

[64] TRC Companies. October 2021. *NIPSCO Commercial Product and Kit Quote w Calcs_REVISED*

is 1.20 kWh. The difference in therms savings is greater, at 4.55 therms. These rounding discrepancies are noted, where applicable, within table notes in the remainder of this report.

Table 269 shows the comparison between reported savings values in the program tracking data compared against provided savings calculations. The values reported are for a single kit, and do not represent the entire Online Marketplace population.

TABLE 269. 2021 C&I ONLINE MARKETPLACE PROGRAM AUDITED PER-KIT SAVINGS

KIT TYPE	*EX ANTE* SAVINGS			AUDITED SAVINGS		
	KWH	KW	THERMS	KWH	KW	THERMS
Dual Fuel Kit – Restaurant	2,482.93	0.508	17.61	2,482.94	0.508	18.03
Dual Fuel Kit – Retail	2,459.70	0.663	1.48	2,459.70	0.663	1.48
Dual Fuel Kit – Office	2,293.79	0.429	2.24	2,293.79	0.429	2.26
Electric Only Kit – Restaurant	2,482.93	0.508	-	2,482.94	0.508	-
Electric Only Kit – Retail	2,459.70	0.663	-	2,459.70	0.663	-
Electric Only Kit – Office	2,293.79	0.429	-	2,293.79	0.429	-
LED Tube - Add-On Pack - Dual Fuel	918.26	0.219	-	918.26	0.219	-
Add-On Pack - Dual Fuel	2,286.73	0.221	-	2,286.73	0.441	-
LED Tube - Add-On Pack - Electric Only	918.26	0.219	-	918.26	0.219	-
Add-On Pack - Electric Only	2,286.73	0.221	-	2,286.73	0.441	-

VERIFIED IN-SERVICE RATE

The evaluation team calculated verified savings using in-service rate (ISR) values obtained by surveying the C&I Online Marketplace customer base. The evaluation team surveyed all customers that received a kit between January 18, 2021, and November 30, 2021, and received responses from 54 customers. To determine ISR, the customers were asked how many units of each measure they installed from the kits they specifically received. Aside from ISR modifications, all other savings calculation methodologies were held constant between *ex ante* and verified savings calculations.

To account for LED lamps currently stored for future use, the evaluation team calculated carryover savings for the LEDs included in the Retail, Office, and Restaurant kits. The evaluation team used the recommended Uniform Methods Project's (UMP's) recommended Discount Future Savings method to calculate carryover savings.[65] This approach is typically used for residential programs, but the evaluation team determined that it was appropriate to apply to the small business sector as well. This method assumes most bulbs placed in storage (up to 97%) are installed within four years (including the initial program year), with 24% of bulbs left over from the first year of the program installed in the second year, 24% in the third year, and so on. However, given expected baseline lighting changes mandated by the Energy Independence and Security Act (EISA) of 2007, all standard LEDs are anticipated to function as baseline lamps. Thus, the evaluation team did not extend general service lamp baseline savings beyond 2022, the second program year in the UMP-recommended method.

The program released the two lighting Add-On kits in late December, and because of the timing, the customer survey did not include any customers or questions regarding the Add-On Linear Tube and Add-On A Shape Bulb kits.

[65] National Renewable Energy Laboratory. 2017. *UMP Chapter 6: Residential Lighting Evaluation Protocol.* https://www.nrel.gov/docs/fy17osti/68562.pdf

Therefore, the ISRs the evaluation team used to calculate verified savings for Add-On kits were unaltered from the *ex ante* ISRs, as these appeared to be reasonable assumptions.

Across measures, verified ISRs varied relatively widely when compared to *ex ante* assumptions. For some measures, like A19 and BR30 LEDs included in the kits, ISRs measured in evaluation surveys were relatively close to the *ex ante* assumptions. The evaluation team found somewhat lower ISRs for candelabra bulbs, and LED Exit signs had the lowest ISRs, with only 18% of measures installed. However, across all water-saving devices, as well as advanced power strips, the evaluation team found higher ISRs than assumed *ex ante*. Table 270 lists the *ex ante* and verified ISRs and resulting verified savings for measures included in each kit.

TABLE 270. 2021 C&I ONLINE MARKETPLACE PROGRAM IN-SERVICE RATE BY MEASURE

KIT MEASURES	QUANTITY PER KIT	*EX ANTE* ISR	VERIFIED ISR	VERIFIED SAVINGS PER KIT KWH	KW	THERMS *(DUAL FUEL ONLY)*
Restaurant Kit (650000 & 650003)						
LED Filament A19 Bulb	12	83%	76%	1,649.22	0.351	-
LED Filament Candle E12 Bulb	6	83%	59%	384.09	0.082	-
LED Exit Sign Retrofit	2	83%	18%	10.05	0.001	-
Power Pre-Rinse Spray Valve	1	30%	33%	89.12	-	4.63
Bathroom Aerator	2	25%	42%	100.64	0.011	6.93
Kitchen Aerator	1	29%	42%	99.36	0.011	4.69
Retail Kit (650001 & 650004)						
LED A19 (60W) Bulb	6	83%	76%	509.65	0.142	-
LED Filament BR30 Bulb	12	83%	75%	1,641.96	0.457	-
LED Exit Sign Retrofit	2	83%	18%	10.42	0.001	-
Tier 1 Advanced Power Strip	1	40%	83%	88.41	-	-
Bathroom Aerator	2	25%	42%	28.98	0.003	2.00
Office Kit (650002 & 650005)						
LED A19 (60W) Bulb	6	83%	76%	526.64	0.102	-
LED Filament BR30 Bulb	10	83%	75%	1,413.92	0.273	-
LED Exit Sign Retrofit	2	83%	18%	10.24	0.001	-
LED Desk Lamp	1	83%	98%	72.74	0.014	-
Tier 1 Advanced Power Strip	1	40%	83%	92.67	-	-
Bathroom Aerator	2	25%	42%	19.85	0.005	1.37
Kitchen Aerator	1	29%	42%	19.60	0.005	1.35
LED Tube Add-on Kit (650008)						
LED T8 linear	25	83%	83%	918.26	0.219	-
A19 LED Add-on Kit (650009)						
LED Filament A19 Bulb	24	83%	83%	2,286.73	0.441	-

Table 271 shows the comparison between the *ex ante* and verified savings. The values reported are for a single kit and do not represent the entire Online Marketplace population.

TABLE 271. 2021 C&I ONLINE MARKETPLACE PROGRAM VERIFIED PER-KIT SAVINGS

KIT TYPE	*EX ANTE* SAVINGS			VERIFIED SAVINGS		
	KWH	KW	THERMS	KWH	KW	THERMS
Dual Fuel Kit – Restaurant	2,482.93	0.508	17.61	2,332.48	0.456	16.25
Dual Fuel Kit – Retail	2,459.70	0.663	1.48	2,279.41	0.604	2.00
Dual Fuel Kit – Office	2,293.79	0.429	2.24	2,155.65	0.400	2.72
Electric Only Kit – Restaurant	2,482.93	0.508	-	2,332.48	0.456	-
Electric Only Kit – Retail	2,459.70	0.663	-	2,279.41	0.604	-
Electric Only Kit – Office	2,293.79	0.429	-	2,155.65	0.400	-
LED Tube - Add-On Pack - Dual Fuel	918.26	0.219	-	918.26	0.219	-
Add-On Pack - Dual Fuel	2,286.73	0.221	-	2,286.73	0.441	-
LED Tube - Add-On Pack - Electric Only	918.26	0.219	-	918.26	0.219	-
Add-On Pack - Electric Only	2,286.73	0.221	-	2,286.73	0.441	-

EX POST GROSS SAVINGS

The evaluation team referred to the 2015 Indiana TRM (v2.2) and Illinois TRM (v9.0) 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. These differences were primarily driven by the following overarching factors:

- As this program did not exist in the previous cycle, *ex ante* assumptions relied on residential EM&V results ISR values (although programs/years referenced for these values are not noted in *ex ante* savings documentation). The evaluation team was able to update ISRs for most measures using more tailored information from C&I Online Marketplace participant survey responses. As discussed in the previous section, the team applied ISR values to verified and *ex post* gross savings for all kits, except add-on kits.
- Like ISR assumptions, *ante* assumptions relied on residential EM&V results for water heater and heating source fuel saturation values (although programs/years referenced for these values are not noted in *ex ante* savings documentation). The evaluation team updated these values for all measures using more tailored information from C&I Online Marketplace participant survey responses and then applied them to *ex post* gross savings. This modification is discussed below.
- The evaluation team did not assign a waste heat factor (WHF) therm penalty to the LED measures, consistent with the approach for all C&I programs. The team incorporated WHFs into calculations for *ex post* gross kWh energy and kW demand savings but is only reporting these values for cost-effectiveness purposes (in alignment with all lighting EM&V). This modification is discussed below.
- For all kit measures, the *ex ante* calculations predominately relied on the Illinois TRM (v9.0) inputs. Since the Illinois TRM (v9.0) has measures more specific to a commercial kit application, the evaluation team used similar methodology for most *ex post* calculations inputs. For some hours of use (HOU), waste heat factor, and coincidence factor (CF) inputs for lighting measures, the evaluation team used the Indiana TRM (v2.2) instead of the Illinois TRM (v9.0) to calculate *ex post* gross savings. This modification is discussed below.

The following sections summarize the team's findings and recommendations based on the engineering review.

FUEL SATURATION

During 2021, C&I Online Marketplace kit recipients were not required to provide data on their water heater fuel source or their space heating fuel source when ordering the kits online. At the beginning of 2022, these two data entry fields were added as required entries as part of the online check out process. The evaluation team will use these data to calculate *ex post* gross savings next year. For 2021, *ex ante* calculations relied on residential EM&V results to determine the fuel saturation ratios by measure. The evaluation team adjusted the saturation rates for the applicable measure by analyzing C&I Online Marketplace participant survey data results. 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 272.

TABLE 272. 2021 C&I ONLINE MARKETPLACE PROGRAM WATER HEATER FUEL SATURATION

SAVINGS TYPE	ELECTRIC WATER HEATING SATURATION RATE	NATURAL GAS WATER HEATING SATURATION RATE	ELECTRIC SPACE HEATING SATURATION RATE	NATURAL GAS SPACE HEATING SATURATION RATE
Ex Ante	22%	78%	22%	78%
Ex Post Gross	42%	58%	15%	85%

WASTE HEAT FACTORS

The C&I Online Marketplace program did not report electric or therm WHFs in *ex ante* calculations. In discussions with NIPSCO, the evaluation team did not include negative therm WHFs in *ex post* therm calculations. Electric (kWh and kW demand) WHF penalties are minor in comparison with therm waste heat factor penalties and were reported within *ex post* savings. To calculate WHFs, the team used values from the 2015 Indiana TRM (v2.2) and assumed a location in South Bend, a system (e.g., gas furnace and electric air conditioner), and an office space type.

Table 273 shows the therm waste heat penalties by applicable measure and kit for the total 2021 population for inclusion in cost-effectiveness calculations. There was a 17,169-therm penalty for the entire C&I Online Marketplace portfolio in 2021.

TABLE 273. 2021 C&I ONLINE MARKETPLACE PROGRAM WASTE HEAT FACTOR PENALTIES

APPLICABLE KIT MEASURES	WHF PENALTY BY INDIVIDUAL MEASURE (THERMS)	2021 POPULATION OF KITS COUNT	WHF PENALTY TOTAL 2021 POPULATION
Restaurant Kit (650000 only)	(25.20)		
LED Filament A19 Bulb	(20.35)	131	(2,666.48)
LED Filament Candle E12 Bulb	(4.74)	131	(621.01)
LED Exit Sign Retrofit	(0.11)	131	(14.02)
Retail Kit (650001 only)	(25.51)		
LED A19 (60W) Bulb	(6.01)	196	(1,178.69)
LED Filament BR30 Bulb	(19.37)	196	(3,797.46)
LED Exit Sign Retrofit	(0.12)	196	(24.10)
Office Kit (650002 only)	(20.53)		
LED A19 (60W) Bulb	(5.34)	432	(2,308.46)
LED Filament BR30 Bulb	(14.35)	432	(6,197.74)
LED Exit Sign Retrofit	(0.10)	432	(42.59)
LED Desk Lamp	(0.74)	432	(318.86)
LED Tube Add-on Kit (650008)			
LED T8 linear	(8.67)	0	-
A19 LED Add-on Kit (650009)			
LED Filament A19 Bulb	(23.20)	0	-
Total			(17,169.42)

MEASURE SAVINGS INPUT MODIFICATIONS

For all kit measures, the *ex ante* calculations predominately relied on inputs from the Illinois TRM (v9.0). 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. However, for WHF and some HOU and CF inputs for lighting measures, the evaluation team used the 2015 Indiana TRM (v2.2) instead. This modification and its application to *ex post* savings is discussed in the following sections and in greater detail within Appendix 14. Table 274 shows the deviations between *ex ante* and *ex post* HOU and CF inputs for applicable measures.

TABLE 274. 2021 C&I ONLINE MARKETPLACE PROGRAM *EX POST* MEASURE INPUT MODIFICATIONS

KIT MEASURES	*EX ANTE*		*EX POST*		SOURCE REFERENCE
	HOU	CF	HOU	CF	
Restaurant Kit (650000 & 650003)					
LED Filament A19 Bulb	4,784	1.00	5,544	0.92	2015 Indiana TRM (v2.2)
LED Filament Candle E12 Bulb	4,784	1.00	5,544	0.92	2015 Indiana TRM (v2.2)
Retail Kit (650001 & 650004)					
LED A19 (60W) Bulb	2,935	0.71	2,935	0.84	Illinois TRM (v9.0) for HOU as it is more specific to small retail than 2015 Indiana TRM (v2.2). 2015 Indiana TRM (v2.2) for CF
LED Filament BR30 Bulb	2,935	0.71	2,935	0.84	Illinois TRM (v9.0) for HOU as it is more specific to small retail than 2015 Indiana TRM (v2.2). 2015 Indiana TRM (v2.2) for CF
Office Kit (650002 & 650005)					
LED A19 (60W) Bulb	3,088	1.00	3,253	0.76	2015 Indiana TRM (v2.2)
LED Filament BR30 Bulb	3,088	1.00	3,253	0.76	2015 Indiana TRM (v2.2)
LED Desk Lamp	3,088	1.00	3,253	0.76	2015 Indiana TRM (v2.2)
LED Tube Add-on Kit (650008)					
LED T8 linear	3,379	0.67	3,253	0.76	2015 Indiana TRM (v2.2)
A19 LED Add-on Kit (650009)					
LED Filament A19 Bulb	3,088	0.52	3,253	0.76	2015 Indiana TRM (v2.2)

EX POST GROSS SAVINGS

Table 275 shows the *ex ante* deemed savings and *ex post* gross per-measure savings for 2021 C&I Online Marketplace program measures. The reasons for differences between *ex ante* and *ex post* gross values are outlined in the sections above.

TABLE 275. 2021 C&I ONLINE MARKETPLACE PROGRAM *EX ANTE* AND *EX POST* GROSS PER-MEASURE SAVINGS

KIT MEASURES	QUANTITY IN KIT	*EX ANTE* SAVINGS			*EX POST* SAVINGS		
		KWH	KW	THERMS	KWH	KW	THERMS
Restaurant Kit (650000 & 650003)							
LED Filament A19 Bulb	12	1,790.27	0.381	-	1,746.73	0.344	-
LED Filament Candle E12 Bulb	6	537.08	0.114	-	406.80	0.082	-
LED Exit Sign Retrofit	2	46.86	0.005	-	9.18	0.001	-
Power Pre-Rinse Spray Valve	1	42.01	-	6.23	89.12	-	4.63
Bathroom Aerator	2	31.09	0.003	5.15	100.64	0.011	6.93
Kitchen Aerator	1	35.62	0.004	6.23	99.36	0.011	6.85
Retail Kit (650001 & 650004)							
LED A19 (60W) Bulb	6	553.24	0.154	-	479.73	0.156	-
LED Filament BR30 Bulb	12	1,806.15	0.503	-	1,545.56	0.503	-
LED Exit Sign Retrofit	2	48.60	0.005	-	9.81	0.001	-
Tier 1 Advanced Power Strip	1	42.76	-	-	88.41	-	-
Bathroom Aerator	2	8.95	0.001	1.48	28.98	0.003	2.00

KIT MEASURES	QUANTITY IN KIT	*EX ANTE* SAVINGS			*EX POST* SAVINGS		
		KWH	KW	THERMS	KWH	KW	THERMS
Office Kit (650002 & 650005)							
LED A19 (60W) Bulb	6	571.68	0.110	-	543.86	0.141	-
LED Filament BR30 Bulb	10	1,555.31	0.300	-	1,460.15	0.380	-
LED Exit Sign Retrofit	2	47.73	0.003	-	10.03	0.001	-
LED Desk Lamp	1	61.09	0.012	-	75.12	0.020	-
Tier 1 Advanced Power Strip	1	44.82	-	-	92.67	-	-
Bathroom Aerator	2	6.13	0.002	1.02	19.85	0.005	1.37
Kitchen Aerator	1	7.03	0.002	1.23	19.60	0.005	1.35
LED Tube Add-on Kit (650008)							
LED T8 linear	25	918.26	0.219	-	882.67	0.229	-
A19 LED Add-on Kit (650009)							
LED Filament A19 Bulb	24	2,286.73	0.221	-	2,361.50	0.614	-

Table 276 shows the comparison between the *ex ante* and *ex post* gross savings. The values reported are for a single kit and do not represent the entire C&I Online Marketplace population.

TABLE 276. 2021 C&I ONLINE MARKETPLACE PROGRAM *EX POST* GROSS PER-KIT SAVINGS

KIT TYPE	*EX ANTE* SAVINGS			*EX POST* GROSS SAVINGS		
	KWH	KW	THERMS	KWH	KW	THERMS
Dual Fuel Kit – Restaurant	2,482.93	0.508	17.61	2,451.83	0.449	18.41
Dual Fuel Kit – Retail	2,459.70	0.663	1.48	2,152.49	0.665	2.00
Dual Fuel Kit – Office	2,293.79	0.429	2.24	2,221.29	0.552	2.72
Electric Only Kit – Restaurant	2,482.93	0.508	-	2,451.83	0.449	-
Electric Only Kit – Retail	2,459.70	0.663	-	2,152.49	0.665	-
Electric Only Kit – Office	2,293.79	0.429	-	2,221.29	0.552	-
LED Tube - Add-On Pack - Dual Fuel	918.26	0.219	-	882.67	0.229	-
Add-On Pack - Dual Fuel	2,286.73	0.221	-	2,361.50	0.614	-
LED Tube - Add-On Pack - Electric Only	918.26	0.219	-	882.67	0.229	-
Add-On Pack - Electric Only	2,286.73	0.221	-	2,361.50	0.614	-

Table 277 highlights notable differences between *ex ante* and *ex post* gross savings estimates by measure type.

TABLE 277. 2021 C&I ONLINE MARKETPLACE NOTABLE DIFFERENCES BETWEEN *EX ANTE* AND *EX POST GROSS*

MEASURE TYPE	*EX ANTE* SOURCES AND ASSUMPTIONS	*EX POST* GROSS SOURCES AND ASSUMPTIONS	PRIMARY REASONS FOR DIFFERENCES
LED Lighting	*Ex ante* savings based on the Illinois TRM (v9.0), and specification data from products within the kits. ISR from Illinois TRM (v9.0)	Indiana TRM (v2.2) and customer survey data to inform ISR and fuel source saturation. WHFs, HOU, and CF from 2015 Indiana TRM (v2.2) by customer type	WHF penalties for kW and kWh, fuel saturation ratio applied to WHF penalties in *ex post* calculations only. The source for HOU and CF values differ between *ex ante* and *ex post* calculations. Differences in ISRs.
Occupancy Sensor Power Strip	*Ex ante* savings from the Illinois TRM (v9.0), and specification data from products within the kits. Unknown ISR source	Illinois TRM (v9.0) and customer survey data to inform ISR	Differences in ISRs
Low flow Aerators	*Ex ante* savings from the Illinois TRM (v9.0), and specification data from product within kit. ISR and	Illinois TRM (v9.0) and customer survey data to inform ISR and fuel source saturation	Differences in ISR and fuel saturation values

MEASURE TYPE	*EX ANTE* SOURCES AND ASSUMPTIONS	*EX POST* GROSS SOURCES AND ASSUMPTIONS	PRIMARY REASONS FOR DIFFERENCES
	fuel saturation ratio from 2019 Residential EM&V values		
Low flow Spray Rinse Valves	*Ex ante* savings from the Illinois TRM (v9.0), and specification data from product within kit. ISR and fuel saturation ratio from 2019 Residential EM&V values	Illinois TRM (v9.0) and customer survey data to inform ISR and fuel source saturation	Differences in ISR and fuel saturation values

REALIZATION RATES

The next three tables (Table 278 through Table 280) show *ex ante*, audited gross, verified gross, and *ex post* gross electric and therm savings for the total population of the C&I Online Marketplace program.

TABLE 278. 2021 C&I ONLINE MARKETPLACE PROGRAM *EX ANTE* AND *EX POST* GROSS ELECTRIC ENERGY SAVINGS

MEASURE	*EX ANTE*[a] ELECTRIC ENERGY SAVINGS (KWH/YR.)	AUDITED GROSS ELECTRIC ENERGY SAVINGS (KWH/YR.)	VERIFIED GROSS ELECTRIC ENERGY SAVINGS (KWH/YR.)	*EX POST* GROSS ELECTRIC ENERGY SAVINGS (KWH/YR.)	*REALIZATION RATE*[b]
Restaurant Kit (650000 & 650003)					
LED Filament A19 Bulb	307,926.18	307,926.18	283,665.33	300,437.20	98%
LED Filament Candle E12 Bulb	92,377.85	92,377.85	66,064.16	69,970.24	76%
LED Exit Sign Retrofit	8,060.44	8,060.44	1,728.58	1,579.81	20%
Power Pre-Rinse Spray Valve	7,226.38	7,226.38	15,328.68	15,328.68	212%
Bathroom Aerator	5,346.90	5,348.95	17,309.57	17,309.57	324%
Kitchen Aerator	6,126.06	6,126.06	17,089.93	17,089.93	279%
Retail Kit (650001 & 650004)					
LED A19 (60W) Bulb	167,630.44	167,630.44	154,423.19	145,357.72	87%
LED Filament BR30 Bulb	547,264.07	547,264.07	497,512.79	468,306.12	86%
LED Exit Sign Retrofit	14,725.41	14,725.41	3,157.90	2,972.51	20%
Tier 1 Advanced Power Strip	12,955.82	12,955.82	26,787.03	26,787.03	207%
Bathroom Aerator	2,712.56	2,713.60	8,781.37	8,781.37	324%
Office Kit (650002 & 650005)					
LED A19 (60W) Bulb	354,442.49	354,442.49	326,516.72	337,193.55	95%
LED Filament BR30 Bulb	964,292.08	964,292.08	876,629.16	905,294.21	94%
LED Exit Sign Retrofit	29,593.14	29,593.14	6,346.31	6,221.41	21%
LED Desk Lamp	37,876.70	37,876.70	45,100.95	46,575.72	123%
Tier 1 Advanced Power Strip	27,788.25	27,788.25	57,454.08	57,454.08	207%
Bathroom Aerator	3,801.67	3,803.13	12,307.18	12,307.18	324%
Kitchen Aerator	4,355.66	4,355.66	12,151.02	12,151.02	279%
LED Tube Add-on Kit (650008)					
LED T8 linear	191,916.37	191,916.37	191,916.37	184,477.70	96%
A19 LED Add-on Kit (650009)					
LED Filament A19 Bulb	242,392.93	242,392.93	242,392.93	250,318.98	103%
Total Savings	3,028,812.58	3,028,815.93	2,862,663.27	2,885,914.04	
Total Program Realization Rate					95%

Note: Totals may not sum properly due to rounding of measure level savings.

[a] Program tracking data is summed at the kit-level (not measure level). Therefore, *ex ante* savings are only reported at the summary level, due to rounding errors.

[b]Measure level realization rates compare to the audited value as the tracking data does not report measure level savings.

TABLE 279. 2021 C&I ONLINE MARKETPLACE PROGRAM *EX ANTE* & *EX POST* GROSS PEAK DEMAND REDUCTION

MEASURE	*EX ANTE*[a] PEAK DEMAND REDUCTION (KW/YR.)	AUDITED GROSS PEAK DEMAND REDUCTION (KW/YR.)	VERIFIED GROSS PEAK DEMAND REDUCTION (KW/YR.)	*EX POST* GROSS PEAK DEMAND REDUCTION (KW/YR.)	REALIZATION RATE[b]
Restaurant Kit (650000 & 650003)					
LED Filament A19 Bulb	65.558	65.558	60.393	59.097	90%
LED Filament Candle E12 Bulb	19.667	19.667	14.065	14.116	72%
LED Exit Sign Retrofit	0.937	0.937	0.201	0.219	23%
Power Pre-Rinse Spray Valve	-	-	-	-	-
Bathroom Aerator	0.583	0.583	1.886	1.886	324%
Kitchen Aerator	0.667	0.667	1.862	1.862	279%
Retail Kit (650001 & 650004)					
LED A19 (60W) Bulb	46.706	46.706	43.026	47.353	101%
LED Filament BR30 Bulb	152.482	152.482	138.620	152.559	100%
LED Exit Sign Retrofit	1.374	1.374	0.295	0.386	28%
Tier 1 Advanced Power Strip	-	-	-	-	-
Bathroom Aerator	0.324	0.324	1.049	1.049	324%
Office Kit (650002 & 650005)					
LED A19 (60W) Bulb	68.367	68.367	62.981	87.666	128%
LED Filament BR30 Bulb	186.000	186.000	169.091	235.364	127%
LED Exit Sign Retrofit	2.011	2.011	0.431	0.790	39%
LED Desk Lamp	7.306	7.306	8.699	12.109	166%
Tier 1 Advanced Power Strip	-	-	-	-	-
Bathroom Aerator	1.014	1.014	3.282	3.282	324%
Kitchen Aerator	1.162	1.162	3.240	3.240	279%
LED Tube Add-on Kit (650008)					
LED T8 linear	45.806	45.806	45.806	47.962	105%
A19 LED Add-on Kit (650009)					
LED Filament A19 Bulb	23.426	46.755	46.755	65.080	278%
Total Savings	623.442	646.718	601.681	734.020	
Total Program Realization Rate					118%

Note: Totals may not sum properly due to rounding of measure level savings.

[a] Program tracking data is summed at the kit-level (not measure level). Therefore, *ex ante* savings are only reported at the summary level, due to rounding errors.

[b]Measure level realization rates compare to the audited value as the tracking data does not report measure level savings.

TABLE 280. 2021 C&I ONLINE MARKETPLACE PROGRAM *EX ANTE* & *EX POST* GROSS NATURAL GAS ENERGY SAVINGS

MEASURE	*EX ANTE*[a] NATURAL GAS ENERGY SAVINGS (THERMS/YR.)	AUDITED GROSS NATURAL GAS ENERGY (THERMS/YR.)	VERIFIED GROSS NATURAL GAS ENERGY SAVINGS (THERMS/YR.)	*EX POST* GROSS NATURAL GAS ENERGY SAVINGS (THERMS/YR.)	REALIZATION RATE[b]
Restaurant Kit (650000 & 650003)					
LED Filament A19 Bulb	-	-	-	-	-
LED Filament Candle E12 Bulb	-	-	-	-	-
LED Exit Sign Retrofit	-	-	-	-	-
Power Pre-Rinse Spray Valve	815.61	815.61	606.48	606.48	74%
Bathroom Aerator	675.05	720.57	908.24	908.24	135%
Kitchen Aerator	815.67	825.64	613.94	897.14	110%
Retail Kit (650001 & 650004)					

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.)	REALIZATION RATE[b]
LED A19 (60W) Bulb	-	-	-	-	-
LED Filament BR30 Bulb	-	-	-	-	-
LED Exit Sign Retrofit	-	-	-	-	-
Tier 1 Advanced Power Strip	-	-	-	-	-
Bathroom Aerator	290.86	290.57	391.33	391.33	135%
Office Kit (650002 & 650005)					
LED A19 (60W) Bulb	-	-	-	-	-
LED Filament BR30 Bulb	-	-	-	-	-
LED Exit Sign Retrofit	-	-	-	-	-
LED Desk Lamp	-	-	-	-	-
Tier 1 Advanced Power Strip	-	-	-	-	-
Bathroom Aerator	439.09	438.66	590.78	590.78	135%
Kitchen Aerator	530.56	537.05	583.55	583.55	110%
LED Tube Add-on Kit (650008)					
LED T8 linear	-	-	-	-	-
A19 LED Add-on Kit (650009)					
LED Filament A19 Bulb	-	-	-	-	-
Total Savings	3,571.39	3,628.10	3,694.32	3,977.52	
Total Program Realization Rate					111%

Note: Totals may not sum properly due to rounding of measure level savings.

[a] Program tracking data is summed at the kit-level (not measure level). Therefore, *ex ante* savings are only reported at the summary level, due to rounding errors.

[b]Measure level realization rates compare to the audited value as the tracking data does not report measure level savings.

EX POST NET SAVINGS

The evaluation team calculated freeridership and participant spillover using survey data collected from 2021 C&I Online Marketplace participants. The team fielded the survey before the end of 2021 and therefore did not capture data from participants who received the add-on lighting packs. Table 281 shows the NTG ratios by measure. As these kits were all distributed for free, we would expect relatively high net-to-gross results.

TABLE 281. 2021 C&I ONLINE MARKETPLACE PROGRAM-LEVEL NTG RATIOS BY MEASURE

MEASURE	RESPONSES (n)	FREERIDERSHIP [a]	PARTICIPANT SPILLOVER	NTG
Standard A-Lamp LEDs	22	10%	1%	91%
BR30 Spotlight LEDs	30	12%	1%	89%
Candelabra LEDs	5	0%	1%	101%
LED Exit Signs	10	13%	1%	88%
LED Desk Lamps	31	3%	1%	98%
Occupancy Sensor Power Strips	30	11%	1%	90%
Bathroom Faucet Aerator	17	2%	1%	99%
Kitchen Faucet Aerators	13	3%	1%	98%
Pre-Rinse Spray Valve	2	0%	1%	101%

[a] This score is an average weighted by verified quantity of measure installed.

FREERIDERSHIP

INTENTION FREERIDERSHIP

The evaluation team calculated measure-level *intention* freeridership values for each participant using the following survey questions:

- FR1. If 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 responded *no* to FR1 were assigned an *intention* freeridership score of 0%. Those who responded *no, I already have them installed in all available locations* were assigned an *intention* freeridership score of 100%. Those who said *yes* to FR1 were asked FR2 and assigned an *intention* freeridership score based on the timing of their decision (Table 282).

TABLE 282. 2021 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 283 shows *intention* freeridership score for each surveyed measure.

TABLE 283. 2021 C&I ONLINE MARKETPLACE PROGRAM INTENTION FREERIDERSHIP BY MEASURE

MEASURE	INTENTION FREERIDERSHIP SCORE
Standard A-Lamp LEDs (n=22)	17%
BR30 Spotlight LEDs (n=30)	20%
Candelabra LEDs (n=5)	0%
LED Exit Signs (n=10)	23%
LED Desk Lamps (n=31)	2%
Occupancy Sensor Power Strips (n=30)	20%
Bathroom Faucet Aerator (n=17)	4%
Kitchen Faucet Aerators (n=13)	3%
Pre-Rinse Spray Valve (n=2)	0%

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 284.

TABLE 284. 2021 C&I ONLINE MARKETPLACE PROGRAM INTENTION FREERIDERSHIP BY MEASURE

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

Error! Reference source not found. shows *influence* freeridership score for each surveyed measure.

TABLE 285. 2021 C&I ONLINE MARKETPLACE PROGRAM INFLUENCE FREERIDERSHIP BY MEASURE

MEASURE	INFLUENCE FREERIDERSHIP SCORE
Standard A-Lamp LEDs (n=22)	3%
BR30 Spotlight LEDs (n=30)	3%
Candelabra LEDs (n=5)	0%
LED Exit Signs (n=10)	3%
LED Desk Lamps (n=31)	3%
Occupancy Sensor Power Strips (n=30)	2%
Bathroom Faucet Aerator (n=17)	0%
Kitchen Faucet Aerators (n=13)	2%
Pre-Rinse Spray Valve (n=2)	0%

FINAL FREERIDERSHIP

The evaluation team calculated the mean of *intention* and the *influence* of freeridership components to estimate final freeridership for each surveyed measure. A higher freeridership score translates to more savings that were deducted from the gross savings estimates. Table 286 lists the *intention*, *influence*, and final freeridership scores for the 2021 C&I Online Marketplace program.

TABLE 286. 2021 C&I ONLINE MARKETPLACE PROGRAM FREERIDERSHIP SCORE BY MEASURE

MEASURE	INTENTION SCORE	INFLUENCE SCORE	FINAL SCORE
Standard A-Lamp LEDs (n=22)	17%	3%	10%
BR30 Spotlight LEDs (n=30)	20%	3%	12%
Candelabra LEDs (n=5)	0%	0%	0%
LED Exit Signs (n=10)	23%	3%	13%
LED Desk Lamps (n=31)	2%	3%	3%
Occupancy Sensor Power Strips (n=30)	20%	2%	11%
Bathroom Faucet Aerator (n=17)	4%	0%	2%
Kitchen Faucet Aerators (n=13)	3%	2%	3%
Pre-Rinse Spray Valve (n=2)	0%	0%	0%

PARTICIPANT SPILLOVER

The evaluation team estimated participant spillover measure savings using specific information about participants collected through surveys and using the 2015 Indiana TRM (v2.2) 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.[66] The participant spillover estimate for the C&I Online Marketplace program is 1%, rounded to the nearest whole percent, shown in Table 287.

TABLE 287. 2021 C&I ONLINE MARKETPLACE PROGRAM PARTICIPANT SPILLOVER RESULTS

MEASURE	SPILLOVER SAVINGS (MMBtu)	PARTICIPANT PROGRAM SAVINGS (MMBtu)	PARTICIPANT SPILLOVER
Total Program	9.3	925.7	1%

RESULTING NET SAVINGS

Table 288 shows the resulting net electric savings, demand reduction, and natural gas savings.

TABLE 288. 2021 C&I ONLINE MARKETPLACE PROGRAM *EX POST* NET SAVINGS BY MEASURE TYPE

MEASURE	*EX POST* GROSS SAVINGS/REDUCTION			NTG	*EX POST* NET SAVINGS/REDUCTION		
	KWH	KW	THERMS		KWH	KW	THERMS
Standard A-Lamp LEDs	1,033,307.45	259.195	-	91%	940,309.78	235.868	-
BR30 Spotlight LEDs	1,373,600.33	387.924	-	89%	1,222,504.30	345.252	-
Candelabra LEDs	69,970.24	14.116	-	101%	70,669.94	14.257	-
LED Exit Signs	10,773.73	1.395	-	88%	9,480.88	1.227	-
LED Desk Lamps	46,575.72	12.109	-	98%	45,644.20	11.867	-

[66] The spillover measures attributed to the program are LEDs, lighting controls, LED exit signs, and a high-efficiency furnace motor that did not receive a program rebate.

MEASURE	*EX POST* GROSS SAVINGS/REDUCTION			NTG	*EX POST* NET SAVINGS/REDUCTION		
	KWH	KW	THERMS		KWH	KW	THERMS
Occupancy Sensor Power Strips	84,241.11	-	-	90%	75,817.00	-	-
Bathroom Faucet Aerator	38,398.12	6.217	1,890.35	99%	38,014.14	6.154	1,871.45
Kitchen Faucet Aerators	29,240.96	5.102	1,480.69	98%	28,656.14	5.000	1,451.07
Pre-Rinse Spray Valve	15,328.68	-	606.48	101%	15,481.97	-	612.54
Linear LED	184,477.70	47.962	-	91%	167,874.71	43.645	-
Total Savings	2,885,914.04	734.020	3,977.52		2,614,453.06	663.271	3,935.06

[a] Linear LED add-on packs were added to the C&I Online Marketplace program late in 2021 and were not part of the survey questions posed. The average electric energy savings program NTG value was applied to this measure category.

Table 289 shows the freeridership for each fuel.

TABLE 289. 2021 C&I ONLINE MARKETPLACE NET-TO-GROSS RESULTS BY FUEL TYPE

SAVINGS TYPE	*EX ANTE* GROSS SAVINGS	*EX POST* GROSS SAVINGS	NTG RATIO (%)	*EX POST* NET SAVINGS
Electric Energy Savings (kWh/yr.)	3,028,812.58	2,885,914.04	91%	2,614,453.06
Peak Demand Reduction (kW)	623.442	734.020	90%	663.271
Natural Gas Energy Savings (therms/yr.)	3,571.39	3,977.52	99%	3,935.06

After calculating the individual freeridership at the fuel level, the evaluation team applied savings-weighted freeridership and spillover, based on MMBtu, to develop a program-level NTG of 91% for 2021 (**Error! Not a valid bookmark self-reference.**).

TABLE 290. 2021 C&I ONLINE MARKETPLACE PROGRAM-LEVEL NET-TO-GROSS

RESPONSES	FREERIDERSHIP	SPILLOVER	NTG RATIO
51	10%	1%	91%

PROCESS EVALUATION

As part of the process evaluation, the evaluation team reviewed the program data and program materials and surveyed program participants. The team also interviewed NIPSCO's program manager and program implementation staff to gain a better understanding of the program design and delivery process and any associated changes or challenges experienced in 2021. The evaluation team sought to answer the following process-related research questions:

- How is the program promoted?
- How do participants learn about the program?
- 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 Online Marketplace itself or the measure offerings?

PARTICIPANT SURVEY

The evaluation team surveyed 54 customers who ordered a kit between January 18, 2021, and November 30, 2021. Most survey respondents (78%) ordered an office kit (Table 291). Few ordered the restaurant kit (15%). Most participants received more than one kit (61%), with 12 customers (22%) receiving the maximum of five kits per eligible account.[67] The following sections describe the findings related to source of awareness, reasons for participation, satisfaction with the program, and program impacts on customers.

TABLE 291. TYPES AND COUNT OF KITS RECEIVED BY SURVEY PARTICIPANTS

KIT TYPE	NUMBER	CUSTOMERS RECEIVED
Office Kit	42	78%
Retail Kit	17	31%
Restaurant Kit	8	15%

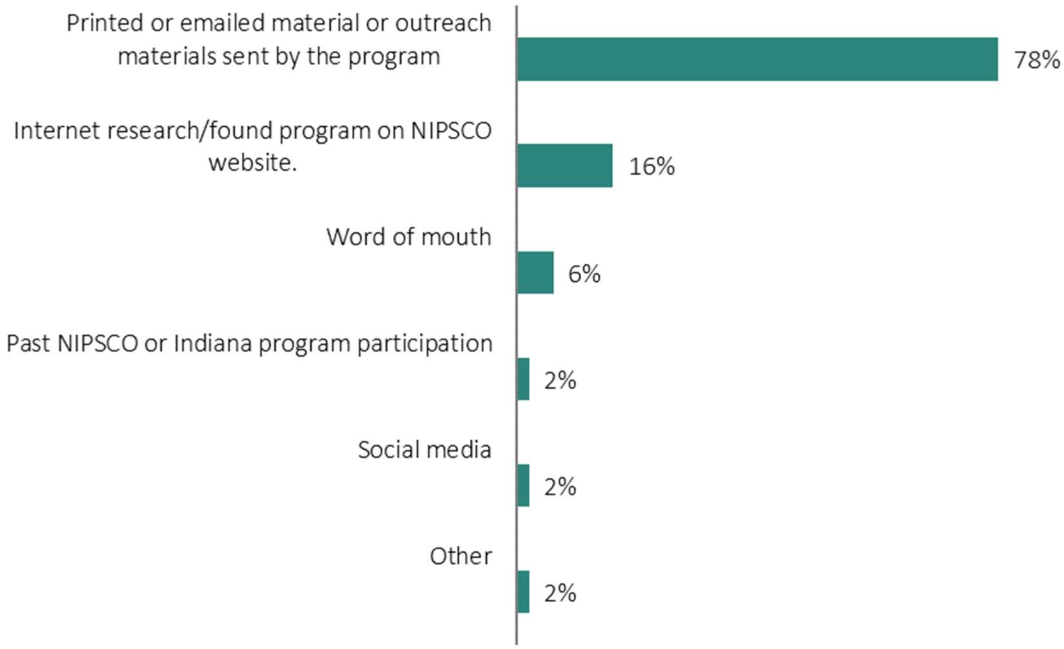
ENERGY EFFICIENCY AWARENESS AND MARKETING

The implementer sent six waves of marketing emails specific to the Business Online Marketplace program to customers, hosted five webinars to customers and trade allies, and provided three trade ally orientation sessions to market the C&I programs to trade allies and nonresidential customers. The implementer also sent printed materials to customers, such as bill inserts and created social media posts, specifically for LinkedIn, Facebook, and Twitter. The implementer sent industry-specific emails to grocery, healthcare, and small businesses customers.

As shown in Figure 89, most respondents heard about the program through printed or emailed outreach materials sent by the program (78%), followed by internet search or the NIPSCO website (16%), word of mouth (6%), past NIPSCO program participation (2%), and social media (2%).

[67] Five respondents received more than five kits; however, those participants have multiple eligible accounts and are therefore eligible to order up to a limit of five kits per eligible account. The five-kit limit per account was correctly upheld throughout the 2021 program year.

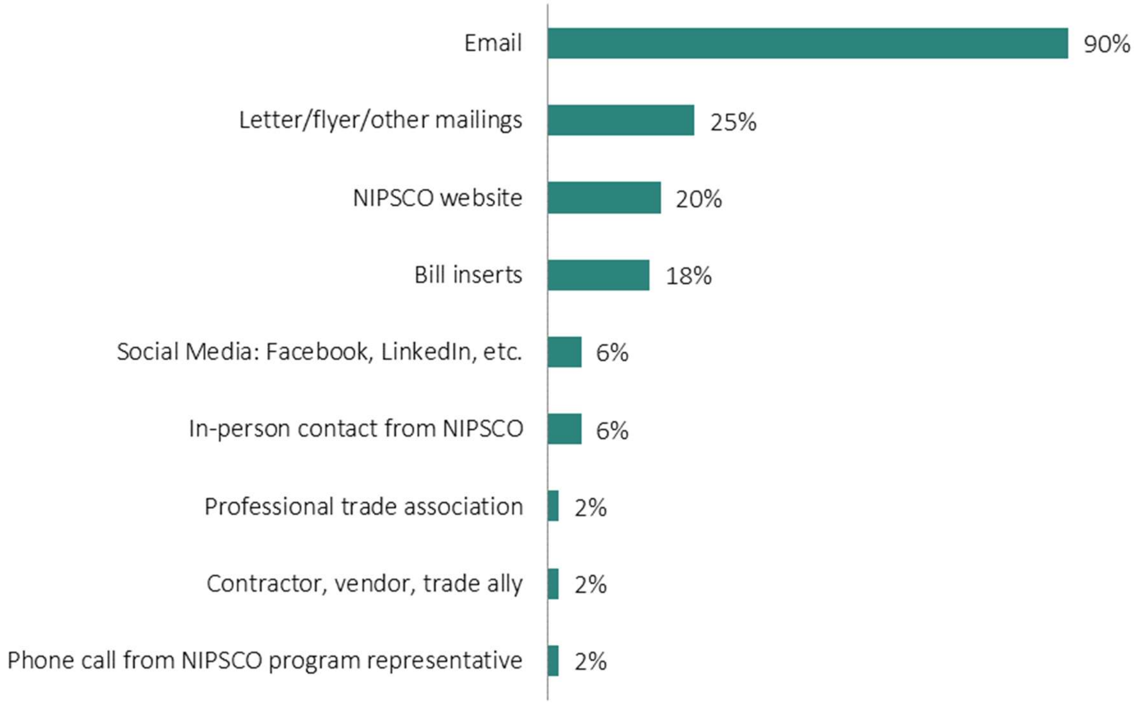
FIGURE 89. HOW PARTICIPANTS LEARNED ABOUT THE ONLINE MARKETPLACE



Source: Survey Question B1: "How did you learn about NIPSCO's Online Marketplace? (Please select all that apply)"
n=50, Multiple responses allowed.

As shown in Figure 90, most respondents preferred to hear about NIPSCO's programs and opportunities to save energy via email (90%), and letters, flyers, or other mailings (25%). Next, participants preferred to learn about NIPSCO's programs via NIPSCO's website (20%), bill inserts (18%), social media (6%), in person (6%), trade association (2%), contractor or trade ally (2%), and phone calls from NIPSCO representative (2%).

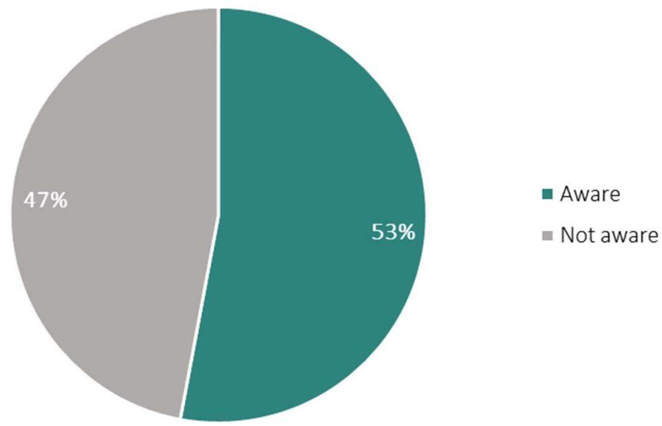
FIGURE 90. PREFERRED ENERGY EFFICIENCY COMMUNICATION CHANNEL



Source: Survey Question B4: “In your opinion, what is the best way for NIPSCO to keep organizations like yours informed about opportunities to save energy? (Please select all that apply)”, n=51 Multiple responses allowed.

More than half (53%) of respondents were aware of other commercial energy efficiency offerings from NIPSCO (Figure 91). Online Marketplace respondents were less aware of other offerings compared to Custom, Prescriptive, SBDI, and New Construction respondents (63%, n=64). Of the Online Marketplace respondents that reported they were aware of other offerings (n=27), they were most aware of HVAC measures (29%), followed by lighting (22%), thermostats (18%), appliances (8%), energy management systems (8%), lighting controls (8%), water heater replacements (6%), and others with less than 5% each.

FIGURE 91. AWARENESS OF OTHER COMMERCIAL ENERGY EFFICIENCY OPPORTUNITIES

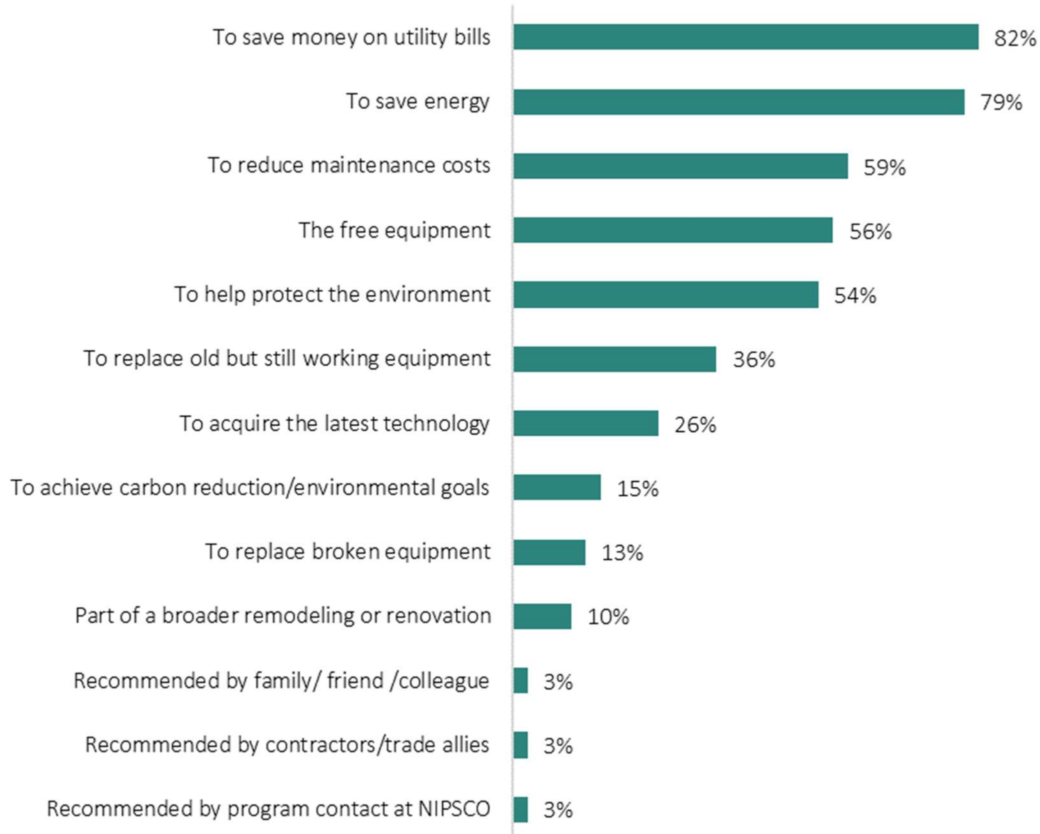


Source: Survey Question B2: “Besides the discounted energy efficiency kits, are you aware that NIPSCO offers rebates for other energy-efficient commercial and industrial equipment and services?”, n=51, Single response allowed.

PARTICIPATION DRIVERS AND BARRIERS

By far, respondents ordered the kits from the C&I Online Marketplace to save money on utility bills (82%) and save energy (79%). Although the kit was free, getting the free kit was not one of the top three reasons for people to order the kit (56%). Figure 92 shows primary customer motivations.

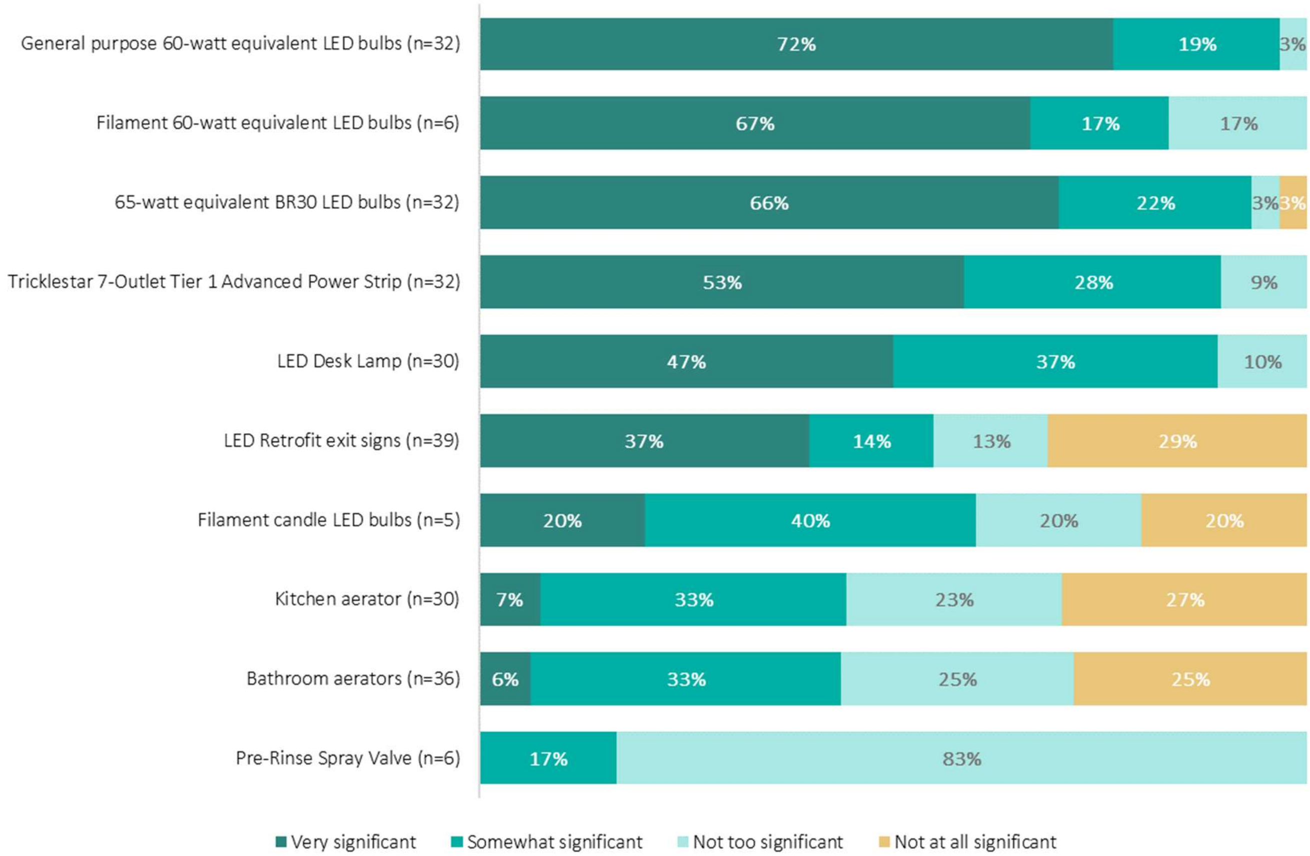
FIGURE 92. PRIMARY MOTIVATION FOR ORDERING THE KIT



Source: Survey Question G1: "What factors were the most important in your decision to order a kit from the NIPSCO Online Marketplace?", n=39 Multiple responses allowed.

Survey respondents were asked which items in the kit were most significant in their decision to order the kit(s). Overall, LED lights and the power strip were the most significant items for respondents (Figure 93). Eighty percent of respondents said that most of the LED lights offered in the kits (general purpose 60-watt equivalent LED bulbs, filament 60-watt equivalent LED bulbs, 65-watt equivalent BR30 LED bulbs, and the LED desk lamp) were *very significant* or *somewhat significant* in their decision to order the kit. Most respondents (81%) also said that the power strip was *very significant* or *somewhat significant* in their decisions to order the kit. Respondents found the water-saving items (pre-rinse spray valve, bathroom aerators, and kitchen aerator) to be the least significant item.

FIGURE 93. SIGNIFICANCE OF EACH ITEM IN THE DECISION TO ORDER THE KIT



Source: Survey Question G2.1-G2.10: "How significant each item was in your decision to order a kit from NIPSCO Online Marketplace?" Single response.

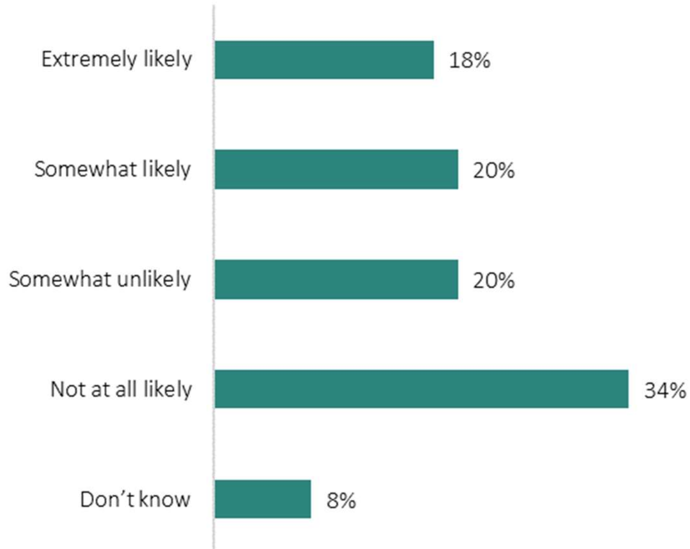
The evaluation team asked participant respondents what significant challenges organizations face when it comes to making energy-efficient improvements. Most respondents (52%) reported that high initial cost was the most significant challenge that their organization faced when considering improvements to increase energy efficiency (Figure 94). Besides high initial cost, technical challenges such as awareness of energy efficiency incentives (46%) and understanding potential areas of improvement (32%) were top concerns of the respondents. Respondents that selected the "*Other*" category mentioned challenges such as "governmental red tape as we are a government organization," and "I'm a small operation so my upgrades save energy but don't generate savings large enough to qualify for incentives."

FIGURE 94. CHALLENGES TO ENERGY EFFICIENCY

Source: Survey Question C1: "When considering improvements to increase commercial and industrial energy efficiency, what are the most significant challenges that organizations face?", n=48, Multiple responses allowed.

The evaluation team sought to understand what the demand for energy-efficient HVAC equipment is and asked how likely the participants were to replace their HVAC equipment in the next five years. Most respondents were either *not at all likely* (34%) or *somewhat unlikely* (20%) to replace their HVAC equipment in the next five years (Figure 95). Eighteen percent of the respondents said that they were *extremely likely* and 10% said they were *somewhat likely*. When asked why they were not at all likely to replace their HVAC equipment in the next five years (n=17), 53% of respondents said because their equipment was still operational. This was followed by 47% of respondents who reported their equipment was new, 24% who reported budget limitations, and 12% who reported they were tenants. For those who said that they were likely to replace their HVAC equipment in the next five years (n=19), the team asked what the rebate would be needed for them to choose high-efficiency HVAC equipment. Most respondents pointed to a value above $1,399 (63%), with 26% reporting $1,399 to $1,698 and 37% above $1,699. Five percent of respondents said $1,099 to $1,398, followed by 16% of respondents reporting $799 to $1,098, and 16% reporting $799 or below.

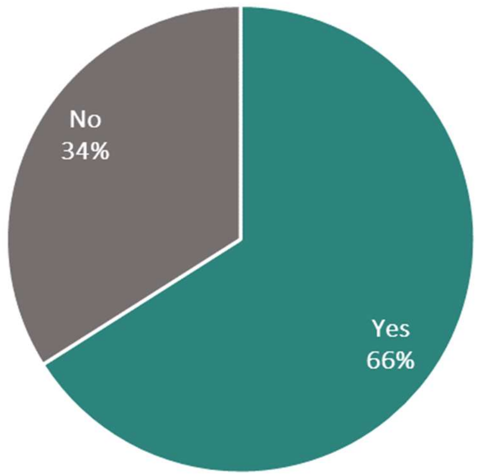
FIGURE 95. LIKELIHOOD TO REPLACE OR UPDATE HVAC EQUIPMENT IN THE NEXT FIVE YEARS



Source: Survey Question C3: "Thinking now specifically about your facility's HVAC equipment, how likely is your company to invest in replacing or upgrading any of that equipment in the next 5 years?", n=50, Single response.

The program implementer expressed that, in 2021, one of the main lingering effects of the COVID pandemic was supply chain issues, and initially, the implementer had difficulties in getting the kits to customers. In addition, many customers were still struggling financially, businesses were short staffed, costs were getting higher, and energy efficiency programs were not a top priority for small to mid-sized business. This perception was confirmed by the survey findings. As shown in Figure 96, most respondents said they still observed lingering effects of the COVID-19 pandemic in their businesses in 2021 (66%). The team asked these respondents (n=33) what effects they experienced and most reported a decrease in business, sales, production, or operating hours (76%), and difficulties in finding products (61%). They also had trouble hiring staff (39%), staff illness or death (36%), difficulties in hiring vendors or finding maintenance (27%), complete closure for an extended period (24%), and staff layoffs (9%).

FIGURE 96. EXPERIENCED CHALLENGES IN 2021 DUE TO THE COVID-19 PANDEMIC

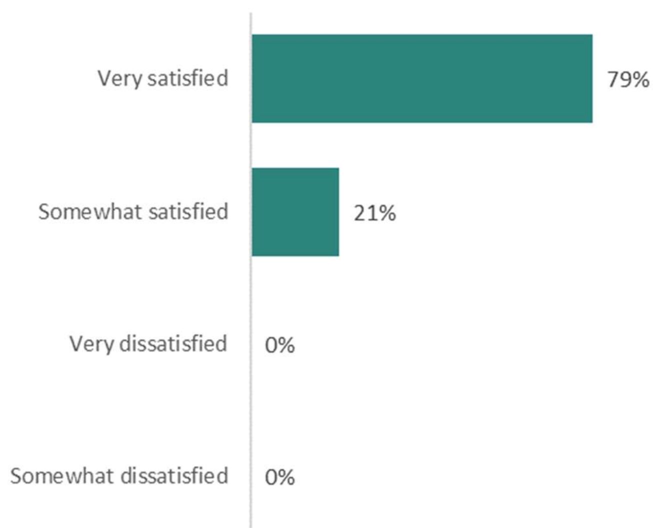


Source: Survey Question C6: "Did your business face any challenges this year related to the COVID-19 pandemic?", n=39, Single response.

SATISFACTION WITH PROGRAM

Respondents expressed very high levels of satisfaction with the program. All respondents (100%) were satisfied with the program, with most saying they were *very satisfied* (Figure 97).

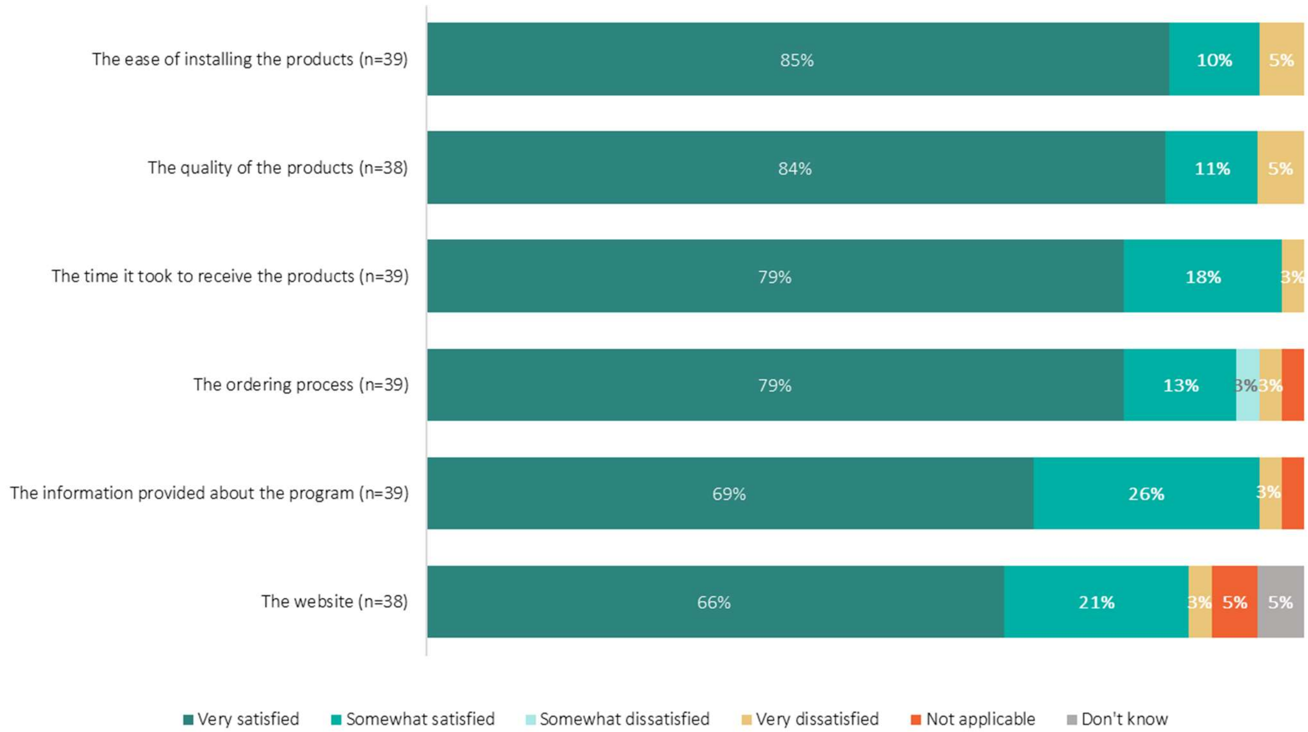
FIGURE 97. OVERALL SATISFACTION



Source: Survey Question G4: "How satisfied are you with NIPSCO's Online Marketplace overall?", n=39, Single response.

Respondents were satisfied with all aspects of the program, with all evaluated components receiving a satisfaction rate of 85% and above (Figure 98). Respondents rated ease of installing products (85%) and quality of the products (84%) the highest, reporting they were *very satisfied* with these aspects of the program.

FIGURE 98. SATISFACTION WITH THE VARIOUS ASPECTS OF THE PROGRAM



Source: Survey Question G3.1 - G3.6: "Please rate your level of satisfaction with each of these components"
Single response.

Most participants did not experience any challenges with the program (92%, n=36); only 8% (n=3) reported facing challenges. From the participants who reported challenges, the following items were mentioned:

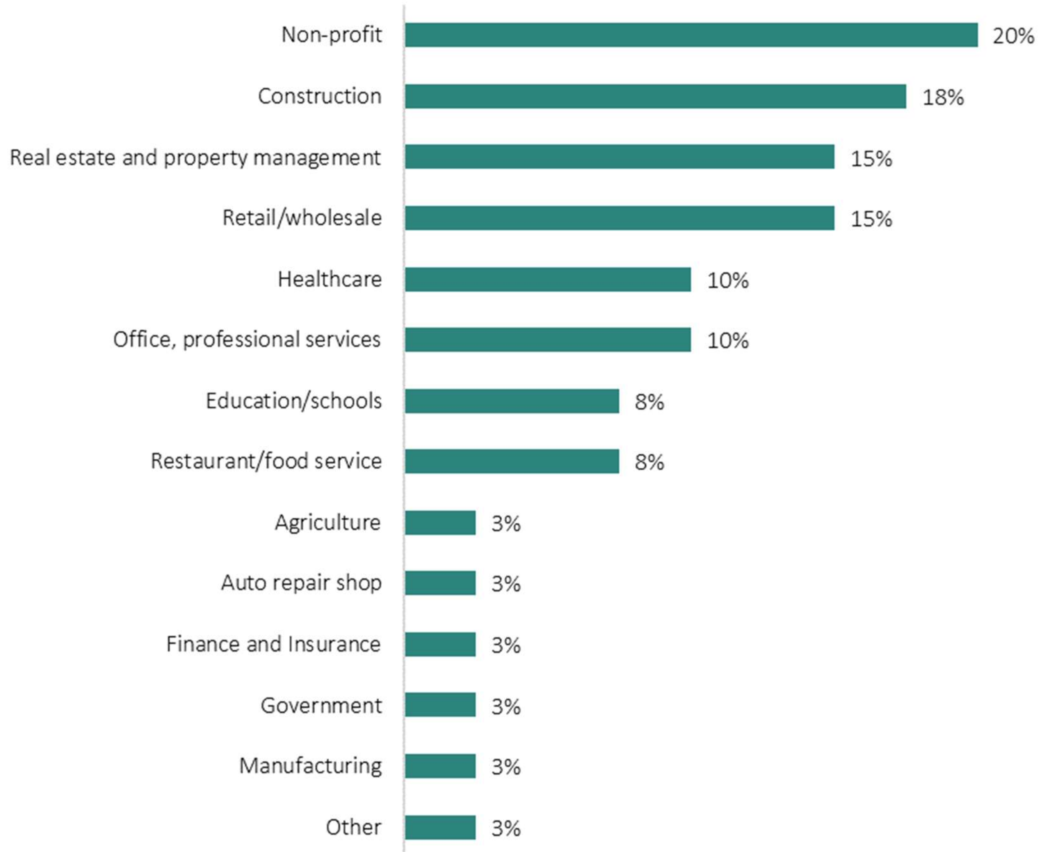
- The ordering process (n=2)
- Unsure about who to contact for information or navigating the program (n=1)
- Problem with the LED linear tubes (n=1)
- Problem with ordering kits for several locations (n=1)

The team asked participants who reported challenges what NIPSCO could have done to help their organization overcome the challenges they faced in using the C&I Online Marketplace. Two respondents said improve the application and ordering process, and one respondent said improve the quality of the products in the kit.

PARTICIPANT SURVEY FIRMOGRAPHICS

NIPSCO's C&I Online Marketplace program reached a wide variety of business industries (Figure 99), from non-profit (20%), construction (18%), retail or wholesale (15%), to healthcare (10%) and restaurant or food service (8%).

FIGURE 99. BUSINESS INDUSTRY REPRESENTATION OF SURVEY RESPONDENTS



Source: Survey Question H1: “What industry is your organization in?”, n=40, Multiple responses allowed.

Most respondents installed the equipment in smaller facilities (n=40): 50% in facilities smaller than 5,000 square feet, 35% in facilities sized between 5,000 and 10,000 square feet, and 10% in facilities sized between 10,000 and 50,000 square feet. None of the respondents had facilities larger than 50,000 square feet. Seventy-eight percent of the respondents owned their facilities, while 25% leased their facilities (n=40).

CONCLUSIONS AND RECOMMENDATIONS

CONCLUSION 1: THE PROGRAM DID NOT ACHIEVE THE SAVINGS GOALS IN ITS FIRST YEAR.

The program fell short of its goals for a variety of reasons. This is the first year of the program, and programs often experience a ramp-up period when building awareness and engagement with the customer base. Additionally, most participants reported that they are continuing to experience challenges driven by the COVID-19 pandemic, including hiring and supply chain issues, which may be affecting businesses more broadly and program participation overall.

Recommendations:

- Continue to expand outreach methods and strategies to attract new customers to the program. 90% of the survey respondents indicated that email was their preferred means of communication. Most participants indicated that saving energy and money on utility bills were the most important drivers for them. Targeting this type of content by email campaign could be a successful program participation driver.

- Continue to evolve the kits to match the needs of potential customers to the Online Marketplace. Satisfaction, significance and ISR values appear to demonstrate that the basic lighting components included in the kits were the most desirable and resulted in the highest installation rates.
- Monitor EISA regulatory changes to baseline lighting wattage as it evolves. The baseline efficiency calculation may need modification to reflect the increasing prevalence of LED technology, thereby reducing the electric energy savings and demand reduction achieved by LED lighting installation in future years.

CONCLUSION 2: EASE OF INSTALLATION DROVE HIGH SATISFACTION RATINGS FROM CUSTOMERS

The program delivered high customer satisfaction and a positive experience for the participants. All respondents (100%) were satisfied with the program, with most saying they were *very satisfied.* Every component received a satisfaction score of 85% or higher. Respondents indicated they were particularly satisfied with the ease of installing the products.

CONCLUSION 3: NIPSCO OUTREACH WAS SUCCESSFUL IN REACHING NEW CUSTOMERS.

NIPSCO targeted new participants to the program through a variety of outreach methods such as targeted emails, and trade ally engagement. Most respondents (78%) learned about the program through NIPSCO outreach by printed or emailed materials. Many respondents did not know about other NIPSCO programs (47%), and as this was the first year of the program, it is likely that this was their first participation in a NIPSCO program.

Recommendations:

- Continue to leverage email in the current marketing strategy to bring more participants to the program.

CONCLUSION 4: MOST PARTICIPANTS WERE SMALL BUSINESSES AND NON-PROFITS.

Half of the participants ordered kits for small facilities, sized 5,000 square feet and less, and none of the participants ordered kits for facilities larger than 50,000 square feet. In addition, most respondents were in the non-profit sector, including several churches, and small business such as stores and medical offices. Furthermore, many of the participants were not aware of other NIPSCO offerings (43%), which could suggest that this is their first time participating in a NIPSCO program.

Recommendations:

- Consider whether this program could serve as a funnel to the SBDI program, given the overlap in customer bases.
- Clarify in program literature which types of businesses are eligible for the C&I Online Marketplace program and who the program target audience is. If small businesses are the target audience, direct the marketing strategy toward this group.

CONCLUSION 5: LIGHTING EQUIPMENT AND SAVINGS WERE THE BIGGEST DRIVERS OF PARTICIPATION.

Eighty percent of participants reported LED lights were *significant* or *very significant* in their decision to order the kit. In addition, participants most frequently cited saving money on utility bills and saving energy as their motivation to participate in the program. Freeridership scores were relatively low for all components, including lighting.

Recommendations:

- Continue to offer LEDs in all kits, as the A shape bulb and BR30 bulb had a high customer-reported ISR.
- Consider adding a lamp to kits that do not currently have one, or adding additional lamps to the office kit, as the LED desk lamps had a very high customer-reported ISR.
- Offer lighting-only kits as a standalone ordering option rather than an add-on option, so that customers only interested in the basic light bulbs have a targeted option to order. Low ISRs for specialty lighting and non-lighting products suggest that customers that were primarily driven to order the kits for the lighting products might have less need or desire for the specialty lighting and non-lighting products.

CONCLUSION 6: SOME OF THE SPECIALTY LIGHTING AND NON-LIGHTING EQUIPMENT INCLUDED IN THE KITS ARE DRIVING HIGHER FREERIDERSHIP AND LOW INSTALLATION RATES.

Customer-reported ISRs were lower for most of the non-lighting products and specialty lighting products. Survey respondents were asked how significant each kit element was in their decision to order the kit, and ratings were lowest for non-lighting and specialty lighting products. By contrast, the occupancy sensor power strip demonstrated high ISR and high decision driver results.

Recommendations:

- Continue to evolve the kits to match the needs of potential customers to the Online Marketplace. ISR and significance drivers will need to be monitored annually to determine the success of each kit component and should inform any modifications made to the kits.
- Continue to offer the occupancy sensor power strip in the office and retail kit. Consider including one in the restaurant kit, as well as adding additional units to the office and retail kits, as the customer reported ISR for this product was very high. 53% of survey respondents indicated the power strip was very significant in their decision to purchase the kit.
- Consider removing or reducing the amount of LED exit signs and candelabra shaped bulbs from the kits, as the customer reported ISRs, and significance ratings were much lower for those measures.

CONCLUSION 7: CURRENT MEASURE CATEGORIZATION LIMITS THE ABILITY TO CALCULATE MORE ACCURATE KIT SAVINGS ESTIMATES.

Current kit savings calculations use an assumed fuel saturation ratio in place of customer specific data. Additionally, WHFs were not incorporated into the 2021 savings calculations. During 2021, C&I Online Marketplace kit recipients were not required to provide data on their water heater fuel source or their space heating fuel source when ordering the kits online. Starting in 2022, kit recipients are required to provide data on their water heater fuel source and their space heating fuel source when ordering the C&I Online Marketplace kits. Collecting and using data on the water heater fuel type is particularly important for customers who have gas-fired water heating but are not NIPSCO gas subscribing customers. The kits they receive are not tailored to this configuration and have a higher cost impact to NIPSCO, since no savings from the domestic hot water using measures can be claimed. Utilizing data from customers regarding their water heating types will assist in determining the true cost-effectiveness of these kits. WHFs will primarily apply to facilities heated by gas and should be incorporated into the cost-effectiveness calculations. This becomes particularly important for customers who have gas space heating but are not NIPSCO gas subscribing customers. The kits they receive potentially have a higher cost impact to NIPSCO. Utilizing data from customers regarding their space heating fuel type will assist in determining the true cost-effectiveness of these kits.

Recommendations:

- Use customer-provided water heater fuel type instead of the fixed fuel saturation ratio when calculating savings for the pre-rinse spray valve, bathroom aerators, and kitchen aerators. This will require expanding the measure categories to capture the two fuel options. An example of this is shown in Table 292.
- Use customer-provided space heat fuel type instead of the fixed fuel saturation ratio when calculating waste heat factors and total savings for the lighting fixtures. This will require expanding the measure categories to capture the fuel and equipment options. Groupings and assumptions can be made regarding location, building types and equipment types to minimize the additional measure categories needed. An example of this is shown in Table 292.

TABLE 292. POSSIBLE MEASURE EXPANSION FOR COMMERCIAL ONLINE MARKETPLACE KITS

CUSTOMER CATEGORY	LIGHTING MEASURES	DHW MEASURES
Dual Fuel Customer – Restaurant Customer Selection 1: Electric Heat Customer Selection 2: Electric Water Heat	WHF determined using AC with electric heat	Savings determined using electric water heater
Dual Fuel Customer – Restaurant Customer Selection 1: Gas Heat Customer Selection 2: Gas Water Heat	WHF determined using AC with natural gas heat. Gas penalty not claimed but factored into Cost Effectiveness	Savings determined using Gas Water Heater
Electric Only Customer – Restaurant Customer Selection 1: Electric Heat Customer Selection 2: Electric Water Heat	WHF determined using AC with electric heat	Savings determined using electric water heater
Electric Only Customer – Restaurant Customer Selection 1: Gas Heat Customer Selection 2: Gas Water Heat	WHF determined using AC with natural gas heat. Gas penalty not claimed but factored into Cost Effectiveness	No savings claimed for these measures
Dual Fuel Customer – Office Customer Selection 1: Electric Heat Customer Selection 2: Electric Water Heat	WHF determined using AC with electric heat	Savings determined using electric water heater
Dual Fuel Customer – Office Customer Selection 1: Gas Heat Customer Selection 3: Gas Water Heat	WHF determined using AC with natural gas heat. Gas penalty not claimed but factored into Cost Effectiveness	Savings determined using Gas Water Heater
Electric Only Customer – Office Customer Selection 1: Electric Heat Customer Selection 2: Electric Water Heat	WHF determined using AC with electric heat	Savings determined using electric water heater

CUSTOMER CATEGORY	LIGHTING MEASURES	DHW MEASURES
Electric Only Customer – Office Customer Selection 1: Gas Heat Customer Selection 2: Gas Water Heat	WHF determined using AC with natural gas heat. Gas penalty not claimed but factored into Cost Effectiveness	No savings claimed for these measures
Dual Fuel Customer – Retail Customer Selection 1: Electric Heat Customer Selection 2: Electric Water Heat	WHF determined using AC with electric heat	Savings determined using electric water heater
Dual Fuel Customer – Retail Customer Selection 1: Gas Heat Customer Selection 2: Gas Water Heat	WHF determined using AC with natural gas heat. Gas penalty not claimed but factored into Cost Effectiveness	Savings determined using Gas Water Heater
Electric Only Customer – Retail Customer Selection 1: Electric Heat Customer Selection 2: Electric Water Heat	WHF determined using AC with electric heat	Savings determined using electric water heater
Electric Only Customer – Retail Customer Selection 1: Gas Heat Customer Selection 2: Gas Water Heat	WHF determined using AC with natural gas heat. Gas penalty not claimed but factored into Cost Effectiveness	No savings claimed for these measures
Dual Fuel Customer – Linear LED Add-on Customer Selection 1: Electric Heat Customer Selection 2: Not applicable to the kit	WHF determined using AC with electric heat	N/A
Dual Fuel Customer – Linear LED Add-on Customer Selection 1: Gas Heat Customer Selection 3: Not applicable to the kit	WHF determined using AC with natural gas heat. Gas penalty not claimed but factored into Cost Effectiveness	N/A
Electric Only Customer – A19 LED Add-on Customer Selection 1: Electric Heat Customer Selection 2: Not applicable to the kit	WHF determined using AC with electric heat	N/A
Electric Only Customer – A19 LED Add-on Customer Selection 1: Gas Heat Customer Selection 2: Not applicable to the kit	WHF determined using AC with natural gas heat. Gas penalty not claimed but factored into Cost Effectiveness	N/A

APPENDIX

Appendix 1: Energy Efficiency (HVAC) Rebates Program

Appendix 2: Residential Lighting Program

Appendix 3: Home Energy Assessment (HEA) Program

Appendix 4: Income-Qualified Weatherization (IQW) Program

Appendix 5: Multifamily Direct Install (MFDI) 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: Employee Education Program

Appendix 12: Residential Online Marketplace (OLM) Program

Appendix 13: Commercial and Industrial (C&I) Programs

Appendix 14: Commercial and Industrial (C&I) Online Marketplace Program

APPENDIX 1: ENERGY EFFICIENCY (HVAC) REBATES PROGRAM

ALGORITHMS AND DETAILED RESULTS FROM ENGINEERING REVIEW

FURNACES

The program tracking data contained 4,962 natural gas furnaces. Per the Indiana TRM (v2.2), the evaluation team used the following natural gas savings algorithm for furnaces:

$$\Delta therms = CAP \times EFLH_H \times \left(\frac{AFUE_{EE}}{AFUE_{BASE}} - 1\right) \times 0.00001$$

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
0.00001	=	Factor to convert from Btu/h to therms

The evaluation team obtained CAP and $AFUE_{EE}$ for each unit from the *ex ante* data, $EFLH_H$ from 2020 billing analysis results based on location, and assigned an $AFUE_{BASE}$ of 80% based on the Indiana TRM (v2.2). Table 293 shows the mean values for 2021.

TABLE 293. 2021 FURNACE MEAN VALUES

INDEPENDENT VARIABLES	2021 MEAN VALUE	SOURCE
Capacity	71,729.34	Actual from program tracking data
EFLH	909.11	2020 Billing Analysis, values vary based on nearest city to project location
AFUE ee	0.96	Actual from program tracking data
AFUE Base [a]	0.80	Indiana TRM (v2.2)

[a] Constants

Evaluated unit therm savings range from 38.68 to 242.08 therms, with an average value of 129.89 therms. The *ex ante* data assigned deemed savings of 187.29 therms for furnaces both with and without an ECM which are close to evaluated savings in program year 2019. The overall natural gas realization rate for this measure category is 69%. This difference is largely due to the reduced heating EFLH values based on the results of the 2020 billing analysis. Table 294 highlights these results.

TABLE 294. DETAILED RESULTS FROM FURNACES

AUDITED COUNT	*EX ANTE* DEEMED SAVINGS PER MEASURE	*EX POST* GROSS AVERAGE SAVINGS PER MEASURE	REALIZATION RATE
4,692	187.29 therms	129.89 therms	69%

FURNACES WITH ECMS – 2020 LEGACY MEASURE

In the 2021 tracking data, there were 527 natural gas furnaces with ECM measures. This measure is a 2020 legacy measure for which the evaluation team assigned a deemed savings value of 129.70 therms to measure *Natural Gas Furnace - 95% AFUE with ECM - Electric and Gas Savings* and 135.07 therms to *Natural Gas Furnace - 95% AFUE with ECM - Gas Only.* These deemed savings are the *ex post* gross per measure savings from the 2020 evaluation. Reference the 2020 NIPSCO HVAC evaluation Appendix for details on how this measure was calculated. As described in the 2020 report, due to code changes regarding ECMs, the evaluation team no longer assigns electric savings associated with these measures.

Ex ante used a deemed therms savings value of 187.29 therms and electric ECM savings of 415.00 kWh compared to an average evaluated therms savings of 132.24 therms and 0 kWh savings, resulting in a gas savings realization rate of 71% for the natural gas furnace with ECM measures.

AIR CONDITIONERS

In the 2021 tracking data, there were 930 air conditioners. The evaluation team used the following equation from the Indiana TRM (v2.2) to calculate energy savings from the SEER upgrade for air conditioners:

$$\Delta kWh = \frac{CAP}{1{,}000} \times EFLH_C \times \left(\frac{0.23}{SEER_{CODE}} + \frac{0.77}{SEER_{STOCK}} - \frac{1}{SEER_{EE}}\right)$$

Where:

CAP = Total cooling capacity in Btu/h

$EFLH_C$ = Equivalent full-load cooling hours from TRM (2.2)

$SEER_{CODE}$ = Baseline SEER value for time-of-sale replacements

$SEER_{STOCK}$ = Baseline SEER value for early replacements

$SEER_{EE}$ = Installed SEER value

ΔkWh_{ECM} = Circulation and heating mode energy savings from an ECM installation

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 2018 participant survey, based on 67 responses, determined that 23% of participants replaced broken units and 77% replaced working units. The evaluation team used the 2018 survey results because of limited responses in the 2020 survey and no survey was conducted in 2021. Based on these percentages and following the Indiana TRM (v2.2) practices for time of sale and early replacement air conditioners, the evaluation team produced a weighted baseline SEER that blends federal code ($SEER_{CODE}$ = 13.0) for broken unit replacements and building stock findings ($SEER_{STOCK}$ = 11.15) 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:

$$\Delta kW = \frac{CAP}{1{,}000} \times \left(\frac{0.23}{EER_{CODE}} + \frac{0.77}{EER_{STOCK}} - \frac{1}{EER_{EE}}\right) \times CF$$

Where:

EER_{CODE} = Baseline EER value for time-of-sale replacements

EER_{STOCK} = 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 = 0.9 * SEER to calculate demand reduction. This produced an average efficient EER of approximately 14.1, resulting in a demand reduction realization rate of 103%. Table 295 shows the mean values for 2021.

TABLE 295. 2021 AIR CONDITIONER MEAN VALUES

INDEPENDENT VARIABLES	2021 MEAN VALUE	SOURCE
Capacity	34,056.41	Actual from program tracking data
EFLHc	429.34	Indiana TRM (v2.2), values assigned based on nearest TRM city to project location
SEERcode[a]	13.00	Indiana TRM (v2.2)
SEERstock[a]	11.15	Indiana TRM (v2.2)
SEERee	15.68	Actual from program tracking data
EERcode[a]	11.00	Assumed 0.9*$SEER_{code}$
EERstock[a]	10.04	0.9*$SEER_{stock}$
EERee	14.12	Assumed 0.9*SEER
CF[a]	0.88	Indiana TRM (v2.2)
ECM_{ECM}[a]	345	2019 Wisconsin TRM

[a]Constants

Cooling savings range from 164.29 kWh to 882.32 kWh, averaging 335.85 kWh. The *ex ante* data shows deemed savings values for all air conditioners of 683.54 kWh; compared to the average *ex post* unit energy savings of 681.32 kWh, resulting in an energy savings realization rate of 100%. Table 296 highlights these results.

TABLE 296. DETAILED RESULTS FROM AIR CONDITIONERS

AUDITED COUNT	*EX ANTE* DEEMED SAVINGS PER MEASURE	*EX POST* GROSS AVERAGE SAVINGS PER MEASURE	REALIZATION RATE
930	683.54 kWh	681.32 kWh	100%
	0.777 kW	0.802 kW	103%

AIR CONDITIONERS INSTALLED WITH FURNACE WITH ECM – 2020 LEGACY MEASURE

Of the 1,036 delivered air conditioner measures, 72 (7%) were installed alongside a furnace with ECM measure in 2020. In addition to those installed alongside a furnace with ECM measure, another 34 air conditioner measures were installed in 2020 without a furnace with ECM measure. These two situations are 2020 legacy measures for which the evaluation team assigned a deemed energy savings value of 423.20 kWh and demand savings value of 0.798 kW. Reference the 2020 NIPSCO HVAC evaluation Appendix for details on how this measure was calculated. As described in the 2020 report, due to code changes regarding ECMs, the evaluation team did not assign ECM savings to ACs installed alongside furnaces with ECMs. For ACs that weren't installed alongside furnaces with ECMs, additional electric ECM savings related to blower operation during air circulation and heating were given. The 2020 program deemed savings used for this legacy measure reflects the 2020 program average electric savings across all these cases.

Ex ante used a deemed energy savings value of 683.54 kWh and demand savings of 0.777 kW, resulting in an energy savings realization rate of 62% and a demand savings realization rate of 103%.

AIR CONDITIONER TUNE-UP

In the 2021 tracking data, there were 289 air conditioner tune-ups. Per the Indiana TRM (v2.2), the evaluation team used the following savings algorithm for air conditioner tune-ups:

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

Where:

$EFLH_{COOL}$	=	Equivalent full-load cooling hours from Indiana TRM (2.2)
$Btuh_{COOL}$	=	Cooling capacity of equipment in Btuh
$SEER_{CAC}$	=	SEER efficiency of existing central air conditioning unit receiving maintenance
1,000	=	Conversion from Btuh to kBtuh
MF_E	=	Maintenance energy savings factor

The evaluation team obtained $EFLH_C$ from the Indiana TRM (v2.2) based on project location. The Indiana TRM (v2.2) suggests values for $Btuh_{COOL}$ (28,994) and $SEER_{CAC}$ (11.15). Of the 289 units for this measure, 227 listed $Btuh_{COOL}$ with an average of 32,088 Btuh. Only six units listed SEER and therefore the average SEER from air conditioners installed was used (15.65); for other inputs, the evaluation team used the TRM to find location specific values.

Per the Indiana TRM (v2.2), 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 assumed an efficient EER = 0.9 * SEER to calculate demand reduction. Table 297 shows the mean values for 2021.

TABLE 297. 2021 AC TUNE UP MEAN VALUES

INDEPENDENT VARIABLES	2021 MEAN VALUE	SOURCE
Btuh_cool	32,088.11	Actual from program tracking data
EFLHcool	430.60	Indiana TRM (v2.2), values assigned based on nearest TRM city to project location
SEERcac	15.58	Actual from program tracking data
MFe[a]	0.05	Indiana TRM (v2.2)
EER	14.03	Assumed 0.9*SEER
MFd[a]	0.05	Indiana TRM (v2.2)
CF[a]	0.88	Indiana TRM (v2.2)

[a]Constants

Evaluated savings range from 24.79 kWh to 82.62 kWh, averaging 44.39 kWh—lower than the reported savings of 51.11 kWh, which match the average evaluated savings from 2019, for a realization rate of 86% for this measure category. The difference between *ex ante* and evaluated savings is largely due to a lower average cooling capacity and greater average SEER in 2021 than in 2019. Table 298 highlights these results.

TABLE 298. DETAILED RESULTS FROM AC TUNE UPS

AUDITED COUNT	*EX ANTE* DEEMED SAVINGS PER MEASURE	*EX POST* GROSS AVERAGE SAVINGS PER MEASURE	REALIZATION RATE
289	51.11 kWh	44.39 kWh	87%
	0.117 kW	0.101 kW	86%

BOILERS

There were 51 boiler measures delivered as part of the program in 2021. These measures followed an algorithm like the furnace measures, including using 2020 furnace billing analysis results for EFLH. *Ex ante* savings were calculated using the Indiana TRM (v2.2) algorithm and assumed base AFUE and South Bend EFLH while assuming an average capacity, an average AFUE of 95% for 92% AFUE measures, and 90% AFUE for 90% AFUE measures, based on 2019 boiler data. The Indiana TRM (v2.2) assumes the same EFLH for boilers and furnaces; any offset between Indiana TRM (v2.2) and billing analysis results for furnaces likely applies to boilers as well. There was one boiler in the tracking data that lacked a reported heating capacity; evaluated savings used the reported model number to look up the heating capacity in the AHRI database. Table 299 shows the mean values for 2021.

TABLE 299. 2021 BOILER MEAN VALUES

INDEPENDENT VARIABLES	2021 MEAN VALUE - 92% AFUE	2021 MEAN VALUE - 90% AFUE	SOURCE
Capacity	120,857.14	97,000.00	Actual from program tracking data
EFLH	914.55	897.00	2020 Billing Analysis, values vary based on nearest city to project location
AFUE ee	0.95	0.91	Actual from program tracking data
AFUE Base[a]	0.80	0.80	Indiana TRM (v2.2)

[a]Constants

Evaluated savings range from 100.9 therms to 324.7 therms, averaging 204.76 therms while *ex ante* deemed savings were either 202.05 therms for 90% AFUE or 303.8 therms for 92% AFUE, averaging 299.12 therms. These savings resulted in a realization rate of 68% for this measure, largely because the evaluation team used each unit's specific reported AFUE and capacities to calculate savings. Table 300 highlights these results.

TABLE 300. DETAILED RESULTS FROM BOILERS

AUDITED COUNT	*EX ANTE* DEEMED SAVINGS PER MEASURE	*EX POST* GROSS AVERAGE SAVINGS PER MEASURE	REALIZATION RATE
51	299.12 therms	204.76 therms	68%

BOILER TUNE-UP

There were three boiler tune-ups as part of the 2021 program. Following the Indiana TRM (v2.2), the evaluation team used the following algorithm to calculate savings for boiler tune-ups:

$$\Delta therms = EFLH_{HEAT} \times \frac{Btuh}{100{,}000} \times ESF$$

Where:

$EFLH_{HEAT}$	=	Equivalent full load heating hours derived via 2020 billing analysis for furnaces
Btuh	=	Size of equipment in Btuh input capacity
ESF	=	Energy savings factor

The evaluation team assumed that the boiler tune-up would have an energy savings factor of 5% and used an $EFLH_{HEAT}$ value based on project location, from the 2020 billing analysis for furnace EFLH. In 2020 *ex ante* followed the Indiana TRM (v2.2) algorithm while assuming an average boiler capacity of 50 Btuh per square foot and a 1,700 square foot average home. For 2021, it appears *ex ante* deviates slightly from this assumption, and based on savings calculated, the assumption would instead be 87,215 Btuh. The average size of delivered units for the efficient boiler measure category was 92,500 Btuh. The evaluation team used the tracking data capacity when available, and the average tracking data capacity when not. Table 301 shows the mean values for 2021.

TABLE 301. 2021 BOILER TUNE UP MEAN VALUES

INDEPENDENT VARIABLES	2021 MEAN VALUE	SOURCE
Capacity	92,500.00	Actual from program tracking data or program average
EFLH	910.00	2020 Billing Analysis, values vary based on nearest city to project location
ESF[a]	0.05	Indiana TRM (v2.2)

[a]Constants

Evaluated savings average 42.17 therms while *ex ante* used a deemed savings value of 62.23 therms resulting in a realization of 68%. Table 302 highlights these results.

TABLE 302. DETAILED RESULTS FROM BOILER TUNE UPS

AUDITED COUNT	*EX ANTE* DEEMED SAVINGS PER MEASURE	*EX POST* GROSS AVERAGE SAVINGS PER MEASURE	REALIZATION RATE
3	62.23 therms	42.17 therms	68%

AIR SOURCE HEAT PUMPS

In the 2021 tracking data, there were four air source heat pumps. The evaluation team used the following algorithm from the Indiana TRM (v2.2) to calculate the total electric energy savings:

$$\Delta kWh = \frac{CAP_C}{1{,}000} \times EFLH_C \times \left(\frac{1}{SEER_{BASE}} - \frac{1}{SEER_{EE}}\right) + \frac{CAP_H}{1{,}000} \times EFLH_H \times \left(\frac{1}{HSPF_{BASE}} - \frac{1}{HSPF_{EE}}\right) + \Delta kWh_{CIRC}$$

Where:

CAP_C	=	Total cooling capacity
$EFLH_C$	=	Effective full-load cooling hours from Indiana TRM (2.2)
$SEER_{BASE}$	=	Baseline SEER
$SEER_{EE}$	=	Efficient SEER
CAP_H	=	Total heating capacity
$EFLH_H$	=	Effective full-load heating hours derived via 2020 billing analysis for furnaces
$HSPF_{BASE}$	=	Baseline heating seasonal performance factor
$HSPF_{EE}$	=	Efficient heating seasonal performance factor
ΔkWh_{CIRC}	=	Circulation mode energy savings from an ECM installation

The evaluation team used CAP_C and CAP_H values from model lookups in the AHRI equipment database. The evaluation team also found $SEER_{EE}$ and $HSPF_{EE}$ in the AHRI database and used $EFLH_C$ values from the Indiana TRM (v2.2) and $EFLH_H$ from the 2020 billing analysis, based on project location. The evaluation team assumed $SEER_{BASE}$ and $HSPF_{BASE}$ to be 13.0 and 7.7, respectively.

The evaluation team used the following algorithm to calculate demand reduction:

$$\Delta kW = \frac{CAP_C}{1{,}000} \times \left(\frac{1}{EER_{BASE}} - \frac{1}{EER_{EE}}\right) \times CF$$

The evaluation team assumed an EER_{BASE} of 11.0 according to the Indiana TRM (v2.2), while CF was 0.88 and the evaluation team calculated EER_{EE} according to $EER_{EE} = SEER_{EE} \times 0.9$, with $SEER_{EE}$ coming from the program data. Table 303 shows the mean values for 2021.

TABLE 303. 2021 ASHP MEAN VALUES

INDEPENDENT VARIABLES	2021 MEAN VALUE	SOURCE
CAPc	32,985.07	Actual from AHRI equipment database
EFLHc	419.40	Indiana TRM (v2.2)
SEERcode[a]	13.00	Indiana TRM (v2.2)

INDEPENDENT VARIABLES	2021 MEAN VALUE	SOURCE
SEERee	16.15	Actual from AHRI equipment database
CAPh	19,600.00	Actual from AHRI equipment database
EFLHh	904.80	2020 Billing Analysis, values vary based on nearest city to project location
HSPFbase[a]	7.70	Indiana TRM (v2.2)
HSPFee	8.75	Actual from AHRI equipment database
CF[a]	0.88	Indiana TRM (v2.2)
ECM_{Circ}[a]	211.14	2019 WIFOE TRM

[a]Constants

Evaluated savings varied from 536.32 kWh to 968.03 kWh, averaging 757.47 kWh. The evaluation team used EFLH values from the TRM and AHRI-verified capacities and efficiencies for this analysis. Using the AHRI-verified capacity made *ex post* vary widely from the *ex ante*. Evaluated demand reduction ranged from 0.453 kW to 0.907 kW, averaging 0.696 kW. The *ex ante* savings used a deemed value of 1,046.06 kWh, and the realization rate for electric energy savings was 72%. Some variances between *ex ante* and *ex post* savings were likely caused by the evaluation team's use of actual values for CAP, and $HSPF_{EE}$. *Ex ante* demand savings were a deemed value of 0.365 kW, and the peak demand realization rate for this measure category was 191%. Table 304 highlights these results.

TABLE 304. DETAILED RESULTS FROM AIR SOURCE HEAT PUMPS

AUDITED COUNT	*EX ANTE* DEEMED SAVINGS PER MEASURE	*EX POST* GROSS AVERAGE SAVINGS PER MEASURE	REALIZATION RATE
4	1,046.06 kWh	757.47 kWh	72%
	0.365 kW	0.696 kW	191%

HEAT PUMP WITH ECM – 2020 LEGACY MEASURE

There was a single heat pump with ECM measure in 2021 which is a 2020 legacy measure. The evaluation team assigned a deemed energy savings value of 1,105.40 kWh and demand savings of 0.147 kW which are the *ex post* gross per measure savings from the 2020 evaluation. *Ex ante* used deemed savings of 1,046.06 kWh and 0.365 kW resulting in an energy and demand savings realization rate of 106% and 40%, respectively. Reference the 2020 NIPSCO HVAC evaluation Appendix for details on how this measure was calculated.

SMART WI-FI THERMOSTATS

There were 2,383 smart Wi-Fi thermostats installed through the program in 2021. 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 305.

TABLE 305. 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	1,236	0.00	0	109.22
Natural gas heat with air conditioner	1,129	168.11	0.191	109.22
Air conditioner only, propane / other heat	10	168.11	0.191	0

MEASURE NAME-DEFINED CONFIGURATION	COUNT OF UNITS [a]	*EX ANTE* UNIT SAVINGS		
		KWH	KW	THERMS
Electric resistance heating with air conditioner	5	3,369.17	0.191	0
Electric resistance heating with no air conditioner	1	3,201.06	0	0
Heat pump	2	839.23	0.229	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 2020 billing analysis examined all 2018 and 2019 participants, revealing net gas savings of 35 therms (5.4%) for 2019 participants receiving one thermostat. The analysis also revealed net cooling electric energy savings of 8.3%—the savings for sites receiving one thermostat in either 2018 or 2019. More detail on these options can be seen in the billing analysis section of the 2020 HVAC evaluation report. The 35 therms gas savings value was applied for all sites with gas heat. In future years the evaluation team recommends that the 2020 billing analysis findings of 47 therms savings (HSF = 7.1%) are applied, as these may be more representative of behavior not impacted by COVID-19. Table 306 shows the mean values for 2021.

TABLE 306. 2021 THERMOSTAT MEAN VALUES

INDEPENDENT VARIABLES	2021 MEAN VALUE - GAS HEATING ONLY	2021 MEAN VALUE - ELECTRIC COOLING AND GAS HEATING	2021 MEAN VALUE - ELECTRIC COOLING AND HEATING	2021 MEAN VALUE - ELECTRIC COOLING ONLY	2021 MEAN VALUE - HEAT PUMP	2021 MEAN VALUE - ELECTRIC HEATING ONLY	SOURCE
CAP_C	-	34,426.46	34,426.46	34,426.46	32,925.33	-	Actual from the program tracking data when possible or average of program ACs or heat pumps
SEER[a]	11.15	11.15	11.15	11.15	11.15	11.15	Indiana TRM (v2.2)
$EFLH_C$	407.26	429.47	419.40	407.80	402.00	431.00	Indiana TRM (v2.2), values vary based on nearest city to project location
ESF_C[a]	0.083	0.083	0.083	0.083	0.083	0.083	2020 Billing Analysis
CAP_H	-	-	71,693.66	-	22,900.00	71,693.66	Actual from the program tracking data, when possible, otherwise program average furnaces or heat pump capacities
COP	-	-	1.00	-	2.26	1.00	Indiana TRM (v2.2) or engineering assumption
$EFLH_H$	919.78	898.88	904.80	912.60	916.50	897.00	2020 Billing Analysis, values vary based on nearest city to project location
ESF_H[a]	0.05	0.05	0.05	0.05	0.05	0.05	2020 Billing Analysis

[a]Constants

To determine energy savings for air conditioning and electric heat sites, the evaluation team used the following equations. For natural gas heating with air conditioning, and for air conditioning alone:

$$\Delta kWh = \frac{CAP_C}{SEER \times 1{,}000} \times EFLH_C \times ESF_C$$

For heat pump systems:

$$\Delta kWh = \left(\frac{CAP_C}{SEER \times 1{,}000} \times EFLH_C \times ESF_C\right) + \left(\frac{CAP_H}{COP \times 3{,}412} \times EFLH_H \times ESF_H\right)$$

Where:

CAP_C	=	System cooling capacity
SEER	=	System SEER
$EFLH_C$	=	Effective full-load cooling hours from Indiana TRM (2.2)
ESF_C	=	Savings factor for cooling derived via 2020 billing analysis, 8.3%
CAP_H	=	System heating capacity
COP	=	Heating system coefficient of performance
3,412	=	Conversion from Btu to kWh (3,412 Btu = 1 kWh)
$EFLH_H$	=	Effective full-load heating hours
ESF_H	=	Savings factor for heating derived via 2020 billing analysis, 5.4%

For thermostats serving natural gas heating systems without air conditioning, no electric energy savings are produced from the Indiana TRM (v2.2) calculations.

The Indiana TRM (v2.2) does not provide guidance on claiming demand reduction for these thermostat measures. Currently, savings for thermostats in most TRMs and evaluations are derived via analysis of billing data, which generally cannot produce values for demand reduction. However, it is likely that some demand reduction for smart Wi-Fi thermostats does exist, and this reduction is accommodated in the Illinois TRM (v9.0).[68] This TRM calculates savings using standard methods for deriving baseline peak load, then applies a smart Wi-Fi thermostat ESF and half the CF normally used for cooling. The evaluation team used that same approach. Here, the standard cooling CF of 0.88 is used, but divided by 2:

$$\Delta kW = \frac{CAP_C}{EER \times 1{,}000} \times \frac{CF}{2} \times ESF_C$$

In this evaluation 2,383 program thermostats were delivered to 2,255 sites; with 128 thermostats (5.4%) being second thermostats 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.[69] However, because NIPSCO thermostats were not found to be given away to adjacent sites, second thermostats are granted no savings.

[68] Illinois Energy Efficiency Stakeholder Advisory Group (SAG). *2021 Illinois Statewide Technical Reference Manual for Energy Efficiency Version 9.0.* September 25,2020.

[69] 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

The overall kWh realization rate for this measure category is 57%, the overall kW realization rate is 60%, and the overall natural gas realization rate is 30%. Table 307 highlights these results.

TABLE 307. DETAILED RESULTS FROM THERMOSTATS

AUDITED COUNT	*EX ANTE* DEEMED SAVINGS PER MEASURE	*EX POST* GROSS AVERAGE SAVINGS PER MEASURE	REALIZATION RATE
2,383	89.47 kWh	51.44 kWh	57%
	0.092 kW	0.056 kW	60%
	108.40 therms	32.87 therms	30%

WATER HEATERS

In the 2021 tracking data, there were 163 water heaters. The evaluation team used the following algorithm to calculate savings for water heaters:

$$\Delta therms = GPD \times 365 \times 8.3 \times \frac{\Delta T}{100{,}000} \times \left(\frac{1}{UEF_{BASE}} - \frac{1}{UEF_{EE}}\right)$$

Where:

GPD	=	Gallons per day per house
365	=	Days per year
8.3	=	Specific heat of water (Btu/gal-°F
ΔT	=	Change in temperature
UEF_{BASE}	=	Baseline uniform energy factor
UEF_{EE}	=	Efficient uniform energy factor

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 value of 53.2. The evaluation team applied groundwater temperature based on the nearest city, and assumed a water temperature setpoint of 120°F.

The current standard for residential water heater efficiency is uniform energy factor (UEF).[70] 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. Storage heaters comprised 41 of these units, and UEF_{BASE} values for them ranged from 0.61 to 0.78, averaging 0.64. The average UEF_{BASE} for instant water heaters was 0.73.

The team also used its actual rated efficient UEF determined from the AHRI database for that model to calculate savings. While conducting lookups in the AHRI database, the evaluation team determined that two reported water heater models are listed as using a propane energy source. One of which was among the 2020 legacy water heater

[70] UEF became the standard on July 13, 2015.
https://www.energy.gov/sites/prod/files/2015/03/f20/water_heater_conversionfactor_nopr.pdf

measures. The evaluation team flagged these two models and applied zero therm savings. Table 308 shows the mean values for 2021.

TABLE 308. 2021 WATER HEATER MEAN VALUES

INDEPENDENT VARIABLES	2021 MEAN VALUE - NATURAL GAS CONDENSING WATER HEATER (≥ 0.70 UEF)	2021 MEAN VALUE - NATURAL GAS TANKLESS WATER HEATER (WHOLE HOUSE; ≥ 0.94 UEF)	2021 MEAN VALUE – NATURAL GAS STORAGE WATER HEATER (≥ 0.70 UEF)	SOURCES
UEFbase	0.64	0.73	0.64	Applied based on equipment tank volume, heater type, and draw patterns found in the AHRI equipment database and in accordance with DOE standards
UEFee	0.78	0.96	0.72	Actual from AHRI equipment database
Cleaned Capacity	10,000.00	449,694.13	27,024.32	Actual from AHRI equipment database
DT	62.60	61.37	61.54	Indiana TRM (v2.2), values vary based on nearest city to project location

The resulting average evaluated unit therm savings were 29.27 therms, compared to an average *ex ante* value of 48.24 therms, for a realization rate of 61% for this measure category. Table 309 highlights these results.

TABLE 309. DETAILED RESULTS FROM WATER HEATERS

AUDITED COUNT	*EX ANTE* DEEMED SAVINGS PER MEASURE	*EX POST* GROSS AVERAGE SAVINGS PER MEASURE	REALIZATION RATE
163	48.24 therms	29.27 therms	61%

WATER HEATERS – 2020 LEGACY MEASURE

For the 2020 legacy water heater measures, the evaluation team assigned a deemed energy savings value of 14.93 therms for *Natural Gas Water Heater (0.67 EF)*, 26.68 therms for *Natural Gas Condensing Water Heater (0.80 EF)*, and 52.45 therms for *Natural Gas Tankless Water Heater (whole house; 0.82 EF),* which are the *ex post* gross per measure savings from the 2020 evaluation. Reference the 2020 NIPSCO HVAC evaluation Appendix for details on how this measure was calculated.

Ex ante used deemed savings of 15.06 therms for the *0.67* and *0.80 EF* measures and 59.76 therms for the *0.82 EF* measure, resulting in a gas savings realization rate of 90%.

DUCTLESS MINI-SPLIT HEAT PUMP

In the 2021 tracking data, there were 48 ductless mini-split heat pumps. The evaluation team used the following algorithm from the Illinois TRM (v9.0) to calculate savings for ductless mini-split heat pump:

$$\Delta kWh = Capacity_{cool} * EFLH_{cool} * \left(\frac{1}{SEER_{Base}} - \frac{1}{SEER_{ee}}\right)/1000 + Capacity_{heat*} * EFLH_{heat} * \left(\frac{1}{HSPF_{Base}} - \frac{1}{HSPF_{ee}}\right)/1000$$

Where:

$Capacity_{cool}$	=	Total cooling capacity
$EFLH_{cool}$	=	Effective full-load cooling hours from TRM (2.2)
$SEER_{Base}$	=	Baseline SEER
$SEER_{ee}$	=	Efficient SEER
$Capacity_{heat}$	=	Total heating capacity
$EFLH_{heat}$	=	Effective full-load heating hours derived via 2020 billing analysis for furnaces
$HSPF_{Base}$	=	Baseline heating seasonal performance factor
$HSPF_{ee}$	=	Efficient heating seasonal performance factor

The evaluation team used EFLH values from the 2020 billing analysis and AHRI-verified capacities and efficiencies for this analysis. Using the AHRI-verified capacities 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 $HSPF_{EE}$.

The evaluation team used the following algorithm from the Illinois TRM (v9.0) to calculate demand reduction:

$$\Delta kW = Capacity_{cool} * \left(\frac{1}{EER_{base}} - \frac{1}{EER_{ee}}\right)/1000 * CF$$

When calculating coincident peak demand savings, six 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 Indiana TRM (v2.2). Table 310 shows the mean values for 2021.

TABLE 310. 2021 DUCTLESS MINI-SPLIT MEAN VALUES

INDEPENDENT VARIABLES	2021 MEAN VALUE	SOURCE
CAPc	19,950.00	Actual from AHRI equipment database
EFLHcool	427.38	Indiana TRM (v2.2), values vary based on nearest city to project location
SEERbase[a]	13.00	Indiana TRM (v2.2)
SEERee	21.21	Actual from AHRI equipment database
CAPh	21,804.17	Actual from the program tracking data[b]
EFLHh	899.44	Actual from AHRI equipment database
HSPFbase[a]	7.70	Indiana TRM (v2.2)
HSPFee	10.84	Actual from AHRI equipment database
EERbase[a]	11.00	Indiana TRM (v2.2)
EERee	12.54	Actual from AHRI equipment database
CF[a]	0.88	Indiana TRM (v2.2)

[a]Constants

[b]Checked against AHRI equipment database, matched for all cases.

Evaluated savings varied from 390.51 kWh to 2,383.98 kWh, averaging 943.37 kWh. The *ex ante* savings used a deemed value of 701.92 kWh, and the realization rate for electric energy savings was 134%. Evaluated coincident peak demand savings ranged from 0 kW to 0.617 kW, averaging 0.172 kW. *Ex ante* demand savings were a deemed value of 0.100 kW, and the peak demand realization rate for this measure category was 172%. Table 311 highlights these results.

TABLE 311. 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
48	701.92 kWh	943.37 kWh	134%
	0.100 kW	0.172 kW	172%

AIR PURIFIERS

In the 2021 tracking data, there were 26 air purifiers. The evaluation team applied the savings approach outlined in the Illinois TRM (v9.0), where deemed savings are dependent on the installed model's smoke free clean air delivery rate (CADR):

$$\Delta kWh = electrical\ \ savings\ in\ kWh, for\ the\ specific\ CADR\ range$$

Where:

$$30 \leq Smoke\ CADR < 100 \qquad = 39\ kWh$$

$$100 \leq Smoke\ CADR < 150 \qquad = 95\ kWh$$

$$150 \leq Smoke\ CADR < 200 \qquad = 173\ kWh$$

$$200 \leq Smoke\ CADR \qquad = 328\ kWh$$

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 (v8), which attributes much higher savings per CADR bin than Illinois TRM (v9.0), which accounts for the low realization rates.

The evaluation team used the following algorithm to calculate demand reduction:

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

Where:

Hours = Average hours of use per year

CF = Summer peak coincidence factor

INDEPENDENT VARIABLES	2021 MEAN VALUE-CADR 50-100	2021 MEAN VALUE-CADR 101-150	2021 MEAN VALUE-CADR 201-250	2021 MEAN VALUE-CADR OVER 250	SOURCE
CAPc	85.00	103.86	232.38	328.00	Actual from ENERGY STAR QPL Look up

The resulting average evaluated unit kWh savings were 234.42 kWh, compared to an average *ex ante* value of 761.04 kWh, for a realization rate of 31%. The resulting average evaluated unit kW savings were 0.027 kW compared to an average *ex ante* value of 0.087 kW which led to a realization rate of 31%. Table 312 highlights these results.

TABLE 312. DETAILED RESULTS FROM AIR PURIFIERS

AUDITED COUNT	*EX ANTE* DEEMED SAVINGS PER MEASURE	*EX POST* GROSS AVERAGE SAVINGS PER MEASURE	REALIZATION RATE
26	761.04 kWh	234.42 kWh	31%
	0.087 kW	0.027 kW	31%

CLOTHES DRYERS

In the 2021 tracking data, there were nine clothes dryers. The evaluation team used the following algorithm from the Illinois TRM (v9.0) 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_{eff} = Combined energy factor (lbs/ kWh) of the ENERGYSTAR unit

N_{cycles} = Number of dryer cycles per year

%Electric = The percent of overall savings coming from electricity

The evaluation team used the following algorithm to calculate demand reduction:

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

Where:

Hours = Annual run hours of clothes dryer

CF = Summer peak coincidence factor

Clothes dryer energy type and installed CEF were determined from model number look ups in the ENERGY STAR QPL. *Ex ante* assumed an electric energy type for all installed clothes dryers, a deemed energy savings value of 160.44 kWh, and demand savings of 0.022 kW; however, it was determined during the model number look up that one installed unit was listed as having a gas energy source type. Aligning with Illinois TRM (v9.0) evaluated savings distributed 16% of energy savings to electric for this unit which resulted in energy savings of 13.08 kWh, demand savings of 0.002 kW, and kWh and kW realization rates of 8%. Table 313 shows the mean values for 2021.

TABLE 313. 2021 CLOTHES DRYERS MEAN VALUES

INDEPENDENT VARIABLES	2021 MEAN VALUE	SOURCE
Load[a]	8.45	2021 Illinois TRM (v9.0)
CEFbase[a]	3.11	2021 Illinois TRM (v9.0)
CEFeff	3.88	Actual from ENERGY STAR QPL Look up
Ncycles[a]	283.00	2021 Illinois TRM (v9.0)
%electric[a]	0.91	2021 Illinois TRM (v9.0)

[a]Constants

For all other units the evaluated savings varied from 160.44 kWh to 161.98 kWh, averaging 161.20 kWh while *ex ante* assumed a deemed energy savings value of 160.44 kWh resulting in an average kWh realization rate of 101%.

Evaluated demand savings for these remaining electric units averaged 0.022 kW while *ex ante* used deemed demand savings of 0.022 kW resulting in an average kW realization rate of 100%.

Overall, the clothes dryer measure category had average evaluated savings of 144.75 kWh and average demand savings of 0.019 kW, resulting in kWh and kW savings realization rates of 90% and 88%, respectively. Table 314 highlights these results.

TABLE 314. DETAILED RESULTS FROM CLOTHES DRYERS

TRACKING DATA	*EX ANTE* DEEMED SAVINGS PER MEASURE	*EX POST* GROSS AVERAGE SAVINGS PER MEASURE	REALIZATION RATE
9	160.44	144.75 kWh	90%
	0.022 kW	0.019 kW	88%

DEHUMIDIFIERS

In the 2021 tracking data, there were 91 dehumidifiers. The evaluation team used the following algorithm from the Illinois TRM (v9.0) 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 315 shows the mean values for 2021.

TABLE 315. 2021 DEHUMIDIFIERS MEAN VALUES

INDEPENDENT VARIABLES	2021 MEAN VALUE - (CAPACITY ≤ 25 PINTS/DAY) (≥ 1.57 L/KWH)	2021 MEAN VALUE - (CAPACITY 25 - 50 PINTS/DAY) (≥ 1.80 L/KWH)	2021 MEAN VALUE - PORTABLE (CAPACITY > 50 PINTS/DAY) (≥ 3.30 L/KWH)	SOURCE
Average Capacity	27.82	46.43	49.89	Actual from ENERGY STAR QPL Look up
Federal Standard L/kWh	1.40	1.60	1.60	2021 Illinois TRM (v9.0)
L/kWh	1.72	1.86	1.84	Actual from ENERGY STAR QPL Look up
Pints to Liters[a]	0.47	0.47	0.47	2021 Illinois TRM (v9.0)
Run Hours/year[a]	1,632.00	1,632.00	1,632.00	2021 Illinois TRM (v9.0)
Hours/day[a]	24.00	24.00	24.00	2021 Illinois TRM (v9.0)

[a]Constants

Ex ante savings varied from 91.80 kWh to 133.32 kWh based on their capacity and L/kWh values, averaging 95.52 kWh. Evaluated savings varied from 77.91 kWh to 178.89 kWh, averaging 126.47 kWh, which resulted in an average kWh realization rate of 132%. *Ex ante* demand savings varied from 0.021 kW to 0.030 kW, averaging 0.022 kW; while evaluated demand savings varied from 0.018 kW to 0.041 kW, averaging 0.029 kW and resulting in an average kW realization rate of 132%. Table 316 highlights these results.

TABLE 316. DETAILED RESULTS FROM DEHUMIDIFIERS

TRACKING DATA	*EX ANTE* DEEMED SAVINGS PER MEASURE	*EX POST* GROSS AVERAGE SAVINGS PER MEASURE	REALIZATION RATE
91	95.52 kWh	126.47 kWh	132%
	0.022 kW	0.029 kW	132%

APPENDIX 2: RESIDENTIAL LIGHTING PROGRAM

LEDS

The evaluation team used the following equations to calculate electric energy and peak demand savings for LEDs:

$$kWh\ savings\ per\ lamp = \frac{(W_{base} - W_{LED}) * (Daily\ hour\ \ of\ use * 365) * (1 + WHF_e)}{1{,}000} * ISR$$

$$kW\ reduction\ per\ lamp = \frac{(W_{base} - W_{LED}) * Coincidence\ Factor * (1 + WHF_d)}{1{,}000} * ISR$$

Where:

W_{base}	=	Wattage of the bulb being replaced, W
W_{LED}	=	Wattage of the LED bulb, W
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)
Coincidence Factor	=	Summer peak coincidence factor
365	=	Number of days per year, days per year
1,000	=	Constant to convert watts to kilowatts
ISR	=	In-service rate

Table 317 lists the input assumptions and source of each assumption for the LED measure savings calculations.

TABLE 317. *EX POST* VARIABLE ASSUMPTIONS FOR LEDS

INPUT	VALUE	SOURCE
W_{base}	Varies	ENERGY STAR lumens bins
W_{LED}	Varies	Actual wattage from 2020 tracking data
Daily Hours of Use x 365	902	Indiana TRM (v2.2)
WHF_e	-0.07	Indiana TRM (v2.2), South Bend values
WHF_d	0.038	Indiana TRM (v2.2), averaged across participant location
Coincidence Factor	0.11	Indiana TRM (v2.2)
ISR	Varies	2015 Opinion Dynamics Market Effects Study

BASELINE WATTAGE FOR PAR AND MR LAMP TYPES

For highly focused directional lamps, the evaluation team used the Center Beam Candle Power (CBCP) and beam angle measurements to accurately estimate the equivalent baseline wattage. The formula below is based on the ENERGY STAR Center Beam Candle Power tool.[71] If CBCP and beam angle information were not available or if the equation below returned a negative value (or undefined), the team used the manufacturer's recommended baseline wattage equivalent.[72] The baseline wattage algorithm below is for reference.

$$Wbase = 375.1 - 4.355(D) - \sqrt{227800} - 937.9(D) - 0.9903(D2) - 1479(BA) - 12.02(D * BA) + 14.69(BA2) - 16720 * ln(CBCP)\ 84$$

Where:

D	=	Bulb diameter (e.g., for PAR20 D = 20)
BA	=	Beam angle
CBCP	=	Center beam candle power

The evaluation team rounded down the result of the ENERGY STAR calculator or equation above to the nearest wattage established by ENERGY STAR, as shown in Table 318.

TABLE 318. BASELINE WATTAGES FOR PAR AND MR LED LAMPS

LAMP DIAMETER	PERMITTED WATTAGES
16	20, 35, 40, 45, 50, 60, 75
20	50
30S	40, 45, 50, 60, 75
30L	50, 75
38	40, 45, 50, 55, 60, 65, 75, 85, 90, 100, 120, 150, 250

BASELINE WATTAGE FOR NONPARTICIPATION AND MR LAMP TYPES

Table 319 shows the distribution of baseline wattages applied using the lumen equivalence method. This approach is specified in the UMP and uses the ENERGY STAR online database to calculate final baseline wattages for all program LEDs except certain PAR and MR lamp types (depending on their stated output).

[71] ENERGY STAR.gov. Accessed March 7, 2022. "ENERGY STAR Lamps v1.1. Center Beam Intensity Benchmark Tool." http://www.energystar.gov/ia/products/lighting/iledl/IntLampCenterBeamTool.zip

[72] The ENERGY STAR CBCP tool does not accurately model baseline wattages for lamps with certain bulb characteristic combinations, specifically for lamps with very high CBCP.

TABLE 319. BASELINE WATTAGES FOR LED LAMPS BY LUMENS AND SHAPE

LAMP SHAPE	LUMEN RANGE LOWER	LUMEN RANGE UPPER	2017–2020 $WATTS_{BASE}$
Omnidirectional, Medium Screw-Base Lamps (A, BT, P, PS, S or T) See exceptions in gray rows below	250	309	25
	310	749	29
	750	1,049	43
	1,050	1,489	53
	1,490	2,600	72
	2,601	3,300	150
	3,301	3,999	200
	4,000	6,000	300
S Shape ≤749 lumens and T Shape ≤749 lumens or T Shape >10-inches long	250	309	25
	310	749	40
Decorative, Medium Screw-Base Lamps (G) See exceptions in gray rows below	250	309	25
	310	749	29
	750	1,049	43
	1,050	1,300	53
G16-1/2, G25, and G30 ≤499 lumens	250	309	25
	310	349	25
	350	499	40
G Shape with diameter ≥5 inches	250	349	25
	350	499	40
	500	574	60
	575	649	75
	650	1,099	100
	1,100	1,300	150
Decorative, Medium Screw-Base Lamps (B, BA, C, CA, DC, F, and ST) See exceptions in gray rows below	70	89	10
	90	149	15
	150	299	25
	300	309	40
	310	499	29
	500	699	29
B, BA, CA, and F ≤499 lumens	70	89	10
	90	149	15
	150	299	25
	300	309	40
	310	499	40
Omnidirectional, Intermediate Screw-Base Lamps (A, BT, P, PS, S or T) See exceptions in gray rows below	250	309	25
	310	749	40
S Shape with a first number ≤12.5 and T Shape with a first number ≤8 and nominal overall length <12 inches	250	309	25
	310	749	40
Decorative, Intermediate Screw-Base Lamps (G) See exceptions in gray rows below	250	309	25
	310	349	25
	350	499	40
G Shape with a first number ≤12.5 or diameter ≥5 inches	250	349	25
	350	499	40
Decorative, Intermediate Screw-Base Lamps (B, BA, C, CA, DC, F, and ST)	70	89	10
	90	149	15
	150	299	25
	300	309	40
	310	499	40
Omnidirectional, Candelabra Screw-Base Lamps (A, BT, P, PS, S, and T) See exceptions in gray rows below	250	309	25
	310	749	40
	750	1,049	60

LAMP SHAPE	LUMEN RANGE LOWER	LUMEN RANGE UPPER	2017–2020 $WATTS_{BASE}$
S Shape with a first number ≤12.5 and T Shape with a first number ≤8 and nominal overall length <12 inches	250	309	25
	310	749	40
	750	1,049	60
Decorative, Candelabra Screw-Base Lamps (G) See exceptions in gray rows below	250	309	25
	310	349	25
	350	499	40
	500	574	60
G Shape with a first number ≤12.5 or diameter ≥5 inches	250	349	25
	350	499	40
	500	574	60
Decorative, Candelabra Screw-Base Lamps (B, BA, C, CA, DC, F, and ST)	70	89	10
	90	149	15
	150	299	25
	300	309	40
	310	499	40
	500	699	60
Directional, Medium Screw-Base Lamps with Diameter ≤2.25 Inches	400	449	40
	450	499	45
	500	649	50
	650	1,199	65
Directional, Medium Screw-Base Lamps (R, ER, BR, BPAR, and similar bulb shapes with diameter >2.5 inches) See exceptions in gray rows below	640	739	40
	740	849	45
	850	1,179	50
	1,180	1,419	65
	1,420	1,789	75
	1,790	2,049	90
	2,050	2,579	100
	2,580	3,300	120
	3,301	3,429	120
	3,430	4,270	150
Directional, Medium Screw-Base Lamps (R, ER, BR, BPAR, and similar bulb shapes with medium screw bases and diameter >2.26 inches and ≤2.5 inches) See exceptions in gray rows below	540	629	40
	630	719	45
	720	999	50
	1,000	1,199	65
	1,200	1,519	75
	1,520	1,729	90
	1,730	2,189	100
	2,190	2,899	120
	2,900	3,300	120
	3,301	3,850	150
ER30, BR30, BR40, or ER40	400	449	40
	450	499	45
	500	649 to 1,179	50
BR30, BR40, or ER40	650	1419	65
R20	400	449	40
	450	719	45
All reflector lamps below lumen ranges specified above	200	299	20
	300	399 to 639	30

LAMP SHAPE	LUMEN RANGE		
	LOWER	UPPER	2017–2020 $WATTS_{BASE}$
Rough Service, Shatter Resistant, Three-Way Incandescent, and Vibration	250	309	25
	310	749	40
	750	1,049	60
	1,050	1,489	75
	1,490	2,600	100
	2,601	3,300	150
	3,301	3,999	200
	4,000	6,000	300

APPENDIX 3: HOME ENERGY ASSESSMENT (HEA) PROGRAM

ALGORITHMS AND ASSUMPTIONS

This appendix contains the assumptions used in electric savings, demand reduction, and gas savings algorithms for the measures within the Home Energy Assessment program. The team examined each assumption behind the algorithms to capture savings and compared it against the Indiana TRM (v2.2), the Pennsylvania TRM 2016, the Uniform Methods Project, and CHA data from the 2019 NIPSCO program. Detailed information on the analysis and supporting assumptions for the following Home Energy Assessment program measures are included within this appendix:

- LEDs
- Kitchen faucet aerators
- Bathroom faucet aerators
- Low flow showerheads
- Shower Start
- Pipe Wrap
- Attic Insulation
- Duct sealing
- Filter Whistle
- Kits

Table 320 lists the assumptions of the *ex post* per-measure savings for direct install measures.

TABLE 320. HEA *EX POST* SAVINGS FOR DIRECT INSTALL 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
Filter Whistle	Motor kW, efficiency improvement, full load heating and cooling hours, and coincidence factor

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 321 lists the input assumptions and source of each assumption for the LED measure savings calculations.

TABLE 321. *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_{LED} (Candelabra)	5	Actual installed wattage
W_{LED} (Globe)	6	Actual installed wattage
W_{LED} (A-Line)	9	Actual installed wattage
Daily hours of use x 365	902	Indiana TRM (v2.2)
WHF_e	-0.07	Indiana TRM (v2.2), values assigned based on nearest TRM city. Value shown is the program average, not the value used to calculate savings for each participant
WHF_d	0.038	Indiana TRM (v2.2), values assigned based on nearest TRM city. Value shown is the program average, not the value used to calculate savings for each participant

INPUT	VALUE	SOURCE
WHF_g	-0.0019	Indiana TRM (v2.2), values assigned based on nearest TRM city. Value shown is the program average, not the value used to calculate savings for each participant
Coincidence Factor	0.11	Indiana TRM (v2.2)
Conversion Factor	1000	Convert watts to kW
Conversion Factor	365	Convert years to days

KITCHEN AND BATHROOM FAUCET AERATORS

The evaluation team used the following equations to calculate electric energy, peak demand, and natural gas energy savings for Low Flow Kitchen and Bathroom Faucet Aerators:

$$kWh\ savings = ISR * \left(GPM_{base} - GPM_{low\ flow}\right) * MPD * \frac{PH}{FH} * DR * 8.3 * (T_{mix} - T_{inlet}) * \frac{365}{RE * 3412}$$

$$kW\ savings = ISR * \left(GPM_{base} - GPM_{low\ flow}\right) * 60 * DR * 8.3 * \frac{T_{mix} - T_{inlet}}{RE * 3412} * CF$$

$$therm\ savings = ISR * \left(GPM_{base} - GPM_{low\ flow}\right) * MPD * \frac{PH}{FH} * DR * 8.3 * (T_{mix} - T_{inlet}) * \frac{365}{RG * 100{,}000}$$

Where:

GPM_{base}	=	Gallons per minute of baseline faucet aerator
$GPM_{low\ flow}$	=	Gallons per minute of low flow faucet aerator
ISR	=	In-service rate, or fraction of units that get installed
MPD	=	Average minutes of faucet use per person per day
PH	=	Average number of people per household
FH	=	Average number of faucets per household
DR	=	Percentage of water flowing down the drain
T_{mix}	=	Mixed water temperature exiting faucet, °F
T_{inlet}	=	Cold water temperature entering the DWH system, °F (depends on location)
RE	=	Recovery efficiency of electric hot water heater
RG	=	Recovery efficiency of natural gas hot water heater
CF	=	Summer peak coincidence factor
60	=	Minutes per Hour
8.3	=	Specific weight of water in pounds per gallon
3,412	=	Constant to convert Btu to kWh
365	=	Days of faucet use per year
100,000	=	Constant to convert Btu to therms

Table 322 lists the assumptions and source of each assumption for kitchen and bathroom faucet aerator measure savings calculations.

TABLE 322. *EX POST* VARIABLE ASSUMPTION FOR KITCHEN AND BATHROOM FAUCET AERATORS

INPUT	VALUE	SOURCE
GPM_{base} (Kitchen)	2.44	Indiana TRM (v2.2)
GPM_{base} (Bathroom)	1.9	Indiana TRM (v2.2)
$GPM_{low\ flow}$ (Kitchen)	1.5	Actual
$GPM_{low\ flow}$ (Bathroom)	1.0	Actual
ISR	1.0	Indiana TRM (v2.2)
MPD (Kitchen)	4.5	Indiana TRM (v2.2)
MPD (Bathroom)	1.6	Indiana TRM (v2.2)
PH	2.64	Indiana TRM (v2.2)
FH (Kitchen)	1.0	Indiana TRM (v2.2)
FH (Bathroom)	2.04	Indiana TRM (v2.2)
DR (Kitchen)	0.50	Indiana TRM (v2.2)
DR (Bathroom)	0.70	Indiana TRM (v2.2)
T_{mix} (Kitchen)	93.00	Indiana TRM (v2.2)
T_{mix} (Bathroom)	86.00	Indiana TRM (v2.2)
T_{inlet}	57.15	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	Indiana TRM (v2.2)
RG	0.76	Indiana TRM (v2.2)
CF	0.11	Indiana TRM (v2.2)
Conversion Factor	60	Minutes per hour
Conversion Factor	8.3	Specific weight of water in pounds per gallon
Conversion Factor	3,412	Constant to convert Btu to kWh
Conversion Factor	365	Days of faucet use per year
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:

$$kWh\ savings = ISR * \left(GPM_{base} - GPM_{low\ flow}\right) * MS * \frac{SPH}{SH} * 8.3 * (T_{mix} - T_{inlet}) * \frac{365}{RE * 3412}$$

$$kW\ savings = ISR * \left(GPM_{base} - GPM_{low\ flow}\right) * 60 * 8.3 * \frac{T_{mix} - T_{inlet}}{RE * 3412} * CF$$

$$therm\ savings = ISR * \left(GPM_{base} - GPM_{low\ flow}\right) * MS * \frac{SPH}{SH} * 8.3 * (T_{mix} - T_{inlet}) * \frac{365}{RG * 100{,}000}$$

Where:

GPM_{base}	=	Gallons per minute of baseline showerhead
$GPM_{low\ flow}$	=	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 323 lists the assumptions and source of each assumption for low flow showerhead measure savings calculations.

TABLE 323. *EX POST* VARIABLE ASSUMPTIONS FOR LOW FLOW SHOWERHEADS

INPUT	VALUE	SOURCE
GPM_{base}	2.63	Indiana TRM (v2.2)
$GPM_{low\ flow}$	1.5	Actual
ISR	1.0	Indiana TRM (v2.2)
MS	7.8	Indiana TRM (v2.2)
SPH	2.45	NIPSCO 2021 Survey Results
SH	1.94	NIPSCO 2019 Survey Results
T_{mix}	101	Indiana TRM (v2.2)
T_{inlet}	57.19	Indiana TRM (v2.2), values assigned based on nearest TRM city. Value shown is the program average, not the value used to calculate savings for each participant
RE	0.98	Indiana TRM (v2.2)
RG	0.76	Indiana TRM (v2.2)
CF	0.0023	Indiana TRM (v2.2)
Conversion Factor	60	Minutes per hour
Conversion Factor	8.3	Specific weight of water in pounds per gallon
Conversion Factor	3,412	Constant to convert Btu to kWh
Conversion Factor	365	Days of faucet use per year

SHOWER START

The evaluation team used the following equations to calculate electric energy, peak demand, and natural gas energy savings for shower start attachments:

$$kWh\ savings = \frac{ISR * GPM}{60} * \frac{8.3}{3412} * (T_{out} - T_{in}) * \frac{SPH}{SH} * \frac{WS}{RE} * 365$$

$$kW\ savings = kWh\ savings * CF$$

$$therm\ savings = \frac{ISR * GPM}{60} * \frac{8.3}{100{,}000} * (T_{out} - T_{in}) * \frac{SPH}{SH} * \frac{WS}{RG} * 365$$

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 seconds 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
60	=	Seconds per Minute
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 324 lists the assumptions and source of each assumption for shower start measure savings calculations.

TABLE 324. *EX POST* VARIABLE ASSUMPTIONS FOR SHOWER START

INPUT	VALUE	SOURCE
GPM_{base}	2.63	Indiana TRM (v2.2). Used for projects where a shower start was installed without a new low flow showerhead.
$GPM_{low\ flow}$	1.5	Actual. Used for projects where a shower start was installed along with a new low flow showerhead.
ISR	1.0	Indiana TRM (v2.2)
SPH	1.45	NIPSCO 2021 Survey Results
SH	1.94	NIPSCO 2019 Survey Results

INPUT	VALUE	SOURCE
WS	59	PA TRM 2016
T_{mix}	101	Indiana TRM (v2.2)
T_{inlet}	57.19	Indiana TRM (v2.2), values assigned based on nearest TRM city. Value shown is the program average, not the value used to calculate savings for each participant
RE	0.98	Indiana TRM (v2.2)
RG	0.76	Indiana TRM (v2.2)
CF	0.00008013	PA TRM 2016
Conversion Factor	60	Seconds per minute
Conversion Factor	8.3	Product of the specific weight of water (pounds per gallon) and the specific heat capacity of water (Btu per pound per °F)
Conversion Factor	3,412	Constant to convert Btu to kWh
Conversion Factor	365	Days of faucet use per year

PIPE WRAP

The evaluation team used the following equations to calculate electric energy, peak demand, and natural gas energy savings for Pipe Wrap:

$$kWh\ savings = \left(\frac{1}{R_{Exist}} - \frac{1}{R_{New}}\right) * \frac{L * C * \Delta T * 8{,}760}{\eta_{DHWE} * 3{,}412}$$

$$kW\ savings = \frac{kWh\ savings}{8{,}760}$$

$$therm\ savings = \left(\frac{1}{R_{Exist}} - \frac{1}{R_{New}}\right) * \frac{L * C * \Delta T * 8{,}760}{\eta_{DHWG} * 100{,}000}$$

Where:

R_{Exist}	=	Pipe heat loss coefficient (R-value) of uninsulated pipe existing
R_{New}	=	Pipe heat loss coefficient (R-value) of insulated pipe
L	=	Feet of pipe from water heating source covered by pipe wrap
C	=	Circumference of pipe in feet
ΔT	=	Average temperature difference between supplied water and ambient air temperature
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 325 lists the assumptions and source of each assumption for pipe wrap savings calculations.

TABLE 325. *EX POST* VARIABLE ASSUMPTIONS FOR PIPE WRAP

INPUT	VALUE	SOURCE
R_{Exist}	1.00	Indiana TRM (v2.2)
R_{New}	4.15	Actual. Based on insulation R-value of 3.15 and bare-pipe R-value of 1.0 (per Indiana TRM (v2.2).
L	4.38	Value shown is the program average, not the value used to calculate savings for each participant.
C	0.196	Actual. Based on assumed pipe diameter of 0.75 inches
ΔT	65	Indiana TRM (v2.2)
η_{DHWE}	.98	Indiana TRM (v2.2)
η_{DHWG}	.75	Indiana TRM (v2.2)
Conversion Factor	3,412	Constant to convert Btu to kWh
Conversion Factor	100,000	Constant to convert Btu to therms

ATTIC INSULATION

The evaluation team used the following equations to calculate electric energy, peak demand, and natural gas energy savings for attic insulation:

$$kWh\ savings = \left(\frac{SF}{1000}\right) * \left(\frac{\Delta kWh}{kSF}\right)$$

$$kW\ savings = \left(\frac{SF}{1000}\right) * \left(\frac{\Delta kW}{kSF}\right) * CF$$

$$therm\ savings = \left(\frac{SF}{1000}\right) * \left(\frac{\Delta MMBtu}{kSF}\right) * 10$$

Where:

SF = Total area of wall insulation in square feet

ΔkWh/kSF = Energy savings expected for every 1,000 square feet of insulation installed with respect to pre-R and post-R values from data tracking information

ΔkW/kSF = Demand savings expected for every 1,000 square feet of insulation installed with respect to pre-R and post-R values from data tracking information

ΔMMBtu/kSF = Natural gas savings expected for every 1,000 square feet of insulation installed with respect to pre-R and post-R values from data tracking information

CF = Coincidence factor

Electric energy, peak demand, and natural gas energy savings are dependent upon pre-R and post-R measure insulation values, calculated using the following steps:

- **Step 1.** Determine variables for insulation compression, R_{ratio}, and void factors
- **Step 2.** Calculate adjusted R-values, R_{adj}
- **Step 3.** Interpolate with Indiana TRM (v2.2) tables to obtain savings per 1,000 square feet of insulation to obtain values for ΔkWh/kSF, ΔkW/kSF, ΔMMBtu/kSF

Step 1. Determine variables for insulation compression, R_{ratio}, and void factors:

Adjusted pre-installation and post-installation R-values are calculated using the following formula:

$$R_{adj} = R_{nominal} * F_{compression} * F_{void}$$

Where:

$R_{nominal}$ = Total installed R-value per manufacturers specifications. This value varies across participants and was calculated on an individual level to account for individual savings between pre and post measure.

$F_{compression}$ = Insulation compression factor, assumed to be 1 for 0% compression (as shown in TRM v2.2), because actual information is unknown.

F_{void} = Void factor, dependent on insulation grade level and percent coverage, assumed to be at the 2% grade per the Indiana TRM (v2.2), because the actual information is unknown.

The void factor, F_{void}, varies based on the ration between the full assembly R-value and he nominal R-value, $R_{nominal}$, including compression effects. Pre and post insulation values are determined next, using the following equation:

$$R_{ratio} = \frac{R_{nominal} * F_{compression}}{R_{nominal} + R_{framing\&airspace}}$$

Where:

$R_{nominal}$ = Total installed R-value per manufacturers specifications. This value varies across participants and was calculated on an individual level to account for individual savings between pre and post measure.

$F_{compression}$ = Insulation compression factor, assumed to be 1 for 0% compression (as shown in TRM v2.2), because actual information is unknown.

$R_{framing\&airspace}$ = R-value for materials, framing, and airspace for the area in which the insulation is installed. Assumed to be R-5, per Indiana TRM (v2.2).

Values for void factors, based on the R_{ratio} calculation are shown in Table 326. The evaluation team assumed a void factor at 2% in accordance with the Indiana TRM (v2.2).

TABLE 326. INSULATION VOID FACTORS

R_{RATIO}	F_{VOID}, 2%
0.50	0.96
0.55	0.96
0.60	0.95
0.65	0.94
0.70	0.94
0.75	0.94
0.80	0.91
0.85	0.88
0.90	0.83
0.95	0.71
0.99	0.33

Step 2. Calculate R_{adj}

Pre-R and post-R values, R_{adj}, are calculated at the participant level using $R_{nominal}$ and R_{ratio}

Step 3. Determine ΔkWh/kSF, ΔkW/kSF, ΔMMBtu/kSF

Electric energy, peak demand, and natural gas savings per thousand square feet values were obtained by interpolating within the Indiana TRM (v2.2) tables and averaging across participant location.

Table 327 lists the assumptions and source for R-values of insulation in the attic insulation measure.

TABLE 327. *EX POST* VARIABLE ASSUMPTIONS FOR ATTIC INSULATION

INPUT	VALUE	SOURCE
$R_{nominal-pre}$ (Not adjusted for voids / compression)	6.02	Value assigned based on CHA report data. Value shown is a program average which was used for the analysis.
$R_{nominal-post}$ (Not adjusted for voids / compression)	40.06	Value assigned based on CHA report data. Value shown is a program average which was used for the analysis.
$R_{framing\&airspace}$	5.0	R-value for materials, framing, and airspace for the area in which the insulation is installed. Assumed to be R-5, per Indiana TRM (v2.2).
$F_{compression}$	1.00	Insulation compression factor, assumed to be 1.0 for 0% compression (as shown in TRM v2.2), because actual information is unknown.
$R\text{-ratio}_{pre}$	0.55	Calculated using $R_{nominal-pre}$, $F_{compression}$, and $R_{framing\&airspace}$
$R\text{-ratio}_{post}$	0.89	Calculated using $R_{nominal-post}$, $F_{compression}$, and $R_{framing\&airspace}$
$F_{void-pre}$	0.96	Interpolated from insulation void factors from the Indiana TRM (v2.2) based on the ratio of $R_{nominal-pre}$ to $R_{nominal-post}$.
$F_{void-post}$	0.84	Interpolated from insulation void factors from the Indiana TRM (v2.2) based on the ratio of $R_{nominal-pre}$ to $R_{nominal-post}$.
$R_{adj-pre}$ (Adjusted for voids / compression)	5.78	Calculated using $R_{nominal-pre}$, $F_{compression}$, and $F_{void-pre}$
$R_{adj-post}$ (Adjusted for voids / compression)	33.69	Calculated using $R_{nominal-post}$, $F_{compression}$, and $F_{void-post}$

Table 328 lists the program-average kWh savings per thousand square feet for the attic insulation measure.

TABLE 328. *EX POST* kWh SAVINGS PER THOUSAND SQUARE FEET OF ATTIC INSULATION

TRM REFERENCE CITY	HVAC SYSTEM TYPE	SAVINGS VALUES
Ft. Wayne	Gas Heating Only	100.2
South Bend	Electric Cooling and Gas Heating	236.0
South Bend	Electric Cooling and Heating	4,942.5
South Bend	Gas Heating Only	102.2

Table 329 lists the program-average KW savings per thousand square feet for the attic insulation measure.

TABLE 329. *EX POST* KW SAVINGS PER THOUSAND SQUARE FEET OF ATTIC INSULATION

TRM REFERENCE CITY	HVAC SYSTEM TYPE	SAVINGS VALUES
Ft. Wayne	Gas Heating Only	0.000
South Bend	Electric Cooling and Gas Heating	0.116
South Bend	Electric Cooling and Heating	0.068
South Bend	Gas Heating Only	0.000

Table 330 lists the program-average MMBtu savings per thousand square feet for the attic insulation measure.

TABLE 330. *EX POST* MMBtu SAVINGS PER THOUSAND PER THOUSAND SQUARE FEET OF ATTIC INSULATION

TRM REFERENCE CITY	HVAC SYSTEM TYPE	SAVINGS VALUES
Ft. Wayne	Gas Heating Only	21.7
South Bend	Electric Cooling and Gas Heating	20.7
South Bend	Electric Cooling and Heating	0.0
South Bend	Gas Heating Only	21.0

DUCT SEALING

The evaluation team used the following equations to calculate electric and natural gas energy savings for duct sealing.

$$kWh\ savings_{cool} = \frac{DE_{coolafter} - DE_{coolbefore}}{DE_{coolafter}} * \frac{EFLH_{cool} * Btuh_{cool}}{SEER * 1{,}000}$$

$$kWh\ savings_{hea} \ = \frac{DE_{heatafter} - DE_{heatbefore}}{DE_{heatafter}} * \frac{EFLH_{heat} * Btuh_{heat}}{3{,}412 * N_{heating}}$$

$$kW\ savings = \left(\frac{DE_{pkafter} - DE_{pkbefore}}{DE_{pkafter}}\right) * \left(\frac{Btuh_{cool}}{EER * 1{,}000} * CF\right)$$

$$therm\ savings = 56.4$$

Where:

$DE_{coolafter}$ = Distribution efficiency after duct sealing

$DE_{coolbefore}$ = Distribution efficiency before duct sealing

$DE_{heatafter}$ = Distribution efficiency after duct sealing

$DE_{heatbefore}$ = Distribution efficiency before duct sealing

$DE_{pkafter}$ = Distribution efficiency under peak summer conditions after duct sealing

$DE_{pkbefore}$ = Distribution efficiency under peak summer conditions before duct sealing

$EFLH_{cool}$ = Full load cooling hours

$EFLH_{heat}$ = Full load heating hours

$BtuH_{cool}$ = Cooling capacity of cooling equipment (Btu per hour)

$BtuH_{heat}$ = Heating capacity of heating equipment (Btu per hour)

N_{heat} = Efficiency in COP of heating equipment

SEER	=	Seasonal average efficiency of air conditioning equipment
EER	=	Peak efficiency of air conditioning equipment
56.4	=	Gas duct sealing savings evaluated through billing analysis in the 2018 program evaluation
CF	=	Coincidence factor

Table 331 lists the assumptions and source of each assumption for the duct sealing savings calculations.

TABLE 331. *EX POST* VARIABLE ASSUMPTIONS FOR DUCT SEALING

INPUT	VALUE	SOURCE
$DE_{coolafter}$ (attic)	0.70	Value assigned based on 2019 program average.
$DE_{coolafter}$ (basement)	0.89	Value assigned based on 2019 program average.
$DE_{coolbefore}$ (attic)	0.62	Value assigned based on 2019 program average.
$DE_{coolbefore}$ (basement)	0.83	Value assigned based on 2019 program average.
$DE_{heatafter}$ (attic)	0.71	Value assigned based on 2019 program average.
$DE_{heatafter}$ (basement)	0.76	Value assigned based on 2019 program average.
$DE_{heatbefore}$ (attic)	0.65	Value assigned based on 2019 program average.
$DE_{heatbefore}$ (basement)	0.71	Value assigned based on 2019 program average.
$DE_{pkafter}$ (attic)	0.58	Value assigned based on 2019 program average.
$DE_{pkafter}$ (basement)	0.87	Value assigned based on 2019 program average.
$DE_{pkbefore}$ (attic)	0.47	Value assigned based on 2019 program average.
$DE_{pkbefore}$ (basement)	0.81	Value assigned based on 2019 program average.
$EFLH_{heat}$	1,417	Indiana TRM (v2.2). values assigned based on nearest TRM city. Value shown is the program average, not the value used to calculate savings for each participant
$EFLH_{cool}$	427	Indiana TRM (v2.2). values assigned based on nearest TRM city. Value shown is the program average, not the value used to calculate savings for each participant
SEER	11.41	Value assigned based on 2019 program average.
EER	10.10	Value assigned based on 2019 program average.
$N_{heating}$	1	Indiana TRM (v2.2)
$BtuH_{cool}$	31,763	Value assigned based on 2019 program average.
$BtuH_{heat}$	80,000	Value assigned based on 2019 program average.
56.43	56.4	Gas duct sealing savings evaluated through billing analysis in the 2018 program evaluation
CF	0.88	Indiana TRM (v2.2)

FILTER WHISTLE

The evaluation team used the following equations to calculate electric energy, peak demand, and natural gas energy savings for Filter Whistle:

$$kWh\ savings = \Delta kWh_{heat} + \Delta kWh_{cool}$$

$$\Delta kWh_{heat} = kW_{motor} * EFLH_{he} \quad * EI * ISR$$

$$\Delta kWh_{cool} = kW_{motor} * EFLH_{cool} * EI * ISR$$

$$kW\ reduction = \frac{\Delta kWh_{cool}}{EFLH_{cool}} * CF$$

$$therms = \frac{\Delta kWh_{heat}}{29.3}$$

Where:

kW_{motor}	=	Average motor full load electric demand, kW
$EFLH_{heat}$	=	Estimated full load heating hours
$EFLH_{cool}$	=	Estimated full load cooling hours
EI	=	Efficiency Improvement
CF	=	Coincidence Factor
ISR	=	In Service Rate

Table 332 lists the assumptions and source of each assumption for pipe wrap savings calculations.

TABLE 332. *EX POST* VARIABLE ASSUMPTIONS FOR PIPE WRAP

INPUT	VALUE	SOURCE
kW_{motor}	0.38	PA TRM 2021
$EFLH_{heat}$	1427	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
EI	0.15	PA TRM 2021
CF	0.49	PA TRM 2021
ISR	1	2020 HEA program in-service rates
Conversion Factor	29.3	Therms to kWh conversion

KITS

The evaluation team used the following equations to calculate electric and natural gas energy savings for measures in the HEA kits.

LEDS

The team used the following equations to calculate electric energy and peak demand savings, as well as natural gas energy penalties, for LEDs.

$$kWh\ savings\ per\ lamp = \frac{(W_{base} - W_{LED}) * HOU * (1 + WHF_e)}{1{,}000} * ISR$$

$$kW\ reduction\ per\ lamp = \frac{(W_{base} - W_{LED}) * CF * (1 + WHF_d)}{1{,}000} * ISR$$

$$therm\ savings\ per\ lamp = \frac{(W_{base} - W_{LED}) * HOU * \left(WHF_g\right) * 10}{1{,}000} * ISR$$

Where:

W_{base} = Wattage of the bulb being replaced, W

W_{LED} = Wattage of the LED bulb, W

HOU = Average annual hours of use, hours

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)

CF = Summer peak coincidence factor

365 = Number of days per year, days/yr.

1,000 = Constant to convert W to kW

10 = Constant to convert MMBtu to therm

ISR = In-service rate

Table 333 lists the input assumptions and source of each assumption for the LED measure savings calculations.

TABLE 333. *EX POST* VARIABLE ASSUMPTIONS FOR LEDS

INPUT	VALUE	SOURCE
W_{base}	35.5	2021 HomeLife Calculator survey, detailed below
W_{LED} for 9-watt (LED)	9	Program data
HOU	1,135	Indiana TRM (v2.2)
WHF_e	-0.071	Indiana TRM (v2.2), Combo kit participants, averaged across participant location
WHF_e	-0.076	Indiana TRM (v2.2), Electric kit participants, averaged across participant location
WHF_d	0.038	Indiana TRM (v2.2), averaged across participant location
WHF_g	-0.0019	Indiana TRM (v2.2), averaged across participant location
CF	0.11	Indiana TRM (v2.2)
ISR	0.80	NIPSCO 2020 HEA survey

Table 334 provides the 2021 survey results and the updated baseline wattage used in the *ex post* analysis.

TABLE 334. 2021 *EX POST* BASELINE WATTAGE

REPLACED BULB	WATTAGE	WEIGHT
Incandescent	60	53%
Halogen	43	0%
CFL	13	13%
LED	9	22%
2021 *Ex post* baseline	35.5	-

NIGHTLIGHTS

The team used the following equation to calculate electric energy savings for LED nightlights:

$$kWh\ savings = \frac{\left((W_{base} - W_{LED}) * IRF\right) * \ HOU * ISR}{1{,}000}$$

Where:

W_{base} = Wattage of the bulb being replaced, W

W_{LED} = Wattage of the LED bulb, W

HOU = Average annual hours of use, hours

ISR = In-service rate

1,000 = Constant to convert W to kW

IRF = Incandescent replacement factor representing the percentage of LED nightlights that replaced incandescent nightlights.

Table 335 lists the input assumptions and source of each assumption for the nightlights measure savings calculations.

TABLE 335. *EX POST* VARIABLE ASSUMPTIONS FOR LED NIGHTLIGHTS

INPUT	VALUE	SOURCE
W_{base}	5	Indiana TRM (v2.2)
W_{LED}	0.33	Indiana TRM (v2.2)
Hours per Year	2,920	Indiana TRM (v2.2)
IRF	0.22	NIPSCO 2021 Homelife survey
ISR	0.85	NIPSCO 2020 HEA survey

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:

$$kWh\ savings = \left(GPM_{base} - GPM_{low\ flow}\right) * MPD * \frac{PH}{FH} * DR * 8.3 * (T_{mix} - T_{inlet}) * \frac{365}{RE*3{,}412} * ISR * WHS_e$$

$$kW\ reduction = \left(GPM_{base} - GPM_{low\ flow}\right) * DR * 60 * 8.3 * \frac{(T_{mix} - T_{inlet})}{RE*3{,}412} * CF * ISR * WHS_e$$

$$therm\ savings = \left(GPM_{base} - GPM_{low\ flow}\right) * MPD * \frac{PH}{FH} * DR * 8.3 * (T_{mix} - T_{inlet}) * \frac{365}{RG*100{,}000} * ISR * WHS_g$$

Where:

GPM_{base} = Gallons per minute of baseline faucet aerator, gpm
$GPM_{low\ flow}$ = Gallons per minute of low flow faucet aerator, gpm
MPD = Average minutes of faucet use per person per day, minutes
PH = Average number of people per household
FH = Average number of faucets per household
DR = Percentage of water flowing down the drain
T_{mix} = Mixed water temperature of existing faucet, °F
T_{inlet} = Cold water temperature entering the DHW system, °F
RE = Recovery efficiency of electric hot water heater
RG = Recovery efficiency of natural gas water heater
CF = Summer peak coincidence factor
8.3 = Specific weight of water in pounds per gallon, multiplied by specific water temp (1.0 Btu/lb-°F)
3,412 = Constant to convert Btu to kWh
365 = Days per year
100,000 = Constant to convert therm
ISR = In-service rate
WHS_e = Percentage of electric water heaters
WHS_g = Percentage of gas water heaters

Table 336 lists the input assumptions and source of each assumption for the kitchen and bathroom faucet aerator measure savings calculations.

TABLE 336. *EX POST* VARIABLE ASSUMPTIONS FOR KITCHEN AND BATHROOM FAUCET AERATORS

INPUT	KITCHEN VALUE	BATHROOM VALUE	SOURCE
GPM_{base}	2.44	1.9	Indiana TRM (v2.2)
$GPM_{low\ flow}$	1.5	1.0	Program data
MPD	4.5	1.6	Indiana TRM (v2.2)
PH	2.64	2.64	Indiana TRM (v2.2)
FH	1	2.21	Indiana TRM (v2.2)
DR	0.5	0.7	Indiana TRM (v2.2)
T_{mix}	93	86	Indiana TRM (v2.2)
T_{inlet}	57.3	57.3	Indiana TRM (v2.2), Combo kits, averaged across participant location
T_{inlet}	56.5	56.5	Indiana TRM (v2.2), Electric-Only kits, averaged across participant location
T_{inlet}	56.3	56.3	Indiana TRM (v2.2), Gas-Only kits, averaged across participant location
RE	0.98	0.98	Indiana TRM (v2.2)
RG	0.76	0.76	Indiana TRM (v2.2)
CF	0.0033	0.0012	Indiana TRM (v2.2)
ISR	0.44	0.33	NIPSCO 2021 survey
WHS_e	0.06	0.06	Participant data, Combo kits
WHS_g	0.94	0.94	Participant data, Combo kits
WHS_e	0.60	0.60	Participant data, Electric-Only kits
WHS_g	0.88	0.88	Participant data, Gas-Only kits

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:

$$kWh\ savings = \left(GPM_{base} - GPM_{low\ flow}\right) * MS * SPD * \frac{PH}{SH} * 8.3 * (T_{mix} - T_{inlet}) * \frac{365}{RE * 3{,}412} * ISR * WHS_e$$

$$kW\ reduction = \left(GPM_{base} - GPM_{low\ flow}\right) * 60 * 8.3 * \frac{(T_{mix} - T_{inlet})}{RE * 3{,}412} * CF * ISR * WHS_e$$

$$therm\ savings = \left(GPM_{base} - GPM_{low\ flow}\right) * MS * SPD * \frac{PH}{SH} * 8.3 * (T_{mix} - T_{inlet}) * \frac{365}{RG * 100{,}000} * ISR * WHS_g$$

Where:

GPM_{base} = Gallons per minute of baseline showerhead, gpm

$GPM_{low\ flow}$ = Gallons per minute of low flow showerhead, gpm

MS = Average minutes per shower event, minutes
SPD = Average number of shower events per person per day
PH = Average number of people per household
SH = Average number of showerheads per household
T_{mix} = Mixed water temperature of existing faucet, °F
T_{inlet} = Cold water temperature entering the DHW system, °F
RE = Recovery efficiency of electric hot water heater
RG = Recovery efficiency of natural gas water heater
CF = Summer peak coincidence factor
8.3 = Specific weight of water in pounds per gallon, multiplied by specific water temp (1.0 Btu/lb-°F)
3,412 = Constant to convert Btu to kWh
365 = Days per year
100,000 = Constant to convert therm
ISR = In-service rate
WHS_e = Percentage of electric water heaters
WHS_g = Percentage of gas water heaters

Table 337 lists the input assumptions and source of each assumption for the low flow showerhead measure savings calculations.

TABLE 337. *EX POST* VARIABLE ASSUMPTIONS FOR LOW FLOW SHOWERHEADS

INPUT	VALUE	SOURCE
GPM_{base}	2.63	Indiana TRM (v2.2)
$GPM_{low\ flow}$)	1.5	Program data
MS	7.8	Indiana TRM (v2.2)
SPD	0.6	Indiana TRM (v2.2)
PH	2.64	Indiana TRM (v2.2)
SH	1.8	Indiana TRM (v2.2)
T_{mix}	101	Indiana TRM (v2.2)
T_{inlet}	57.3	Indiana TRM (v2.2), Combo kits, averaged across participant location
T_{inlet}	56.5	Indiana TRM (v2.2), Electric-Only kits, averaged across participant location
T_{inlet}	56.3	Indiana TRM (v2.2), Gas-Only kits, averaged across participant location
RE	0.98	Indiana TRM (v2.2)
RG	0.76	Indiana TRM (v2.2)
CF	0.0023	Indiana TRM (v2.2)
ISR	0.43	NIPSCO 2020 HEA survey
WHS_e	0.06	Participant data, Combo kits
WHS_g	0.94	Participant data, Electric-Only kits
WHS_e	0.60	Participant data, Gas-Only kits
WHS_g - Gas Only Kits	0.88	Participant data

FILTER WHISTLES

The team used the following equations to calculate electric energy and peak demand savings for Filter Whistles:

$$kWh\ savings = \Delta kWh_{hea} + \Delta kWh_{cool}$$

$$\Delta kWh_{heat} = kW_{motor} * EFLH_{heat} * EI * ISR$$

$$\Delta kWh_{cool} = kW_{motor} * EFLH_{cool} * EI * ISR * \%CAC$$

$$kW\ reduction = \frac{\Delta kWh_{cool}}{EFLH_{cool}} * CF$$

Where:

kW_{motor} = Average motor full load electric demand, kW
$EFLH_{heat}$ = Estimated full load heating hours
$EFLH_{cool}$ = Estimated full load cooling hours
EI = Efficiency Improvement
ISR = In-service rate
%CAC = Percent of homes with air conditioning
CF = Coincidence Factor

Table 338 lists the input assumptions and source of each assumption for the filter whistle measure savings calculations.

TABLE 338. *EX POST* VARIABLE ASSUMPTIONS FOR FILTER WHISTLES

INPUT	VALUE	SOURCE
kW_{motor}	0.377	2021 Pennsylvania TRM
$EFLH_{heat}$	1427	Indiana TRM (v2.2)
$EFLH_{cool}$	431	Indiana TRM (v2.2)
EI	0.15	2021 Pennsylvania TRM
CF	0.218	2021 Pennsylvania TRM, assume Bradford
% CAC	0.93	Participant data, Combo kits
% CAC	0.60	Participant data, Electric-Only kits
% CAC	0.88	Participant data, Gas-Only kits
ISR	0.30	NIPSCO 2020 HEA survey

APPENDIX 4: INCOME-QUALIFIED WEATHERIZATION (IQW) PROGRAM

ALGORITHMS AND ASSUMPTIONS

This appendix contains the assumptions used in electric savings, demand reduction, and gas savings algorithms for the measures within the IQW program. The team examined each assumption behind the algorithms to capture savings and compared it against the Indiana TRM (v2.2), as well as other state and industry approaches. Detailed information on the analysis and supporting assumptions for the following IQW program measures are included within this appendix:

- LEDs (A-Line, Candelabra, and Globe)
- Kitchen Faucet Aerators
- Bathroom Faucet Aerators
- Low Flow Showerheads
- Shower Start
- Refrigerator Replacement
- Pipe Wrap
- Programmable Thermostats
- Filter Whistles
- Duct Sealing

Table 339 lists the assumptions of the *ex post* per-measure savings.

TABLE 339. IQW PROGRAM MEASURES

MEASURE	REVIEWED ASSUMPTIONS
LEDs	New and baseline wattages, hours of use, waste heat factors, coincidence factors
Kitchen Faucet Aerator	New and baseline flow rates, people per house, minutes of use per day, faucets per home, water temperatures, water heater fuel type and efficiency
Bathroom Faucet Aerator	New and baseline flow rates, people per house, minutes of use per day, faucets per home, water temperatures, water heater fuel type and efficiency
Low Flow Showerhead	New and baseline flow rates, people per house, minutes of use per day, showerheads per home, water temperatures, water heater fuel type and efficiency
Shower Start	New and baseline flow rates, people per house, minutes of use per day, showerheads per home, water temperatures, water heater fuel type and efficiency
Pipe Wrap	New and baseline R-values, pipe diameter, water heater recovery efficiency
Filter Whistle	Motor kW, efficiency improvement, full load heating and cooling hours, and coincidence factor
Duct Sealing	New and baseline distribution efficiencies, full load heating and cooling hours, capacities, and efficiencies of heating and cooling equipment
Refrigerator replacement	New and baseline energy use
Programmable thermostat	Heating and cooling BtuHs, ESFs, efficiencies, and full load hours

The algorithms and assumptions the evaluation team used to calculate *ex post* savings for each of these measures follow.

LEDS

The team used the following equations to calculate electric energy and peak demand savings, as well as natural gas energy penalties, for LEDs:

$$kWh\ savings\ per\ lamp = \frac{(W_{base} - W_{LED}) * (Daily\ hours\ of\ use * 365) * (1 + WHF_e)}{1{,}000}$$

$$kW\ reduction\ per\ lamp = \frac{(W_{base} - W_{LED}) * Coincidence\ Factor * (1 + WHF_d)}{1{,}000}$$

$$therm\ savings\ per\ lamp = \frac{(W_{base} - W_{LED}) * (Daily\ hours\ of\ use * 365) * WHF_g}{1{,}000}$$

Where:

W_{base} = Wattage of the bulb being replaced, W

W_{LED} = Wattage of the LED bulb, W

Daily hours of use = Average hours of use per day, hr

WHF_e = Waste heat factor for energy to account for HVAC interactions with lighting (depends on location)

WHF_d = Waste heat factor for demand to account for HVAC interactions with lighting (depends on location)

WHF_g = Waste heat factor for gas to account for HVAC interactions with lighting (depends on location)

Coincidence Factor = Summer peak coincidence factor

365 = Number of days per year, days/yr

1,000 = Constant to convert watts to kW

Table 340 lists the input assumptions and source of each assumption for the LED measure savings calculations.

TABLE 340. *EX POST* VARIABLE ASSUMPTIONS FOR LEDS

INPUT	VALUE	SOURCE
W_{base} for 9-watt (LED)	43	Ch. 6 Residential Lighting Evaluation Protocol, UMP
W_{base} for 6-watt (Candelabra LED)	40	Ch. 6 Residential Lighting Evaluation Protocol, UMP
W_{base} for 5-watt (Globe LED)	40	Ch. 6 Residential Lighting Evaluation Protocol, UMP
W_{LED} for 9-watt (LED)	9	Actual installed wattage
W_{LED} for 6-watt (Candelabra LED)	5	Actual installed wattage
W_{LED} for 5-watt (Globe LED)	6	Actual installed wattage
Daily hours of use x 365	902	Indiana TRM (v2.2)
WHF_e	-0.07	Indiana TRM (v2.2), averaged across participant location
WHF_g	-0.0019	Indiana TRM (v2.2), averaged across participant location
WHF_d	0.038	Indiana TRM (v2.2), averaged across participant location
Coincidence Factor	0.11	Indiana TRM (v2.2)

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:

$$kWh\ savings = ISR * (GPM_{base} - GPM_{low\ flow}) * MPD * \frac{PH}{FH} * DR * 8.3 * (T_{mix} - T_{inlet}) * \frac{365}{RE * 3412}$$

$$kW\ savings = ISR * (GPM_{base} - GPM_{low\ flow}) * 60 * DR * 8.3 * \frac{T_{mix} - T_{inlet}}{RE * 3412} * CF$$

$$therm\ savings = ISR * (GPM_{base} - GPM_{low\ flow}) * MPD * \frac{PH}{FH} * DR * 8.3 * (T_{mix} - T_{inlet}) * \frac{365}{RG * 100{,}000}$$

Where:

GPM_{base}	=	Gallons per minute of baseline faucet aerator
$GPM_{low\ flow}$	=	Gallons per minute of low flow faucet aerator
ISR	=	In-service rate, or fraction of units that get installed
MPD	=	Average minutes of faucet use per person per day
PH	=	Average number of people per household
FH	=	Average number of faucets per household
DR	=	Percentage of water flowing down the drain
T_{mix}	=	Mixed water temperature exiting faucet, °F
T_{inlet}	=	Cold water temperature entering the DWH system, °F (depends on location)
RE	=	Recovery efficiency of electric hot water heater
RG	=	Recovery efficiency of natural gas hot water heater
CF	=	Summer peak coincidence factor
60	=	Minutes per Hour
8.3	=	Specific weight of water in pounds per gallon
3,412	=	Constant to convert Btu to kWh
365	=	Days of faucet use per year
100,000	=	Constant to convert Btu to therms

Table 341 lists the assumptions and source of each assumption for kitchen and bathroom faucet aerator measure savings calculations.

TABLE 341. *EX POST* VARIABLE ASSUMPTION FOR KITCHEN AND BATHROOM FAUCET AERATORS

INPUT	VALUE	SOURCE
GPM_{base} (Kitchen)	2.44	Indiana TRM (v2.2)
GPM_{base} (Bathroom)	1.9	Indiana TRM (v2.2)
$GPM_{low\ flow}$ (Kitchen)	1.5	Actual
$GPM_{low\ flow}$ (Bathroom)	1.0	Actual
ISR	1.0	Indiana TRM (v2.2)
MPD (Kitchen)	4.5	Indiana TRM (v2.2)
MPD (Bathroom)	1.6	Indiana TRM (v2.2)
PH	2.64	Indiana TRM (v2.2)
FH (Kitchen)	1.0	Indiana TRM (v2.2)
FH (Bathroom)	2.04	Indiana TRM (v2.2)
DR (Kitchen)	0.50	Indiana TRM (v2.2)
DR (Bathroom)	0.70	Indiana TRM (v2.2)
T_{mix} (Kitchen)	93.00	Indiana TRM (v2.2)
T_{mix} (Bathroom)	86.00	Indiana TRM (v2.2)
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	Indiana TRM (v2.2)
RG	0.76	Indiana TRM (v2.2)
CF (Bathroom)	0.0012	Indiana TRM (v2.2)
CF (Kitchen)	0.0033	Indiana TRM (v2.2)
Conversion Factor	60	Minutes per hour
Conversion Factor	8.3	Specific weight of water in pounds per gallon
Conversion Factor	3,412	Constant to convert Btu to kWh
Conversion Factor	365	Days of faucet use per year
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:

$$kWh\ savings = ISR * \left(GPM_{base} - GPM_{low\ flow}\right) * MS * SPD * \frac{SPH}{SH} * 8.3 * (T_{mix} - T_{inlet}) * \frac{365}{RE * 3412}$$

$$kW\ savings = ISR * \left(GPM_{base} - GPM_{low\ flow}\right) * 60 * 8.3 * \frac{T_{mix} - T_{inlet}}{RE * 3412} * CF$$

$$therm\ savings = ISR * \left(GPM_{base} - GPM_{low\ flow}\right) * MS * SPD * \frac{SPH}{SH} * 8.3 * (T_{mix} - T_{inlet}) * \frac{365}{RG * 100{,}000}$$

Where:

GPM_{base}	=	Gallons per minute of baseline showerhead
$GPM_{low\ flow}$	=	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 342 lists the assumptions and source of each assumption for low flow showerhead measure savings calculations.

TABLE 342. *EX POST* VARIABLE ASSUMPTIONS FOR LOW FLOW SHOWERHEADS

INPUT	VALUE	SOURCE
GPM_{base}	2.63	Indiana TRM (v2.2)
$GPM_{low\ flow}$	1.5	Actual
ISR	1.0	Indiana TRM (v2.2)
MS	7.8	Indiana TRM (v2.2)
SPH	1.45	2021 NIPSCO survey results
SH	1.8	2020 NIPSCO survey results
T_{mix}	101	Indiana TRM (v2.2)
T_{inlet} (Gas)	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	Indiana TRM (v2.2)
RG	0.76	Indiana TRM (v2.2)
CF	0.0023	Indiana TRM (v2.2)
Conversion Factor	60	Minutes per hour
Conversion Factor	8.3	Specific weight of water in pounds per gallon
Conversion Factor	3,412	Constant to convert Btu to kWh
Conversion Factor	365	Days of faucet use per year

SHOWER START

The evaluation team used the following equations to calculate electric energy, peak demand, and natural gas energy savings for shower start attachments:

$$kWh\ savings = \frac{ISR * GPM_{base}}{60} * \frac{8.3}{3412} * (T_{mix} - T_{in}) * \frac{SPH}{SH} * \frac{WS}{RE} * 365$$

$$kW\ savings = kWh\ savings * CF$$

$$therm\ savings = \frac{ISR * GPM_{base}}{60} * \frac{8.3}{100{,}000} * (T_{out} - T_{in}) * \frac{SPH}{SH} * \frac{WS}{RG} * 365$$

Where:

GPM_{base}	=	Flow rate (in gallons per minute) of the existing showerhead equipped with a Shower Start attachment.
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 seconds saved by Shower Start attachment
T_{mix}	=	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
60	=	Seconds per Minute
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 343 lists the assumptions and source of each assumption for shower start measure savings calculations.

TABLE 343. *EX POST* VARIABLE ASSUMPTIONS FOR SHOWER START

INPUT	VALUE	SOURCE
GPM_{base}	2.63	Indiana TRM (v2.2). Used for projects where a shower start was installed without a new low flow showerhead.
$GPM_{low\ flow}$	1.5	Actual. Used for projects where a shower start was installed along with a new low flow showerhead.
ISR	1.0	Indiana TRM (v2.2)
SPH	1.45	NIPSCO 2021 survey results
SH	1.8	NIPSCO 2020 survey results
WS	59	PA TRM 2016
T_{mix}	101	Indiana TRM (v2.2)

INPUT	VALUE	SOURCE
Tinlet	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	Indiana TRM (v2.2)
RG	0.76	Indiana TRM (v2.2)
CF	0.00008013	PA TRM 2016
Conversion Factor	60	Seconds per minute
Conversion Factor	8.3	Product of the specific weight of water (pounds per gallon) and the specific heat capacity of water (Btu per pound per °F)
Conversion Factor	3,412	Constant to convert Btu to kWh
Conversion Factor	365	Days of faucet use per year

PIPE WRAP

The evaluation team used the following equations to calculate electric energy, peak demand, and natural gas energy savings for Pipe Wrap:

$$kWh\ savings = \left(\frac{1}{R_{Exist}} - \frac{1}{R_{New}}\right) * \frac{L * C * \Delta T * 8{,}760}{\eta_{DHWE} * 3{,}412}$$

$$kW\ savings = \frac{kWh\ savings}{8{,}760}$$

$$therm\ savings = \left(\frac{1}{R_{Exist}} - \frac{1}{R_{New}}\right) * \frac{L * C * \Delta T * 8{,}760}{\eta_{DHWG} * 100{,}000}$$

Where:

R_{Exist} = Pipe heat loss coefficient (R-value) of uninsulated pipe existing

R_{New} = Pipe heat loss coefficient (R-value) of insulated pipe

L = Feet of pipe from water heating source covered by pipe wrap

C = Circumference of pipe in feet

ΔT = Average temperature difference between supplied water and ambient air temperature

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 344 lists the assumptions and source of each assumption for pipe wrap savings calculations.

TABLE 344. *EX POST* VARIABLE ASSUMPTIONS FOR PIPE WRAP

INPUT	VALUE	SOURCE
R_{Exist}	1.00	Indiana TRM (v2.2)
R_{New}	4.15	Actual. Based on insulation R-value of 3.15 and bare-pipe R-value of 1.0 (per Indiana TRM (v2.2).
L	3.44	Value shown is the program average, not the value used to calculate savings for each participant.
C	0.196	Actual. Based on assumed pipe diameter of 0.75 inches
ΔT	65	Indiana TRM (v2.2)
η_{DHWE}	.98	Indiana TRM (v2.2)
η_{DHWG}	.75	Indiana TRM (v2.2)
Conversion Factor	3,412	Constant to convert Btu to kWh
Conversion Factor	100,000	Constant to convert Btu to therms

FILTER WHISTLE

The team used the following equations to calculate electric energy and peak demand savings for Filter Whistles:

$$kWh\ savings = \Delta kWh_{heat} + \Delta kWh_{cool}$$

$$\Delta kWh_{heat} = kW_{motor} * EFLH_{heat} * EI * ISR$$

$$\Delta kWh_{cool} = kW_{motor} * EFLH_{cool} * EI * ISR$$

$$kW\ reduction = \frac{\Delta kWh_{cool}}{EFLH_{cool}} * CF$$

$$therms = \frac{\Delta kWh_{heat}}{29.3}$$

Where:

kWmotor = Average motor full load electric demand, kW
EFLHheat = Estimated full load heating hours
EFLHcool = Estimated full load cooling hours
EI = Efficiency Improvement
CF = Coincidence Factor
ISR = In Service Rate

Table 345 lists the input assumptions and source of each assumption for the Filter Whistle measure savings calculations.

TABLE 345. *EX POST* VARIABLE ASSUMPTIONS FOR FILTER WHISTLES

INPUT	VALUE	SOURCE
kW_{motor}	0.38	2021 Pennsylvania TRM
$EFLH_{heat}$	1427	Indiana TRM (v2.2)
$EFLH_{cool}$	431	Indiana TRM (v2.2)
EI	0.15	2021 Pennsylvania TRM
CF	0.49	2021 Pennsylvania TRM
Conversion Factor	29.3	Therms to kWh

PROGRAMMABLE THERMOSTAT

The evaluation team used the following equations to calculate electric and natural gas energy savings for programmable thermostats. There are no summer peak coincidence demand savings associated with this measure.

$$kWh\ savings\_cool = \frac{1}{SEER} * EFLH_{cool} * \frac{Btuh_{cool}}{1{,}000} * ESF_{cool}$$

$$kWh\ savings\_heat = EFLH_{heat} * \frac{BtuH_{heat}}{N_{hea} * 3412} * ESF_{heat}$$

$$therm\ savings = EFLH_{heat} \frac{BtuH_{FF} * ESF_{heat}}{100{,}000}$$

Where:

- SEER = Seasonal average efficiency ratio
- $EFLH_{cool}$ = Full load cooling hours
- $BtuH_{cool}$ = Cooling system capacity in Btu per hour
- ESF_{cool} = Cooling energy savings fraction
- $EFLH_{heat}$ = Full load heating hours
- $BtuH_{heat}$ = Heating system capacity in Btu per hour
- N_{heat} = Efficiency in COP of heating equipment
- $BtuH_{FF}$ = Heating capacity of gas equipment

Table 346 lists the assumptions and source of each assumption for the smart thermostat measure savings calculations.

TABLE 346. *EX POST* VARIABLE ASSUMPTIONS FOR PROGRAMMABLE THERMOSTATS

INPUT	VALUE	SOURCE
SEER	11.15	Indiana TRM (v2.2)
$EFLH_{cool}$	419.4	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
$Btuh_{cool}$	28,994	Indiana TRM (v2.2)
ESF_{cool}	0.09	Indiana TRM (v2.2)
$EFLH_{heat}$	1412.8	Indiana TRM (v2.2), values assigned based on nearest TRM city. Value shown is the program average, not the value used to calculate savings for each participant
$Btuh_{FF}$	77,386	Indiana TRM (v2.2)
ESF_{heat}	0.068	Indiana TRM (v2.2)

DUCT SEALING

The evaluation team used the following equations to calculate electric and natural gas energy savings for duct sealing.

$$kWh\ savings_{cool} = \frac{DE_{coolafter} - DE_{coolbefore}}{DE_{coolafter}} * \frac{EFLH_{cool} * Btuh_{cool}}{SEER * 1{,}000}$$

$$kWh\ savings_{heat} = \frac{DE_{heatafter} - DE_{heatbefore}}{DE_{heatafte}} * \frac{EFLH_{heat} * Btuh_{heat}}{3{,}412 * N_{heating}}$$

$$kW\ savings = \left(\frac{DE_{pkafter} - DE_{pkbefore}}{DE_{pkafter}}\right) * \left(\frac{Btuh_{cool}}{EER * 1{,}000} * CF\right)$$

$$therm\ savings = 56.4$$

Where:

$DE_{coolafter}$	=	Distribution efficiency after duct sealing
$DE_{coolbefore}$	=	Distribution efficiency before duct sealing
$DE_{heatafter}$	=	Distribution efficiency after duct sealing
$DE_{heatbefore}$	=	Distribution efficiency before duct sealing
$DE_{pkafter}$	=	Distribution efficiency under peak summer conditions after duct sealing
$DE_{pkbefore}$	=	Distribution efficiency under peak summer conditions before duct sealing
$EFLH_{cool}$	=	Full load cooling hours
$EFLH_{heat}$	=	Full load heating hours
$BtuH_{cool}$	=	Cooling capacity of cooling equipment (Btu per hour)
$BtuH_{heat}$	=	Heating capacity of heating equipment (Btu per hour)
N_{heat}	=	Efficiency in COP of heating equipment
SEER	=	Seasonal average efficiency of air conditioning equipment
EER	=	Peak efficiency of air conditioning equipment
56.4	=	Gas duct sealing savings evaluated through billing analysis in the 2018 program evaluation
CF	=	Coincidence factor

Table 347 lists the assumptions and source of each assumption for the smart duct sealing savings calculations.

TABLE 347. *EX POST* VARIABLE ASSUMPTIONS FOR DUCT SEALING

INPUT	VALUE	SOURCE
$DE_{coolafter}$ (attic)	0.70	Value assigned based on 2019 program average.
$DE_{coolafter}$ (basement)	0.89	Value assigned based on 2019 program average.
$DE_{coolbefore}$ (attic)	0.62	Value assigned based on 2019 program average.
$DE_{coolbefore}$ (basement)	0.83	Value assigned based on 2019 program average.
$DE_{heatafter}$ (attic)	0.71	Value assigned based on 2019 program average.
$DE_{heatafter}$ (basement)	0.76	Value assigned based on 2019 program average.
$DE_{heatbefore}$ (attic)	0.65	Value assigned based on 2019 program average.
$DE_{heatbefore}$ (basement)	0.71	Value assigned based on 2019 program average.
$DE_{pkafter}$ (attic)	0.58	Value assigned based on 2019 program average.
$DE_{pkafter}$ (basement)	0.87	Value assigned based on 2019 program average.
$DE_{pkbefore}$ (attic)	0.47	Value assigned based on 2019 program average.
$DE_{pkbefore}$ (basement)	0.81	Value assigned based on 2019 program average.

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
$EFLH_{cool}$	427	Indiana TRM (v2.2). values assigned based on nearest TRM city. Value shown is the program average, not the value used to calculate savings for each participant
SEER	11.41	Value assigned based on 2019 program average.
EER	10.10	Value assigned based on 2019 program average.
$N_{heating}$	1	Indiana TRM (v2.2)
$BtuH_{cool}$	31,763	Value assigned based on 2019 program average.
$BtuH_{heat}$	80,000	Value assigned based on 2019 program average.
56.43	56.4	Gas duct sealing savings evaluated through billing analysis in the 2018 program evaluation
CF	0.88	Indiana TRM (v2.2)

REFRIGERATOR REPLACEMENT

The evaluation team used the following equations to calculate electric energy savings for refrigerator replacement. There are no natural gas savings associated with this measure.

$$kWh = UEC_{existing} - UEC_{efficient}$$

$$kW = \frac{kWh}{8760} * TAF * LSAF$$

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 348 lists the assumptions and source of each assumption for the refrigerator replacement measure savings calculations.

TABLE 348. *EX POST* VARIABLE ASSUMPTIONS FOR REFRIGERATOR REPLACEMENT

INPUT	VALUE	SOURCE
$UEC_{existing}$	824.1	Indiana TRM (v2.2), values based on equipment age. Value shown is the program average, not the value used to calculate savings for each participant
$UEC_{efficient}$	418.4	Actual model specification. Value shown is the program average, not the value used to calculate savings for each participant
TAF	1.21	Indiana TRM (v2.2)
LSAF	1.06	Indiana TRM (v2.2)
8760	8760	Hours per year

APPENDIX 5: MULTIFAMILY DIRECT INSTALL (MFDI) PROGRAM

MFDI 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 Indiana TRM (v2.2), 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)

Table 349 lists our assumptions for the *ex post* per measure savings.

TABLE 349. MFDI 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, 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

DETAILS BY MEASURE

The algorithms and assumptions the evaluation team used to calculate *ex post* savings for each of these measures follow.

LEDS

The following equations are used to calculate electric, demand, and therm penalties for LEDs:

$$kWh\ savings\ per\ lamp = \frac{(W_{base} - W_{LED}) * (Daily\ hours\ of\ use * 365) * (1 + WHF_e)}{1{,}000}$$

$$kW\ reduction\ per\ lamp = \frac{(W_{base} - W_{LED}) * Coincidence\ Factor * (1 + WHF_d)}{1{,}000}$$

$$Therm\ savings\ per\ lamp = \frac{(W_{base} - W_{LED}) * (Daily\ hours\ of\ use * 365) * WHF_g}{1{,}000} \times 10$$

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 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
365	=	Number of days per year, days/yr
1,000	=	Constant to convert watts to kW

Table 350 input assumptions and source of each assumption for the LED measure savings calculations.

TABLE 350. *EX POST* VARIABLE ASSUMPTIONS FOR LEDS

INPUT	VALUE	SOURCE
$Watts_{Base}$ (9 W LEDs)	43	Indiana TRM V2.2; NREL Residential Lighting Protocol Post-EISA and post-EISA exempt baseline wattages based on a 2020 ENERGY STAR QPL analysis
$Watts_{Base}$ (Globe LEDs)	40	
$Watts_{Base}$ (Candelabras)	40	
$Watts_{Eff}$ (9 W LEDs)	9	Actual installed wattage
$Watts_{Eff}$ (Globe LEDs)	6	
$Watts_{Eff}$ (Candelabras)	5	
ISR	1	Indiana TRM V2.2
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

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:

$$therm\ savings = \left(GPM_{base} - GPM_{low\ flow}\right) * MPD * \frac{PH}{FH} * DR * 8.3 * (T_{mix} - T_{inlet}) * \frac{365}{RG * 100{,}000}$$

Where:

GPM_{base}	=	Gallons per minute of baseline faucet aerator
$GPM_{low\ flow}$	=	Gallons per minute of low flow faucet aerator
MPD	=	Average minutes of faucet use per person per day
PH	=	Average number of people per household
FH	=	Average number of faucets per household

T_{mix}	=	Mixed water temperature exiting faucet, °F
T_{inlet}	=	Cold water temperature entering the domestic hot water (DHW) system, °F
RG	=	Recovery efficiency of gas hot water heater
60	=	Minutes per hour, min/hr
8.3	=	Specific weight of water in pounds per gallon, then multiplied by specific water temperature (1.0 Btu/lb-°F)
3,412	=	Constant to convert Btu to kWh
365	=	Days per year, day/yr
100,000	=	Constant to convert MMBtu to therm

Table 351 lists the input assumptions and source of each assumption for the kitchen and bathroom faucet aerator measure savings calculations.

TABLE 351. VARIABLE ASSUMPTIONS FOR FAUCET AERATORS

INPUT	KITCHEN VALUE	BATHROOM VALUE	SOURCE
GPM_{base}	2.44	1.90	Indiana TRM (v2.2)
$GPM_{low\ flow}$	1.5	1.0	Actual
MPD	4.5	1.6	Indiana TRM (v2.2)
PH	1.83	1.83	Indiana TRM (v2.2) for multifamily housing
FH	1	1.43	Indiana TRM (v2.2) for multifamily housing
T_{mix}	93	86	Indiana TRM (v2.2)
T_{inlet}	57.4˚F	57.4˚F	Indiana TRM V2.2, assumed South Bend.
DR	0.5	0.7	Indiana TRM (v2.2)
RG	0.76	0.76	Indiana TRM (v2.2)
CF	0.0033	0.0012	Indiana TRM (v2.2)

LOW FLOW SHOWERHEADS

The evaluation team used the following equations to calculate natural gas energy savings for low flow showerheads:

$$kWh\ savings = ISR * \left(GPM_{base} - GPM_{low\ flow}\right) * MS * SPD * \frac{PH}{SH} * 8.3 * (T_{mix} - T_{inlet}) * \frac{365}{RE * 3412}$$

$$kW\ savings = ISR * \left(GPM_{base} - GPM_{low\ flow}\right) * 60 * 8.3 * \frac{T_{mix} - T_{inlet}}{RE * 3412} * CF$$

$$therm\ savings = ISR * \left(GPM_{base} - GPM_{low\ flow}\right) * MS * SPD * \frac{PH}{SH} * 8.3 * (T_{mix} - T_{inlet}) * \frac{365}{RG * 100{,}000}$$

Where:

GPM_{base}	=	Gallons per minute of baseline showerhead
$GPM_{low\ flow}$	=	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
SPD	=	Average number of shower events per person per day
PH	=	Average number of people per household
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 352 lists the input assumptions and source of each assumption for the low flow showerhead measure savings calculations.

TABLE 352. *EX POST* VARIABLE ASSUMPTIONS FOR LOW FLOW SHOWERHEADS

INPUT	VALUE	SOURCE
GPM_{base}	2.63	Indiana TRM (v2.2)
$GPM_{low\ flow}$	1.5	Actual
ISR	1.0	Indiana TRM (v2.2)
MS	7.8	Indiana TRM (v2.2)
SPD	0.60	Indiana TRM (v2.2)
PH	1.83	Indiana TRM (v2.2) for multifamily housing
SH	1.2	Indiana TRM (v2.2) for multifamily housing
T_{mix}	101	Indiana TRM (v2.2)
T_{inlet}	57.4	Indiana TRM (v2.2), values assigned based on nearest TRM city. Assumed South Bend for calculation
RE	0.98	Indiana TRM (v2.2)
RG	0.76	Indiana TRM (v2.2)
CF	0.0023	Indiana TRM (v2.2)
Conversion Factor	60	Minutes per hour
Conversion Factor	8.3	Specific weight of water in pounds per gallon
Conversion Factor	3,412	Constant to convert Btu to kWh
Conversion Factor	365	Days of faucet use per year

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 2021 program year, the evaluation team estimated per-unit energy savings estimates for recycled refrigerators and freezers using historical meter data and multivariate regression models. The Indiana TRM (v2.2) and the UMP were used to estimate recycled refrigerator and freezer demand savings. The Indiana TRM (v2.2) was used to estimate recycled room AC energy and demand savings. The Mid-Atlantic TRM (v10) 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 UMP to estimate savings resulting from the Appliance Recycling program. Table 353 lists the UMP model specification used to estimate the annual unit energy consumption (UEC) of refrigerators recycled in 2021, along with the model's estimated coefficients.

TABLE 353. 2021 APPLIANCE RECYCLING REFRIGERATOR UNIT ENERGY CONSUMPTION REGRESSION MODEL ESTIMATES

INDEPENDENT VARIABLES	COEFFICIENT	P-VALUE
Intercept	0.81	0.134
Age (years)	0.021	0.035
Dummy: Manufactured Pre-1990	1.04	0.000
Size (cubic feet)	0.06	0.021
Dummy: Single Door	-1.75	0.000
Dummy: Side-by-Side	1.12	0.000
Dummy: Primary	0.56	0.003
Interaction: Unconditioned Space * HDDs[a]	-0.04	0.000
Interaction: Unconditioned Space * CDDs[a]	0.03	0.239

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.
Note: Dependent Variable = Average Daily kWh, R2 = 0.30

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 353, an increase of one cubic foot in refrigerator size resulted in an increase of 0.06 kWh in daily 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 0.56 for the variable indicating whether a refrigerator was a primary unit; thus, with all else equal, a primary refrigerator consumed 0.56 kWh per day more than a secondary unit.

Table 354 lists the UMP model specification used to estimate the annual UEC of freezers recycled in 2021, along with the model's estimated coefficients. Again, as the UMP only specified a refrigerator model, the evaluation team created an analogous freezer model.

TABLE 354. 2021 APPLIANCE RECYCLING PROGRAM FREEZER UNIT ENERGY CONSUMPTION REGRESSION MODEL ESTIMATES

INDEPENDENT VARIABLES	COEFFICIENT	P-VALUE
Intercept	-0.96	0.236
Age (years)	0.045	0.010
Dummy: Manufactured Pre-1990	0.54	0.202
Size (cubic feet)	0.12	0.001
Dummy: Chest Freezer	0.30	0.273
Interaction: Unconditioned Space * HDDs	-0.03	0.035
Interaction: Unconditioned Space * CDDs	0.08	0.026

Note: Dependent Variable = Average Daily kWh, R2 = 0.45

Table 355 lists the mean values derived from 2021 data used to estimate the annual UEC of refrigerators recycled in 2021, along with the model's estimated coefficients. It also includes our model coefficients and means derived from 2021 data for recycled freezers.

TABLE 355. 2021 APPLIANCE RECYCLING PROGRAM PARTICIPANT MEAN VARIABLES AND MODEL COEFFICIENTS

	INDEPENDENT VARIABLES	2021 MEAN VALUE	2021 MODEL COEFFICIENT
Refrigerator	Intercept	1.00	0.81
	Age (years)	20.52	0.021
	Dummy: Manufactured Pre-1990	0.08	1.04
	Size (cubic feet)	19.12	0.06
	Dummy: Single Door	0.05	-1.75
	Dummy: Side-by-Side	0.27	1.12
	Dummy: Primary	0.58	0.56
	Interaction: Unconditioned Space * HDDs[a]	4.66	-0.04
	Interaction: Unconditioned Space * CDDs[a]	0.84	0.03
Freezer	Intercept	1.00	-0.96
	Age (years)	26.64	0.045
	Dummy: Manufactured Pre-1990	0.30	0.54
	Size (cubic feet)	15.53	0.12
	Dummy: Chest Freezer	0.34	0.30
	Interaction: Unconditioned Space * HDDs	7.48	-0.03
	Interaction: Unconditioned Space * CDDs	1.34	0.08

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 UMP-defined model was used. For the refrigerator UEC calculation, this included average appliance characteristics:

$$UEC_{Ref} = 365.25\ days * [0.81 + (0.021 * (20.52\ years\ old)) + \big(1.04 * (8\%\ units\ manufactured\ before\ 1990)\big) + (0.06 * \ 19.12\ unit\ size\ ft.^3\ ) \mp (-1.75 * 5\%\ single\ door\ units) + \ (1.12 * \ 27\%\ side - by - side\ units) \mp (0.56 * \ 58\%\ primary\ usage) \mp (-0.04 * 4.66\ unconditioned\ HDDs) + \ (0.03 * 0.84\ Unconditioned\ CDDs)] = 1{,}036\ kWh\ \text{year}$$

The following regression model shows how the UMP-defined model was used. For the freezer UEC calculation, this included average appliance characteristics:

$$UEC_{Frz} = \ 365.25\ days * [-0.96 + (0.045 * (26.64\ years\ old)) + \big(0.54 * (30\%\ units\ manufactured\ before\ 1990)\big) + (0.12 * \ 15.53\ unit\ size\ ft.^3\ ) \mp (0.30 * 34\%\ units\ that\ are\ chest\ freezers) \mp (-0.03 * 7.48\ unconditioned\ HDDs) + \ (0.08 * 1.34\ Unconditioned\ CDDs)] = 822\ kWh\ \text{year}$$

Using the values from Table 356, the evaluation team estimated the *ex post* annual UEC for an average program refrigerator and freezer.

TABLE 356. 2021 APPLIANCE RECYCLING PROGRAM AVERAGE UNIT ENERGY CONSUMPTION BY APPLIANCE TYPE

MEASURE	AVERAGE PER-UNIT ENERGY CONSUMPTION (KWH/YEAR)
Refrigerators	1,036
Freezers	822

DEMAND IMPACTS

To calculate demand reduction, the team used adjustment factors shown in Table 357, drawn from the Indiana TRM (v2.2), 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.

$$kW\ reduction = \frac{Average\ per\ Measure\ kWh\ Savings}{8{,}760} * TAF * LSAF$$

Where:

TAF = Temperature adjustment factor

LSAF = Load shape adjustment factor

TABLE 357. 2021 APPLIANCE RECYCLING DEMAND REDUCTION ASSUMPTIONS FOR APPLIANCE RECYCLING PROGRAM–RECYCLED REFRIGERATORS AND FREEZERS

VARIABLE	RECYCLED APPLIANCE VALUE
Temperature Adjustment Factor	1.21
Load Shape Adjustment Factor	1.06

Using the values from Table 358 the evaluation team estimated the *ex post* annual gross peak demand reduction for an average program refrigerator and freezer.

TABLE 358. 2021 APPLIANCE RECYCLING PROGRAM AVERAGE UNIT ENERGY DEMAND REDUCTION BY APPLIANCE TYPE

APPLIANCE	AVERAGE PER-UNIT GROSS PEAK DEMAND REDUCTION (KW/YEAR)
Refrigerators	0.152
Freezers	0.121

PART-USE FACTOR

Applying the part-use factors calculated from the 2020 survey to the modeled annual consumption and demand reduction from Table 356 and Table 358 yielded average gross, per-unit energy savings and demand reductions. Table 359 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 2021 evaluation.

TABLE 359. 2021 APPLIANCE RECYCLING PROGRAM *EX POST* PER-UNIT ENERGY SAVINGS AND DEMAND REDUCTION

SAVINGS TYPE	AVERAGE PER-UNIT ANNUAL ENERGY SAVINGS (KWH/YEAR)	AVERAGE PER-UNIT ANNUAL PEAK DEMAND REDUCTION (KW/YEAR)	PART-USE FACTOR	*EX POST* PER-UNIT GROSS ENERGY SAVINGS (KWH/YEAR)	*EX POST* PER-UNIT PEAK DEMAND REDUCTION (KWH/YEAR)
Refrigerators	1,036	0.152	0.89	922	0.135
Freezers	822	0.121	0.90	740	0.109

DEHUMIDIFIERS

Dehumidifier recycling is not included in the Indiana TRM (v2.2); therefore, the evaluation team used the default values from the Mid-Atlantic TRM (v10) to calculate *ex post* per-measure energy savings and demand reduction for recycled dehumidifiers. The evaluation team applied the default, average usage and savings values provided in Mid-Atlantic TRM (v10) because the evaluation team could not confirm the pints of water per day capacity of the units in the program tracking data. Additionally, the Mid-Atlantic TRM (v10) includes a default replacement rate to account for recycled dehumidifiers that are replaced. The replacement dehumidifier is assumed to be a new, federal baseline dehumidifier. The equation below includes the assumed replacement rate (RR), the annual baseline usage of the recycled dehumidifier (Recycled kWh), and the federal baseline usage of the new dehumidifier (Federal kWh).

The evaluation team used the following equation to determine savings for recycled dehumidifiers:

$$kWh\ savings\ = Recycled\ kWh * (1 - RR) + ((Recycled\ kWh - Federal\ kWh) * RR)$$

$$kW\ reduction\ = \frac{kWh\ Saved}{Hours} * CF$$

Where:

Recycled kWh = Recycled annual kWh

RR = Replacement rate

Federal kWh	=	Federal annual kWh
Hours	=	Annual operating hours
CF	=	Summer peak coincidence factor

Table 360 shows a summary of the recycled dehumidifier savings assumptions and assumption source.

TABLE 360. 2021 APPLIANCE RECYCLING PROGRAM VARIABLE ASSUMPTIONS FOR RECYCLED DEHUMIDIFIER

VARIABLE	DEHUMIDIFIER VALUE	SOURCE
Recycled kWh	1,260	Mid-Atlantic TRM (v10)
RR (Replacement Rate)	80%	
Federal kWh	908	
Hours	1,632	
CF	0.30	

Table 361 shows resulting *ex post* per-unit savings for recycled dehumidifiers.

TABLE 361. 2021 APPLIANCE RECYCLING PROGRAM DEHUMIDIFIERS *EX POST* PER-UNIT SAVINGS

MEASURE	*EX POST* PER-MEASURE SAVINGS	
	KWH	KW
Dehumidifier	533.60	0.121

WINDOW AIR CONDITIONERS

The evaluation team used the following equations from the Indiana TRM (v2.2) to calculate *ex post* per-measure energy savings and demand reduction for recycled window air conditioners:

$$kWh\ savings = \frac{EFLH_c * \text{Btuh}}{1{,}000} * \left(\frac{1}{EER_{exist}} - \frac{\%_{replaced}}{EER_{new}}\right)$$

$$kW\ reduction = \frac{Btuh * CF}{1{,}000} * \left(\frac{1}{EER_{exist}} - \frac{\%_{replaced}}{EER_{new}}\right)$$

Where:

$EFLH_c$	=	Equivalent full-load cooling hours for residents in Ft. Wayne, Indiana
Btuh	=	Actual size of the recycled AC in Btuh units (where 1 ton=12,000 Btuh)
EER_{exist}	=	Energy efficiency rating of the recycled AC
$\%_{replaced}$	=	Average percentage of recycled ACs replaced with new ACs
EER_{new}	=	Energy efficiency rating of the newly installed 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 362 shows a summary of the recycled window air conditioner savings assumptions and assumption source.

TABLE 362. 2021 APPLIANCE RECYCLING PROGRAM VARIABLE ASSUMPTIONS FOR RECYCLED WINDOW AIR CONDITIONERS

VARIABLE	WINDOW AIR CONDITIONER VALUE	SOURCE
Equivalent Full-Load Cooling Hours ($EFLH_c$)	257	Indiana TRM (v2.2)
Btuh	11,357	
Energy Efficiency Rating – Existing (EER_{exist})	7.7	
Percentage Replaced ($\%_{replaced}$)	76%	
Energy Efficiency Rating – New (EER_{new})	10.9	
Coincidence Factor (CF)	0.30	

Table 363 shows resulting *ex post* per-unit savings for recycled window air conditioners.

TABLE 363. 2021 APPLIANCE RECYCLING PROGRAM WINDOW AIR CONDITIONER *EX POST* PER-UNIT SAVINGS

MEASURE	*EX POST* PER-UNIT SAVINGS	
	KWH	KW
Window Air Conditioner	175.55	0.205

APPENDIX 7: BEHAVIORAL PROGRAM

No appendix for this program this year.

APPENDIX 8: RESIDENTIAL NEW CONSTRUCTION PROGRAM

ALGORITHMS AND ASSUMPTIONS

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 2021 PROGRAM IMPACTS

For participants in the first half of the 2021 program (January – June), the evaluation team used the same 2020 prototype models developed from the 2020 program homes and estimated savings using the 2020 Indiana Residential Code as the baseline. The definition of tiers for the first half of the 2021 program was identical to the 2020 program. The distribution of the participants by tier was similar for the first half of 2021 as 2020. A sample size of 197 rebates from the 2020 program was used to estimate savings by building prototype models with the 2020 program homes' characteristics. The models were updated with benchmarked efficient lighting data from the 2020 published CenterPoint Indiana program evaluation.[73] This study showed that 100% of interior, 99% of garage, and 99% of exterior lightbulbs were efficient. Because the new 2020 Indiana Residential code increases the baseline for efficient lighting, air sealing and insulation, changes were anticipated to have a significant impact on electric energy savings in program homes.

For participants in the second half of the 2021 program, the evaluation team evaluated gross savings for Residential New Construction program electric and gas rebates by drawing a random sample of 62 builder applications HERS certificates.

The evaluation team reviewed 62 random Ekotrope-generated HERS reports (62 of these reports were for natural gas homes, and six were for combination gas and electric homes). Based on these reports, the team compiled the homes' characteristics, such as insulation levels and square footage, into a database for energy modeling. Table 364 shows the sample of the PY 2021 homes.

[73] Cadmus. June 4, 2021. *2020 Vectren Demand-Side Management Portfolio Process and Electric Impacts Evaluation*. Prepared for CenterPoint Energy (formerly Vectren Indiana). https://www.vectren.com/assets/downloads/planning/irp/IRP-2020-vectren-electric-dsm-evaluation.pdf

TABLE 364. 2021 SECOND HALF HERS CERTIFICATE SAMPLE[74]

NIPSCO FUEL	SAMPLE	PY 2021 REBATES
Electric	6	12
Natural Gas	62	248

Table 365 shows the number of rebates in the 2021 program as well as the sample homes that were used for the evaluation in each category.

TABLE 365. 2021 RESIDENTIAL NEW CONSTRUCTION PROGRAM SAMPLING

MEASURE	PY 2021 REBATES	NATURAL GAS SAMPLE	ELECTRIC SAMPLE
Silver 66-75 (Jan-Jun 2021) Electric	71	0	18
Silver 66-75 (Jan-Jun 2021) Natural Gas	102	23	0
Gold 57-65 (Jan-Jun 2021) Electric	281	0	48
Gold 57-65 (Jan-Jun 2021) Natural Gas	531	85	0
Platinum <=56 (Jan-Jun 2021) Electric	41	0	7
Platinum <=56 (Jan-Jun 2021) Natural Gas	89	16	0
Subtotal Jan-Jun 2021	**1,115**	**124**	**73**
Silver 59-62 (July-Dec 2021) Electric	2	0	2
Silver 59-62 (July-Dec 2021) Natural Gas	148	41	0
Gold 57-58 (July-Dec 2021) Electric	1	0	1
Gold 57-58 (July-Dec 2021) Natural Gas	51	11	0
Platinum <=56 (July-Dec 2021) Electric	9	0	3
Platinum <=56 (July-Dec 2021) Natural Gas	49	10	0
Subtotal July-Dec 2021	**260**	**62**	**6**
Total	1,375		

Table 366 presents the average home characteristics from sample homes in the second half of 2021, as found in the HERS certificates, compared to the 2020 program evaluation. For 2021, the team treated the home characteristics separate from the customer utility account fuel use. All homes in the 2021 sample had natural gas furnaces, although some homes had electric water heaters. Most of the homes had tank water heaters. HERS certificates generated with the Ekotrope modeling software do not provide information about the percentage of efficient lighting in rated homes. Since all 62 HERS certificates were generated using Ekotrope, the evaluation team did not have sufficient data to estimate the percentage of efficient lightbulbs for the energy models. Once again, the team used benchmarked efficient lighting data from the 2020 published CenterPoint Indiana program evaluation. This study showed that 100% of interior, 99% of garage, and 99% of exterior lightbulbs were efficient.

TABLE 366. 2021 AND 2020 RESIDENTIAL NEW CONSTRUCTION PROGRAM HOME CHARACTERISTICS

HOME CHARACTERISTIC	2021 SECOND HALF REBATES	2020 ELECTRIC REBATES	2020 NATURAL GAS REBATES
Sample Size	62	73	124
Participants	260	814	1,475
Home Size (sq ft)	3,276	3,153	2,723
Ceiling R Value	42	40	42
Walls R Value	15	17	16
Basement Wall R Value	11	11	11

[74] Electric sampled homes were combination gas and electric homes. There was a total of 12 electric homes, and 248 gas homes in the second half of the 2021 program year. Cadmus calculates precision estimates based on each year's population and sample size, assuming standard variability. Cadmus expected most metrics to be estimated at 90% confidence. Note that we did not calculate confidence and precision for individual metrics.

HOME CHARACTERISTIC	2021 SECOND HALF REBATES	2020 ELECTRIC REBATES	2020 NATURAL GAS REBATES
Windows U Factor	0.292	0.304	0.300
Home Tightness ACH50	2.81	3.30	3.37
Duct Tightness CFM25/100 sq ft	1.63	2.14	2.51
Furnace AFUE	95	93	94
Air Conditioner SEER	13.6	13.1	13.4
Percentage High-Efficiency Lighting	99.3%	99.3%	99.3%
Natural Gas Water Heat Energy Factor	0.64	0.64	0.68
Electric Water Heat Energy Factor	0.95	N/A	0.95

To evaluate electric and natural gas savings for the participating homes, the evaluation team developed eight prototype energy models using REM/Rate v16.0.6. Using characteristics of the homes documented in the HERS certificates, the number of prototypes needed was determined by groupings of common characteristics. The models represented typical characteristics of the sampled participant home as they varied by water heater type, foundation type, and nearest weather station. The team made some assumptions for the prototype energy models when the HERS certificates lacked the information necessary to complete the model in REM/Rate (e.g., homes were two stories above grade, were single-family detached, had uninsulated slabs for basements, had R-10 sub-slab insulation for slab-on-grade homes, had 2x6 16" on center wall framing). The team also assumed heating and cooling setpoints were 68°F and 78°F, respectively. These assumptions have an impact on the overall energy consumption of the home but reflect typical construction methods in the industry.

Table 367 shows the eight home prototypes developed from the sampled population of HERS certificates submitted in the second half of 2021. The prototypes are grouped by the common characteristics shown in the table along with the number of homes in the sampled population that fit that category.

TABLE 367. SECOND HALF 2021 RESIDENTIAL NEW CONSTRUCTION PROGRAM PROTOTYPE MODELS

FOUNDATION TYPE	WATER HEATER FUEL	WATER HEATER TYPE	NEAREST WEATHER STATION	NUMBER OF HOMES
Conditioned Basement	Natural Gas	Tank	South Bend	25
Conditioned Basement	Natural Gas	Tankless	South Bend	1
Slab on Grade	Electric	Tank	South Bend	2
Slab on Grade	Natural Gas	Tank	South Bend	8
Conditioned Basement	Natural Gas	Tank	Fort Wayne	18
Conditioned Basement	Natural Gas	Tankless	Fort Wayne	3
Slab on Grade	Electric	Tank	Fort Wayne	1
Slab on Grade	Natural Gas	Tank	Fort Wayne	4
Total				62

The team developed an average weighted kWh, kW, and therm savings based on the number of sampled homes that fit into each prototype. The sample-wide realization rate was then based on this savings estimate versus the weighted *ex ante* savings value for the modeled homes.

TABLE 368 and Table 369 show the first half and second half of the 2021 program year realization rates for therms, kWh, and kW, respectively. For 2021 first half participants (TABLE 368), realization rates are based on the as-built 2020 prototype models, with 99.3% efficient lighting and 2020 IN code baseline, compared to the 2021 weighted *ex ante* savings, which were not based on 2020 IN code baseline. *Ex ante* savings for the first half of the year overestimated therm savings, and significantly overestimated kWh and kW savings, compared to modeled results.

TABLE 368. FIRST HALF OF 2021 RESIDENTIAL NEW CONSTRUCTION PROGRAM REALIZATION RATES

METRIC	AVERAGE WEIGHTED REPORTED (*EX ANTE*) SAVINGS OF SAMPLE	AVERAGE WEIGHTED EVALUATED (*EX POST*) SAVINGS OF SAMPLE	REALIZATION RATE
Therms (Sample size: 197)	317.38	245.67	77%
kWh (Sample: 197)	1,123.85	397.09	35%
KW (Sample: 197)	0.299	0.171	57%

The second half realization rates (Table 369) used prototype models sampled from the 2021 second half participants. As illustrated in the table, *ex ante* savings underestimated therm savings and kWh savings, and overestimated kW savings, compared to modeled results.

TABLE 369. SECOND HALF OF 2021 RESIDENTIAL NEW CONSTRUCTION PROGRAM REALIZATION RATES

METRIC	AVERAGE WEIGHTED REPORTED (*EX ANTE*) SAVINGS OF SAMPLE	AVERAGE WEIGHTED EVALUATED (*EX POST*) SAVINGS OF SAMPLE	REALIZATION RATE
Therms (Sample size: 62)	241.21	308.19	128%
kWh (Sample: 62)	191.64	460.63	240%
KW (Sample: 62)	0.444	0.240	54%

The evaluation team then applied the first half and second half realization rates to the *ex ante* savings at the tier level to determine the *ex post* savings at the tier level for both the first half and second half of the 2021 program year, as shown in Table 370.

TABLE 370. 2021 PROGRAM YEAR *EX POST* SAVINGS BY TIER

MEASURE	*EX POST* KWH	*EX POST* KW	*EX POST* THERMS
Silver 66-75 (Jan-Jun 2021)	386.01	0.125	238.80
Gold 57-65 (Jan-Jun 2021)	394.14	0.182	243.86
Platinum <=56 (Jan-Jun 2021)	433.84	0.187	268.39
Silver 59-62 (July-Dec 2021)	460.63	0.240	300.26
Gold 57-58 (July-Dec 2021)	460.63	0.240	315.86
Platinum <=56 (July-Dec 2021)	460.63	0.240	332.27

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 Indiana TRM (v2.2), as well as other state and industry approaches. Detailed information on the analysis and supporting assumptions for the following Residential School Education program measures are included within this appendix:

- LEDs
- Nightlights
- Kitchen Faucet Aerators
- Bathroom Faucet Aerators
- Low flow Showerheads
- Filter Whistles

Table 371 lists the assumptions of the *ex post* per-measure savings.

TABLE 371. SCHOOL EDUCATION PROGRAM MEASURES

MEASURE	REVIEWED ASSUMPTIONS
LEDs	New and baseline wattages, house of use, waste heat factors, coincidence factors
Nightlights	New and baseline wattages, house of use, 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
Filter Whistle	Full load heating and cooling hours, efficiency ratings, efficiency improvement

The algorithms and assumptions the evaluation team used to calculate *ex post* savings for 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.

$$kWh\ savings\ per\ lamp = \frac{(W_{base} - W_{LED}) * HOU * (1 + WHF_e)}{1{,}000} * ISR$$

$$kW\ reduction\ per\ lamp = \frac{(W_{base} - W_{LED}) * CF * (1 + WHF_d)}{1{,}000} * ISR$$

$$therm\ savings\ per\ lamp = \frac{(W_{base} - W_{LED}) * HOU * \left(WHF_g\right) * 10}{1{,}000} * ISR$$

Where:

W_{base}	=	Wattage of the bulb being replaced, W
W_{LED}	=	Wattage of the LED bulb, W
HOU	=	Average annual hours of use, hours
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
WHF_g	=	Waste heat factor for gas to account for HVAC interactions with lighting
CF	=	Summer peak coincidence factor
365	=	Number of days per year, days/yr.
1,000	=	Constant to convert W to kW
10	=	Constant to convert MMBtu to therm
ISR	=	In-service rate

Table 372 lists the input assumptions and source of each assumption for the LED measure savings calculations.

TABLE 372. *EX POST* VARIABLE ASSUMPTIONS FOR LEDS

INPUT	VALUE	SOURCE
W_{base}	38.4	2021 survey, detailed below
W_{LED} for 9-watt (LED)	9	Program data
HOU	1,135	Indiana TRM (v2.2)
WHF_e	-0.07	Indiana TRM (v2.2)
WHF_d	0.038	Indiana TRM (v2.2)
WHF_g	-0.0019	Indiana TRM (v2.2)
CF	0.11	Indiana TRM (v2.2)
ISR	0.73	NIPSCO 2021 survey

Table 373 provides the 2021 survey results and the updated baseline wattage used in the *ex post* analysis.

TABLE 373. 2021 SCHOOL EDUCATION *EX POST* BASELINE WATTAGE

REPLACED BULB	WATTAGE	WEIGHT
Incandescent	60	51%
Halogen	43	9%
CFL	13	15%
LED	9	22%
2021 *Ex post* baseline	38.4	-

NIGHTLIGHTS

The team used the following equation to calculate electric energy savings for LED nightlights:

$$kWh\ savings = \frac{(W_{base} - W_{LED}) * HOU * ISR}{1{,}000} * IRF$$

Where:

W_{base} = Wattage of the bulb being replaced, W

W_{LED} = Wattage of the LED bulb, W

HOU = Average annual hours of use, hours

ISR = In-service rate

1,000 = Constant to convert W to kW

IRF = Incandescent replacement factor representing the percentage of LED nightlights that replaced incandescent nightlights.

Table 374 lists the input assumptions and source of each assumption for the nightlights measure savings calculations.

TABLE 374. *EX POST* VARIABLE ASSUMPTIONS FOR LED NIGHTLIGHTS

INPUT	VALUE	SOURCE
W_{base}	5	Indiana TRM (v2.2)
W_{LED}	0.5	Program data
Hours per Year	2,920	Indiana TRM (v2.2)
IRF	0.14	NIPSCO 2021 survey
ISR	0.70	NIPSCO 2021 survey

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:

$$kWh\ savings = \left(GPM_{base} - GPM_{low\ flow}\right) * MPD * \frac{PH}{FH} * DR * 8.3 * (T_{mix} - T_{inlet}) * \frac{365}{RE*3{,}412} * ISR * WHS_e$$

$$kW\ reduction = \left(GPM_{base} - GPM_{low\ flow}\right) * DR * 60 * 8.3 * \frac{(T_{mix} - T_{inlet})}{RE*3{,}412} * CF * ISR * WHS_e$$

$$therm\ savings = \left(GPM_{base} - GPM_{low\ flow}\right) * MPD * \frac{PH}{FH} * DR * 8.3 * (T_{mix} - T_{inlet}) * \frac{365}{RG*100{,}000} * ISR * WHS_g$$

Where:

GPM_{base} = Gallons per minute of baseline faucet aerator, gpm

$GPM_{low\ flow}$ = Gallons per minute of low flow faucet aerator, gpm

MPD = Average minutes of faucet use per person per day, minutes

PH = Average number of people per household

FH = Average number of faucets per household

DR = Percentage of water flowing down the drain

T_{mix} = Mixed water temperature of existing faucet, °F

T_{inlet} = Cold water temperature entering the DHW system, °F

RE = Recovery efficiency of electric hot water heater

RG = Recovery efficiency of natural gas water heater

CF = Summer peak coincidence factor

8.3 = Specific weight of water in pounds per gallon, multiplied by specific water temperature (1.0 Btu/lb-°F)

3,412 = Constant to convert Btu to kWh

365 = Days per year

100,000 = Constant to convert therm

ISR = In-service rate

WHS_e = Percentage of electric water heaters

WHS_g = Percentage of gas water heaters

Table 375 lists the input assumptions and source of each assumption for the kitchen and bathroom faucet aerator measure savings calculations.

TABLE 375. *EX POST* VARIABLE ASSUMPTIONS FOR KITCHEN AND BATHROOM FAUCET AERATORS

INPUT	KITCHEN VALUE	BATHROOM VALUE	SOURCE
GPM_{base}	2.44	1.9	Indiana TRM (v2.2)
$GPM_{low\ flow}$	1.5	1.0	Program data
MPD	4.5	1.6	Indiana TRM (v2.2)
PH	4.74	4.74	NIPSCO 2021 HEW
FH	1	2.65	NIPSCO 2021 survey
DR	0.5	0.7	Indiana TRM (v2.2)
T_{mix}	93	86	Indiana TRM (v2.2)
T_{inlet}	57.4	57.4	Indiana TRM (v2.2)
RE	0.98	0.98	Indiana TRM (v2.2)
RG	0.76	0.76	Indiana TRM (v2.2)

INPUT	KITCHEN VALUE	BATHROOM VALUE	SOURCE
CF	0.0033	0.0012	Indiana TRM (v2.2)
ISR	0.35	0.28	NIPSCO 2021 survey
WHS_e	0.23	0.23	NIPSCO 2021 HEW
WHS_g	0.62	0.62	NIPSCO 2021 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:

$$kWh\ savings = (GPM_{base} - GPM_{low\ flow}) * MS * SPD * \frac{PH}{SH} * 8.3 * (T_{mix} - T_{inlet}) * \frac{365}{RE*3{,}412} * ISR * WHS_e$$

$$kW\ reduction = (GPM_{base} - GPM_{low\ flow}) * 60 * 8.3 * \frac{(T_{mix} - T_{inlet})}{RE * 3{,}412} * CF * ISR * WHS_e$$

$$therm\ savings = (GPM_{base} - GPM_{low\ flow}) * MS * SPD * \frac{PH}{SH} * 8.3 * (T_{mix} - T_{inlet}) * \frac{365}{RG*100{,}000} * ISR * WHS_g$$

Where:

GPM_{base} = Gallons per minute of baseline showerhead, gpm
$GPM_{low\ flow}$ = Gallons per minute of low flow showerhead, gpm
MS = Average minutes per shower event, minutes
SPD = Average number of shower events per person per day
PH = Average number of people per household
SH = Average number of showerheads per household
T_{mix} = Mixed water temperature of existing faucet, °F
T_{inlet} = Cold water temperature entering the DHW system, °F
RE = Recovery efficiency of electric hot water heater
RG = Recovery efficiency of natural gas water heater
CF = Summer peak coincidence factor
8.3 = Specific weight of water in pounds per gallon, multiplied by specific water temperature (1.0 Btu/lb-°F)
3,412 = Constant to convert Btu to kWh
365 = Days per year
100,000 = Constant to convert therm
ISR = In-service rate
WHS_e = Percentage of electric water heaters
WHS_g = Percentage of gas water heaters

Table 376 lists the input assumptions and source of each assumption for the low flow showerhead measure savings calculations.

TABLE 376. *EX POST* VARIABLE ASSUMPTIONS FOR LOW FLOW SHOWERHEADS

INPUT	VALUE	SOURCE
GPM_{base}	2.63	Indiana TRM (v2.2)
$GPM_{low\ flow}$)	1.5	Program data
MS	7.8	Indiana TRM (v2.2)
SPD	0.6	Indiana TRM (v2.2)
PH	4.74	NIPSCO 2021 HEW
SH	1.99	NIPSCO 2021 survey
T_{mix}	101	Indiana TRM (v2.2)
T_{inlet}	57.4	Indiana TRM (v2.2)
RE	0.98	Indiana TRM (v2.2)
RG	0.76	Indiana TRM (v2.2)
CF	0.0023	Indiana TRM (v2.2)
ISR	0.30	NIPSCO 2021 survey
WHS_e	0.23	NIPSCO 2021 HEW
WHS_g	0.62	NIPSCO 2021 HEW

FILTER WHISTLES

The team used the following equations to calculate electric energy and peak demand savings for filter whistles:

$$kWh\ savings = \Delta kWh_{heat} + \Delta kWh_{cool}$$

$$\Delta kWh_{heat} = kW_{motor} * EFLH_{heat} * EI * ISR$$

$$\Delta kWh_{cool} = kW_{motor} * EFLH_{cool} * EI * ISR * \%CAC$$

$$kW\ reduction = \frac{\Delta kWh_{cool}}{EFLH_{cool}} * CF$$

Where:

kW_{motor} = Average motor full load electric demand, kW
$EFLH_{heat}$ = Estimated full load heating hours
$EFLH_{cool}$ = Estimated full load cooling hours
EI = Efficiency Improvement
ISR = In-service rate
%CAC = Percent of homes with air conditioning
CF = Coincidence Factor

Table 377 lists the input assumptions and source of each assumption for the filter whistle measure savings calculations.

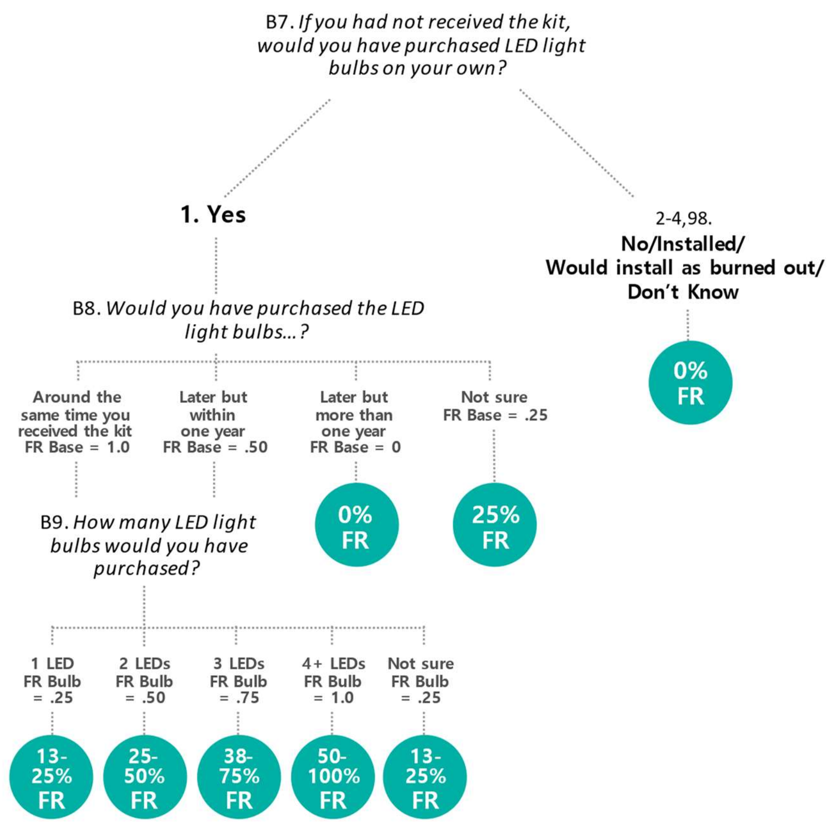
TABLE 377. *EX POST* VARIABLE ASSUMPTIONS FOR FILTER WHISTLES

INPUT	VALUE	SOURCE
kW_{motor}	0.377	2021 Pennsylvania TRM
$EFLH_{heat}$	1427	Indiana TRM (v2.2)
$EFLH_{cool}$	431	Indiana TRM (v2.2)
EI	0.15	2021 Pennsylvania TRM
CF	0.218	2021 Pennsylvania TRM, assume Bradford
% CAC	0.81	Indiana TRM (v2.2)
ISR	0.20	NIPSCO 2021 survey

FREERIDERSHIP AND SPILLOVER

Below is a flow chart (Figure 100) detailing the evaluation approach to assessing freeridership for LEDs.

FIGURE 100. FREERIDERSHIP APPROACH



Three spillover participants installed a total of three additional energy efficient measures generating a total of 50.28 MMBtu in energy savings. These additional measures and their respective savings values are summarized below (Table 378). The evaluation team reviewed program tracking data from the HVAC, HEA, IQW, and Residential New Construction programs to ensure that spillover participants did not receive a rebate for these additional measures. None of the spillover participants received a rebate for the additional measures installed.

Table 378. School Education Program qualifying Spillover measures

SPILLOVER MEASURE	COUNT OF MEASURES INSTALLED	SOURCE OF ASSIGNED SAVINGS VALUES [a]	MMBTU (KWH) SAVINGS	MMBTU (THERM) SAVINGS	TOTAL MMBTU
Air Sealing	1	NIPSCO 2021 IQW Evaluation	0.29	9.86	10.14
ENERGY STAR Clothes Washer	1	Indiana TRM	0.45	0.12	0.57
ENERGY STAR Dishwasher	1	Indiana TRM	0.26	1.30	1.56
Totals	3		1.00	11.28	12.27

[a] For spillover measures that qualify for a NIPSCO program (e.g., air sealing), adjusted savings values from this year's evaluation were assigned.

APPENDIX 10: HOMELIFE CALCULATOR PROGRAM

ALGORITHMS AND ASSUMPTIONS

This appendix contains the assumptions used in electric savings, demand reduction, and gas savings algorithms for the measures within the Homelife Calculator program. The team examined each assumption behind the algorithms to capture savings and compared it against the 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:

- LEDs
- Nightlights
- Kitchen faucet aerators
- Bathroom faucet aerators
- Low flow showerheads
- Filter whistles

Table 379 lists the assumptions of the *ex post* per-measure savings.

TABLE 379. HOMELIFE CALCULATOR PROGRAM MEASURES

MEASURE	REVIEWED ASSUMPTIONS
LEDs	New and baseline wattages, house of use, waste heat factors, coincidence factors
Nightlights	New and baseline wattages, house of use, 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
Filter Whistle	Full load heating and cooling hours, efficiency ratings, efficiency improvement

The algorithms and assumptions the evaluation team used to calculate *ex post* savings 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.

$$kWh\ savings\ per\ lamp = \frac{(W_{base} - W_{LED}) * HOU * (1 + WHF_e)}{1{,}000} * ISR$$

$$kW\ reduction\ per\ lamp = \frac{(W_{base} - W_{LED}) * CF * (1 + WHF_d)}{1{,}000} * ISR$$

$$therm\ savings\ per\ lamp = \frac{(W_{base} - W_{LED}) * HOU * \left(WHF_g\right) * 10}{1{,}000} * ISR$$

Where:

W_{base}	=	Wattage of the bulb being replaced, W
W_{LED}	=	Wattage of the LED bulb, W
HOU	=	Average annual hours of use, hours
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)
CF	=	Summer peak coincidence factor
365	=	Number of days per year, days/yr.
1,000	=	Constant to convert W to kW
10	=	Constant to convert MMBtu to therm
ISR	=	In-service rate

Table 380 lists the input assumptions and source of each assumption for the LED measure savings calculations.

TABLE 380. *EX POST* VARIABLE ASSUMPTIONS FOR LEDS

INPUT	VALUE	SOURCE
W_{base}	35.47	2021 Homelife Calculator survey, detailed below
W_{base}	38.4	2021 School Education survey, detailed below
W_{LED} for 9-watt (LED)	9	Program data
HOU	1,135	Indiana TRM (v2.2)
WHF_e	-0.0705	Indiana TRM (v2.2), Combo Kit customers, averaged across participant location

INPUT	VALUE	SOURCE
WHF_e	-0.0719	Indiana TRM (v2.2), Electric Only Kit Customers, averaged across participant location
WHF_d	0.038	Indiana TRM (v2.2), averaged across participant location
WHF_g	-0.0019	Indiana TRM (v2.2), averaged across participant location
CF	0.11	Indiana TRM (v2.2)
ISR	0.80	NIPSCO 2020 and 2021 Homelife surveys

Table 381 provides the 2021 survey results and the updated baseline wattage used in the *ex post* analysis.

TABLE 381. 2021 HOMELIFE CALCULATOR *EX POST* BASELINE WATTAGE

REPLACED BULB	WATTAGE	WEIGHT
Incandescent	60	53%
Halogen	43	0%
CFL	13	13%
LED	9	22%
2021 *Ex post* baseline	35.47	-

NIGHTLIGHTS

The team used the following equation to calculate electric energy savings for LED nightlights:

$$kWh\ savings = \frac{((W_{base} - W_{LED}) * IRF + \ \ HOU * ISR}{1{,}000}$$

Where:

W_{base} = Wattage of the bulb being replaced, W

WLED = Wattage of the LED bulb, W

HOU = Average annual hours of use, hours

ISR = In-service rate

1,000 = Constant to convert W to kW

IRF = Incandescent replacement factor representing the percentage of LED nightlights that replaced incandescent and halogen nightlights.

Table 382 lists the input assumptions and source of each assumption for the nightlights measure savings calculations.

TABLE 382. *EX POST* VARIABLE ASSUMPTIONS FOR LED NIGHTLIGHTS

INPUT	VALUE	SOURCE
W_{base}	5	Indiana TRM (v2.2)
W_{LED}	0.33	Program data

INPUT	VALUE	SOURCE
Hours per Year	2,920	Indiana TRM (v2.2)
IRF	0.22	NIPSCO 2021 Homelife survey
ISR	0.87	NIPSCO 2020 and 2021 Homelife surveys

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:

$$kWh\ savings = \left(GPM_{base} - GPM_{low\ flow}\right) * MPD * \frac{PH}{FH} * DR * 8.3 * (T_{mix} - T_{inlet}) * \frac{365}{RE*3,412} * ISR * WHS_e$$

$$kW\ reduction = \left(GPM_{base} - GPM_{low\ flow}\right) * DR * 60 * 8.3 * \frac{(T_{mix} - T_{inlet})}{RE*3,412} * CF * ISR * WHS_e$$

$$therm\ savings = \left(GPM_{base} - GPM_{low\ flow}\right) * MPD * \frac{PH}{FH} * DR * 8.3 * (T_{mix} - T_{inlet}) * \frac{365}{RG*100,000} * ISR * WHS_g$$

Where:

GPMbase = Gallons per minute of baseline faucet aerator, gpm
GPMlow flow = Gallons per minute of low flow faucet aerator, gpm
MPD = Average minutes of faucet use per person per day, minutes
PH = Average number of people per household
FH = Average number of faucets per household
DR = Percentage of water flowing down the drain
Tmix = Mixed water temperature of existing faucet, °F
Tinlet = Cold water temperature entering the DHW system, °F
RE = Recovery efficiency of electric hot water heater
RG = Recovery efficiency of natural gas water heater
CF = Summer peak coincidence factor
8.3 = Specific weight of water in pounds per gallon, multiplied by specific water temperature (1.0 Btu/lb-°F)
3,412 = Constant to convert Btu to kWh
365 = Days per year
100,000 = Constant to convert therm
ISR = In-service rate
WHS_e = Percentage of electric water heaters
WHS_g = Percentage of gas water heaters

Table 383 lists the input assumptions and source of each assumption for the kitchen and bathroom faucet aerator measure savings calculations.

TABLE 383. *EX POST* VARIABLE ASSUMPTIONS FOR KITCHEN AND BATHROOM FAUCET AERATORS

INPUT	KITCHEN VALUE	BATHROOM VALUE	SOURCE
GPM_{base}	2.44	1.9	Indiana TRM (v2.2)
$GPM_{low\ flow}$	1.5	1.0	Program data
MPD	4.5	1.6	Indiana TRM (v2.2)
PH	2.64	2.64	Indiana TRM (v2.2)
FH	1	2.21	NIPSCO 2021 Homelife survey
DR	0.5	0.7	Indiana TRM (v2.2)
T_{mix}	93	86	Indiana TRM (v2.2)
T_{inlet}	57.32	57.32	Indiana TRM (v2.2), Combo kits, averaged across participant location
T_{inlet}	57.12	57.12	Indiana TRM (v2.2), Electric-Only kits, averaged across participant location
T_{inlet}	56.31	56.31	Indiana TRM (v2.2), Gas-Only kits, averaged across participant location
RE	0.98	0.98	Indiana TRM (v2.2)
RG	0.76	0.76	Indiana TRM (v2.2)
CF	0.0033	0.0012	Indiana TRM (v2.2)
ISR	0.49	0.36	NIPSCO 2020 and 2021 Homelife surveys
WHS_e	0.23	0.23	NIPSCO 2021 HEW
WHS_g	0.62	0.62	NIPSCO 2021 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:

$$kWh\ savings = \left(GPM_{base} - GPM_{low\ flow}\right) * MS * SPD * \frac{PH}{SH} * 8.3 * (T_{mix} - T_{inlet}) * \frac{365}{RE*3{,}412} * ISR * WHS_e$$

$$kW\ reduction = \left(GPM_{base} - GPM_{low\ flow}\right) * 60 * 8.3 * \frac{(T_{mix} - T_{inlet})}{RE * 3{,}412} * CF * ISR * WHS_e$$

$$therm\ savings = \left(GPM_{base} - GPM_{low\ flow}\right) * MS * SPD * \frac{PH}{SH} * 8.3 * (T_{mix} - T_{inlet}) * \frac{365}{RG*100{,}000} * ISR * WHS_g$$

Where:

GPM_{base} = Gallons per minute of baseline showerhead, gpm

$GPM_{low\ flow}$ = Gallons per minute of low flow showerhead, gpm

MS = Average minutes per shower event, minutes

SPD = Average number of shower events per person per day

PH = Average number of people per household

SH	=	Average number of showerheads per household
T_{mix}	=	Mixed water temperature of existing faucet, °F
T_{inlet}	=	Cold water temperature entering the DHW system, °F
RE	=	Recovery efficiency of electric hot water heater
RG	=	Recovery efficiency of natural gas water heater
CF	=	Summer peak coincidence factor
8.3	=	Specific weight of water in pounds per gallon, multiplied by specific water temperature (1.0 Btu/lb-°F)
3,412	=	Constant to convert Btu to kWh
365	=	Days per year
100,000	=	Constant to convert therm
ISR	=	In-service rate
WHS_e	=	Percentage of electric water heaters
WHS_g	=	Percentage of gas water heaters

Table 384 lists the input assumptions and source of each assumption for the low flow showerhead measure savings calculations.

TABLE 384. *EX POST* VARIABLE ASSUMPTIONS FOR LOW FLOW SHOWERHEADS

INPUT	VALUE	SOURCE
GPM_{base}	2.63	Indiana TRM (v2.2)
$GPM_{low\ flow}$)	1.5	Program data
MS	7.8	Indiana TRM (v2.2)
SPD	0.6	Indiana TRM (v2.2)
PH	2.64	Indiana TRM (v2.2)
SH	1.77	NIPSCO 2021 Homelife survey
T_{mix}	101	Indiana TRM (v2.2)
T_{inlet}	57.32	Indiana TRM (v2.2), Combo kits, averaged across participant location
T_{inlet}	57.12	Indiana TRM (v2.2), Electric-Only kits, averaged across participant location
T_{inlet}	56.31	Indiana TRM (v2.2), Gas-Only kits, averaged across participant location
RE	0.98	Indiana TRM (v2.2)
RG	0.76	Indiana TRM (v2.2)
CF	0.0023	Indiana TRM (v2.2)
ISR	0.42	NIPSCO 2020 and 2021 Homelife surveys
WHF_e	0.23	NIPSCO 2021 HEW
WHF_g	0.62	NIPSCO 2021 HEW

FILTER WHISTLES

The team used the following equations to calculate electric energy and peak demand savings for Filter Whistles:

$$kWh\ savings = \Delta kWh_{heat} + \Delta kWh_{cool}$$

$$\Delta kWh_{heat} = kW_{motor} * EFLH_{heat} * EI * ISR$$

$$\Delta kWh_{cool} = kW_{motor} * EFLH_{cool} * EI * ISR * \%CAC$$

$$kW\ reduction = \frac{\Delta kWh_{cool}}{EFLH_{cool}} * CF$$

Where:

kW_{motor} = Average motor full load electric demand, kW

$EFLH_{heat}$ = Estimated full load heating hours

$EFLH_{cool}$ = Estimated full load cooling hours

EI = Efficiency Improvement

ISR = In-service rate

%CAC = Percent of homes with air conditioning

CF = Coincidence Factor

Table 385 lists the input assumptions and source of each assumption for the filter whistle measure savings calculations.

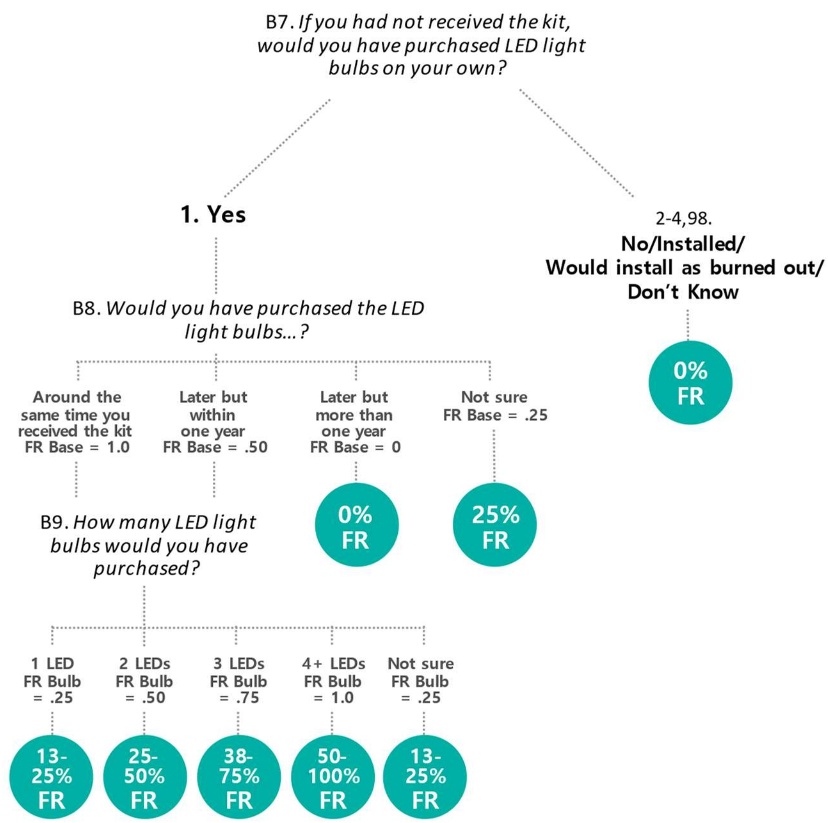
TABLE 385. *EX POST* VARIABLE ASSUMPTIONS FOR FILTER WHISTLES

INPUT	VALUE	SOURCE
kW_{motor}	0.377	2021 Pennsylvania TRM
$EFLH_{heat}$	1427	Indiana TRM (v2.2)
$EFLH_{cool}$	431	Indiana TRM (v2.2)
EI	0.15	2021 Pennsylvania TRM
CF	0.218	2021 Pennsylvania TRM, assume Bradford
% CAC	0.81	Indiana TRM (v2.2)
ISR	0.25	NIPSCO 2020 and 2021 Homelife surveys

FREERIDERSHIP (LEDS)

Below is a flow chart (Figure 101) detailing the evaluation approach to assessing freeridership for LEDs.

FIGURE 101. FREERIDERSHIP APPROACH



PARTICIPANT DEMOGRAPHICS AND HOME CHARACTERISTICS

Most respondents (85%) live in a single-family home and 80% are owners. Natural gas was the primary heating source for most homes (75%).

Most respondents (87.5%) have one or two showers in their home. Over two thirds of respondents (70%) have one- or two-bathroom faucets and almost all have one kitchen sink (90%) in their home.

The following (Table 386) is a snapshot of self-reported home characteristics:

- Heating equipment: 85% heat their homes with a furnace.
- Cooling equipment: 78% have central air conditioning and 13% use AC units.
- One respondent reported not having to their water heater and one respondent did not have access to their furnace.

TABLE 386. HOME CHARACTERISTICS OF SURVEYED 2021 HOMELIFE CALCULATOR PROGRAM PARTICIPANTS

HOME CHARACTERISTICS	COUNT	PERCENT
Type of residence		
Single-family detached home	34	85%
Multifamily apartment or condo building (with 4 or more units)	3	7.5%
Attached house (townhouse, row house, or twin)	3	7.5%
Total	40	100.0%
Ownership of residence		
Own	32	80%
Rent	8	20%
Total	40	100.0%
Primary fuel source for heating		
Electricity	3	7.5%
Natural gas	30	75%
Not sure/other	7	17.5%
Total	40	100.0%
Year home was built		
1900 to 1939	5	12.5%
1940 to 1959	7	17.5%
1960 to 1979	5	12.5%
1980 to 1989	1	2.5%
1990 to 1999	5	12.5%
2000 to 2004	1	2.5%
2005 or later	7	17.5%
Total	40	100.0%
Number of kitchen sinks		

HOME CHARACTERISTICS	COUNT	PERCENT
1	36	90%
2	2	5%
3	1	2.5%
Prefer not to answer	1	2.5%
Total	**40**	**100.0%**
Number of bathroom faucets		
1	10	25%
2	18	45%
3	7	17.5%
4	3	7.5%
Total	**38**	**100.0%**
Number of showers		
1	13	32.5%
2	22	55%
3	3	10%
Prefer not to answer	1	2.5%
Total	**40**	**100.0%**

Demographic characteristics were varied among surveyed participants (Table 387). About one-half (43%) reported having lived in their home for five years or less (n=40). Almost a third (27.5%) had a least a 4-year college degree (n=40). Most frequently, family households were made up by one or two people (55%).

TABLE 387. DEMOGRAPHICS OF SURVEYED 2021 HOMELIFE CALCULATOR PROGRAM PARTICIPANTS

PARTICIPANT DEMOGRAPHICS	COUNT	PERCENT
Number of people living in home		
1-2	22	55%
3-4	11	27.5%
5-6	6	15%
Prefer not to answer	1	2.5%
Total	**40**	**100.0%**
Number of years living in home		
One year or less	4	10%
2-3 years	11	27.5%
4-5 years	2	5%
6-10 years	7	17.5%
More than 10	15	37.5
Prefer not to answer	1	2.5%
Total	**40**	**100.0%**
Year born		
1900 to 1939	2	5%

PARTICIPANT DEMOGRAPHICS	COUNT	PERCENT
1940 to 1959	9	22.5%
1960 to 1979	10	25%
1980 to 1989	9	22.5%
1990 to 1999	5	12.5%
Prefer not to answer	5	12.5%
Total	40	100.0%
Highest level of education completed		
High school or less	14	35%
Some college, no degree	5	12.5%
Two-year college degree	5	12.5%
Four-year college degree	6	15%
Graduate or professional degree	5	12.5%
Prefer not to answer	5	12.5%
Total	40	100.0%
Income		
Under $25,000	5	12.5%
$25,000 to under $35,000	4	10%
$35,000 to under $50,000	5	12.5%
$50,000 to under $75,000	8	20%
$75,000 to under $100,000	3	7.5%
$100,000 to under $150,000	6	15%
Over $150,000	1	2.5%
Prefer not to answer	8	20%
Total	40	100.0%

APPENDIX 11: EMPLOYEE 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 Employee Education program. The team examined each assumption behind the algorithms to capture savings and compared it against the Indiana TRM (v2.2), as well as other state and industry approaches. Detailed information on the analysis and supporting assumptions for the following Residential Employee Education program measures are included within this appendix:

- LEDs
- Nightlights
- Kitchen faucet aerators
- Bathroom faucet aerators
- Low flow showerheads
- Filter whistles

Table 388 lists the assumptions of the *ex post* per-measure savings.

TABLE 388. EMPLOYEE EDUCATION PROGRAM MEASURES

MEASURE	REVIEWED ASSUMPTIONS
LEDs	New and baseline wattages, house of use, waste heat factors, coincidence factors
Nightlights	New and baseline wattages, house of use, 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
Filter Whistle	Full load heating and cooling hours, efficiency ratings, efficiency improvement

The algorithms and assumptions the evaluation team used to calculate *ex post* savings for 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.

$$kWh\ savings\ per\ lamp = \frac{(W_{base} - W_{LED}) * HOU * (1 + WHF_e)}{1{,}000} * ISR$$

$$kW\ reduction\ per\ lamp = \frac{(W_{base} - W_{LED}) * CF * (1 + WHF_d)}{1{,}000} * ISR$$

$$therm\ savings\ per\ lamp = \frac{(W_{base} - W_{LED}) * HOU * \left(WHF_g\right) * 10}{1{,}000} * ISR$$

Where:

W_{base} = Wattage of the bulb being replaced, W

W_{LED} = Wattage of the LED bulb, W

HOU = Average annual hours of use, hours

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)

CF = Summer peak coincidence factor

365 = Number of days per year, days/yr.

1,000 = Constant to convert W to kW

10 = Constant to convert MMBtu to therm

ISR = In-service rate

Table 389 lists the input assumptions and source of each assumption for the LED measure savings calculations.

TABLE 389. *EX POST* VARIABLE ASSUMPTIONS FOR LEDS

INPUT	VALUE	SOURCE
W_{base}	35.47	2021 Homelife Calculator survey, detailed below
W_{LED} for 9-watt (LED)	9	Program data
HOU	1,135	Indiana TRM (v2.2)
WHF_e	-0.0705	Indiana TRM (v2.2), Combo Kit customers, averaged across participant location
WHF_e	-0.0719	Indiana TRM (v2.2), Electric Only Kit Customers, averaged across participant location
WHF_d	0.038	Indiana TRM (v2.2), averaged across participant location
WHF_g	-0.0019	Indiana TRM (v2.2), averaged across participant location
CF	0.11	Indiana TRM (v2.2)
ISR	0.80	NIPSCO 2020 and 2021 Homelife surveys

Table 390 provides the 2021 survey results and the updated baseline wattage used in the *ex post* analysis.

TABLE 390. 2021 EMPLOYEE EDUCATION *EX POST* BASELINE WATTAGE

REPLACED BULB	WATTAGE	WEIGHT
Incandescent	60	53%
Halogen	43	0%
CFL	13	13%
LED	9	22%
2021 *ex post* baseline	35.47	-

NIGHTLIGHTS

The team used the following equation to calculate electric energy savings for LED nightlights:

$$kWh\ savings = \frac{\left((W_{base} - W_{LED}) * IRF\right) * HOU * ISR}{1{,}000}$$

Where:

W_{base}	=	Wattage of the bulb being replaced, W
W_{LED}	=	Wattage of the LED bulb, W
HOU	=	Average annual hours of use, hours
ISR	=	In-service rate
1,000	=	Constant to convert W to kW
IRF	=	Incandescent replacement factor representing the percentage of LED nightlights that replaced incandescent and halogen nightlights.

Table 391 lists the input assumptions and source of each assumption for the nightlights measure savings calculations.

TABLE 391. *EX POST* VARIABLE ASSUMPTIONS FOR LED NIGHTLIGHTS

INPUT	VALUE	SOURCE
W_{base}	5	Indiana TRM (v2.2)
W_{LED}	0.33	Indiana TRM (v2.2)
Hours per Year	2,920	Indiana TRM (v2.2)
IRF	0.22	NIPSCO 2021 Homelife survey
ISR	0.87	NIPSCO 2020 and 2021 Homelife surveys

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:

$$kWh\ savings = \left(GPM_{base} - GPM_{low\ flow}\right) * MPD * \frac{PH}{FH} * DR * 8.3 * (T_{mix} - T_{inlet}) * \frac{365}{RE * 3{,}412} * ISR * WHS_e$$

$$kW\ reduction = \left(GPM_{base} - GPM_{low\ flow}\right) * DR * 60 * 8.3 * \frac{(T_{mix} - T_{inlet})}{RE * 3{,}412} * CF * ISR * WHS_e$$

$$therm\ savings = \left(GPM_{base} - GPM_{low\ flow}\right) * MPD * \frac{PH}{FH} * DR * 8.3 * (T_{mix} - T_{inlet}) * \frac{365}{RG * 100{,}000} * ISR * WHS_g$$

Where:

GPM_{base} = Gallons per minute of baseline faucet aerator, gpm

$GPM_{low\ flow}$ = Gallons per minute of low flow faucet aerator, gpm

MPD = Average minutes of faucet use per person per day, minutes

PH = Average number of people per household

FH = Average number of faucets per household

DR = Percentage of water flowing down the drain

T_{mix} = Mixed water temperature of existing faucet, °F

T_{inlet} = Cold water temperature entering the DHW system, °F

RE = Recovery efficiency of electric hot water heater

RG = Recovery efficiency of natural gas water heater

CF = Summer peak coincidence factor

8.3 = Specific weight of water in pounds per gallon, multiplied by specific water temperature (1.0 Btu/lb-°F)

3,412 = Constant to convert Btu to kWh

365 = Days per year

100,000 = Constant to convert therm

ISR = In-service rate

WHS_e = Percentage of electric water heaters

WHS_g = Percentage of gas water heaters

Table 392 lists the input assumptions and source of each assumption for the kitchen and bathroom faucet aerator measure savings calculations.

TABLE 392. *EX POST* VARIABLE ASSUMPTIONS FOR KITCHEN AND BATHROOM FAUCET AERATORS

INPUT	KITCHEN VALUE	BATHROOM VALUE	SOURCE
GPM_{base}	2.44	1.9	Indiana TRM (v2.2)
$GPM_{low\ flow}$	1.5	1.0	Program data
MPD	4.5	1.6	Indiana TRM (v2.2)
PH	2.64	2.64	Indiana TRM (v2.2)
FH	1	2.21	NIPSCO 2021 Homelife survey
DR	0.5	0.7	Indiana TRM (v2.2)
T_{mix}	93	86	Indiana TRM (v2.2)
T_{inlet}	57.32	57.32	Indiana TRM (v2.2), Combo kits, averaged across participant location
T_{inlet}	57.12	57.12	Indiana TRM (v2.2), Electric-Only kits, averaged across participant location
T_{inlet}	56.31	56.31	Indiana TRM (v2.2), Gas-Only kits, averaged across participant location
RE	0.98	0.98	Indiana TRM (v2.2)
RG	0.76	0.76	Indiana TRM (v2.2)
CF	0.0033	0.0012	Indiana TRM (v2.2)
ISR	0.49	0.36	NIPSCO 2020 and 2021 Homelife surveys
WHS_e	0.23	0.23	NIPSCO 2021 HEW
WHS_g	0.62	0.62	NIPSCO 2021 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:

$$kWh\ savings = \left(GPM_{base} - GPM_{low\ flow}\right) * MS * SPD * \frac{PH}{SH} * 8.3 * (T_{mix} - T_{inlet}) * \frac{365}{RE*3,412} * ISR * WHS_e$$

$$kW\ reduction = \left(GPM_{base} - GPM_{low\ flow}\right) * 60 * 8.3 * \frac{(T_{mix} - T_{inlet})}{RE * 3,412} * CF * ISR * WHS_e$$

$$therm\ savings = \left(GPM_{base} - GPM_{low\ flow}\right) * MS * SPD * \frac{PH}{SH} * 8.3 * (T_{mix} - T_{inlet}) * \frac{365}{RG*100,000} * ISR * WHS_g$$

Where:

GPM_{base} = Gallons per minute of baseline showerhead, gpm

$GPM_{low\ flow}$ = Gallons per minute of low flow showerhead, gpm

MS = Average minutes per shower event, minutes

SPD = Average number of shower events per person per day

PH = Average number of people per household

SH = Average number of showerheads per household

T_{mix} = Mixed water temperature of existing faucet, °F

T_{inlet} = Cold water temperature entering the DHW system, °F

RE = Recovery efficiency of electric hot water heater

RG = Recovery efficiency of natural gas water heater

CF = Summer peak coincidence factor

8.3 = Specific weight of water in pounds per gallon, multiplied by specific water temperature (1.0 Btu/lb-°F)

3,412 = Constant to convert Btu to kWh

365 = Days per year

100,000 = Constant to convert therm

ISR = In-service rate

WHS_e = Percentage of electric water heaters

WHS_g = Percentage of gas water heaters

Table 393 lists the input assumptions and source of each assumption for the low flow showerhead measure savings calculations.

TABLE 393. *EX POST* VARIABLE ASSUMPTIONS FOR LOW FLOW SHOWERHEADS

INPUT	VALUE	SOURCE
GPM_{base}	2.63	Indiana TRM (v2.2)
$GPM_{low\ flow}$)	1.5	Program data
MS	7.8	Indiana TRM (v2.2)
SPD	0.6	Indiana TRM (v2.2)
PH	2.64	Indiana TRM (v2.2)
SH	1.77	NIPSCO 2021 Homelife survey
T_{mix}	101	Indiana TRM (v2.2)
T_{inlet}	57.32	Indiana TRM (v2.2), Combo kits, averaged across participant location
T_{inlet}	57.12	Indiana TRM (v2.2), Electric-Only kits, averaged across participant location
T_{inlet}	56.31	Indiana TRM (v2.2), Gas-Only kits, averaged across participant location
RE	0.98	Indiana TRM (v2.2)
RG	0.76	Indiana TRM (v2.2)
CF	0.0023	Indiana TRM (v2.2)
ISR	0.42	NIPSCO 2020 and 2021 Homelife surveys
WHF_e	0.23	NIPSCO 2021 HEW
WHF_g	0.62	NIPSCO 2021 HEW

FILTER WHISTLES

The team used the following equations to calculate electric energy and peak demand savings for filter whistles:

$$kWh\ savings = \Delta kWh_{heat} + \Delta kWh_{cool}$$

$$\Delta kWh_{heat} = kW_{motor} * EFLH_{heat} * EI * ISR$$

$$\Delta kWh_{cool} = kW_{motor} * EFLH_{cool} * EI * ISR * \%CAC$$

$$kW\ reduction = \frac{\Delta kWh_{cool}}{EFLH_{cool}} * CF$$

Where:

kW_{motor} = Average motor full load electric demand, kW

$EFLH_{heat}$ = Estimated full load heating hours

$EFLH_{cool}$ = Estimated full load cooling hours

EI = Efficiency Improvement

ISR = In-service rate

%CAC = Percent of homes with air conditioning

CF = Coincidence Factor

Table 394 lists the input assumptions and source of each assumption for the filter whistle measure savings calculations.

TABLE 394. *EX POST* VARIABLE ASSUMPTIONS FOR FILTER WHISTLES

INPUT	VALUE	SOURCE
kW_{motor}	0.377	2021 Pennsylvania TRM
$EFLH_{heat}$	1427	Indiana TRM (v2.2)
$EFLH_{cool}$	431	Indiana TRM (v2.2)
EI	0.15	2021 Pennsylvania TRM
CF	0.218	2021 Pennsylvania TRM, assume Bradford
% CAC	0.81	Indiana TRM (v2.2)
ISR	0.25	NIPSCO 2020 and 2021 Homelife surveys

APPENDIX 12: RESIDENTIAL ONLINE MARKETPLACE (OLM) PROGRAM

ALGORITHMS AND ASSUMPTIONS

This appendix contains the assumptions used in electric savings, demand reduction, and gas savings algorithms for the measures within the Residential Online Marketplace program. The team examined each assumption behind the algorithms to capture savings and compared it against the Indiana TRM (v2.2) or the Illinois TRM v9.0, 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
- Smart LED
- Low Flow Showerhead
- Low Flow Showerhead with Shower Start
- Pipe Wrap
- Shower Start
- Smart Plug
- Wi-Fi Thermostat
- Bathroom Kit – LED Globe (8)
- Bathroom Kit – Low Flow Showerhead
- Bathroom Kit – Bathroom Aerator
- Bathroom Kit – LED Nightlight
- Home Office/Back to School Kit – Smart LEDs (2)
- Home Office/Back to School Kit – Advanced Power Strip Tier 1
- Home Office/Back to School Kit – Desk Lamp
- Home Office/Back to School Kit – LED Nightlight
- Home Office/Back to School Kit Add-On – LED Reflector

ADVANCED POWER STRIP TIER 1

The evaluation team used the following equations from Illinois TRM v9.0 p. 64 to calculate electric energy and peak demand savings for advanced power strips (tier 1):

$$\Delta kWh = kWh * ISR$$

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

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 395 lists the assumptions and source of each assumption for advanced power strip tier 1 measure savings calculations.

TABLE 395. *EX POST* VARIABLE ASSUMPTION FOR ADVANCED POWER STRIP TIER 1

INPUT	VALUE	SOURCE
kWh (7-unit plug) – time of sale	73.10	Illinois TRM v9.0
kWh (7-unit plug) – single-family energy efficiency kit	56.70	Illinois TRM v9.0
ISR	87%	2021 NIPSCO Residential OLM survey
Hours	7,129	Illinois TRM v9.0
CF	0.80	Illinois TRM v9.0

ADVANCED POWER STRIP TIER 2

The evaluation team used the following equations from Illinois TRM v9.0 p. 62 to calculate electric energy and peak demand savings for advanced power strips (tier 2):

$$\Delta kWh = ERP * BaselineEnergy_{AV} * ISR$$

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

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 396 lists the assumptions and source of each assumption for advanced power strip tier 1 measure savings calculations.

TABLE 396. *EX POST* VARIABLE ASSUMPTION FOR ADVANCED POWER STRIP TIER 1

INPUT	VALUE	SOURCE
ERP	40% 25%	Illinois TRM v9.0, infrared only Illinois TRM v9.0, infrared, and occupancy sensor
$BaselineEnergy_{AV}$	466	Illinois TRM v9.0
ISR	87%	2021 NIPSCO Residential OLM survey
Hours	4,380	Illinois TRM v9.0
CF	0.80	Illinois TRM v9.0

AIR PURIFIER

The team used the following equation from Illinois TRM v9.0 p. 6 to calculate electric energy savings for air purifiers:

$$\Delta kWh = Annual\ Electrical\ Savings$$

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

Where:

Annual Electrical Savings	=	Electrical savings in kWh, for the specific CADR range
ΔkWh	=	Gross customer annual kWh savings for the measure
Hours	=	Average hours of use per year
CF	=	Summer Peak Coincidence Factor for measure

Table 397 lists the input assumptions and source of each assumption for the air purifier measure savings calculations.

TABLE 397. *EX POST* VARIABLE ASSUMPTIONS FOR AIR PURIFIERS

INPUT	VALUE	SOURCE
Annual Electrical Savings	95	Illinois TRM v9.0 for CADR range between 100 - 150
Hours	5844	Illinois TRM v9.0
CF	0.67	Illinois TRM v9.0

KITCHEN AND BATHROOM FAUCET AERATORS

The evaluation team used the following equations from Indiana TRM (v2.2) p. 68 to calculate electric energy, peak demand, and natural gas energy savings for Low flow Kitchen and Bathroom Faucet Aerators:

$$\Delta kWh = ISR * \left(GPM_{base} - GPM_{low\ flow}\right) * MPD * \frac{PH}{FH} * DR * 8.3 * (T_{mix} - T_{inlet}) * \frac{365}{RE * 3412}$$

$$\Delta kW = ISR * \left(GPM_{base} - GPM_{low\ flow}\right) * 60 * DR * 8.3 * \frac{T_{mix} - T_{inlet}}{RE * 3412} * CF$$

$$\Delta MMBtu = ISR * \left(GPM_{base} - GPM_{low\ flow}\right) * MPD * \frac{PH}{FH} * DR * 8.3 * (T_{mix} - T_{inlet}) * \frac{365}{RG * 100{,}000}$$

Where:

GPM_{base} = Gallons per minute of baseline faucet aerator
$GPM_{low\ flow}$ = Gallons per minute of low flow faucet aerator
ISR = In-service rate, or fraction of units that get installed
MPD = Average minutes of faucet use per person per day
PH = Average number of people per household
FH = Average number of faucets per household
DR = Percentage of water flowing down the drain
T_{mix} = Mixed water temperature exiting faucet, °F
T_{inlet} = Cold water temperature entering the DWH system, °F (depends on location)
RE = Recovery efficiency of electric hot water heater
RG = Recovery efficiency of natural gas hot water heater
CF = Summer peak coincidence factor
60 = Minutes per Hour
8.3 = Specific weight of water in pounds per gallon
3,412 = Constant to convert Btu to kWh
365 = Days of faucet use per year
100,000 = Constant to convert Btu to therms

Table 398 lists the assumptions and source of each assumption for kitchen and bathroom faucet aerator measure savings calculations.

TABLE 398. *EX POST* VARIABLE ASSUMPTION FOR KITCHEN AND BATHROOM FAUCET AERATORS

INPUT	VALUE	SOURCE
GPM_{base} (Kitchen)	2.44	Indiana TRM (v2.2)
GPM_{base} (Bathroom)	1.9	Indiana TRM (v2.2)
$GPM_{low\ flow}$ (Kitchen)	1.5	Actual
$GPM_{low\ flow}$ (Bathroom)	1.0	Actual
ISR (Bathroom Kits) ISR (Bathroom) ISR (Kitchen)	44% 95% 86%	2021 NIPSCO Residential OLM survey 2021 HEA survey 2021 HEA survey
MPD (Kitchen)	4.5	Indiana TRM (v2.2)
MPD (Bathroom)	1.6	Indiana TRM (v2.2)
PH	2.64	Indiana TRM (v2.2)
FH (Kitchen)	1.0	Indiana TRM (v2.2)
FH (Bathroom)	2.04	Indiana TRM (v2.2)
DR (Kitchen)	0.50	Indiana TRM (v2.2)
DR (Bathroom)	0.70	Indiana TRM (v2.2)
T_{mix} (Kitchen)	93.00	Indiana TRM (v2.2)
T_{mix} (Bathroom)	86.00	Indiana TRM (v2.2)
T_{inlet} (Kitchen, Electric)	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
T_{inlet} (Kitchen, Gas)	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
T_{inlet} (Bathroom, Electric)	57.2	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
T_{inlet} (Bathroom, Gas)	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	Indiana TRM (v2.2)
RG	0.76	Indiana TRM (v2.2)
CF (Bathroom)	0.0012	Indiana TRM (v2.2)
CF (Kitchen)	0.0033	Indiana TRM (v2.2)

Conversion Factor	60	Minutes per hour
Conversion Factor	8.3	Specific weight of water in pounds per gallon
Conversion Factor	3,412	Constant to convert Btu to kWh
Conversion Factor	365	Days of faucet use per year
Conversion Factor	100,000	Constant to convert Btu to therms

LEDS AND SMART LEDS

The 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:

$$\Delta kWh = \frac{(W_{base} - W_{LED}) * (ISR * Hours) * (1 + WHF_e)}{1{,}000}$$

$$\Delta kW = \frac{(W_{base} - W_{LED}) * Coincidence\ Factor * ISR * (1 + WHF_d)}{1{,}000}$$

$$\Delta MMBtu_{WH} = \frac{(W_{base} - W_{LED}) * (ISR * Hours) * \left(WHF_g\right)}{1{,}000}$$

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[216]

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 399 lists the input assumptions and source of each assumption for the LED measure savings calculations.

TABLE 399. *EX POST* VARIABLE ASSUMPTIONS FOR LEDS

INPUT	VALUE	SOURCE
W_{base} for 4-watt (Globe LED, kit)	20.64	2021 NIPSCO Residential OLM survey, in-situ

INPUT	VALUE	SOURCE
W_{base} for 9.5-watt (Reflector LED, kit)	27.13	2021 NIPSCO Residential OLM survey, in-situ
W_{base} for 4-watt (Decorative/ Mini LED)	40	Ch. 6 Residential Lighting Evaluation Protocol, UMP
W_{base} for 5-watt (Decorative/ Mini LED)	40	Ch. 6 Residential Lighting Evaluation Protocol, UMP
W_{base} for 4-watt (Filament LED)	40	Ch. 6 Residential Lighting Evaluation Protocol, UMP
W_{base} for 6.5-watt (Decorative/Mini LED)	50	Ch. 6 Residential Lighting Evaluation Protocol, UMP
W_{base} for 9.5-watt (BR/Par)	65	Ch. 6 Residential Lighting Evaluation Protocol, UMP
W_{base} for 10-watt (BR/Par)	90	Ch. 6 Residential Lighting Evaluation Protocol, UMP
W_{base} for 9-watt (Smart LED, kit)	34.66	2021 NIPSCO Residential OLM survey, in-situ
W_{base} for 9-watt (Smart LED)	60	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 (Globe LED, kit)	4	Actual installed wattage
W_{LED} for 9.5-watt (Reflector LED, kit)	9.5	Actual installed wattage
W_{LED} for 4-watt (Decorative/ Mini LED)	4	Actual installed wattage
W_{LED} for 5-watt (Decorative/ Mini LED)	5	Actual installed wattage
W_{LED} for 4-watt (Filament LED)	4	Actual installed wattage
W_{LED} for 6.5-watt (Decorative/ Mini LED)	6.5	Actual installed wattage
W_{LED} for 9.5-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
Hours	902	Indiana TRM (v2.2)
WHF_e	-0.070	Indiana TRM (v2.2), averaged across participant location
WHF_d	0.038	Indiana TRM (v2.2), averaged across participant location
WHF_g	-0.0019	Indiana TRM (v2.2), averaged across participant location
Coincidence Factor	0.11	Indiana TRM (v2.2)
ISR (Bathroom Kit, LED globes) ISR (Home Office/Back to School Kit, Smart LED) ISR (Home Office/Back to School Kit, LED reflector) ISR (Standalone)	75% 85% 61% 89%	2021 NIPSCO Residential OLM survey 2021 NIPSCO Residential OLM survey 2021 NIPSCO Residential OLM survey Blended ISR from 2021 Residential Lighting evaluation

LED NIGHT LIGHT

The team used the following equation from Indiana TRM (v2.2) p. 135 to calculate electric energy savings for LED Night Lights:

$$\Delta kWh = \frac{(W_{base} - W_{LED}) * (Hours\ per\ Year) * ISR}{1{,}000} * IRF$$

Where:

W_{base} = Wattage of the bulb being replaced, W

W_{LED}	=	Wattage of the LED bulb, W
Hours per Year	=	Average hours of use per year, hr.
ISR	=	In-Service Rate
IRF	=	Incandescent replacement factor representing the percentage of LED night lights that replaced incandescent night lights.
1,000	=	Constant to convert watts to kW

Table 400 lists the input assumptions and source of each assumption for the LED night lights measure savings calculations.

TABLE 400. *EX POST* VARIABLE ASSUMPTIONS FOR LED NIGHT LIGHTS

INPUT	VALUE	SOURCE
W_{base}	5	Indiana TRM (v2.2)
W_{LED}	0.33	Indiana TRM (v2.2)
Hours per Year	2,920	Indiana TRM (v2.2)
ISR	0.85	2021 Residential OLM survey
IRF	0.18	2021 Residential OLM survey

DESK LAMP

The evaluation team used the following equations from Indiana TRM (v2.2) p. 130 to calculate electric energy, peak demand, and natural gas energy savings for Desk Lamps:

$$\Delta kWh = \frac{(W_{base} - W_{LED}) * (ISR * Hours) * (1 + WHF_e)}{1{,}000}$$

$$\Delta kW = \frac{(W_{base} - W_{LED}) * Coincidence\ Factor * ISR * (1 + WHF_d)}{1{,}000}$$

$$\Delta MMBtu_{WH} = \frac{(W_{base} - W_{LED}) * (ISR * Hours) * \left(WHF_g\right)}{1{,}000}$$

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[216]

365 = Number of days per year, days/yr.

1,000 = Constant to convert watts to kW

Table 401 lists the input assumptions and source of each assumption for the desk lamp measure savings calculations.

TABLE 401. *EX POST* VARIABLE ASSUMPTIONS FOR DESK LAMPS

INPUT	VALUE	SOURCE
W_{base}	38	LED Application Series, DOE
W_{LED}	3.2	Actual Installed wattage
Hours	300	Residential Lighting End-Use Consumption Study, DOE
WHF_e	-0.070	Indiana TRM (v2.2), averaged across participant location
WHF_d	0.038	Indiana TRM (v2.2), averaged across participant location
WHF_g	-.002	Indiana TRM (v2.2), averaged across participant location
Coincidence Factor	0.11	Indiana TRM (v2.2)
ISR	81%	2021 Residential OLM survey

LOW FLOW SHOWERHEAD

The evaluation team used the following equations from Indiana TRM (v2.2) p. 73 to calculate electric energy, peak demand, and natural gas energy savings for Low flow Showerheads:

$$\Delta kWh = ISR * \left(GPM_{base} - GPM_{low\ flow}\right) * MS * SPD \frac{PH}{SH} * 8.3 * (T_{mix} - T_{inlet}) * \frac{365}{RE * 3412}$$

$$\Delta kW = ISR * \left(GPM_{base} - GPM_{low\ flow}\right) * 60 * 8.3 * \frac{T_{mix} - T_{inlet}}{RE * 3412} * CF$$

$$\Delta MMBtu = ISR * \left(GPM_{base} - GPM_{low\ flow}\right) * MS * SPD * \frac{PH}{SH} * 8.3 * (T_{mix} - T_{inlet}) * \frac{365}{RG * 100{,}000}$$

Where:

GPM_{base} = Gallons per minute of baseline showerhead

$GPM_{low\ flow}$ = 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

SPD = Average number of shower events per person per day

PH = Average number of people per household

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 402 lists the assumptions and source of each assumption for low flow showerhead measure savings calculations.

TABLE 402. *EX POST* VARIABLE ASSUMPTIONS FOR LOW FLOW SHOWERHEADS

INPUT	VALUE	SOURCE
GPM_{base}	2.63	Indiana TRM (v2.2)
$GPM_{low\ flow}$	1.5	Actual
ISR (Bathroom Kits) ISR (Standalone)	60% 88%	2021 Residential OLM survey 2021 HEA survey
MS	7.8	Indiana TRM (v2.2)
PH ∗ SPD	1.4252	2021 HEA/IQW survey
SH	1.94	2019 NIPSCO survey results
T_{mix}	101	Indiana TRM (v2.2)
T_{inlet} (Electric)	57.2	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
T_{inlet} (Gas)	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	Indiana TRM (v2.2)
RG	0.76	Indiana TRM (v2.2)
CF	0.0023	Indiana TRM (v2.2)
Conversion Factor	60	Minutes per hour
Conversion Factor	8.3	Specific weight of water in pounds per gallon

INPUT	VALUE	SOURCE
Conversion Factor	3,412	Constant to convert Btu to kWh
Conversion Factor	365	Days of faucet use per year

PIPE WRAP

The evaluation team used the following equations from Indiana TRM (v2.2) p. 77 to calculate electric energy, peak demand, and natural gas energy savings for Pipe Wrap:

$$\Delta kWh = \left(\frac{1}{R_{Exist}} - \frac{1}{R_{New}}\right) * \frac{L * C * \Delta T * 8{,}760}{\eta_{DHWE} * 3{,}412}$$

$$\Delta kW = \frac{\Delta kWh}{8{,}760}$$

$$\Delta MMBtu = \left(\frac{1}{R_{Exist}} - \frac{1}{R_{New}}\right) * \frac{L * C * \Delta T * 8{,}760}{\eta_{DHWG} * 100{,}000}$$

Where:

R_{Exist}	=	Pipe heat loss coefficient (R-value) of uninsulated pipe existing
R_{New}	=	Pipe heat loss coefficient (R-value) of insulated pipe
L	=	Feet of pipe from water heating source covered by pipe wrap
C	=	Circumference of pipe in feet
ΔT	=	Average temperature difference between supplied water and ambient air temperature
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 403 lists the assumptions and source of each assumption for pipe wrap savings calculations.

TABLE 403. *EX POST* VARIABLE ASSUMPTIONS FOR PIPE WRAP

INPUT	VALUE	SOURCE
R_{Exist}	1.00	Indiana TRM (v2.2)
R_{New}	3.00	Actual. Based on insulation R-value of 2 and bare-pipe R-value of 1 (per Indiana TRM (v2.2).
L	15	Actual.
C	0.196	Actual. Based on assumed pipe diameter of 0.75 inches
ΔT	65	Indiana TRM (v2.2)
η_{DHWE}	.98	Indiana TRM (v2.2)
η_{DHWG}	.75	Indiana TRM (v2.2)

Conversion Factor	3,412	Constant to convert Btu to kWh
Conversion Factor	100,000	Constant to convert Btu to therms

SHOWER START

The evaluation team used the following equations from Illinois TRM v9 p. 231 to calculate electric energy, peak demand, and natural gas energy savings for shower start attachments:

$$therm\ savings = ISR * (\%\ Fossil\ DHW) * (GPM_{base} * L_{showe\quad device}) * Household * SPCD * \left(\frac{365.25}{SPH}\right) * \frac{8.33 * 1.0 * (ShowerTemp - ShowerSuppy)}{RE_{gas} * 100{,}000}$$

Where:

ISR = In-service rate, or fraction of units that get installed

% Fossil DHW = Proportion of water heating supplied by natural gas heating

GPM_{base} = Flow rate of base case showerhead

$L_{shower\ device}$ = Hot water waste time avoided due to thermostatic restrictor valve

Household = Average number of people per household

SPCD = Showers per capita per day

365.25 = Days per year on average

SPH = Showerheads per household so that per-showerhead savings fractions can be determined

8.3 = Specific weight of water in pounds per gallon

ShowerTemp = Assumed temperature of water

ShowerSupply = Assumed temperature of water entering house

RE_{gas} = Recovery efficiency of gas water heater

100,000 = Constant to convert Btu to therms

Table 404 lists the assumptions and source of each assumption for shower start measure savings calculations.

TABLE 404. *EX POST* VARIABLE ASSUMPTIONS FOR SHOWER START

INPUT	VALUE	SOURCE
ISR	88%	2021 Residential OLM survey
% Fossil DHW	83	2021 Residential OLM survey
GPM_{base}	2.63	Indiana TRM (v2.2)
$L_{shower\ device}$	0.89	Illinois TRM v9.0
Household * SPCD	1.452	2021 HEA/IQW survey
SPH	1.94	NIPSCO 2019 survey
ShowerTemp	101	Indiana TRM (v2.2)

INPUT	VALUE	SOURCE
ShowerSupply	56.4	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_{gas}	.76	Indiana TRM (v2.2)
Conversion Factor	365.25	Days per year on average
Conversion Factor	8.3	Specific weight of water in pounds per gallon
Conversion Factor	100,000	Constant to convert Btu to therms

SMART PLUG

The evaluation team determined that because this measure was not included in the Illinois TRM v9.0 or the Indiana TRM (v2.2), *ex post* savings would not be granted.

WI-FI THERMOSTAT

The evaluation team used the following equations from Indiana TRM (v2.2) and Illinois TRM v9.0 (for demand) to calculate electric energy savings for programmable thermostats. The thermostat 2020 billing analysis examined all 2018 and 2019 participants, revealing net gas savings of 35 therms (5.4%) for 2019 participants receiving one thermostat.

$$\Delta kWh = ISR\left(\frac{1}{SEER} * EFLH_{cool} * \frac{Btuh_{cool}}{1{,}000} * ESF_{cool} + EFLH_{heat} * \frac{Btuh_{heat}}{N_{heat} * 3412} * ESF_{heat}\right)$$

The Indiana TRM (v2.2) does not provide guidance on claiming demand reduction for these thermostat measures. Currently savings for thermostats in most TRMs and evaluations are derived via analysis of billing data, which generally cannot produce values for demand reduction. However, it is likely that some demand reduction for smart Wi-Fi thermostats does exist, and this reduction is accommodated in the Illinois TRM v9.0.[75] This TRM calculates savings using standard methods for deriving baseline peak load, then applies a smart Wi-Fi thermostat ESF and half the coincidence factor normally used for cooling. The evaluation team used that same approach. Here, the standard cooling coincidence factor of 0.88 is used, but divided by 2:

$$\Delta kW = \frac{CAP_C}{SEER \times 1{,}000} \times \frac{Coincidence\ Factor}{2} \times ESF_C$$

Where:

SEER	=	Seasonal average efficiency ratio
$EFLH_{cool}$	=	Full load cooling hours
$BtuH_{cool}$	=	Cooling system capacity in Btu per hour
ESF_{cool}	=	Cooling energy savings fraction
$EFLH_{heat}$	=	Full load heating hours

[75] Illinois Energy Efficiency Stakeholder Advisory Group (SAG). *2021 Illinois Statewide Technical Reference Manual for Energy Efficiency Version 9.0.* September 25,2020.

$BtuH_{heat}$ = Heating system capacity in Btu per hour

N_{heat} = Efficiency in COP of heating equipment

ESF_{heat} = Heating energy savings fraction

ISR = In-service rate, or fraction of units that get installed

CAP_C = System cooling capacity

ESF_C = Savings factor for cooling derived via 2020 billing analysis, 8.3%

Coincidence Factor = Standard cooling coincidence factor, 0.88

Table 405 lists the assumptions and source of each assumption for the Wi-Fi thermostat measure savings calculations.

TABLE 405. *EX POST* VARIABLE ASSUMPTIONS FOR WI-FI THERMOSTATS

INPUT	VALUE	SOURCE
SEER	11.15	Indiana TRM (v2.2)
$EFLH_{cool}$	429	Indiana TRM (v2.2), values assigned based on nearest TRM city. Value shown is the program average, not the value used to calculate savings for each participant
$Btuh_{cool}$	34,054	AC, average of 2020 program data
	32,907	HP, average of 2020 program data
ESF_{cool}	0.083	2020 billing analysis
$EFLH_{heat}$	899	2020 billing analysis, values assigned based on nearest TRM city. Value shown is the program average, not the value used to calculate savings for each participant
$Btuh_{heat}$	72,636	ERH, average of 2020 program data
	24,000	HP, average of 2020 program data
ESF_{heat}	0.054	2020 billing analysis
ISR	79%	2021 NIPSCO Residential OLM survey

APPENDIX 13: COMMERCIAL AND INDUSTRIAL (C&I) PROGRAM

IMPACT EVALUATION NON-LIGHTING DETAILS

COMPRESSED AIR

The C&I Prescriptive, Custom, and New Construction programs installed compressed air measures in 2021. Table 406 shows the number of measures, savings, and sample sizes by program. The team evaluated 14 compressed air measures across the C&I programs. All compressed air measures were randomly selected.

TABLE 406. 2021 C&I PROGRAMS SAMPLED COMPRESSED AIR MEASURES

PROGRAM	NUMBER OF MEASURES				PROPORTION OF PROGRAM SAVINGS EVALUATED		
	TOTAL	SAMPLED TOTAL	HANDPICKED	RANDOM	KWH	KW	THERMS
Prescriptive	2	2	-	2	100%	100%	N/A
Custom	115	12	-	12	16%	25%	N/A
New Construction	1	0			0%	N/A	N/A
SBDI	-	-					
Total	118	14	-	14	17%	53%	0%

All 14 measures resulted in a 100% kWh realization rate. Five of the measures demonstrated kW demand savings. Three of the five measures resulted in a 100% kW demand reduction realization rate. The team adjusted the remaining two measures for the following reasons:

- The reported kW savings for one Custom measure was determined by a deemed savings value in the 2015 Indiana TRM (v2.2). The evaluation team adjusted the calculation of peak coincident demand reduction to reflect the project specific metrics given this was a custom project. The resulting kW realization rate was 263%.
- The reported kW savings for one Prescriptive measure did not equate to the deemed savings value in the 2015 Indiana TRM (v2.2), typically utilized for Prescriptive projects. The evaluation team adjusted the calculation of peak coincident demand reduction to reflect the deemed value in the 2015 Indiana TRM (v2.2). The resulting kW realization rate was 72%.

Table 407 shows the *ex ante* savings and the measure-specific realization rates from the sampled compressed air measures in the 2021 C&I programs. The table shows the actual realization rates the evaluation team estimated for randomly sampled projects; however, the team did not extrapolate those realization rates to the rest of the compressed air measure group population. The team aggregated non-lighting measure types to create realization rates for each program as a full measure category and then extrapolated the non-lighting realization rates to the complete non-lighting population for each program.

TABLE 407. 2021 C&I PROGRAMS *EX ANTE* SAVINGS AND REALIZATION RATES FOR SAMPLED COMPRESSED AIR MEASURES

PROGRAM	SAMPLED *EX ANTE*			REALIZATION RATES (KWH)		REALIZATION RATES (KW)	
	KWH	KW	THERMS	HAND PICKED	RANDOM	HAND PICKED	RANDOM
Prescriptive	86,519.16	16.387	-	-	100%	-	81%
Custom	718,399.00	6.650	-	-	100%	-	155%
New Construction	-						
SBDI	-						
Total	804,918.16	23.037	-	-	100%	-	102%

Figure 102 illustrates the distribution of realization rates for the individually sampled projects by program. As illustrated, all projects met a 100% realization rate.

FIGURE 102. 2021 C&I PROGRAMS SAMPLED COMPRESSED AIR MEASURES *EX ANTE* IMPACT AND REALIZATION RATE

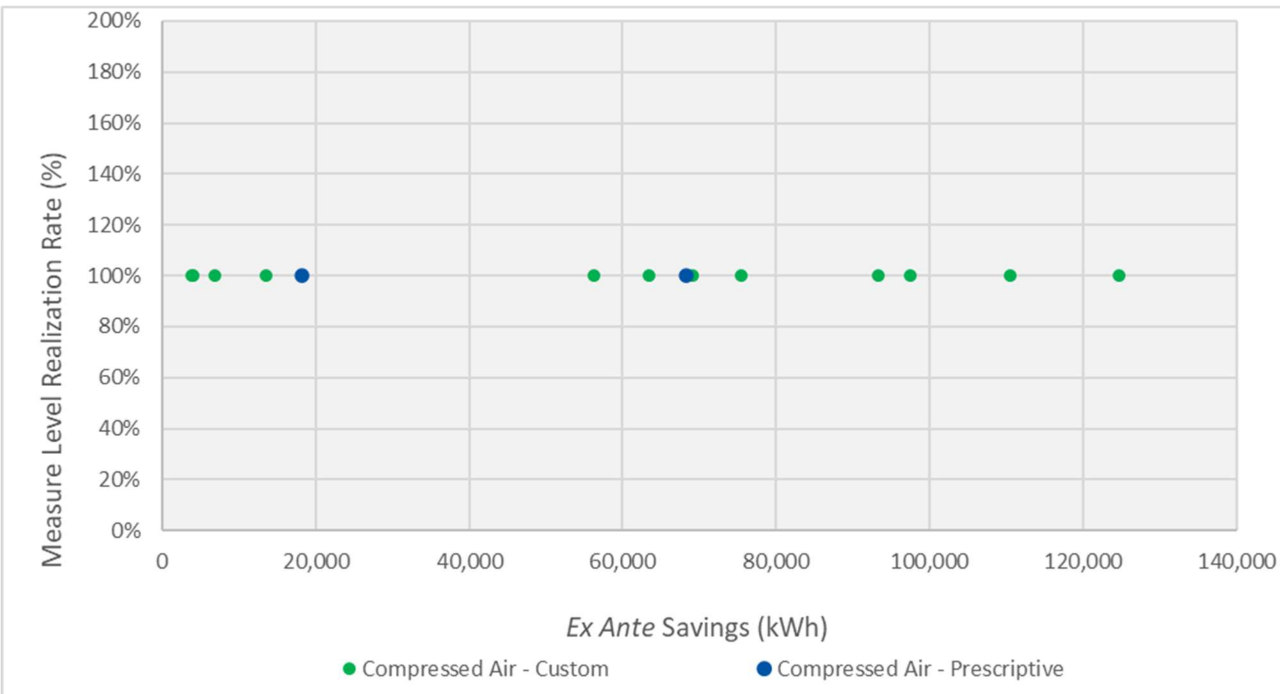


Table 408 summarizes notable differences between *ex ante* and *ex post* gross estimates from the measures sampled.

TABLE 408. 2021 C&I PROGRAMS NOTABLE DIFFERENCES BETWEEN *EX ANTE* & *EX POST* GROSS COMPRESSED AIR MEASURES

MEASURE CATEGORY	*EX ANTE* SOURCES AND ASSUMPTIONS	*EX POST* GROSS SOURCES AND ASSUMPTIONS	PRIMARY REASONS FOR DIFFERENCES
Compressed Air	*Ex ante* savings were determined through deemed values from the 2015 Indiana TRM (v2.2).	2015 Indiana TRM (v2.2). All inputs were verified through project documentation, virtual site visits or interviews.	Modifications based on customer attained data to the load profile, hours of use, and pressure to custom projects only. Deviations from the 2015 Indiana TRM (v2.2) for Prescriptive projects.

CONTROLS

The C&I Custom program installed controls measures in 2021. Table 409 details the number of measures, savings, and sample size. The team evaluated two controls measures from the Custom program.

TABLE 409. 2021 C&I PROGRAMS SAMPLED CONTROLS MEASURES

PROGRAM	NUMBER OF MEASURES				PROPORTION OF PROGRAM SAVINGS EVALUATED		
	TOTAL	SAMPLED TOTAL	HAND PICKED	RANDOM	KWH	KW	THERMS
Prescriptive	-	-					
Custom	15	2	1	1	34%	0%	0%
New Construction	-	-					
SBDI	-	-					
Total	15	2	1	1	34%	0%	0%

The evaluation team adjusted both measures based on evaluation findings:

- One randomly sampled measure was adjusted slightly to account for differing equipment capacities from what was reported. The customer was interviewed and provided counts and name plates to confirm capacity designations and equipment counts. The slight adjustment resulted in a realization rate of 101%.
- One handpicked measure was adjusted based on virtual site visit data collected from the customer. The programming ranges of two of the retro-commissioning measures implemented were adjusted by the customer post verification to better meet the customer's conditioning needs. The adjustments made by the customer reduced the projected savings from two measures slightly. The resulting realization rate was 84% for the measure.

Table 410 shows the *ex ante* savings and the measure-specific realization rates from the sampled controls measures in the 2021 C&I programs. The evaluation team applied the measure-specific realization rates from the handpicked sampled projects to only those specific projects. The table shows actual realization rates that the team estimated for randomly sampled projects; however, the team did not extrapolate those realization rates to the rest of the population. The team aggregated non-lighting measure types to create realization rates for each program as a full measure category and then extrapolated the non-lighting realization rates to the complete non-lighting population for each program.

TABLE 410. 2021 C&I PROGRAMS *EX ANTE* SAVINGS & REALIZATION RATES FOR SAMPLED CONTROLS MEASURES

PROGRAM	SAMPLED *EX ANTE*			REALIZATION RATES (KWH)		REALIZATION RATES (KW)	
	KWH	KW	THERMS	HAND PICKED	RANDOM	HAND PICKED	RANDOM
Prescriptive	-						
Custom	467,275.54	-	-	84%	101%	-	-
New Construction	-						
SBDI	-						
Total	467,275.54	-	-	84%	101%	-	-

Figure 103 illustrates the distribution of realization rates for the individually sampled projects by program. The larger impact project had a realization rate of 84%.

FIGURE 103. 2021 C&I PROGRAMS SAMPLED CONTROLS MEASURES

EX ANTE IMPACT AND REALIZATION RATES

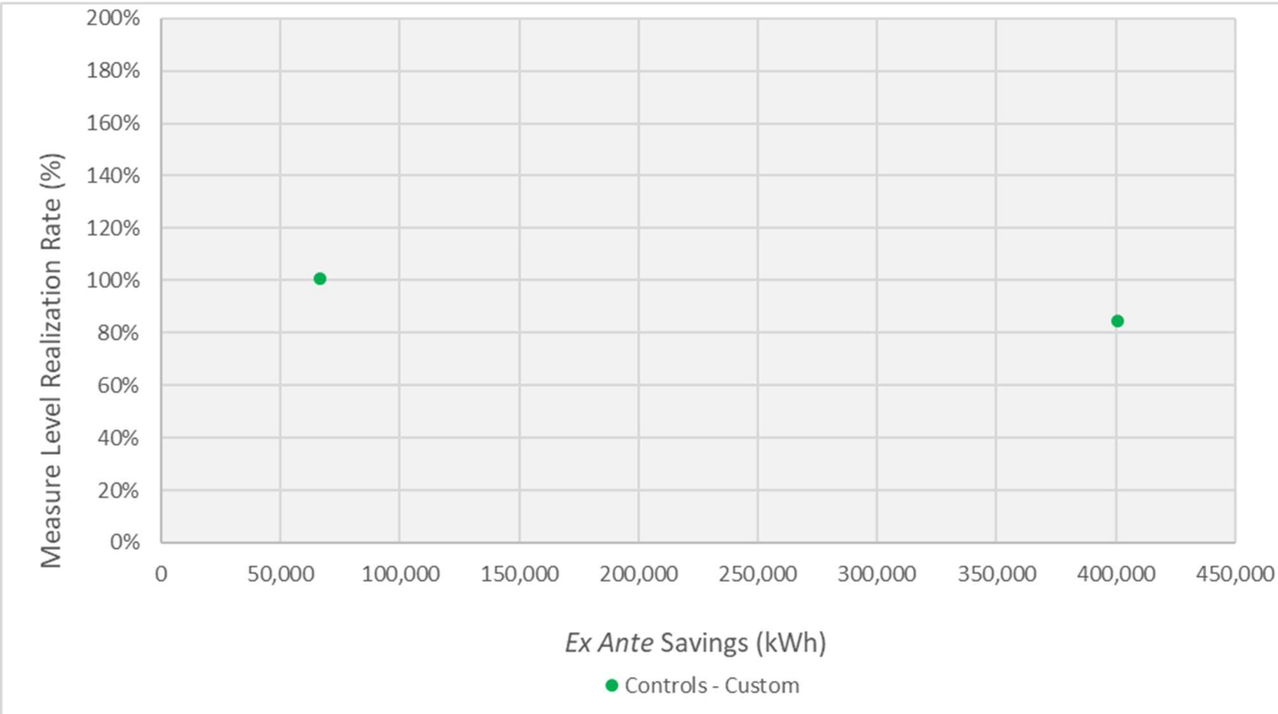


Table 411 summarizes notable differences between *ex ante* and *ex post* gross estimates from the measures sampled.

TABLE 411. 2021 C&I PROGRAMS NOTABLE DIFFERENCES BETWEEN *EX ANTE* & *EX POST* GROSS WATER HEAT MEASURES

MEASURE CATEGORY	*EX ANTE* SOURCES AND ASSUMPTIONS	*EX POST* GROSS SOURCES AND ASSUMPTIONS	PRIMARY REASONS FOR DIFFERENCES
Controls	*Ex ante* savings were determined by the 2015 Indiana TRM (v2.2) and 2021 Wisconsin TRM.	2015 Indiana TRM (v2.2) and 2021 Wisconsin TRM. All inputs were verified through project documentation, virtual site visits, or interviews.	Equipment capacity did not match reported capacity. Customer collected data demonstrated RCx programming modifications to implemented measures.

HEATING VENTILATION AND AIR CONDITIONING (HVAC)

All four C&I programs offered HVAC measures in 2021. Table 412 shows the number of measures, savings, and sample sizes. The evaluation team evaluated 19 HVAC measures across the C&I programs, which represented 29% of the gas savings for the measure group.

TABLE 412. 2021 C&I PROGRAMS SAMPLED HVAC MEASURES

PROGRAM	NUMBER OF MEASURES				PROPORTION OF PROGRAM SAVINGS EVALUATED		
	TOTAL	SAMPLED TOTAL	HAND PICKED	RANDOM	KWH	KW	THERMS
Prescriptive	71	3	1	2	6%	31%	94%
Custom	44	4	-	4	0%	0%	16%
New Construction	102	11	3	8	1%	3%	43%
SBDI	3	1	-	1	N/A	N/A	94%
Total	220	19	4	15	4%	8%	29%

Most (14) of the 19 measures resulted in a 100% realization rate. The evaluation team adjusted the remaining five measures for the following types of issues:

- One handpicked New Construction measure was adjusted to match the submitted calculations. There appears to have been a rounding error or data entry error in the translation into the Captures portal and reported savings. The provided documentation was hardcoded. The resulting therm realization rate was 98%.
- Two randomly selected New Construction measures were adjusted to match the submitted calculations. There appears to have been a rounding error or data entry error in the translation into the Captures portal and reported savings. The discrepancy appears to stem from a difference in occupied hours and quantities between versions of the applications created for the measure. The resulting therm realization rates for the measures were 96% and 98%.
- One randomly selected New Construction measure was adjusted to match the specified floor temperature and heating degree days specified by the customer and applicable to the building type and region. The resulting therm realization rate for the measure was 99%.
- One randomly selected Prescriptive measure did not have supporting calculations provided within the documentation. The evaluation team re-created the savings calculations based on project documentation metrics and customer data, and found slightly different results, resulting in a therm realization rate of 105%.

TABLE 413 shows the *ex ante* savings and the measure-specific realization rates from the sampled HVAC measures in the 2021 C&I programs by fuel type. The team applied the measure-specific realization rates from the handpicked sampled projects to only those specific projects. The table shows actual realization rates the team estimated for randomly sampled projects; however, the team did not extrapolate those realization rates to the rest of the HVAC population. The team aggregated the non-lighting measure types to create realization rates for each program as a full measure category and then extrapolated the non-lighting realization rates to the complete non-lighting population for each program.

TABLE 413. 2021 C&I PROGRAMS *EX ANTE* SAVINGS VALUES FOR HVAC MEASURES AND REALIZATION RATES FOR SAMPLED HVAC MEASURES

PROGRAM	SAMPLED *EX ANTE*			REALIZATION RATES (KWH)		REALIZATION RATES (KW)		REALIZATION RATES (THERMS)	
	KWH	KW	THERMS	HAND PICKED	RANDOM	HAND PICKED	RANDOM	HAND PICKED	RANDOM
Prescriptive	-	-	3,179.12					100%	103%
Custom	37,058.00	22.644	17,580.00	-	99%	-	103%	-	100%
New Construction	4,888.00	11.292	231,518.09	-	101%	-	100%	99%	99%
SBDI	-	-	3,997.28					-	100%
Total	41,946.00	33.936	256,274.49	-	100%	-	102%	99%	99%

Figure 104 and Figure 105 illustrate the distribution of realization rates for the individually sampled projects by program and by fuel source. As illustrated, both projects with kWh savings met a 100% realization rate. There were more therms projects in this category, most with very near 100% realization rates.

FIGURE 104. 2021 C&I PROGRAMS SAMPLED HVAC MEASURES KWH *EX ANTE* IMPACT AND REALIZATION RATES

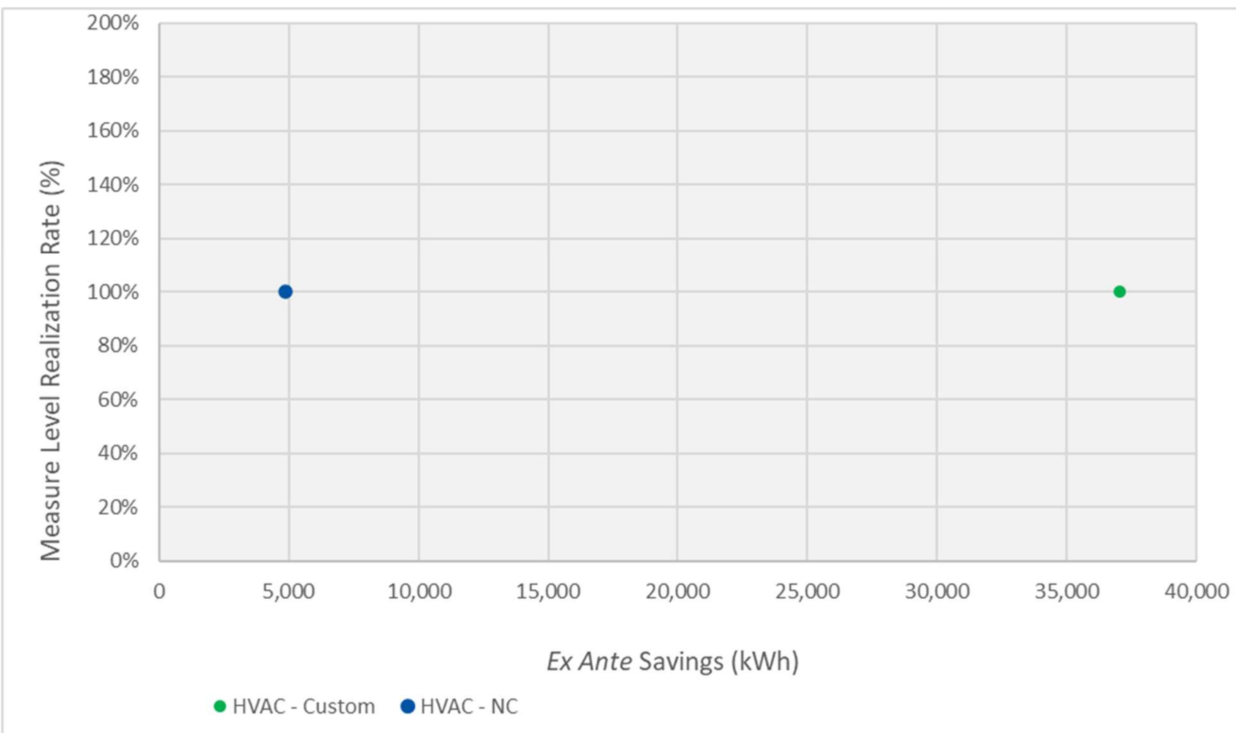


FIGURE 105. C&I PROGRAMS SAMPLED HVAC MEASURES THERM *EX ANTE* IMPACT AND REALIZATION RATES

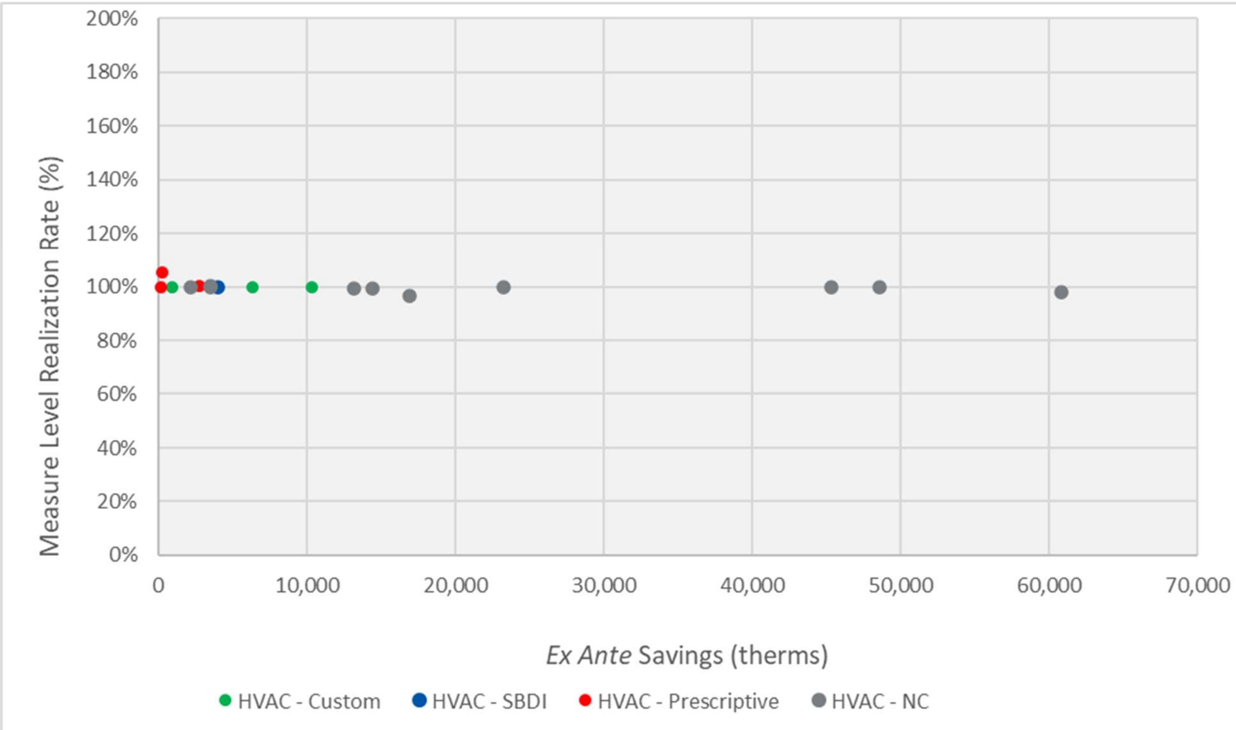


Table 414 summarizes notable differences between *ex ante* and *ex post* gross estimates from the measures sampled.

TABLE 414. 2021 C&I PROGRAMS NOTABLE DIFFERENCES BETWEEN *EX ANTE* & *EX POST* GROSS HVAC MEASURES

MEASURE CATEGORY	*EX ANTE* SOURCES AND ASSUMPTIONS	*EX POST* GROSS SOURCES AND ASSUMPTIONS	PRIMARY REASONS FOR DIFFERENCES
HVAC	*Ex ante* savings were determined by the 2015 Indiana TRM (v2.2), calculated through the application Excel tool.	2015 Indiana TRM (v2.2), calculated through the application Excel tool. All inputs were verified through project documentation, virtual site visits, or interviews.	Installed equipment efficiencies for energy and demand savings calculations. Missing calculations were re-created with evaluator created furnace savings calculation spreadsheets resulting in minor differences in claimed savings. Some slight clerical errors in data entry into thee Captures portal.

MOTORS

The Custom and New Construction programs reported savings from motor measures in 2021. Table 415 details the number of measures, savings, and sample sizes. The team evaluated three motor measures, capturing nearly all the energy and demand savings for the motor measure group.

TABLE 415. 2021 C&I PROGRAMS SAMPLED MOTOR MEASURES

PROGRAM	NUMBER OF MEASURES				PROPORTION OF PROGRAM SAVINGS EVALUATED		
	TOTAL	SAMPLED TOTAL	HAND PICKED	RANDOM	KWH	KW	THERMS
Prescriptive	-	-					
Custom	4	2	1	1	98%	99%	N/A
New Construction	1	1	-	1	100%	100%	N/A
SBDI	-	-					
Total	5	3	1	2	98%	99%	N/A

One randomly selected New Construction motor measure received a 100% kWh realization rate. The evaluation team modified the remaining two measures for the following reasons:

- One Custom measure was handpicked due to its size and impact and represented 92% of the total kWh savings amongst the five total motor measures in the C&I portfolio. A virtual site visit with the customer was conducted, and the customer supplied the evaluation team with an application specific power factor and motor load for the motor. The evaluation team adjusted the power factor (reduced) and motor load (reduced) in the savings calculation. The resulting kWh realization rate was 104%, and kW demand realization rate was 112%.
- The *ex ante* savings value of one randomly selected Custom measure was calculated from a deemed Michigan Energy Measure Database value. Since the project was a custom application of a process pump, which is typically dependent on project specific inputs, the evaluation team utilized several different hybrid calculators developed by various TRMs, including Wisconsin, California, and Mid Atlantic. All resulted in similar savings values. The evaluation team selected the Wisconsin TRM hybrid calculation, which resulted in the highest savings and a realization rate of 65% for the measure.

Table 416 shows the *ex ante* savings and the measure-specific realization rates from the sampled motor measures in the 2021 Custom and New Construction programs. The evaluation team applied measure-specific realization rates from the handpicked sampled projects to only those specific projects. The table shows actual realization rates the team estimated for randomly sampled projects; however, the team did not extrapolate those realization rates to the rest of the motors population. The team aggregated the non-lighting measure types to create realization rates for each program as a full measure category and then extrapolated the non-lighting realization rates to the complete non-lighting population for each program.

TABLE 416. 2021 C&I PROGRAMS *EX ANTE* SAVINGS AND REALIZATION RATES FOR SAMPLED MOTOR MEASURES

PROGRAM	SAMPLED *EX ANTE*			REALIZATION RATES (KWH)		REALIZATION RATES (KW)	
	KWH	KW	THERMS	HAND PICKED	RANDOM	HAND PICKED	RANDOM
Prescriptive	-	-	-	-	-	-	-
Custom	585,415.00	50.973	-	104%	65%	112%	97%
New Construction	6,170.00	-	-	-	100%	-	
SBDI	-	-	-	-	-	-	-
Total	591,585.00	50.973		104%	72%	112%	97%

Figure 106 illustrates the distribution of realization rates for the individually sampled projects by program. The largest impact project had a realization rate of 104%. A much smaller impact custom project had a realization rate of 65%.

FIGURE 106. C&I PROGRAMS SAMPLED MOTOR MEASURES *EX ANTE* IMPACT AND REALIZATION RATES

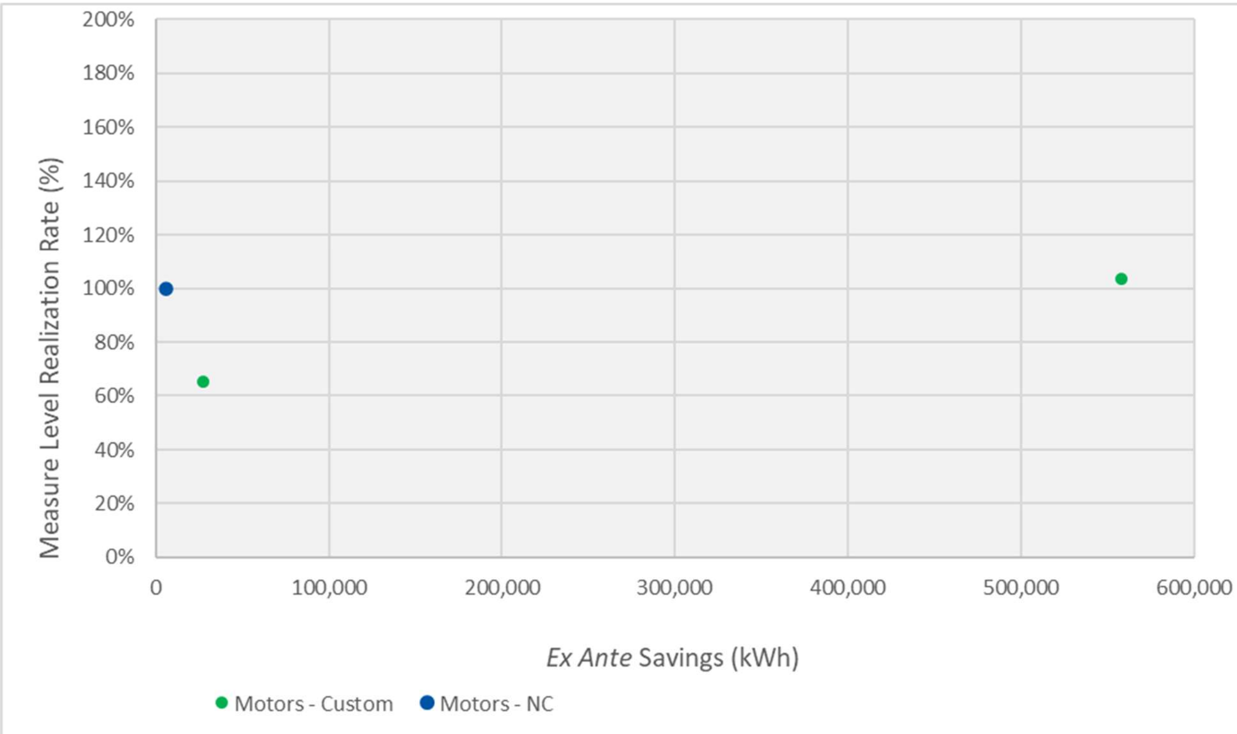


Table 417 summarizes notable differences between *ex ante* and *ex post* gross estimates from the measure sampled.

TABLE 417. 2021 C&I PROGRAMS NOTABLE DIFFERENCES BETWEEN *EX ANTE* AND *Ex Post* Gross MOTOR MEASURES

MEASURE CATEGORY	*EX ANTE* SOURCES AND ASSUMPTIONS	*EX POST* GROSS SOURCES AND ASSUMPTIONS	PRIMARY REASONS FOR DIFFERENCES
Motors	*Ex ante* savings were determined through engineering calculations, 2015 Indiana TRM (v2.2) and Michigan TRM	2015 Indiana TRM (v2.2), Michigan TRM and hybrid VFD calculators from other TRMs, including Wisconsin and California. All inputs were verified through project documentation, virtual site visits, or interviews. Customer data was requested to supplement inputs.	Modifications based on interview customer data to the measure inputs. Different hybrid VFD calculations were used to determine a more accurate savings value generated from more project specific inputs.

PROCESS

The C&I Custom program installed process measures in 2021. Table 418 details the number of measures, savings, and sample size. The team evaluated two process measures from the Custom program.

TABLE 418. 2021 C&I PROGRAMS SAMPLED PROCESS MEASURES

PROGRAM	NUMBER OF MEASURES				PROPORTION OF PROGRAM SAVINGS EVALUATED		
	TOTAL	SAMPLED TOTAL	HAND PICKED	RANDOM	KWH	KW	THERMS
Prescriptive	-	-					
Custom	5	2	1	1	36%	0%	100%
New Construction	-	-					
SBDI	-	-					
Total	5	2	1	1	36%	0%	100%

Both measures received a 100% realization rate in both kWh savings and therm savings.

Table 419 shows the *ex ante* savings and the measure-specific realization rates from the sampled process measures in the 2021 Custom program. The evaluation team applied the measure-specific realization rates from the handpicked sampled projects to only those specific projects. The table shows actual realization rates the team estimated for randomly sampled projects; however, the team did not extrapolate those realization rates to the rest of the process population. The team aggregated the non-lighting measure types to create realization rates for each program as a full measure category and then extrapolated the non-lighting realization rates to the complete non-lighting population for the program.

TABLE 419. 2021 C&I PROGRAMS *EX ANTE* SAVINGS AND REALIZATION RATES FOR SAMPLED PROCESS MEASURES

PROGRAM	SAMPLED *EX ANTE*			REALIZATION RATES (KWH)		REALIZATION RATES (KW)		REALIZATION RATES (THERMS)	
	KWH	KW	THERMS	HAND PICKED	RANDOM	HAND PICKED	RANDOM	HAND PICKED	RANDOM
Prescriptive	-	-	-						
Custom	370,543.00	-	161,251.00	-	100%	-	-	100%	-
New Construction	-	-	-						
SBDI	-	-	-						
Total	370,543.00	-	161,251.00	-	100%	-	-	100%	

Table 420 summarizes notable differences between *ex ante* and *ex post* gross estimates from the measures sampled.

TABLE 420. 2021 C&I PROGRAMS NOTABLE DIFFERENCES BETWEEN *EX ANTE* AND *EX POST* GROSS PROCESS MEASURES

MEASURE CATEGORY	*EX ANTE* SOURCES AND ASSUMPTIONS	*EX POST* GROSS SOURCES AND ASSUMPTIONS	PRIMARY REASONS FOR DIFFERENCES
Process	*Ex ante* savings were determined through engineering calculations	2015 Indiana TRM (v2.2). All inputs were verified through project documentation, virtual site visits, or interviews.	No deviations found.

REFRIGERATION

All four C&I programs reported savings for refrigeration measures in 2021. Table 421 details the number of measures, savings, and sample sizes for refrigeration measures. The team evaluated seven refrigeration measures across the C&I programs.

TABLE 421. 2021 C&I PROGRAMS SAMPLED REFRIGERATION MEASURES

PROGRAM	NUMBER OF MEASURES				PROPORTION OF PROGRAM SAVINGS EVALUATED		
	TOTAL	SAMPLED TOTAL	HAND PICKED	RANDOM	KWH	KW	THERMS
Prescriptive	35	3	1	2	94%	92%	N/A
Custom	4	2	1	1	7%	33%	N/A
New Construction	4	1	-	1	29%	0%	N/A
SBDI	6	1	-	1	47%	47%	N/A
Total	49	7	2	5	47%	44%	N/A

Five of the seven measures had kWh realization rates at or near 100%. The evaluation team adjusted one measure for kW demand savings and one measure for kWh and kW demand savings, detailed below:

- One Custom measure's baseline consumption was derived from engineering calculations that did not fit the equipment type installed. The 2015 Indiana TRM (v2.2) has an appropriate measure outline that more accurately estimates the consumption of this type of equipment. Additionally, there were some equipment specification errors made in the *ex ante* calculation, which were corrected in the evaluated savings calculations. Both issues drove the evaluated baseline consumption significantly downward, resulting in a much smaller savings value for the project overall. This project was handpicked since it constituted 79% of the Prescriptive refrigeration savings and 42% of the refrigeration measure group savings across the C&I portfolio. The resulting realization rate was 34% for kWh savings and 51% for kW savings.
- One handpicked Prescriptive measure's *ex ante* savings were derived from a program deemed value for kWh and kW, likely originating from the Michigan Energy Measures Database. The resulting kWh savings from the deemed value aligned with the 2015 Indiana TRM (v2.2) for this measure. However, the kW demand savings value was 1,300% higher than the 2015 Indiana TRM (v2.2) savings calculation for this measure. Since this was a prescriptive project and there is an existing measure in the TRM, the evaluated savings for this measure were calculated using the 2015 Indiana TRM (v2.2) values. This resulted in a kW realization rate of 8%. This was a handpicked measure, and the realization rate was not extrapolated; however, the reduction of 53 kW for the Prescriptive program influenced the overall Prescriptive non-lighting kW realization rate downward.

Table 422 shows the *ex ante* savings and the measure-specific realization rates from the sampled refrigeration measures in the 2021 C&I programs. The evaluation team applied the measure-specific realization rates from the handpicked sampled projects to only those specific projects. The table shows actual realization rates the team estimated for randomly sampled projects; however, the team did not extrapolate those realization rates to the rest of the refrigeration population. The team aggregated the non-lighting measure types to create realization rates for each program as a full measure category and then extrapolated the non-lighting realization rates to the complete non-lighting population for each program.

TABLE 422. 2021 C&I PROGRAMS *EX ANTE* SAVINGS AND REALIZATION RATES FOR SAMPLED REFRIGERATION MEASURES

PROGRAM	SAMPLED *EX ANTE*			REALIZATION RATES (KWH)		REALIZATION RATES (KW)	
	KWH	KW	THERMS	HANDPICKED	RANDOM	HANDPICKED	RANDOM
Prescriptive	42,712.00	57.483	N/A	102%	100%	8%	100%
Custom	519,290.55	39.692	N/A	34%	100%	51%	109%
New Construction	742.00	-	N/A		117%		
SBDI	7,074.00	0.966	N/A		100%		109%
Total	569,818.55	98.141	-	39%	101%	25%	108%

Figure 107 illustrates the distribution of realization rates for the individually sampled projects by program. Most projects in this category were small impact, most with realization rates near 100%. One larger impact custom project had a realization rate of 34%.

FIGURE 107. 2021 C&I PROGRAMS SAMPLED REFRIGERATION MEASURES *EX ANTE* IMPACT AND REALIZATION RATES

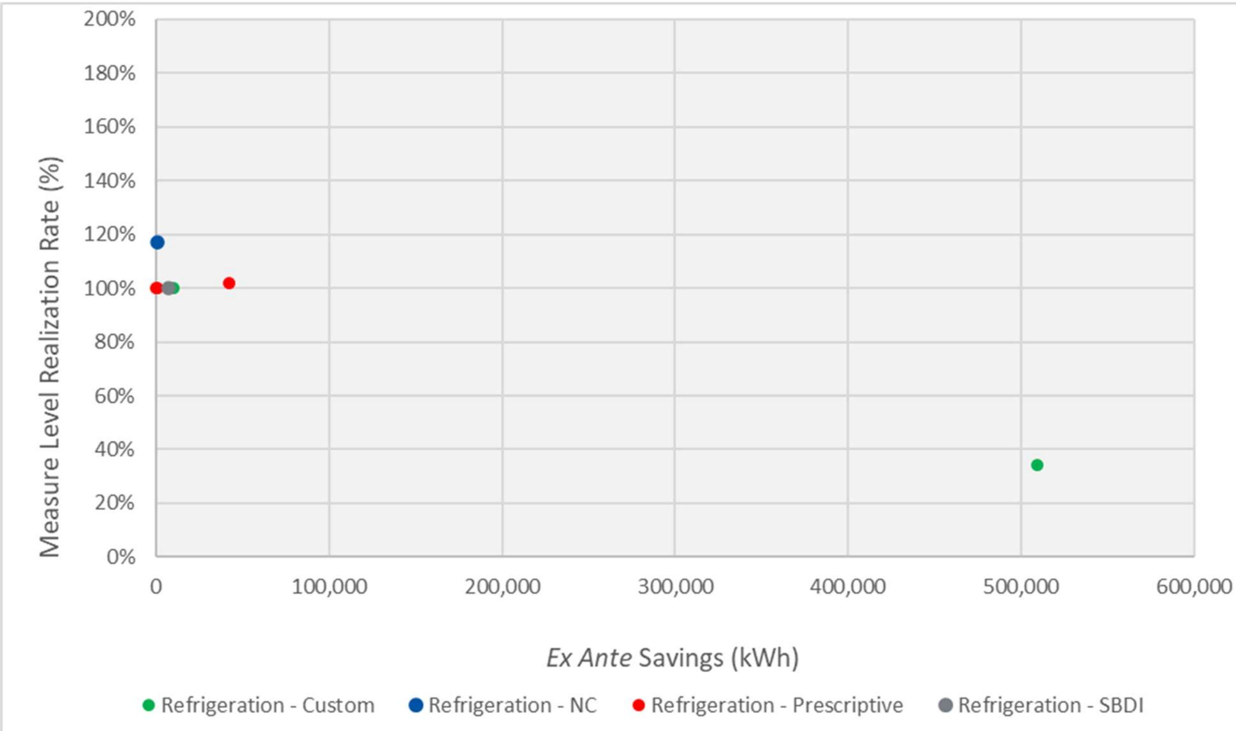


Table 423 summarizes notable differences between *ex ante* and *ex post* gross estimates from the measures sampled.

TABLE 423. 2021 C&I PROGRAMS NOTABLE DIFFERENCES BETWEEN *EX ANTE* & *EX POST* GROSS REFRIGERATION MEASURES

MEASURE CATEGORY	*EX ANTE* SOURCES AND ASSUMPTIONS	*EX POST* GROSS SOURCES AND ASSUMPTIONS	PRIMARY REASONS FOR DIFFERENCES
Refrigeration	*Ex ante* savings were determined by the 2015 Indiana TRM (v2.2), Michigan Energy Measure Database, or through engineering calculations.	2015 Indiana TRM (v2.2). All inputs were verified through project documentation, virtual site visits, or interviews.	Modifications to baseline case volumes, capacities composed most adjustments. Deviation from the 2015 Indiana TRM (v2.2) Prescriptive calculations.

VARIABLE FREQUENCY DRIVES (VFD)

Only the Prescriptive program rebated VFD measures in 2021. Table 424 documents the number of measures, savings, and sample size for the measures. The evaluation team sampled two VFD measures.

TABLE 424. 2021 C&I PROGRAMS SAMPLED VFD MEASURES

PROGRAM	NUMBER OF MEASURES				PROPORTION OF PROGRAM SAVINGS EVALUATED		
	TOTAL	SAMPLED TOTAL	HAND PICKED	RANDOM	KWH	KW	THERMS
Prescriptive	45	2	-	2	5%	8%	N/A
Custom	-	-					
New Construction	-	-					
SBDI	-	-					
Total	45	2	-	2	5%	8%	N/A

Both evaluated measures received a 100% realization rate.

Table 425 shows the *ex ante* savings and the measure-specific realization rates from the sampled VFD measures in the Prescriptive program. The evaluation team applied the measure-specific realization rates from the handpicked sampled projects to only those specific projects. The table shows actual realization rates the team estimated for randomly sampled projects; however, the team did not extrapolate those realization rates to the rest of the VFD population. The team aggregated the non-lighting measure types to create realization rates for the program as a full measure category and then extrapolated the non-lighting realization rates to the complete non-lighting population for the program.

TABLE 425. 2021 C&I PROGRAMS *EX ANTE* SAVINGS & REALIZATION RATES FOR SAMPLED VFD MEASURES

PROGRAM	SAMPLED *EX ANTE*			REALIZATION RATES (KWH)		REALIZATION RATES (KW)	
	KWH	KW	THERMS	HAND PICKED	RANDOM	HAND PICKED	RANDOM
Prescriptive	36,995.40	9.707	N/A	-	100%	-	106%
Custom	-	-	-				
New Construction	-	-	-				
SBDI	-	-	-				
Total	36,995.40	9.707	N/A	-	100%	-	106%

Figure 108 illustrates the distribution of the realization rates for the individually sampled projects by program. Both projects had realization rates of 100%.

FIGURE 108. 2021 C&I PROGRAMS SAMPLED VFD MEASURES *EX ANTE* IMPACT AND REALIZATION RATES

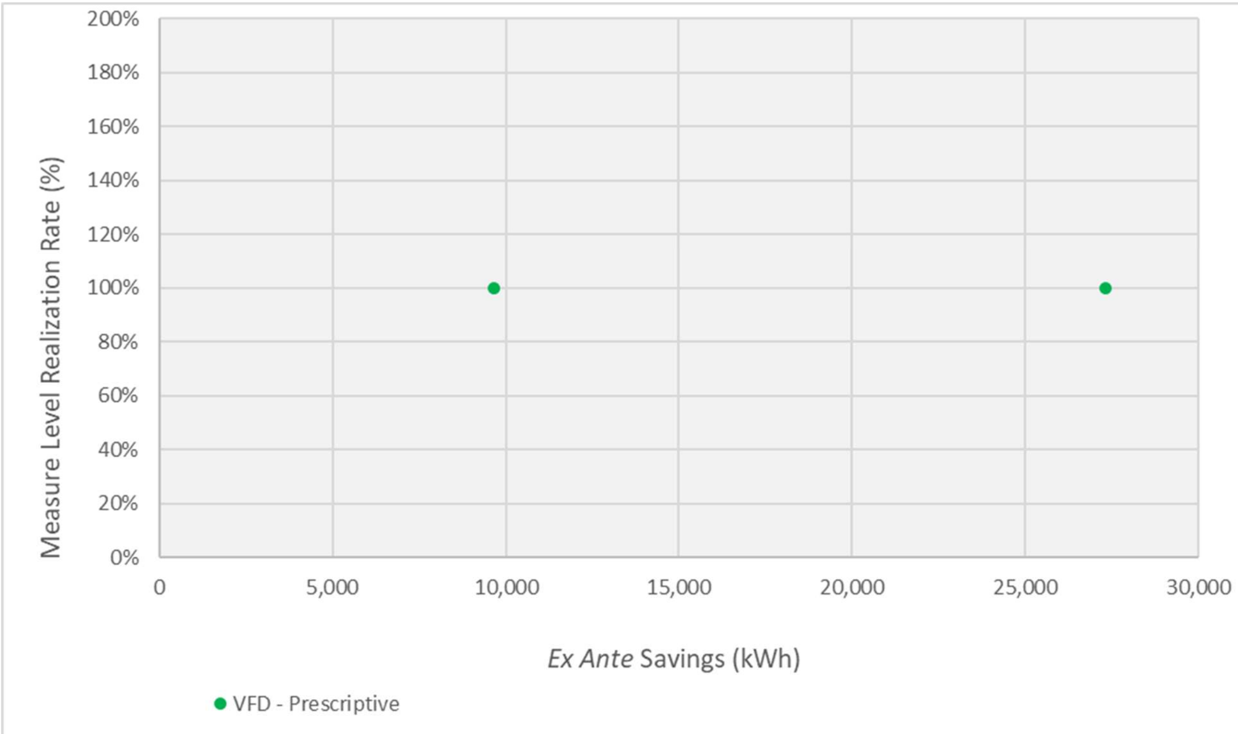


Table 426 summarizes notable differences between *ex ante* and *ex post* gross estimates from the measures sampled.

TABLE 426. 2021 C&I PROGRAMS NOTABLE DIFFERENCES BETWEEN *EX ANTE* AND *EX POST* GROSS VFD MEASURES

MEASURE CATEGORY	*EX ANTE* SOURCES AND ASSUMPTIONS	*EX POST* GROSS SOURCES AND ASSUMPTIONS	PRIMARY REASONS FOR DIFFERENCES
VFD	*Ex ante* savings were deemed through the application Excel tool	2015 Indiana TRM (v2.2). All inputs were verified through project documentation, virtual site visits, or interviews. Engineering calculations with VFD curves adapted from the Bonneville Power Administration ASD Calculator and the California TRM VFD Fan Analysis workbook.	The deemed savings values do not account for operating hours or loading of the VFDs. The California TRM VFD Fan Analysis workbook results resulted in 0 kW savings due to projections of motor running at full during midday. Changes to installed horsepower and hours of use based on customer data.

OTHER CATEGORY

The evaluation team grouped measures that had low participation and low savings impact into the *Other* category. These measures include Other, Building Redesign, Kitchen, Ventilation, and Water Heat. Table 427 details the number of measures, savings, and sampling sizes for measures within the *Other* category. No measures from the building redesign or the ventilation measure group were sampled in the 2021 evaluation given their relatively small impact to the New Construction and Custom programs.

TABLE 427. 2021 C&I PROGRAMS SAMPLED OTHER CATEGORY MEASURES

PROGRAM	NUMBER OF MEASURES				PROPORTION OF PROGRAM SAVINGS EVALUATED		
	TOTAL	SAMPLED TOTAL	HAND PICKED	RANDOM	KWH	KW	THERMS
Building Redesign Measures							
Prescriptive	-	-					
Custom	-	-					
New Construction	1	-	-	-	-	-	-
SBDI	-	-					
Kitchen Measures							
Prescriptive	1	1	-	1	100%	100%	N/A
Custom	-	-					
New Construction	-	-					
SBDI	-	-					
Other Measures							
Prescriptive	-	-					
Custom	7	1	1		N/A	N/A	66%
New Construction	-	-					
SBDI	-	-					
Ventilation Measures							
Prescriptive	-	-					
Custom	7	-	-	-	-	-	-
New Construction	-	-					
SBDI	-	-					
Water Heat Measures							
Prescriptive	8	1	-	1	N/A	N/A	5%
Custom	1	-					
New Construction	2	1	-	1	N/A	N/A	63%
SBDI	-	-					

Kitchen. The team evaluated one (of one) kitchen measure from the Prescriptive program. The measure received a 100% realization rate.

The engineering analysis decreased savings by 5,094 kWh. The team adjusted the sampled measure to align with 2015 Indiana TRM (v2.2) measure savings outlined for combo ovens. The *ex ante* savings were based on a different source. The evaluation team deemed the existing 2015 Indiana TRM (v2.2) measure to be the best source to determine savings.

Other. The team evaluated one (of seven) Other measure from the Custom program. The handpicked measure was a retro-commissioning project. This same project was sampled within the controls measure group. The savings for the measure was split into two measures, spanning two different measure groups. The controls measure captured only kWh and kW savings, the Other measure captured all gas savings from the project. The evaluated savings were adjusted based on virtual site visit data collected from the customer. The programming ranges of two of the retro-commissioning measures implemented were adjusted by the customer post verification to better meet the customer's conditioning needs. The adjustments made by the customer reduced the projected savings from the two implemented measures slightly. The resulting therm realization rate was 86% for the measure.

Water Heat. The team evaluated two (of 11) water heat measures from the Prescriptive and New Construction programs. Both projects received a 100% realization rate.

Table 428 shows the *ex ante* savings and the measure specific realization rates from the sampled Other measures in the 2021 C&I programs. The evaluation team applied the measure-specific realization rates from the handpicked sampled projects to only those specific projects. The table shows actual realization rates the team estimated for randomly sampled projects; however, the team did not extrapolate those realization rates to the rest of the *Other* population. The team aggregated the non-lighting measure types to create realization rates for each program as a full measure category and then extrapolated the non-lighting realization rates to the complete non-lighting population for each program.

TABLE 428. 2021 C&I PROGRAMS *EX ANTE* SAVINGS AND REALIZATION RATES FOR SAMPLED OTHER MEASURES

PROGRAM	SAMPLED *EX ANTE*			REALIZATION RATES (KWH)		REALIZATION RATES (KW)		REALIZATION RATES (THERMS)	
	KWH	KW	THERMS	HAND PICKED	RANDOM	HAND PICKED	RANDOM	HAND PICKED	RANDOM
Building Redesign Measures									
Prescriptive	-	-	-						
Custom	-	-	-						
New Construction	-	-	-						
SBDI	-	-	-						
Kitchen Measure									
Prescriptive	5,278.00	0.806	-		100%		100%		N/A
Custom	-	-	-						
New Construction	-	-	-						
SBDI	-	-	-						
Other Measures									
Prescriptive	-	-	-						
Custom	-	-	31,450.00	N/A		N/A		86%	
New Construction	-	-	-						
SBDI	-	-	-						
Ventilation Measures									
Prescriptive	-	-	-						
Custom	-	-	-						
New Construction	-	-	-						
SBDI	-	-	-						
Water Heat Measures									
Prescriptive	-	-	208.00		N/A		N/A		100%
Custom	-	-	-						
New Construction	-	-	114.00		N/A		N/A		100%
SBDI	-	-	-						
Total	5,278.00	0.806	31,772.00						

Figure 109 illustrates the distribution of realization rates for the individually sampled electric savings projects by program, and Figure 110 illustrates the distribution of realization rates distribution for the individually sampled gas savings projects by program. The single kWh saving kitchen project had a realization rate of 100%. There was some deviation in therms savings realization rates, with the larger impact project achieving a realization rate of 86%.

FIGURE 109. 2021 C&I PROGRAMS SAMPLED OTHER MEASURES
KWH *EX ANTE* IMPACT AND REALIZATION RATES

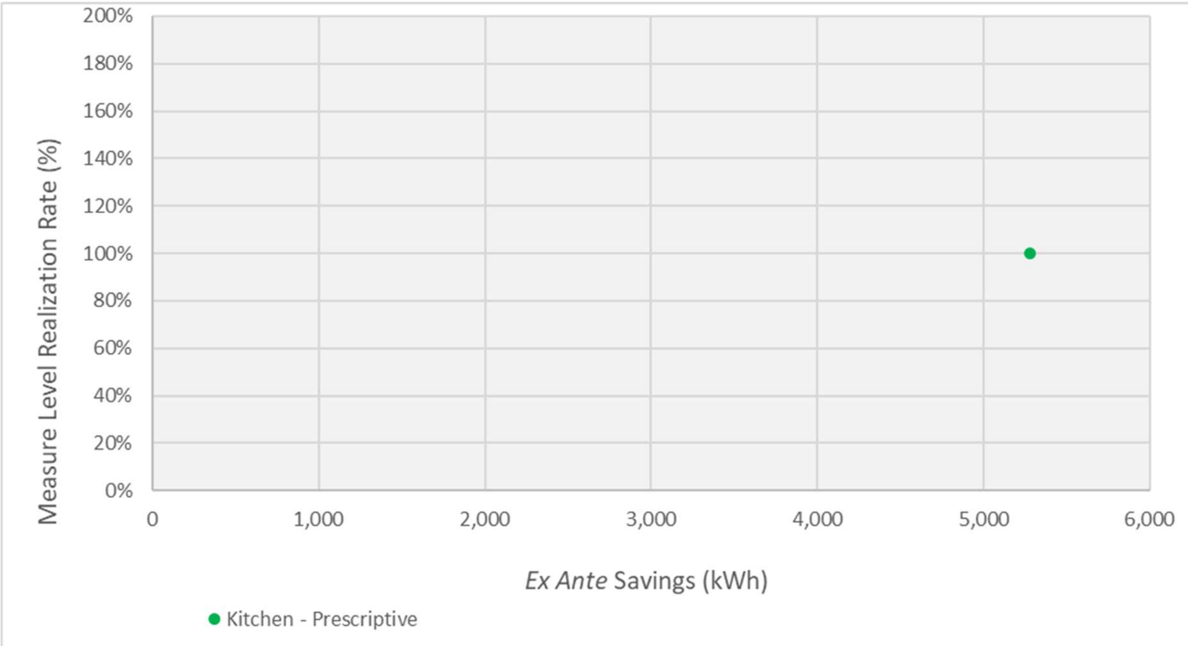


FIGURE 110. 2021 C&I PROGRAMS SAMPLED OTHER MEASURES
THERM *EX ANTE* IMPACT AND REALIZATION RATES

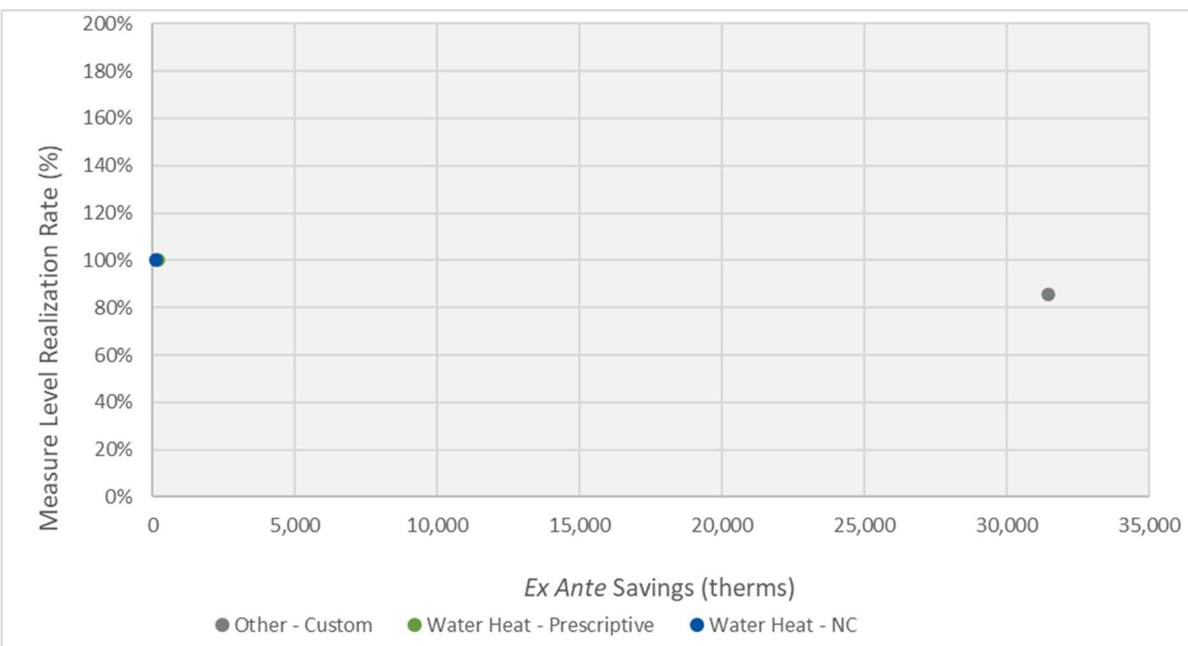


Table 429 summarizes notable differences between *ex ante* and *ex post* gross estimates from the measures sampled.

TABLE 429. 2021 C&I PROGRAMS NOTABLE DIFFERENCES BETWEEN *EX ANTE* & *EX POST* GROSS OTHER MEASURES

MEASURE CATEGORY	*EX ANTE* SOURCES AND ASSUMPTIONS	*EX POST* GROSS SOURCES AND ASSUMPTIONS	PRIMARY REASONS FOR DIFFERENCES
Kitchen	*Ex ante* savings were determined through engineering calculations derived from the MI Energy Measures Database.	2015 Indiana TRM (v2.2), Michigan Energy Measures Database. All inputs were verified through project documentation, virtual site visits or interviews.	No deviations found.
Other	*Ex ante* savings were determined through engineering calculations.	2015 Indiana TRM (v2.2). All inputs were verified through project documentation, virtual site visits or interviews.	Customer collected data demonstrated RCx programming modifications to implemented measures
Water Heat	*Ex ante* savings were determined by the 2015 Indiana TRM (v2.2).	2015 Indiana TRM (v2.2). All inputs were verified through project documentation, virtual site visits or interviews.	No deviations found.

NON-LIGHTING ADJUSTMENT SUMMARY

Table 430 shows the *ex ante* savings and the measure-specific realization rates from the sampled non-lighting measures in the 2021 C&I programs by fuel type. The evaluation team applied measure-specific realization rates from the handpicked sampled projects to only those specific projects. The table shows realization rates the team estimated for randomly sampled projects; however, the team did not extrapolate those realization rates to the rest of a given population. The team aggregated non-lighting measure types to create realization rates for each program as a full measure category and then extrapolated the non-lighting realization rates to the complete non-lighting population for each program. The extrapolated non-lighting realization rates for all programs combined was 96% for electric, 93% for demand, and 99% for natural gas, respectively. The complete set of extrapolated realization rates is shown in Table 430.

TABLE 430. 2021 C&I PROGRAMS *EX ANTE* SAVINGS AND REALIZATION RATES FOR SAMPLED NON-LIGHTING MEASURES

PROGRAM		SAMPLED *EX ANTE*			REALIZATION RATES (KWH)		REALIZATION RATES (KW)		REALIZATION RATES (THERMS)	
		KWH	KW	THERMS	HAND PICKED	RANDOM	HAND PICKED	RANDOM	HAND PICKED	RANDOM
Building Redesign	Prescriptive	-	-	-						
	Custom	-	-	-						
	New Construction	-	-	-						
	SBDI	-	-	-						
Compressed Air	Prescriptive	86,519.16	16.387	-		100%		81%		
	Custom	718,399.00	6.650	-		100%		155%		
	New Construction	-	-	-						
	SBDI	-	-	-						
Controls	Prescriptive	-	-	-						
	Custom	467,275.54	-	-	84%	101%				
	New Construction	-	-	-						
	SBDI	-	-	-						
HVAC	Prescriptive	-	-	3,179.120					100%	103%
	Custom	37,058.00	22.644	17,580.00		100%		103%		100%
	New Construction	4,888.00	11.292	231,518.09		100%		100%	99%	99%
	SBDI	-	-	3,997.28						100%
Kitchen	Prescriptive	5,278.00	0.806	-		100%		100%		
	Custom	-	-	-						
	New Construction	-	-	-						
	SBDI	-	-	-						
Motors	Prescriptive	-	-	-						
	Custom	585,415.00	50.973	-	104%	65%	112%	97%		
	New Construction	6,170.00	-	-		100%				
	SBDI	-	-	-						
Other	Prescriptive	-	-	-						
	Custom	-	-	31,450.00					86%	
	New Construction	-	-	-						
	SBDI	-	-	-						
Process	Prescriptive	-	-	-						
	Custom	370,543.00	-	161,251.00		100%			100%	
	New Construction	-	-	-						
	SBDI	-	-	-						
Refrigeration	Prescriptive	42,712.00	57.483	-	102%	100%	8%	100%		
	Custom	519,290.55	39.692	-	34%	100%	51%	109%		
	New Construction	742.00	-	-		117%				
	SBDI	7,074.00	0.966	-		100%		109%		
Ventilation	Prescriptive	-	-	-						
	Custom	-	-	-						
	New Construction	-	-	-						
	SBDI	-	-	-						
VFD	Prescriptive	36,995.40	9.707	-		100%		106%		
	Custom	-	-	-						
	New Construction	-	-	-						
	SBDI	-	-	-						
Water Heat	Prescriptive	-	-	208.00						100%
	Custom	-	-	-						
	New Construction	-	-	114.00						100%
	SBDI	-	-	-						

Figure 111 and Figure 112 illustrate the distribution of realization rates for the individually sampled projects by program and fuel source. Most kWh saving projects achieved a realization rate of near 100%, including the largest impact project. The second and third largest kWh impact projects achieved realization rates of 34% and 84% respectively. Most therms saving projects achieved near 100% realization rates, with one slight deviation of 86% for a handpicked ‘other’ category project.

FIGURE 111. 2021 C&I PROGRAMS SAMPLED NON-LIGHTING ELECTRIC MEASURES *EX ANTE* IMPACT AND REALIZATION RATES

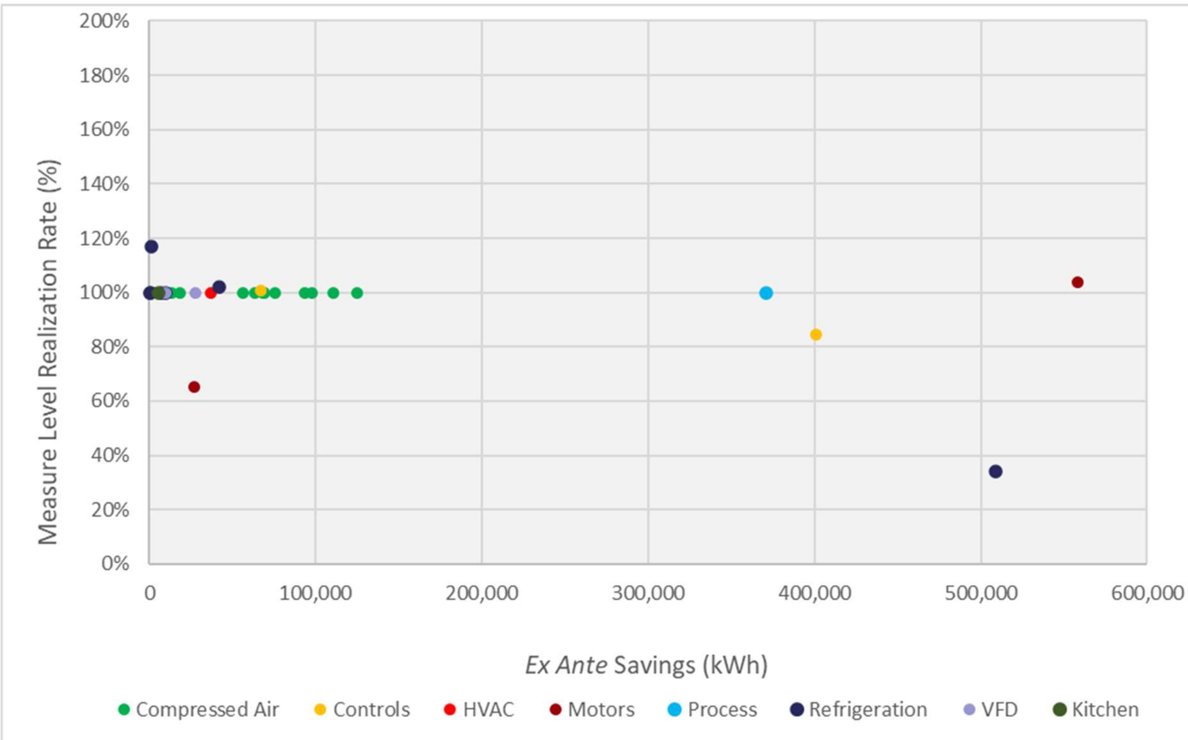
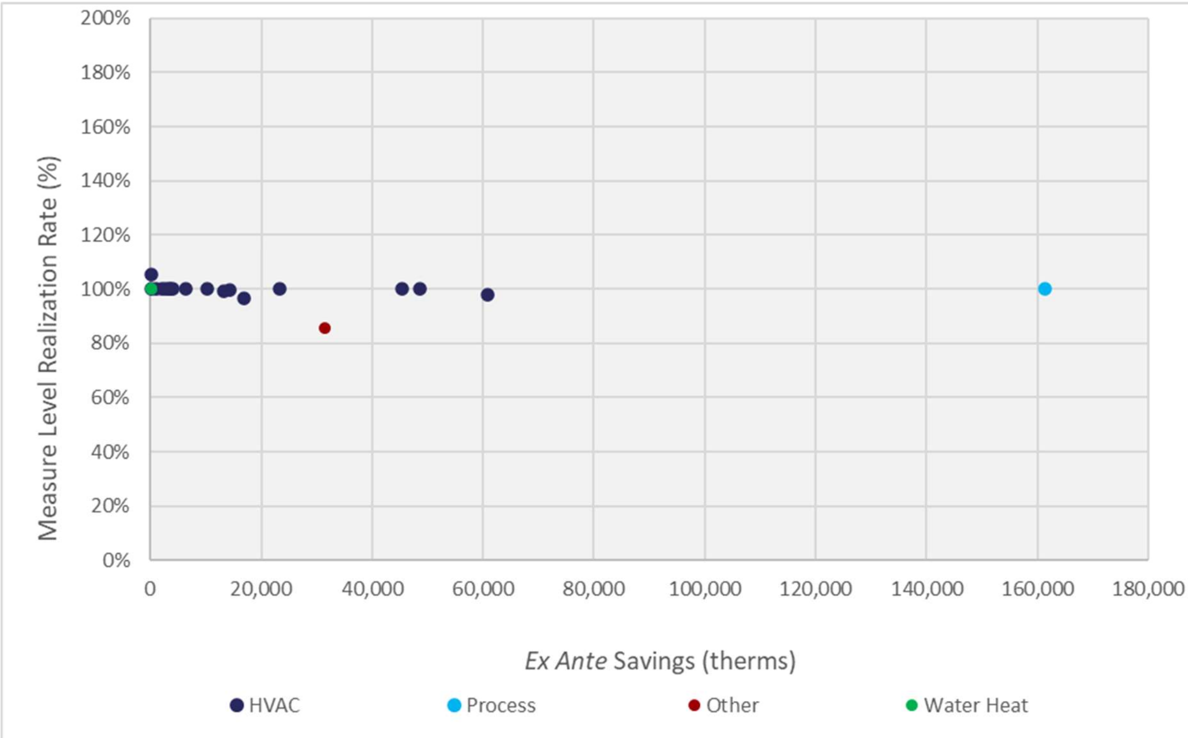


FIGURE 112. 2021 C&I PROGRAMS SAMPLED NON-LIGHTING GAS MEASURES *EX ANTE* IMPACT AND REALIZATION RATES



ALL MEASURES AND ADJUSTMENT SUMMARY

Table 431 shows the realization rates for lighting and non-lighting projects by C&I program and overall. The cumulative realization rates were driven primarily by the random sample realization rates that were extrapolated 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. For example, this is evident in the Prescriptive non-lighting kW demand realization rate, where a low realization rate achieved by a single handpicked refrigeration measure affected the overall realization rate more strongly than other programs.

TABLE 431. 2021 C&I PROGRAMS SAMPLE REALIZATION RATES

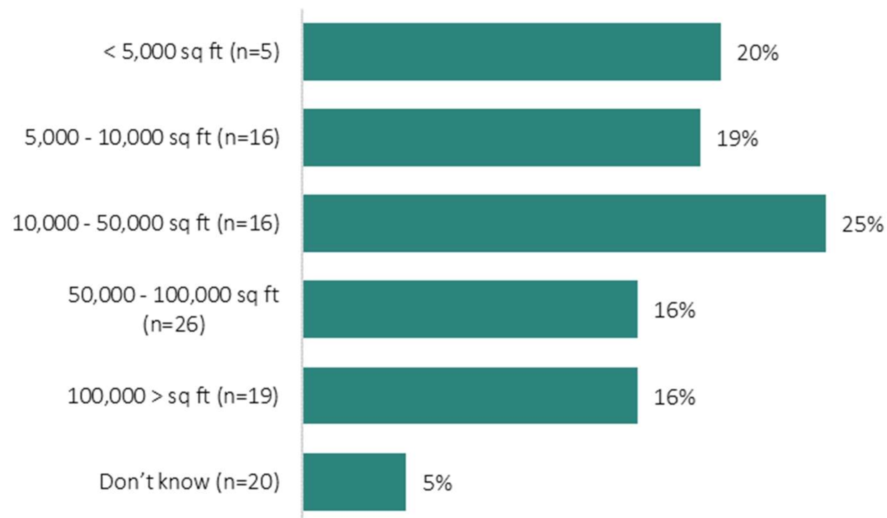
MEASURE CATEGORY	HAND PICKED SAMPLE REALIZATION RATE			RANDOM SAMPLE REALIZATION RATE			CUMULATIVE REALIZATION RATE		
	KWH	KW	THERMS	KWH	KW	THERMS	KWH	KW	THERMS
Prescriptive Program									
Lighting	108%	120%	N/A	108%	113%	N/A	108%	113%	N/A
Non-Lighting	102%	8%	100%	100%	90%	102%	100%	76%	102%
Custom Program									
Lighting	N/A	N/A	N/A	109%	119%	N/A	109%	119%	N/A
Non-Lighting	74%	84%	98%	99%	112%	100%	95%	104%	99%
New Construction Program									
Lighting	104%	110%	N/A	103%	112%	N/A	103%	111%	N/A
Non-Lighting	N/A	N/A	99%	101%	100%	99%	95%	104%	99%
SBDI Program									
Lighting	89%	118%	N/A	103%	132%	N/A	101%	132%	N/A
Non-Lighting	N/A	N/A	N/A	100%	109%	100%	100%	109%	100%

PROCESS EVALUATION APPENDIX

PARTICIPANT SURVEY FIRMOGRAPHICS

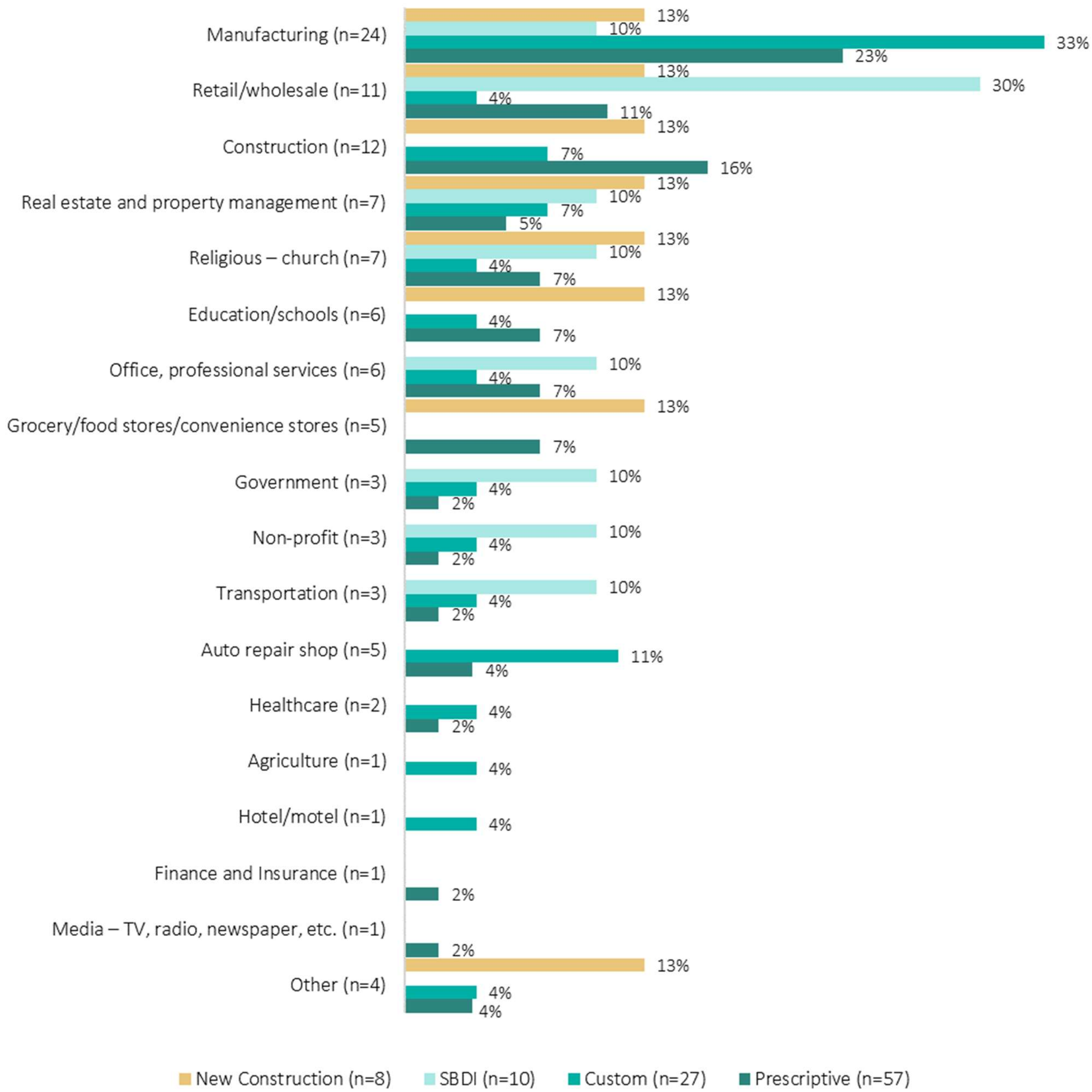
In terms of facility size, there is also a wide range of sizes represented in the survey (Figure 113). One quarter (25%) of respondents made efficiency improvements in facilities ranging between 10,000 and 50,000 square feet, followed by 20% of facilities with less than 5,000 square feet, 19% of facilities between 5,000 and 10,000 square feet, and 16% of facilities between 50,000 and 100,000 square feet and larger than 100,000 square feet, respectively. Most respondents own their facilities (78%), while 18% lease their facilities. In one case, the respondent reported that the facility is borrowed from a related company. As shown in Figure 114, NIPSCO's C&I energy efficiency programs reach a wide variety of business types.

FIGURE 113. FACILITY SIZE



Source: Survey Question K2: "What is the approximate square footage of space in the facility where you made the efficiency improvements?" Single response allowed.

FIGURE 114: SURVEY RESPONDENT INDUSTRY TYPE



Source: Survey Question K1: "What industry is your organization in?" Single response allowed.

C&I MEASURE ALGORITHMS AND ASSUMPTIONS

This appendix contains the assumptions used in electric savings, demand reduction, and gas savings algorithms for the measures within the C&I programs. The team examined each assumption behind the algorithms to capture savings and compared it against the Indiana TRM v2.2, as well as other state and industry approaches. Detailed information on the *ex post* savings analysis and supporting assumptions for the following C&I program measures are included within this appendix. Table 432 lists the assumptions of the *ex post* per-measure savings.

TABLE 432. C&I MEASURES

MEASURE	REVIEWED ASSUMPTIONS
Lighting Replacement	New and baseline wattages, house of use, waste heat factors, coincidence factors
Lighting Power Density Reduction	Square footage, baseline allowed watts, installed watts, operating hours, waste heating factors
Lighting Controls	New and baseline wattages, house of use, waste heat factors, coincidence factors
Refrigeration LED Case Lighting	New and baseline wattages, number of doors, house of use, waste heat factors, coincidence factors
HVAC – Package Unit Replacement	Full load heating and cooling hours, equipment capacities, equipment efficiencies
HVAC – Hydronic Unit Replacement	Full load heating and cooling hours, equipment capacities, equipment efficiencies
HVAC – VFDs Pumps and Fans	Motor size, motor efficiency, average equipment speed, operating hours, power consumption under baseline and VFD control
HVAC – Programmable Thermostats	Equipment heating and cooling capacities, equipment heating and cooling efficiencies, equivalent full load hours
HVAC Furnaces	Methodology for calculating shell heat loss, infiltration heat loss, stratification rates, setback controls, equipment efficiencies.
HVAC – Pipe Insulation	New and baseline R-values, pipe diameter, water heater recovery efficiency
HVAC – Steam Traps	Steam pressure, trap orifice diameter
VFD Air Compressors	Equipment capacity, equipment performance, average CFM load, operating hours
Kitchen Equipment	Pounds of food cooked per day, equipment efficiency, idle energy rate, production capacity, preheat time, preheat energy
Water Heating	Gallons per day of plant, equipment efficiency, equipment hot water temperature setpoint

LIGHTING – REPLACEMENT

The team used the following equations to calculate electric energy and peak demand savings for interior and exterior lighting replacement measures, as well as natural gas energy penalties:

$$kWh\ savings = \frac{(W_{base} - W_{EE}) * (Hours) * (1 + WHF_e)}{1{,}000}$$

$$kW\ reduction = \frac{(W_{base} - W_{LED}) * Coincidence\ Factor * (1 + WHF_d)}{1{,}000}$$

$$therm\ savings = (kWh\ savings) * \left(1 + WHF_g\right) * 10\ therms/MMBtu$$

Where:

W_{base} = Total wattage of the baseline lighting system, W

W_{EE} = Total wattage of the installed lighting system, W

Hours = Annual operating hours of system from TRM or posted site schedules, hrs/yr

WHF_e = Waste heat factor for energy to account for HVAC interactions with lighting (depends on location, building type, and HVAC system type)

WHF_d = Waste heat factor for demand to account for HVAC interactions with lighting (depends on location, building type, and HVAC system type)

WHF_g = Waste heat factor for gas to account for HVAC interactions with lighting (depends on location, building type, and HVAC system type)

Coincidence Factor = Summer peak coincidence factor from TRM based on building type

1,000 = Constant to convert watts to kW

10 = Constant to convert MMBtu to therm

Table 433 lists the input assumptions and source of each assumption for the lighting replacement measure savings calculations.

TABLE 433. *EX POST* VARIABLE ASSUMPTIONS FOR LIGHTING REPLACEMENTS

INPUT	VALUE	SOURCE
W_{base}	Varies	Based on existing number of fixtures and fixture type
W_{EE}	Varies	Based on installed number of fixtures and fixture type
Hours	Varies	Indiana TRM v2.2 or posted operating hours of business
WHF_e (Electric Only)	Varies	Indiana TRM v2.2, dependent on building type, location, and HVAC system type
WHF_d	Varies	Indiana TRM v2.2, dependent on building type, location, and HVAC system type
WHF_g	Varies	Indiana TRM v2.2, dependent on building type, location, and HVAC system type
Coincidence Factor	Varies	Indiana TRM v2.2, 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 434 lists the input assumptions and source of each assumption for the lighting power density reduction measure savings calculations.

TABLE 434. *EX POST* VARIABLE ASSUMPTIONS FOR LIGHTING POWER DENSITY REDUCTION

INPUT	VALUE	SOURCE
LPD_{base}	Varies	ASHRAE 90.1-2007 Table 9.5.1 or Table 9.6.1
LPD_{EE}	Varies	Actual installed wattage
AREA	Varies	Actual building square footage
HOURS	Varies	Indiana TRM (v2.2), or actual operating hours of building
WHF_e	Varies	Indiana TRM (v2.2), based on location, building type, and HVAC system type
WHF_d	Varies	Indiana TRM (v2.2), based on location, building type, and HVAC system type
WHF_g	Varies	Indiana TRM (v2.2), based on location, building type, and HVAC system type
CF	Varies	Indiana TRM (v2.2), 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 435 lists the input assumptions and source of each assumption for the lighting occupancy sensor measure savings calculations.

TABLE 435. *EX POST* VARIABLE ASSUMPTIONS FOR LIGHTING OCCUPANCY SENSOR MEASURES

INPUT	VALUE	SOURCE
$kW_{controlled}$	Varies	Based on actual wattage controlled per sensor
Hours	Varies	Indiana TRM v2.2 or posted operating hours of business
ESF	Varies	Indiana TRM v2.2, dependent on control type
WHF_e	Varies	Indiana TRM v2.2, dependent on building type, location, and HVAC system type
WHF_d	Varies	Indiana TRM v2.2, dependent on building type, location, and HVAC system type
WHF_g	Varies	Indiana TRM v2.2, dependent on building type, location, and HVAC system type
CF	Varies	Indiana TRM v2.2, dependent on building type

LIGHTING – REFRIGERATION LED CASE LIGHTING

The team used the following equations to calculate electric energy and peak demand savings for refrigeration case lighting replacement measures. There are no natural gas energy penalties for this measure:

$$kWh\ savings = \frac{(W_{base} - W_{EE}) * (Hours) * (N+1) * (1 + WHF_e) * ESF_{MC}}{1{,}000}$$

$$kW\ reduction = \frac{(W_{base} - W_{EE}) * (N+1) * CF * \ (1 + WHF_d) * DSF_{MC}}{1{,}000}$$

Where:

W_{base} = Wattage per door of the baseline lighting system, W

W_{EE} = Wattage per door of the installed lighting system, W

Hours = Annual operating hours of system from TRM or posted site schedules, hrs/yr

N = Number of doors (= l; note: N+1 accounts for the additional fixture that is present in a row of case lighting doors)

ESF_{MC} = Energy savings factor; additional savings percentage achieved with a motion sensor (= 1.0 if no motion sensor is installed; = 1.43 if motion sensor installed)

WHF_e = Waste heat factor for energy to account for cooling savings from efficient lighting (= 0.41 for refrigerated space; = 0.52 for freezer space)

WHF_d = Waste heat factor for energy to account for cooling savings from efficient lighting (= 0.41 for prescriptive refrigerated lighting measures; = 0.52 for freezer space)

DSF_{MC} = Demand savings factor; additional savings percentage achieved with a motion sensor (= 1.0 if no motion sensor is installed; = 1.43 if motion sensor installed)

CF = Summer peak coincidence factor (= 0.92)

1,000 = Constant to convert watts to kW

Table 436 lists the input assumptions and source of each assumption for the LED case lighting measure savings calculations.

TABLE 436. *EX POST* VARIABLE ASSUMPTIONS FOR LED CASE LIGHTING MEASURES

INPUT	VALUE	SOURCE
W_{base}	Varies	Based on baseline number of lamps and lamp wattage
W_{EE}	Varies	Based on installed number of lamps and lamp wattage
Hours	Varies	Indiana TRM v2.2 or posted operating hours of business
WHF_e	Varies	Indiana TRM v2.2, = 0.41 for refrigerated space; = 0.52 for freezer space
WHF_d	Varies	Indiana TRM v2.2, dependent on building type, location, and HVAC system type, = 0.41 for refrigerated space; = 0.52 for freezer space
ESF_{MC}	Varies	Indiana TRM v2.2, = 1.0 if no motion sensor is installed; = 1.43 if motion sensor installed
DSF_{MC}	Varies	Indiana TRM v2.2, = 1.0 if no motion sensor is installed; = 1.43 if motion sensor installed
CF	0.92	Indiana TRM v2.2

HVAC – PACKAGE UNITS REPLACEMENT

The evaluation team used the following equations to calculate electric and natural gas energy savings for HVAC package units.

$$kWh\ savings_{cool} = Btuh_{cool} * \left(\frac{1}{SEER_{base}} - \frac{1}{SEER_{EE}}\right) * \frac{EFLH_{cool}}{1{,}000}$$

$$kW\ reduction = Btuh_{cool} * \left(\frac{1}{EER_{base}} - \frac{1}{EER_{EE}}\right) * \frac{CF}{1{,}000}$$

$$therm\ savings = Btuh_{heat} * \left(\frac{1}{EFF_{base}} - \frac{1}{EFF_{EE}}\right) * \frac{EFLH_{heat}}{100{,}000}$$

Where:

$Btuh_{cool}$ = actual capacity of the cooling equipment installed, Btu/hr

$SEER_{base}$ = seasonal energy efficiency ratio of the baseline equipment, from TRM or ASHRAE 90.1 2007, Btu/W-hr

$SEER_{EE}$ = actual seasonal energy efficiency ratio of installed equipment, Btu/W-hr

$EFLH_{cool}$ = equivalent full load hours for cooling, from TRM based on building type and location, hrs/yr

1000 = conversion from watts to kilowatts

EER_{base} = full load energy efficiency ratio of the baseline equipment, from TRM or ASHRAE 90.1 2007, Btu/W-hr

EER_{EE} = actual energy efficiency ratio of installed equipment, Btu/W-hr

CF = summer coincidence factor, from TRM

$Btuh_{heat}$ = actual capacity of the natural gas heating equipment installed, Btu/hr

EFF_{base} = baseline heating efficiency, 80%

EFF_{EE} = actual heating efficiency of installed equipment

$EFLH_{heat}$ = equivalent full load hours for heating, from TRM based on building type and location, hrs/yr

100,000 = conversion factor from Btu to therm

Table 437 lists the assumptions and source of each assumption for the HVAC package unit measure savings calculations.

TABLE 437. *EX POST* VARIABLE ASSUMPTIONS FOR HVAC PACKAGE UNITS

INPUT	VALUE	SOURCE
$Btuh_{cool}$	Varies	Equipment specifications
$SEER_{base}$	Varies	Indiana TRM (v2.2), ASHRAE 90.1 2007
$SEER_{EE}$	Varies	Equipment specifications
$EFLH_{cool}$	Varies	Indiana TRM (v2.2)
EER_{base}	Varies	Indiana TRM (v2.2), ASHRAE 90.1 2007
EER_{EE}	Varies	Equipment specifications
CF	Varies	Indiana TRM (v2.2)
$Btuh_{heat}$	Varies	Equipment specifications
EFF_{base}	80%	ASHRAE 90.1 2007
EFF_{EE}	Varies	Equipment specifications
$EFLH_{heat}$	Varies	Indiana TRM (v2.2)

HVAC – HYDRONIC UNIT REPLACEMENT

The evaluation team used the following equations to calculate electric and natural gas energy savings for HVAC hydronic units.

$$kWh\ savings_{cool} = TONS * (\frac{3.516}{IPLV_{base}} - \frac{3.516}{IPLV_{EE}}) * EFLH_{cool}$$

$$kW\ reduction = TONS * (\frac{3.516}{COP_{base}} - \frac{3.516}{COP_{EE}}) * CF$$

$$therm\ savings = Btuh_{heat} * (\frac{1}{EFF_{base}} - \frac{1}{EFF_{EE}}) * \frac{EFLH_{heat}}{100{,}000}$$

Where:

TONS = Actual cooling capacity of chiller, tons

$IPLV_{base}$ = Integrated part load value efficiency of the baseline equipment, from TRM or ASHRAE 90.1 2007, COP

$IPLV_{EE}$ = Integrated part load value efficiency of actual installed equipment, COP

$EFLH_{cool}$	=	Equivalent full load hours for cooling, from TRM based on building type and location, hrs/yr
COP_{base}	=	Coefficient of performance of the baseline equipment, from TRM or ASHRAE 90.1 2007, unitless
COP_{EE}	=	Actual coefficient of performance of installed equipment, unitless
CF	=	Summer coincidence factor, from TRM
$Btuh_{heat}$	=	Actual capacity of the boiler installed, Btu/hr
EFF_{base}	=	Baseline heating efficiency, 80%
EFF_{EE}	=	Actual heating efficiency of installed equipment
$EFLH_{heat}$	=	Equivalent full load hours for heating, from TRM based on building type and location, hrs/yr
100,000	=	Conversion factor from Btu to therm

Table 438 lists the assumptions and source of each assumption for the HVAC hydronic unit measure savings calculations.

TABLE 438. *EX POST* VARIABLE ASSUMPTIONS FOR HVAC HYDRONIC UNITS

INPUT	VALUE	SOURCE
TONS	Varies	Equipment specifications
$IPLV_{base}$	Varies	Indiana TRM (v2.2), ASHRAE 90.1 2007
$IPLV_{EE}$	Varies	Equipment specifications
$EFLH_{cool}$	Varies	Indiana TRM (v2.2)
COP_{base}	Varies	Indiana TRM (v2.2), ASHRAE 90.1 2007
COP_{EE}	Varies	Equipment specifications
CF	Varies	Indiana TRM (v2.2)
$Btuh_{heat}$	Varies	Equipment specifications
EFF_{base}	80%	ASHRAE 90.1 2007
EFF_{EE}	Varies	Equipment specifications
$EFLH_{heat}$	Varies	Indiana TRM (v2.2)

HVAC – VFD PUMPS AND FANS

The evaluation team used the following equations to calculate electrical energy savings and summer coincidence peak demand savings associated with this measure. There are no natural gas savings associated with this measure.

$$kWh\ savings = HP * \left(\frac{CLF_{base} - CLF_{VFD}}{EFF_m}\right) * HOURS * 0.746$$

$$kW\ reduction = HP * \left(\frac{CLF_{base} - CLF_{VFD}}{EFF_m}\right) * CF * 0.746$$

Where:

HP	=	Motor horsepower of installed equipment, hp
CLF_{base}	=	Controlled load factor of baseline equipment at average flow conditions, adapted from the Bonneville Power Administration ASD Calculator curves, %
CLF_{VFD}	=	Controlled load factor of VFD controlled equipment at average flow conditions, adapted from the Bonneville Power Administration ASD Calculator curves, %

EFF_M = Motor efficiency, actual or from NEMA guidelines, %

HOURS = Operating hours of equipment, from facility interviews or logged data, hrs/yr

0.746 = Conversion from hp to kW

CF = Summer peak coincidence factor, varies depending on operating schedule and loading of pump or fan during the utility peak period

Table 439 lists the assumptions and source of each assumption for the VFD pumps and fans measure savings calculations.

TABLE 439. *EX POST* VARIABLE ASSUMPTIONS FOR VFD PUMPS AND FANS

INPUT	VALUE	SOURCE
HP	Varies	Equipment specifications
CLF_{base}	Varies	Adapted from the Bonneville Power Administration ASD Calculator curves at average flow conditions, varies depending on baseline control method
CLF_{VFD}	Varies	Adapted from the Bonneville Power Administration ASD Calculator curves at average flow conditions
EFF_M	Varies	Equipment specifications, typical NEMA values at equipment horsepower
HOURS	Varies	Facility staff interviews, logged run time
CF	Varies	Facility staff interviews, logged run time and loading of equipment during utility peak period

HVAC – PROGRAMMABLE THERMOSTATS

The evaluation team would have used the following equations to calculate energy savings for programmable thermostat replacements if enough information was available in the project documentation. There are no peak coincident demand savings for this measure.

$$kWh\ savings = \frac{Btuh_{cool} * EFLH_{cool} * ESF_{cool}}{SEER * \ 1{,}000}$$

$$therm\ savings = \frac{Btuh_{ff} * EFLH_{heat} * ESF_{hea}}{SEER * \ 100{,}000}$$

Where:

$Btuh_{cool}$ = Cooling system capacity, actual, Btu/hr

$EFLH_{cool}$ = Equivalent full load cooling hours, from TRM dependent on location, hrs/yr

ESF_{cool} = Cooling energy savings fraction, 0.09 from TRM

SEER = Seasonal average energy efficiency ratio, actual or from TRM, Btu/W-hr

1,000 = Constant to convert W to kW

$Btuh_{ff}$ = Heating system capacity, actual, Btu/hr

$EFLH_{heat}$ = equivalent full load heating hours, from TRM dependent on location, hrs/yr

ESF_{heat} = Heating energy savings fraction, 0.068 from TRM

100,000 = Constant to convert Btu to therm

Table 440 lists the assumptions and source of each assumption for the programmable thermostat measure savings calculations.

TABLE 440. *EX POST* VARIABLE ASSUMPTIONS FOR PROGRAMMABLE THERMOSTATS

INPUT	VALUE	SOURCE
$Btuh_{cool}$	Varies	Project application, invoices, spec sheets
$EFLH_{cool}$	Varies	Indiana TRM v2.2, dependent on location
ESF_{cool}	0.09	Indiana TRM v2.2
SEER	Varies	Actual or Indiana TRM v2.)
$Btuh_{ff}$	Varies	Project application, invoices, spec sheets
$EFLH_{heat}$	Varies	Indiana TRM v2.2, dependent on location
ESF_{heat}	0.068	Indiana TRM v2.2

HVAC – FURNACES

The evaluation team used a calculation workbook developed by the implementer to determine the energy savings for furnace measures in large warehouses and manufacturing facilities. In future program years, using Trane TRACE 700 to estimate savings is also an acceptable methodology.

Figure 115 shows an example of this calculation spreadsheet.

FIGURE 115. FURNACE CALCULATION SPREADSHEET

Schedule (Imported from Standardized)			
Day	# Shifts	Occ Hours	UnOcc Hours
Monday	2.0	16	8
Tuesday	2.0	16	8
Wednesday	2.0	16	8
Thursday	2.0	16	8
Friday	2.0	16	8
Saturday	1.0	8	16
Sunday	0.0	0	24

Weighted Variable Table					
Climate Zone - Weather Station/City			1 - Rockford AP / Rockford		
	Hour Factor	t_{stat}	TRM t_{eff}	Weighted t_{eff}	Weighted t_{stat}
Occupied	0.5224	65	6436	3362	34.0
Night time	0.2374	55	4880	1159	13.1
Weekend (Unocc)	0.2374	55	4880	1159	13.1
			Sum	5679	60.1

Should have Northern Indiana Values

*TRM Climate Zone 2 - Chicago O'Hare AP/Chicago

0.9973

Destratification 1.0+ ACH Continuous, prorate less than 1.0 ACH (ACH x 1.0 Cont)

Inputs (Imported from project info input tab)			
Variable	Value	Units	
A_r	45,000	Roof Area (ft²)	
Wall Length 1	300	ft	
Wall Length 2	150	ft	
Roof Height	35	ft	
A_w	31500	Wall Area (ft²)	
Thermostat Location	Floor	(from equipment type)	
T_{tstat}	60.1	Weighted Temperature Set Point (°F)	
$T_{f,s}$	60.1	Inside air at floor (if tstat is on wall assume 5ft height)	
Outdoor Temp	0	°F	
Stratification Factor	0.8	°F/ft	
R_r	15.38	Overall Thermal Resistance (Roof) (hr*ft²*°F/Btu)	Table 5.5-5 ASHRAE 90.1-2007
R_w	8.85	Overall Thermal Resistance (Wall) (hr*ft²*°F/Btu)	Table 5.5-5 ASHRAE 90.1-2007
t_{eff}	5,679	Weighted Effective Annual Operation Time (hr)	
η	88.3%	Thermal Efficiency of Heating Equipment (calc from eqpt schedule)	*Applicance device efficiency*

	Year	U	Assembly U
Roof	2016	0.082	0.037 (est.)
Wall	2016	0.162	0.05 (est.)
Roof	2007	0.065	0.065
Wall	2007	0.113	0.113
Roof	2013	0.082	0.037
Wall	2013	0.162	0.05

Outputs - Assuming Thermostat Located on Floor		
Variable	Value	Units
$T_{r,s}$	88.1	Indoor Temperature at Roof Deck, Stratified (°F)
$T_{r,d}$	61.1	Indoor Temperature at Roof Deck, Destratified (°F)
$T_{w,s}$	74.1	Average Indoor Air Temp for Wall Heat Loss, Stratified (°F)
$T_{w,d}$	60.6	Average Indoor Air Temp for Wall Heat Loss, Destratified (°F)
ΔQ_r	78,975	Heat Loss Through the Roof
ΔQ_w	48,053	Heat Loss Through the Walls

Transmisson Heat Loss @ Daytime Temp		
Variable	Value	Units
A_r	45,000	area roof
A_w	31,500	area walls
P	900	perimeter
U_r	0.07	transmission coefficient roof
U_w	0.11	transmission coefficient walls
F	0.8	transmission coefficient floor
T_{set}	65	thermostat set point
T_i	79	integrated inside air, stratified
T_o	0	outside air
T_f	61	inside air at floor
H_r	265,736	transmission heat loss roof
H_w	281,201	transmission heat loss walls
H_f	43,920	transmission heat loss floor
H_t	590,857	transmission heat loss (BTUh)

Transmisson Heat Loss @ Set Back Temp		
Variable	Value	Units
A_r	45,000	area roof
A_w	31,500	area walls
P	900	perimeter
U_r	0.07	transmission coefficient roof
U_w	0.11	transmission coefficient walls
F	0.8	transmission coefficient floor
T_{set}	55	thermostat set point
T_i	69	integrated inside air, stratified
T_o	0	outside air
T_f	51	inside air at floor
H_r	232,099	transmission heat loss roof
H_w	245,606	transmission heat loss walls
H_f	36,720	transmission heat loss floor
H_t	514,424	transmission heat loss (BTUh)

Setback Calcs					
		24/7	1 shift/5 day Original EFF	1 shift/5 day New Eff	
BLC @65 (btuh/deg)		13,904	13,904	13,904	
BLC @55 (btuh/deg)		10,055	10,055	10,055	
DTDD (F*day)		6,343	6,343	6,343	
NTDD (F*day)		6,343	4,308	4,308	
FUL (BTU/therm)		100,000	100,000	100,000	
EFF		0.8	0.8	85.4%	
	Hour Factor				
Daytime	0.5224	13,821	13,821	12,945	therms
Night time	0.2374	6,282	3,085	2,890	therms
Weekend	0.2374	6,282	3,085	2,890	therms
	Usage	26,386	19,992	18,724	therms

*from Overall Systematic Eff

Project Summary		
Baseline Usage	19,992	therms
Efficient Usage	10,549	therms
Efficiency Savings	1,268	therms
Destrat Savings	8,175	therms
Total Savings	9,443	therms
Percent Savings	0.36	

New	Existing
#NAME?	0.20

Infiltration Heat Loss		
Variable	Value	Units
c_p	0.24028	specific heat air
p	0.0736	density of air lb/ft3 (at 60°F and 1 atm)
n	0.09	air shift (1/hr) (.09 New, .20 existing)
V_{ACH}	2,363	volumetric air flow (cfm) (Use Roof sq ft)
T_i	79	integrated inside air, stratified
T_o	0	outside air
H_i	198,063.57	infiltration heat loss (BTUh)

Infiltration Heat Loss		
Variable	Value	Units
c_p	0.24028	specific heat air
p	0.0763	density of air lb/ft3 (at 60°F and 1 atm)
n	0.09	air shift (1/hr)
V_{ACH}	2,363	volumetric air flow (cfm)
T_i	69	integrated inside air, stratified
T_o	0	outside air
H_i	179,338	infiltration heat loss (BTUh)

Ventilation		
$V_{combustion}$	-	required combustion air flow (cfm)
$V_{scheduled}$	500	volumetric air flow, if known (cfm)
R_a	0.06	cfm/ft² (for occupancy category) (infiltration?)
R_p	-	cfm/person (for occupancy category)
P_z	-	zone population
V_{ASHRAE}	2,700	volumetric air flow (cfm)
T_i	79	integrated inside air, stratified
T_o	0	outside air
H_v	226,358.36	ventilation heat loss (BTUh)

Ventilation		
$V_{combustion}$	-	required combustion air flow (cfm)
$V_{scheduled}$		volumetric air flow, if known (cfm)
R_a	-	cfm/ft² (for occupancy category) (0 Unoccup)
R_p	-	cfm/person (for occupancy category)
P_z	-	zone population
V_{ASHRAE}	-	volumetric air flow (cfm)
T_i	69	integrated inside air, stratified
T_o	0	outside air
H_v	-	ventilation heat loss (BTUh)

Ventilation		
$V_{combustion}$	-	required combustion air flow (cfm)
$V_{scheduled}$	500	volumetric air flow, if known (cfm)
R_a	0.06	cfm/ft² (for occupancy category) (infiltration?)
R_p	-	cfm/person (for occupancy category)
P_z	-	zone population
V_{ASHRAE}	2,700	volumetric air flow (cfm)
T_i	79	integrated inside air, stratified
T_o	0	outside air
H_v	226,358.36	ventilation heat loss (BTUh)

Ventilation		
$V_{combustion}$	-	required combustion air flow (cfm)
$V_{scheduled}$		volumetric air flow, if known (cfm)
R_a	-	cfm/ft² (for occupancy category) (0 Unoccup)
R_p	-	cfm/person (for occupancy category)
P_z	-	zone population
V_{ASHRAE}	-	volumetric air flow (cfm)
T_i	69	integrated inside air, stratified
T_o	0	outside air
H_v	-	ventilation heat loss (BTUh)

Overhead Doors Heat Loss		
Variable	Value	Units
Area	248	total door area (ft²)
V_{door}	4	volumetric air flow (cfm/ft²) (4 Cfm infreq)
H_D	83,165.74	door heat loss (BTUh)

Overhead Doors Heat Loss		
Variable	Value	Units
Area	-	total door area (ft²)
V_{door}	4	volumetric air flow (cfm/ft²)
Q_{Door}	-	heat loss per door (BTUh)*

Door Inputs			
QTY	Height (ft)	Width (ft)	Total Area (ft²)
1	8	10	80
1	12	14	168

Total Building Heat Loss		
Variable	Value	Units
H_{total}	1,098,444	Builidng heat loss (BTUh)
BLC	13,904	BTUh/°F

Total Building Heat Loss		
Variable	Value	Units
H_{total}	693,762	Builidng heat loss (BTUh)
BLC	10,055	BTUh/°F

Table 441 lists the assumptions and source of each assumption for the HVAC furnace measure savings calculations

TABLE 441. *EX POST* VARIABLE ASSUMPTIONS FOR HVAC FURNACES

INPUT	VALUE	SOURCE
T_{SET}	Varies	Temperature setpoint during occupied and setback operation from equipment control screens
Schedule	Varies	Operating hours for occupied and setback operation from equipment control screens
Baseline Stratification Factor	0.8 °F/ft	Approved value for this type of measure
Infiltration air shift	0.9 ACH new construction, 0.20 existing construction	Approved values for these type of measures
Efficiency	Varies	80% for baseline efficiency, actual equipment efficiency for installed unit

HVAC – PIPE INSULATION

The evaluation team used the following equations to calculate natural gas energy savings for hot water and steam pipe insulation. There are no electrical energy or summer peak coincident demand savings associated with this measure.

$$therm\ savings = \frac{(Btu_{base} - Btu_{ee}) * Hours * LF}{EFF * \ 100{,}000}$$

Where:

Btu_{base}	=	Energy loss per linear foot from uninsulated pipe, calculated using 3E Plus, Btu/hr-ft
Btu_{ee}	=	Energy loss per linear foot from insulated pipe, calculated using 3E plus, Btu/hr-ft
Hours	=	Annual operating hours of steam or hot water system, actual, hrs/yr
LF	=	Linear feet of piping, actual, ft
EFF	=	Efficiency of hot water or steam boilers, actual or assumed 80%
100,000	=	constant to Btu to therm

Table 442 lists the assumptions and source of each assumption for the HVAC pipe insulation savings calculations.

TABLE 442. *EX POST* VARIABLE ASSUMPTIONS FOR HVAC PIPE INSULATION

INPUT	VALUE	SOURCE
Btu_{base}	Varies	3E Plus. Calculated based on process fluid temperature, pipe diameter, insulation material, and insulation thickness
Btu_{EE}	Varies	3E Plus. Calculated based on process fluid temperature, pipe diameter, insulation material, and insulation thickness
LF	Varies	Project application, invoices, spec sheets
Hours	Varies	Dependent on operating hours of heating system
EFF	Varies	Assumed 80% unless information on the actual heating efficiency of the boiler system is available

HVAC – STEAM TRAP REPLACEMENT

The evaluation team used the following equations to calculate natural gas energy savings for steam trap replacements. There are no electrical energy or summer peak coincident demand savings associated with this measure.

$$therm\ savings = \frac{24.24\ * P_{Abs} * D^2 * h_{fg} * HOU * DF}{EFF *\ 100{,}000}$$

Where:

P_{Abs}	=	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
h_{fg}	=	Latent heat of vaporization for water at P_{Abs}, 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 443 lists the assumptions and source of each assumption for the steam trap replacement measure savings calculations.

TABLE 443. *EX POST* VARIABLE ASSUMPTIONS FOR STEAM TRAP REPLACEMENTS

INPUT	VALUE	SOURCE
P_{Abs}	Varies	From project specific operating pressure
D	Varies	From steam trap specifications
h_{fg}	Varies	From steam tables, dependent on P_{Abs}
DF	32%	From 2019 Wisconsin Focus on Energy Technical Reference Manual
EFF	Varies	Assumed 80% unless information on the actual heating efficiency of the boiler system is available

KITCHEN EQUIPMENT

The evaluation team used the following equations to calculate electric energy savings for kitchen equipment measures.

$$kWh\ savings = \ kWh_{base} - \ kWh_{EE}$$

$$kWh_{base} = \left(\frac{LB *\ E_{FOOD}}{EFF_{base}} + IE_{base} * \left(H - \frac{LB}{PC_{base}} - \frac{T_P}{60}\right) + E_{p,base}\right) * DAYS$$

$$kkWh_{EE} = \left(\frac{LB *\ E_{FOOD}}{EFF_{EE}} + IE_{EE} * \left(H - \frac{LB}{PC_{EE}} - \frac{T_P}{60}\right) + E_{p,EE}\right) * DAYS$$

$$kW\ reduction = kWh\ Savings * \frac{CF}{HOURS}$$

Where:

LB	=	Pounds of food cooked per day, actual or assumed 100 lbs/day
E_{FOOD}	=	Amount of energy absorbed by the food during cooking, 0.139 kWh/lb
EFF_{BASE}	=	Cooking efficiency of baseline equipment
EFF_{EE}	=	Cooking efficiency of installed equipment
IE_{BASE}	=	Idle energy rate of baseline equipment
IE_{EE}	=	Idle energy rate of installed equipment
H	=	Daily operating hours, actual or assumed 12 hrs/day
PC_{BASE}	=	Production capacity of baseline equipment, lbs/hr
PC_{EE}	=	Production capacity of installed equipment, lbs/hr
T_P	=	Preheat time for equipment to reach operating temperature, actual or assumed 15 min/day
$E_{P,BASE}$	=	Preheat energy per day for baseline equipment, kWh/day
$E_{P,EE}$	=	Preheat energy per day for installed equipment, kWh/day
DAYS	=	Operating days per year
CF	=	Summer peak coincidence factor, 0.84
HOURS	=	Annual operating hours of kitchen, actual or 4,380 hrs/yr

Table 444 lists the assumptions and source of each assumption for the kitchen equipment measure savings calculations.

TABLE 444. *EX POST* VARIABLE ASSUMPTIONS FOR KITCHEN EQUIPMENT

INPUT	VALUE	SOURCE
LB	Varies	Actual or from Indiana TRM v2.2
EFOOD	0.139	Indiana TRM v2.2
EFFBASE	0.6	Indiana TRM v2.2
EFFEE	Varies	Actual or from Indiana TRM v2.2
IEBASE	2.4	Indiana TRM v2.2
IEEE	Varies	Actual or from Indiana TRM v2.2
H	Varies	Actual or from Indiana TRM v2.2
PCBASE	35	Indiana TRM v2.2
PCEE	Varies	Actual or from Indiana TRM v2.2
TP	Varies	Actual or from Indiana TRM v2.2
EP,BASE	4	Indiana TRM v2.2
EP,EE	Varies	Actual or from Indiana TRM v2.2
DAYS	Varies	Actual or from Indiana TRM v2.2
CF	0.84	Indiana TRM v2.2
HOURS	Varies	Actual or from Indiana TRM v2.2

VFD AIR COMPRESSORS

VFD air compressor projects should be calculated using the methodologies outlined in the National Renewable Energy Laboratory's Chapter 22: Compressed Air Evaluation Protocol document.[76]

[76] From: https://www.nrel.gov/docs/fy17osti/68577.pdf

DOMESTIC HOT WATER HEATERS

The evaluation team used the following equations to calculate natural gas energy savings for water heater measures. There are no electrical energy savings or summer peak coincidence demand savings associated with this measure.

$$therm\ savings = GPD * 365 * 8.3 * \left(\frac{1}{EFF_{base}} - \frac{1}{EFF_{EE}}\right) * \frac{TD}{100{,}000}$$

Where:

GPD = Average daily hot water consumption, gallons per day

365 = Days per year

8.3 = Constant, Btu/gal-°F

EFF_{base} = Baseline heating efficiency, 80%

EFF_{EE} = Actual heating efficiency of installed equipment

TD = Temperature differential between the hot water setpoint and average groundwater temperature for the region, °F

100,000 = Conversion factor from Btu to therms

Table 445 lists the assumptions and source of each assumption for the water heater measure savings calculations.

TABLE 445. *EX POST* VARIABLE ASSUMPTIONS FOR WATER HEATERS

INPUT	VALUE	SOURCE
GPD	Varies	From TRM or based on actual usage of site
EFF_{base}	80%	ASHRAE 90.1 2007
EFF_{EE}	Varies	Equipment specifications
TD	Varies	Hot water setpoint is actual temperature the water heater operates at. The groundwater temperature is from Indiana TRM v2.2 based on the region the site is located.

C&I SELF-REPORT FREERIDERSHIP METHODOLOGY

This appendix describes the team's methodology to estimate freeridership for the Prescriptive, Custom, SBDI and New Construction programs.

INTENTION FREERIDERSHIP SCORE

The evaluation team estimated *intention* freeridership scores for all participants based on their responses to the *intention*-focused freeridership questions. Table 446 illustrates how initial responses are translated into whether the response is "yes," "no," or "partially" indicative of freeridership (in parentheses). The value in brackets is the scoring decrement associated with each response option. Each participant freeridership score starts with 100%, which the evaluation team then decrement based on their responses to the ten questions.

TABLE 446. RAW SURVEY RESPONSES TRANSLATION TO INTENTION FREERIDERSHIP SCORING MATRIX TERMINOLOGY AND SCORING

I1. WITHOUT THE INCENTIVE AND PROGRAM INFORMATION FROM NIPSCO WOULD YOU HAVE PURCHASED [MEASURE]?	I2. [IF I2=YES OR DK] DID YOUR ORGANIZATION HAVE SPECIFIC PLANS TO PURCHASE AND INSTALL THE [MEASURE] BEFORE LEARNING ABOUT THE NIPSCO PROGRAM INCENTIVE?	I3. [IF I2=YES] HAD YOUR ORGANIZATION ALREADY ORDERED OR PURCHASED THE [MEASURE] BEFORE YOU HEARD ABOUT THE PROGRAM?	I4. [ASK IF I2= YES] PRIOR TO HEARING ABOUT THE PROGRAM INCENTIVE, WAS THE PURCHASE OF THE [MEASURE] INCLUDED IN YOUR ORGANIZATION'S CAPITAL BUDGET?	I5. [ASK IF I1=NO] SO, WITHOUT THE INCENTIVE AND PROGRAM INFORMATION FROM NIPSCO, YOU WOULD NOT HAVE INSTALLED [MEASURE] AT ALL. IS THAT CORRECT?	I6. AND WOULD YOU HAVE INSTALLED THE SAME QUANTITY OF [MEASURE] WITHOUT THE INCENTIVE AND PROGRAM INFORMATION FROM NIPSCO?	I7. WITHOUT THE INCENTIVE AND PROGRAM INFORMATION FROM NIPSCO, WOULD YOU HAVE PURCHASED [MEASURE] THAT WAS JUST AS EFFICIENT, MORE EFFICIENT, OR LESS EFFICIENT THAN THE ONE YOU PURCHASED?	I8. WITHOUT THE INCENTIVE AND PROGRAM INFORMATION FROM NIPSCO, WHEN WOULD YOU HAVE INSTALLED THIS EQUIPMENT WITHOUT THE PROGRAM? WOULD YOU HAVE INSTALLED IT ...	I9. DOES YOUR ORGANIZATION USE A MINIMUM ACCEPTABLE RETURN ON INVESTMENT (ROI) OR HURDLE RATE WHEN SELECTING ENERGY-EFFICIENCY PROJECTS?	I11. WHICH OF THE FOLLOWING STATEMENTS DO YOU MOST AGREE WITH REGARDING THE RELATIONSHIP BETWEEN THE PROGRAM INCENTIVE AND THE MINIMUM ACCEPTABLE RETURN ON INVESTMENT (ROI) FOR THIS PROJECT?
Yes (Yes) [-0%]	Yes (Yes) [-0%]	Yes (Yes) [100% Intention FR Score assigned]	Yes (Yes) [-0%]	Yes/correct, would not have installed anything without the program incentive (No) [-100%]	Yes, same quantity (Yes) [-0%]	Just as efficient (Yes) [-0%]	In the same year (Yes) [-0%]	Yes (No) [-0%]	The program incentive was key to meeting the ROI (No) [-50%]
No (No) [-50%]	No (No) [-50%]	No (No) [-50%]	No (No) [-50%]	No/not correct, would have installed something without the incentive (Yes) [-0%]	No, would have installed fewer (No) [-50%]	More efficient (Yes) [-0%]	Within one to two years (Partial) [-25%]	Yes (Yes) [-0%]	The program incentive was not key to meeting the ROI (Yes) [-0%]
Don't know (Partial) [-25%]	Don't know (Partial) [-25%]	Don't know (Partial) [-0%]	Don't know (Partial) [-25%]	Don't know (Partial) [-25%]	No, would have installed more (Yes) [-0%]	Less efficient (Yes) [-100%]	Within three to five years (No) [-100%]	Don't know (Partial) [-0%]	Don't know (Partial) [-0%]
-	-	-	-	-	Don't know (Partial) [-25%]	Don't know (Partial) [-25%]	In more than five years (No) [-100%]	-	-
-	-	-	-	-	-	-	Never (No) [-100%]	-	-
-	-	-	-	-	-	-	Don't know (Partial) [-25%]	-	-

INFLUENCE FREERIDERSHIP SCORE

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

- The NIPSCO incentive
- Information provided by NIPSCO on energy savings opportunities
- Information from a contractor or vendor
- 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 447.

TABLE 447. INTENTION FREERIDERSHIP SCORING

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

FINAL FREERIDERSHIP SCORE

The evaluation team calculated the arithmetic mean of the *ex post* gross program savings weighted intention and influence freeridership scores to estimate a final freeridership value for a program.

APPENDIX 14: COMMERCIAL AND INDUSTRIAL (C&I) ONLINE MARKETPLACE PROGRAM

ALGORITHMS AND ASSUMPTIONS

This appendix contains the assumptions used in electric savings, demand reduction, and gas savings algorithms for the measures within the C&I Online Marketplace program. The evaluation team examined each assumption behind the algorithms to capture savings and compared it against the 2015 Indiana TRM (v2.2), as well as other state and industry approaches. Detailed information on the analysis and supporting assumptions for the C&I Online Marketplace program measures are included within this appendix:

- Advanced Power Strip Tier 1
- Bathroom Aerator
- Kitchen Aerator
- Pre-Rinse Spray Valve
- LED Bulbs
- LED Exit Sign
- LED Desk Lamp

ADVANCED POWER STRIP TIER 1

The evaluation team used the following equations from the Illinois TRM (v9.0) p. 673 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 weekday 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.
- ISR = in-service rate. The Illinois TRM (v9.0) specifies 0.969 for commercial direct install application; however, 0.4 was used in the *ex ante* calculation with no reference as to the source.

Table 448 lists the assumptions and source of each assumption for advanced power strip tier 1 measure savings calculations.

TABLE 448. *EX POST* VARIABLE ASSUMPTION FOR ADVANCED POWER STRIP TIER 1

INPUT	VALUE	SOURCE
kWwkday	0.0315	Illinois TRM (v9.0) pg. 673
kWwkend	0.00617	Illinois TRM (v9.0) pg. 673
hrswkday	106	Illinois TRM (v9.0) pg. 673
hrswkend	62	Illinois TRM (v9.0) pg. 673
hrswkdayopen	50	Illinois TRM (v9.0) pg. 673
hrswkendopen	0	Illinois TRM (v9.0) pg. 673
weeks/year	52.2	Illinois TRM (v9.0) pg. 673
ISR	83%	2021 NIPSCO C&I Online Marketplace Customer Survey

KITCHEN AND BATHROOM FAUCET AERATORS, AND KITCHEN PRE-RINSE SPRAY VALVE

The evaluation team used the following equations from Illinois TRM (v9.0) p. 131 to calculate electric energy, peak demand, and natural gas energy savings for low flow kitchen and bathroom faucet aerators:

$$\Delta kWh = ISR * \%ElectricDHW * -GPM_{base} - \frac{GPM_{low\ flow}}{GPM_{base}} * Usage * EPG\ electric$$

$$\Delta kW = (kWh/Hours) * CF$$

$$\Delta therms = ISR * \%GasDHW * \left(GPM_{base} - \frac{GPM_{low\ flow}}{GPM_{base}}\right) * Usage * EPG\ gas$$

Where:

- ISR = in-service rate.
- % ElectricDHW = specified as 100% for electric DHW heaters and 0% for gas DHW heaters in the TRM; however, it was used as the fuel saturation ratio in *ex ante* and *ex post* calculation. *Ex ante* utilized 22% electric and 78% gas. *Ex post* utilized 42% electric and 58% gas.
- % Gas DHW = specified as 100% for electric DHW heaters and 0% for gas DHW heaters in the TRM; however, it was used as fuel saturation ratio in *ex ante* and *ex post* calculation. *Ex ante* utilized 22% electric and 78% gas. *Ex post* utilized 42% electric and 58% gas.
- GPM_{base} = gallons per minute of baseline faucet aerator. As used or 1.39.
- $GPM_{low\ flow}$ = gallons per minute of low flow faucet aerator. As used (1.0 provided in kit).
- Usage = default usage of annual gallons mixed water per faucet.
- EPG Electric = energy per gallon of mixed water used by faucet, incorporates specific weight of water, heat capacity of water, water inlet temperature, water outlet temperature, and thermal recovery efficiency of electric water heater.
- EPG Gas = energy per gallon of mixed water used by faucet, incorporates specific weight of water, heat capacity of water, water inlet temperature, water outlet temperature, and thermal recovery efficiency of gas water heater.

- Hours = annual DHW recovery hours for faucet use, dependent on space type.
- CF = Coincidence factor. Table 449 lists the assumptions and source of each assumption for kitchen and bathroom faucet aerator measure savings calculations.

TABLE 449. *EX POST* VARIABLE ASSUMPTION FOR KITCHEN AND BATHROOM FAUCET AERATORS

INPUT	VALUE	SOURCE
GPM_{base} (Kitchen)	2.75	Illinois TRM (v9.0) pg. 131
GPM_{base} (Bathroom)	1.39	Illinois TRM (v9.0) pg. 131
$GPM_{low\ flow}$ (Kitchen)	1.5	Actual
$GPM_{low\ flow}$ (Bathroom)	1.0	Actual
ISR (Bathroom and Kitchen)	42%	2021 NIPSCO C&I Online Marketplace survey
ISR (Pre Rinse Spray)	33%	2021 NIPSCO C&I Online Marketplace survey
% Electric DHW	42%	2021 NIPSCO C&I Online Marketplace survey
% Gas DHW	58%	2021 NIPSCO C&I Online Marketplace survey
Usage (Office)	2,500	Illinois TRM (v9.0) pg. 131.
Usage (Retail)	3,650	Illinois TRM (v9.0) pg. 131.
Usage (Restaurant)	12,674.5	Illinois TRM (v9.0) pg. 131. Average of fast food (9,581 gallons) and sit-down restaurant (15,768 gallons)
EPG Electric (Bathroom)	0.0795	Illinois TRM (v9.0) pg. 131. Assumes specific weight of water 8.33, water temp supply 54.1 degrees F, water temp out 86 degrees F, and RE Electric 95% recovery efficiency of electric water heater
EPG Electric (Kitchen)	0.0969	Illinois TRM (v9.0) pg. 131. Assumes specific weight of water 8.33, water temp supply 54.1 degrees F, water temp out 93 degrees F, and RE Electric 95% recovery efficiency of electric water heater
EPG Electric (Pre Rinse)	0.3	Illinois TRM (v9.0) pg. 131. Assumes specific weight of water 8.33, water temp supply 54.1 degrees F, water temp out 124.1 degrees F, and RE Electric 95% recovery efficiency of electric water heater
EPG Gas (Bathroom)	0.003966	Illinois TRM (v9.0) pg. 131. Assumes specific weight of water 8.33, water temp supply 54.1 degrees F, water temp out 86 degrees F, and RE Gas 67% recovery efficiency of gas water heater
EPG Gas (Kitchen)	0.004836	Illinois TRM (v9.0) pg. 131. Assumes specific weight of water 8.33, water temp supply 54.1 degrees F, water temp out 93 degrees F, and RE Gas 67% recovery efficiency of gas water heater
EPG Gas (Pre Rinse)	0.008703	Illinois TRM (v9.0) pg. 131. Assumes specific weight of water 8.33, water temp supply 54.1 degrees F, water temp out 124.1 degrees F, and RE Gas 67% recovery efficiency of gas water heater
Hours (Office)	24	Illinois TRM (v9.0) pg. 131
Hours (Retail)	36	Illinois TRM (v9.0) pg. 131
Hours (Restaurant)	123	Illinois TRM (v9.0) pg. 131 Average of fast food (93 hrs.) and sit-down restaurant (153 hrs.)
CF (office)	0.0064	Illinois TRM (v9.0) pg. 131
CF (Retail)	0.0043	Illinois TRM (v9.0) pg. 131
CF (Restaurant)	0.0134	Illinois TRM (v9.0) pg. 131. Average of fast food (0.0084) and sit-down restaurant (0.0184)

LED BULBS, LED EXIT SIGN, AND LED DESK LAMP

The team used the following equations from the 2015 Indiana TRM (v2.2) p. 492 and 509 to calculate electric energy and peak demand savings, as well as natural gas energy penalties, for all LED bulbs, including the A19 shape, BR30, candelabra base, exit signs, and linear tubes. The following equation also applies to the LED desk lamp.

$$\Delta kWh = (FS_{Gas} * kWh_{Gas}) + ((1 - FS_{Gas}) * kWh_{Elec})$$

$$\Delta kWh_{Gas} = \frac{(W_{base} - W_{LED}) * (ISR * Hours) * (1 + WHF_{eGasHeat})}{1{,}000}$$

$$\Delta kWh_{Elec} = FS_{Gas} * \frac{(W_{base} - W_{LED}) * (ISR * Hours) * (1 + WHF_{eElecHeat})}{1{,}000}$$

$$\Delta kW = (FS_{Gas} * kW_{Gas}) + ((1 - FS_{Gas}) * kW_{Elec})$$

$$\Delta kW_{Gas} = \frac{(W_{base} - W_{LED}) * Coincidence\ Factor * ISR * (1 + WHF_{dGasHeat})}{1{,}000}$$

$$\Delta kW_{Elec} = \frac{(W_{base} - W_{LED}) * Coincidence\ Factor * ISR * (1 + WHF_{dElecHeat})}{1{,}000}$$

$$\Delta therms = FS_{Gas} * \frac{(W_{base} - W_{LED}) * (ISR * Hours) * \left(WHF_{g}\right)}{1{,}000}$$

Where:

- FSgas = Fuel saturation of gas/electric ratio.
- W_{base} = Wattage of the bulb being replaced, W
- W_{LED} = Wattage of the LED bulb, W
- Hours = Average hours of use per year
- $WHF_{e\ GAS\ HEAT}$= Waste heat factor for energy to account for HVAC interactions with lighting
- $WHF_{e\ ELEC\ HEAT}$= Waste heat factor for energy to account for HVAC interactions with lighting
- $WHF_{d\ GAS\ HEAT}$ = Waste heat factor for demand to account for HVAC interactions with lighting
- $WHF_{d\ ELEC\ HEAT}$ = Waste heat factor for demand to account for HVAC interactions with lighting
- WHF_{g} = Waste heat factor for gas to account for HVAC interactions with lighting
- Coincidence Factor = Summer peak coincidence factor
- ISR = In-service rate, or fraction of units that get installed
- 365 = Number of days per year, days/yr.
- 1,000 = Constant to convert watts to kW

Table 450 lists the input assumptions and source of each assumption for the LED measure savings calculations.

TABLE 450. *EX POST* VARIABLE ASSUMPTIONS FOR LEDS

INPUT	VALUE	SOURCE
FS_{Gas}	85%	2021 NIPSCO C&I Online Marketplace customer survey. 85% gas heating source versus 15% electric heating source
W_{base} for A19 60-watt equivalent (Globe LED, kit)	43	Illinois TRM (v9.0) pg. 492.
W_{base} for Filament 60-watt equivalent (Filament LED, kit)	43	Illinois TRM (v9.0) pg. 492.
W_{base} for Filament Candle E12 base (Decorative/ Mini LED)	25	Illinois TRM (v9.0) pg. 492.
W_{base} for R30 day light (BR/Par LED, kit)	65	Illinois TRM (v9.0) pg. 492.
W_{base} for exit sign (Specialty LED, kit)	7	Illinois TRM (v9.0) pg. 509.
W_{base} for Linear tube LED (Linear LED)	28.2	Illinois TRM (v9.0) pg. 492.
W_{base} for LED Desk Lamp (Specialty LED, kit)	25	Ch. 6 Residential Lighting Evaluation Protocol, UMP

INPUT	VALUE	SOURCE
W_{LED} for A19 60-watt equivalent (Globe LED, kit)	9	Actual installed wattage
W_{LED} for Filament 60-watt equivalent (Filament LED, kit)	8	Actual installed wattage
W_{LED} for Filament Candle E12 base (Decorative/ Mini LED)	4	Actual installed wattage
W_{LED} for R30 day light (BR/Par LED, kit)	9.5	Actual installed wattage
W_{LED} for exit sign (Specialty LED, kit)	4	Actual installed wattage
W_{LED} for Linear tube LED (Linear LED)	16	Actual installed wattage
W_{LED} for LED Desk Lamp (Specialty LED, kit)	3.2	Actual installed wattage
Hours (Office)	3253	Indiana TRM (v2.2)
Hours (Retail)	2935	Illinois TRM (v9.0) pg. 509. This value appears to be more specific than Indiana TRM (v2,2) to the likely type of retail that this kit is designed for, therefore utilized over 2015 Indiana TRM (v2.2)
Hours (Restaurant)	5544	Indiana TRM (v2.2)
$WHF_{e\ Gas\ Heat}$	0.122	Indiana TRM (v2.2), assumes South Bend location, small office
$WHF_{e\ Electric\ Heat}$	-0.169	Indiana TRM (v2.2), assumes South Bend location, small office
$WHF_{d\ Gas\ Heat}$	0.200	Indiana TRM (v2.2), assumes South Bend location, small office
$WHF_{d\ Electric\ Heat}$	0.200	Indiana TRM (v2.2), assumes South Bend location, small office
WHF_{g}	-0.0015	Indiana TRM (v2.2), assumes South Bend location, small office
Coincidence Factor (Office)	0.76	Indiana TRM (v2.2)
Coincidence Factor (Retail)	0.84	Indiana TRM (v2.2)
Coincidence Factor (Restaurant)	0.92	Indiana TRM (v2.2)
Coincidence Factor (Exit Signs)	1.0	Indiana TRM (v2.2)
ISR (A19 globe, A19 Filament)	76%	2021 NIPSCO C&I Online Marketplace customer survey
ISR (Filament candelabra E12 base)	59%	2021 NIPSCO C&I Online Marketplace customer survey
ISR (BR30)	75%	2021 NIPSCO C&I Online Marketplace customer survey
ISR (Linear LED)	82.5%	Illinois TRM (v9.0) pg. 492. 2021 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)	17.7%	2021 NIPSCO C&I Online Marketplace customer survey
ISR (Desk Lamp)	98.2%	2021 NIPSCO C&I Online Marketplace customer survey