

INDIANA GAS COMPANY, INC.

d/b/a VECTREN ENERGY DELIVERY OF INDIANA, INC.

A CENTERPOINT ENERGY COMPANY

(VECTREN NORTH)

IURC CAUSE NO. 45468

DIRECT TESTIMONY

OF

RINA H. HARRIS

DIRECTOR, ENERGY EFFICIENCY

ON

NATURAL GAS ENERGY EFFICIENCY

2022-2025 POLICY AND PROGRAMS

SPONSORING PETITIONER'S EXHIBIT NO. 14,

ATTACHMENTS RHH-1 THROUGH RHH-4

FILED

December 18, 2020

**INDIANA UTILITY
REGULATORY COMMISSION**

Glossary of Acronyms

2022 – 2025 EE Plan	2022 – 2025 Energy Efficiency Plan
AFUE	Annual Fuel Utilization Efficiency
CAC	Citizens Action Coalition
CenterPoint	CenterPoint Energy, Inc.
C&I	Commercial and Industrial
Company	Indiana Gas Company, Inc. d/b/a Vectren Energy Delivery of Indiana, Inc.
DLC	Direct Load Control
DR	Demand Response
DSM	Demand Side Management
EMI	EMI Consulting
EE	Energy Efficiency
EER	Energy Efficiency Rider
EM&V	Evaluation, Measurement & Verification
GDS	GDS Associates, Inc.
HEA	Home Energy Assessment
IQW	Income Qualified Weatherization
IURC or Commission	Indiana Utility Regulatory Commission
MPS	Market Potential Study
MPSAP	Market Potential Study and Action Plan
NTG	Net to Gross ratio
Petitioner	Indiana Gas Company, Inc. d/b/a Vectren Energy Delivery of Indiana, Inc.
OUCC	Office of Utility Consumer Counselor
RIM	Ratepayer Impact Measure
SEM	Strategic Energy Management
TRC	Total Resource Cost
TRM	Technical Resource Manual
UCT	Utility Cost test
Vectren	Vectren Corporation
Vectren North	Indiana Gas Company, Inc. d/b/a Vectren Energy Delivery of Indiana, Inc.
Vectren Ohio	Vectren Energy Delivery of Ohio, Inc.
Vectren South	Southern Indiana Gas and Electric Company d/b/a Vectren Energy Delivery of Indiana, Inc.
VOB	Vectren Oversight Board

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DIRECT TESTIMONY OF RINA H. HARRIS

1 **I. INTRODUCTION**

2

3 **Q. Please state your name and business address.**

4 A. My name is Rina H. Harris. My business address is 211 NW Riverside Drive,
5 Evansville, Indiana, 47708.

6

7 **Q. By whom are you employed?**

8 A. I am employed by Vectren Corporation ("Vectren"), a wholly-owned subsidiary of
9 CenterPoint Energy, Inc. ("CenterPoint").

10

11 **Q. On whose behalf are you testifying in this proceeding?**

12 A. I am testifying on behalf of Indiana Gas Company, Inc. d/b/a Vectren Energy Delivery
13 of Indiana, Inc. ("Petitioner", "Vectren North" or "the Company"), which is a subsidiary
14 of Vectren.

15

16 **Q. What is your role with respect to Petitioner Vectren North?**

17 A. I am the Director of Energy Efficiency ("EE") for Vectren, which is the parent company
18 of Petitioner. I have the same role with two other utility subsidiaries of Vectren –
19 Southern Indiana Gas and Electric Company d/b/a Vectren Energy Delivery of Indiana,
20 Inc. ("Vectren South") and Vectren Energy Delivery of Ohio, Inc. ("Vectren Ohio").

21

22 **Q. Please describe your educational background.**

23 A. I received a Bachelor of Science degree in Public Affairs from Indiana University in

1 2005. I also received a Master of Science degree in Public Affairs from Indiana
2 University in 2007.

3

4 **Q. Please describe your professional experience.**

5 A. I have been employed with Vectren since 2008 in a few different positions. Previously,
6 I was the Manager of Gas Conservation and Demand Side Management ("DSM"), with
7 responsibility for the management of all aspects of the gas conservation portfolio for
8 Vectren North, Vectren South and Vectren Ohio, and oversight over all Evaluation and
9 Planning activities. Prior to that, I was the Supervisor of DSM Evaluation and Planning,
10 with responsibility for the management of all electric and gas evaluation activities,
11 program planning, and conservation related market research. I have also worked in
12 Market Research, with a focus on conservation initiatives, related to demographic
13 analysis, segmentation, targeted marketing, and other special projects.

14

15 **Q. What are your present duties and responsibilities as Director of Energy**
16 **Efficiency?**

17 A. I am responsible for managing all aspects of gas and electric EE and DSM programs
18 for CenterPoint's Indiana and Ohio regulated utilities, including the Direct Load Control
19 ("DLC") program. In this position, I oversee all aspects of implementation, planning,
20 marketing, execution, evaluation and reporting of the EE and Demand Response
21 ("DR") Programs.

22

23 **Q. Have you ever testified before any state regulatory commission?**

24 A. Yes. Most recently, I testified on behalf of Vectren South in its general gas rate case
25 proceeding under Cause No. 45447. I testified in Cause No. 45387, where Vectren

1 South sought approval to continue its electric energy efficiency programs. I testified in
2 Cause No. 43405-DSMA17, where Vectren South sought approval to recover costs
3 associated with customer participation in Company sponsored EE and DR (including
4 DLC) programs and lost revenues resulting from implementation of approved
5 programs. I testified in Cause No. 45222, where Vectren requested an extension of its
6 EE Gas Programs and the EER through the issuance of an Order in this general rate
7 case. I testified in Cause No. 45052, where Vectren South proposed to construct a
8 combined cycle gas turbine. I testified in Cause No. 44927, where Vectren South
9 sought approval of its 2018 – 2020 Energy Efficiency Plan. I have also testified in
10 Vectren South's Cause No. 44645 remand case, where Vectren South received
11 approval to recover lost revenues associated with the Vectren South 2016 – 2017
12 Electric DSM Plan. I testified in Cause No. 44598, where Vectren North and Vectren
13 South, collectively, sought approval for their Indiana gas EE programs, including
14 integrated gas and electric programs.

15

16 **Q. What is the purpose of your testimony in this proceeding?**

17 A. Similar to the Vectren South request in its pending rate case, Cause No. 45447, the
18 purpose of my testimony is to: (1) provide support for the extension of the Company's
19 2020 energy efficiency plan and associated Energy Efficiency Rider ("EER" or "EE
20 Rider") through December 31, 2021; (2) provide support for approval of the Company's
21 2022 – 2025 energy efficiency plan ("2022 – 2025 Plan"); (3) briefly discuss Vectren's
22 current natural gas energy efficiency initiatives; (4) describe the role of its Market
23 Potential Study and Action Plan ("MPSAP"); and (5) discuss the reasons why
24 continuation of natural gas energy efficiency programs is in the public interest and why
25 it should be approved as presented, without any modifications.

1 **Q. Please summarize the relief Vectren is seeking in this proceeding.**

2 A. In Cause No. 44598, Vectren received authority to continue its energy efficiency
3 programs for program years 2016-2019. Vectren subsequently received approval in
4 Cause No. 45222 to continue offering its current EE programs until the later of
5 December 31, 2020 or the date an Order is issued in its next base rate case. Vectren
6 anticipates receiving an Order in this Cause in late 2021, and its 2022 – 2025 Plan will
7 not go into effect until January 1, 2022. As I will explain in my testimony, the 2022 –
8 2025 Plan is largely a continuation of the current plan, and the current plan is already
9 authorized to remain in place through most of 2021. Since program budgets are
10 presented on a calendar year basis and since we seek to avoid an interruption in our
11 programs, Vectren is therefore seeking authority to extend its 2020 EE program and
12 associated EE Rider through December 31, 2021, at which point its 2022 – 2025 Plan
13 (described below) will go into effect. This extension will also be consistent with and
14 better mesh with our EER filings. Vectren is also requesting authority to offer the
15 energy efficiency portfolio of programs defined in its 2020 – 2025 MPSAP for program
16 years 2022 – 2025. The 2022 – 2025 Plan (or “Action Plan”) is defined as beginning
17 January 1, 2022 through December 31, 2025 with the goal of reducing residential,
18 commercial and industrial (“C&I”) customer natural gas usage by approximately 3
19 million therms annually over the four-year term. The proposed Action Plan consists of
20 twelve (12) residential and three (3) C&I energy efficiency programs. Apart from Action
21 Plan approval, the Company seeks to recover all costs associated with offering the
22 2022 - 2025 Plan through the EE Rider, which includes recovery of DSM Program
23 costs, including program delivery and administrative costs, and costs associated with
24 evaluation, measurement and verification (“EM&V”). The Company also seeks
25 continuation of decoupling in connection with approval of the Action Plan, as described

1 by Petitioner's Witness Katie J. Tieken.

2

3 **Q. Is Vectren requesting continuation of EE programs for all eligible Indiana gas**
4 **ratepayers?**

5 A. Yes. Vectren is requesting authority to continue the energy efficiency portfolio for all
6 eligible ratepayers, as described later in testimony. Vectren does not plan EE
7 programs for its North and South customers separately, as the program offerings and
8 associated incentives are available to all eligible Indiana gas ratepayers. For this
9 reason, Vectren will request authority to continue Indiana gas energy efficiency
10 programs, and associated cost recovery through its energy efficiency rider ("EER"), in
11 this proceeding and in the pending Vectren South rate case proceeding Cause No.
12 45447.

13

14 **Q. Are you sponsoring any attachments in this proceeding?**

15 A. Yes. I am sponsoring the following attachments in this proceeding:

- 16 • Petitioner's Exhibit No. 14, Attachment RHH-1: 2020 Gas DSM Operating Plan
- 17 • Petitioner's Exhibit No. 14, Attachment RHH-2: Historical
18 Scorecards/Performance
- 19 • Petitioner's Exhibit No. 14, Attachment RHH-3: 2019 Vectren Evaluation,
20 Measurement, and Verification Report Results
- 21 • Petitioner's Exhibit No. 14, Attachment RHH-4: 2022 – 2025 MPSAP

22

23 **Q. Were these attachments prepared by you or under your supervision?**

24 A. Yes, they were.

1 **II. BACKGROUND**

2

3 **Q. Briefly describe Vectren's energy efficiency initiatives.**

4 A. Vectren has delivered natural gas energy efficiency programs since December 1,
5 2006, following the Commission's issuance of a Final Order in consolidated Cause
6 Nos. 42943 and 43046 that approved the first set of natural gas EE Programs in
7 Indiana. Subsequently, the Commission has approved the continuation and extension
8 of natural gas energy efficiency programs in Cause Nos. 44019, 44598 and 45222.

9

10 Since launching the first portfolio of EE Programs, Vectren has created a culture of
11 conservation and energy efficiency within its workforce, and has worked with trade
12 allies, customers, and other stakeholders to support efficiency efforts. Furthermore,
13 this sentiment is cultivated by CenterPoint, and supported by its rich history in offering
14 energy efficiency programs since 1992. Vectren has also focused its overall customer
15 relations efforts on the promotion of energy efficiency. Vectren utilizes sponsorships,
16 bill inserts, events, media and other forms of customer communication to promote its
17 EE Programs and focus on the benefits of energy efficiency. Since energy efficiency
18 programs are seasonal in nature, Vectren will continue to coordinate its energy
19 efficiency program marketing seasonally through the use of a variety of media
20 channels including network and cable television, radio, digital/online, bill inserts, bill
21 messages, customer e-newsletters, print publications, direct mail, etc.

22

23 **Q. Does Vectren have authority to continue programs in 2021?**

24 A. Yes, in part. As described in the above referenced Orders in Cause Nos. 44598 and
25 45222, the terms of Vectren's EE Settlement for its 2016 – 2019 Programs and 2020

1 Program extension, and associated EER will remain in effect until the later of
2 December 31, 2020 or the date of the rate case Orders to ensure EE Gas Programs
3 do not lapse until the date of the rate case Orders.

4

5 **Q. What is Vectren North proposing with respect to any period of time between the**
6 **issuance of an Order in this case and January 1, 2022?**

7 **A.** As I noted, our current plan continues through the issuance of an Order in this Cause,
8 and it would be expected that the Order in this Cause may be issued in late 2021.
9 Therefore, Vectren North is requesting authority in this Cause to extend the 2020
10 program (which will be in place for most of 2021 as a result of the Order in Cause No.
11 45222) and the associated EER through the end of 2021. The 2022 – 2025 Plan will
12 begin January 1, 2022.

13

14 **Q. Briefly describe the Orders in Cause Nos. 44598 and 45222, specifically the**
15 **terms of Vectren's EE Settlement for continuation of 2016-2019 programs and**
16 **continuation of its 2020 programs.**

17 **A.** Vectren received authority to continue energy efficiency programs consistent with its
18 MPSAP for program years 2016 – 2019 on September 9, 2015. Subsequently, on April
19 9, 2019, Vectren filed for authority to continue to offer its EE programs, consistent with
20 its updated MPSAP. The Commission issued an Order on July 17, 2019 granting
21 approval to continue offering EE programs until the later of December 31, 2020 or the
22 date an order is issued in the next base rate case (for Vectren North, this proceeding).
23 Given a Rate Order will not be issued prior to the start of the 2021 EE program year,
24 Vectren will extend its 2020 programs and associated EER, and any Vectren Oversight

1 Board ("VOB")¹ approved modifications to program design, into 2021. Vectren will
2 continue to work with the VOB to offer programs in calendar year 2021.

3

4 **Q. Please describe 2021 EE programs.**

5 A. The 2021 EE Plan will be a continuation of 2020 program offerings. Please see Table
6 RHH-1 for a list of 2021 programs, budget, and estimated savings. Detailed program
7 descriptions are available in Petitioner's Exhibit No. 14, Attachment RHH-1. Table
8 RHH-1 below program designs may be slightly modified per VOB approval as Vectren
9 finalizes its 2021 Plan.

¹ VOB consists of the Indiana Office of Utility Consumer Counselor ("OUCC") and Citizens Action Coalition ("CAC") as voting members.

Table RHH-1 – 2021 EE Plan (2020 Plan Continuation)

Residential Programs	Participation	Energy Savings (Therms)	Budget	TRC	UCT
Residential Prescriptive	13,055	1,438,176	\$3,661,906	1.03	1.64
Residential New Construction	885	305,177	\$529,005	1.00	2.25
Home Energy Assessment	400	28,793	\$70,720	2.90	2.72
Income Qualified Weatherization - South	900	57,322	\$777,446	0.40	0.40
Energy Efficient Schools - South	2,600	32,595	\$85,022	1.53	1.53
Residential Behavioral Savings - South	26,935	283,100	\$104,852	1.34	1.34
Multi-Family Direct Install - Statewide	1,026	68,652	\$461,365	1.46	1.46
Targeted Income (Gas – North)	101	15,023	\$100,220	1.31	1.31
HEHC Integrated – Duke (Gas - North)	1,122	49,368	\$191,044	2.01	2.01
Neighborhood Program Duke (Gas - North)	1,000	130,440	\$198,851	5.10	5.10
Residential Sector Total	48,024	2,408,647	\$6,180,431	1.11	1.63
Commercial Programs	Participation	Energy Savings (Therms)	Budget	TRC	TRC
Commercial Prescriptive - VEDI	1,067	340,000	\$924,264	3.40	2.64
Commercial Custom - VEDI	53	483,000	\$1,084,144	1.97	2.88
Small Business Energy Solutions	15	3,000	\$12,292	1.10	1.54
Commercial Sector Portfolio	1,135	826,000	\$2,020,700	2.41	2.76
Commercial & Residential Sub-Total	49,159	3,234,647	\$8,201,130		
Portfolio Costs					
Contact Center			\$130,000		
Online Audit			\$232,435		
Customer Outreach			\$534,863		
Evaluation			\$409,429		
Total Portfolio Costs			\$1,306,727		
Total Other Cost			\$341,100		
Total Portfolio & Other Costs			\$1,647,827		
Total Portfolio	49,159	3,234,647	\$9,848,958	1.20	1.59

1 **Q. What EE Programs does Vectren currently offer?**

2 A. Vectren currently offers the following natural gas EE Programs to residential and
3 general service customers, included in Petitioner's Exhibit No. 14, Attachment RHH-1
4 (2020 Operating Plan):

5

6 Residential (*indicates integrated with Vectren or Duke Electric):

- 1 • Residential Prescriptive*
- 2 ○ Midstream Pilot
- 3 ▪ Natural Gas Furnaces (>95% AFUE)
- 4 ▪ Natural Gas Furnaces (>97% AFUE)
- 5 • Residential New Construction*
- 6 • Home Energy Assessment (HEA)*
- 7 • Income Qualified Weatherization (IQW)*
- 8 • Energy Efficient Schools*
- 9 • Residential Behavioral Savings*
- 10 • Multi-Family Direct Install
- 11 • Targeted Income
- 12 • Home Energy House Call*
- 13 • Neighborhood Program*

14 General Service (*indicates integrated with Vectren or Duke Electric):

- 15 • Commercial Prescriptive
- 16 • Commercial Custom*
- 17 ○ Custom Program
- 18 ○ Commercial New Construction
- 19 ○ Building Tune Up
- 20 ○ Strategic Energy Management (SEM)
- 21 • Small Business Energy Solutions*

22

23 **Q. Briefly describe the performance results of Vectren's current EE Programs.**

24 A. Vectren's natural gas energy efficiency programs consistently have performed well
25 and either have met or exceeded the annual savings goals set by the VOB. Please

1 see Petitioner's Exhibit No. 14, Attachment RHH-2 for a copy of Vectren's historical
2 performance scorecards. The EM&V results for 2019 indicate the programs realized
3 95% of verified savings and a portfolio net-to-gross ratio ("NTG") of 77%. Please see
4 Petitioner's Exhibit No. 14, Attachment RHH-3 for a copy of Vectren's 2019 Gas
5 Program EM&V Report results. These favorable results are consistent with historical
6 evaluated results. Cumulatively through 2019, approximately 178.2 million net therms
7 or 230.6 million gross therms of natural gas have been saved since the programs were
8 first introduced in 2006.

9

10 Furthermore, natural gas EE Programs have been well received by Vectren's
11 customers. As part of a continuous improvement and customer satisfaction focus,
12 Vectren monitors customer program satisfaction (rebate and process) on a monthly
13 basis. Vectren's Evaluation vendor monitors program satisfaction and conducts
14 quarterly customer satisfaction surveys in addition to customer satisfaction by program
15 included in the annual evaluation report. Vectren gas rebate process satisfaction was
16 approximately 98% in 2019. Overall program satisfaction has remained strong, as we
17 hovered in the 98%-99% range between 2016 and 2018. Vectren's Evaluation vendor
18 plans to continue overseeing these monitoring efforts and Vectren will make program
19 process adjustments as needed to ensure customers are satisfied with our programs.

20

21

22 **III. 2022 – 2025 PLAN PROPOSED PROGRAMS**

23

24 **Q. How did Vectren design its proposed natural gas programs?**

25 A. The VOB hired and worked with GDS Associates, Inc. (GDS) and its subcontractor

1 EMI Consulting (EMI) to conduct a MPSAP to design a portfolio of EE Programs for
2 years 2020 – 2025, with a focus on program years 2022 – 2025 for the purposes of
3 this filing. The VOB approved the MPSAP in March 2019.
4

5 **Q. Please describe the results of the 2022 – 2025 MPSAP.**

6 A. In their analysis, GDS determined the potential natural gas savings available in therms
7 and as a percentage of the 2018 sales forecast in Vectren's service territory from 2022
8 through 2025, using five categories of potential savings. **Technical Potential** is the
9 theoretical upper limit of DSM potential and it assumes the adoption of every available
10 measure, regardless of cost. **Economic Potential** represents the adoption of all cost-
11 effective DSM programs, where cost effectiveness is measured by results of the utility
12 cost test ("UCT"). Achievable Potential, maximum and realistic, refines Economic
13 Potential by applying customer participation rates that account for market barriers,
14 customer awareness and attitudes, program maturity and other factors that affect
15 market penetration of DSM measures. **Maximum Achievable Potential** estimates
16 achievable potential on paying incentives equal to 100% of measure incremental costs
17 and aggressive adoption rates, while **Realistic Achievable Potential** estimates
18 achievable potential with Vectren paying incentives as a percent of incremental
19 technology cost. Lastly, **Program Potential** refers to the efficiency potential possible
20 given specific program funding levels and designs. In this Market Potential Study
21 ("MPS"), program potential is captured in the EE Action Plan, which further addresses
22 issues such as market dynamics (net versus gross impacts), timeframe differences,
23 proxy versus specific program delivery approaches, and budget realities. Vectren's
24 2022 – 2025 Action Plan is based on the Program Potential results, as it presents the
25 most realistic forecast of natural gas savings achievement possible in Vectren's

1 service territories. Below in Table RHH-2 is a summary of the EE savings potential as
2 a percent of eligible sales.

3

4

Table RHH-2 – 2022-2025 EE Savings Potential

	2022	2023	2024	2025
Energy Savings (as % of Forecast)				
Technical	7.3%	6.5%	5.8%	5.1%
Economic	5.8%	5.2%	4.6%	4.0%
MAP	4.5%	4.1%	3.7%	3.3%
RAP	1.9%	1.9%	1.9%	1.8%
Program	0.4%	0.4%	0.4%	0.4%

5

6

7 **Q. How was the 2022 – 2025 Action Plan developed?**

8 A. EMI Consulting partnered with GDS to develop an Action Plan once the MPS was
9 complete, resulting in the comprehensive MPSAP document. There were many
10 steps involved in developing the 2022 – 2025 Action Plan. The objective of these
11 steps was to develop a plan based on market-specific information for Vectren,
12 which could be successfully implemented utilizing realistic assessments of
13 achievable market potential.

14

15 The first step in the process was to review the results of the MPS where the
16 Achievable Potential was used to help guide program design. The second step in
17 the program planning process was to obtain input from various sources to help
18 develop and refine a workable plan. Input was obtained from the Vectren program
19 managers who oversee current Vectren programs, as well as from vendors and
20 other implementation partners who operate current programs. They provided
21 suggestions for program changes and enhancements. They also provided technical
22 information and recommendations about measures to include, incentives,

1 estimates of participation and estimated implementation costs. This data provided
2 a foundation for the Action Plan based on actual experience within Vectren's
3 territory.

4

5 Other sources of program information were also considered. The latest available
6 evaluations were used for adjustments to inputs as well as applicable Technical
7 Reference Manuals ("TRMs"). In addition, best practices were researched and
8 reviewed to gain insights into the program design of successful DSM programs
9 implemented at other utilities. Considering all of the above, adjustments were made
10 to delivery mechanisms, measure bundles, participation rates, and other factors as
11 appropriate to fine-tune the data for the four-year program implementation period.
12 Results indicate the program potential savings are approximately .4% of eligible
13 sales, which is consistent with past and current practice. This result is well within
14 industry norms for this step in the planning process.

15

16 The last step was cost benefit analysis. The Action Plan measures and programs
17 were analyzed for cost effectiveness. The outputs include the California Standard
18 Practice Manual results for total resource cost ("TRC"), UCT, Participant and
19 ratepayer impact measure ("RIM") tests. Inputs into the model include participation
20 rates, incentives paid, and energy savings of the measure, life of the measure,
21 implementation costs, administrative costs, and incremental costs to the participant
22 of the high efficiency measure. Financial inputs such as escalation rates and
23 discount rates are provided by Vectren.

1 **Q. Does the 2022 – 2025 Action Plan include DSM programs for all customer**
2 **classes?**

3 A. The 2022 – 2025 Action Plan includes DSM programs for all residential, general
4 service and school/government transportation service customers. Other transport
5 customers are not eligible. Specifically, programs are available to Vectren North
6 customers serviced under rate tariffs: 210, 220, and 225 and Vectren South
7 customers serviced under rate tariffs: 110, 120, and 125.

8

9 **Q. Please describe the proposed programs for which Vectren seeks approval.**

10 A. The 2022 – 2025 Plan is the result of Vectren's recently conducted natural gas MPSAP
11 for years 2020 – 2025 and consistent with its current natural gas EE offering. The Plan
12 is a continuation of current program offerings, while expanding and modifying some
13 program designs and adding new measures. Please see Table RHH-3 for a list of
14 programs included in the proposed Action Plan. While a brief description of some
15 programs is included in my testimony, detailed program descriptions are available in
16 the Plan (Petitioner's Exhibit No. 14, Attachment RHH-1) starting on page 9.

Table RHH-3 – 2022-2025 Plan Programs

Residential Programs	Continuation from Previous Plan	New or Expanded Offering	Pilot Program	Integrated with Vectren or Duke Electric
Residential Prescriptive (Including Midstream)	X			X
Residential New Construction	X			X
Income Qualified Weatherization	X			X
Energy Efficient Schools	X			X
Residential Behavioral Savings	X			X
Multi-Family Direct Install	X			
Targeted Income	X			
Home Energy House Call	X			X
Neighborhood Program	X			X
Home Energy Assessment	X			X
Food Bank		X		X
Home Energy Management Systems		X	X	X

Commercial/Industrial Programs	Continuation from Previous Plan	New or Expanded Offering	Pilot Program	Integrated with Vectren or Duke Electric
Commercial Prescriptive	X	X		X
Commercial Custom	X	X		X
Small Business	X	X		X

1 **Q. Please highlight any program expansions/offerings that have taken place over**
2 **the past five years.**

3 A. Since 2015, Vectren has made several program expansions and enhancements to
4 continue to help customers save energy, keeping up with market shifts and new
5 technologies. Below is an outline of such program expansions and enhancements
6 offered with VOB approval:

7

8

- 1 • **Residential Prescriptive**
- 2 ○ Furnace Tune Up
- 3 ○ Duct Sealing – redesigned delivery of measure
- 4 ○ Natural Gas Water Heaters
- 5 ○ Natural Gas Tankless Water Heaters
- 6 • **Residential New Construction**
- 7 ○ Gold Star HERS rating moved from 65 to 63 (Higher efficiency)
- 8 ○ Platinum Star Plus HERS Index Score 60 – North & South – requires
- 9 builders to reach HERS level PLUS install high-efficient HVAC
- 10 ○ Habitat Kits
- 11 • **Home Energy Assessment – redesigned for better customer experience**
- 12 **using local contractor**
- 13 ○ Smart Thermostats
- 14 ○ Furnace filter whistles
- 15 • **Income Qualified Weatherization**
- 16 ○ Smart Thermostats
- 17 ○ Furnace filter whistles
- 18 ○ Furnace Tune-Up
- 19 ○ Furnace Replacement (upgraded from 92% to 95%)
- 20 ○ Pipe wrap
- 21 ○ Deeper retrofit pilot – redesign for quality over quantity approach and
- 22 deeper retrofit measures and higher H&S budget threshold per home
- 23 • **Multi-Family Direct Install**
- 24 ○ Smart Thermostats
- 25 ○ Furnace filter whistles

1 • **Commercial Prescriptive**

- 2 ○ Midstream HVAC Pilot at distributor level (furnaces & boilers)
- 3 (i) Added in 2019 during planning process based on MPSAP review of
- 4 2020 – 2025 programs
- 5 ○ 97% Annual Fuel Utilization Efficiency (AFUE) Furnace
- 6 ○ Furnace Tune Up
- 7 ○ Wi-Fi Enabled Thermostat
- 8 ○ Commercial Dishwasher
- 9 ○ Steam Boiler
- 10 ○ Pipe Insulation – Hot Water
- 11 ○ Pipe Insulation – Steam
- 12 ○ Unit Heater
- 13 ○ Showerheads
- 14 ○ Gas Modulating Valves for Dryers

15 • **Commercial Custom**

- 16 ○ Strategic Energy Management Pilot added in 2019

17 • **Small Business**

- 18 ○ Wi-Fi Enabled Thermostat
- 19 ○ Furnace Tune-Up
- 20 ○ Steam-Trap – Dry Cleaner
- 21 ○ Weather Stripping – Exterior Door

22

23 **Q. Is Vectren introducing any new programs in its 2022 – 2025 Plan not currently**
24 **offered or discussed in its MPSAP?**

1 A. No. Vectren North is not adding any new programs but is introducing enhanced
2 features / delivery channels such as an online marketplace and instant rebate program
3 within the residential portfolio. These program enhancements will include new delivery
4 mechanisms to complement the existing program design. This expansion will include
5 many of the same measures from Residential Prescriptive to be offered through instant
6 rebates and an online marketplace. The online marketplace allows customers to
7 purchase smart thermostats and other measures with an instant rebate applied. The
8 Instant Rebates will provide Vectren customers the flexibility to receive targeted
9 coupons either in store or via email that can be used at point-of-purchase for measures
10 such as smart thermostats and water heaters. Additionally, Vectren will offer a
11 residential and commercial HVAC midstream program that will allow customers to
12 receive a discount at the time of purchase. Through midstream incentives, the program
13 aims to influence the equipment that distributors stock, fine-tune incentives to fit
14 desired program outcomes. Because distributors have a large influence on the HVAC
15 equipment that customers eventually install, the program will be able to encourage
16 distributors to supply more energy-efficient options. Because customers receive a
17 discount at the time of purchase, the program may influence quicker purchasing
18 decisions.

19

20 **Q. Please describe the changes to the Residential Prescriptive program.**

21 A. The Residential Prescriptive program will continue to run mostly unchanged from
22 previous years and will start incorporating minor measure level changes starting in
23 2022. Program enhancements will include new delivery mechanisms to complement
24 the existing program design. This expansion will include many of the same measures
25 from Residential Prescriptive to be offered through Residential Midstream, instant

1 rebates and an online marketplace. These additional channels of program delivery will
2 be provided to reach additional customers and markets.

3

4 **Q. Please describe the changes to the Commercial & Industrial Custom program.**

5 A. The Commercial and Industrial Custom program will not have any changes from its
6 current design; however, Vectren will continue to expand upon its Strategic Energy
7 Management (SEM) Program, introduced in 2020.

8

9 **Q. Does the Action Plan include any integrated gas and electric programs?**

10 A. Yes. Vectren has delivered integrated gas and electric programs since 2016. Vectren
11 plans to continue to offer integrated programs in its 2022 – 2025 Plan. Please see
12 Table RHH-3 to see a list of gas and electric integrated programs.

13

14 **Q. Have integrated gas and electric programs been successful?**

15 A. Yes. Vectren's implementation team has developed a strategy to gain both gas and
16 electric savings from its residential and commercial programs. Vectren has offered
17 integrated programs for several years and they have proven to be cost-effective and
18 successful in terms of program performance, as determined through our
19 implementation and evaluation process.

20

21 **Q. Where can the Commission find additional details regarding the programs
22 included in the 2022 – 2025 Plan?**

23 A. Petitioner's Exhibit No. 14, Attachment RHH-4 sets forth the energy savings and
24 program budgets for each program and portfolio level costs (i.e., the indirect and other
25 costs of offering the programs) and provides a detailed description of each program.

1 **IV. 2022 – 2025 PLAN BUDGET AND SAVINGS GOALS**

2

3 **Q. What are the estimated program costs and savings associated with the Action**
4 **Plan?**

5 A. The 2022 – 2025 Plan has an estimated cost of \$36 million, with \$8.3 million in 2022,
6 \$8.7 million in 2023, \$9.4 million in 2024, and \$9.5 million in 2025. As previously
7 discussed, these costs are fully recovered in the EER and not included in base rates.

8

9 In addition, consistent with its previously approved Plans in Cause Nos. 45222 and
10 44598, Vectren is requesting authority to roll forward, into the next program year, any
11 unused and approved budget funds from the 2022 – 2025 Plan that remain unspent,
12 if any, at the end of each program year. This approval ensures that all funds approved
13 by the Commission for use by Vectren during the Plan Period to save energy will be
14 used for that purpose. Vectren requests that if budget funds are rolled forward within
15 the 2022 – 2025 program years, these funds should be incremental and not reduce
16 approved flex funding available to obtain savings.

17

18 The 2022 – 2025 Plan establishes a portfolio of programs to achieve energy savings
19 of 11.6 million therms, with 2.7 million therms to be saved in 2022, 2.8 million therms
20 to be saved in 2023, 3 million therms to be saved in 2024, and 3.1 million therms saved
21 in 2025. Table RHH-4 below outlines the program goals and shows participation,
22 energy/demand impacts and program costs at the Residential and C&I sector level.
23 Table RHH-5 provides additional detail at the program level.

24

Table RHH-4 – 2022 - 2025 Program Goals and Budget Summary

Residential			
Year	Participants in Year	Energy Savings in Therms Savings in Year	Budget, 000\$
2022	60,139	1,911,720	5,900
2023	57,315	1,977,090	6,179
2024	57,537	2,054,181	6,678
2025	57,738	2,125,438	6,719
Total	232,729	8,068,429	25,476
Commercial			
Year	Participants in Year	Energy Savings in Therms Savings in Year	Budget, 000\$
2022	2,518	832,956	2,444
2023	2,810	863,798	2,544
2024	3,152	903,045	2,698
2025	3,514	943,252	2,785
Total	11,994	3,543,051	10,471
Total			
Year	Participants in Year	Energy Savings in Therms Savings in Year	Budget, 000\$
2022	62,657	2,744,676	8,345
2023	60,125	2,840,888	8,723
2024	60,689	2,957,226	9,377
2025	61,252	3,068,690	9,504
Total	244,723	11,611,480	35,949

*Residential & Commercial Budget includes indirect costs.

Table RHH-5 – 2022 - 2025 Program Detail

2022 Portfolio Targets						
	Number of Participants	Total Therms Savings	Admin.	Implementation	Incentives	Total Budget
Residential						
Residential Prescriptive	9,522	579,226	\$30,555	\$535,505	\$858,470	\$1,424,530
Residential New Construction	1,075	462,060	\$3,819	\$424,689	\$561,725	\$990,233
Home Energy Assessment	420	29,294	\$3,819	\$56,774	-	\$60,593
Income-Qualified Weatherization	564	63,502	\$15,277	\$980,165	-	\$995,443
Energy-Efficient Schools	2,600	38,480	\$22,916	\$30,743	-	\$53,659
Residential Behavioral Savings	34,778	375,933	\$22,916	\$111,671	-	\$134,587
Food Bank	6,312	41,628	\$15,278	\$4,700	-	\$19,977
Home Energy Management Systems	1,000	54,400	\$11,458	\$187,100	-	\$198,558
Multi-Family Direct Install	1,700	68,591	\$15,277	\$409,925	-	\$425,202
Targeted Income	46	15,022	\$30,555	\$76,872	-	\$107,427
Home Energy House Call-Integrated	1,122	49,144	\$30,555	\$185,318	-	\$215,872
Neighborhood Program-Integrated	1,000	134,440	\$30,555	\$191,907	-	\$222,462
Residential Subtotal	60,139	1,911,720	\$232,980	\$3,195,369	\$1,420,195	\$4,848,544
Commercial & Industrial (C&I)						
C&I Prescriptive	1,312	338,606	\$68,748	\$541,210	\$286,137	\$896,095
C&I Custom	71	472,810	\$76,387	\$509,731	\$489,600	\$1,075,718
Small Business	1,135	21,540	\$3,819	\$3,375	\$6,216	\$13,410
C&I Subtotal	2,518	832,956	\$148,955	\$1,054,315	\$781,953	\$1,985,223
Indirect Costs						
Contact Center						\$136,340
Online Audit						\$207,034
Outreach						\$552,116
Portfolio Costs Subtotal						\$895,490
Subtotal (Before Evaluation)						\$7,729,257
Evaluation						\$415,538
DSM Portfolio Total						\$8,144,795
Other Costs						
Emerging Markets						\$200,000
Market Potential Study						-
Other Costs Subtotal						\$200,000
DSM Portfolio Total including Other Costs						\$8,344,795

2023 Portfolio Targets						
	Number of Participants	Total Therms Savings	Admin.	Implementation	Incentives	Total Budget
Residential						
Residential Prescriptive	9,565	580,541	\$31,044	\$544,073	\$863,520	\$1,438,637
Residential New Construction	1,253	537,581	\$3,880	\$491,921	\$650,275	\$1,146,077
Home Energy Assessment	504	35,153	\$3,880	\$57,682	-	\$61,563
Income-Qualified Weatherization	591	66,991	\$15,522	\$1,060,825	-	\$1,076,347
Energy-Efficient Schools	2,600	38,480	\$23,283	\$32,758	-	\$56,041
Residential Behavioral Savings	34,778	375,933	\$23,283	\$113,458	-	\$136,741
Food Bank	3,156	20,814	\$15,522	\$4,775	-	\$20,297
Home Energy Management Systems	1,000	54,400	\$11,641	\$172,100	-	\$183,741
Multi-Family Direct Install	1,700	68,591	\$15,522	\$416,484	-	\$432,005
Targeted Income	46	15,022	\$31,044	\$78,102	-	\$109,146
Home Energy House Call-Integrated	1,122	49,144	\$31,044	\$188,283	-	\$219,326
Neighborhood Program-Integrated	1,000	134,440	\$31,044	\$194,978	-	\$226,021
Residential Subtotal	57,315	1,977,090	\$236,708	\$3,355,439	\$1,513,795	\$5,105,942
Commercial & Industrial (C&I)						
C&I Prescriptive	1,479	365,992	\$69,848	\$598,626	\$307,777	\$976,251
C&I Custom	71	472,810	\$77,609	\$517,886	\$489,600	\$1,085,096
Small Business	1,260	24,996	\$3,880	\$3,561	\$6,456	\$13,898
C&I Subtotal	2,810	863,798	\$151,338	\$1,120,073	\$803,833	\$2,075,244
Indirect Costs						
Contact Center						\$138,522
Online Audit						\$210,346
Outreach						\$560,949
Portfolio Costs Subtotal						\$909,818
Subtotal (Before Evaluation)						\$8,091,004
Evaluation						\$431,543
DSM Portfolio Total						\$8,522,547
Other Costs						
Emerging Markets						\$200,000
Market Potential Study						-
Other Costs Subtotal						\$200,000
DSM Portfolio Total including Other Costs						\$8,722,547

2024 Portfolio Targets						
	Number of Participants	Total Therms Savings	Admin.	Implementation	Incentives	Total Budget
Residential						
Residential Prescriptive	9,584	579,541	\$31,540	\$552,778	\$864,995	\$1,449,314
Residential New Construction	1,428	612,092	\$3,943	\$558,080	\$737,775	\$1,299,797
Home Energy Assessment	504	35,153	\$3,943	\$58,605	-	\$62,548
Income-Qualified Weatherization	619	70,571	\$15,770	\$1,120,207	-	\$1,135,977
Energy-Efficient Schools	2,600	38,480	\$23,655	\$35,464	-	\$59,119
Residential Behavioral Savings	34,778	375,933	\$23,655	\$115,273	-	\$138,929
Food Bank	3,156	20,814	\$15,770	\$4,851	-	\$20,622
Home Energy Management Systems	1,000	54,400	\$11,828	\$198,260	-	\$210,088
Multi-Family Direct Install	1,700	68,591	\$15,770	\$423,147	-	\$438,918
Targeted Income	46	15,022	\$31,540	\$79,352	-	\$110,892
Home Energy House Call-Integrated	1,122	49,144	\$31,540	\$191,295	-	\$222,835
Neighborhood Program-Integrated	1,000	134,440	\$31,540	\$198,097	-	\$229,638
Residential Subtotal	57,537	2,054,181	\$240,495	\$3,535,411	\$1,602,770	\$5,378,676
Commercial & Industrial (C&I)						
C&I Prescriptive	1,712	402,215	\$70,966	\$611,299	\$335,962	\$1,018,227
C&I Custom	71	472,810	\$78,851	\$526,173	\$489,600	\$1,094,624
Small Business	1,369	28,020	\$3,943	\$3,736	\$6,666	\$14,344
C&I Subtotal	3,152	903,045	\$153,759	\$1,141,208	\$832,228	\$2,127,195
Indirect Costs						
Contact Center						\$140,738
Online Audit						\$213,712
Outreach						\$569,925
Portfolio Costs Subtotal						\$924,375
Subtotal (Before Evaluation)						\$8,430,246
Evaluation						\$446,225
DSM Portfolio Total						\$8,876,471
Other Costs						
Emerging Markets						\$200,000
Market Potential Study						\$300,000
Other Costs Subtotal						\$500,000
DSM Portfolio Total including Other Costs						\$9,376,471

2025 Portfolio Targets						
	Number of Participants	Total Therms Savings	Admin.	Implementation	Incentives	Total Budget
Residential						
Residential Prescriptive	9,591	577,456	\$32,045	\$561,623	\$864,845	\$1,458,513
Residential New Construction	1,592	681,668	\$4,006	\$620,174	\$819,500	\$1,443,680
Home Energy Assessment	504	35,153	\$4,006	\$59,543	-	\$63,549
Income-Qualified Weatherization	649	74,337	\$16,022	\$1,156,992	-	\$1,173,014
Energy-Efficient Schools	2,600	38,480	\$24,034	\$39,008	-	\$63,041
Residential Behavioral Savings	34,778	375,933	\$24,034	\$117,118	-	\$141,151
Food Bank	3,156	20,814	\$16,023	\$4,929	-	\$20,952
Home Energy Management Systems	1,000	54,400	\$12,017	\$214,420	-	\$226,437
Multi-Family Direct Install	1,700	68,591	\$16,022	\$429,918	-	\$445,940
Targeted Income	46	15,022	\$32,045	\$80,621	-	\$112,666
Home Energy House Call-Integrated	1,122	49,144	\$32,045	\$194,356	-	\$226,401
Neighborhood Program-Integrated	1,000	134,440	\$32,045	\$201,267	-	\$233,312
Residential Subtotal	57,738	2,125,438	\$244,343	\$3,679,968	\$1,684,345	\$5,608,656
Commercial & Industrial (C&I)						
C&I Prescriptive	1,964	439,398	\$72,101	\$737,459	\$363,357	\$1,172,917
C&I Custom	71	472,810	\$80,112	\$534,591	\$489,600	\$1,104,304
Small Business	1,479	31,044	\$4,006	\$3,915	\$6,876	\$14,797
C&I Subtotal	3,514	943,252	\$156,219	\$1,275,965	\$859,833	\$2,292,017
Indirect Costs						
Contact Center						\$142,990
Online Audit						\$217,131
Outreach						\$579,043
Portfolio Costs Subtotal						\$939,165
Subtotal (Before Evaluation)						\$8,839,838
Evaluation						\$464,552
DSM Portfolio Total						\$9,304,390
Other Costs						
Emerging Markets						\$200,000
Market Potential Study						-
Other Costs Subtotal						\$200,000
DSM Portfolio Total including Other Costs						\$9,504,390

1 **Q. What types of costs are associated with the 2022 – 2025 Plan budget?**

2 A. The total planned program budget includes the direct and indirect costs of
3 implementing Vectren's gas energy efficiency programs. In addition, a budget for other
4 costs is being requested which consists of the Emerging Markets budget described
5 further below. Direct program costs include three main categories: vendor
6 implementation, program incentives, and administration costs.

7

8 Indirect costs are costs that are not directly tied to a single program, but rather support
9 multiple programs or the entire portfolio. These include: Contact Center, Online Audit,
10 Outreach & Education, and EM&V.

11

12 **Q. Please discuss the Emerging Markets budget included in the Action Plan.**

13 A. The Emerging Markets funding allows Vectren's staff to work with the VOB to make
14 modifications and additions to its portfolio to take advantage of leading-edge program
15 designs for next-generation technologies, services, and engagement strategies in
16 Vectren's service territory. This funding will be utilized with VOB approval and will not
17 be used to support existing measures or programs, but rather support new program
18 development or new measures within an existing program.

19

20

21 **V. PROGRAM OVERSIGHT AND REPORTING**

22

23 **Q. How does Vectren report program progress to the Commission?**

24 A. Pursuant to the Order issued by the Commission on July 17, 2019 in Cause No. 45222,
25 and previously in Cause No. 44598, Vectren files with the Commission:

- 1 (1) Annual operating plan (within 60 days of the start of each program year);
- 2 (2) Quarterly performance reports (scorecards) to gauge performance during the
- 3 program year (within 60 days of each quarter end);
- 4 (3) Annual final report (within 60 days of year-end); and
- 5 (4) Annual EM&V results (within 30 days of VOB approval).
- 6

6

7 **Q. Is Vectren proposing any changes to the VOB?**

- 8 A. No, Vectren is not proposing any changes to the VOB. Vectren and the VOB have
- 9 worked well together over the years, and the Company desires to continue building
- 10 upon that strong foundation. Vectren requests that the VOB continues to retain all
- 11 the same authority previously granted to that governing body, which is important
- 12 because the Company will potentially need to adjust the programs throughout the
- 13 program term.

14

15

16 **VI. PROGRAM IMPLEMENTATION AND EVALUATION**

17

18 **Q. How does Vectren plan to implement EE programs included in the 2022 – 2025**

19 **Plan?**

- 20 A. Vectren, with direction from the VOB, will continue to implement the EE programs
- 21 included in the 2022 – 2025 Plan as currently established and will contract with
- 22 program implementers, as necessary. Vectren will maintain its gas EE program staff
- 23 to provide program oversight, regulatory reporting, evaluation and outreach related to
- 24 the EE programs outlined in the Plan.

25

1 **Q. How will Vectren measure the results of EE programs included in the Action**
2 **Plan?**

3 A. Evaluation for all programs will continue to be conducted by an independent third-party
4 evaluator. Evaluation activity will occur every year for a select set of the prior year's
5 programs. Top measures and/or programs are evaluated every two to three years.

6

7 **Q. Please describe the EM&V process.**

8 A. The evaluation covers three areas of investigation: Process Evaluation, Impact
9 Evaluation and Market Effects.

10

11 The impact evaluation can take many forms, from a general engineering desk review
12 to a rigorous billing analysis using a control and treatment group. The sampling
13 methods utilized by Vectren's evaluator for verification have been rigorous and
14 typically exceed industry-accepted statistical confidence and precision standards.

15

16 The process evaluation will be performed to identify how well programs are
17 implemented. The objective of the process evaluation is to examine the effectiveness
18 and efficiency with which programs are designed and delivered. The evaluator will
19 examine each program through the perspective of customers, trade allies, and Vectren
20 staff and determine what worked well, areas that may need improvement, and
21 recommendations to refine the program.

22

23 An assessment of the program market effects will also be conducted to determine any
24 changes and trends from the prior year, where applicable. Market transformation may
25 take place over many years, as increased awareness, increased stocking of EE

1 products, trained trade allies, etc., are many times caused by EE programs. As such,
2 the evaluation process helps assess both the short term and long-term impact.

3

4

5 **VII. COST-EFFECTIVENESS TESTING**

6

7 **Q. Please discuss the cost effectiveness testing of the energy efficiency programs**
8 **included in the Action Plan.**

9 A. EMI Consulting, MPSAP partner to GDS, conducted cost benefit testing associated
10 with Vectren's Action Plan. Utilizing DSMore, the measures and programs were
11 analyzed for cost effectiveness. The DSMore tool is used in many states across the
12 country to determine cost-effectiveness. The economic analysis consisted of a full
13 range of market perspectives including: The Participant Test, UCT, RIM Test and the
14 TRC Test. Each of the tests was conducted for each program. All of the economic
15 tests were based on the cost-effectiveness methodologies from the California
16 Standard Practice Manual: Economic Analysis of Demand-Side Programs and
17 Projects, California Governor's Office of Planning and Research, 2002.

18

19 **Q. What data was used in the cost effectiveness modeling?**

20 A. The data inputs for cost effectiveness modeling for all program years, consist of:
21 program participation, incentives paid, implementation costs, administrative costs,
22 energy savings assumptions, life of measure, incremental costs, and avoided cost
23 information.

24

1 **Q. Did all the programs in the 2022 – 2025 Plan pass the TRC and UCT cost**
2 **effectiveness test?**

3 A. Yes, each EE Program in the Plan passes the TRC and UCT, except for low income
4 programs which do not need to pass cost-effectiveness tests in order to promote a
5 greater social good. The residential portfolio passes TRC between 1.22 in 2022 and
6 2.08 in 2025. The commercial portfolio passes TRC between 2.03 in 2022 and 2.27 in
7 2025. The overall portfolio passes TRC between 1.29 in 2022 and 1.89 in 2025. See
8 Table RHH-6 below for the cost effectiveness test results associated with the 2022 –
9 2025 Plan.

Table RHH-6 – Cost Effectiveness Results for 2022 – 2025

2022	TRC	UCT	PCT	RIM	NET Benefits TRC	NET Benefits UCT
Residential						
Residential Prescriptive	1.07	1.84	1.71	0.60	\$ 158,279	\$ 1,044,529
Residential New Construction	1.17	2.54	1.22	0.72	\$ 313,327	\$ 1,321,648
Home Energy Assessment	1.11	2.83	1.56	0.67	\$ 14,520	\$ 96,215
Income Qualified Weatherization	0.45	0.45	0.00	0.30	\$ (476,356)	\$ (476,356)
Energy Efficient Schools	3.69	3.69	0.00	0.70	\$ 125,485	\$ 125,485
Residential Behavioral Savings	1.64	1.64	0.00	0.54	\$ 75,154	\$ 75,154
Home Energy Management Systems	1.17	1.17	0.00	0.49	\$ 28,598	\$ 28,598
Multi-Family Direct Install	1.74	1.74	0.00	0.60	\$ 271,770	\$ 271,770
Target Income	1.02	1.02	0.00	0.47	\$ 1,957	\$ 1,957
Home Energy House Call-Integrated	1.65	1.66	0.00	0.58	\$ 123,199	\$ 124,174
Neighborhood Program - Integrated	4.40	4.40	0.00	0.74	\$ 656,675	\$ 656,675
Residential Subtotal	1.22	1.80	1.97	0.61	\$ 1,370,003	\$ 3,351,796
Commercial & Industrial						
Commercial Prescriptive	1.53	2.06	3.12	0.67	\$ 569,132	\$ 842,769
Commercial Custom	2.26	4.32	2.51	0.81	\$ 2,253,125	\$ 3,103,778
Small Business	11.13	10.99	20.74	0.91	\$ 116,568	\$ 116,431
Commercial & Industrial Subtotal	2.03	3.33	2.76	0.77	\$ 2,938,825	\$ 4,062,978
Indirect Costs						
Contact Center	-	-	-	-	-	-
Online Audit	-	-	-	-	-	-
Outreach	-	-	-	-	-	-
Portfolio Costs Subtotal	-	-	-	-	-	-
Subtotal (Before Evaluation)	-	-	-	-	-	-
Evaluation	-	-	-	-	-	-
DSM Portfolio Total	-	-	-	-	-	-
Other Costs						
Emerging Markets	-	-	-	-	-	-
Market Potential Study	-	-	-	-	-	-
Total Costs (Indirect, Evaluation & Other)	-	-	-	-	\$ (1,310,961)	\$ (1,310,961)
DSM Portfolio Total including Other Costs	1.29	1.84	2.20	0.63	\$ 2,996,163	\$ 6,102,108

2023	TRC	UCT	PCT	RIM	NET Benefits TRC	NET Benefits UCT
Residential						
Residential Prescriptive	1.10	1.90	1.75	0.62	\$ 209,518	\$ 1,049,869
Residential New Construction	1.43	3.13	1.24	0.88	\$ 872,981	\$ 1,976,122
Home Energy Assessment	1.22	3.46	1.59	0.71	\$ 31,087	\$ 122,460
Income Qualified Weatherization	0.45	0.45	0.00	0.30	\$ (477,335)	\$ (477,335)
Energy Efficient Schools	3.66	3.66	0.00	0.71	\$ 120,828	\$ 120,828
Residential Behavioral Savings	1.65	1.65	0.00	0.54	\$ 72,389	\$ 72,389
Home Energy Management Systems	1.31	1.31	0.00	0.52	\$ 45,743	\$ 45,743
Multi-Family Direct Install	1.78	1.78	0.00	0.62	\$ 271,701	\$ 271,701
Target Income	1.04	1.04	0.00	0.48	\$ 3,325	\$ 3,325
Home Energy House Call-Integrated	1.68	1.69	0.00	0.59	\$ 121,496	\$ 122,404
Neighborhood Program - Integrated	4.47	4.47	0.00	0.75	\$ 634,981	\$ 634,981
Residential Subtotal	1.31	1.96	1.93	0.66	\$ 1,934,272	\$ 3,974,287
Commercial & Industrial						
Commercial Prescriptive	1.68	2.25	3.32	0.69	\$ 742,261	\$ 1,016,545
Commercial Custom	2.32	4.42	2.58	0.82	\$ 2,212,978	\$ 3,005,833
Small Business	12.78	13.19	21.83	0.93	\$ 136,800	\$ 137,156
Commercial & Industrial Subtotal	2.12	3.44	2.90	0.78	\$ 3,092,039	\$ 4,159,533
Indirect Costs						
Contact Center	-	-	-	-	-	-
Online Audit	-	-	-	-	-	-
Outreach	-	-	-	-	-	-
Portfolio Costs Subtotal	-	-	-	-	-	-
Subtotal (Before Evaluation)	-	-	-	-	-	-
Evaluation	-	-	-	-	-	-
DSM Portfolio Total	-	-	-	-	-	-
Other Costs						
Emerging Markets	-	-	-	-	-	-
Market Potential Study	-	-	-	-	-	-
Total Costs (Indirect, Evaluation & Other)	-	-	-	-	\$ (1,248,034)	\$ (1,248,034)
DSM Portfolio Total including Other Costs	1.37	1.97	2.20	0.66	\$ 3,778,276	\$ 6,885,786

2024	TRC	UCT	PCT	RIM	NET Benefits TRC	NET Benefits UCT
Residential						
Residential Prescriptive	1.97	3.28	2.66	0.75	\$ 2,886,209	\$ 4,076,976
Residential New Construction	2.03	4.46	1.27	1.23	\$ 2,214,999	\$ 3,393,418
Home Energy Assessment	1.26	3.52	1.63	0.72	\$ 33,907	\$ 119,072
Income Qualified Weatherization	0.47	0.47	0.00	0.31	\$ (457,332)	\$ (457,332)
Energy Efficient Schools	3.60	3.60	0.00	0.72	\$ 115,935	\$ 115,935
Residential Behavioral Savings	1.69	1.69	0.00	0.55	\$ 72,060	\$ 72,060
Home Energy Management Systems	1.19	1.19	0.00	0.51	\$ 29,971	\$ 29,971
Multi-Family Direct Install	1.82	1.82	0.00	0.63	\$ 272,180	\$ 272,180
Target Income	1.06	1.06	0.00	0.49	\$ 4,612	\$ 4,612
Home Energy House Call-Integrated	1.71	1.72	0.00	0.59	\$ 119,852	\$ 120,699
Neighborhood Program - Integrated	4.54	4.54	0.00	0.76	\$ 614,355	\$ 614,355
Residential Subtotal	1.54	2.33	1.93	0.78	\$ 3,324,927	\$ 5,386,451
Commercial & Industrial						
Commercial Prescriptive	1.74	2.32	3.42	0.71	\$ 821,036	\$ 1,101,814
Commercial Custom	2.39	4.53	2.65	0.84	\$ 2,173,991	\$ 2,912,974
Small Business	14.22	15.17	22.75	0.95	\$ 152,682	\$ 153,409
Commercial & Industrial Subtotal	2.17	3.49	3.00	0.79	\$ 3,147,708	\$ 4,168,197
Indirect Costs						
Contact Center	-	-	-	-	-	-
Online Audit	-	-	-	-	-	-
Outreach	-	-	-	-	-	-
Portfolio Costs Subtotal	-	-	-	-	-	-
Subtotal (Before Evaluation)	-	-	-	-	-	-
Evaluation	-	-	-	-	-	-
DSM Portfolio Total	-	-	-	-	-	-
Other Costs						
Emerging Markets	-	-	-	-	-	-
Market Potential Study	-	-	-	-	-	-
Total Costs (Indirect, Evaluation & Other)	-	-	-	-	\$ (1,260,769)	\$ (1,260,769)
DSM Portfolio Total including Other Costs	1.52	2.19	2.21	0.74	\$ 5,211,866	\$ 8,293,879

2025	TRC	UCT	PCT	RIM	NET Benefits TRC	NET Benefits UCT
Residential						
Residential Prescriptive	1.21	2.09	1.83	0.68	\$ 379,998	\$ 1,127,260
Residential New Construction	3.39	7.48	1.31	2.03	\$ 5,355,772	\$ 6,584,539
Home Energy Assessment	1.29	3.58	1.66	0.73	\$ 36,165	\$ 115,543
Income Qualified Weatherization	0.46	0.49	5.40	0.32	\$ (475,343)	\$ (419,531)
Energy Efficient Schools	3.49	3.49	0.00	0.72	\$ 110,567	\$ 110,567
Residential Behavioral Savings	1.76	1.76	0.00	0.57	\$ 75,133	\$ 75,133
Home Energy Management Systems	1.15	1.15	0.00	0.51	\$ 23,127	\$ 23,127
Multi-Family Direct Install	1.87	1.87	0.00	0.65	\$ 272,178	\$ 272,178
Target Income	1.07	1.07	0.00	0.50	\$ 5,762	\$ 5,762
Home Energy House Call-Integrated	1.74	1.75	0.00	0.60	\$ 118,072	\$ 118,861
Neighborhood Program - Integrated	4.62	4.62	0.00	0.77	\$ 594,216	\$ 594,216
Residential Subtotal	2.08	3.19	1.91	1.06	\$ 6,522,912	\$ 8,638,605
Commercial & Industrial						
Commercial Prescriptive	1.90	2.54	3.60	0.73	\$ 1,021,956	\$ 1,311,328
Commercial Custom	2.46	4.63	2.72	0.85	\$ 2,133,464	\$ 2,822,236
Small Business	15.59	17.16	23.61	0.97	\$ 167,143	\$ 168,189
Commercial & Industrial Subtotal	2.27	3.63	3.14	0.80	\$ 3,322,563	\$ 4,301,752
Indirect Costs						
Contact Center	-	-	-	-	-	-
Online Audit	-	-	-	-	-	-
Outreach	-	-	-	-	-	-
Portfolio Costs Subtotal	-	-	-	-	-	-
Subtotal (Before Evaluation)	-	-	-	-	-	-
Evaluation	-	-	-	-	-	-
DSM Portfolio Total	-	-	-	-	-	-
Other Costs						
Emerging Markets	-	-	-	-	-	-
Market Potential Study	-	-	-	-	-	-
Total Costs (Indirect, Evaluation & Other)	-	-	-	-	\$ (1,128,058)	\$ (1,128,058)
DSM Portfolio Total including Other Costs	1.89	2.76	2.23	0.91	\$ 8,717,416	\$ 11,812,299

1 **Q. Is Vectren requesting performance incentives as part of the Plan?**

2 A. No. While performance incentives are beneficial to encourage the utility to implement
3 and drive cost effective energy efficiency programs, Vectren is not requesting
4 performance incentives as part of this Plan.

5

6 **Q. Is Vectren's 2022 – 2025 Plan in the public interest?**

7 A. Yes, approval of the 2022 – 2025 Plan is in the public interest and approving it will
8 allow Vectren to continue providing opportunities for customers to reduce their energy
9 usage and make more educated choices about how they consume energy. Vectren's
10 Plan continues to promote the efficient use of energy by better aligning the Company's

1 interests with those of its customers. In addition, approval of 2022 – 2025 programs
2 will allow Vectren to continue to integrate gas and electric programs resulting in lower
3 program costs, higher EE benefits for the customer, and a more enhanced customer
4 experience.

5

6

7 **VIII. CONCLUSION**

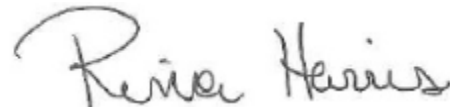
8

9 **Q. Does this conclude your prepared direct testimony?**

10 **A.** Yes, it does.

VERIFICATION

I, Rina Harris, affirm under the penalties of perjury that the forgoing representations of fact in my Direct Testimony are true to the best of my knowledge, information and belief.

A handwritten signature in cursive script that reads "Rina Harris".

Rina Harris

Dated: December 18, 2020



Vectren
2020 Gas DSM Operating Plan

Prepared by:
Vectren Energy Delivery of Indiana ("VEDI")

November 14, 2019

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Abbreviations and Acronyms

Acronym	Description
AFUE	Annual Fuel Utilization Efficiency
BAS	Building Automation System
BTU	Building Tune-Up
C&I	Commercial & Industrial
CAA	Community Action Agencies
DSM	Demand Side Management
EAP	Energy Assistance Program
EDA	Energy Design Assistance
EE	Energy Efficiency
FPL	Federal Poverty Level
GPM	Gallons Per Minute
H&S	Health and Safety
HEA	Home Energy Assessment
HEHC	Home Energy House Call
HEM	Home Energy Management
HERS	Home Efficiency Rating System
IHCDA	Indiana Housing & Community Development Authority
INCAA	Indiana Community Action Agency
EM&V	Evaluation, Measurement & Verification
HVAC	Heating, Ventilation and Air Conditioning
IQW	Income Qualified & Weatherization
MAT	Mobile Assessment Tool
NEF	National Energy Foundation
NP	Neighborhood Program
NPV	Net Present Value
NTG	Net to Gross
O&M	Operations and Maintenance
PCT	Participant Cost Test
RBS	Residential Behavioral Savings
RFQ	Request for Qualification
RIM	Ratepayer Impact Measure
SBES	Small Business Energy Solutions
SEER	Seasonal Energy Efficiency Ratio
TRC	Total Resource Cost
TRM	Technical Reference Manual
UCT	Utility Cost Test

1. Executive Summary

Indiana Gas Company, Inc. d/b/a Vectren Energy Delivery of Indiana, Inc. a CenterPoint Energy Company (“Vectren North”) and Southern Indiana Gas and Electric Company d/b/a Vectren Energy Delivery of Indiana, Inc. a CenterPoint Energy Company (“Vectren South”) (collectively “Vectren”) is pleased to offer the following programs in the Vectren 2020 Gas DSM Operating Plan.

The gas DSM plan was filed for approval on February 27, 2015 as Cause No. 44598 and was approved on September 9, 2015. The approved filing allowed Vectren to implement a new portfolio of energy efficiency programs for years 2016-2019. Cause No. 45222 is the 2020 Energy Efficiency Program Extension of conditions set forth in Cause No. 44598. Order approving the extension requested, in Cause No. 45222, was issued on July 17, 2019. The 2020 Operating Plan establishes a goal of reducing residential and commercial customer usage by 3.2M gross therms during 2020.

A summary is provided below for programs with notable changes for 2020 Operating Plan.

2. Program Changes

A. Residential Program Changes

Residential Prescriptive – Natural Gas Water Heater and Natural Gas Tankless Water Heaters have been added to the gas measure mix.

Residential New Construction – Platinum Star Incentive increased to \$1000 for G&E, and to \$500 for Gas only due to recommendation in the 2018 EM&V report.

Income Qualified Weatherization - For 2020, the 2019 “Whole Home IQW” pilot will continue to ensure we are meeting customer needs and providing valuable savings opportunities to those most in need. The traditional IQW will continue in its current state offering a home audit, direct install measures and air sealing for customers up to 300% FPL. Additionally, a “Whole Home IQW” will be offered to customers who qualify with income of up to 200% FPL, along with addressing relevant H&S issues that would otherwise prevent the EE measures being installed. Below outlines the measures and details for the Whole Home IQW.

- Whole Home IQW - Income requirement of up to 200% FPL. Includes all the “Traditional” measures plus:
 - Water heater replacement
 - Attic Insulation
 - Wall Insulation
 - Exterior caulking
 - Central AC or Furnace Replacement

B. Commercial & Industrial Program Changes

C&I Prescriptive Program – The Commercial Prescriptive will be offering a variety of new measures in 2020. Showerheads will be offered as a commercial solution, targeting gyms, hospitals and schools. Gas Modulating Valves for Dryers will also be added to the 2020 plan.

C&I Prescriptive Measure	2020	
Showerheads	\$10	Previously not offered as a commercial solution. Will target gyms, hospitals, hotels.
Gas Modulating Valve for Dryers	\$60	New technology adopted by CA utilities for PR measures

Additionally, a targeted marketing effort will be launched related to food service equipment, offering a bonus incentive to Trade Allies to push the adoption of the equipment to customers. The 2019 midstream pilot within prescriptive will expand beyond just furnaces to cover large HVAC equipment and water heaters as well.

For all C&I Programs, a formal C&I Trade Ally Network will be offered to participating Trade Allies and provide access to several new tools and services. The program will also take the simple functionality of the Mobile Assessment Tool used in the Small Business Program and expand it into the prescriptive program. This will allow members the option of generating a report detailing all the savings opportunities and their associated rebates for any of their Vectren customers.

Table 1 below compares the 2020 filed plan and the 2020 Gas Operating Plan.

Table 1. 2020 Gas DSM Operating Plan Compared to 2020 Filed Plan

Residential Programs	2020 Filed Plan					2020 Operating Plan				
	Participation	Energy Savings (Therms)	Budget	TRC	UCT	Participation	Energy Savings (Therms)	Budget	TRC	UCT
Residential Prescriptive	15,750	1,438,213	\$3,576,693	1.04	1.70	13,055	1,438,176	\$3,661,906	1.03	1.64
Residential New Construction	704	305,150	\$669,158	1.00	2.12	885	305,177	\$529,005	1.00	2.25
Home Energy Assessment	300	20,924	\$58,700	1.00	2.50	400	28,793	\$70,720	2.90	2.72
Income Qualified Weatherization - South	513	56,971	\$887,002	0.42	0.42	900	57,322	\$777,446	0.40	0.40
Energy Efficient Schools - South	2,600	38,480	\$50,597	3.57	3.57	2,600	32,595	\$85,022	1.53	1.53
Residential Behavioral Savings - South	34,778	375,933	\$145,182	1.26	1.26	26,935	283,100	\$104,852	1.34	1.34
Multi-Family Direct Install - Statewide	1,700	68,591	\$411,915	1.64	1.64	1,026	68,652	\$461,365	1.46	1.46
Targeted Income (Gas - North)	46	15,022	\$104,070	0.98	0.98	101	15,023	\$100,220	1.31	1.31
HEHC Integrated – Duke (Gas - North)	1,122	49,144	\$209,127	1.58	1.59	1,122	49,368	\$191,044	2.01	2.01
Neighborhood Program Duke (Gas - North)	1,000	134,440	\$215,510	4.20	4.20	1,000	130,440	\$198,851	5.10	5.10
Residential Sector Total	58,513	2,502,868	\$6,327,954	1.10	1.64	48,024	2,408,647	\$6,180,431	1.11	1.63
Commercial Programs	Participation	Energy Savings (Therms)	Budget	TRC	TRC	Participation	Energy Savings (Therms)	Budget	TRC	TRC
Commercial Prescriptive - VEDI	1,112	298,228	\$759,897	1.32	1.83	1,067	340,000	\$924,264	3.40	2.64
Commercial Custom - VEDI	71	472,810	\$1,057,403	2.11	4.07	53	483,000	\$1,084,144	1.97	2.88
Small Business Energy Solutions	592	16,788	\$12,682	8.32	7.68	15	3,000	\$12,292	1.10	1.54
Commercial Sector Portfolio	1,775	787,826	\$1,829,982	1.87	3.16	1,135	826,000	\$2,020,700	2.41	2.76
Commercial & Residential Sub-Total	60,288	3,290,694	\$8,157,936			49,159	3,234,647	\$8,201,130		
Total Portfolio Costs			\$1,349,922					\$1,306,727		
Total Other Cost			\$341,100					\$341,100		
Total Portfolio & Other Costs			\$1,691,022					\$1,647,827		
Total Portfolio*	60,288	3,290,694	\$9,848,958	1.15	1.67	49,159	3,234,647	\$9,848,958	1.20	1.59

The total approved budget in Order 45222, July 17, 2019, for 2020 is \$9,848,958. Cause No. 45222 is the 2020 Energy Efficiency Program Extension of conditions set forth in Cause No. 44598 for the year 2020.

* SEM, Commercial New Construction and Building Tune-Up are rolled into the Commercial Custom; Multi-Family Retrofit is rolled into Small Business; Midstream HVAC is rolled into C&I Prescriptive.

** Other Costs includes Emerging Markets of \$200,000 and Home Energy Management of \$141,000 - approved in order 45222.

3. 2020 Plan Objectives and Impact

Table 2 below provides an overview of energy savings, participation and budget by the residential and C&I sectors and for the total portfolio. The budget is broken out by administration, implementation and incentives. The administration budget contains Vectren related operating expenses including internal labor, memberships and consulting.

Table 2. 2020 Vectren Gas DSM Portfolio Targets and Budget

Residential Programs	Participants	Energy Savings Therms	Administration	Implementation	Incentives	Total Program Costs
Residential Prescriptive	13,055	1,438,176	\$26,250	\$1,228,711	\$2,406,945	\$3,661,906
Residential New Construction	885	305,177	\$7,500	\$170,055	\$351,450	\$529,005
Home Energy Assessment	400	28,793	\$7,500	\$56,500	\$6,720	\$70,720
Income Qualified Weatherization	900	57,322	\$22,500	\$754,946		\$777,446
Energy Efficient Schools	2,600	32,595	\$56,250	\$28,772		\$85,022
Residential Behavioral Savings	26,935	283,100	\$26,250	\$78,602		\$104,852
Multi-Family Direct Install	1,026	68,652	\$11,250	\$450,115		\$461,365
Targeted Income - (Gas - North)	101	15,023	\$18,750	\$81,470		\$100,220
HEHC - Duke (Gas - North)	1,122	49,368	\$18,750	\$172,294		\$191,044
Neighborhood Program - Duke (Gas - North)	1,000	130,440	\$18,750	\$180,101		\$198,851
Residential Sector Total	48,024	2,408,647	\$213,750	\$3,201,566	\$2,765,115	\$6,180,431
Commercial Programs	Participants	Energy Savings Therms	Administration	Implementation	Incentives	Total Program Costs
Commercial Prescriptive	1,067	340,000	\$82,500	\$516,764	\$325,000	\$924,264
Commercial Custom	53	483,000	\$75,000	\$516,144	\$493,000	\$1,084,144
Small Business Energy Solutions	15	3,000	\$3,750	\$2,042	\$6,500	\$12,292
Commercial Sector Portfolio	1,135	826,000	\$161,250	\$1,034,950	\$824,500	\$2,020,700
Contact Center						\$130,000
Online Audit						\$232,435
Outreach						\$534,863
Evaluation						\$409,429
Emerging Markets & Home Energy Management						\$341,100
Portfolio Level Cost*						\$1,647,827
Portfolio Total	49,159	3,234,647	\$ 375,000	\$ 4,236,515	\$ 3,589,615	\$9,848,958

Cost Effectiveness Results

Utilizing DSMore, the measures and programs were analyzed for cost effectiveness. The outputs of DSMore include all the California Standard Practice Manual results including Total Resource Cost (TRC), Utility Cost Test (UCT), Participant Cost Test (PCT) and Ratepayer Impact Measure (RIM) tests. Inputs into the model include the following: participation rates, incentives paid, energy savings of the measure, life of the measure, implementation costs, and administrative costs, incremental costs to the participant of the high efficiency measure, and escalation rates and discount rates. Per an Evaluation, Measurement and Verification (EM&V) recommendation, for 2020 planning purposes, 5% was added the program-level NTG estimate (except for Income Qualified Weatherization or Energy Efficient Schools) to account for Nonparticipant Spillover.

Table 3 below outlines that the total portfolio, the residential and commercial sectors and all programs, except IQW, pass the UCT & TRC test with a score of greater than one.

Table 3. 2020 Gas DSM Operating Portfolio Summary & Cost Effectiveness Results

Residential	TRC	UCT	RIM	PCT	TRC Net Benefits	UCT Net Benefits
Residential Prescriptive	1.03	1.64	0.53	1.71	\$ 1,025,818	\$ 3,868,819
Residential New Construction	1.00	2.25	0.59	1.24	\$ 1,425	\$ 661,465
Home Energy Assessment	2.90	2.72	0.60	70.85	\$ 125,987	\$ 121,667
Income Qualified Weatherization	0.40	0.40	0.26	n/a	\$ (465,547)	\$ (465,547)
Energy Efficient Schools	1.53	1.53	0.50	n/a	\$ 45,378	\$ 45,378
Residential Behavioral Savings	1.34	1.34	0.45	n/a	\$ 35,898	\$ 35,898
Multi-Family Direct Install - (Gas - North)	1.46	1.46	0.58	n/a	\$ 187,661	\$ 187,661
Targeted Income - (Gas - North)	1.31	1.31	0.57	n/a	\$ 31,235	\$ 31,235
HEHC - Duke (Gas - North)	2.01	2.01	0.66	n/a	\$ 192,444	\$ 192,444
Neighborhood Program - Duke (Gas - North)	5.10	5.10	0.83	n/a	\$ 814,401	\$ 814,401
Residential Sector Total	1.11	1.63	0.54	1.92	\$ 1,131,987	\$ 3,977,147
Commercial	TRC	UCT	RIM	PCT	TRC Net Benefits	UCT Net Benefits
Commercial Prescriptive	3.40	2.64	0.61	28.63	\$ 1,722,583	\$ 1,516,900
Commercial Custom	1.97	2.88	0.62	3.49	\$ 1,537,318	\$ 2,037,649
Small Business Energy Solutions	1.10	1.54	0.51	2.17	\$ 1,660	\$ 6,590
Commercial Sector Portfolio	2.41	2.76	0.61	5.52	\$ 3,261,560	\$ 3,561,139
Portfolio Level Costs					\$ (1,647,827)	\$ (1,647,827)
Total Portfolio	1.20	1.59	0.53	2.38	\$ 2,745,720	\$ 5,890,458

*Portfolio level costs include contact center (\$130,000), online audit (\$232,435), outreach (\$534,863), evaluation (\$409,429), and emerging markets and Home Energy Management (\$341,100).

4. Program Descriptions

The 2020 Plan is built from the existing programs currently being offered by Vectren to its customers. The following programs will continue to be offered by Vectren through implementation partners.

Residential Programs

- Residential Prescriptive
- Residential New Construction
- Home Energy Assessment (HEA)
- Income Qualified Weatherization
- Energy Efficient Schools
- Residential Behavior Savings Program
- Multi-Family Direct Install - North
- Targeted Income - North
- Home Energy House Call – Vectren North (Duke)
- Neighborhood Program – Vectren North (Duke)

Commercial Programs

- Commercial & Industrial Prescriptive
- Commercial & Industrial Custom
- Small Business Energy Solutions (SBES)

A. Residential Prescriptive

Program Description

The program is designed to incent customers to purchase energy efficient equipment by covering part of the incremental cost. The program also offers home weatherization rebates to residential customers for attic, wall insulation and duct sealing. If a product vendor or contractor chooses to do so, the rebates can be presented as an “instant discount” to Vectren residential customers on their invoice.

Eligible Customers

Any residential customer located in the Vectren Energy Delivery of Indiana natural gas service territory. For the equipment rebates, the applicant must reside in a single-family home or multi-family complex with up to 12 units. Only single-family homes are eligible for insulation measures.

Marketing Plan

The marketing plan includes program specific marketing materials that will target contractors and trade allies in the HVAC industry. The HVAC industry will be marketed to by using targeted direct marketing, direct contact by the program vendor personnel, trade shows and trade association outreach. The program will be promoted through trade allies, distributors, manufacturers, industry organizations and appropriate retail outlets. Vectren will also use web banners, bill inserts, and mass market advertising. Program marketing will direct customers and contractors to the Vectren website or call center for additional information.

Barriers/Theory

The initial cost is one of the key barriers to the adoption of EE technology. Customers do not always understand the long-term benefits of the energy savings from these efficient alternatives. Trade allies are also often reluctant to sell the higher cost items as they do not want to be the high cost bidder. Incentives help address the initial cost issue and provide a good reason for Trade Allies to promote these higher efficient options.

Initial Measures, Products and Services

Details of the measures, savings, and incentives can be found in Appendix A. Measures included in the program will change over time as baselines change, new technologies become available and customer needs are identified.

Table 4. Residential Prescriptive Program Budget & Energy Savings Targets

Market	Program	2020 Total Program
Residential	Residential Prescriptive - Statewide	
	Number of Participants	13,055
	Therms Savings	1,438,176
	Total Program Budget	\$3,661,906
	Per Participant Therm Savings	110.2
	Weighted Avg Measure Life	19
	Net to Gross Ratio	62%

Program Delivery

Vectren will oversee the program and will partner with CLEAResult to deliver the program.

Integration

Vectren will offer this program in its natural gas only and its combined natural gas and electric service territory. Vectren has allocated implementation costs based on the net benefits split between natural gas and electric.

During 2020, Vectren is integrating the following measures: Insulation, Duct Sealing, Wi-fi Basic and Smart Thermostats. Cost sharing was determined based on the net benefits split between the fuel sources and was applicable to all program costs excluding Vectren Administration.

Evaluation, Measurement and Verification

As part of the Quality Assurance/Quality Control process, the vendor will provide 100% paper verification that the equipment/products purchased meet the program efficiency standards and a field verification of 5% of the measures installed. A third-party evaluator will review the program using appropriate EM&V protocols.

B. Residential New Construction

Program Description

The Residential New Construction program will produce long-term natural gas savings by encouraging the construction of single-family homes, duplexes, or end-unit townhomes with only one shared wall that are inspected and evaluated through the Home Efficiency Rating System (HERS). Two incentive levels have been defined by the HERS Index score the house achieves. Gold Star homes must achieve a HERS rating of 61 to 63. Platinum Star homes must meet a HERS rating of 60 or less. This year's program will include a "Platinum Plus" tier which incentivizes builders to install high efficiency domestic hot water equipment. Builders who reach the Platinum-eligible HERS rating of 60 or below and install a tankless water heater will receive the platinum plus rebate, which offers a higher incentive amount.

The Residential New Construction Program will provide incentives and encourage home builders to construct homes that are more efficient than current building codes and address the lost opportunities in this customer segment by promoting EE at the time the initial decisions are being made. The Residential New Construction Program will work closely with builders, educating them on the benefits of energy efficient new homes. Homes may feature additional insulation, better windows, and higher efficiency appliances. The homes should also be more efficient and comfortable than standard homes constructed to current building codes.

Program incentives are designed to be paid to both gas service only homes in the Vectren North and combination homes that have natural gas heating in the Vectren South territory. It is important to note that the program is structured such that an incentive will not be paid for an all-electric home that has natural gas available to the home site.

Additionally, we will be providing energy efficiency kits for new homes being constructed by Habitat for Humanity.

Eligible Customers

Any customer or home builder constructing a home to the program specifications in the Vectren Energy Delivery of Indiana natural gas service territory.

Marketing Plan

In order to move the market toward an improved home building standard, education will be required for home builders, architects, designers, HERS raters, and customers buying new homes. A combination of in-person meetings with these market participants as well as other educational methods will be necessary.

Barriers/Theory

There are three primary barriers addressed by the Residential New Construction program. The first is customer knowledge. The HERS rating system allows customers to understand building design and construction improvements through a rating system completed by professionals. The second barrier is first cost. The program provides incentives to help reduce the first cost of the EE upgrades. The third barrier is the lack of skill and knowledge of the builders. The program provides opportunities for builders and developers to gain knowledge and skills concerning EE building practices and coaches them on application of these skills.

Incentive Strategy

Incentives can be paid to either the home builder or the customer/account holder. Incentives will be based on the rating tier qualification. Incentives levels will be:

Vectren Gas & Electric Service or Electric Service only (South):

Tier	HERS Rating	Total Incentive	Gas Incentive Portion	Electric Incentive Portion
Platinum Plus	60 or less	\$1,200	\$900	\$300
Platinum	60 or less	\$1,000	\$750	\$250
Gold	61 to 63	\$700	\$525	\$175

Vectren Gas Service only (North):

Tier	HERS Rating	Total Incentive
Platinum Plus	60 or less	\$700
Platinum	60 or less	\$500
Gold	61 to 63	\$350

Table 5. Residential New Construction Program Budget & Energy Savings Targets

Market	Program	Program
Residential	Residential New Construction - Statewide	
	Number of Participants	885
	Therms Savings	305,177
	Total Program Budget	\$529,005
	Per Participant Therm Savings	344.8
	Weighted Avg Measure Life	25
	Net to Gross Ratio	54%

Program Delivery

Vectren will oversee the program and will partner with CLEAResult to deliver the program.

Integration

Vectren will offer this integrated natural gas/electric EE program in its combined natural gas and electric service territory. Vectren has allocated implementation costs based on the net benefits split between natural gas and electric.

Evaluation, Measurement and Verification

As part of the Quality Assurance/Quality Control process, the HERS Assessment is completed by a certified third party HERS Rater. As part of the Quality Assurance/Quality Control process, the vendor will provide

100% paper verification that the equipment/products purchased meet the program efficiency standards. A third-party evaluator will review the program using standard EM&V protocols.

C. Home Energy Assessment

Program Description

The Home Energy Assessment (HEA) program is designed to produce long term energy and demand savings in the residential market. The program provides direct installation of energy-saving measures such as light bulbs, aerators, pipe wrap, water heater set-back and a smart thermostat (if qualified). It also provides a detailed report which educates consumers on ways to reduce energy consumption further.

The contractor will educate the customer while performing installation of appropriate direct install measures during the assessment. An educational leave behind report outlining the results and recommendations is also provided. If duct sealing or wall/attic insulation measures are recommended, the contractor will specify the leak reduction and Vectren will coordinate with an approved insulation contractor for installation.

Eligible Customers

Any residential customer located in the Vectren South gas and electric service territory. Any customer that qualifies for the residential low-income weatherization program will be referred to that program and not included in the HEA program. Additional requirements include:

- Home was not built within the last five years;
- Home has not had an assessment within the last three years; and
- Is owner occupied or authorized non-owner occupied where the occupants have the electric and gas service in their name.
- Building type is single-family or condo/apartment with four units or less

Marketing Plan

Vectren will be utilizing direct mailers, email blasts, online audit tools, and bill inserts as well as other outreach and education efforts and promotional campaigns throughout the year to ensure participation levels are maximized. The preferred program contractor will also market the program to their current customer base as an additional incentive opportunity for use of their services.

Barriers/Theory

The primary barrier addressed through this program is customer education and awareness. Often customers do not understand what opportunities exist to reduce their home energy use. This program not only informs the customer but helps them start down the path of energy savings by directly installing low cost measures. The program is also a “gateway” to other Vectren gas and electric programs.

Initial Measures, Products, and Services

The direct install measures available for installation at no cost include:

- High Efficiency Kitchen and Bathroom Aerators
- High Efficiency Showerhead (Standard or Handheld)
- Pipe Wrap
- Smart Thermostat
- Filter Whistle
- Water Heater Temperature Setback is performed
- Duct Sealing (requires co-pay)

For customers who elect to move forward with air sealing or attic insulation recommended in the audit report, a rebate is available through the Residential Prescriptive Program.

Table 6. Home Energy Assessment Budget & Energy Savings Targets

Market	Program	2020 Total
Residential	Home Energy Assessment	
	Number of Participants	400
	Therms Savings	28,793
	Total Program Budget	\$70,720
	Per Participant Therm Savings	72.0
	Weighted Avg Measure Life	17
	Net to Gross Ratio	82%

Program Delivery

Vectren will oversee the program and partner with a local contractor to deliver the program.

Integration

Vectren will offer this integrated natural gas/electric EE program in its combined natural gas and electric service territory. Vectren has allocated implementation costs based on the net benefits split between natural gas and electric.

Evaluation, Measurement and Verification

To assure compliance with program guidelines, field visits with auditors will occur as well as spot check verifications of measure installations. A third-party evaluator will evaluate the program using EM&V protocols.

D. Income Qualified Weatherization

Program Description

The Income Qualified Weatherization (IQW) program is designed to produce long term energy savings in the residential market. The program is designed to provide weatherization upgrades to low income homes that otherwise would not have been able to afford the energy saving measures. The program provides direct installation of energy-saving measures and educates consumers on ways to reduce energy consumption. Customers eligible through the Income Qualified Weatherization program will have the opportunity to receive deeper retrofit measures including refrigerators, attic insulation, duct sealing, and air infiltration reduction

Collaboration and coordination between gas and electric low-income programs along with state and federal funding is recommended to provide the greatest efficiencies among all programs. The challenge of meeting the goals set for this program have centered on health and safety as well as customer cancellations and scheduling. Vectren is committed to finding innovative solutions to these areas. A health and safety (H&S) budget have been established and we continue to work on improving methods of customer engagement with various confirmations via phone and email reminders prior to the appointment. Vectren will look for ways to do more of a qualitative approach within this program to ensure the maximum savings is reached and H&S issues are addressed appropriately.

Eligible Customers

The program is available to residential customer who receive either electric only or gas and electric service from Vectren where Vectren is the homes primary heat source. Homes must be built prior to 1/1/2015, have not received an audit within the last three years; and is owner occupied or authorized non-owner occupied where occupants have the service in their name. Eligible homes must be less than 4 units, and units should not be stacked. Eligible income qualified customer must receive a total household income up to 300% below the federal-established poverty level. The traditional IQW will continue in its current state offering a home audit, direct install measures and air sealing for customers up to 300% FPL. Additionally, any weatherization preformed under a “Whole Home IQW” will be offered to customers who qualify with income of up to 200% FPL.

Marketing Plan

Vectren will provide a list to the implementation contractor of high consumption customers who have received Energy Assistance Program (“EAP”) funds within the past 12 months to help prioritize those customers who will benefit most from the program. In addition to utilizing the EAP List, the program will utilize census data to target low-income areas within Vectren territory through door-to-door canvassing. The program is marketed to the public as “Neighborhood Weatherization” at various community events also working closely with the Vectren/CNP Foundation.

Barriers/Theory

Lower income homeowners do not have the money to make even simple improvements to lower their bill and often live in homes with the most need for EE improvements. They may also lack the knowledge, experience, or capability to do the work. Health and Safety (H&S) can also be at risk for low income homeowners, as their homes typically are not as “tight”, and indoor air quality can be compromised. In order to increase participation and eligibility, Vectren South has incorporated a H&S budget into the

program. An average of \$250 per fuel type or \$500 per home has been budgeted, but H&S dollars can be spent up to \$5,000 per home, upon Vectren approval. This program provides those customers with basic improvements to help them start saving energy without needing to make the investment themselves.

Initial Measures, Products and Services

As specified above under program changes, the measures available for installation will vary based on the home and include:

- Traditional IQW - Income requirement of up to 300% FPL
 - LED bulbs/lamps (interior/exterior/candelabras)
 - High Efficiency Kitchen and Bathroom Aerators
 - High Efficiency Showerhead (Standard or Handheld)
 - Pipe wrap
 - Filter whistles
 - Infiltration reduction
 - Attic insulation
 - Duct repair, seal and insulation
 - Air Sealing - Gas Furnace with CAC, Heat Pump, Electric Furnace with CAC
 - Refrigerator replacement
 - Smart thermostat
 - Water Heater Temperature Setback
 - Smart power strips
 - Furnace/AC Tune-Up

- Whole Home IQW - Income requirement of up to 200% FPL. Includes all the “Traditional” measures plus:
 - Water heater replacement
 - Attic Insulation
 - Wall Insulation
 - Exterior caulking
 - Central Ac or Furnace Replacement

Table 7. Income Qualified Weatherization Program Budget & Energy Savings Targets

Market	Program	2020 Total Program
Residential	Income Qualified Weatherization - South	
	Number of Participants	900
	Therms Savings	57,322
	Total Program Budget	\$777,446
	Per Participant Therm Savings	63.7
	Weighted Avg Measure Life	13
	Net to Gross Ratio	100%

Program Delivery

Vectren will oversee the program and will partner with CLEAResult to deliver the program.

Integration

Vectren will offer this integrated natural gas/electric EE program in its combined natural gas and electric service territory. Vectren has allocated implementation costs based on the net benefits split between natural gas and electric.

Evaluation, Measurement and Verification

To assure quality installations, 5% of the installations will be field inspected. A third-party evaluator will evaluate the program using standard EM&V protocols.

E. Energy Efficient Schools

Program Description

The Energy Efficient Schools Program is designed to impact students by teaching them how to conserve energy and to produce cost effective energy savings by influencing students and their families to focus on conservation and the efficient use of energy.

The program consists of a school education program for 5th grade students attending schools served by Vectren South. To help in this effort, each child that participates will receive a take-home energy kit with various energy saving measures for their parents to install in the home. The kits, along with the in-school teaching materials, are designed to make a lasting impression on the students and help them learn ways to conserve energy.

Eligible Customers

The program will be available to selected 5th grade students/schools in the Vectren South service territory.

Marketing Plan

The program will be marketed directly to elementary schools in Vectren South gas and electric service territory as well as other channels identified by the implementation contractor. A list of the eligible schools will be provided by Vectren South to the implementation contractor for direct marketing to the schools via email, phone, and mail (if necessary) to obtain desired participation levels in the program.

Barriers/Theory

This program addresses the barrier of education and awareness of EE opportunities. Working through schools, both students and families are educated about opportunities to save. As well, the families receive energy savings devices they can install to begin their savings.

Initial Measures, Products and Services

The kits for students will include:

- High Efficiency Kitchen Aerator
- High Efficiency Bathroom Aerators (2)
- High Efficiency Showerhead
- LED bulbs 11 Watt (2)
- LED Bulb 15 Watt (1)
- LED nightlight
- Filter Whistle

Table 8. Energy Efficient Schools Program Budget & Energy Savings Targets

Market	Program	2020 Total Program
Residential	Energy Efficient Schools	
	Number of Participants	2,600
	Therms Savings	32,595
	Total Program Budget	\$85,022
	Per Participant Therm Savings	12.5
	Weighted Avg Measure Life	9
	Net to Gross Ratio	100%

Program Delivery

Vectren will oversee the program and will partner with National Energy Foundation (NEF) to deliver the program.

Integration

Vectren will offer this integrated natural gas/electric EE program in its combined natural gas and electric service territory. Vectren has allocated implementation costs based on the net benefits split between natural gas and electric.

Evaluation, Measurement and Verification

Classroom participation will be tracked. A third-party evaluator will evaluate the program using standard EM&V protocols.

F. Residential Behavior Savings Program

Program Description

The Residential Behavioral Savings (RBS) Program motivates behavior change and provides relevant, targeted information to the consumer through regularly scheduled direct contact via mailed and emailed home energy reports. The report and web portal include a comparison against a group of similarly sized and equipped homes in the area, usage history comparisons, goal setting tools, and progress trackers. The Home Energy Report program anonymously compares customers' energy use with that of their neighbors of similar home size and demographics. Customers can view the past twelve months of their energy usage and compare their energy consumption and costs with others in the same neighborhood. Once a consumer understands better how they use energy, they can then start conserving energy.

Program data and design was provided by Oracle (Previously Opower), the implementation vendor for the program. Oracle provides energy usage insight that drives customers to act by selecting the most relevant information for each household, which ensures maximum relevancy and high response rate to recommendations.

Eligible Customers

Residential customers who receive natural gas and electric service from Vectren are eligible to participate in this integrated natural gas and electric EE program. This program is designed as an opt-out program and is not currently marketed.

Barriers/Theory

The Residential Behavioral Savings program provides residential customers with better energy information through personalized reports delivered by mail, email and an integrated web portal to help them put their energy use in context and make better energy use decisions. Behavioral science research has demonstrated that peer-based comparisons are highly motivating ways to present information. The program will leverage a dynamically created comparison group for each residence and compare it to other similarly sized and located households.

Implementation & Delivery Strategy

The program will be delivered by Oracle and include energy reports and a web portal. Customers typically receive between 4 - 6 reports annually. These reports provide updates on energy consumption patterns compared to similar homes and provide energy savings strategies to reduce energy use. They can promote other Vectren programs to interested customers. The web portal is an interactive system for customers to perform a self-audit, monitor energy usage over time, access energy savings tips and be connected to other Vectren South gas and electric programs.

Table 9. Residential Behavior Savings Program Budget & Energy Savings Targets

Market	Program	2020 Total Program
Residential	Residential Behavioral Savings	
	Number of Participants	26,935
	Therms Savings	283,100
	Total Program Budget	\$104,852
	Per Participant Therm Savings	10.5
	Weighted Avg Measure Life	1
	Net to Gross Ratio	100%

Program Delivery

Vectren will oversee the program and partner with Oracle to deliver the program.

Integration

Vectren will offer this integrated natural gas/electric EE program in its combined natural gas and electric service territory. Vectren has allocated implementation costs based on the net benefits split between natural gas and electric.

Evaluation, Measurement and Verification

A third-party evaluator will complete the evaluation of this program and work with Vectren South to select the participant and non-participant groups.

G. Multi-Family Direct Install - North

Program Description

The Multi-Family Direct Install Program is a program supporting residents of multi-family properties with easy-to-install upgrades of energy efficient measures. The program provides customers information on energy best practices and promotes energy efficiency best practices through the installation of energy efficient technologies including: high efficiency showerheads, aerators, and Smart Thermostats. The program is open for, and promoted to, owners and managers of multi-family properties in the Vectren North territory.

Eligible Customers

Multi-family properties with active residential or general service natural gas service within the Vectren North territory.

Marketing Plan

The target market for the program is multi-family properties of more than 4 units, on residential or general service rates. The program will be promoted through direct outreach to property managers and communication and training provided by landlord and tenant associations. Additionally, in 2020, concentrated marketing efforts will be conducted in low-income service territories.

Table 10. Multi-Family Direct Install Program Budget & Energy Savings Targets

Market	Program	2020 Total Program
Residential	Multi-Family Direct Install - (Gas - North)	
	Number of Participants	1,026
	Therms Savings	68,652
	Total Program Budget	\$461,365
	Per Participant Therm Savings	66.9
	Weighted Avg Measure Life	11
	Net to Gross Ratio	100%

Program Delivery

Vectren will oversee the program and partner with CLEAResult to deliver the program.

Evaluation, Measurement & Verification

A third-party evaluator will evaluate the program using standard EM&V protocols

H. Targeted Income

Program Description

The Targeted Income Program will provide a comprehensive home energy audit and energy efficiency upgrades to consumers with qualifying incomes, at or below 200 percent of Federal Poverty Guidelines. The audit will identify cost-effective opportunities to reduce energy consumption through the installation of energy efficient mechanical equipment and shell measures. The Program will provide financial assistance to cover the cost to retrofit homes and educate customers on ways to reduce their energy use and manage their utility costs through behavior modification. These services will be delivered in conjunction with the Weatherization Assistance Program through local weatherization assistance providers (e.g., Community Action Agencies (CAA) and Housing Rehabilitation Organizations) where possible to minimize administrative costs by supplementing and leveraging existing funding sources and convenient opportunities to recruit targeted customers.

Indiana Housing & Community Development Authority (IHCDA) will receive rebate applications via the State of Indiana's Weatherization reporting system. Those rebates are aggregated and sent to the implementer for review, verification, and processing every month.

Eligible Customers

Eligibility requirements for program participation include:

- Customers must be Vectren North natural gas residential customers.
- Household incomes must be below 200% of the Federal Poverty Guidelines.
- Program available to single-family homes and duplexes.
- Equipment must meet the specifications and installation standards defined in the Indiana State Weatherization Guidelines.

Marketing Plan

The target market for the Program is Vectren Energy Delivery of Indiana residential customers with household incomes at or below 200% of the Federal Poverty Guidelines. The program will be promoted through the following marketing channels:

- Work with IHCDA, INCAA, and/or CAA to obtain referrals of qualified customers.
- Working with the CAA network to increase customer awareness of utility partnership in the Weatherization program services during customer education, which takes place as part of the Weatherization Process. All marketing materials will be submitted to Vectren for approval.

Barriers/Theory

The primary barrier addressed through this program is customer education and awareness. Often customers do not understand what opportunities exist to reduce their home energy use. This program not only informs the customer but helps them start down the path of energy savings by directly installing low cost measures. The program is also a “gateway” to other Vectren gas programs.

Initial Measures, Products and Services

The direct install measures available for installation at no cost include:

- Air Sealing
- High Efficiency Bath Aerator
- Ceiling Insulation
- Duct 20% Leakage Reduction
- Furnace 92% AFUE
- Water Heater
- High Efficiency Kitchen Aerator
- High Efficiency Showerhead
- Wall Insulation
- Water Heater

Table 11. Targeted Income Program Budget & Energy Savings Targets

Market	Program	2020 Total Program
Residential	Targeted Income - (Gas - North)	
	Number of Participants	101
	Therms Savings	15,023
	Total Program Budget	\$100,220
	Per Participant Therm Savings	148.7
	Weighted Avg Measure Life	19
	Net to Gross Ratio	100%

Program Delivery

Vectren will oversee the program and will partner with CLEAResult to deliver the program.

Evaluation, Measurement & Verification

A third-party evaluator will evaluate the program using standard EM&V protocols.

I. Home Energy House Call Integrated – Vectren North (Duke)

Program Description

This program works jointly with Duke Energy's Home Energy House Call (HEHC) program in the Vectren North territory. The in-home energy assessment is provided to customers at no additional cost. An energy specialist completes a 60 to 90-minute walk through assessment of the home and analyzes energy usage specific to the home to identify energy saving opportunities. The Building Performance Institute (BPI) certified energy specialist provides and discusses a customized report to the customer that identifies actions the customer can take to increase energy efficiency in their home. The recommendations will range from behavioral changes to equipment modifications that can save energy and reduce cost. The primary goal is to empower customers to better manage their energy usage. Example recommendations might include the following:

- Turning off vampire load equipment and lights when not in use
- Using energy efficient lighting in light fixtures
- Using a programmable thermostat to better manage heating and cooling usage
- Replacing older equipment and adding insulation and sealing the home

Customers also receive an Energy Efficiency Kit with a variety of measures that can be directly installed by the energy specialist at the time of the assessment. The direct install measures available for installation at the home include the following (Note: *measures capturing gas savings modeled in Vectren's 2020 Operating Plan):

- High Efficiency kitchen and bath aerators*
- High Efficiency showerheads*
- Foam weather stripping
- Weather stripping*
- Energy efficient lighting

Eligible Customers

To qualify for this program, the customer must be a Duke Energy customer. Vectren claims savings only from customers that have Vectren service. The customer must own a single-family home and have lived there for at least four months

Marketing Plan

Vectren will work closely with Duke Energy in marketing the program.

Program Delivery

Duke Energy will oversee the program and may partner with an implementation provider to deliver the program.

Table 12. Home Energy House Call Integrated – Vectren North (Duke) Program Budget & Energy Savings Targets

Market	Program	Program
Residential	HEHC - Duke (Gas - North)	
	Number of Participants	1,122
	Therms Savings	49,368
	Total Program Budget	\$191,044
	Per Participant Therm Savings	44.0
	Weighted Avg Measure Life	16
	Net to Gross Ratio	100%

J. Neighborhood Program Integrated – Vectren North (Duke)

Program Description

This program works jointly with Duke Energy's Neighborhood Program (NP) in the Vectren North territory. This program is designed to provide customized weatherization upgrades to low income homes in the Vectren North gas and Duke Energy electric overlap territory that otherwise would not be able to afford the energy saving measures.

The Neighborhood Energy Saver assists low-income customers in reducing energy costs through energy education and installation of energy efficient measures. The primary goal of the program is to empower low-income customers to better manage their energy usage. Customers participating in the program will receive a walk-through energy assessment and one-on-one education. Additionally, the customer receives a comprehensive package of energy efficient measures. Each measure listed below is installed or provided to the extent the measure is identified as energy efficiency opportunity based on the results of the energy assessment (Note: *measures capturing gas savings modeled in Vectren's 2020 Operating Plan):

- LED Bulbs
- Electric Water Heater Wrap and Insulation for Water Pipes
- Electric Water Heater Temperature Check and Adjustment
- High Efficiency Faucet Aerators*
- High Efficiency Showerheads*
- Wall Plate Thermometer
- HVAC Winterization Kits
- HVAC Filters
- Change Filter Calendar
- Air Infiltration Reduction Measures*

Eligible Customers

This program is available to residential customers living in select, census-defined communities identified by Duke Energy. Customers must be Duke Energy electric customers. Vectren claims savings only from customers that have Vectren service. Both homeowners and renters are eligible to participate. However, renters must obtain landlord approval before an energy assessment can take place.

Marketing Plan

Vectren will work closely with Duke Energy in marketing the program.

Program Delivery

Duke Energy will oversee the program and may partner with an implementation provider to deliver the program.

Table 13. Neighborhood Program Integrated – Vectren North (Duke) Budget & Energy Savings Targets

Market	Program	2020 Total
Residential	Neighborhood Program - Duke (Gas - North)	
	Number of Participants	1,000
	Therms Savings	130,440
	Total Program Budget	\$198,851
	Per Participant Therm Savings	130.4
	Weighted Avg Measure Life	16
	Net to Gross Ratio	100%

K. Commercial & Industrial Prescriptive Program

Program Description

The Commercial & Industrial (C&I) Prescriptive Program is designed to provide financial incentives on qualifying products to produce greater energy savings in the C&I market. The rebates are designed to promote lower energy consumption, assist customers in managing their energy costs, and build a sustainable market around EE.

Program participation is achieved by offering incentives structured to cover a portion of the customer's incremental cost of installing prescriptive efficiency measures.

Within the Gas C&I Prescriptive Program, Vectren will provide a midstream incentive at the distributor level to encourage them to stock and promote more energy efficient boilers, furnaces, water heaters and food service equipment. The midstream offering will partner with willing HVAC, water heater and kitchen equipment distributors serving Vectren gas territory that agree to share customer locations where their equipment gets installed. Additionally, the distributors will be given a limited incentive budget to help control first year participation and evaluation risk.

Eligible Customers

Applicants must be an active natural gas General Service customer of Vectren Energy Delivery of Indiana on Rate 120, 125 Vectren South or 220, 225 Vectren North at the location of installation.

Marketing Plan

Proposed marketing efforts include trade ally outreach, trade ally meetings, direct mail, face-to-face meetings with customers, marketing campaigns and bonuses, web-based marketing, and coordination with key account executives.

Barriers/Theory

Customers often have the barrier of higher first cost for EE measures, which precludes them from purchasing the more efficient alternative. They also lack information on high efficiency alternatives. Trade allies often run into the barrier of not being able to promote more EE alternatives because of first cost or lack of knowledge. They also gain credibility with customers for their EE claims when a measure is included in a utility prescriptive program. Through the program, the Trade Allies can promote EE measures directly to their customers.

Initial Measures, Products and Services

Prescriptive program measures primarily involve space and water heating (e.g., boilers, furnaces, thermostats) and commercial kitchen equipment (e.g., gas fryers, ovens, broilers). They include both capital measures (e.g., new steam cooker) and operational/maintenance measures (e.g., boiler tune-ups, steam trap services). Note that measures and incentives included in the program will change over time as baselines change, new technologies become available and customer needs are identified. Details of the measures, savings and incentives can be found in Appendix A.

Implementation & Delivery Strategy

The program will be delivered primarily through the trade allies working with their customers. Vectren and its implementation partners will work with the trade allies to make them aware of the offerings and help them promote the program to their customers. The implementation partner will provide training and technical support to the trade allies to become familiar with the EE technologies offered through the program. The program will be managed by the same implementation provider as the Commercial & Industrial Custom program so that customers can seamlessly receive assistance and all incentives can be efficiently processed through a single procedure.

Incentive Strategy

Incentives are provided to customers to reduce the first cost of energy-saving measures. There is no fixed incentive percentage amount based on the difference in price because some technologies are newer and need higher amounts. Others have been available in the marketplace longer and do not need as much to motivate customers. Incentives will be adjusted to respond to market activity and bonuses may be available for limited time, if required, to meet goals.

Table 14. Commercial & Industrial Prescriptive Program Budget & Energy Savings Targets

Market	Program	2020 Total Program
Commercial	Commercial Prescriptive	
	Number of Participants	1,067
	Therms Savings	340,000
	Total Program Budget	\$924,264
	Per Participant Therm Savings	318.7
	Weighted Avg Measure Life	15
	Net to Gross Ratio	84%

Program Delivery

Vectren will oversee the program and partner with Nexant to deliver the program.

Evaluation, Measurement and Verification

Site visits will be made on 5% of all installations, as well as all projects receiving incentive greater than \$20,000, to verify the correct equipment was installed. Standard EM&V protocols will be used for the third-party evaluation of the program.

L. Commercial & Industrial Custom

Program Description

To maximize cost-effectiveness and streamline program delivery, the Commercial Custom Program encompasses several different options for commercial & industrial customers to participate. These include: Custom Program, Commercial New Construction, Building Tune Up, and Strategic Energy Management (SEM).

The **Custom Program** promotes the implementation of customized energy-saving projects at qualifying customer facilities. Incentives promoted through this program serve to reduce the cost of implementing energy-reducing projects and upgrading to high-efficiency equipment. Due to the nature of a custom EE program, a wide variety of projects are eligible.

Specific to **Commercial New Construction**, this program provides value by promoting EE designs with the goal of developing projects that are more energy efficient than current Indiana building code. This program applies to new construction and major renovation projects. Major renovation is defined as the replacement of at least two systems (e.g. lighting, HVAC, controls, building envelope) within an existing space. The program provides incentives as part of the facility design process to explore opportunities in modeling EE options to craft an optimal package of investments. The program also offers customers the opportunity to receive prescriptive or custom rebates toward eligible equipment in order to reduce the higher capital cost for the EE solutions.

The **Building Tune-Up** program provides a targeted, turnkey, and cost-effective retro-commissioning solution for small- to mid-sized customer facilities. It is designed as a comprehensive customer solution that will identify, validate, quantify, and encourage the installation of both operational and capital measures. Most of these measures will be no- or low-cost with low payback periods and will capture energy savings from a previously untapped source: building automation systems.

Vectren will pilot a **Strategic Energy Management (SEM)** offering to select large energy users throughout 18-month training process. Upon enrollment, the customer is assigned an energy manager to provide personalized service, as well as technical support, and a facility audit.

Eligible Customers

Applicants must be an active natural gas General Service customer of Vectren Energy Delivery of Indiana on Rate 120, 125 Vectren South or 220, 225 Vectren North at the location of installation.

Building Tune-Up and SEM also require applicants to be both an active Vectren South electric customer on a qualifying commercial rate and an active natural gas General Service customer on Rate 120 or 125.

Marketing Plan

Proposed marketing efforts include individualized outreach to large C&I customers through a variety of channels and coordination with key account representatives to leverage the contacts and relationships they have with the customers. Direct mail, media outreach, trade shows, marketing campaigns and bonuses, trade ally meetings, and educational seminars could also be used to promote the program. The Building Tune-Up and Commercial New Construction programs will be marketed through outreach and direct personal communication from Vectren South staff and third-party contractors.

Barriers/Theory

Applications of some specific EE technologies are unique to that customer's application or process. The energy savings estimates for these measures are highly variable and cannot be assessed without an engineering estimation of that application; however, they can offer an opportunity for significant energy savings. To promote the installation of these highly efficient technologies or measures, the Commercial & Industrial Custom program will provide incentives based on the total therms saved, as calculated by the engineering analysis. To assure savings, these projects will require program engineering reviews and pre-approvals. The program will also offer energy assessments to select customers to help remove customer barriers regarding opportunity identification and energy savings potential.

The Building Tune-Up program will typically target customers with buildings between 50,000 square feet and 150,000 square feet. Customers in this size range face unique barriers to energy efficiency. For example, although they are large enough to have a Building Automation System (BAS), they are usually too small to have a dedicated facility manager or staff with experience achieving operational efficiency. Also, most retro-commissioning service companies prefer larger projects and are too expensive for small-to-midsized customers. We have specifically tailored the incentive structure and program design to eliminate these barriers. The Building Tune-Up program is designed as a comprehensive customer solution that will identify, validate, quantify, and encourage the installation of both operational and capital measures eligible for incentive offerings.

Initial Measures, Products and Services

All technologies or measures that save therms qualify for the program. There are different services offered in the Building Tune-Up, New Construction and SEM subprograms. The BTU program will specifically target measures that provide no- and low-cost operational savings. Most measures involve optimizing the building automation system (BAS) settings but the program will also investigate related capital measures, like controls, operations, processes, and HVAC.

The New Construction offering provides energy design assistance at the design phase to encourage new buildings to go beyond what Indiana code requires. Each recommendation is provided to the customer through a report that estimates the savings and cost impacts. Customers are then provided additional rebates for each recommendation they select and install from the report.

The SEM program provides in-depth consulting and support to large energy users who are interested in becoming ISO 50001 Ready. The program assigns a certified trainer to help set up their Energy Management System and trains them on best practices of energy management over an 18-month period. The participating customer will also receive an energy audit that will identify areas of opportunity to optimize the energy use in their facility.

Implementation & Delivery Strategy

The implementation partner will work collaboratively with Vectren South staff to recruit and screen customers for receiving facility energy assessments, technical assistance and energy management education. The implementation partner will also provide engineering field support to customers and trade allies to calculate the energy savings. Customers or trade allies with a proposed project will complete an application form with the energy savings calculations for the project. The implementation team will review all calculations and where appropriate complete site visits to assess

and document pre installation conditions. Customers will be informed, and funds reserved for the project. Implementation engineering staff will review the final project information as installed and verify the energy savings. Incentives are then paid on the verified savings.

C&I New Construction - The new construction program is designed as a proactive, cost-effective way to achieve energy efficiency savings and foster economic growth. Typically, program participants face time and cost constraints throughout the project that make it difficult to invest in sustainable building practices. Participants need streamlined and informed solutions that are specific to their projects and locations. This scenario is particularly true for small- to medium-sized new construction projects, where design fees and schedules provide for a very limited window of opportunity.

To help overcome the financial challenge, a Standard Energy Design Assistance (EDA) is offered. This provides additional engineering expertise during the design phase to identify energy-saving opportunities. Commercial and industrial projects for buildings greater than 100,000 square feet still in the conceptual design phase qualify for Vectren South's Enhanced EDA incentives which include energy modeling. The Vectren South implementation partner staff expert will work with the design team through the conceptual design, schematic design and design development processes providing advice and counsel on measures that should be considered and EE modeling issues. Incentives will be paid after the design team submits completed construction documents for review to verify that the facility design reflects the minimum energy savings requirements. For those projects that are past the phase where EDA can be of benefit, the C&I New Construction program offers the opportunity to receive prescriptive or custom rebates towards eligible equipment.

The **Building Tune-Up** program is designed to encourage high levels of implementation by customers seeking to optimize the operation of their existing HVAC system.

SEM is a comprehensive new approach to energy management, customers are provided with comprehensive support during their participation in the program. As soon as a customer enrolls in the program, an energy manager is assigned to provide personalized service throughout the 18-month training process. That process starts with a series of trainings that will introduce SEM and ISO 50001 concepts to the customer and gives them specific instructions on how they can implement lasting change within their organization. Key strategies include:

- **Energy Managers.** Program-provided energy managers guide customers through the process, helping them complete program requirements, and supporting their implementation of SEM.
- **High-Quality Training.** Energy Managers prepare each customer's energy champion for the cohort training, which is conducted in which customers learn the basic elements of ISO 50001 and how to apply them to their facilities.

- **Free Facility Audit.** SEM is focused on long-term change, and the program provides each customer with a free facility audit to identify both operational and capital energy efficiency projects. The energy audit also serves as a teaching moment for the companies' energy team on how to systematically identify opportunities for improvement. The low- and no-cost operational projects can be completed almost immediately, while the capital projects help customers continue to take advantage of savings.

Incentive Strategy

Incentives will be calculated on a per-therm basis. The program will target a nominal incentive of \$1.00/therm on custom natural gas saving projects. Incentives are paid based on the first-year annual savings reduction. Rates may change over time and vary with special initiatives. Incentives will not pay more than 50% of the project cost, nor provide incentives for projects with paybacks less than 12 months. Vectren will offer a cost share on facility energy assessments that will cover up to 100% of the assessment cost.

Table 15. Commercial & Industrial Custom Program Budget & Energy Savings Targets

Market	Program	2020 Total Program
Commercial	Commercial Custom	
	Number of Participants	53
	Therms Savings	483,000
	Total Program Budget	\$1,084,144
	Per Participant Therm Savings	9,113.2
	Weighted Avg Measure Life	13
	Net to Gross Ratio	85%

Program Delivery

Vectren will oversee the program and will partner with Nexant to deliver the program.

Evaluation, Measurement and Verification

Given the variability and uniqueness of each project, all projects will be pre-approved. Pre and post visits to the site to verify installation and savings will be performed as defined by the program implementation partner. Monitoring and verification may occur on the largest projects. A third-party evaluator will be used for this project and use standard EM&V protocols.

M. Small Business Energy Solutions (SBES)

Program Description

The Small Business Energy Solutions Program provides value by directly installing EE products such as high efficiency lighting, pre-rinse sprayers, refrigeration controls, electrically-commutated motors, smart thermostats and vending machine controls. The program helps small businesses and multi-family customers identify and install cost effective energy saving measures by providing an on-site energy assessment customized for their business. The Multi-Family Retrofit program that began in 2017 will continue to be offered in 2020 under the SBES program. This program is an integrated gas and electric and is targeting dual fuel customers.

Eligible Customers

Any participating Vectren South business customer with a maximum peak energy demand of less than 400 kW. Multifamily building owners with Vectren general electric service may also qualify for the program, including apartment buildings, condominiums, cooperatives, duplexes, quadraplexes, townhomes, nursing homes and retirement communities. Starting in 2020, the program will also permit eligible non-profit establishment of any size to participate. In order to qualify for natural gas measures and savings applicants also must be an active natural gas General Service customer on Rate 120 or 125.

Marketing Plan

The SBES Program will be marketed primarily through in-network trade ally outreach. The program implementer will provide trade ally-specific marketing collateral to support trade allies as they connect with customers.

The program will provide targeted marketing efforts as needed to individual customer segments (e.g., hospitality, grocery stores, and non-profit organizations) to increase participation in under-performing segments, including direct customer outreach and enhanced incentive campaigns. Additional program marketing may occur through direct mail, trade associations, local business organizations, marketing campaigns and bonuses, educational seminars, and direct personal communication from Vectren South staff and third-party contractors. Vectren will continue to target Multi-Family, Non-Profit, and Civil/Governmental sectors within this program.

Barriers/Theory

Small business customers generally do not have the knowledge, time or money to invest in EE upgrades. This program assists these small businesses with direct installation and turn-key services to get measures installed at no or low out-of-pocket cost.

There is an implementation contractor in place providing suggested additions and changes to the program based on results and local economics.

Implementation & Delivery Strategy

Trade Ally Network: Trained trade ally energy advisors will provide energy assessments to business customers with less than 400 kW peak demand and to multifamily and non-profit buildings. The program implementer will issue an annual Request for Qualification (RFQ) to select the trade allies with the best ability to provide high-quality and cost-effective service to small businesses and provide training to Small Business Energy Solutions (SBES) trade allies on the program process, with an emphasis on improving energy efficiency sales.

Energy Assessments: Trade allies will walk through small businesses and record site characteristics and energy efficiency measures at no cost to the customer. They will provide a generated energy assessment report that will detail customer-specific opportunities, savings, incentives, simple paybacks, and other available energy efficiency programs. The trade ally will review the report with the customer, presenting the program benefits and process, while addressing any questions.

Initial Measures, Products and Services

The program will have two types of measures provided. The first are measures that will be installed at no cost to the customer. They will include but are not limited to the following:

(Note: *measures capturing gas savings modeled in Vectren's 2020 Operating Plan).

- Wi-fi enabled thermostats*
- Programmable thermostats*
- Program the programable thermostat*
- Pre-rinse sprayers*
- Faucet aerators*
- Furnace Tune Up*
- Steam Trap Replacement – Dry Cleaner*

The second types of measures require the customer to pay a portion of the labor and materials. They will include but are not limited to the following:

- Interior LED lighting (replacing incandescent, high bays and linear fluorescents)
- Exterior LED lighting
- EC Motors
- Lighting Controls
- Refrigerated LED
- Refrigerated Case Cover
- Anti-sweat heater controls
- Furnace Tune-Up
- Steam Trap Replacement
- Vending Machine Control

Incentive Strategy

In addition to the no-cost measures identified during the audit, the program will also pay a cash incentive on every recommended improvement identified through the assessment. Incentive rates may change over time and vary with special initiatives.

Table 16. Small Business Energy Solutions Program Budget & Energy Savings Targets

Market	Program	2020 Total Program
Commercial	Small Business Energy Solutions	
	Number of Participants	15
	Therms Savings	3,000
	Total Program Budget	\$12,292
	Per Participant Therm Savings	200
	Weighted Avg Measure Life	11
	Net to Gross Ratio	101%

Program Delivery

Vectren will oversee the program and partner with Nexant to deliver the program.

Integration with Vectren South Natural Gas

Vectren will offer this integrated natural gas and electric EE program in its combined natural gas and electric service territory.

Evaluation, Measurement and Verification

On-site verification will be provided for the first three projects completed by each trade ally, in addition to the program standard 5% of all completed projects and all projects receiving incentives greater than \$20,000. These verifications allow the program to validate energy savings, in addition to providing an opportunity to ensure the trade allies are providing high-quality customer services and the incentivized equipment satisfies program requirements. A third-party evaluator will evaluate the program using standard EM&V protocols.

5. Support Services

A. Outreach and Education

Vectren's Customer Outreach and Education program serves to raise awareness and drive customer participation as well as educate customers on how to manage their energy bills. The customer outreach and education budget are \$534,863. The program includes the following goals as objectives:

- Build awareness;
- Educate consumers on how to conserve energy and reduce demand;
- Educate customers on how to manage their energy costs and reduce their bill;
- Communicate support of customer energy efficiency needs; and,
- Drive participation in the DSM programs.

The marketing approach includes paid media, as well as web-based tools to help analyze bills, energy audit tools, energy efficiency and DSM program education and information. Informational guides and sales promotion materials for specific programs are included in this budget.

This effort is the key to achieving greater energy savings by convincing the families and businesses making housing/facility, appliance and equipment investments to opt for greater energy efficiency. The first step in convincing the public and businesses to invest in energy efficiency is to raise their awareness.

It is essential that a broad public education and outreach campaign not only raise awareness of what consumers can do to save energy and control their energy bills, but to prime them for participation in the various DSM programs.

Marketing Plan

This effort will provide funding for cross-program public education activities, outreach, marketing and promotion to raise awareness of the benefits and methods of improving energy efficiency in homes and commercial businesses. Beyond energy efficiency education, an objective will be to motivate participation in the programs.

Types of activities that will be included in this effort are:

- Enhancement of the Save Energy website to include the latest energy efficiency information for residential and commercial use.
- Targeted educational campaign for businesses to support the programs.
- Targeted educational campaign for residences to support the programs.
- Targeted training and educational program for trade allies.
- Distribution of federal Energy Star and other national organization materials in the service territory.

Delivery Organization

Vectren will oversee outreach and education for the programs. The Company will work closely with its implementation partners to provide consistent messaging across different program outreach and

education efforts. Vectren South will utilize the services of communication and energy efficiency experts to deliver the demand and energy efficiency message.

B. Contact Center

The Vectren Contact Center, called the Energy Efficiency Advisory Team, fields referrals from the company's general call center and serves as a resource for interested customers. A toll-free number is provided on all outreach and education materials. Direct calls are initial contacts from customers or market providers coming through the dedicated toll-free number printed on all Vectren's conservation materials. Transferred calls are customers that have spoken with a Vectren Energy Efficiency Advisor and have either asked or been offered a transfer to an Energy Efficiency Advisor who is trained to respond to energy efficiency questions or conduct the on-line energy audit. The budget for the Contact Center is \$130,000.

These customer communication channels provide support mechanisms for Vectren customers to receive the following services:

- Provide general guidance on energy saving behaviors and investments using customer specific billing data via the on-line tool (bill analyzer and energy audit).
- Respond to questions about the residential and general service programs.
- Facilitate the completion of and provide a hard copy report from the online audit tool for customers without internet access or who have difficulty understanding how to use the tool.
- Respond to inquiries about rebate fulfillment status.

C. Online Energy Audit Tool

The Online Energy Audit tool is a customer engagement and messaging tool which uses actual billing data from a customer's energy bills to pinpoint ways to save energy in their home. Data collected drives account messaging through providing tips and rebates relevant to that customer's situation. Additionally, data collected from the online energy audit is used to validate neighbor comparison data which illustrates how the customer's monthly energy use compares to their neighbors and is designed to inspire customers to try and save more energy than their efficient neighbors. This tool provides the online ability and means to communicate, cross promote, and educate customers about energy efficiency and Vectren's energy efficiency programs. The Online Energy Audit tool provides tools and messaging to educate customers and provide suggestions, tips, and advice on energy usage. The budget for the Online Audit tool is \$232,435. Costs for this tool are shared across Vectren's Indiana Gas DSM, Electric DSM and Vectren Energy Delivery of Ohio, Inc. (VEDO) DSM portfolios.

D. Evaluation

Vectren Energy Delivery of Indiana (Vectren) will work with an independent third-party evaluator to conduct an evaluation of Vectren's 2020 demand-side management (DSM) programs. The evaluation budget is \$409,429.

The evaluation will use standard Evaluation, Measurement and Verification (EM&V) such as a process, impact, and/or market effects evaluation of Vectren's portfolio of energy efficiency programs. Gas impacts will be calculated for all Vectren's integrated gas programs.

E. Emerging Markets & Home Energy Management

The Emerging Markets funding allows Vectren's DSM portfolio to offer leading-edge program designs for next-generation technologies, services, and engagement strategies to growing markets in the Vectren territory. The budget is \$341,100 for 2020 and will not be used to support existing programs, but rather support new program development or new measures within an existing program. This budget includes \$200,000 Emerging Markets budget as well as \$141,100 from the Home Energy Management (HEM) budget as the original HEM Project has been delayed while we evaluate vendors and best alternatives for this program.

Incentives promoted through this program may range from innovative rebate offerings to engineering and trade ally assistance. This funding will be utilized with Vectren Oversight Board approval and will not be used to support existing measures or programs, but rather support new program development or new measures within an existing program. In Cause No. 44927, the Commission approved a similar program for Vectren South.

6. Appendix A – Program Measure Details Residential listings, participation and initial incentives

Program	Measure	2020		Total Therm	Measure		Incentive/ Unit
		Participation	Therms/ Participant		Life	NTG	
Residential Prescriptive	Attic Insulation - North (Gas Only)	109	188.09	20,502	25		\$ 450.00
Residential Prescriptive	Attic Insulation - South (Dual - Gas & Electric)	139	174.71	24,285	25		\$ 90.00
Residential Prescriptive	Duct Sealing - North (Gas Only)	25	111.28	2,782	20		\$ 300.00
Residential Prescriptive	Duct Sealing - South (Dual - Gas & Electric)	21	81.49	1,711	20		\$ 60.00
Residential Prescriptive	Furnace Tune Up	750	38.60	28,947	2		\$ 25.00
Residential Prescriptive	Natural Gas Boilers (>90% AFUE)	17	258.05	4,387	18		\$ 300.00
Residential Prescriptive	Natural Gas Furnaces (>95% AFUE)	7,683	135.03	1,037,403	20		\$ 250.00
Residential Prescriptive	Natural Gas Furnaces (>97% AFUE)	538	158.66	85,361	20		\$ 300.00
Residential Prescriptive	Natural Gas Water Heater (>.67 EF)	50	22.60	1,130	13		\$ 100.00
Residential Prescriptive	Natural Gas Tankless Water Heater	30	41.40	1,242	13		\$ 250.00
Residential Prescriptive	Smart Programmable Thermostat - North (Gas Only)	2,138	74.50	159,286	15		\$ 75.00
Residential Prescriptive	Smart Programmable Thermostat - South (Dual - Gas & Electric)	900	53.90	48,514	15		\$ 15.00
Residential Prescriptive	Smart Programmable Thermostat - South (Gas Only)	189	53.90	10,188	15		\$ 75.00
Residential Prescriptive	Wall Insulation - North (Gas Only)	16	53.20	851	25		\$ 450.00
Residential Prescriptive	Wall Insulation - South (Dual - Gas & Electric)	110	34.51	3,797	25		\$ 90.00
Residential Prescriptive	Wifi Thermostat - North (Gas Only)	200	25.97	5,194	15		\$ 50.00
Residential Prescriptive	Wifi Thermostat - South (Dual - Gas & Electric)	100	18.54	1,854	15		\$ 10.00
Residential Prescriptive	Wifi Thermostat - South (Gas Only)	40	18.54	742	15		\$ 50.00
Residential Prescriptive	Total	13,055		1,438,176	19	62%	
Residential New Construction	Gold Star: HERS Index Score ≤ 63 - Gas Heated North	522	332.16	173,390	25		\$ 350.00
Residential New Construction	Gold Star: HERS Index Score ≤ 63 - Gas Heated South (Gas)	90	341.31	30,718	25		\$ 525.00
Residential New Construction	Habitat Kit Gas Only	40	92.01	3,680	14		\$ -
Residential New Construction	Habitat Kit Gas and Electric	20	92.01	1,840	14		\$ -
Residential New Construction	Platinum Star Plus: HERS Index Score ≤ 60 - Gas Heated North	5	543.13	2,716	25		\$ 700.00
Residential New Construction	Platinum Star Plus: HERS Index Score ≤ 60 - Gas Heated South (Gas)	5	543.13	2,716	25		\$ 900.00
Residential New Construction	Platinum Star: HERS Index Score ≤ 60 - Gas Heated North	155	440.92	68,343	25		\$ 500.00
Residential New Construction	Platinum Star: HERS Index Score ≤ 60 - Gas Heated South (Gas)	48	453.64	21,775	25		\$ 750.00
Residential New Construction	Total	885		305,177	25	54%	
Home Energy Assessment	Bathroom Aerator 1.0 gpm - Gas DHW	312	1.04	325	10		
Home Energy Assessment	Customer Education (Audit & Report)	400	5.08	2,031	1		
Home Energy Assessment	Duct Sealing Gas Heating w/ CAC	6	81.49	489	20		
Home Energy Assessment	Attic Insulation - South (Dual - Gas & Electric)	5	174.71	874	25		
Home Energy Assessment	Wall Insulation - South (Dual - Gas & Electric)	2	34.51	69	25		
Home Energy Assessment	Furnace Whistle (Gas)	258	15.58	4,023	15		
Home Energy Assessment	Kitchen Flip Aerator 1.5 gpm - Gas DHW	122	7.17	874	5		
Home Energy Assessment	Low Flow Showerhead 1.5 gpm - Gas DHW	215	11.41	2,456	10		
Home Energy Assessment	Pipe Wrap - Gas DHW (per home)	148	2.96	439	15		

Program	Measure	2020 Participation	Therms/ Participant	Total Therms	Measure Life	NTG	Incentive/ Unit
Home Energy Assessment	Smart Thermostat - Elec Heated	43	14.40	621	15		
Home Energy Assessment	Smart Thermostat - Gas Heated	316	50.98	16,129	15		
Home Energy Assessment	Water Heater Setback - Gas DHW	162	2.85	462	15		
Home Energy Assessment	Total	400		28,793	17	82%	
IQW (South)-Gas	Air Sealing Gas Furnace w/ CAC	30	89.33	2,680	15		
IQW (South)-Gas	Attic Insulation - Gas Heated (Gas)	60	226.67	13,600	25		
IQW (South)-Gas	Audit Recommendations - dual (Gas)	700	8.80	6,157	1		
IQW (South)-Gas	Bathroom Aerator 1.0 gpm - Gas DHW	210	1.52	320	10		
IQW (South)-Gas	Duct Sealing Gas Heating with A/C	30	96.08	2,882	20		
IQW (South)-Gas	Filter Whistle	14	16.13	226	15		
IQW (South)-Gas	Health and Safety	500			1		
IQW (South)-Gas	HVAC/Furnace Tune Up (With filter replacement - filter whistle savings)	165	54.04	8,916	2		
IQW (South)-Gas	IQW MFDI Bathroom Aerator 1.0 gpm - Gas DHW	54	1.29	70	10		
IQW (South)-Gas	IQW MFDI Filter Whistle	6	7.28	44	15		
IQW (South)-Gas	IQW MFDI Furnace Tune Up	25	19.30	482	2		
IQW (South)-Gas	IQW MFDI Kitchen Flip Aerator 1.5 gpm - Gas DHW	140	4.26	596	10		
IQW (South)-Gas	IQW MFDI Low Flow Showerhead 1.5 gpm - Gas DHW	130	11.74	1,526	5		
IQW (South)-Gas	IQW MFDI Pipe Wrap - Gas DHW (per home)	10	3.30	33	15		
IQW (South)-Gas	IQW MFDI Site Visit and DI - dual (Gas)	200	3.92	783	1		
IQW (South)-Gas	IQW MFDI Smart Thermostat (Gas)	170	31.13	5,292	15		
IQW (South)-Gas	IQW - Whole Home (Dual - Gas & Electric)	-	120.78				
IQW (South)-Gas	Kitchen Flip Aerator 1.5 gpm - Gas DHW	210	6.41	1,346	10		
IQW (South)-Gas	Low Flow Showerhead 1.5 gpm - Gas DHW	140	15.07	2,110	5		
IQW (South)-Gas	Natural Gas Furnaces (>95% AFUE)	-	135.03	-	20		
IQW (South)-Gas	Pipe Wrap - Gas DHW (per home)	35	4.43	155	15		
IQW (South)-Gas	Smart Thermostat (Gas)	140	69.00	9,660	15		
IQW (South)-Gas	Wall Insulation - Dual (gas heated)	15	21.25	319	25		
IQW (South)-Gas	Water Heater Replacement	35					
IQW (South)-Gas	Water Heater Temperature Setback - Gas DHW	35	3.59	126	4		
IQW (South)-Gas	Total	900		57,322	13	100%	
Energy Efficient Schools	Low Flow Showerhead 1.5 gpm - Gas DHW	2,600	5.97	15,524	15	100%	
Energy Efficient Schools	Aerators Pack (1 Kitchen and 2 Bathroom)	2,600	3.44	8,933	10	100%	
Energy Efficient Schools	Filter Whistle	2,600	3.13	8,138	16	100%	
Energy Efficient Schools	Total	2,600		32,595	9	100%	
Residential Behavioral (Opower)	Total	26,935	10.51	283,100	1	100%	

Program	Measure	2020 Participation	Therms/ Participant	Total Therms	Measure Life	NTG	Incentive/ Unit
MFDI (North)-Gas	Bathroom Aerator 1.0 gpm - Gas DHW	1,026	1.55	1,593	10	100%	
MFDI (North)-Gas	Filter Whistle	513	7.72	3,960	15	100%	
MFDI (North)-Gas	Kitchen Flip Aerator 1.5 gpm - Gas DHW	770	4.91	3,780	10	100%	
MFDI (North)-Gas	Low Flow Showerhead 1.5 gpm - Gas DHW	1,026	13.14	13,478	5	100%	
MFDI (North)-Gas	Pipe Wrap - Gas DHW (per home)	308	3.65	1,123	15	100%	
MFDI (North)-Gas	Site Visit and DI - Gas only	1,026	9.54	9,788	1	100%	
MFDI (North)-Gas	Smart Thermostat - Gas Heated (Gas)	872	40.05	34,931	15	100%	
MFDI (North)-Gas	Total	1,026		68,652	11	100%	
Targeted Income (North)-Gas	Air Sealing - 28% Reduction	46	132.35	6,088	15	100%	
Targeted Income (North)-Gas	Bath Aerator - 1.0 GPM (1 unit)	35	1.82	64	10	100%	
Targeted Income (North)-Gas	Ceiling Insulation Pre R0 to Post R38	3	518.65	1,556	25	100%	
Targeted Income (North)-Gas	Ceiling Insulation Pre R8 to Post R38	7	146.80	1,028	25	100%	
Targeted Income (North)-Gas	Duct 20% leakage Reduction - Gas Heated (Gas)	-	82.79	-	20	100%	
Targeted Income (North)-Gas	Furnace 92% AFUE	44	94.97	4,179	20	100%	
Targeted Income (North)-Gas	Kitchen Aerator - 1.5 GPM (1 unit)	33	9.24	305	10	100%	
Targeted Income (North)-Gas	Showerhead - 1.5 GPM (1 unit)	18	17.68	318	5	100%	
Targeted Income (North)-Gas	Wall Insulation - R13	15	73.39	1,101	25	100%	
Targeted Income (North)-Gas	Water Heater - 0.67 EF	5	77.10	385	13	100%	
Targeted Income (North)-Gas	Total	101		15,023	19	100%	
Home Energy House Call	Air Infiltration Reduction Measures		19.00		16		
Home Energy House Call	Bathroom Faucet Aerators		11.00		16		
Home Energy House Call	Kitchen Faucet Aerators		11.00		16		
Home Energy House Call	Form Weather Stripping		3.00		16		
Home Energy House Call	Total	1,122	44.00	49,368	16	100%	
Neighborhood Program	Air Infiltration Reduction Measures		102.00		16		
Neighborhood Program	Low Flow Showerhead/Single Detached		18.00		16		
Neighborhood Program	Faucet Aerators/Single Detached		10.00		16		
Home Energy House Call	Total	1,000	130.00	130,440	16	100%	
Total Residential Gas		48,024		2,408,647	19	100%	

Commercial & Industrial listings, participation and initial incentives

Program	Measure	2020 Participation	Therms/ Participant	Total Therms	Measure Life	NTG	Incentive/ Unit
Commercial Prescriptive	Boiler, ≥90% AFUE <300 MBH	5	332	1,660	20	83%	\$500.00
Commercial Prescriptive	Boiler, ≥90% TE 300-499 MBH	3	787	2,361	20	83%	\$1,500.00
Commercial Prescriptive	Boiler, ≥90% TE 500-999 MBH	3	1,001	3,003	20	83%	\$2,500.00
Commercial Prescriptive	Boiler, ≥90% TE ≥1000 MBH	24	4,522	108,521	20	83%	\$5,000.00
Commercial Prescriptive	Boiler Reset Control	6	974	5,844	20	83%	\$250.00
Commercial Prescriptive	Boiler Tune-Up	103	198	20,380	5	83%	\$200.00
Commercial Prescriptive	Gas Modulating Valve for Clothes Dryer	1	60	60	10	83%	\$60.00
Commercial Prescriptive	Food Service - Combination Oven	4	661	2,644	12	83%	\$900.00
Commercial Prescriptive	Food Service - Convection Oven	8	612	4,896	12	83%	\$700.00
Commercial Prescriptive	Food Service - Commercial Dishwasher	7	207	1,449	16	83%	\$618.45
Commercial Prescriptive	Food Service - Fryer	25	487	12,174	12	83%	\$500.00
Commercial Prescriptive	Furnace, 92% AFUE	80	106	8,480	20	83%	\$102.00
Commercial Prescriptive	Furnace, 95% AFUE	229	158	36,182	20	83%	\$250.00
Commercial Prescriptive	Furnace, 97% AFUE	4	159	636	20	83%	\$300.00
Commercial Prescriptive	Furnace Tune-Up	1	21	21	2	83%	\$20.00
Commercial Prescriptive	Food Service - Griddle	10	71	710	12	83%	\$100.00
Commercial Prescriptive	Food Service - Infrared Charbroiler	1	280	280	12	83%	\$500.00
Commercial Prescriptive	Food Service - Infrared Heater	10	114	1,140	15	83%	\$350.00
Commercial Prescriptive	Food Service - Infrared Upright Broiler	1	259	259	10	83%	\$1,000.00
Commercial Prescriptive	Food Service - Low Flow Pre-Rinse Sprayer	1	19	19	5	83%	\$10.00
Commercial Prescriptive	Showerheads	1	19	189	5	83%	\$10.00
Commercial Prescriptive	Pipe Insulation - Hot Water	2	1	2	15	83%	\$3.00
Commercial Prescriptive	Pipe Insulation - Steam	10	2	20	15	83%	\$10.00
Commercial Prescriptive	Programmable Thermostat	215	92	19,760	15	83%	\$50.00
Commercial Prescriptive	Food Service - Steam Boiler	1	227	227	20	83%	\$15.00
Commercial Prescriptive	Food Service - Steam Cooker	30	249	7,470	12	83%	\$200.00
Commercial Prescriptive	Steam Trap Replacement - Dry Cleaner	84	512	42,979	6	83%	\$250.00
Commercial Prescriptive	Steam Trap Replacement - Low P < 15 psi	1	673	673	6	83%	\$50.00
Commercial Prescriptive	Unit Heater	1	266	266	12	83%	\$200.00
Commercial Prescriptive	Water Heater - 88% TE	15	1,603	24,045	12	83%	\$500.00
Commercial Prescriptive	Water Heater - Tankless	15	911	13,671	20	83%	\$500.00
Commercial Prescriptive	Wifi-Enabled Thermostat	166	120	19,978	15	83%	\$100.00
Total C&I Prescriptive		1,067		340,000	15	84%	

Program	Measure	2020 Participation	Therms/ Participant	Total Therms	Measure Life	NTG	Incentive/ Unit
Commercial Custom & CNC	Custom Gas	20	19,456	389,119	19	83%	\$19,451.00
Commercial Custom & CNC	EDA Non-Lighting (Gas)	28	2,667	74,676	10	83%	\$2,667.00
Building Tune-Up	Building Tune-Up (Gas)	3	2,500	7,500	7	83%	\$1,200.00
Strategic Energy Management	Strategic Energy Management (Gas)	2	5,853	11,705	13	83%	\$5,851.00
Total C&I Custom		53		483,000	13	85%	
Small Business Energy Solutions (SBES)	Low Flow Pre-Rinse Sprayer	6	9	51	5	83%	\$12.00
Small Business Energy Solutions (SBES)	Furnace Tune-Up	11	20	223	2	83%	\$50.91
Small Business Energy Solutions (SBES)	Steam Trap Replacement - Dry Cleaner	2	509	1,019	6	83%	\$250.00
Small Business Energy Solutions (SBES)	Programmable Thermostat	7	28	196	15	83%	\$60.00
Small Business Energy Solutions (SBES)	Wifi-Enabled Thermostat	43	28	1,204	15	83%	\$113.00
Small Business Energy Solutions (SBES)	Program the Programmable Thermostat	11	28	307	5	83%	\$6.25
Total Small Business Direct Install		15		3,000	11	101%	
Commercial & Industrial Total		1,135		826,000			
TOTAL RESIDENTIAL AND COMMERCIAL & INDUSTRIAL		49,159		3,234,647			

Attachment RHH-2 provided in Excel format

CADMUS

2019 Vectren Demand-Side Management Portfolio Natural Gas Impacts Evaluation

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PREPARED FOR

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Acronyms

Acronym	Definition
AFUE	Annual fuel utilization efficiency
AHRI	Air Conditioning, Heating, & Refrigeration Institute
AMI	Advanced metering infrastructure
ASHP	Air-source heat pump
BTUH	British thermal units per hour
C&I	Commercial and industrial
CAC	Central air conditioner
CDD	Cooling degree days
CF	Coincidence factor
CFL	Compact fluorescent lamp
CFM	Cubic feet per minute
COP	Coefficient of precision
DHP	Ductless heat pump
DHW	Domestic hot water
DK/RF	Don't know/refused
DOE	U.S. Department of Energy
DSM	Demand-side management
ECM	Electronically commutated motor
EER	Energy efficiency ratio
EES Program	Energy Efficient Schools Program
EFLH	Effective full-load hours
EISA	Energy Security and Independence Act of 2007
ERI	Energy Rating Index
FLH	Full load hours
HDD	Heating degree days
HEA Program	Home Energy Assessment Program
HER	Home energy report
HERS	Home Energy Rating System
HEW	Home Energy Worksheet
HOU	Hours of use
hp	Horsepower
HSPF	Heating seasonal performance factor
IHCDA	Indiana Housing and Community Authority

Acronym	Definition
IQW Program	Income Qualified Weatherization Program
ISR	In-service rate
kBtu	Kilowatt per British thermal unit
kBtuh	Kilowatt per British thermal unit per hour
KPI	Key performance indicator
kW	Kilowatt
kWh	Kilowatt per hour
LED	Light-emitting diode
MMBTU	One million British thermal units
MFDI Program	Multifamily Direct Install Program
NEF	National Energy Foundation
NTG	Net to gross
OLS	Ordinary least square
RBS Program	Residential Behavioral Savings Program
RECS	Residential Energy Consumption Survey
RESNET	Residential Energy Services Network
RNC Program	Residential New Construction Program
SBDI Program	Small Business Direct Install Program
SEER	Seasonal energy efficiency ratio
TMY3	Typical meteorological year
TRM	Technical reference manual
UMP	Uniform Methods Project
VFD	Variable frequency drive
WHF	Waste heat factor

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Executive Summary

Vectren Energy Delivery of Indiana, a subsidiary of CenterPoint Energy, has a demand-side management (DSM) portfolio containing 15 programs, 12 of which contribute natural gas savings to the portfolio.¹ Vectren administers the portfolio in conjunction with several third-party implementers. The programs serve the residential, multifamily, commercial, and industrial sectors. This report provides the results of Cadmus' impact assessment of Vectren's 2019 natural gas DSM portfolio.²



PORTFOLIO-LEVEL IMPACTS

The following table presents the natural gas savings achieved by the 2019 Vectren DSM Portfolio.³

Overall, the portfolio achieved 2,689,031 therms of evaluated, net natural gas savings.

¹ The Residential Lighting, Appliance Recycling, and Community-Based LED Distribution programs are electric-only programs.

² Electric energy savings and demand reductions are reported separately in the 2019 Vectren Demand-Side Management Portfolio Process and Electric Impacts Evaluation.

³ Reported ex ante natural gas savings are derived from Vectren's 2019 DSM Scorecard.

2019 VECTREN DSM PROGRAM PORTFOLIO NATURAL GAS SAVINGS

Program	Ex Ante Savings (therms)			Evaluated Ex Post Savings (therms)	Realization Rate (therms)	NTG Ratio	Evaluated Net Savings (therms)	Net Savings Goal (therms)	Percent Net Savings Goal Achieved
	Reported	Audited	Verified						
RESIDENTIAL PROGRAMS									
Residential Prescriptive	1,520,383	1,520,383	1,507,702	1,513,376	100%	58%	877,202	640,293	137%
Residential New Construction	379,756	379,756	378,520	272,851	72%	64%	175,187	145,021	121%
Home Energy Assessment 2.0	16,753	16,777	16,490	18,777	112%	91%	17,072	11,857	144%
Income Qualified Weatherization	60,411	60,410	59,555	63,830	106%	100%	63,830	51,674	124%
Energy Efficient Schools	29,198	29,198	20,465	21,397	73%	100%	21,397	29,175	73%
Residential Behavioral Savings	409,096	409,096	409,096	284,371	70%	N/A	284,371	324,900	88%
Smart Cycle (Smart Thermostats)	0	0	0	37,978	N/A	96%	36,459	N/A	N/A
Targeted Income	15,022	15,022	14,937	14,743	98%	100%	14,743	15,022	98%
Multifamily Direct Install	68,149	55,308	51,225	68,676	101%	100%	68,676	58,660	117%
COMMERCIAL AND INDUSTRIAL PROGRAMS									
C&I Prescriptive ¹	334,888	334,888	334,611	337,952	101%	83%	280,500	187,500	150%
C&I Custom	837,768	837,768	837,768	837,768	100%	92%	770,747	600,000	128%
Small Business Direct Install	1,058	1,058	1,058	936	88%	96%	900	2,580	35%
▶ Total	3,672,481	3,659,663	3,631,426	3,472,656	95%	75%	2,611,084	2,066,682	126%
Nonparticipant Spillover ²	N/A	N/A	N/A	N/A	N/A	105%	77,947	N/A	N/A
▶ Total Adjusted Portfolio	3,672,481	3,659,663	3,631,426	3,472,656	95%	77%	2,689,031	2,066,682	130%

¹ Savings represent a subset of 2019 C&I Prescriptive Program gas projects.

² Cadmus calculated nonparticipant spillover as part of the 2017 portfolio evaluation.

“ I felt rewarded for doing the right thing and putting in an energy-saving furnace... people who might be tight on money would opt for a less efficient model if it weren't for the rebate. ”

– Residential Prescriptive Program participant

Summary of Recommendations

Based on the findings from the 2019 evaluation, Cadmus proposed several recommendations to enhance Vectren's DSM portfolio. Detailed findings and conclusions in support of these recommendations are included in the individual program chapters. Below is a summary of these recommendations.

2019 PROGRAM RECOMMENDATIONS

RESIDENTIAL PROGRAMS



Residential Prescriptive

There are no gas-related recommendations for this program.



Residential New Construction

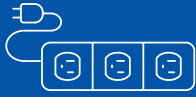
Ensure instruction for Habitat for Humanity offices are clear.

Kit measures are intended to be installed by builders, not by the homeowner, and the importance on energy savings for the homeowner should be emphasized. Consider offering builders or Habitat for Humanity offices that direct install kit measures for homeowners a small per-kit or larger raffle incentive to motivate proper program participation.

Weigh the costs and benefits of collecting contact information for kit recipients.

Conducting a short follow-up survey could provide a better understanding of measure persistence, installation experience, awareness of Vectren's sponsorship of the kits, and satisfaction by Habitat for Humanity homeowners.

Because Indiana adopted a new residential building code (2020 Indiana Residential Code) in December 2019, **increase the minimum qualifications for program homes to ensure that the program continues to encourage homes be built beyond minimum code requirements.** Conduct an analysis to determine the Home Energy Rating System (HERS) requirements that will allow the program to generate savings, given the new code requirements, and weigh the costs and benefits of incorporating these program requirement changes.



Home Energy Assessment 2.0 (HEA 2.0)

If conversion to other Vectren programs becomes a priority, **provide the program implementer with best practices** for how to discuss Vectren's other residential rebates and to provide estimated payback calculations with and without those rebates.

Weigh the costs and benefits of offering door sweeps and weatherstripping through the HEA 2.0 Program.

If conversion to other Vectren programs becomes a priority, **follow up with customers one week or one month after the assessment** by emailing a copy of the report, reminders of no- to low-cost energy-saving tips, and links to Vectren's webpages for its other residential programs. This reminder will keep the assessment fresh in customers' minds and encourage them to participate in other Vectren programs.

Update natural gas savings for aerators and pipe insulation to address differences in reported and evaluated savings. Reported savings based on the 2016 program evaluation are outdated.



Income Qualified Weatherization

Provide additional or more in-depth energy education information for customers who already take action to reduce their energy usage. Customize these additional behavioral recommendations so individual customers learn applicable "next steps."

To evaluate savings more accurately, it is important to have reliable information about the baseline thermostat. **Ensure that installation contractors consistently collect and track existing thermostat data** for the IQW Program. Provide these data for evaluation.

For thermostats installed in multifamily homes, apply an adjustment factor of 60% to 2018 evaluated savings to account for differences in heating load for single-family and multifamily homes. This adjustment factor was derived using Residential Energy Consumption Survey (RECS) square footage data. Alternatively, the evaluated savings for 2019 multifamily smart thermostats can be used for reported savings since these include the adjustment.

Adjust reported savings estimates for furnace replacements to better reflect the IQW Program population that includes customers who probably reside in smaller homes when compared to the rest of Vectren's residential population.

Track reasoning for not implementing phase 2 and phase 3 measures. This will allow Vectren to better understand the low conversion rate for these higher impact measures.



Energy Efficient Schools

There are no recommendations for this program.



Residential Behavioral Savings

Employ a mixed-mode survey (consider online, phone, and/or print surveys) in future evaluations to test any response bias related to the survey mode.

Increase the survey sample size in future evaluations to improve the statistical power needed to detect statistically significant differences between groups.

Have a third party conduct the randomization and power analysis of any new wave launched for the program. Vectren plans to launch a new wave of low-income customers in 2020. It is best practice for a third party to conduct the randomization and conduct a power analysis to ensure proper sample sizes.

Work with the program implementer on diversifying and refining the energy-saving tips to sustain customer engagement and relevancy. New ideas could include tracking the status of tips at the customer level (e.g., complete, incomplete, or irrelevant), framing tips as social rather than energy-saving activities (e.g., emphasize more family time when you turn off electronics), and integrating customer segmentation and demographic data (e.g., housing type, income, early adopter).

Review the current cross-program marketing approaches in the home energy reports (HERs) and consider ways to revise these approaches to better reach and engage RBS Program treatment customers. Cross-promoting new or pilot programs may generate positive uplift if the HERs encourage early program adoption. Even though a positive uplift result would require removing double-counted savings from the RBS Program itself, positive uplift generates overall net-positive impacts to the portfolio by increasing the participation and savings in the other energy efficiency programs.



Smart Cycle (Smart Thermostats)

Claim gas savings for Nest thermostat installations in homes with gas heating.

Consider letting A+Derr handle both recruitment and scheduling all at once so there is no break in communication (from recruit to schedule call). This will help increase the time given to recruit customers for an installation appointment and possibly decrease the dropout rate.



Targeted Income

Redesign the leave-behind flier to include a phone number that customers can call to learn more, in addition to the link to Vectren's website. The leave-behind flier could also include energy-saving tips so customers can take action directly.

In addition to the leave-behind flier, consider working with the Indiana Housing and Community Authority (IHCDA) to **include the Vectren brand in the marketing materials for participants to see when considering and enrolling in the Targeted Income Program.**



Multifamily Direct Install

Weigh the costs and benefits of the furnace filter whistle to determine its inclusion as a measure in 2020 and future program years.

If the measure remains cost-effective at current installation rates, keep it as part of the program. If it does not prove cost-effective, remove it and consider focusing efforts on other measures with higher savings potential, such as the smart thermostat.

If tenants are present during smart thermostat installation, ensure that all are engaged.

Train tenants on proper use of the smart thermostat by emphasizing the learning capabilities and walking them through the educational material.

Consider emphasizing the auto-schedule setting as the primary message and most effective way for tenants to use the smart thermostat

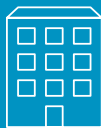
and benefit from energy savings. By encouraging tenants to take advantage of the learning capabilities, along with explaining that they can manually adjust it, tenants may better understand the purpose of a smart thermostat.

Consider adding a small sticker or tag directly to the smart thermostat that emphasizes the ease of using the auto-schedule setting

and explains how the smart thermostat will learn their behaviors and adjust accordingly. This may be simpler for tenants who find the educational material and manual confusing or dense or choose not to look at the material at all. This sticker or tag could also have contact information for Vectren or the program implementer so tenants could call and easily obtain assistance.

Update the ex ante savings of 25 therms to the 2019 evaluated savings of 42.51 therms to account for an exclusively natural gas savings baseline.

COMMERCIAL AND INDUSTRIAL PROGRAMS



C&I Prescriptive

Report hours of use that were used to estimate reported savings for boilers, boiler tune-ups, and furnaces.

These additional data will help identify discrepancies in reported and evaluated savings inputs, especially if the realization rate drops next year because of fewer early replacement measures.

Because the number of early replacement measures varies year to year, Vectren should be prepared when planning for program realization rates and consider requesting these data

in the rebate application and encouraging trade allies to target opportunities for early replacement projects.



C&I Custom

Through 2021, to align with Vectren's filed program cycle, **maintain the current practice of applying the baseline at no setback and 100% outside air to warehouse heating unit measures.** Beginning in 2021, adopt code as the baseline and begin phasing out warehouse heating unit measures from the program.

Develop a plan for maintaining regular communications across program teams and coordinating with customers. To support this effort and bolster participation, particularly for more complex program offerings like building tune-ups and strategic energy management, consider reinstating periodic check-in meetings between Vectren key account managers and Nexant outreach staff.



Small Business Direct Install

Modify the online assessment tool to allow trade allies to reference past assessments. This will assist trade allies in following up with these leads and could result in greater participation.

To reassure trade allies about installing no-cost measures such as LEDs, thermostats, aerators, and pre-rinse sprayers, **incorporate measure-level training and discussion** into annual and one-on-one training modules.

Require that thermostat measures be installed only in facilities or zones where the existing thermostat is a manual thermostat or a programmable thermostat that is not programmed.

Update the data collection and ex ante savings calculation to account for the size of the conditioned space rather than the size of the entire facility.

Rather than scheduling no-cost measure installations at the same time as the recommended low-cost measures, **encourage trade allies to keep an inventory of no-cost measures with them when conducting site assessments to foster immediate savings.** Require trade ally staff to keep records through the online assessment tool whether no-cost measures were offered and reasons the measures were declined.

Consider implementing another geotargeted marketing campaign (similar to that launched in Newburgh, Indiana) in a dual fuel community. Since trade allies proved crucial to the campaign's success, ensure they are adequately informed and financially motivated to support the effort. To foster greater achievement toward the overall program therm-savings goal, consider additional incentives to encourage trade allies to deliver therm-saving measures to community businesses.

Introduction

Vectren tasked Cadmus with evaluating its 2019 demand-side management (DSM) programs. Cadmus conducted an impact evaluation for 12 natural gas-saving programs.⁴

Program Descriptions

THIS SECTION BRIEFLY
SUMMARIZES EACH PROGRAM.

Residential Programs

Through the **Residential Prescriptive Program**, Vectren seeks to achieve energy savings by influencing residential customers to purchase energy-efficient residential products. The program includes a variety of energy-efficient measures, such as smart thermostats, furnaces, and insulation. All residential customers are eligible to participate in the program and receive rebates that vary by measure.

Through the **Residential New Construction Program**, Vectren provides incentives to builders who construct homes that receive a Home Energy Rating System (HERS) score of 63 or lower. All builders constructing high-efficiency homes in Vectren's service territory can participate in the program.

Through the **Home Energy Assessment 2.0 Program**, Vectren offers a walk-through home audit to analyze participant energy use. The assessor recommends efficiency upgrades and facilitates the direct installation of energy-saving measures, including energy-efficient showerheads, hot water pipe wrap, and faucet aerators.

Through the **Income Qualified Weatherization Program**, Vectren offers its low-income customers a walk-through home energy audit that includes full diagnostic testing for the home. Auditors recommend weatherization measures or upgrades that facilitate the installation of energy-saving measures at no cost to the customer.

Through the **Energy Efficient Schools Program**, Vectren works with fifth-grade teachers to educate students about energy efficiency and how they can make an impact at school and at home. Participating teachers receive classroom curriculum and take-home efficiency kits to distribute to their students.

Through the **Residential Behavioral Savings Program**, Vectren uses home energy reports to educate customers about their energy consumption patterns. Customers receive a targeted, individualized report that is intended to motivate them to engage in energy-saving actions. The report displays customers' recent energy use, compares this use to similarly sized homes nearby, and provides energy-saving tips.

Through the **Smart Cycle Program**, Vectren direct installed smart thermostats for residential customers to call load control events during the summer peak season. Although the program targets demand reductions during peak summer hours, the program also achieves energy savings from the smart thermostats throughout the year.

Through the **Targeted Income Program**, Vectren offers its northern territory income-qualified customers a walk-through home energy audit and energy-saving home improvements, including weatherization and HVAC upgrades, at no cost to the customer.

Through the **Multifamily Direct Install Program**, Vectren reduces energy consumption in rental units in its northern territory. Because the parties responsible for paying utility bills in the rental segment vary, Vectren provides and arranges for the installation of energy-saving measures, including smart thermostats, faucet aerators, and showerheads, at no cost to tenants and landlords.

⁴ Process evaluations and market performance indicator assessments are reported separately in the 2019 Vectren Demand-Side Management Portfolio Process and Electric Impacts Evaluation. Because the Targeted Income and Multifamily Direct Install programs are gas-only, the condensed process evaluation findings for these two programs are included in this report. Cadmus conducted market performance indicator assessments only for electric and dual fuel programs (not for natural gas-only programs).

Commercial and Industrial Programs

Through the **C&I Prescriptive Program**, Vectren provides prescriptive rebates to facilities, based on the installation of energy-efficient equipment and system improvements. Rebates address lighting, variable frequency drives, HVAC, refrigeration, and commercial kitchen appliances.

Through the **C&I Custom Program**, Vectren focuses on energy-saving projects unique to the commercial participant's application or process. Customers and/or their trade allies submit engineering analyses showing first-year savings to qualify for program incentives.

Through the **Small Business Direct Install Program**, Vectren helps qualifying businesses identify savings opportunities by providing free on-site energy assessments, free installation of energy-efficient measures, and low-cost pricing for energy-efficient measures recommended in the assessments.



“Not only are we putting in efficient equipment, but the benefits [Vectren] offers and incentives help a lot ”

– C&I Custom Program participant

Research Approach

Cadmus conducted an impact evaluation for Vectren's natural gas-saving DSM programs as well as a condensed process evaluation to follow up on previous years' evaluation recommendations and monitor program activities and changes for the Targeted Income and Multifamily Direct Install programs.⁵

Data Collection

The next table shows the number of interviews and surveys Cadmus completed for the 2019 Vectren DSM portfolio evaluation. Cadmus conducted staff interviews for all programs but conducted trade ally interviews for only a subset.⁶ For the purposes of the natural gas impacts evaluation, Cadmus conducted

customer surveys for nearly all programs focused primarily on measure verification and net-to-gross (NTG) analysis. Where noted in the individual program chapters, Cadmus tested for statistically significant differences in historical customer survey response data using t-tests at the $p \leq 0.1$ level.

⁵ Process evaluation findings for integrated, dual fuel programs are included in 2019 Vectren Demand-Side Management Portfolio Process and Electric Impacts Evaluation.

⁶ Findings from the program staff and trade ally interviews are primarily reported on in the 2019 Vectren Demand-Side Management Portfolio Process and Electric Impacts Evaluation.

SURVEY RESPONDENT GROUPS BY PROGRAM

Respondent Group	Population ¹	Included in Sample Frame ²	Target Completes	Achieved Completes
RESIDENTIAL PROGRAMS				
RESIDENTIAL PRESCRIPTIVE				
Vectren Staff	N/A	1	1	1
CLEAResult staff	N/A	1	1	1
Participating Customers (Quarterly Freeridership and Customer Experience Surveys)	11,513	6,561	1,000	1,348
Participating Customers (Annual Spillover Surveys)	11,513	954	300	308
Participating Contractors	752	752	20	20
RESIDENTIAL NEW CONSTRUCTION				
Vectren Staff	N/A	1	1	1
CLEAResult Staff	N/A	1	1	1
Participating Builders	44	44	10	10
HOME ENERGY ASSESSMENT 2.0 (HEA 2.0)				
Vectren Staff	N/A	1	1	1
J.E. Shekell Staff	N/A	1	1	1
Participating Customers	351	313	80	87

Respondent Group	Population ¹	Included in Sample Frame ²	Target Completes	Achieved Completes
INCOME QUALIFIED WEATHERIZATION				
Vectren Staff	N/A	1	1	1
CLEAResult Staff	N/A	1	1	1
Participating Customers	1,437	575	70	71
ENERGY EFFICIENT SCHOOLS				
Vectren Staff	N/A	1	1	1
National Energy Foundation (NEF) Staff	N/A	1	1	1
Participating Customers (2018-2019)	3,121	658	70	42
RESIDENTIAL BEHAVIORAL SAVINGS				
Vectren Staff	N/A	1	1	1
Oracle Staff	N/A	1	1	1
Treatment and Control Group Customers	41,264 treatment 6,139 control	40,143 treatment 6,139 control	75 treatment 75 control	75 treatment 75 control
SMART CYCLE (SMART THERMOSTATS)				
Vectren Staff	N/A	1	1	1
A+Derr Staff	N/A	1	1	1
Participating Customers	1,005	713	70	251
TARGETED INCOME PROGRAM				
Vectren Staff	N/A	1	1	1
CLEAResult Staff	N/A	1	1	1
Participating Customers	93	81	Census	27
MULTIFAMILY DIRECT INSTALL PROGRAM				
Vectren Staff	N/A	1	1	1
CLEAResult Staff	N/A	1	1	1
Participating Customers	1,346	1,099	70	70
COMMERCIAL AND INDUSTRIAL PROGRAMS				
C&I PRESCRIPTIVE				
Vectren Staff	N/A	1	1	1
Nexant Staff	N/A	1	1	1
Participating Customers	357	230	70	69
C&I CUSTOM				
Vectren Staff	N/A	1	1	1
Nexant Staff	N/A	1	1	1
Participating Customers	45	39	Census	10
Trade Allies	30	23	Census	11
SMALL BUSINESS DIRECT INSTALL				
Vectren Staff	N/A	1	1	1
Nexant Staff	N/A	1	1	1
Participating Customers	246	201	Census	41
Trade Allies	14	14	Census	8

¹ Population includes both electric and gas participants.

² Cadmus removed customers from the sample frames if they were contacted about their participation in another program, they had been recently surveyed through another evaluation effort, or they had missing contact information.

Impact Evaluation

AS A PART OF THE IMPACT EVALUATION, CADMUS REVIEWED GROSS SAVINGS, VERIFIED MEASURE INSTALLATION, AND DETERMINED FREERIDERSHIP AND SPILLOVER TO CALCULATE AN NTG RATIO AND ESTIMATED REALIZED PROGRAM SAVINGS. CADMUS DEFINED THESE KEY SAVINGS TERMS FOR THE IMPACT EVALUATION:

Reported ex ante savings. Annual gross savings for the evaluation period, as reported by Vectren in the 2019 Natural Gas DSM Scorecard.

Audited savings. Annual gross savings after Vectren's per-unit calculations and measure counts were confirmed by Cadmus (using 2019 program tracking data).

Verified savings. Annual gross savings adjusted for the in-service rate (percentage).

Evaluated ex post savings. Annual gross savings adjusted for in-service rate (percentage) and savings adjustments resulting from the gross savings review.

Realization rate. The percentage of savings the program actually realized, calculated as follows:

$$\text{REALIZATION RATE} = \frac{\text{EX POST SAVINGS}}{\text{EX ANTE SAVINGS}}$$

Evaluated net savings. Evaluated ex post savings, adjusted for NTG (i.e., freeridership and spillover)

GROSS SAVINGS REVIEW

Cadmus calculated natural gas savings for all programs (and a subset of C&I Prescriptive Program measures). *Appendix A. Impact Evaluation Methodology* details the specific methodology Cadmus used to determine savings and its associated assumptions. The table below lists the evaluation activities Cadmus performed for each program, including these:

Engineering analysis. To assess Vectren's claimed measure energy savings and coincident peak demand reduction, Cadmus conducted an engineering desk review for most of Vectren's 2019 DSM programs. Cadmus used utility program data, assumptions from technical reference manuals (TRMs) from Indiana and other states, and industry studies to determine inputs to the savings estimates, which were calibrated with survey results where possible. Cadmus also determined if any additional savings were generated from the early replacement of measures installed through the residential and commercial and industrial (C&I) prescriptive programs, based on program data and survey results.

REM/Rate analysis. Cadmus conducted a REM/Rate analysis for the Residential New Construction Program, which entailed modeling a baseline home, which Cadmus compared to participant homes that received program incentives. Cadmus relied on the HERS certificates for key data inputs modeling home savings.

Regression/billing analysis. Through billing analyses of the Residential Behavior Savings and Appliance Recycling programs, Cadmus modelled savings by comparing monthly consumption of program participants before and after measure installation (or comparing consumption to nonparticipants) while controlling for exogenous factors such as weather. These models made use of control groups, matched comparison groups, and pre- and post-installation efficient conditions.

IMPACT EVALUATION TASKS BY PROGRAM

Program	Engineering Analysis	REM/Rate Analysis	Regression/Billing Analysis
RESIDENTIAL PROGRAMS			
Residential Prescriptive	✓	--	--
Residential New Construction	✓	✓	--
Home Energy Assessment 2.0	✓	--	--
Income Qualified Weatherization	✓	--	--
Energy Efficient Schools	✓	--	--
Residential Behavioral Savings	--	--	✓
Smart Cycle (Smart Thermostats)	✓	--	--
Targeted Income	✓	--	--
Multifamily Direct Install	✓	--	--
COMMERCIAL AND INDUSTRIAL PROGRAMS			
C&I Prescriptive	✓	--	--
C&I Custom	✓	--	--
Small Business Direct Install	✓	--	--

MEASURE VERIFICATION

Cadmus reviewed tracking data to verify measure installations for all programs. As shown in the table below, for most programs, Cadmus conducted telephone or online surveys with program participants (including participant builders) to confirm customer participation status, the number and type of measures that received program incentives, and the persistence of installations. Cadmus used this equation to calculate the in-service rate for each program:

$$\text{IN-SERVICE RATE} = \frac{\text{VERIFIED INSTALLATIONS}}{\text{REPORTED INSTALLATIONS}}$$

MEASURE VERIFICATION METHOD BY PROGRAM

Program	Tracking Data Review	Participant Surveys	Trade Ally Interviews
RESIDENTIAL PROGRAMS			
Residential Prescriptive	✓	✓	--
Residential New Construction	✓	--	✓
Home Energy Assessment 2.0	✓	✓	--
Income Qualified Weatherization	✓	✓	--
Energy Efficient Schools	✓	✓	--
Residential Behavioral Savings	✓	--	--
Smart Cycle (Smart Thermostats)	✓	✓	--
Targeted Income	✓	✓	--
Multifamily Direct Install	✓	✓	--
COMMERCIAL AND INDUSTRIAL PROGRAMS			
C&I Prescriptive	✓	✓	--
C&I Custom	✓	✓	--
Small Business Direct Install	✓	✓	--

NET-TO-GROSS

Cadmus calculated the savings that were directly attributable to Vectren's programs (net savings) by estimating program-specific (or measure-specific, where applicable) NTG ratios. The NTG ratios were used to adjust the verified gross savings estimates to account for freeridership and spillover.

FOR VECTREN'S PORTFOLIO OF PROGRAMS, CADMUS USED TWO METHODS FOR DETERMINING NTG RATIOS FOR VECTREN'S NATURAL GAS-SAVING PROGRAMS:

Control group comparison generates inherently net savings. Cadmus used billing/regression analysis to estimate net impacts for the Residential Behavioral Savings Program. In this method, Cadmus calculated net savings by developing a comparison (control) group, which isolates the program impacts from exogenous effects.

Self-report surveys for most residential and C&I programs. Cadmus utilized survey results to derive net savings by adjusting *ex post* gross savings to account for a NTG ratio. To mitigate self-report bias, Cadmus used a battery of freeridership questions that collect data on each participant's *intention* and factors that might have had *influence*. The *intention* and *influence* scores contributed equally to the total freeridership score. Cadmus computed the overall freeridership score for each participant by calculating the arithmetic mean of the intention and influence scores.

- > **Participant spillover** is the program's influence on customers' decisions to invest in additional energy efficiency measures for which they did not receive any Vectren incentives. Cadmus gathered the necessary data from the self-report surveys to calculate participant spillover. Cadmus included measures that are program-eligible (known as like spillover) as well as any non-program-eligible measures (known as non-like spillover) for which Cadmus could provide a reasonable savings documentation.
- > **Nonparticipant spillover (NPSO)** is created by Vectren's marketing and education efforts among residential customers who did not participate in any program. Cadmus applied a 5% NPSO across all residential programs using results from a residential nonparticipant survey conducted during the 2017 evaluation.

This table lists the NTG approach Cadmus used for each program. The individual program chapters and *Appendix B. Net-to-Gross Detailed Findings* detail the specific methodology Cadmus used to determine each program's NTG ratio.

NET-TO-GROSS METHOD BY PROGRAM

Program	Self-Report Surveys	Control Group
RESIDENTIAL PROGRAMS		
Residential Prescriptive	✓	--
Residential New Construction	✓	--
Home Energy Assessment (HEA 2.0)	✓	--
Income Qualified Weatherization	✓ ¹	--
Energy Efficient Schools	-- ¹	--
Residential Behavioral Savings	--	✓
Smart Cycle (Smart Thermostats)	✓	--
Targeted Income	✓ ¹	--
Multifamily Direct Install	✓ ¹	--
COMMERCIAL AND INDUSTRIAL PROGRAMS		
C&I Prescriptive	✓	--
C&I Custom	✓	--
Small Business Direct Install	✓	--

¹ Cadmus applied a deemed 100% NTG. Cadmus used the surveys to qualitatively assess participant spillover for the income-qualified programs.

Residential Prescriptive Program

The Residential Prescriptive Program encourages customers to purchase energy-efficient products by offering prescriptive rebates for a wide range of energy-efficient equipment, including Wi-Fi-enabled (non-learning) and smart (learning) thermostats, furnaces, and weatherization. All residential Vectren customers are eligible to participate in the program and receive rebates. CLEAResult is the program implementer overseeing program delivery.

Accomplishments

Table 1 shows the program's achievements against goals in 2019. Vectren and the program implementer agreed that the Residential Prescriptive Program continues to be in high demand. The natural gas furnace (95% AFUE) measure stood out as the top performer in 2019, accounting for 66% of all program evaluated net savings.

Table 1. 2019 Residential Prescriptive Goals and Achievements¹

Unit	2019 Actual	2019 Planning Goal	Percentage of Goal
Gross Therms Savings	1,520,383	1,455,212	104%
Participants	14,784	14,669	101%
Program Expenditures	\$3,694,421	\$3,694,421	100%

¹ Goals and achievements from Vectren's 2019 DSM Scorecard. Actuals represent *ex ante* reported values.

Table 2 lists the evaluated savings summary for the Residential Prescriptive program. Realization rates for most measures offered in this program varied due to changes in program data and other measure-specific adjustments. The program had an overall realization rate of 99.5% (rounded to 100%).

Table 2. 2019 Residential Prescriptive Natural Gas Savings

Energy Savings Unit	Ex Ante Savings			Evaluated Ex Post Savings	Realization Rate	NTG Ratio	Evaluated Net Savings
	Reported	Audited	Verified				
Total Therms	1,520,383	1,520,383	1,507,702	1,513,376	100%	58%	877,202

Conclusions and Recommendations

Conclusions and recommendations may be derived from the process evaluation activities Cadmus conducted for the Residential Prescriptive Program. Process evaluation findings are presented in the *2019 Vectren DSM Portfolio Process and Electric Impacts Evaluation*.

Program Satisfaction

Overall satisfaction was high for the program in 2019. All 20 trade allies interviewed were satisfied with their program experience and the support they receive from program representatives. Likewise, 98% of customers were satisfied with the program, 99% were satisfied with their contractors, and 99% were satisfied with their program measures.

Impact Evaluation

Impact Evaluation Methods and Findings

The Residential Prescriptive Program impact evaluation included multiple data collection efforts and analysis tasks:

- Tracking database review
- Engineering analysis based on 2015 Indiana TRM v2.2 and other evaluation resources
- Online survey with 1,348 program participants, stratified by measure category, administered on a quarterly basis throughout the year to capture measure verification and freeridership data
- Online survey with 308 program participants, stratified by measure category, administered after the conclusion of the program year to gather spillover data

Gross Savings Review

Cadmus assigned savings to each measure in the tracking database using savings analyses derived primarily from the 2015 Indiana TRM v2.2 and participant survey data.⁷ Additional details regarding the calculations and assumptions used to estimate gross savings are provided in *Appendix A. Impact Evaluation Methodology*. Table 3 provides per-unit annual gross savings for each program measure.

Table 3. 2019 Residential Prescriptive Per-Unit Gross Savings

Measure	Annual Gross Savings (Therms)	
	Reported	Evaluated
HVAC		
Furnace Tune-Up	39	69
Natural Gas Boilers - 90%	275	242
Natural Gas Furnaces - 95%	134	132
Natural Gas Furnace - 97%	165	155
Thermostats		
Nest On-Line Store North	59	73
Nest On-Line Store South	55	55
Smart Programmable Thermostat - North	57	64
Smart Programmable Thermostat - South	54	48
Wi-Fi Thermostat – North	20	25
Wi-Fi Thermostat – South	18	19

⁷ Cadmus. July 28, 2015. *Indiana Technical Reference Manual Version 2.2*.

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Measure	Annual Gross Savings (Therms)	
	Reported	Evaluated
Weatherization		
Attic Insulation - Pre R11, Post R43 North	212	188
Attic Insulation - Pre R11, Post R43 South	198	226
Duct Sealing North	112	103
Duct Sealing South	82	95
Wall Insulation North	67	37
Wall Insulation South	65	61

Vectren's *ex ante* savings are derived primarily from 2017 evaluated savings. In general, Cadmus' 2019 evaluation used the same methodology as in 2017, so the differences between *ex ante* and *ex post* are largely because of minor differences in participant survey results and program tracking data.⁸ Exceptions to this rule are discussed below.

The *ex ante* savings for the furnace tune-up measure was not based on a past evaluation, as it was new in 2019. To calculate its savings, Cadmus developed a savings methodology using the Illinois TRM V7 as there was no applicable savings methodology in the 2015 Indiana TRM v2.2.⁹ The Illinois TRM V7 applies a derating value of 6.4%, which is somewhat higher than other sources.¹⁰ A derating value closer to 3% yields savings that are much closer to the *ex ante* savings. Cadmus suspects the derating value is the main driver of the difference between the furnace tune-up *ex ante* and *ex post* savings.

The methodologies for boiler and furnace measure savings rely on a baseline efficiency metric. In 2019, Cadmus used program tracking data, not previously provided by Vectren, to determine equipment age and establish baseline efficiency for each installation. The average boiler equipment age was older than Cadmus had assumed in prior evaluations. This made the comparative baseline efficiency used in the savings calculation lower than past years, resulting in higher boiler *ex post* savings in 2019.

All other differences between *ex ante* and *ex post* savings are from differences in yearly program tracking data and participant survey results. This is also true when comparing 2019 evaluated savings to

⁸ Changes in year-to-year program tracking data include installed equipment efficiencies, equipment age, home square footage, install location, baseline information (i.e., programmable thermostat prevalence and usage patterns), percentage of installs considered to be early replacements, etc.

⁹ Illinois Commerce Commission. September 28, 2018. *2019 Illinois Statewide Technical Reference Manual for Energy Efficiency Version 7.0*. https://s3.amazonaws.com/ilsag/IL-TRM_Effective_010119_v7.0_Vol_3_Res_092818_Final.pdf

¹⁰ A furnace's derating value is a percentage description that captures the effect derating has on a furnace's heat output. Derating a furnace involves making a permanent physical change to the furnace to reduce its heat output capacity. These changes include replacing an existing burner with a lower-rated burner, replacing fans and motors with smaller versions, and others. For the furnace tune-up measure, the Illinois TRM V7 used a derating value to approximate the performance of a furnace prior to its tune-up.



savings of previous evaluation years. Wall insulation measure savings are lower than previous years because of abnormally small conditioned square footage according to the program tracking data. Table 4 lists the evaluated gross per-unit energy savings for each program measure by year.

Table 4. Residential Prescriptive Historical Per-Unit Savings

Measure	Evaluated Annual Gross Savings (Therms)				
	2015	2016	2017	2018	2019
HVAC					
Furnace Tune-Up	N/A	N/A	N/A	N/A	69
Natural Gas Boilers - 90%	N/A	238	275	258	242
Natural Gas Furnaces - 95%	147	161	165	135	132
Natural Gas Furnace - 97%	N/A	137.4	134	159	155
Thermostats					
Nest On-Line Store North	N/A	N/A	59	77	73
Nest On-Line Store South	N/A	N/A	55	57	55
Smart Programmable Thermostat – North	40	38	57	75	64
Smart Programmable Thermostat - South (Gas)	25	30	54	54	48
Wi-Fi Thermostat – North	N/A	N/A	20	26	25
Wi-Fi Thermostat – South	N/A	N/A	18	19	19
Weatherization					
Attic Insulation - Pre R11, Post R43 North	178	157	212	188	188
Attic Insulation - Pre R11, Post R43 South			198	175	226
Duct Sealing North	83	111	112	111	103
Duct Sealing South		78	82	81	95
Wall Insulation North	63	61	67	53	37
Wall Insulation South			65	35	61

Measure Verification

Cadmus calculated verified savings for the Residential Prescriptive Program by applying an in-service rate (ISR) by survey measure group, as shown in Table 5. The measure counts in the program tracking data matched the scorecard perfectly. In-service rates below 100% are because of self-reported measure persistence data from the participant survey for each measure group (respondents who indicated removing an item after it was initially installed).

Notably, four of the 504 participant survey respondents for furnace in-service-rate said the furnace was no longer installed in their home, resulting in an in-service-rate of 99%. This is unusual considering furnaces are expensive and not easily removed.

**Table 5. 2019 Residential Prescriptive Measure Verification Results – In-Service Rates**

Measure	Survey Measure Category	Installations			In-Service Rate
		Reported	Audited	Verified	
HVAC					
Furnace Tune-Up	Furnace	473	473	473	100%
Natural Gas Boilers - 90%	Furnace	23	23	23	99%
Natural Gas Furnaces - 95%	Furnace	8,165	8,165	8,084	99%
Natural Gas Furnace - 97%	Furnace	496	496	491	99%
Thermostats					
Nest On-Line Store North	Smart Thermostat	244	244	243	100% ¹
Nest On-Line Store South	Smart Thermostat	31	31	31	100% ¹
Smart Programmable Thermostat - North	Smart Thermostat	2,359	2,359	2,349	100% ¹
Smart Programmable Thermostat - South (Gas)	Smart Thermostat	1,330	1,330	1,324	100% ¹
Wi-Fi Thermostat - North	Wi-Fi Enabled Thermostat	813	813	813	100%
Wi-Fi Thermostat - South	Wi-Fi Enabled Thermostat	382	382	382	100%
Weatherization					
Attic Insulation - Pre R11, Post R43 North	Weatherization	147	147	147	100%
Attic Insulation - Pre R11, Post R43 South	Weatherization	155	155	155	100%
Duct Sealing North	Weatherization	9	9	9	100%
Duct Sealing South	Weatherization	14	14	14	100%
Wall Insulation North	Weatherization	37	37	37	100%
Wall Insulation South	Weatherization	106	106	106	100%
Total		14,784	14,784	14,681	99%

¹ Smart thermostat in-service rate is rounded to the nearest whole percentage; the in-service rate is 99.57%.

Table 6 shows historical in-service rates for each program measure. These vary year to year due to yearly differences in reported (gas DSM scorecard) to audited (program tracking data) installations and participant survey self-report persistence data.

**Table 6. Residential Prescriptive Historical In-Service Rates**

Measure	In-Service Rate				
	2015	2016	2017	2018	2019
HVAC					
Furnace Tune-Up	N/A	N/A	N/A	N/A	100%
Natural Gas Boilers - 90%	N/A	100%	99%	100%	99%
Natural Gas Furnaces - 95%	100%	100%	100%	99%	99%
Natural Gas Furnace - 97%	N/A	100%	100%	99%	99%
Thermostats					
Nest On-Line Store North	N/A	N/A	100%	98%	100%
Nest On-Line Store South	N/A	N/A	100%	98%	100%
Smart Programmable Thermostat – North	99%	100%	100%	98%	100%
Smart Programmable Thermostat – South (Gas)	101%	101%	100%	98%	100%
Wi-Fi Thermostat – North	N/A	N/A	100%	96%	100%
Wi-Fi Thermostat – South	N/A	N/A	100%	96%	100%
Weatherization					
Attic Insulation - Pre R11, Post R43 North	99%	97%	151%	100%	100%
Attic Insulation - Pre R11, Post R43 South	99%	93%	75%	100%	100%
Duct Sealing North	100%	98%	100%	100%	100%
Duct Sealing South	100%	100%	100%	100%	100%
Wall Insulation North	100%	98%	180%	100%	100%
Wall Insulation South	100%	98%	88%	100%	100%

Net-to-Gross Analysis

Cadmus stratified the 2019 Residential Prescriptive Program participant survey by six measure categories to calculate NTG at the measure category level. The methodology and findings are described in greater detail in *Appendix A. Impact Evaluation Methodology*.

Cadmus weighted the measure category-level NTG estimates by the *ex post* population energy savings to arrive at an overall program-level NTG estimate of 58%, as shown in Table 7. The overall program NTG of 58% is weighted by the combination of electric and gas gross evaluated program population savings. However, the gas-specific NTG ratio of 58% is weighted specifically using gas saving measures. The overall program NTG of 58% is heavily weighted toward the gas-specific NTG estimate of 58% because *ex post* gross gas savings account for 94% of the total 2019 Residential Prescriptive Program MMBTU energy savings.

Table 7. 2019 Residential Prescriptive Net-to-Gross Ratio

Survey Measure Category	Freeridership	Spillover	NTG Ratio	Total Program Ex Post MMBTU Savings
Furnace (n=576 for FR; n=112 for SO)	47%	1%	54%	118,052
Heat Pump/CAC (n=88 for FR; n=18 for SO)	32%	0%	68%	5,424
Smart Thermostat (n=454 for FR; n=122 for SO)	33%	3%	70%	25,338
Wi-Fi Enabled Thermostat (n=135 for FR; n=27 for SO)	27%	3%	76%	2,997
Weatherization (n=33 for FR; n=12 for SO)	24%	1%	77%	7,950
Other (n=48 for FR; n=17 for SO)	25%	10%	85%	1,016
Total Program (n=1,642)²	43%¹	1%¹	58%¹	160,776³
Electric-Specific NTG			71%	9,439
Demand-Specific NTG			72%	5.59⁴
Gas-Specific NTG			58%	151,338

¹ Weighted by evaluated *ex post* program population MMBTU savings

² 1,334 respondents answered the freeridership (FR) questions through the quarterly freeridership surveys. 308 respondents answered the spillover (SO) questions through the annual spillover specific survey. Not all respondents surveyed answered the freeridership and spillover questions.

³ MMBTU savings do not sum due to rounding.

⁴ MMBTU/hour savings.

Table 8 lists historical program-level NTG ratios by year. The primary factor accounting for the decrease in overall program NTG from 2018 to 2019 is that furnace NTG decreased by two percentage points and smart thermostat NTG decreased by eight percentage points from 2018 to 2019. Furnace and smart thermostats are consistently high-impact measures, accounting for 89% of the 2019 evaluated gross population energy savings and 89% of the 2018 evaluated gross population energy savings.

Table 8. Residential Prescriptive Historical Net-to-Gross Ratios

Program Year	Freeridership	Spillover	NTG Ratio
2015	53%	3%	50%
2016	50%	3%	53%
2017	58%	2%	44%
2018	39%	2%	63%
2019	43%	1%	58%

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Freeridership and Spillover

Cadmus estimated freeridership by combining two methods—the standard self-report intention method and the intention/influence method. By combining the standard self-report *intention* methodology with an *influence* methodology, Cadmus produced a program freeridership score.¹¹

Cadmus calculated the arithmetic mean of the savings weighted *intention* and *influence* freeridership components to estimate measure category freeridership estimates,¹² as shown in the following equation:

$$\text{Final Freeridership \%} = \frac{\text{Intention FR Score}(0\% \text{ to } 100\%) + \text{Influence FR Score}(0\% \text{ to } 100\%)}{2}$$

Table 9 summarizes intention, influence, and overall freeridership scores for each measure category.

Table 9. 2019 Residential Prescriptive Intention, Influence and Overall Freeridership Score by Measure Category

Measure Category	n	Intention Score	Influence Score	Freeridership Score
Furnace	576	77%	17%	47%
Heat Pump/CAC	88	57%	7%	32%
Smart Thermostat	454	53%	13%	33%
Wi-Fi Enabled	135	45%	9%	27%
Weatherization	33	47%	1%	24%
Other	48	42%	7%	25%

Sixteen participants reported installing a total of 17 high-efficiency measures after participating in the program. These respondents did not receive an incentive and said participation in the program was very influential on their decision to install additional measures. Cadmus attributed spillover savings to measures including a high-efficiency clothes washer, dishwashers, refrigerator, water heaters, insulation, windows, duct sealing, smart thermostats, and HVAC equipment.

Cadmus used *ex post* savings estimated for the 2019 evaluation in combination with the 2015 Indiana TRM v2.2 to estimate savings for all spillover measures attributed to the program. Cadmus divided the total survey sample spillover savings for each measure category by the gross program savings from the survey sample to obtain the measure category spillover estimates in Table 10.

¹¹ *Intention* and *influence* freeridership scores both have a maximum of 100%.

¹² *Ex post* gross program savings.

**Table 10. 2019 Residential Prescriptive Program Spillover Estimates by Measure Category**

Measure Category	Survey Sample Spillover MMBTU Savings	Survey Sample Program MMBTU Savings	Percentage Spillover Estimate
Furnace	10.6	1,499.5	1%
Heat Pump/CAC	0.0	29.4	0%
Smart Thermostat	19.6	772.5	3%
Wi-Fi Enabled	1.5	54.3	3%
Weatherization	2.0	189.4	1%
Other	8.7	90.5	10%

Evaluated Net Savings Adjustments

Table 11 lists evaluated net savings for the Residential Prescriptive. The overall program NTG of 58% presented in the *Net-to-Gross Analysis* section is weighted by the combination of electric and gas gross evaluated program savings. However, the overall program-level NTG estimate presented in this table is weighted specifically to gas savings. The program achieved 877,202 therms net savings.

Table 11. 2019 Residential Prescriptive Natural Gas Savings

Measure	Ex Ante Savings (Therms)			Evaluated Ex Post Savings (Therms)	Realization Rates (Therms)	NTG Ratio	Evaluated Net Savings (Therms)
	Reported	Audited	Verified				
HVAC							
Furnace Tune-Up	18,256	18,256	18,256	32,536	178%	54%	17,569
Natural Gas Boilers - 90%	6,330	6,330	6,267	5,506	87%	54%	2,973
Natural Gas Furnaces - 95%	1,096,000	1,096,000	1,085,149	1,066,419	97%	54%	575,866
Natural Gas Furnace - 97%	81,663	81,663	80,854	76,059	93%	54%	41,072
Thermostats							
Nest On-Line Store North	14,425	14,425	14,363	17,763	123%	70%	12,434
Nest On-Line Store South	1,697	1,697	1,690	1,687	99%	70%	1,181
Smart Programmable Thermostat - North	134,407	134,407	133,826	149,709	111%	70%	104,797
Smart Programmable Thermostat - South (Gas)	71,331	71,331	71,023	63,769	89%	70%	44,639
Wi-Fi Thermostat - North	15,911	15,911	15,911	20,156	127%	76%	15,319
Wi-Fi Thermostat - South	6,901	6,901	6,901	7,103	103%	76%	5,398
Weatherization							
Attic Insulation - Pre R11, Post R43 North	31,167	31,167	31,167	27,565	88%	77%	21,225
Attic Insulation - Pre R11, Post R43 South	30,743	30,743	30,743	34,983	114%	77%	26,937
Duct Sealing North	1,010	1,010	1,010	926	92%	77%	713
Duct Sealing South	1,150	1,150	1,150	1,332	116%	77%	1,026
Wall Insulation North	2,463	2,463	2,463	1,371	56%	77%	1,056
Wall Insulation South	6,928	6,928	6,928	6,490	75%	77%	4,998
Total	1,520,383	1,520,383	1,507,702	1,513,376¹	100%	58%	877,202

¹ Totals may not add up to the sum of the column due to rounding.

Residential New Construction Program

The Residential New Construction (RNC) Program provides incentives to builders for constructing homes that meet a specified Home Energy Rating System (HERS) Index Score. Builders can submit applications for homes in both the Vectren South (dual fuel) and North (gas only) territories.

HERS raters measure and verify home energy performance. Under HERS, the lower the score the higher the home's efficiency. The U.S. Department of Energy has determined that a typical resale home scores 130 and a standard new home scores 100 on the HERS index.¹³ In 2019, Vectren provided three incentive tiers: Gold Star homes (rating 61 to 63), Platinum Star homes (rating 60 or less), and Platinum Plus homes (rating 60 or less with high-efficiency HVAC equipment installed). Vectren added the Platinum Plus tier in 2019. The rating thresholds and incentive tiers are shown in Table 12.

Table 12. 2019 Residential New Construction Program Incentive Summary

Tier	HERS Rating	Total Incentive (Dual Fuel Homes)	Electric Only Incentive	Gas Only Incentive
Gold Star	61 to 63	\$700	\$175	\$525
Platinum Star	60 or less	\$800	\$200	\$600
Platinum Plus	60 or less with energy efficient HVAC equipment ¹	\$1,300	\$400	\$900

¹ Energy efficient HVAC equipment is considered to be a 97% AFUE furnace, 16 SEER A/C and 16 SEER heat pump.

Vectren works with CLEAResult to implement the RNC Program. The program implementer markets the program, verifies program eligibility, processes rebates, and documents and tracks program performance. In 2019, to target income-qualified homeowners, Vectren also provided energy efficiency kits to new homes constructed by Habitat for Humanity.

Kit contents varied depending on the territory where the home was built, as shown in Table 13. Vectren works with the program implementer to distribute the kits directly to Habitat for Humanity offices and instruct participating Habitat for Humanity builders to install every measure.

¹³ Residential Real Energy Services Network. "What is the HERS Index?" <https://www.resnet.us/hers-index>

Table 13. 2019 Residential New Construction Program Habitat for Humanity Kit Contents

Measure	Vectren Fuel Service		
	Dual Fuel Kit Quantity	Electric Only Kit Quantity	Gas Only Kit Quantity
9 W LED	5	5	0
LED 5W Globe	3	3	0
LED R30 Dimmable	1	1	0
5W Candelabra	3	3	0
Bathroom Aerator (1.0 gpm)	1	1	1
Kitchen Flip Aerator (1.5 gpm)	1	1	1
Low Flow Showerhead (1.5 gpm)	1	1	1
Smart Thermostat	1	1	1

Accomplishments

Table 14. shows the program's achievements against goals in 2019. The program met its expenditures goal and surpassed its savings and participation goals. CLEAResult attributed this success primarily to greater outreach with HERS Raters to ensure that awareness of the program's existence was transferred to builders.

Table 14. 2019 Residential New Construction Goals and Achievements¹

Unit	2019 Actual	2019 Planning Goal	Percentage of Goal
Gross Therms Savings	379,756	290,041	131%
Participants (Homes and Habitat for Humanity Kits)	1,006	720	140%
Program Expenditures	\$628,170	\$628,170	100%

¹ Goals and achievements from Vectren's 2019 DSM Scorecard. Actuals represent *ex ante* reported values.

In 2019, Vectren's RNC Program provided incentives for 190 dual fuel homes, 91 Gold Star and 99 Platinum Star, and 774 gas only homes, 559 Gold Star and 215 Platinum Star.¹⁴ In addition, Vectren provided 20 dual fuel Habitat for Humanity kits and 22 gas only Habitat for Humanity kits.

Table 15 shows the number of reported homes certified through the program, as well as the number of kits distributed to Habitat for Humanity builders.

Table 15. 2019 Residential New Construction Program Summary

Tier	Dual Fuel Homes	Gas Only Homes	Total
Gold Star	91	559	650
Platinum Star	99	215	314
Platinum Plus	0	0	0
Total Homes	190	774	964
Habitat for Humanity Kits	20	22	42

¹⁴ Electric only homes are evaluated in the 2019 Vectren DSM Portfolio Electric Impacts Evaluation report.

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Table 16 lists the evaluated savings summary for the RNC Program. Realization rates for energy savings were driven by smaller home sizes with lower efficiencies in wall and window insulation, more homes with air leaks and leaky ducts, and more high-efficiency lighting compared to the 2017 evaluation, on which Vectren's reported savings are based. An increase in high-efficiency lighting means less waste heat, which is made up for with higher therms consumption. Smaller homes generally achieve lower energy savings because the baseline and efficient consumption of a smaller home is less.

Table 16. 2019 Residential New Construction Natural Gas Savings

Energy Savings Unit	Ex Ante Savings			Evaluated Ex Post Savings	Realization Rates	NTG Ratio	Evaluated Net Savings
	Reported	Audited	Verified				
Total Therms	379,756	379,756	378,520	272,851	72%	64%	175,187

Conclusions and Recommendations

Some of the following conclusions and recommendations may be derived from the process evaluation activities Cadmus conducted for this program. Process evaluation findings are presented in the *2019 Vectren DSM Portfolio Process and Natural Gas Impacts Evaluation*.

Participant Satisfaction

Builders are highly satisfied with the program. All 10 interviewed builders were satisfied with their overall program experience and were all *very likely* to recommend the program to another builder. Two of the three Habitat for Humanity builders did not participate in the application process, as they distributed kits only in 2019. The other eight builders were all satisfied with the application process. Seven of eight builders were satisfied with the HERS rating process as well. Vectren improved the application process for 2019 by having the program implementer send quarterly reminders to builders to submit rebate applications.

Platinum Plus Tier Requirements

The Platinum Plus tier did not effectively motivate builders. To increase program savings, Vectren implemented the Platinum Plus tier in 2019, which offered incentives to builders to install high-efficiency HVAC equipment. However, this tier was not financially realistic for builders and therefore saw no participation. Six of eight interviewed participating builders were aware of the Platinum Plus tier, indicating relatively strong awareness among builders. However, all reported that the cost of such efficient HVAC equipment was too high for participation in the Platinum Plus tier in 2019. In 2020, Vectren plans to lower the incentives for this tier and switch the requirement to a tankless water heater with an efficiency of 0.90.

Habitat for Humanity Kits

The Habitat for Humanity kit delivery did not function as designed, leading to a discount in potential savings. Marketing material provided by Vectren and delivered with kits indicated that all measures should be installed in Habitat for Humanity homes by the builders. Additionally, the implementer directly instructs Habitat for Humanity builders to install the kit measures on behalf of homeowners.

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However, contrary to this instruction, two of three interviewed Habitat for Humanity builders said they did not install the measures and instead gave the kits directly to homeowners to install themselves. As a result, Cadmus could not assume all kit measures were installed and instead used benchmarked in-service rates from other self-install kit programs. The overall in-service rate for the Habitat for Humanity kits was 55% for natural gas kits and 83% for dual fuel kits.

Recommendation: Ensure instruction for Habitat for Humanity offices are clear: kit measures are intended to be installed by builders, not by the homeowner, and to emphasize the importance on energy savings for the homeowner. Consider offering builders or Habitat for Humanity offices that direct install kit measures for homeowners a small per-kit or larger raffle incentive to motivate proper program participation.

Recommendation: Weigh the costs and benefits of collecting contact information for kit recipients. Conducting a short-follow up survey could provide better understanding of measure persistence, installation experience, awareness of Vectren's sponsorship of the kits, and satisfaction by Habitat for Humanity homeowners.

Building Code Changes

Indiana adopted the 2020 Indiana Residential Code in December 2019.¹⁵ The 2020 Indiana Residential Code includes minimum energy efficiency requirements based on the 2018 International Residential Code (Chapter 11 of the code document) with state-specific amendments.^{16,17} Compliance with the energy efficiency requirements can be achieved prescriptively, through a performance-based approach, or by meeting a specified Energy Rating Index (ERI) score.¹⁸ A HERS score is the most commonly available method for demonstrating compliance with the ERI. Builders must achieve an ERI (equivalent to a HERS score) of 62 or less in climate zone 4 (Evansville) and 61 or less in climate zone 5 (Indianapolis).

The 2020 Indiana Residential Code increased some mandatory energy efficiency requirements, which must be met regardless of the compliance path selected by the builder, including reducing the air

¹⁵ The 2020 Indiana Residential Code is based on the 2018 International Residential Code.

¹⁶ International Code Council. January 2020. *2020 Indiana Residential Code. Chapter 11 – Energy Efficiency.* <https://codes.iccsafe.org/content/INRC2020/chapter-11-re-energy-efficiency>.

¹⁷ Indiana's state-specific amendments retained most of the 2005 Indiana Residential Code building envelope requirements, except for air leakage rate; these requirements were roughly equivalent to the 2009 International Energy Conservation Code.

¹⁸ New to the 2020 Indiana Residential Code, the ERI score is defined as a numerical score where 100 is equivalent to the 2006 International Energy Conservation Code and 0 is equivalent to a net-zero home. Each integer value on the scale represents a one percent change in the total energy use of the rated home relative to the total energy use of the ERI reference home.

leakage rate from 7 ACH50 to 5 ACH50.¹⁹ Changes made to the prescriptive building requirements, such as insulation, were minimal.

As such, all homes complying with the minimum code requirements through the ERI compliance option since January 1, 2020, qualify as Gold Star homes. Indiana's adoption of the 2020 Indiana Residential Code, which raises the program savings baseline to minimum program requirements for homes complying via the ERI path, eliminates savings for Gold Star homes (which require a HERS score of 63 to qualify). Platinum Star homes, requiring a HERS score of 60, would likely see a reduction in savings.

Recommendation: Increase the minimum qualifications for Residential New Construction Program homes to ensure that the program continues to encourage homes to be built beyond minimum code requirements. Conduct an analysis to determine the HERS score that will allow the program to generate savings, given the new code requirements, and weigh the costs and benefits of incorporating these program requirement changes.

Impact Evaluation

Impact Evaluation Methods and Findings

The Residential New Construction impact evaluation included multiple data collection efforts and analysis tasks:

- Review of 2019 program tracking data for completeness and accuracy
- Review a random sample of 123 HERS certificates (out of 964) for home characteristics
- Develop characteristic energy models using REM/Rate V16.0 to verify energy savings
- Interviews with 10 builder participants to estimate self-report NTG
- Conduct an engineering analysis of measures included in the Habitat for Humanity kits based on builder interviews and secondary research

Gross Savings Review

Table 17 provides per-unit annual gross savings for each program home category and the Habitat for Humanity kits.

¹⁹ Indiana's state-specific amendments also allow visual inspection for air leakage requirements; air leakage testing is not required.

Table 17. 2019 Residential New Construction Per-Unit Gross Savings

Measure	Annual Gross Savings (Therms)	
	Reported	Evaluated
New Construction		
Gold Star (Dual Fuel)	336	243
Gold Star (Gas Only)	336	243
Platinum (Dual Fuel)	500	361
Platinum Star (Gas Only)	500	361
Habitat for Humanity Kits		
Habitat For Humanity Kit (Dual Fuel)	93	44
Habitat For Humanity Kit (Gas Only)	94	69

For the new construction component of the program, the lower evaluated savings compared to reported are primarily driven by lower efficiencies in insulation and home and duct tightness, higher heating loads due to more high efficiency lighting compared to 2017 (2019 reported savings are based on 2017 evaluated savings), and a decrease in home size compared to 2017.

Vectren's reported savings for the Habitat for Humanity kits are provided at the kit-level, rather than the measure-level. Vectren did not provide the assumptions used for the kits' *ex ante* savings. Cadmus evaluated savings for each measure in the Habitat for Humanity kit using algorithms from the 2015 Indiana TRM v2.2 and rolled the savings up to the kit level, as shown in Table 17. Cadmus' detailed assumptions for measure-level savings can be found in *Appendix A. Impact Evaluation Methodology*.

Table 18 lists the evaluated gross per-unit energy savings for each new construction incentive tier since 2015.²⁰ A significant driver of savings is home size, which has varied year by year. Similarly, the individual measures installed within the homes vary each year which causes variations in program savings. Levels of specific types of insulation (wall and basement wall), the amount of high-efficiency lighting, and gas water heater efficiency have varied over the years. On the other hand, furnace efficiency and other specific types of insulation such as ceiling, windows, and crawlspace wall insulation, have remained mostly constant.

²⁰ The Residential New Construction Program was introduced as a pilot in 2013, and no evaluation of the program was conducted in 2014. The pilot offered only the Gold Star incentive tier.

Table 18. Residential New Construction Historical Per-Unit Savings

Measure	Evaluated Annual Gross Savings (Therms)				
	2015	2016	2017	2018	2019
New Construction					
Gold Star (Dual Fuel)	216	295	336	341	243
Gold Star (Gas Only)	252	287		332	243
Platinum Star (Dual Fuel)	216	392	500	454	361
Platinum Star (Gas Only)	137	381		441	361

Measure Verification

After reviewing the program tracking data, Cadmus verified accounting for 100% of the reported program homes constructed. However, when interviewing builders, Cadmus found lower in-service rates for the Habitat for Humanity kits; two of three Habitat for Humanity builders said they did not install the kit measures themselves, as instructed by the program implementer. Because most Habitat for Humanity kits were distributed to end users and were self-installed (rather than direct installed by the builder), Cadmus applied in-service rates calculated for the 2019 Energy Efficient Schools Program and from benchmarking research. The overall in-service rate for the kits is the average weighted measure in-service rate (details on individual in-service rates can be found in the *Appendix A. Impact Evaluation Methodology*). Table 19 lists the in-service rates for each program measure category.

Table 19. 2019 Residential New Construction Measure Verification Results – In-Service Rates

Measure	Installations			In-Service Rate
	Reported	Audited	Verified	
New Construction				
Gold Star (Dual Fuel)	91	91	91	100%
Gold Star (Gas Only)	559	559	559	100%
Platinum Star (Dual Fuel)	99	99	99	100%
Platinum Star (Gas Only)	215	215	215	100%
Habitat for Humanity Kits				
Habitat For Humanity Kit (Dual Fuel)	20	20	17	83%
Habitat For Humanity Kit (Gas Only)	22	22	12	55%
Total	1,006	1,006	993	99%

Table 20. shows that the program achieved 100% realization for all new construction measures each year but 2016.

Table 20. Residential New Construction Historical In-Service Rates

Measure	In-Service Rates				
	2015	2016	2017	2018	2019
New Construction					
Gold Star (Dual Fuel)	100%	100%	100%	100%	100%
Gold Star (Gas Only)	100%	100%	100%	100%	100%
Platinum Star (Dual Fuel)	100%	100%	100%	100%	100%
Platinum Star (Gas Only)	100%	99%	100%	100%	100%

Table 21 shows the in-service rates applied to the measures in the Habitat for Humanity kits, as well as the sources for those rates.

Table 21. Habitat For Humanity Kit Measure In-Service Rates

Kit Measure	2019 In-Service Rate	Source
Bathroom Aerator 1 gpm	36%	Vectren 2019 School Kits Evaluation
Kitchen Aerator 1.5 gpm	43%	Vectren 2019 School Kits Evaluation
Low Flow Showerhead	43%	Vectren 2019 School Kits Evaluation
Smart Thermostat	98%	Focus on Energy 2018 Simple Energy Evaluation Report

Net-to-Gross Analysis

Cadmus analyzed NTG for the 2019 RNC Program through interviews with 10 participating builders.²¹ Cadmus estimated freeridership using the intention/influence freeridership method. The intention freeridership score was calculated from builders' responses about how their organization's building practices would have differed in absence of the program. The influence freeridership score was calculated by asking respondents to rate the influence of program elements on their building practices. Table 22 presents the NTG results for the program. These findings are described in greater detail in *Appendix B. Net-to-Gross Detailed Findings*.

Table 22. 2019 Residential New Construction Program Net-to-Gross Ratio

Measure	Freeridership	Spillover	NTG Ratio
New Construction Incentives	36%	0%	64% ¹
Habitat For Humanity Kit Incentives	0%	0%	100%

¹Absolute precision at 90% confidence interval is $\pm 10\%$.

²¹ Eight interviewed builders received new construction incentives. One of these eight builders also installed Habitat For Humanity Kits in homes. Two additional interviewed participants only installed Habitat For Humanity Kits in homes. All three interviewed participants who installed Habitat For Humanity Kits answered "No" to the question "Would you have purchased and installed any of the Habitat for Humanity Kit items in homes if you had not received them in your kits from Vectren?" Cadmus estimates 0% freeridership, 0% spillover and 100% NTG for the Habitat for Humanity Kits.

Table 23 lists historical program-level NTG ratios by year for new construction incentives. Cadmus derived these estimates through interviews with participating builders. Because of the relatively small sample sizes, NTG can vary year-to-year based on builder response and the level of individual contribution to overall program savings. In 2019, the three interviewed builders with the most savings represented 71% of the analysis sample *ex post* gross MMBTU savings. These three builders' combined savings-weighted average freeridership was 23%. (In 2018, one interviewed builder represented 72% of the analysis sample *ex post* gross MMBTU savings and were estimated at 50% freeridership.)

Table 23. Residential New Construction Incentives Historical Net-to-Gross Ratios

Program Year	Freeridership	Spillover	NTG Ratio
2015 (n=5)	50%	0%	50%
2016 (n=10)	64%	0%	36%
2017 (n=10)	50%	0%	50%
2018 (n=10)	46%	0%	54%
2019 (n=8)	36%	0%	64%

Freeridership and Spillover – New Construction Incentives

Table 24 shows a wide difference between the intention and influence scores. This results from builders' reporting that their organization's building practices would not have differed much in the absence of the program then subsequently reporting, on average, that program-related factors were very influential in their decision to build homes to the RNC Program requirement of HERS 63 standard or lower. Program-related factors include program incentives, marketing, information about energy-efficient building practices provided by Vectren, information from a HERS rater, and previous participation in a Vectren energy efficiency program.

Table 24 lists the program's intention, influence, and freeridership scores for new construction incentives in the 2019 program year.

Table 24. 2019 Residential New Construction Program Intention/Influence Freeridership Scores

n	Intention Score	Influence Score	Freeridership Score
8	35%	1%	36%

The 2019 RNC Program spillover estimate is 0%. None of the interviewed builders said they had voluntarily raised the energy efficiency standard of the appliances or materials they used to build homes that were not eligible for the RNC Program.

Building Code Changes

In December 2019, Indiana adopted the 2020 Indiana Residential Code, which became effective on January 1, 2020. This code includes updated energy efficiency requirements based on the 2018 International Residential Code with state-specific amendments (Chapter 11 of the code documents). Compliance with the energy efficiency requirements can be achieved prescriptively, through a

performance-based approach, or by meeting a specified ERI score. Mandatory code requirements must be met by builders regardless of the compliance path chosen.

Prescriptive Approach

To comply with the energy provisions of the 2020 Indiana Residential Code using the prescriptive compliance path, builders must ensure that their homes meet the minimum prescriptive requirements for building characteristics as stated in Chapter 11. These requirements were based on the 2018 International Residential Code, yet most were significantly amended to levels included in the previous iteration of the code. Table 25 lists select prescriptive requirements from Indiana's previous code requirements (2005 Indiana Residential Code), the 2020 Indiana Residential Code, and the 2018 International Residential Code for comparison. Prescriptive requirements may not be traded off.

The 2020 Indiana Residential Code increased certain mandatory energy efficiency requirements, which must be met regardless of the compliance path selected by the builder. These include reducing home air leakage from 7 ACH50 to 5 ACH50 and increasing the percentage of high efficacy lighting from 50% to 90%.²² Mandatory requirements are also indicated in Table 25.

Performance-Based Compliance

To comply using the performance-based approach, the proposed design of a home must be shown to have an annual energy cost that is less than or equal to the annual energy cost of the standard reference design or a home built to the minimum prescriptive requirements. System trade-offs are permitted after mandatory requirements are met.

Energy Rating Index Compliance

The 2020 Indiana Residential Code now includes a path for code compliance through meeting an ERI score, a compliance option not previously available to builders. Though prescriptive requirements were significantly amended from the 2018 IECC, the ERI path was not amended, making it a more stringent compliance path than the other compliance options. A HERS score is the most commonly available method for demonstrating compliance with the ERI. Builders must achieve an ERI (equivalent to a HERS score) of 62 or less in climate zone 4 (Evansville) and 61 or less in climate zone 5 (Indianapolis). Therefore, all homes with HERS scores of 63 in climate zone 4 and 63 or 62 in climate zone 5 would not be code-compliant, even though they qualify as Gold Star homes under current program standards.

²² Indiana's state-specific amendments also allow visual inspection for air leakage requirements; air leakage testing is not required.

Table 25. Indiana Residential Prescriptive Code Requirements

Key Requirements	Requirement Type	2005 Indiana Residential Code		2020 Indiana Residential Code		2018 International Residential Code	
		Climate Zone 4 (Evansville)	Climate Zone 5 (Indianapolis)	Climate Zone 4 (Evansville)	Climate Zone 5 (Indianapolis)	Climate Zone 4 (Evansville)	Climate Zone 5 (Indianapolis)
Ceiling R-Value	Prescriptive	38	38	38	38	49	49
Wall R-Value (wood frame) ¹	Prescriptive	13	20 or 13+5	15	20 or 13+5	20 or 13+5	20 or 13+5
Wall R-Value (mass wall) ²	Prescriptive	5/10	13/17	5/10	13/17	8/13	13/17
Basement Wall R-Value ³	Prescriptive	10/13	10/13	10/13	10/13	10/13	15/19
Crawlspace Wall R-Value ³	Prescriptive	10/13	10/13	10/13	15/19	10/13	15/19
Windows U-Factor	Prescriptive	0.35	0.35	0.35	0.35	0.32	0.30
Home Tightness ACH50	Mandatory	7 ACH50 *can be tested or visually inspected	7 ACH50 *can be tested or visually inspected	5 ACH 50 *can be tested or visually inspected	5 ACH 50 *can be tested or visually inspected	3 ACH *testing required	3 ACH *testing required
Duct Tightness CFM25/100ft ²	Prescriptive	Rough-in: ≤ 6 or ≤ 4 where air handler not installed Postconstruction: ≤ 8	Rough-in: ≤ 6 or ≤ 4 where air handler not installed Postconstruction: ≤ 8	Rough-in: ≤ 4 or ≤ 3 where air handler not installed Postconstruction: ≤ 4	Rough-in: ≤ 4 or ≤ 3 where air handler not installed Postconstruction: ≤ 4	Rough-in: ≤ 4 or ≤ 3 where air handler not installed Postconstruction: ≤ 4	Rough-in: ≤ 4 or ≤ 3 where air handler not installed Postconstruction: ≤ 4
Percentage High-Efficacy Lighting	Mandatory	50%	50%	90%	90%	90%	90%
Skylight U-factor	Prescriptive	0.60	0.60	0.60	0.60	0.55	0.55

¹ "13+5" means R-13 cavity insulation with an additional R-5 insulated sheathing applied to the exterior of the wall. If structural sheathing covers 25 percent or less of the exterior, R-5 sheathing is not required where sheathing is used. If structural sheathing covers more than 25 percent of exterior, structural sheathing shall be supplemented with insulated sheathing of at least R-2.

² The second R-value applies when more than half the insulation is on the interior.

³ The first R-value applies to continuous insulation, the second to framing cavity insulation; either insulation meets the requirement.



Evaluated Net Savings Adjustments

Table 26 lists evaluated net savings for the Residential New Construction. The program achieved 175,187 therms net savings.

Table 26. 2019 Residential New Construction Natural Gas Savings

Measure	Ex Ante Savings (Therms)			Evaluated Ex Post Savings (Therms)	Realization Rates (Therms)	NTG Ratio	Evaluated Net Savings (Therms)
	Reported	Audited	Verified				
New Construction							
Gold Star (Dual Fuel)	30,617	30,617	30,617	22,101	72%	64%	14,144
Gold Star (Gas Only)	188,076	188,076	188,076	135,761	72%	64%	86,887
Platinum Star (Dual Fuel)	49,543	49,543	49,543	35,762	72%	64%	22,888
Platinum Star (Gas Only)	107,593	107,593	107,593	77,665	72%	64%	49,706
Habitat for Humanity Kits							
Habitat For Humanity Kit (Dual Fuel)	1,865	1,865	1,557	728	39%	100%	728
Habitat For Humanity Kit (Gas Only)	2,062	2,062	1,134	834	40%	100%	834
Total	379,756	379,756	378,520	272,851	72%	64%	175,187

Home Energy Assessment (HEA 2.0) Program

The Home Energy Assessment (HEA) 2.0 Program offers a walk-through audit and direct installation of energy efficiency measures for single-family homes at no cost to the customer. In 2018, Vectren revamped the 2017 version of the program to reset savings goals and focus on treating fewer participants with deeper savings. The HEA 2.0 Program ran as a pilot in 2018 and became an official program in 2019.

A local contracting company, J.E. Shekell, implemented the program in 2019 and was responsible for recruiting participants, conducting on-site home energy assessments, installing program measures, and recommending further energy-saving home improvements. While at the home, energy assessors employed by the program implementer provide energy education, a detailed report about the home's energy use, and suggestions for further actions to reduce energy consumption.

Assessors install these natural gas energy-saving products through the HEA 2.0 Program:

Water-saving devices

- Bathroom aerator
- Kitchen aerator
- Efficient showerhead

HVAC and water heating measures

- Filter whistle
- Pipe insulation
- Water heater temperature setback
- Smart thermostat

Accomplishments

Table 27 shows the program's achievements against goals in 2019. The program exceeded its therms savings goals despite not reaching its participation goal. The program implementer said the program's customer education and a switch to a more attractive chrome handheld showerhead were key to meeting 2019 savings goals. The implementer installed showerheads in 53% of the 351 homes that participated in the 2019 HEA 2.0 Program compared to 42% in 2018.

Table 27. 2019 HEA 2.0 Program Goals and Achievements¹

Unit	2019 Actual	2019 Planning Goal	Percentage of Goal
Gross Therms Savings	16,753	11,857	141%
Participants	351	400	88%
Program Expenditures	\$46,477	\$49,199	94%

¹ Goals and achievements from Vectren's 2019 DSM Scorecard. Actuals represent *ex ante* reported values.

Table 28 lists the evaluated savings summary for the HEA 2.0 Program. Overall, the program achieved a natural gas realization rate of 112%. The realization rate is almost entirely driven by higher evaluated savings for smart thermostats. The primary reason evaluated savings were higher than reported savings a different methodology was used to account for the baseline thermostat type.

Table 28. 2019 HEA 2.0 Program Natural Gas Savings

Energy Savings Unit	Ex Ante Savings			Evaluated Ex Post Savings	Realization Rates	NTG Ratio	Evaluated Net Savings
	Reported	Audited	Verified				
Total Therms	16,753	16,777	16,490	18,777	112%	91%	17,072

Conclusions and Recommendations

Conclusions and recommendations may be derived from the process evaluation and literature review activities Cadmus conducted for the Home Energy Assessment 2.0. Process evaluation and literature findings are presented in the *2019 Vectren DSM Portfolio Process and Electric Impacts Evaluation*.

Customer Satisfaction

Overall satisfaction remained high for the HEA 2.0 program in 2019. The program exceeded its participation goals, with 94% of customers reporting they were satisfied with the program (statistically similar to 97% in 2018) and 98% of customers reporting they were likely to recommend the program to others (statistically similar to 100% in 2018).

Conversion to Other Vectren Programs

Though most HEA 2.0 Program survey respondents reported taking action on the energy-savings recommendations they received, their participation in other Vectren programs remains low. Sixty-nine percent of respondents said they implemented recommended energy-savings recommendations they received at the time of their assessment, but just 2% also participated in other Vectren programs, down from 3% in 2018.

Recommendation: If conversion to other Vectren programs becomes a priority, provide the program implementer with best practices for how to discuss Vectren's other residential rebates and to provide estimated payback calculations with and without those rebates.

Recommendation: If conversion to other Vectren programs becomes a priority, follow up with customers one week or one month after the assessment by emailing a copy of the report, reminders of no- to low-cost energy-saving tips, and links to Vectren's webpages for its other residential programs. This reminder will keep the assessment fresh in customers' minds and encourage them to participate in other Vectren programs.

Program Planning

Reported savings for faucet aerators and pipe insulation are understated. Similar to 2018, Vectren's reported gas savings for faucet aerators and pipe insulation were lower than evaluated. Reported savings were based on 2016 HEA 2.0 Program results for pipe insulation, where savings were calculated in MMBTU instead of therms. For faucet aerators, beginning in 2017, the flow rate for the faucet aerator changed from 1.5 gpm to 1.0 gpm. This resulted in higher evaluated savings for the bathroom faucet aerator measure in 2019, since savings are still based on the 2016 results.

Recommendation: Update natural gas savings for aerators and pipe insulation to address these differences in reported and evaluated savings.

Potential New Program Measures

Vectren's current program offering is comprehensive compared to other utility residential direct install programs but there are weatherization measures that could increase program savings.

Vectren's program offers 10 of the 14 measures included in benchmarked direct install programs. The other four measures—water heater blanket, exterior door and attic hatch weatherstripping, and door sweeps—would take minimal time for the assessor to install.

Recommendation: As more pilot evaluation research is published, weigh the costs and benefits of offering door sweeps and weatherstripping through the HEA 2.0 Program. Vectren can plan for future program years by using the per-unit savings estimates in Table 29 to determine *ex ante* savings.

Table 29. Per-Unit Savings Estimates for Proposed Measures

Proposed Measure	Customer HVAC System	Per-Unit Gross Savings Estimates for Planning		
		kWh	kW	therms
Exterior Door Weatherstripping and Door Sweep ¹	AC with Natural Gas Heat	4.7	0.008	2.50
	Heat Pump	32.0	0.011	0.00
	AC with Electric Heat	62.9	0.014	0.00
	Natural Gas Heat Only	1.2	0.000	2.65
	Electric Heat Only	57.6	0.000	0.00

¹ These estimates are based on the Indiana TRM v2.2 and the 2001 ASHRAE Fundamentals Handbook, which does not distinguish effective leakage area estimates for exterior door weatherstripping and door sweeps separately. These savings estimates assume weatherstripping and door sweeps would be installed together.

Impact Evaluation

Impact Evaluation Methods and Findings

The HEA 2.0 Program impact evaluation included multiple data collection efforts and analysis tasks:

- A tracking database review of the number of measures installed
- A survey of 87 program participants to verify number of measures installed
- An engineering analysis of *ex ante* energy savings per measure and per home
- A freeridership and spillover analysis to calculate an NTG ratio by program measure

Gross Savings Review

Cadmus conducted an engineering desk review to assess natural gas savings for the gas-saving measures distributed through the HEA 2.0 Program. Cadmus also assessed the savings achieved by participants' implementation of additional recommendations from the on-site energy assessment. Table 30 provides per-unit annual gross savings for each program measure. Additional details for measure-level savings can be found in *Appendix A. Impact Evaluation Methodology*.

Table 30. 2019 HEA 2.0 Program Per-Unit Gross Savings

Measure	Annual Gross Savings (Therms)	
	Reported ¹	Evaluated
Audit Education		
Audit Fee	5.46	4.72
HVAC and Water Heating Measures		
Filter Whistle	17.77	14.72
Pipe Insulation	0.25	3.04
Smart Thermostat	46.87	54.10
Water Heater Setback	3.71	3.59
Water-Saving Devices		
Bathroom Aerator	0.40	0.86
Kitchen Aerator	5.04	6.29
Showerhead	9.05	9.89

¹ The 2019 DSM Scorecard did not include per-unit gas savings. The savings in this table are the audited per-unit gas savings from the 2019 program tracking data.

Vectren's reported savings are primarily based on 2016 evaluated savings, rather than the 2017 evaluated savings as for most of its other programs. Some measures had realization rates above or below 100% (evaluated savings compared to reported savings) for the following reasons:

- **Audit education.** The largest driver for lower evaluated savings was that fewer participants were eligible for the savings attributable to programming their thermostat correctly because they already had a smart thermostat installed through the program. In 2019, 67% of participants had a smart thermostat installed through the program compared to fewer than 1% in 2016, on which reported savings were based.
- **HVAC and water heating.**
 - **Pipe insulation.** For pipe insulation, the reported per-unit savings were lower because evaluated savings were recorded in MMBTU instead of therms.
 - **Smart thermostat.** The most impactful difference between reported and evaluated savings was for smart thermostats, which accounted for 72% of the program's reported natural gas savings. A study conducted in Vectren South territory found that a smart thermostat that replaced a manual thermostat produced gas heating savings of 69 therms, and a programmable thermostat replacing a manual thermostat saved 30 therms.²³ For the 2019 HEA 2.0 Program, Cadmus used evaluated savings of 69 therms for smart thermostats replacing manual thermostats and 50 therms for smart thermostats replacing programmable thermostats.

Though reported savings also accounted for baseline technology type, per-unit savings for each baseline technology were different. Reported savings used savings of 60 therms per

²³ Cadmus. January 29, 2015. *Evaluation of the 2013-2014 Programmable and Smart Thermostat Program*.



smart thermostat replacing a manual thermostat and 30 therms per smart thermostat replacing a programmable thermostat (which the 2013-2014 report intended for replacement of a manual thermostat). The 60 therms just came from applying the 30 therms twice. These differences led to a 115% realization rate for smart thermostats. More details on Cadmus' approach for adjusting the baseline technology are contained in *Appendix A.3.2. HVAC and Water Heating Measures*.

- **Water-saving devices.** For bathroom aerators, reported savings were based on the installation of a 1.5 gpm bathroom aerator. In 2019, the program began offering a 1.0 gpm bathroom aerator, which led to significantly higher evaluated savings. Other differences for direct install water-saving devices were due to changes in survey responses from year to year (for people per home, bathroom faucets per home, and showers per home). In particular, the average number of people per home in 2019 was 2.47 compared to 2.0 in 2017, which led to higher evaluated savings for water-savings devices.

Table 31 lists the evaluated gross per-unit energy savings for each program measure by year. Evaluated per-unit savings vary over time because of annual variance in survey response data, gradual shifts in measure efficiency (such as moving from a 1.5 gpm bathroom aerator in 2019), and the methodological reasons stated above.

Table 31. HEA 2.0 Program Historical Per-Unit Savings

Measure	Evaluated Annual Gross Savings (Therms)				
	2015	2016	2017	2018	2019
Audit Education					
Audit Fee	9.73	5.46	9.54	5.08	4.72
HVAC and Water Heating Measures					
Filter Whistle	15.54	17.77	16.17	15.58	14.72
Pipe Insulation	1.92	0.25	3.65	2.96	3.04
Smart Thermostat	N/A	14.4	14.4	50.98 ¹	54.10 ¹
Water Heater Setback	N/A	N/A	3.59	2.85	3.59
Water-Saving Devices					
Bathroom Aerator	0.46	0.4	1	1.04	0.86
Kitchen Aerator	6.6	5.98	6.5	7.17	6.29
Showerhead	10.94	9.05	11.18	11.41	9.89

¹These are smart thermostats, compared to programmable in prior years.

Measure Verification

Cadmus calculated verified savings for the HEA 2.0 Program by applying a persistence rate to program measure savings. The persistence rate is an indicator of the number of measures that remained installed in homes after initial participation according to self-report survey response. Cadmus used the persistence rate as the in-service-rate (ISR), assuming that reported installations were accurate because the program implementer's quality control process ensured that actual and reported measure installations matched. Table 32 lists the in-service rates for each program measure.

**Table 32. 2019 HEA 2.0 Program Measure Verification Results – In-Service Rates**

Measure	Installations			In-Service Rate
	Reported ¹	Audited	Verified	
Audit Education				
Audit Fee	N/A	351	351	100%
HVAC and Water Heating Measures				
Filter Whistle	N/A	10	10	100%
Pipe Insulation	N/A	141	141	100%
Smart Thermostat	N/A	252	252	100%
Water Heater Setback	N/A	136	136	100%
Water-Saving Devices				
Bathroom Aerator	N/A	286	265	93%
Kitchen Aerator	N/A	106	98	92%
Showerhead	N/A	186	160	86%
Total²	N/A	1,468	1,412	96%

¹The number of reported installations in the 2019 DSM Scorecard was based on number of households served (n=351).

² Totals may not add up to the sum of the column due to rounding.

Table 33 shows historical in-service rates for each program measure. In-service rates were generally comparable across years, except for filter whistles. One of the largest drivers is few survey respondents (only 15 furnace whistle installations through the program overall and four respondents), so in-service rates can differ widely.

Table 33. HEA 2.0 Program Historical In-Service Rates

Measure	In-Service Rate				
	2015	2016	2017	2018	2019
Audit Education					
Audit Fee	100%	100%	100%	100%	100%
HVAC and Water Heating Measures					
Filter Whistle	100%	44%	71%	57%	100%
Pipe Insulation	100%	100%	100%	100%	100%
Smart Thermostat	N/A	88%	100%	100%	100%
Water Heater Setback	N/A	88%	100%	100%	100%
Water-Saving Devices					
Bathroom Aerator	100%	93%	95%	84%	93%
Kitchen Aerator	87%	93%	100%	90%	92%
Showerhead	83%	96%	90%	89%	86%

Net-to-Gross Analysis

Cadmus calculated freeridership and spillover for the HEA 2.0 Program as a whole using findings from a survey conducted with 87 program participants. The overall program NTG of 87% is weighted by the combination of electric and gas gross evaluated program population savings. However, the gas-specific NTG ratio of 91% is weighted specifically to gas savings due to the application of measure-level NTG estimates. Table 34 presents the NTG results for the program. These findings are described in greater detail in *Appendix B. Net-to-Gross Detailed Findings*.

Table 34. 2019 HEA 2.0 Program Net-to-Gross Ratio

Measure	Freeridership	Spillover	NTG Ratio	Total Program Ex Post MMBTU Savings
Total Program	16%¹	3%¹	87%¹	3,703
Electric-Specific NTG			85%	1,825
Demand-Specific NTG			82%	0.16²
Gas-Specific NTG			91%	1,878

¹ Weighted by evaluated *ex post* program population MMBTU savings.

² MMBTU/hour savings.

Table 35 lists historical program-level NTG ratios by year. The main driver of the of the higher NTG estimate in 2019 compared to 2018 is that freeridership for smart thermostats decreased by 15 percentage points in 2019 from 2018. Smart thermostats represented 50% of the HEA 2.0 Program *ex post* population MMBTU savings in 2019 and 47% in 2018. A possible factor accounting for the decrease in smart thermostat freeridership is that in 2018 Cadmus used a pure intention-based freeridership method for smart thermostats and in 2019 used an intention and influence freeridership method for smart thermostats that aligns with methods used for smart thermostat measures in the Residential Prescriptive Program and Smart Cycle Program.²⁴

Table 35. HEA 2.0 Program Historical Net-to-Gross Ratios

Program Year	Freeridership	Spillover	NTG Ratio
2015	5%	3%	98%
2016	13%	5%	92%
2017	7%	9%	102%
2018	25%	3%	78%
2019	16%	3%	87%

²⁴ If the 2019 smart thermostat freeridership estimate of 13% was applied to 2018 smart thermostat *ex post* population MMBTU savings, the 2018 HEA 2.0 Program NTG estimate would have been 87% NTG, the same as the 2019 HEA 2.0 Program NTG estimate.

Freeridership and Spillover

Cadmus estimated freeridership using a pure intentions-based method for all measures except smart thermostats.²⁵ Smart thermostats, the highest impact measure in 2019, used an intention and influence freeridership method that aligns with methods used for smart thermostat measures in the Residential Prescriptive Program and Smart Cycle Program.

Cadmus asked respondents questions then weighted their measure-level freeridership scores by their verified installed units to arrive at measure-level freeridership estimates. Most survey respondents had multiple measures installed through the HEA 2.0 Program and were asked freeridership questions about each measure. Cadmus then weighted the measure-level freeridership estimates by the evaluated gross population savings for each measure.

The resulting program NTG ratio is 87% after including spillover of 3%. Table 36 lists NTG results by measure.

²⁵ An *influence* score component is not included in the freeridership methodology of non-smart thermostat direct install measures. This exclusion aligns with the Illinois TRM V7 for NTG evaluation of no-cost, direct install measures delivered through a single-family home energy audit program. Given the low cost of the measures provided through the direct-install component of most audit programs and the number of measures received per participant, efforts have been made to streamline the freeridership battery to reduce the respondent's burden. Illinois Energy Efficiency Stakeholder Advisory Group. September 28, 2019. *2019 Illinois Statewide Technical Reference Manual for Energy Efficiency*. Version 7.0. Volume 4: Cross-Cutting Measures and Attachments. Section 4.5. http://ilsagfiles.org/SAG_files/Technical_Reference_Manual/Version_7/Final_9-28-18/IL-TRM_Effective_010119_v7.0_Vol_4_X-Cutting_Measures_and_Attach_092818_Final.pdf

**Table 36. 2019 HEA 2.0 Program NTG by Measure**

Measure	n	Freeridership	Spillover	NTG	Evaluated Ex Post Population Savings (MMBTU)
Audit Fee ¹	0	0%	0%	100%	253
Bathroom Aerator	44	16%	4%	88%	27
Filter Whistle	2	0%	4%	104%	18
Kitchen Aerator	36	16%	4%	88%	74
LED Light Bulbs	64	24%	4%	80%	1,112
LED Nightlight ¹	0	0%	0%	100%	45
Pipe Insulation	31	12%	4%	92%	51
Showerhead	28	26%	4%	78%	189
Smart Strips	56	13%	4%	91%	22
Smart Thermostat	50	13%	4%	91%	1,862
Water Heater Setback ¹	0	0%	0%	100%	51
Overall⁴	N/A	16%²	3%³	87%	3,703⁴

¹ No NTG surveys completed, assuming 0% freeridership.

² Weighted by evaluated ex post program population MMBTU savings.

³ Weighted by evaluated gross program population MMBTU savings. The survey results resulted in a 4% spillover estimate. The 4% survey-based spillover estimate was only applied to measures that had freeridership response data from the survey. For measures that did not have freeridership response data Cadmus applied a 100% NTG ratio and did not apply the 4% survey-based spillover estimate to the measures. The overall program-level spillover estimate of 3% is the evaluated program population MMBTU savings weighted average of all spillover estimates in this table.

⁴ Totals may not add up to the sum of the column due to rounding.

Three participants reported that after participating in the HEA 2.0 Program they installed additional high-efficiency measures for which they did not receive an incentive.²⁶ These respondents said participation in the program was very important in their decision.

Cadmus used *ex post* savings estimated from the 2019 Residential Prescriptive Program along with the 2015 Indiana TRM v2.2 to estimate savings for all spillover measures attributed to the HEA 2.0 Program. Cadmus divided the total survey sample spillover savings by the gross program savings from the survey sample to obtain the 4% spillover estimate for the program measures with valid freeridership response data, as shown in Table 37.²⁷

²⁶ These measures were a gas tank-less water heater, attic insulation, duct sealing, clothes washers, a refrigerator, a central air conditioner and a dehumidifier.

²⁷ Weighted by evaluated gross program population MMBTU savings. The survey results resulted in a 4% survey-based spillover estimate. This estimate was applied only to measures that had freeridership response data from the survey. For measures that did not have freeridership response data, Cadmus applied a 100% NTG ratio and did not apply the 4% survey-based spillover estimate to the measures. The overall program-level spillover estimate of 3% is the evaluated program population MMBTU savings weighted average of all spillover estimates.

**Table 37. 2019 HEA 2.0 Program Spillover Estimate**

Survey Sample Spillover MMBTU Savings	Survey Sample Program MMBTU Savings	Spillover Percentage Estimate (from Surveys)	Spillover Percentage Estimate (Overall Program)
33	889 ¹	4%	3%

¹ 2019 evaluated gross energy savings.

Evaluated Net Savings Adjustments

Table 38 lists evaluated net savings for the HEA 2.0 Program, which achieved 17,072 therms net savings.

Table 38. 2019 HEA 2.0 Program Natural Gas Savings

Measure	Ex Ante Savings (Therms)			Evaluated Ex Post Savings (Therms)	Realization Rates (Therms)	NTG Ratio	Evaluated Net Savings (Therms)
	Reported	Audited	Verified				
Audit Education							
Audit Fee	N/A	1,916	1,916	1,658	87%	100%	1,658
HVAC and Water Heating Measures							
Filter Whistle	N/A	178	178	147	83%	104%	153
Pipe Insulation	N/A	35	35	429	1,216%	92%	394
Smart Thermostat	N/A	11,811	11,811	13,633	115%	91%	12,406
Water Heater Setback	N/A	505	505	488	97%	100%	488
Water-Saving Devices							
Bathroom Aerator	N/A	114	106	227	198%	88%	200
Kitchen Aerator	N/A	534	492	614	115%	88%	538
Showerhead	N/A	1,683	1,447	1,581	94%	78%	1,234
Total¹	16,753	16,777	16,490	18,777	112%	91%	17,072

¹ Totals may not add up to the sum of the column due to rounding.

Income Qualified Weatherization Program

The Income-Qualified Weatherization (IQW) Program, referred to customers as the Neighborhood Weatherization Program, offers a walk-through audit and direct installation of energy efficiency measures for income-qualified homes at no cost to the customer. Program eligibility extends to homeowners and tenants who have a total household income up to 300% of the federal poverty level.

The program implementer, CLEAResult, is responsible for recruiting income-qualified participants and providing turnkey implementation services. Energy auditors employed by the program implementer conduct on-site assessments and install or recommend three categories of program measures:

- **Phase 1 measures** were installed by the program implementer energy auditors during the on-site assessment. These measures include pipe wrap, water heater setbacks, furnace filter whistles, showerheads, aerators, and smart thermostats.
- **Phase 2 measures** include air and duct sealing. After initial recommendation by energy auditors during the on-site assessment, phase 2 measures were installed by the implementer's field technicians.
- **Phase 3 measures** offer deeper household energy savings, including insulation, refrigerator replacement, and air conditioner tune-ups and replacements. After initial recommendation by energy auditors during the on-site assessment, phase 3 measures were installed by a participating trade ally.

To facilitate these energy efficiency upgrades, the IQW Program also offers funding for health and safety improvements. In previous years, the program set a soft cap of \$250 per home to mitigate health and safety hazards. In 2019, to increase the number of homes that could receive as many eligible measures as possible, Vectren raised the cap to up to \$5,000 per home (with case-by-case approval).

In 2019, Vectren launched the Whole Home IQW Pilot to eligible customers whose income was up to 200% of the federal poverty level. The pilot is intended to offer income-qualified customers whole-home weatherization with more comprehensive upgrades than are available through the IQW Program. In addition to additional funding for health and safety, pilot participants are eligible for water heater replacement, wall insulation, interior caulking, and central air conditioner or furnace replacement. Vectren plans to roll out the pilot as an integrated part of the IQW Program in 2020.

Accomplishments

Table 39 shows the program's achievements against goals in 2019. The IQW Program exceeded its savings and participation goals while spending 100% of its budget. This may be due to the higher health and safety budget, which allowed more homes to be served and receive the phase 2 and phase 3 measures associated with deeper per-home savings. In 2019, of the 108 homes recommended for measures beyond phase 1, 70% went on to phase 2 or phase 3. As a result, 5.3% of all program homes received phase 2 or phase 3 measures, consistent with 5% in 2018. These homes saved 175 therms compared to 31 therms for homes that received only phase 1 measures. The IQW Program served 27 homes through the new Whole Home IQW Pilot measures.

**Table 39. 2019 Income Qualified Weatherization Goals and Achievements¹**

Unit	2019 Actual	2019 Planning Goal	Percentage of Goal
Gross Therms Savings	60,411	51,674	117%
Participants	1,084	813	133%
Program Expenditures	\$426,145	\$426,146	100%

¹ Goals and achievements from Vectren's 2019 DSM Scorecard. Actuals represent *ex ante* reported values.

Table 40 lists the evaluated savings summary for the Income Qualified Weatherization Program. Overall, the program achieved a natural gas realization rate of 106%. Higher evaluated savings for attic insulation was the primary driver for a realization rate above 100%. Evaluated savings for attic insulation were higher because the average existing R-value was lower than in previous years. According to Vectren, the implementer purposefully targeted homes with minimal or no insulation. Evaluated savings for furnaces drove the realization rate down because smaller furnaces were installed in the IQW Program compared to the Residential Prescriptive Program on which the reported savings were based.

Table 40. 2019 Income Qualified Weatherization Natural Gas Savings

Energy Savings Unit	<i>Ex Ante</i> Savings			Evaluated <i>Ex Post</i> Savings	Realization Rates	NTG Ratio	Evaluated Net Savings
	Reported	Audited	Verified				
Total therms	60,411 ¹	60,410 ¹	59,555	63,830	106%	100%	63,830

¹Cadmus confirmed differences in audited and reported savings were due to rounding.

Conclusions and Recommendations

Some of the following conclusions and recommendations may be derived from the process evaluation activities Cadmus conducted for this program. Process evaluation findings are presented in the *2019 Vectren DSM Portfolio Process and Electric Impacts Evaluation*.

Program Administration and Delivery

Average natural gas savings per home increased 26% in 2019, likely due to changes in program design.

Since 2016, the IQW Program natural gas savings per home has dropped each year. However, in 2019, savings per home rose by 26%. In the past, a primary barrier to installing the measures that achieve deeper savings, such as measures installed after phase 1 direct install measures, has been health and safety problems in the home and insufficient funding to address these problems.

In 2019, Vectren raised the health and safety funding cap to \$5,000 per home (approved on a case-by-case basis) from the previous soft cap of \$250 per home and launched the Whole Home IQW Pilot, which offered additional measures such as HVAC replacements, for eligible households at or below the 200% federal poverty level (stricter income eligibility guidelines than the overall program).

In 2020, Vectren plans to integrate the Whole Home IQW Pilot into the IQW Program and anticipates serving even more homes with these additional measures. Despite these program advances, there continues to be opportunity to achieve deeper savings per home. Though the implementer recommended 108 homes for phase 2 measures, only 30 homes (28%) did so.

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Recommendation: Track reasoning for not implementing phase 2 and phase 3 measures. This will allow Vectren to better understand the low conversion rate for these higher impact measures.

Customer Satisfaction

Most customers are generally satisfied with the IQW Program. Overall, 89% (n=71) of survey respondents are satisfied with the IQW Program. Most of the less satisfied participants wanted more energy-saving information from the program because they did not think the level of information and direct install measures made an impact on their homes' efficiency. Some of these participants said they already take behavioral actions to reduce their energy use. Nevertheless, most measures received satisfaction ratings of at least 92%.

Recommendation: Provide additional or more in-depth energy education information for customers who already take action to reduce their energy usage. Customize these additional behavioral recommendations so individual customers learn applicable "next steps."

Data Tracking

Tracking existing thermostat data will increase savings reliability. In 2019, no information was provided on the existing thermostat technology for participants who received smart thermostats. Instead, Cadmus used a small sample of survey data to determine baseline technology (n=19). According to Vectren, the implementer started collecting existing thermostat data partway through 2019.

Recommendation: To evaluate savings more accurately, it is important to have reliable information about the type of baseline thermostat. Ensure that installation contractors consistently collect and track these data for the IQW Program. Provide these data for evaluation.

Program Planning

Thermostats installed in multifamily homes have lower savings than those installed in single-family homes. To account for differences in heating equipment sizes in multifamily homes compared to single-family homes, Cadmus applied a square footage adjustment factor to the single-family savings.

Recommendation: For thermostats installed in multifamily homes, apply an adjustment factor of 60% to 2018 evaluated savings to account for differences in heating load for single-family and multifamily homes. This adjustment factor was derived using Residential Energy Consumption Survey (RECS) square footage data. Alternatively, the evaluated savings for 2019 multifamily smart thermostats can be used for reported savings since these include the adjustment.

Reported savings for natural gas furnace replacements are overstated. Reported savings for the IQW Program were based on the 2017 Residential Prescriptive Program evaluation. Evaluated savings for furnaces installed through the IQW Program in 2019 (53,273 BTUH) were lower than for furnaces installed through the Residential Prescriptive Program in 2017 (78,217 BTUH). This is because homes are smaller in the IQW Program participant population. In addition, the average full load heating hours were lower for the IQW Program, which operates only in Evansville, than for the Residential Prescriptive program, included installations near Indianapolis.

Recommendation: Adjust reported savings estimates for furnace replacements to better reflect the IQW Program population.

Impact Evaluation

Impact Evaluation Methods and Findings

The Income Qualified Weatherization impact evaluation included multiple data collection efforts and analysis tasks:

- A tracking database review of the number of measures installed
- A survey of 71 program participants to verify number of measures installed
- An engineering analysis of energy savings per measure and per home

Gross Savings Review

Cadmus conducted an engineering desk review to assess energy savings for the natural gas-saving measures distributed through Vectren's IQW Program. Cadmus also assessed the savings achieved by participants' implementation of additional recommendations from the on-site energy assessment. Table 41 provides per-unit annual gross savings for each program measure. Specific details on measure-level savings can be found in *Appendix A. Impact Evaluation Methodology*.

Table 41. 2019 Income Qualified Weatherization Per-Unit Gross Savings

Measure	Annual Gross Savings (Therms)	
	Reported	Evaluated
Audit Education		
Audit Fee (Dual Fuel Single-Family)	8	10
Audit Fee (Dual Fuel Multifamily)	9	2
Water-Saving Devices		
Bathroom Aerator (Gas Multifamily)	1	1
Bathroom Aerator (Gas Single-Family)	2	2
Kitchen Aerator (Gas Multifamily)	5	5
Kitchen Aerator (Gas Single-Family)	7	6
Low Flow Showerhead (Gas Multifamily)	12	11
Low Flow Showerhead (Gas Single-Family)	16	14
HVAC and Water Heating Measures		
Filter Whistle (Multifamily)	8	4
Filter Whistle (Single-Family)	15	9
Furnace Tune-Up	54	42
Natural Gas Furnaces - 95%	134	73
Pipe Wrap (Gas DHW, per home)	4	5
Smart Thermostat (Gas Multifamily)	25	30
Smart Thermostat (Dual Fuel)	69	67
Water Heater Temperature Setback (Gas)	4	4

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Measure	Annual Gross Savings (Therms)	
	Reported	Evaluated
Weatherization Measures		
Air Sealing 20% Infil. Reduction (Dual Fuel)	77	87
Attic Insulation (Dual Fuel)	209	270
Duct 10% leakage Reduction (Dual Fuel)	93	66
Wall Insulation (Gas Heated Home)	61	65

Vectren's reported savings for single-family homes are primarily based on 2017 evaluated savings. Reported savings for multifamily-specific were new in 2019. Several measures had realization rates above or below 100% (evaluated savings compared to reported savings) for the following reasons:

- **Audit education.** The audit education measures vary from year to year depending on how many surveyed participants respond they have implemented energy-saving actions. A higher percentage of surveyed participants said they took the recommended energy-savings actions in 2019 compared to 2017. In particular, 58% said they programmed the thermostat correctly in 2019, compared to 34% in 2017, which led to higher evaluated savings than reported savings in 2019. Before 2019, the IQW Program did not distinguish between the square footage of multifamily and single-family homes. In 2019, Cadmus applied a square footage adjustment to evaluated savings, which led to lower evaluated savings. Reported savings were not based on previous years (because the multifamily designation did not exist before 2019). It is not clear why reported savings for multifamily homes were higher than for single-family homes.
- **Water-saving devices.** Small differences in water-saving devices were driven by differences in survey inputs, such as people per home, showers per home, and bathroom faucets per home from year to year. In 2019, fewer people per home (2.44) was the largest driver for lower evaluated savings than reported savings (2.69 people per home in 2017). Savings inputs (people and water fixtures per home) for multifamily measures were based on survey data from the 2019 Multifamily Direct Install Program because there were not enough multifamily responses in the IQW Program survey data.
- **HVAC and water heating measures.** Evaluated savings for filter whistles were lower than reported due to updating the input capacity using actual furnace capacity data from furnaces installed through the 2019 IQW Program. This better reflects the actual furnace size of participants in the program. This change lowered the assumed capacity from 77,386 BTUH to 53,273 BTUH and consequently lowered evaluated savings for filter whistles.
 - Furnace tune-ups had significantly lower evaluated savings than reported. *Ex ante* savings was not based on a past evaluation because this measure is new in 2019. Cadmus used the 2015 Indiana TRM v2.2 methodology, which assumes an energy savings factor of 5%, combined with the average installed furnace capacity of 53,273 BTUH taken from furnace installation data (and not from the TRM, which assumes 77,386 BTUH). One reason for lower evaluated savings is likely smaller equipment capacities in 2019. The other likely driver is that reported savings used a higher energy savings factor or a different methodology.

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- Furnace replacements also had significantly lower evaluated savings than reported savings. The two primary drivers for this were lower equipment capacities and lower full load heating hours than assumed. The average installed capacity in the 2019 IQW Program was 53,273 BTUH compared to 78,217 BTUH in the 2017 Residential Prescriptive Program, on which reported savings for the IQW Program were based. This is likely homes are smaller in the IQW Program participant population. The full load heating hours used in the 2019 IQW Program evaluation were all based on Evansville (982 hours), whereas the 2017 Residential Prescriptive program were based on Evansville and Indianapolis (on average 1,228 hours).
- **Weatherization measures.** The *ex ante* and evaluated savings for weatherization measures differed widely because each installation had site-specific data that affected the amount of savings given each home:
 - Air sealing had slightly higher evaluated savings, primarily due to higher infiltration reduction in 2019.
 - Duct sealing was significantly lower due to updating the furnace capacity assumption. Similar to filter whistles, the assumed furnace capacity was updated to 53,273 BTUH based on furnace installation data. Previously the Cadmus team used a value of 77,386 BTUH from the 2015 Indiana TRM v2.2.
 - Attic insulation had higher evaluated savings than expected, primarily because of lower existing R-values in 2019 than in 2017 (on which reported savings were based). This was because homes with minimal or no existing insulation were targeted in 2019.

Table 42 lists the evaluated gross per-unit energy savings for each program measure by year. For measures that distinguished between multifamily and single-family homes in 2019, these were averaged across the measure type. Evaluated per-unit savings vary over time because of annual variance in survey response data and the methodological reasons stated above.

Table 42. Income Qualified Weatherization Historical Per-Unit Savings

Measure	Evaluated Annual Gross Savings (Therms)				
	2015	2016	2017	2018	2019 ¹
Audit Education					
Audit Fee (Dual Fuel)	3.35	1.83	7.95	8.8	9.26
Water-Saving Devices					
Bathroom Aerator ²	0.53	0.74	1.66	1.52	1.51
Kitchen Flip Aerator	5.28	5.98	6.84	6.41	5.84
Low Flow Showerhead	13.19	15.95	16.22	15.07	13.21
HVAC and Water Heating Measures					
Filter Whistle	16.27	17.77	15.44	16.13	9.03
Furnace Tune-Up	-	-	-	-	42.18
Natural Gas Furnaces - 95%	-	-	-	-	72.89
Pipe Wrap, per home (Gas)	6.61	8.22	4.59	4.43	4.53
Smart Thermostat (Dual Fuel)	-	-	69.00	69.00	66.65



Measure	Evaluated Annual Gross Savings (Therms)				
	2015	2016	2017	2018	2019 ¹
Water Heater Temperature Setback (Gas)	-	-	3.59	3.59	3.59
Phase 2 Measures					
Air Sealing 10% Infil. Reduction (Dual Fuel)	-	93.07	76.68	89.33	86.95
Attic Insulation (Dual Fuel)	-	132.22	209.45	226.67	270.39
Duct Sealing 10% Infil. Reduction (Dual Fuel)	-	81.47	92.88	96.08	66.14
Wall Insulation (Gas)	-	-	-	63.29	64.89

¹ 2019 savings include multifamily savings which lowered savings for some measures

² In 2017 the bathroom aerator changed from 1.5 gpm to 1.0 gpm

Measure Verification

Cadmus calculated verified savings for the IQW Program by applying a persistence rate to measure savings. The persistence rate is an indicator of the number of measures that remained installed in homes after initial participation. Cadmus used the persistence rate from self-report survey data as the in-service rate, assuming the reported installations were accurate because the program implementer's quality control process ensured that actual and reported measure installations matched. Cadmus also reviewed the program tracking data. Table 43 lists the in-service rates for each program measure.

Table 43. 2019 Income Qualified Weatherization Measure Verification Results – In-Service Rates

Measure	Installations			In-Service Rate
	Reported	Audited	Verified	
Audit Education				
Audit Fee SF (Dual Fuel Single-Family)	1,142	1,142	1,142	100%
Audit Fee MF (Dual Fuel Multifamily)	163	163	163	100%
Water-Saving Devices				
Bathroom Aerator (Gas Multifamily)	75	75	75	100%
Bathroom Aerator (Gas Single-Family)	440	440	440	100%
Kitchen Aerator (Gas Multifamily)	134	134	129	96%
Kitchen Aerator (Gas Single-Family)	384	384	369	96%
Low Flow Showerhead (Gas Multifamily)	86	86	76	89%
Low Flow Showerhead (Gas Single-Family)	218	218	194	89%
HVAC and Water Heating Measures				
Filter Whistle (Multifamily)	2	2	1	67%
Filter Whistle (Single-Family)	44	44	29	67%
Furnace Tune-Up	17	17	17	100%
Natural Gas Furnaces - 95%	19	19	19	100%
Pipe Wrap (Gas)	75	75	75	100%
Smart Thermostat (Gas Multifamily)	143	143	143	100%
Smart Thermostat (Dual Fuel Single-Family)	238	238	238	100%
Water Heater Temperature Setback (Gas)	40	40	40	100%



Measure	Installations			In-Service Rate
	Reported	Audited	Verified	
Phase 2 Measures				
Air Sealing 20% Infil. Reduction (Dual Fuel)	34	34	34	100%
Attic Insulation (Dual Fuel)	65	65	65	100%
Duct 10% leakage Reduction (Dual Fuel)	3	3	3	100%
Wall Insulation (Gas)	11	11	11	100%
Total	3,333	3,333	3,263	98%

Table 44 shows historical in-service rates for each program measure. Installation rates are nearly identical except for filter whistles. The primary reason for this is low sample size in both 2017 (n=14) and 2018 (n=4) values, leading to more variability.

Table 44. Income Qualified Weatherization Historical In-Service Rates

Measure	In-Service Rate				
	2015	2016	2017	2018	2019
Audit Education					
Audit Fee SF (Dual Fuel Single-Family)	100%	100%	100%	100%	100%
Audit Fee MF (Dual Fuel Multifamily)	100%	100%	100%	100%	100%
Water-Saving Devices					
Bathroom Aerator (Gas Multifamily)	99%	100%	98%	93%	100%
Bathroom Aerator (Gas Single-Family)	99%	100%	98%	93%	100%
Kitchen Aerator (Gas Multifamily)	99%	94%	93%	95%	96%
Kitchen Aerator (Gas Single-Family)	99%	94%	93%	95%	96%
Low Flow Showerhead (Gas Multifamily)	100%	92%	92%	91%	89%
Low Flow Showerhead (Gas Single-Family)	100%	92%	92%	91%	89%
HVAC and Water Heating Measures					
Filter Whistle (Multifamily)	97%	50%	71%	50%	67%
Filter Whistle (Single-Family)	97%	50%	71%	50%	67%
Furnace Tune-Up	-	-	-	-	100%
Natural Gas Furnaces - 95%	-	-	-	-	100%
Pipe Wrap (Gas)	91%	100%	100%	100%	100%
Smart Thermostat (Gas Multifamily)	-	88% ¹	100%	100%	100%
Smart Thermostat (Dual Fuel Single-Family)	-	88% ¹	100%	100%	100%
Water Heater Temperature Setback (Gas)	-	-	100%	100%	100%
Phase 2 Measures					
Air Sealing 20% Infil. Reduction (Dual Fuel)	-	100%	100%	100%	100%
Attic Insulation (Dual Fuel)	-	100%	100%	100%	100%
Duct 10% leakage Reduction (Dual Fuel)	-	100%	100%	100%	100%
Wall Insulation (Gas)	-	-	-	100%	100%

¹ These were all programmable thermostats in 2016.

Net-to-Gross Analysis

Evaluations generally assume that most income-qualified customers would not have the discretionary income to install measures on their own outside of the financial support of the program. Consequently, the NTG ratio for income-qualified programs is assumed to be 1.0 and net savings are calculated the same as *ex post* savings.

To give Vectren a sense of the level of energy efficiency action its income-qualified population takes as a result of program participation, Cadmus included spillover questions in its participant survey. Cadmus did not assess freeridership, so it did not apply the spillover results to the evaluated net savings and is reporting them for planning purposes only.

Spillover

Six participants reported that after participating in the program they installed an additional high-efficiency measure for which they did not receive an incentive. These measures were a gas boiler, clothes washer, and four insulation projects. Respondents said participation in the program was very important in their decision. Cadmus used the 2015 Indiana TRM v2.2 to estimate savings for all spillover measures attributed to the program. Cadmus divided the total survey sample spillover savings by the gross program savings from the survey sample to obtain an estimate of 2% spillover for the program, as shown in Table 45.

Table 45. 2019 IQW Program Spillover Estimate

Survey Sample Spillover MMBTU Savings	Survey Sample Program MMBTU Savings	Spillover Percentage Estimate
8.2	494.1 ¹	2%

Evaluated Net Savings Adjustments

Table 46 lists evaluated net savings for the Income Qualified Weatherization. The program achieved 63,830 therms net savings.

Table 46. 2019 Income Qualified Weatherization Natural Gas Savings

Measure	Ex Ante Savings (Therms)			Evaluated Ex Post Savings (Therms)	Realization Rates (Therms)	NTG Ratio	Evaluated Net Savings (Therms)
	Reported	Audited	Verified				
Audit Education							
Audit Fee SF (Dual Fuel Single-Family)	9,068	9,068	9,068	11,718	129%	100%	11,718
Audit Fee MF (Dual Fuel Multifamily)	1,403	1,403	1,403	371	26%	100%	371
Water-Saving Devices							
Bathroom Aerator (Gas Multifamily)	105	105	105	91	87%	100%	91
Bathroom Aerator (Gas Single-Family)	731	731	731	687	94%	100%	687
Kitchen Aerator (Gas Multifamily)	689	689	661	614	89%	100%	614

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Measure	Ex Ante Savings (Therms)			Evaluated Ex Post Savings (Therms)	Realization Rates (Therms)	NTG Ratio	Evaluated Net Savings (Therms)
	Reported	Audited	Verified				
Kitchen Aerator (Gas Single-Family)	2,626	2,626	2,521	2,291	87%	100%	2,291
Low Flow Showerhead (Gas Multifamily)	1,053	1,053	936	832	79%	100%	832
Low Flow Showerhead (Gas Single-Family)	3,536	3,536	3,143	2,738	77%	100%	2,738
HVAC and Water Heating Measures							
Filter Whistle (Multifamily)	15	15	10	6	38%	100%	6
Filter Whistle (Single-Family)	679	679	453	271	40%	100%	271
Furnace Tune-Up	919	919	919	717	78%	100%	717
Natural Gas Furnaces - 95%	2,550	2,550	2,550	1,385	54%	100%	1,385
Pipe Wrap (Gas)	331	331	331	340	103%	100%	340
Smart Thermostat (Gas Multifamily)	3,575	3,575	3,575	4,318	121%	100%	4,318
Smart Thermostat (Dual Fuel Single-Family)	16,353	16,353	16,353	15,863	97%	100%	15,863
Water Heater Temperature Setback (Gas)	143	143	143	143	100%	100%	143
Phase 2 Measures							
Air Sealing 20% Infil. Reduction (Dual Fuel)	2,607	2,607	2,607	2,956	113%	100%	2,956
Attic Insulation (Dual Fuel)	13,614	13,614	13,614	17,575	129%	100%	17,575
Duct 10% leakage Reduction (Dual Fuel)	279	279	279	198	71%	100%	198
Wall Insulation (Gas)	676	676	676	714	106%	100%	714
Total	60,411¹	60,410¹	59,555¹	63,830²	106%	100%	63,830²

¹ Measure-level reported, audited, and verified savings do not equal the total because the scorecard and 2019 program tracking data include heating penalties for lighting measures. These heating penalties are not included in the measure-level savings in this table but are represented in the totals. Difference in reported and audited total savings is due to rounding.

² Totals may not add up to the sum of the column due to rounding.

Energy Efficient Schools Program

Through the Energy Efficient Schools (EES) Program, Vectren encourages students and their families to focus on conservation and the efficient use of electricity and natural gas. The EES Program is designed to help students and their families identify opportunities to manage their energy consumption. The EES Program targets fifth-grade teachers at schools in Vectren's territory to distribute energy-savings kits to their students.

These kits contain energy-efficient measures that students can install at home along with other educational materials and activities. The kits also contain a self-report survey, the Home Energy Worksheet (HEW), which students and their guardians fill out to indicate which kit measures they installed at home. Teachers and students receive incentives for returning the HEWs to the program implementer. These are the contents in the electric and natural gas energy-saving kits.

Electric measures

- One 15-watt LED
- Two 11-watt LEDs
- LED night light

Electric and natural gas measures

- Kitchen faucet aerator (1.5 gpm)
- Two bathroom faucet aerators (1.0 gpm)
- Energy-efficient showerhead (1.5 gpm)
- Furnace filter whistle alarm

In 2019, Vectren worked directly with the National Energy Foundation (NEF) to implement the EES Program. NEF is responsible for day-to-day management, program outreach, and teacher enrollment.

Accomplishments

The EES Program met its gross energy-savings and participation goals, distributing a total of 2,502 kits in 2019. Vectren attributed this success to the continuation of strong relationships with teachers as well as keeping engagement high with new and refreshed teacher materials and activities. Program expenditures were 25% under the planning goal. Table 47 shows the program's achievements against goals in 2019.

Table 47. 2019 Energy Efficient Schools Program Goals and Achievements¹

Unit	2019 Actual	2019 Planning Goal	Percentage of Goal
Gross therm Savings	29,198	29,175	100%
Participants (Kits)	2,502	2,500	100%
Program Expenditures	\$50,931	\$67,930	75%

¹ Goals and achievements from Vectren's 2019 DSM Scorecard. Actuals represent *ex ante* reported values.

Table 48 provides evaluated savings for the EES Program, a total of 21,397 therms across all 2,502 kits distributed, or 8.55 therms per kit. Evaluated savings reflect engineering adjustments Cadmus made to reported measure savings claimed by the program, including for water heater fuel saturation rates and in-service rates (ISRs). Cadmus updated in-service rates for 2019 by surveying student households that

received kits in 2018 and 2019.²⁸ The main driver for the 73% realization rate is that in-service rates for all gas saving measures decreased in 2019 relative compared to 2017 (Vectren based its reported savings on evaluated savings from 2017).²⁹ Evaluated values do not include a heating penalty for LEDs; Cadmus accounted for electric interactive effects only within the electric portfolio (no penalty to the gas portfolio).

Table 48. 2019 Energy Efficient Schools Program Natural Gas Savings

Energy Savings Unit	Ex Ante Savings			Evaluated Ex Post Savings	Realization Rate	NTG Ratio	Evaluated Net Savings
	Reported	Audited	Verified				
Total Therms	29,198	29,198	20,465	21,397	73%	100%	21,397

Conclusions and Recommendations

Some of the following conclusions and recommendations may be derived from the process evaluation activities Cadmus conducted for the EES Program. Process evaluation findings are presented in the *2019 Vectren DSM Portfolio Process and Electric Impacts Evaluation*.

Satisfaction

Student household satisfaction was high in 2019. Nearly all (98%, n=42) student households that responded to the participant survey were satisfied with the program. Furthermore, satisfaction for all measures was above 90%. Kitchen faucet aerators (n=18) and LED night lights (n=29) both had the highest satisfaction at 100%. The filter whistles (n=11) had the lowest overall satisfaction at 91%.

Teachers continue to enroll in the program year after year, indicating satisfaction. Most participating teachers in 2019 were repeat participants from previous program years (81%, n=98), an increase from 2018 when 70% (n=96) had participated in prior years. The implementer said keeping repeat teachers engaged was important to meeting higher participation goals for 2019 and will be for 2020 when the goal for kit distribution is raised to 2,600 kits (from 2,500 in 2019). In 2019, the implementer made efforts to keep teachers satisfied by changing their incentive from a \$50 Visa gift card to a \$50 Amazon gift card, which is easier for teachers to redeem. NEF also added installation videos to the content of the lesson plans to simplify the amount of instruction needed from teachers.

Online Transition

The program is investing in online engagement tools to boost installation rates. NEF is looking at online options to expand interactivity for student households and therefore raise installation rates. In 2019, NEF added an online interactive installation game correlated to teacher materials to spark student enthusiasm. The program implementer sent a postcard that featured becoming an “energy sidekick”

²⁸ Cadmus included parent contact data from 2018 in the 2019 evaluation due to the small sample of student household contacts each year.

²⁹ In 2019, Cadmus used survey data to update in-service rates rather than benchmarking, as was used in 2017.

which presented energy savings facts and smart phone app-connecting capabilities to make installation more interactive for students as well as parents.

The implementer currently offers the HEW both online and on paper since more than 50% of the submissions continue to be on paper. Although the program actively offers both types of submission, there are some potential issues with the collection and eligibility of the HEW data. In 2019, 22% of teachers (22 of 98) received kit materials but did not return any HEW data to the program implementer. Additionally, Cadmus could not use 26% of the 726 parent contacts provided by the implementer (collected from 2018 and 2019 HEWs) for the participant phone surveys because of incorrect phone numbers (perhaps because of data entry error or inability to read handwriting on the paper HEWs).

Impact Evaluation

Impact Evaluation Methods and Findings

The Energy Efficient Schools Program impact evaluation included multiple data collection efforts and analysis tasks:

- Engineering analysis of energy savings for kit measures
- Database review of the number of kits distributed
- Review of data collected from the HEWs (n=1,571)
- Participant survey to verify measures installed (n=42)

Gross Savings Review

Table 49 lists the per-unit annual gross natural gas savings for each measure contained in the kit. Note that each kit contained two bathroom aerators, but the table shows savings for one unit only. Evaluated savings include all adjustments for water heater fuel type saturation rates and in-service rates. Evaluated savings were lower than reported due to the decrease in in-service rates for all gas saving measures in 2019 relative to the 2017 evaluation from which *ex ante* reported savings were based. Additional details for measure-level savings can be found in *Appendix A. Impact Evaluation Methodology*.

Table 49. 2019 Energy Efficient Schools Program Per-Unit Gross Savings¹

Measure	Annual Gross Savings (Therms)	
	Reported	Evaluated
Energy-Efficient Bathroom Aerator (one unit only) ²	0.46	0.31
Energy-Efficient Kitchen Aerator	2.40	2.41
Energy-Efficient Showerhead	5.55	3.90
Furnace Filter Whistle	4.85	1.62

¹ Reported and evaluated savings include in-service rates

² There are two bathroom aerators in each kit; however, the evaluated savings are for one unit only.

Table 50 list the per-kit annual gross natural gas savings for the kit contents. These savings account for two bathroom aerators in each kit.

Table 50. 2019 Energy Efficient Schools Program Per-Kit Gross Savings¹

Measure	Annual Gross Savings (Therms)	
	Reported	Evaluated
Energy-Efficient Bathroom Aerator ²	0.92	0.62
Energy-Efficient Kitchen Aerator	2.40	2.41
Energy-Efficient Showerhead	5.55	3.90
Furnace Filter Whistle	4.85	1.62
Total per kit	13.72	8.55

¹ Reported and evaluated savings include in-service rates

² These savings account for two bathroom aerators in each kit.

Table 51 lists the evaluated gross per-unit energy savings for each program measure by year. To provide a normalized comparison of per-unit gross savings over time, Cadmus removed the per-unit savings adjustments for water heater fuel type saturation rates and in-service rates.

Most measures have relatively stable savings for at least the past five years. The large changes for bathroom aerators, showerheads, and filter whistles in 2019 are because of new data from the participant survey. For aerators and showerheads, survey data indicated an increase in water fixtures per household compared to 2017. For filter whistles, survey data indicated a decrease in natural gas furnace saturation compared to RECS 2009 data.³⁰

Table 51. Energy Efficient Schools Program Historical Per-Unit Savings

Measure	Evaluated Annual Gross Savings (Therms)				
	2015	2016	2017	2018	2019
Energy-Efficient Bathroom Aerator (one unit only) ¹	2.16	2.17	2.36	2.29	1.91
Energy-Efficient Kitchen Aerator	12.00	11.36	12.32	11.99	12.30
Energy-Efficient Showerhead	23.73	23.70	25.71	25.00	19.92
Furnace Filter Whistle	N/A	11.17	11.17	11.17	5.73

¹ There are two bathroom aerators in each kit; however, these savings are for one unit only.

Measure Verification

For the impact evaluation, Cadmus first reviewed the program tracking data to confirm the number of kits distributed and to verify that program savings were accurately tracked and reported. Cadmus verified kit quantity by comparing reported quantities from the Vectren 2019 DSM Scorecard with year-end shipment data from the program implementer. Both sources confirmed shipment of 2,502 kits.

Measure-Level In-Service Rates

In previous evaluation years, there was very limited participant contact information available with which to field a participant survey. Therefore, for the previous two evaluation years (2017 and 2018 but only

³⁰ U.S. Energy Information Administration. 2009 Residential Energy Consumption Survey.

<https://energy.gov/sites/prod/files/2015/02/f19/UMPChapter21-residential-lighting-evaluation-protocol.pdf>



for LEDs in 2017), Cadmus relied on benchmarked in-service rates from similar school kits programs in other jurisdictions. For evaluations for 2015, 2016, and 2017, Cadmus used the in-service rates from the 2014 Energizing Indiana Statewide Core EES Program.

The program implementer combined the parent comment cards with the home energy worksheets for the first time in 2018. This change improved the percentage of parent contact data collected by the program and enabled more complete surveys for 2019. This in turn supported the collection and analysis of more accurate data for in-service rates.

Cadmus applied the new 2019 in-service rates adjustments to *ex ante* savings to generate verified savings for each measure in the kit, as shown in Table 52. Evaluated in-service rates account for measure persistence after initial receipt of the kit and according to the self-reported survey response.

Table 52. 2019 Energy Efficient Schools Program Measure Verification Results – In-Service Rates

Measure	Measures Distributed			In-Service Rate	
	Reported	Audited	Verified	Reported	Verified
Energy-Efficient Bathroom Aerator	5,004	5,004	1,787	47%	36%
Energy-Efficient Kitchen Aerator	2,502	2,502	1,072	47%	43%
Energy-Efficient Showerhead	2,502	2,502	1,072	52%	43%
Furnace Filter Whistle	2,502	2,502	706	43%	28%
Total	12,510	12,510	4,637	47%	37%

Table 53 shows historical in-service rates for each program measure.

Table 53. Energy Efficient Schools Program Historical In-Service Rates

Measure	In-Service Rate							
	2012	2013	2014	2015	2016	2017	2018	2019
Energy-Efficient Bathroom Aerator	60%	48%	47%	47%	47%	47%	43%	36%
Energy-Efficient Kitchen Aerator	60%	48%	47%	47%	47%	47%	42%	43%
Energy-Efficient Showerhead	60%	50%	52%	52%	52%	52%	49%	43%
Furnace Filter Whistle	45%	43%	43%	N/A	43%	43%	28%	28%

Water Heating Fuel Saturation

Cadmus also adjusted the *ex ante* natural gas water heater fuel saturation rates for water-saving measures by analyzing data from the 2019 HEW results. For 2019, 46% of homes use natural gas as their water heater fuel. This rate is comparable to previous years' rates.

**Table 54. Energy Efficient Schools Program
Historical Natural Gas Water Heater Saturation Rates**

Program Year	Natural Gas Saturation Rate
2019	46%
2018	49%
2017	41%
2016	45%
2015	48%
2014	46%
2013	48%
2012	52%

Net-to-Gross Analysis

School kit programs tend to induce minimal freeridership because the kits are free to students and contain some items that are not typically found in the average home. Cadmus did not estimate or apply any NTG adjustments to the *ex post* gross savings for the EES Program. NTG ratios for school kit programs tend to be close to 100%, and this is consistent with previous years' evaluations.

Evaluated Net Savings Adjustments

Table 55 lists evaluated net savings for the Energy Efficient Schools Program. The program achieved 21,397 therms net savings.

Table 55. 2019 Energy Efficient Schools Program Natural Gas Savings

Measure	Ex Ante Savings (therms)			Evaluated Ex Post Savings (therms)	Realization Rates (therms)	NTG Ratio	Evaluated Net Savings (therms)
	Reported	Audited	Verified				
Energy-Efficient Bathroom Aerator	2,295	2,295	1,737	1,561	68%	100%	1,561
Energy-Efficient Kitchen Aerator	5,995	5,995	5,443	6,029	101%	100%	6,029
Energy-Efficient Showerhead	13,881	13,881	11,353	9,766	70%	100%	9,766
Furnace Filter Whistle	12,126	12,126	7,881	4,042	33%	100%	4,042
Total¹	29,198²	29,198²	20,465²	21,397	73%	100%	21,397

¹ Totals may not add up to the sum of the column due to rounding.

² Measure-level reported, audited, and verified savings do not equal the total because the scorecard and 2019 program tracking data include heating penalties for lighting measures. These heating penalties are not included in the measure-level savings in this table but are represented in the totals.

Residential Behavioral Savings Program

Since 2012, the Residential Behavioral Savings (RBS) Program has been sending customers home energy reports (HERs), which provide energy consumption information and encourage the adoption energy-saving behaviors and home improvements. These reports contain the household's energy use data, a similar neighbor comparison on energy use, and energy-saving tips.

The RBS Program uses an experimental design called a randomized control trial wherein customers are randomly assigned to either a treatment group (recipients of HERs) or a control group (nonrecipients). Treatment group customers are mailed print HERs, and those with valid email addresses also receive the reports via email. All of Vectren's residential customers can access the program-affiliated online portal to obtain information on saving energy and details about their home energy use.

However, treatment group customers received specific encouragement in the HERs to use the online portal. Control group customers did not receive the HERs nor any encouragement to use the portal. Therefore, this group's consumption provides a baseline for measuring the program's energy savings.

Treatment and control group customers are further segmented by Vectren fuel service (dual fuel and electric only customers). At the start of 2019, the dual fuel program population contained 29,130 treatment group customers and 3,237 control group customers, as shown in Table 56.³¹ The 2019 program design did not expand its customer population nor perform a refill of the customer population. The Wave 1 treatment group customers have been receiving reports since 2012. During 2019, all treatment group customers were mailed four print HERs. Customers for whom Vectren had email addresses also received 12 (monthly) email HERs. The program implementer, Oracle, was responsible for forecasting and tracking savings, producing the report content, distributing the reports to customers, and running the online portal.

Table 56. 2019 RBS Program Design

Group and Wave	Program Treatments	Customer Count ¹
Treatment Group		
Wave 1 – Dual Fuel	4 print HERs; 12 email HERs; encouragement to visit online portal	29,130
Total Treatment Group		29,130
Control Group		
Wave 1 – Dual Fuel	--	3,237
Total Control Group		3,237

¹ Total count for the treatment group shown in table (29,130) does not match the participant count reported in Vectren's 2019 DSM Scorecard (29,300) because Cadmus relies on the program tracking data provided by Oracle to track participation.

³¹ The treatment group count value does not include customers who became inactive or opted out of the program prior to 2019. This methodology for determining participant count is consistent with previous evaluations.

Accomplishments

Table 57 shows the RBS Program's achievements against goals in 2019. According to Vectren's DSM Scorecard, the program exceeded its 2019 natural gas savings goal. Oracle and Vectren introduced program product changes and enhancements in 2019. Oracle revised the content of the HERs, and Vectren integrated advanced metering infrastructure (AMI) data into the program's online portal. These changes and enhancements may have contributed toward the program exceeding its energy savings goal by re-engaging customers to take energy-saving actions within their homes.

Table 57. 2019 RBS Program Goals and Achievements¹

Unit	2019 Actual	2019 Planning Goal	Percentage of Goal
Gross Therms Savings	409,096	324,900	126%
Participants	29,300	29,300	100%
Program Expenditures	\$98,382	\$103,973	95%

¹ Goals and achievements from Vectren's 2019 DSM Scorecard. Actuals represent *ex ante* reported values.

Table 58 lists the evaluated savings summary for the RBS Program. Although Cadmus found a 70% realization rate, Vectren's reported savings fall within the 90% confidence interval around evaluated savings, suggesting that the two estimates are not statistically different.

Table 58. 2019 RBS Program Natural Gas Savings

Energy Savings Unit	Ex Ante Savings			Evaluated Ex Post Savings	Realization Rates	NTG Ratio	Evaluated Net Savings
	Reported	Audited	Verified				
Total Therms	409,096	409,096	409,096	284,371	70%	N/A	284,371

Conclusions and Recommendations

Some of the following conclusions and recommendations may be derived from the process evaluation activities Cadmus conducted for this program. Process evaluation findings are presented in the *2019 Vectren DSM Portfolio Process and Electric Impacts Evaluation*.

Report Engagement and Influence

The HERs sent to customers achieved strong readership and provided value. Most treatment group survey respondents (84%, n=74) said they read or skimmed the last HER they received. Most agreed with the statements about the reports being easy to understand (90%, n=70), helpful (79%, n=66), and relevant (75%, n=64). Around two-thirds of respondents agreed with the statements about adopting the tips (68%, n=65) and adopting the products (62%, n=69) recommended in the reports.

HERs do not appear to increase customers' engagement with energy information online. Overall, a small proportion of respondents reported visiting the website and portal. This may be partly biased by using a telephone survey mode, which could have skewed responses toward customers who were less likely to engage online.

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Treatment group respondents (12%, n=74) and control group respondents (9%, n=75) showed similar proportions of visits to the Vectren website to look for ways to save. Fewer treatment group respondents (15%, n=75) than control group respondents (23%, n=75) reported visiting the online portal to view their home's energy data details, but this difference was not statistically significant.

Recommendation: Employ a mixed-mode survey (consider online, phone, and/or print surveys) in future evaluations to test any response bias related to the survey mode.

Energy Efficiency Awareness

Sending HERs to customers did not increase their awareness of Vectren DSM programs. The evaluation expected to see greater awareness of energy efficiency programs among treatment group customers than control group customers, especially for the Home Energy Assessment 2.0 (HEA 2.0) Program and the Appliance Recycling Program, which were both promoted in the HERs. In general, more treatment group respondents (59%, n=75) than control group respondents (45%, n=74) were familiar with energy efficiency programs, but this difference was not statistically significant. More treatment group respondents than control group respondents named the HEA 2.0 Program and the Appliance Recycling Program, but similarly, these differences were not statistically significant. The lack of statistical difference between groups may also be because of the small survey sample size, which makes it harder to detect statistical significance. Though Cadmus asked questions about customer awareness of energy efficiency programs rather than about participation in other programs, these findings can still help explain the negative participation uplift observed in the impact evaluation.

Recommendation: Increase the survey sample size in future evaluations to improve the statistical power needed to detect statistically significant differences between groups.

Customer Satisfaction

Customer satisfaction with the HERs did not immediately increase due to content updates and AMI integration. In 2019, 78% of treatment group respondents said they were satisfied with the reports (n=69). Satisfaction with the reports in 2019 was statistically similar to 2017 (81%, n=70) when the survey was last conducted. Cadmus asked respondents about their reasons for satisfaction (n=60). Respondents who were less satisfied said they disliked the neighbor comparison (10%), the tips were not relevant to them (8%), the reports were not helpful (3%), and the reports were not accurate (3%). These reasons are not unique to Vectren's program. Other Cadmus evaluations have found that customer dissatisfaction with the neighbor comparison, the tips, and accuracy of the reports are very common among this type of behavior program. Seeing the impacts on customer experience from program enhancements, such as revising report content and integrating AMI, may take some time.

Recommendation: Work with the program implementer on diversifying and refining the energy-saving tips to sustain customer engagement and relevancy. New ideas could include tracking the status of tips at the customer level (e.g., complete, incomplete, or irrelevant), framing tips as social rather than energy-saving activities (e.g., emphasize more family time when you turn off electronics), and integrating customer segmentation and demographic data (e.g., housing type, income, early adopter).

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Savings and Uplift

Consistent with previous program years, there was no participation and savings uplift from HER treatment customers participating in Vectren's other energy efficiency programs. Cadmus evaluated the lift in savings and participation in Vectren's other energy efficiency programs that were attributable to the HER treatment but found that treatment group customers rarely cross-participated at higher rates or saved more per home in other programs than did control group customers, resulting in negative uplift for most programs. The exception was the Income Qualified Weatherization (IQW) Program, which experienced a positive lift in participation and savings from treatment customers in both the dual fuel and electric only customer segments. One theory for this result is that the RBS Program encouraged the early adoption of incentivized energy efficiency measures, and now control customers are catching up. It is likely that if uplift savings were tracked over time through the estimated useful lives of installed measures, they would overall be positive.

Recommendation: Review the current cross-program marketing approaches in the HERs and consider ways to revise these approaches to better reach and engage RBS Program treatment customers. Cross-promoting new or pilot programs may generate positive uplift if the HERs encourage early program adoption. Even though a positive uplift result would require removing double-counted savings from the RBS Program itself, positive uplift generates overall net-positive impacts to the portfolio by increasing the participation and savings in the other energy efficiency programs—Vectren is currently losing out on those savings.

Recommendation: Have a third party conduct the randomization and power analysis of any new wave launched for the program. Vectren plans to launch a new wave of low-income customers in 2020. It is best practice for a third party to conduct the randomization and conduct a power analysis to ensure proper sample sizes.

Impact Evaluation

Impact Evaluation Methods and Findings

The RBS Program impact evaluation included multiple data collection efforts and analysis tasks:

- Billing data collection, review, and preparation
- Equivalency checks on treatment and control groups
- Billing analysis
- Energy-savings estimations
- Energy efficiency program channeling analysis (i.e., uplift)

Cadmus used a panel regression analysis of customer monthly bills to estimate the program's natural gas savings in dual fuel homes. Cadmus analyzed program participation and measure savings data to determine participation uplift in other efficiency programs as well as the RBS Program savings counted in other efficiency programs. The methods Cadmus used to complete each task are detailed in the *Appendix A. Impact Evaluation Methodology*.

Savings Review

Table 59 shows the 2019 reported and evaluated program net savings and the realization rates for the RBS Program. Because the experimental design uses a control group as the savings baseline, the regression analysis produces only net savings estimates (no gross estimates). Savings in this table do not include the uplift findings.

Table 59. 2019 Residential Behavioral Savings Program Savings

Customer Segment	Annual Net Gas Savings (therms/yr)		90% Confidence Interval		Relative Precision	Realization Rate
	Reported	Evaluated	Lower Bound	Upper Bound		
Dual Fuel	409,096	284,371	116,032	452,710	59%	70%
Total	409,096	284,371	116,032	452,710	59%	70%

Although the realization rate is 70%, the relative precision is large ($\pm 59\%$ with 90% confidence) and the 90% confidence interval around the evaluated program savings include the reported ex ante value, suggesting the two estimates are not significantly different. The large variability may be due to the small control group size—as noted in the 2019 electric evaluation report, attrition has reduced the control group sizes such that future evaluations may have difficulties detecting significant savings. Less than 60% of the originally randomized control group customers were still active at the beginning of 2019.

Table 60 lists the evaluated average daily savings per customer by year. Savings both in absolute per day and as a percentage of control group consumption decreased in 2019, consistent with the declining trend observed after savings peaked in 2017. This trend may be in-part weather-driven: while savings have remained consistently around 0.03 therms/day since 2014, savings relative to control group consumption increased through 2017 (2016 was an exception to this) before declining to 1.47% in 2019, suggesting that control group consumption is changing slightly over the years.

Table 60. Residential Behavioral Savings Program Historical Daily Savings Per Customer

Program Year	Dual Fuel	
	therms/day ¹	Percentage ²
2012	0.012 (0.003) ***	0.78%
2013	0.021 (0.006) ***	1.06%
2014	0.029 (0.008) ***	1.33%
2015	0.031 (0.007) ***	1.64%
2016	0.024 (0.007) ***	1.45%
2017	0.030 (0.008) ***	1.80%
2018	0.031 (0.010) ***	1.53%
2019	0.028 (0.010) ***	1.47%

¹ Standard errors clustered on customers are presented after the estimated treatment effect in parentheses (***) Significant at 1%; ** Significant at 5%; * Significant at 10%). The treatment effects represent the average daily savings per treatment group customer.

² Percentage savings are relative to control group consumption in the same time period.



Uplift Analysis

The RBS Program's HERs can increase participation in Vectren efficiency programs by promoting and encouraging customer participation in other Vectren efficiency programs and raising their general awareness and knowledge of energy efficiency. The lift in participation in these other efficiency programs that results in savings is known as participation and savings uplift.

Uplift savings appeared in the regression-based estimates of RBS Program savings and in the savings evaluated for other programs that experienced the lift in participation and savings due to the HERs. Cadmus removed any uplift savings that occurred from the Vectren's portfolio to avoid double-counting.

Table 61 shows the rate of participation per 1,000 treated homes and as a percentage of control group participation rates for each program in the uplift analysis. Overall, 1.79 more control customers (per 1,000) than treatment customers participated in another Vectren program. The RBS Program increased participation in two programs—Residential Prescriptive Program and Income Qualified Weatherization (IQW) Program. Treatment customers participated in the IQW Program at a rate of 19% more than observed for control group customers.

**Table 61. 2019 Wave 1 Residential Behavioral Savings Program
Participation Uplift for Efficiency Programs¹**

Program	Dual Fuel	
	Participation Uplift (per 1,000 treated homes)	Percentage Participation Uplift ¹
Home Energy Assessment 2.0	-1.30	-35%
Income Qualified Weatherization	1.89	19%
Residential Prescriptive	0.93	3%
Smart Cycle	-0.62	-8%
Overall	1.79	4%

¹ Percentage participation uplift is relative to the control group participation rate.

Table 62 shows gas savings uplift in the HEA 2.0, IQW, Residential Prescriptive, and Smart Cycle programs in 2019. These savings reflect the effects of the RBS Program on participation rates and on the number and type of measures installed through Vectren's other programs. Only the IQW Program experienced any savings uplift from the RBS Program. Though the Residential Prescriptive Program experienced positive participation uplift, treatment customers did not save as much through their engagement as control customers did, resulting in negative savings uplift. Overall, the RBS Program achieved negative uplift savings, and therefore none of the savings in the RBS Program were double-counted in Vectren's other energy efficiency programs. Therefore, Cadmus made no adjustment to Vectren's portfolio savings.



**Table 62. 2019 Residential Behavioral Savings Program
Gas Savings from Uplift**

Program	Dual Fuel	
	Annual Savings Uplift per Home (therms/yr)	Total Uplift Savings (therms/yr)
Home Energy Assessment 2.0	-0.014	-403
Income Qualified Weatherization	0.067	1,964
Residential Prescriptive	-0.033	-970
Smart Cycle	-0.060	-1,758
Total	-0.040	-1,167

Evaluated Net Savings Adjustments

Table 63 lists evaluated net savings for the RBS Program. Because the program uses a control group to estimate program savings, the evaluated savings are inherently net. Cadmus did not make any adjustment to program savings because of participation uplift, as discussed in the *Uplift Analysis* section. The program achieved 284,371 therms net savings.

Table 63. 2019 Residential Behavioral Savings Natural Gas Savings

Measure	Ex Ante Savings (Therms)			Evaluated Ex Post Savings (Therms)	Realization Rates (Therms)	NTG Ratio	Evaluated Net Savings (Therms)
	Reported	Audited	Verified				
Total	409,096	409,096	409,096	284,371	70%	N/A	284,371
Uplift	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Total	409,096	409,096	409,096	284,371	70%	N/A	284,371

Smart Cycle Program

Through the Smart Cycle Program, Vectren direct installs smart thermostats in residential households to call load control events during the summer peak season. Although the program targets demand reductions during peak summer hours, the program also achieves energy savings from the smart thermostats throughout the year.

Each year, Vectren recruits up to 1,000 participants from the long-running Summer Cycler Program to transition to the Smart Cycle Program.³² Summer Cycler participants receive complimentary removal of their load control switches, a Nest thermostat installed by a technician at no additional cost, and automatic enrollment into the Smart Cycle Program.

Vectren contracted with a local HVAC company, A+Derr, to schedule and perform the removal of the Summer Cycler load control switches and their replacement with Nest thermostats. Customers recruited by Vectren were contacted by the installation contractor via phone or email to schedule an installation.

The 2019 Smart Cycle Program evaluation focused only on savings derived from normal use of the Nest thermostats that were direct installed during the 2019 program year. Cadmus did not evaluate the demand response impacts from the program's load control events during 2019.

Accomplishments

Vectren did not claim gas savings for the Smart Cycle Program thermostats in 2019. Nevertheless, the program achieves gas savings from smart thermostats installed in homes with gas heating equipment. Table 64 lists the evaluated savings summary for the thermostats.

Table 64. 2019 Smart Cycle Program Natural Gas Savings

Energy Savings Unit	Ex Ante Savings			Evaluated Ex Post Savings	Realization Rate	NTG Ratio	Evaluated Net Savings
	Reported	Audited	Verified				
Total therms	N/A	N/A	N/A	37,978	N/A	96%	36,459

³² The Summer Cycler Program is another Vectren program designed to reduce residential and small commercial air-conditioning and water-heating electricity loads during summer peak hours. Through this program, customers receive bill credits for allowing Vectren to use radio communication equipment and load control switches to cycle off selected appliances during the summer.

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Conclusions and Recommendations

Some of the following conclusions and recommendations may be derived from the process evaluation activities Cadmus conducted for this program. Process evaluation findings are presented in the *2019 Vectren DSM Portfolio Process and Electric Impacts Evaluation*.

Customer Satisfaction

Throughout the process, from scheduling the appointment to educating the customer, the smart thermostat installation technician delivered a positive customer experience. Respondents who received a Nest thermostat in 2019 had a positive experience with the installation process and were satisfied with the technician (98%; n=248). Most respondents agreed that scheduling the Nest installation appointment was easy (99%) and instructions on how to use it were useful (98%; n=229). Most survey respondents (95%; n=243) were satisfied with the program and were also likely to recommend it to family, friends, or neighbors (93%; n=244).

Customers are highly satisfied with their thermostats. Despite the installation contractor reporting a 5% to 10% failure rate for the thermostats after initial install, nearly all survey respondents (94%, n=249) were satisfied with the thermostats they received through the program.

Customer Recruitment

The program achieved its participation goal despite having almost a quarter of customers drop out from recruitment to installation. The installation contractor, estimated a 25% customer dropout rate from Vectren recruitment to thermostat installation, noting the difficulty of reaching customers via phone and email to schedule an installation appointment. The installation contractor also noted that there have been delays in receiving the recruitment list from Vectren which reduced the amount of time to recruit enough participants to hit the target given the 25% dropout rate. Vectren typically sends the recruitment lists to the implementation contractor on a weekly basis.

Recommendation: Consider letting A+Derr handle both recruitment and scheduling all at once so there is no break in communication (from recruit to schedule call). This will help increase the time given to recruit customers for an installation appointment and possibly decrease the dropout rate.

Gas Savings for Thermostats

The program achieves gas impacts from smart thermostats installed in homes with gas heating equipment. Smart thermostats save heating energy compared to manual and programmable thermostat baselines. Though the Smart Cycle Program installs smart thermostats for the purpose of kW demand reduction through load control events on cooling equipment, many of these thermostats control gas heating equipment such as furnaces or boilers as well.

Recommendation: Claim gas savings for Nest thermostat installations in homes with gas heating.

Impact Evaluation

Impact Evaluation Methods and Findings

The Smart Cycle impact evaluation included multiple data collection efforts and analysis tasks:

- Tracking database review
- Engineering desk review
- Online survey with 251 program participants

Gross Savings Review

Table 65 provides per-unit annual gross savings for the Nest thermostats. Details regarding the calculations and assumptions used to estimate gross savings are provided in *Appendix A. Impact Evaluation Methodology*.

Table 65. 2019 Smart Cycle Program Per-Unit Gross Savings

Measure	Annual Gross Savings (therms)	
	Reported	Evaluated
Smart Cycle Thermostat - Dual Fuel	N/A ¹	56

¹ Vectren's 2019 DSM Scorecard did not include gas savings for the Smart Cycle thermostats.

Table 66 lists the evaluated gross per-unit energy savings for the Smart Cycle thermostats in 2018 and 2019. Differences in savings between 2018 and 2019 are due to small changes in participant survey results. In 2018, Cadmus used Residential Prescriptive Program participant survey results, whereas in 2019 Cadmus used survey results from the Smart Cycle Program participant survey.

Table 66. Smart Cycle Program Historical Per-Unit Savings

Measure	Evaluated Annual Gross Savings (therms)	
	2018	2019
Smart Cycle Thermostat - Dual Fuel	57	56

Measure Verification

Cadmus calculated verified savings for the Smart Cycle Program by applying an in-service rate, as shown in Table 67. The in-service rate is based on 2019 survey results where participating customers reported whether or not they removed the smart thermostat after it was installed.

Table 67. 2019 Smart Cycle Program Measure Verification Results – In-Service Rates

Measure	Installations			In-Service Rate
	Reported	Audited	Verified	
Smart Cycle Thermostat - Dual Fuel	N/A ¹	687 ¹	679	99%
Total	N/A	687	679	99%

¹ Vectren's 2019 Gas DSM scorecard did not include gas savings for Smart Cycle thermostats, so Cadmus relied on the Electric DSM scorecard. However, it does not break out Smart Cycle thermostat installation count by fuel type. Cadmus applied fuel and equipment type saturations determined from Smart Cycle survey data to distribute the total installs across these two thermostat fuel types.

Table 68 shows historical the 2019 in-service rates compared to 2018. Evaluated installations includes all smart thermostats installed during the program year. In 2018, only some of these thermostats were installed in time for summer load control events; therefore, the reported installations were lower than the evaluated installations in 2018. That was not the case in 2019. Additionally, in 2018 Cadmus used the Residential Prescriptive Program survey results for smart thermostats to inform the in-service rate for Smart Cycle Program thermostats. In 2019, Cadmus conducted a participant survey for the Smart Cycle Program to inform the in-service rate.

Table 68. Smart Cycle Program Historical In-Service Rates

Measure	In-Service Rate	
	2018	2019
Smart Cycle Thermostats	107%	99%

Net-to-Gross Analysis

Cadmus calculated freeridership and spillover for the Smart Cycle Program using findings from a survey conducted with 162 dual fuel smart thermostat participants.³³ The program resulted in a 96% NTG ratio for gas savings. Table 69 presents the NTG results for the program. These findings are described in greater detail in *Appendix B. Net-to-Gross Detailed Findings*.

Table 69. 2019 Smart Cycle Program Net-to-Gross Ratio

Measure	Freeridership ¹	Spillover	NTG Ratio
Smart Cycle Thermostat - Dual Fuel	9%	5%	96%
Total Program	9%	5%	96%

¹ Weighted by evaluated *ex post* program MMBTU savings

Freeridership and Spillover

Cadmus estimated freeridership by combining two methods—the standard self-report intention method and the intention/influence method. By combining the standard self-report *intention* methodology with an *influence* methodology, Cadmus produced a program freeridership score.³⁴

Cadmus calculated the arithmetic mean of the *intention* and *influence* freeridership components to estimate the final program freeridership of 9% for dual fuel smart thermostat participants, as shown in Table 70.

³³ The Smart Cycle survey collected 251 total responses, but only 246 respondents answered freeridership and spillover questions and 162 of the 246 were classified as dual fuel Smart Cycle thermostat recipients.

³⁴ *Intention* and *influence* freeridership scores both have a maximum of 100%.

Table 70. 2019 Smart Cycle Program Freeridership Estimate

Freeridership Metric	Estimate
Intention Score	14% ¹
Influence Score	4% ¹
Final Freeridership Score	9%

¹ Weighted by *ex post* gross program MMBTU savings

Six dual fuel smart thermostat participants reported that after participating in the Smart Cycle Program they installed additional high-efficiency measures for which they did not receive an incentive.³⁵ These respondents said participation in the program was very important in their decision.

Cadmus used *ex post* savings estimated from the 2019 Residential Prescriptive Program along with the 2015 Indiana TRM v2.2 to estimate savings for all spillover measures attributed to the Smart Cycle Program. Cadmus divided the total survey sample spillover savings by the gross program savings from the survey sample to obtain the 5% spillover estimate for the dual fuel smart thermostat program participants, as shown in Table 71.

Table 71. 2019 Smart Cycle Program Spillover Estimate

Survey Sample Spillover MMBTU Savings	Survey Sample Program MMBTU Savings	Spillover Percentage Estimate
60	1,230 ¹	5%

¹ 2019 evaluated gross energy savings.

Evaluated Net Savings Adjustments

Table 72 lists evaluated net savings for the Smart Cycle. The program achieved 36,459 therms net savings.

Table 72. 2019 Smart Cycle Program Natural Gas Savings

Measure	<i>Ex Ante</i> Savings (therms)			Evaluated <i>Ex Post</i> Savings (therms)	Realization Rates (therms)	NTG Ratio	Evaluated Net Savings (therms)
	Reported	Audited	Verified				
Smart Cycle Thermostat - Dual Fuel	N/A ¹	N/A	N/A	37,978	N/A	96%	36,459
Total	N/A ¹	N/A	N/A	37,978	N/A	96%	36,459

¹ Vectren's 2019 DSM Scorecard did not include gas savings for the Smart Cycle thermostats.

³⁵ These measures were a clothes washers, dishwashers, gas furnaces, central air conditioners, duct sealing, windows and attic insulation.

Targeted Income Program

The Targeted Income Program serves natural gas customers in Vectren's North territory who live at or below 200% of the federal poverty guidelines. Participants are eligible to receive a comprehensive home energy audit and energy efficiency upgrades, at no cost to the customer, funded by Vectren. The Indiana Housing and Community Authority (IHCA) delivers the program in coordination with the federal Weatherization Assistance Program. The IHCA is overseen by CLEAResult, the program implementer, which reviews, verifies, and processes applications and invoices.

Participants in the 2019 Targeted Income Program were eligible for the following direct install measures:

- Air sealing
- Two bathroom aerators
- Two kitchen aerators
- Wall insulation
- Ceiling insulation
- 92% AFUE furnace
- Water heater
- Two energy-efficient showerheads

Accomplishments

Table 73 shows the program's achievements against goals in 2019. The program achieved 100% of its natural gas savings while meeting 90% of its participation goal and 94% of its expense goal.

Table 73. 2019 Targeted Income Program Goals and Achievements¹

Unit	2019 Actual	2019 Planning Goal	Percentage of Goal
Gross Therms Savings	15,022	15,022	100%
Participants	93	103	90%
Program Expenditures	\$81,278	\$86,510	94%

¹ Goals and achievements from Vectren's 2019 DSM Scorecard. Actuals represent *ex ante* reported values.

Table 74 lists the evaluated savings summary for the Targeted Income Program. Overall, the program achieved evaluated, net natural gas savings of 14,743 therms, with a realization rate of 98%. The primary drivers for the realization rate were higher than expected evaluated savings for air sealing and lower than expected savings for furnaces. Gas furnace replacements had lower evaluated savings because smaller furnaces were installed. Air sealing had higher evaluated savings due to the higher savings-per-cubic feet per minute (cfm) reduction, because installations occurred in colder climates.

Savings for these two measures account for 84% of total evaluated savings. *Ex ante* savings were based on Evansville, which has one of the most moderate climates in the 2015 Indiana TRM v2.2, whereas Vectren's North territory is mostly in a different climate zone (Indianapolis).

Table 74. 2019 Targeted Income Program Natural Gas Savings

Energy Savings Unit	Ex Ante Savings			Evaluated Ex Post Savings	Realization Rates	NTG Ratio	Evaluated Net Savings
	Reported	Audited	Verified				
Total Therms	15,022	15,022	14,937	14,743	98%	100%	14,743

Conclusions and Recommendations

Customer Satisfaction

Customers are highly satisfied with the Targeted Income Program. All surveyed participants (100%, n=27) were very satisfied with the program and would recommend the program to a neighbor (100%, n=26). All installed measures received a 100% satisfaction rating except for kitchen aerators, which had a small sample size (n=4) and only one respondent indicating lower satisfaction. The respondent who was not as satisfied with the kitchen faucet aerator said the aerator had been installed improperly.

Marketing and Outreach

Participants are generally unaware that Vectren sponsors the program. Although participants began to receive a Vectren-branded follow-up thank you card in addition to the leave-behind flier, 67% (n=27) of participants did not know that Vectren sponsored the program prior to the phone survey.

Recommendation: In addition to the leave-behind flier, consider working with the IHCD to include the Vectren brand in the marketing materials for participants to see when considering and enrolling in the Targeted Income Program.

Energy Education

Current forms of energy education may be lost on customers who do not have internet access. The main source of energy efficiency education provided to Targeted Income Program participants is a flier that is left behind after the audit and installations have been completed. This flier directs participants to Vectren's website to learn about more energy efficiency rebates and find energy saving tips. However, 41% of surveyed participants (n=27) do not have internet in their homes so have limited access to the information.

Recommendation: Redesign the leave-behind flier to include a phone number that customers can call to learn more, in addition to the link to Vectren's website. The leave-behind flier could also include energy-saving tips so customers can take action directly.

Process Evaluation

TARGETED INCOME PROGRAM

2019 Process Analysis Activities

1 VECTREN staff interview
1 CLEAResult® staff interview

1 ihcda Indiana Housing & Community Development Authority staff interview

27 participant customer phone surveys

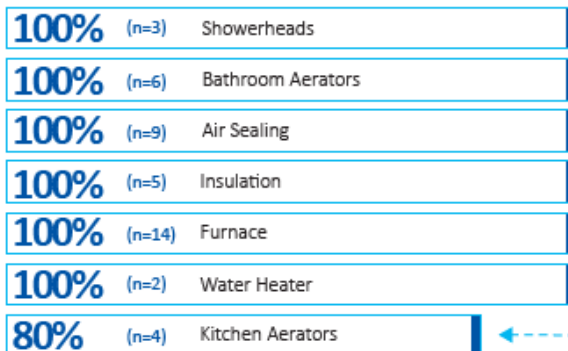
2019 Program Changes

Added water heater replacement for qualifying participants (at no cost to the customer)

No planned program changes for 2020

Key Process Evaluation Findings

There was high satisfaction by measure:



100%

of participants are very satisfied with the program overall



Improper installation caused one participant to have lower satisfaction with the kitchen aerator.

100% of participants are likely to recommend the program to a neighbor (n=26)

96% of participants found Vectren's suggestions to reduce energy usage useful (n=26)

100% of participants were satisfied with the variety of programs offered by Vectren (n=25)

96% of participants were satisfied with Vectren's efforts to help them manage their monthly usage (n=25)

Although participants receive a flier and thank you card directing them to Vectren's website for further energy-saving tips and programs

41% of participants do not have internet in their home (n=27)

67% of participants were not aware that Vectren sponsored the program before the phone survey (n=27)

Impact Evaluation

Impact Evaluation Methods and Findings

The Targeted Income Program impact evaluation included multiple data collection efforts and analysis tasks:

- Tracking database review of measures installed
- Survey of 27 program participants (29% of total participation) to verify number of measures installed
- Engineering analysis of energy savings per measure and per home
- Spillover assessment

Gross Savings Review

Cadmus conducted an engineering desk review to assess energy savings for the natural gas-saving measures distributed through Vectren's Targeted Income Program. Table 75 provides per-unit gross savings for each program measure.

Table 75. 2019 Targeted Income Program Per-Unit Gross Savings

Measure	Annual Gross Savings (Therms)	
	Reported	Evaluated
Water Saving Measures		
Bathroom Aerator	1	2
Kitchen Aerator	5	7
Showerhead	13	15
Weatherization Measures		
Air Infiltration Reduction	141	189
Ceiling Insulation (Pre R8 to Post R38)	73	117
Ceiling Insulation (Pre R0 to Post R38)	73	569
Sidewall Insulation	121	77
Equipment Replacement		
Natural Gas Furnaces ($\geq 92\%$ AFUE)	139	82
Natural Gas Water Heaters ($\geq .67$ EF)	25	51

Cadmus used inputs and algorithms from the 2015 Indiana TRM v2.2 with exceptions only if the TRM algorithm was not available and if more recent inputs were available. The following explains differences in *ex ante* and *ex post* savings. Additional information regarding *ex post* savings assumptions can be found in the *Appendix A. Impact Evaluation Methodology*.

- **Water-saving measures.** For bathroom aerators, evaluated savings were significantly higher than reported savings because the installed efficiency of the aerator was 1.0 gpm, not the 1.5 gpm on which the reported savings were based. Other differences stem from differences in survey data, such as number of people per home and devices per home. The average groundwater temperature was also lower for the Targeted Income Program than for the 2015

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Income Qualified Weatherization Program, on which *ex ante* savings are based, which led to higher savings for all water saving direct install devices. The reason for this was the IQW groundwater temperatures were based on Evansville, which has amongst the highest ground water temperatures in the 2015 Indiana TRM v2.2, whereas Vectren's North territory is mostly in a different climate zone (Indianapolis) with lower groundwater temperature.

- **Weatherization measures.** Savings were higher than expected for ceiling insulation and air sealing and lower than expected for sidewall insulation.

For air sealing, higher evaluated savings were driven primarily by a larger savings-per-cfm reduction than was used in the 2015 Income Qualified Weatherization Program evaluation, on which the *ex ante* savings are derived. This is because the Income Qualified Weatherization Program operates in Evansville, which has the most moderate climate zone in the TRM. The Targeted Income Program operates primarily in Indianapolis where the heating load is greater.

For ceiling insulation, *ex ante* savings were also derived from the 2015 Income Qualified Weatherization Program evaluation. Cadmus used R-values and square footage from the program tracking database to calculate savings. Evaluated savings were higher because the installed quantity was greater than used in 2015 and the average existing R-value was also lower. Additionally, the therm savings per square foot of insulation installed were higher because installations were in colder climates than Evansville, on which the savings for the 2015 Income Qualified Weatherization Program were based.

For sidewall insulation, assumptions for *ex ante* calculations were not available. The likely drivers behind lower evaluated savings are lesser quantities and lower efficiencies installed than assumed. All else being held equal, that is, similar R-values installed and similar climate zones, approximately 1,500 square feet of insulation would have had to be installed to save 120.71 therms; however, on average, 962 square feet of wall insulation was installed.

- **Equipment replacement.** Cadmus looked up all efficient measure information using model numbers from the program tracking data when possible.

Evaluated savings for water heaters exceeded expected savings mainly because one of the two installed was an instantaneous water heater, which is significantly more efficient than the assumed baseline of a natural gas storage water heater.

For furnaces, differences in actual average input capacities, installed efficiencies, and assumed baseline efficiencies were the likely reasons that *ex ante* and *ex post* savings differed. *Ex ante* savings are not based on any prior evaluation; however, the *ex ante* savings estimate of 139 therms for the Targeted Income Program is comparable to the 135 therms for the 2018 Residential Prescriptive Program for natural gas furnaces with similar installed efficiency levels. Furnaces had an average input capacity of 51,273 BTUH in the Targeted Income Program and

76,438 BTUH in the 2018 Residential Prescriptive Program, indicating that lower capacities were the likely drivers for lower evaluated savings.³⁶

Table 76 lists the evaluated gross per-unit energy savings for each program measure by year. For water-saving measures, people per home was 2.22 in 2019 compared to 2.46 in 2018, which led to lower savings in 2019. Air sealing savings were higher in 2019 than in 2018 due to higher cfm reductions observed in 2019. The average cfm reduction was 1,481 in 2019 compared to 1,067 in 2018. For ceiling insulation, only three were projects were installed each year, causing savings to be more volatile. Lower savings for R8 to R38 ceiling insulation were primarily because lower quantities were installed. On average, 732 square feet of insulation was installed in 2019 compared to 924 square feet in 2018. Natural gas water heaters had lower savings in 2019 than in 2018 due to updating the baseline equipment to the federal baseline given that all water heaters were indicated to be replaced on failure

Table 76. Targeted Income Program Historical Per-Unit Savings

Measure	Evaluated Annual Gross Savings (Therms)	
	2018	2019
Water Saving Measures		
Bathroom Aerator	1.82	1.53
Kitchen Aerator	9.24	7.02
Showerhead	17.68	15.24
Weatherization Measures		
Air Infiltration Reduction	132.35	189.21
Ceiling Insulation (Pre R8 to Post R38)	146.8	117.23
Ceiling Insulation (Pre R0 to Post R38)	518.65	569.01
Sidewall Insulation	73.39	76.96
Equipment Replacement		
Natural Gas Furnaces (≥ 92% AFUE)	94.97	82.14
Natural Gas Water Heaters (≥ .67 EF)	77.1	51.01

Measure Verification

Cadmus calculated verified savings for the Targeted Income Program by applying a persistence rate, gathered from survey data, to program measure savings. The persistence rate is an indicator of the number of measures that remained installed in homes after initial participation. Cadmus used the persistence rate as the in-service-rate (ISR), assuming that the reported installations were accurate because the program implementer's quality control process ensured that actual and reported measure installations matched.

³⁶ Exact assumptions for gas furnace *ex ante* calculations were not available. Cadmus identified the most likely drivers behind savings differentials for natural gas furnaces.



Table 77 lists the in-service rates for each program measure. Some of the water saving measures had lower than 100% persistence, with the showerhead having the lowest persistence at 75%. Additional details for measure-level savings can be found in *Appendix A. Impact Evaluation Methodology*.

Table 77. 2019 Targeted Income Program Measure Verification Results – In-Service Rates

Measure	Installations			In-Service Rate
	Reported	Audited	Verified	
Water Saving Measures				
Bathroom Aerator	36	36	36	100%
Kitchen Aerator	24	24	21	88%
Showerhead	21	21	16	75%
Weatherization Measures				
Air Infiltration Reduction	46	46	46	100%
Ceiling Insulation (Pre R8 to Post R38)	2	2	2	100%
Ceiling Insulation (Pre R0 to Post R38)	1	1	1	100%
Sidewall Insulation	14	14	14	100%
Equipment Replacement				
Natural Gas Furnaces ($\geq 92\%$ AFUE)	44	44	44	100%
Natural Gas Water Heaters ($\geq .67$ EF)	2	2	2	100%
Total	190	190	182	96%

Table 78 shows historical in-service rates for each program measure. The water saving measures are the only ones with variation in persistence. Slightly larger year-to-year variation in in-service rates is to be expected for this program given the small sample sizes available for these measures.

Table 78. Targeted Income Program Historical In-Service Rates

Measure	In-Service Rate	
	2018	2019
Water Saving Measures		
Bathroom Aerator	89%	100%
Kitchen Aerator	78%	88%
Showerhead	86%	75%
Weatherization Measures		
Air Infiltration Reduction	100%	100%
Ceiling Insulation (Pre R8 to Post R38)	100%	100%
Ceiling Insulation (Pre R0 to Post R38)	100%	100%
Sidewall Insulation	100%	100%
Equipment Replacement		
Natural Gas Furnaces ($\geq 92\%$ AFUE)	100%	100%
Natural Gas Water Heaters ($\geq .67$ EF)	100%	100%

Net-to-Gross Analysis

Evaluations generally assume that most low-income customers would not have the discretionary income to install measures on their own outside of the financial support of the program. Consequently, the NTG ratio is assumed to be 1.0, and net savings are calculated the same as *ex post* savings.

To give Vectren a sense of the level of energy efficiency action that its low-income population takes as a result of program participation, Cadmus included spillover questions in its participant survey. Cadmus found no spillover activity attributable to Vectren from the survey responses.

Evaluated Net Savings Adjustments

Table 79 lists evaluated net savings for the Targeted Income Program. The program achieved a total of 14,743 therms in net savings.

Table 79. 2019 Targeted Income Program Natural Gas Savings

Measure	Ex Ante Savings (Therms)			Evaluated Ex Post Savings (Therms)	Realization Rates (Therms)	NTG Ratio	Evaluated Net Savings (Therms)
	Reported	Audited	Verified				
Water Saving Measures							
Bathroom Aerator	19	19	19	55	288%	100%	55
Kitchen Aerator	127	127	111	147	116%	100%	147
Showerhead	277	277	208	240	87%	100%	240
Weatherization Measures							
Air Infiltration Reduction	6,505	6,505	6,505	8,704	134%	100%	8,704
Ceiling Insulation (Pre R8 to Post R38)	147	147	147	234	160%	100%	234
Ceiling Insulation (Pre R0 to Post R38)	73	73	73	569	776%	100%	569
Sidewall Insulation	1,690	1,690	1,690	1,077	64%	100%	1,077
Equipment Replacement							
Natural Gas Furnaces (≥ 92% AFUE)	6,134	6,134	6,134	3,614	59%	100%	3,614
Natural Gas Water Heaters (≥ .67 EF)	50	50	50	102	204%	100%	102
Total¹	15,022	15,022	14,937	14,743	98%	100%	14,743

¹ Totals may not add up to the sum of the column due to rounding.

Multifamily Direct Install Program

The Multifamily Direct Install (MFDI) Program provides energy-saving measures to residential units in multifamily buildings with more than four tenant units. Because the parties responsible for paying utility bills vary in the residential rental segment, the program provides and installs these energy-saving measures at no cost to tenants or landlords.

CLEAResult, the MFDI Program implementer, installs the following natural gas-saving measures in tenant units:

- Energy-efficient bathroom faucet aerators (1.0 gpm)
- Energy-efficient kitchen faucet aerators (1.5 gpm)
- Energy-efficient showerheads (1.5 gpm)
- Furnace filter whistle
- Pipe wrap (6 feet)
- Smart thermostats (Nest E learning thermostat)

Accomplishments

The MFDI Program surpassed its savings and participation goals in 2019. The program implementer attributes this to several factors. It began outreach earlier than in prior years, so potential properties were prepared for participation at the very beginning of 2019. In addition, it designated one of the three technicians solely to multifamily units, which had not been the case in prior years, so the installation process was more efficient. Finally, the implementer said the increase in savings in 2019 was partially because more units had more than one bathroom, which allowed for more measures per unit.

Table 80 shows the program's achievements against goals in 2019.

Table 80. 2019 MFDI Program Goals and Achievements¹

Unit	2019 Actual	2019 Planning Goal	Percentage of Goal
Gross therms Savings	68,149	58,660	116%
Participants	1,346	1,250	108%
Program Expenditures	\$383,397	\$383,397	100%

¹ Goals and achievements from Vectren's 2019 DSM Scorecard. Actuals represent *ex ante* reported values.

Table 81 lists the evaluated savings summary for the MFDI Program. Audited savings differ from reported because the program tracking data included savings for the site visit in addition to the measures installed. This is a departure from previous years where program tracking data did not include savings for the site visit.

Table 81. 2019 MFDI Program Natural Gas Savings

Energy Savings Unit	Ex Ante Savings			Evaluated Ex Post Savings	Realization Rates	NTG Ratio	Evaluated Net Savings
	Reported	Audited	Verified				
Total therms	68,149	55,308	51,225	68,676	101%	100%	68,676

Conclusions and Recommendations

Furnace Filter Whistles

Property managers are opting out from receiving furnace filter whistles. Of 1,346 participating tenant units, only 40 (3%) had furnace filter whistles installed. The program implementer reported that property managers often opt not to install this measure to minimize tenant disruption. It said most maintenance staff already abide by a regular schedule to do upkeep in units, such as control pests or test smoke detector functionality. However, furnace whistles must be replaced when they go off, which would raise the number of times maintenance staff enter the units. To address this barrier, in 2020 the program implementer plans to better educate property managers of the measure's benefits to ensure that more installations are completed.

Recommendation: Weigh the costs and benefits of the furnace filter whistle to determine its inclusion as a measure in 2020 and future program years. If the measure remains cost-effective at current installation rates, keep it as part of the program. If it does not prove cost-effective, remove it and consider focusing efforts on other measures with higher savings potential, such as the smart thermostat.

Smart Thermostats

Smart thermostats achieved higher savings than expected by Vectren. Vectren's *ex ante* assumptions for smart thermostats involved a mix of electric and natural gas heated homes. Since the MFDI Program is offered exclusively in Vectren's North territory, participating tenant units are 100% natural gas.

Recommendation: Update the *ex ante* savings of 25 therms to the 2019 evaluated savings of 42.51 therms to account for an exclusively natural gas savings baseline.

Customer satisfaction was high for all measures except smart thermostats. All program measures, except smart thermostats, received 92% or higher satisfaction from surveyed tenants.

In 2019, fewer respondents said they were satisfied with the smart thermostat (85%, n=62), than in 2018 (91%, n=54), but this difference was not statistically significant. Vectren informed Cadmus that one property received faulty thermostats, which impacted all installations at that property. The program implementer immediately mitigated the issue by reinstalling functioning thermostats at the property. Note that only one of the nine surveyed tenants who indicated low satisfaction with the smart thermostat was impacted by this faulty batch of thermostats. Nine respondents said their reasons for lower satisfaction were that the thermostat broke/stopped working, the home was not comfortable due to the thermostat's learning function, or they did not understand how to use the thermostat.

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Thirty-eight percent of surveyed tenants (n=60) said they received training or instruction on how to use their thermostat, and 77% (n=60) found the educational material and Nest thermostat manual left behind by contractors useful. According to the implementer, installation staff provide education to the tenant if the tenant is present and, if the tenant is not present, they provide education to the facilities team to pass along to tenants. Nevertheless, some low satisfaction with smart thermostats appeared to be attributed to not feeling adequately educated. Twelve percent of surveyed tenants said they were home at the time of installation but did not receive training or instruction on how to use the thermostat. When asked about the educational material and Nest thermostat manual, 22% (n=60) said the material was either too difficult to understand or they did not read the material at all. Seven of the nine respondents who were less than satisfied with their smart thermostat did not engage with or understand the materials. Because smart thermostats have the highest impact on MFDI Program savings, customer satisfaction is key to its prolonged and correct use.

Recommendation: If tenants are present during smart thermostat installation, ensure that all are engaged. Train tenants on proper use of the smart thermostat by emphasizing the learning capabilities and walking them through the educational material.

Recommendation: Consider emphasizing the auto-schedule setting as the primary message and most effective way for tenants to use the smart thermostat and benefit from energy savings. By encouraging tenants to take advantage of the learning capabilities, along with explaining that they can manually adjust it, tenants may better understand the purpose of a smart thermostat.

Recommendation: Consider adding a small sticker or tag directly to the smart thermostat that emphasizes the ease of using the auto-schedule setting and explains how the smart thermostat will learn their behaviors and adjust accordingly. This may be simpler for tenants who find the educational material and manual confusing or dense or choose not to look at the material at all. This sticker or tag could also have contact information for Vectren or the program implementer so tenants could call and easily obtain assistance.

Process Evaluation

MULTIFAMILY DIRECT INSTALL PROGRAM

2019 Process Analysis Activities

-  **1**  VECTREN staff interview
-  **1**  CLEAResult® staff interview



2019 Program Changes

Vectren added pipe wrap and furnace filter whistles to increase program savings

CLEAResult expanded the energy-savings tips and added Nest thermostat instructions to the educational leave behind

CLEAResult left the Nest thermostat manual with website links at the properties to ensure tenants had additional resources for the technology

77% of tenants (n=60) who received the educational fact sheet and manual thought the material was useful; 12% thought the material was hard to understand

CLEAResult implemented a pre-visit for newly recruited properties:

A technician or QA/QC specialist spoke with maintenance staff to introduce measures and minimize potential installation issues, giving property managers confidence in the program

2020 Planned Program Changes

CLEAResult plans to revise the leave behind materials to be more engaging and informative regarding the upgrades made within tenant homes

To minimize tenant disruption, many properties do not opt for the furnace filter measure. CLEAResult plans to better educate property managers to ensure this measure reaches its installation goals in 2020

Vectren is preparing for potential market saturation and working to identify strategies to mitigate that, including:

- Decreasing participation and savings goals for 2020
- Contacting properties that have participated more than three years earlier
- Considering collaboration with other utilities and offering furnace tune-ups

Key Process Evaluation Findings

Tenant measure satisfaction:



100% (n=34)

of respondents who were present during the installation said the installation staff were courteous and respectful

Reasons for lower thermostat satisfaction: (n=9)



Vectren reported one property received a batch of faulty thermostats which was turned over to CLEAResult insurance for resolution. One of the nine respondents with lower satisfaction lived at this property.

Other reasons for lower thermostat satisfaction:

Thermostat broke/stopped working; house not comfortable due to learning function; customer not understanding how to use.

12% (n=60)

said they were home at the time of installation but that they did not receive training or instruction on how to use the thermostat which may impact customer satisfaction with the measure

Impact Evaluation

Impact Evaluation Methods and Findings

The Multifamily Direct Install Program impact evaluation included multiple data collection efforts and analysis tasks:

- Database review of the number of participants and measures distributed
- Engineering analysis of energy savings for all measures
- Tenant survey for installation rates (n=70)

Gross Savings Review

Table 82 provides the 2019 MFDI Program's per-unit annual *ex ante* and *ex post* gross natural gas savings for each measure installed through the program.

Table 82. 2019 MFDI Program Per-Unit Gross Savings

Measure	Annual Gross Savings (therms)	
	Reported	Evaluated
Energy-Efficient Bathroom Aerator	1.41	1.46
Energy-Efficient Kitchen Aerator	5.26	5.64
Energy-Efficient Showerhead	12.25	12.22
Furnace Filter Whistle	7.72	8.76
Pipe Wrap	3.65	3.55
Smart Thermostat	25.00	42.51

Ex ante and *ex post* savings for showerheads and aerators were calculated using algorithms and inputs from the 2015 Indiana TRM v2.2. In 2019, evaluated savings for these measures were very similar to *ex ante* savings (derived from 2017 MFDI Program evaluated savings). The driving factors for the small differences in savings were updated values for people per household (more people means more savings) and fixtures per household (more fixtures means less savings), which come from the 2019 participant survey and are direct multipliers to energy savings. Additional details for measure-level gross savings can be found in *Appendix A. Impact Evaluation Methodology*.

Smart thermostats were a new measure for the MFDI Program starting in 2018. Vectren used the same *ex ante* savings estimate of 25 therms in 2019 as in 2018. This estimate was calculated for planning purposes and is a weighted average that includes both electric and natural gas heated homes. The estimate is low for the MFDI Program, which included only customers with natural gas heated homes.

Cadmus calculated *ex post* savings using values from the 2013-2014 evaluation of programmable and smart thermostats in Vectren's Indiana territory.³⁷ For the MFDI Program evaluation, Cadmus incorporated actual participant locations in Vectren North territory where homes require more full load

³⁷ Cadmus. January 29, 2015. *Evaluation of the 2013-2014 Programmable and Smart Thermostat Program*.



heating hours (Indianapolis, 1,341 hours) than in Vectren South territory (Evansville, 982 hours). Because this was a single-family study, Cadmus applied a 45% adjustment factor to account for smaller multifamily residences, as shown in *Appendix A*.

Table 83 lists the evaluated gross per-unit energy savings for each program measure by year. Evaluated savings for 2019 are comparable to historical values.

Table 83. MFDI Program Historical Per-Unit Savings

Measure	Evaluated Annual Gross Savings (therms)				
	2015	2016	2017	2018	2019
Energy-Efficient Bathroom Aerator	N/A ¹	1.6	1.41	1.55	1.46
Energy-Efficient Kitchen Aerator	N/A ¹	6.9	5.26	4.91	5.64
Energy-Efficient Showerhead	N/A ¹	16.4	12.25	13.14	12.22
Furnace Filter Whistle	N/A ¹	N/A ¹	N/A ¹	N/A ¹	8.76
Pipe Wrap	N/A ¹	N/A ¹	N/A ¹	N/A ¹	3.55
Programmable Thermostat	16.12	14.4	17.73	N/A ²	N/A ²
Smart Thermostat	N/A ¹	N/A ¹	N/A ¹	40.05	42.51

¹ These measures were not offered in these years.

² Programmable thermostats were phased out in favor of smart thermostats in 2018. Programmable thermostat per-unit savings are provided here for context.

Measure Verification

Cadmus calculated verified savings for the MFDI Program by applying an in-service rate to program measures. The in-service rate is an indicator of the number of measures that remained installed at participants' homes at the time of the participant survey. Respondents indicated if they had removed any of the measures that had been installed. Table 84 lists the in-service rates for each program measure.

Table 84. 2019 MFDI Program Measure Verification Results – In-Service Rates

Measure	Installations			In-Service Rate
	Reported ¹	Audited	Verified	
Energy-Efficient Bathroom Aerator	1,539	1,539	1,513	98%
Energy-Efficient Kitchen Aerator	1,062	1,062	1,044	98%
Energy-Efficient Showerhead	1,515	1,515	1,437	95%
Furnace Filter Whistle ²	42	42	40	96%
Pipe Wrap	392	392	392	100%
Smart Thermostat	1,090	1,090	971	89%
Total	5,640	5,640	5,397	96%

¹ The 2019 DSM Scorecard tracked participation by number of rental units served (n=1,346). These reported installations are representative of the program tracking database.

² Furnace filter whistle installations are much lower than other measures because it is not always possible to install this measure and many landlords opt not to have them installed.



Table 85 shows historical installation rates for each program measure. In-service rates for 2019 are typically comparable to historical values; however, the smart thermostat in-service rate is 89%, which is a decrease from 2018 (95%). Seven respondents said they removed the smart thermostat that was installed as part of the program. Their reasons were that the smart thermostat broke/stopped working, the respondent did not know how to use it, and it was not compatible with the customer's wiring.

Cadmus used the MFDI Program's weighted average in-service rate for the furnace filter whistle because no survey data were available. Only 42 furnace whistles were installed during 2019, and only one participant with a furnace whistle was surveyed. Based on other programs with this measure, this in-service rate could be much lower but there are no data available from this program to support this.

Table 85. MFDI Program Historical In-Service Rates

Measure	In-Service Rate				
	2015	2016	2017	2018	2019
Energy-Efficient Bathroom Aerator	N/A ¹	100%	100%	98%	98%
Energy-Efficient Kitchen Aerator	N/A ¹	100%	89%	100%	98%
Energy-Efficient Showerhead	N/A ¹	90%	99%	94%	95%
Furnace Filter Whistle	N/A ¹	N/A ¹	N/A ¹	N/A ¹	96%
Pipe Wrap	N/A ¹	N/A ¹	N/A ¹	N/A ¹	100%
Programmable thermostat	100%	88%	100%	N/A ²	N/A ²
Smart Thermostat	N/A ¹	N/A ¹	N/A ¹	95%	89%

¹ These measures were not offered in these years.

² Programmable thermostats phased out in favor of smart thermostats in 2018. Programmable thermostat installation rate provided here for context.

Net-to-Gross Analysis

Cadmus found no spillover activity attributable to Vectren from the participant survey responses and, therefore, applied an NTG ratio of 100% to the program. Freeridership is assumed to be 0% for the current program year because the decision to participate is typically by the property manager or landlord rather than by the end user (tenant).

Evaluated Net Savings Adjustments

Table 86 lists evaluated net savings for the MFDI Program. The program achieved 68,676 therms net savings.

**Table 86. 2019 MFDI Program Natural Gas Savings**

	<i>Ex Ante</i> Savings (therms)			Evaluated <i>Ex Post</i> Savings (therms)	Realization Rates (therms)	NTG Ratio	Evaluated Net Savings (therms)
	Reported	Audited	Verified				
Energy-Efficient Bathroom Aerator	2,164	2,164	2,128	2,217	102%	100%	2,217
Energy-Efficient Kitchen Aerator	5,584	5,584	5,491	5,894	106%	100%	5,894
Energy-Efficient Showerhead	18,554	18,554	17,595	17,557	95%	100%	17,557
Furnace Filter Whistle	324	324	310	352	109%	100%	352
Pipe Wrap	1,431	1,431	1,431	1,391	97%	100%	1,391
Smart Thermostat	27,250	27,250	24,270	41,266	151%	100%	41,266
Total²	68,149¹	55,308	51,225	68,676	101%	100%	68,676

¹ 2019 DSM Scorecard savings includes savings for the site visit itself. Cadmus removed these savings for audited therms.

² Totals may not add up to the sum of the column due to rounding.

Commercial and Industrial Prescriptive Program

The Commercial and Industrial (C&I) Prescriptive Program promotes the installation of high-efficiency equipment to nonresidential customers, including government and nonprofit businesses. Vectren offers financial incentives to offset the higher purchase costs of high-efficiency upgrades for HVAC, commercial kitchen, and water heating equipment. The program implementer, Nexant, processes program paperwork and, with the help of trade allies, promotes the program to Vectren customers.

Accomplishments

Table 87 shows the program's achievements against goals in 2019. The C&I Prescriptive Program achieved 146% of its participation and 108% of its gross therms savings goals, while the C&I portfolio remained within 100% of its budget. The following measures drove the majority of the program's reported savings:

- Boiler measures contributed 60% of the C&I Prescriptive Program's reported gross therms
- Boiler tune-ups contributed 20%
- Furnaces contributed 11%

Table 87. 2019 C&I Prescriptive Program Goals and Achievements^{1,2}

Unit	2019 Actual	2019 Planning Goal	Percentage of Goal
Gross Therms Savings	364,961	250,000	146%
Participants (Measures)	880	816	108%

¹ Goals and achievements from Vectren's 2019 DSM Scorecard. The "2019 Actual" column represents *ex ante* reported values.

² The 2019 Actual column reflects the C&I Prescriptive Program as a whole; at the request of Vectren, Cadmus evaluated a subset of these measures.

Of the 11 natural gas measure categories offered in the C&I Prescriptive Program, Vectren asked Cadmus to focus its impact evaluation on these six: boilers, boiler tune-ups, furnaces, steam traps, tankless water heaters, and thermostats (Wi-Fi and programmable). These measure categories made up 92% of total program reported savings. Three of these (boilers, boiler tune-ups, and furnaces) made up 83% of total reported savings.

Table 88 lists the evaluated savings summary for the C&I Prescriptive Program. The program realization rate of 101% was primarily due to an increase in early replacement projects than in previous program years.

Table 88. 2019 C&I Prescriptive Program Natural Gas Savings¹

Energy Savings Unit	Ex Ante Savings			Evaluated Ex Post Savings	Realization Rates	NTG Ratio	Evaluated Net Savings
	Reported	Audited	Verified				
Total Therms	334,888	334,888	334,611	337,952	101%	83%	280,500

¹ Savings represent a subset of 2019 C&I Prescriptive Program gas projects.

Conclusions and Recommendations

Some of the following conclusions and recommendations may be derived from the process evaluation activities Cadmus conducted for this program. Process evaluation findings are presented in the *2019 Vectren DSM Portfolio Process and Electric Impacts Evaluation*.

Customer Satisfaction

C&I Prescriptive Program participants are highly satisfied. Nearly all surveyed participants were satisfied with the program overall (92%, n=68), and most are very likely to recommend the program to another business (83%, n=69).

Marketing and Outreach

Contractors remain the driving force of program awareness. Participants continue to learn of the program primarily through their trade allies. In 2019, 60% of respondents (n=63) reported learning of the program through contractors, compared to 53% in 2018 (n=70) and 44% in 2017 (n=64). Vectren and Nexant introduced a marketing campaign to promote food service incentives to the Vectren restaurant market segment, resulting in a minimal uptick in participation (from nine participants in 2018 to 10 in 2019). However, the one food service business participant who took Cadmus' survey reported awareness through one of the bill inserts developed to promote the program.

Program Planning

Updated baseline standards lowered savings, but relatively large savings for early replacement (compared to 2018) contributed to an overall positive program realization rate. Updated baselines to meet changes in federal standards lowered evaluated savings for boilers. However, this was offset by large savings for boiler and furnace projects identified as early replacement in program tracking data. In 2019, 43% of boilers installed were early replacement compared to 32% in 2018, and 57% of furnaces installed were early replacement compared to 7% in 2018.

Recommendation: Because the number of early replacement measures vary year to year, Vectren should be prepared when planning for program realization rates and consider requesting these data in the rebate application and encouraging trade allies to target opportunities for early replacement projects.

Recommendation: Report hours of use that were used to estimate reported savings for boilers, boiler tune-ups, and furnaces. These additional data will help identify discrepancies in reported and evaluated savings inputs, especially if the realization rate drops next year because of fewer early replacement measures.

Impact Evaluation

Impact Evaluation Methods and Findings

The impact evaluation of the C&I Prescriptive Program involved these data collection efforts and analysis tasks:

- Audit program tracking database for alignment with Vectren scorecard
- Review *ex ante* savings methodologies and algorithms for the six of 11 program measure categories
- Develop evaluated (*ex post* gross) savings using the 2015 Indiana TRM v2.2 or, for measures not present, the Illinois TRM v7³⁸
- Incorporate site-specific findings, including in-service rate, spillover, and freeridership into evaluated savings via telephone surveys (n=69)
- Incorporate early replacement savings for boilers and furnaces identified as retrofit projects

Gross Savings Review

Table 89 provides per-unit annual gross savings (total savings divided by installed units) for each program measure category. Additional details for measure-level savings can be found in *Appendix A. Impact Evaluation Methodology*.

Table 89. 2019 C&I Prescriptive Program Per-Unit Gross Savings

Measure	Annual Gross Savings (Therms)	
	Reported ¹	Evaluated
Boiler	3,100	2,784
Boiler Tune-up	425	425
Furnace	102	160
Tankless Water Heater	167	209
Thermostat	81	81
Steam Trap	392	393

¹ The gas scorecard did not distill savings by measure. Only the total amount of savings were reported, so Cadmus used the audited savings for measure-level savings.

The following describes the larger discrepancies Cadmus found for boilers, furnaces, and tankless water heaters:

- **Boiler.** Cadmus found the baseline efficiencies in the 2015 Indiana TRM v2.2, on which reported savings were base, do not meet the current minimum federal efficiency requirements. To

³⁸ Illinois Energy Efficiency Stakeholder Advisory Group. September 28, 2018. *2019 Illinois Statewide Technical Reference Manual for Energy Efficiency Version 7.0—Volume 2: Commercial and Industrial Measures*. https://s3.amazonaws.com/ilsag/IL-TRM_Effective_010119_v7.0_Vol_2_C_and_I_092818_Final.pdf.

CADMUS

evaluate savings, Cadmus updated the baseline to current federal standards, which decreased savings.³⁹ Cadmus also accounted for early replacement savings, which Vectren currently does not,⁴⁰ in 43% of boilers (projects marked in the program tracking data as “retrofit existing equipment”), which increased the savings.⁴¹ In 2018, only 32% of boilers were considered early replacement.

- **Furnace.** Cadmus accounted for early replacement savings in 57% of furnace projects, increasing evaluated savings. In 2018, only 7% of furnaces were identified in program tracking data as early replacement.
- **Tankless water heater.** Cadmus found the baseline efficiencies for residential-duty tankless water heaters (i.e., tankless water heaters with input capacities less than 200,000 BTUH) were overestimated in reported savings.⁴² According to the program design, the baseline for residential-duty tankless water heaters installed in commercial settings should be a federal standard residential-duty storage water heater.⁴³ In these cases, Cadmus did not use the baseline used in reported savings (0.80 thermal efficiency—which is the efficiency for commercial-sized water heaters) but used 0.56 uniform energy factor instead—which is the residential-sized federal standard. Additionally, Cadmus did not apply standby loss savings for residential-duty water heaters (as there are no standby losses on residential-duty water heaters), which lowered evaluated savings compared to reported. However, this was offset by higher savings resulting from the change in the baseline.

Table 90 lists the evaluated gross per-unit energy savings for each program measure category by year. Differences (where applicable) are mainly driven by measure attributes, not evaluation findings. For example, the average boiler capacity for tune-up measures was 1,918 kBtuh in 2016, 1,373 kBtuh in 2017, 1,059 kBtuh in 2018, and 1,815 kBtuh in 2019. The therms savings, in that case, are limited by the input capacities.

³⁹ The 2015 Indiana TRM v2.2 uses ASHRAE 90.1-2007 standards for the boiler baseline, which do not meet current federal standards.

⁴⁰ Vectren does not currently account for early replacement savings. Cadmus began to incorporate these into the *ex post* analysis in 2017.

⁴¹ In this case, Cadmus assumed the efficiencies in the 2015 Indiana TRM v2.2 were the efficiencies for existing boilers.

⁴² For a tankless gas water heater with an input capacity less than 200,000 BTUH, the equivalent federal standard storage water heater is not a storage water heater with an equivalent input capacity as the tankless water heater; it is a storage water heater with an input capacity less than or equal to 75,000 BTUH. See the ENERGY STAR residential water heaters criteria for more information.
https://www.energystar.gov/products/water_heaters/residential_water_heaters_key_product_criteria

⁴³ This is because qualifying tankless water heaters only need to meet the federal standard. However, in 2019, every tankless water heater installed was an ENERGY STAR tankless water heater.

Table 90. C&I Prescriptive Program Historical Per-Unit Savings

Measure	Evaluated Annual Gross Savings (Therms)			
	2016	2017	2018	2019
Boiler	860 ¹	N/A	2,571	2,784
Boiler Tune-up		277	198	425
Furnace	160	N/A	162	160
Steam Trap	540	N/A	511	209
Tankless water heater	N/A	N/A	854	81
Thermostat ²	95	79	109	393

¹ In 2016, boilers and boiler tune-ups were reported as one measure.

² These include programmable and Wi-Fi thermostats.

Measure Verification

Table 91 lists the in-service rates for each program measure category. Cadmus used self-report survey data from 2019 program participants to determine measure persistence since initial installation. Cadmus' survey samples at the program-level, as opposed to the measure-level—so the in-service rate is all currently installed measures divided by all reportedly installed measures. Cadmus found an in-service rate of 99.9%. The survey found that two lighting fixtures failed out of 2,419 total reported measure installations included in the survey sample.⁴⁴ The C&I Prescriptive Program has consistently achieved an in-service rate of 100% annually since 2015. Two lighting fixtures failing does not represent a systemic issue, and 2019's ISR still rounds to 100%.

Table 91. 2019 C&I Prescriptive Program Measure Verification Results – In-Service Rates

Measure	Installations			In-Service Rate ²
	Reported ¹	Audited	Verified	
Boiler	N/A	65	65	100%
Boiler Tune-up	N/A	154	154	100%
Furnace	N/A	366	366	100%
Steam Trap	N/A	64	64	100%
Tankless water heater	N/A	155	155	100%
Thermostat	N/A	19	19	100%
Total	N/A	823	822³	100%

¹ The 2019 DSM Scorecard does not distill quantities by measure. The total measures reported in the scorecard (n=880) is for the program as a whole, Cadmus evaluated a subset of program measures.

² All in-service rates are 99.9% but rounded to 100% in this table.

³ Total does not sum due to rounding.

⁴⁴ Cadmus assessed in-service rate at the program-level, not stratified by measure or fuel type.

Net-to-Gross Analysis

Cadmus calculated freeridership and spillover for the C&I Prescriptive Program as a whole using findings from a survey conducted with 58 program participants.^{45,46} The program resulted in an 83% NTG ratio. Table 92 presents the NTG results for the program. These findings are described in greater detail in *Appendix B. Net-to-Gross Detailed Findings*.

Table 92. 2019 C&I Prescriptive Program Net-to-Gross Ratio

Measure	Freeridership	Spillover	NTG Ratio
Total Program	17%	0%	83% ¹

¹ Absolute precision at 90% confidence interval is $\pm 5\%$.

Table 93 lists historical program-level NTG ratios by year.⁴⁷ The NTG ratios have been relatively consistent over the years.

Table 93. C&I Prescriptive Program Historical Net-to-Gross Ratios

Program Year	Freeridership	Spillover	NTG Ratio
2015	15%	2%	87%
2016	20%	2%	82%
2017	26%	1%	75%
2018	16%	0%	84%
2019	17%	0%	83%

Freeridership and Spillover

Cadmus estimated freeridership by combining two methods used in prior C&I Prescriptive Program evaluations—the standard self-report intention method and the intention/influence method. By combining the standard self-report *intention* methodology with an *influence* methodology, Cadmus

⁴⁵ Only 58 of the 69 survey respondents completed the questions relating to freeridership.

⁴⁶ NTG values are not separately calculated by fuel type. Electric and gas savings are combined and standardized using MMBTUs, and the overall NTG ratio is applied to both fuel types.

⁴⁷ Evaluations in 2015, 2016 and 2017 used two different freeridership methods: the standard self-report intention freeridership method and the Intention/Influence freeridership method. The 2018 and 2019 analyses used a new method: the intention questions from the standard self-report intention freeridership method for an intention freeridership score and the influence questions from the Intention/Influence method for an influence freeridership score.

produced a program freeridership score.⁴⁸ The arithmetic mean of the *intention* and *influence* freeridership components results in the final program freeridership of 17%, as shown in Table 94.

Table 94. 2019 C&I Prescriptive Program Freeridership Estimate

Freeridership Metric	Estimate
Intention Score	31% ¹
Influence Score	3% ¹
Final Freeridership Score	17%

¹ Weighted by *ex post* gross program savings

None of the interviewed participants reported that, after participating in the program, they had installed additional high-efficiency equipment for which they did not receive an incentive and that participation in the program was very important in their decision. Therefore, no spillover is attributed to the program.

Evaluated Net Savings Adjustments

Table 95 lists evaluated net savings for the C&I Prescriptive Program. The program achieved 280,500 therms net savings.

Table 95. 2019 C&I Prescriptive Program Natural Gas Savings

	Ex Ante Savings (Therms)			Evaluated Ex Post Savings (Therms)	Realization Rates (Therms)	NTG Ratio	Evaluated Net Savings (Therms)
	Reported ¹	Audited	Verified				
Boiler	N/A	201,500	201,333	180,832	90%	83%	150,091
Boiler Tune-up	N/A	65,397	65,343	65,343	100%	83%	54,234
Furnace	N/A	37,298	37,267	58,402	157%	83%	48,473
Tankless Water Heater	N/A	10,688	10,679	13,376	125%	83%	11,102
Thermostat	N/A	12,551	12,541	12,541	100%	83%	10,409
Steam Trap	N/A	7,454	7,448	7,459	100%	83%	6,191
Total²	334,888	334,888	334,611	337,952	101%	83%	280,500

¹ The 2019 DSM Scorecard does not distill quantities by measure.

² The totals represent a subset of measures Cadmus evaluated. Cadmus did not evaluate 30,073 reported therms savings. The reported program total in the 2019 DSM Scorecard is 364,961 therms.

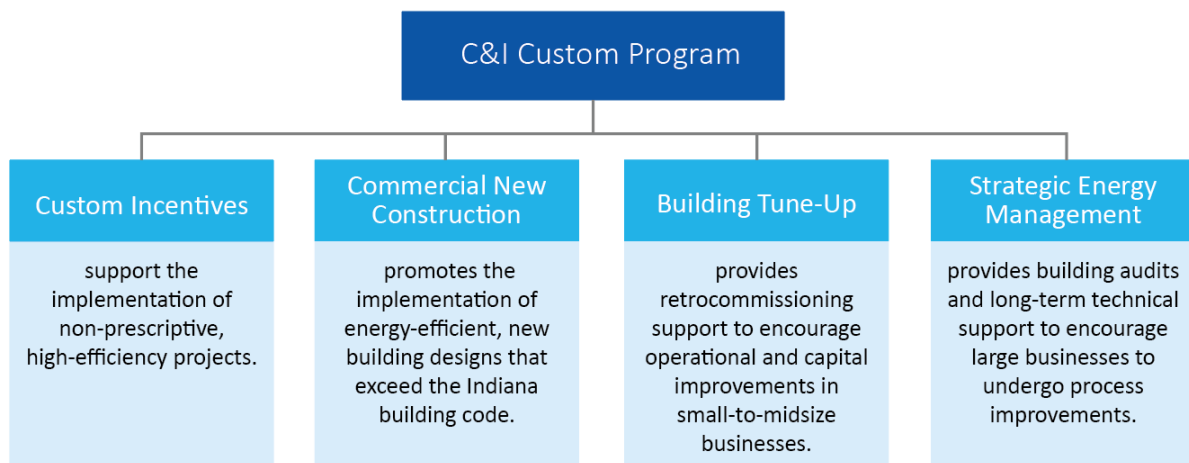
⁴⁸ *Intention* and *influence* freeridership scores both have a maximum of 100%.

Commercial and Industrial Custom Program

The Commercial and Industrial (C&I) Custom Program enables business customers to implement energy-efficient projects or technologies that are not available through Vectren's other DSM programs. These measures may be unique to the participant's business and require individual engineering analyses to determine savings. Vectren calculates program incentive levels on a basis of estimated first-year, amount-of-energy saved (\$0.10 per kWh saved and \$1.00 per therm saved). Incentives cannot exceed 50% of total project costs and have a maximum of up to \$100,000 for qualified projects. Projects achieving a simple payback of one year or less do not qualify for the program.

The C&I Custom Program includes multiple subcomponents, as described in Figure 1.

Figure 1. C&I Custom Program Subcomponents



Vectren administers the program. Nexant, as program implementer, is responsible for program operations, managing day-to-day tasks, marketing (which it shares with Vectren), and confirming that all *ex ante* engineering calculations accurately represent installed measures for each project.

In 2019, to support the natural gas service territory, Nexant subcontracted with the Weidt Group (now Willdan) to engage design teams to incorporate C&I Custom Program offerings into their new construction building designs and sales practices. Trade allies, including design firms and installation contractors, promote the C&I Custom Program to customers and execute custom energy efficiency measures.

Accomplishments

The C&I Custom Program achieved 258% of its participation and 134% of its gross therm savings goals. The program was successful through a variety of measures, including HVAC controls upgrades or operational changes, HVAC equipment-related installations or upgrades, and building envelope upgrades, all of which are common and building-specific and benefit from a custom analysis. Table 96 shows the program's achievements against goals in 2019.

**Table 96. 2019 C&I Custom Program Goals and Achievements¹**

Unit	2019 Actual	2019 Planning Goal	Percentage of Goal
Gross therms Savings	837,768	625,000	134%
Participants (Measures)	80	31	258%

¹ Goals and achievements from Vectren's 2019 DSM Scorecard. Actuals represent *ex ante* reported values.

Although Vectren does not set targets for each specific program subcomponent, the following describes how each C&I Custom Program subcomponent performed in 2019 (*ex ante*, reported achievements):

- **C&I Custom incentives** contributed 12% of the program's gross therm savings, similar to 2018 (16%).
- **Commercial new construction** projects accounted for 88% of 2019 gross therm savings achievement, compared to 84% in 2018.
- **Building tune-up** offerings, which Vectren introduced as a program subcomponent in 2018, had a minor impact on program savings in 2019, with less than 1% of 2019 gross therm savings compared to 0% in 2018.
- **Strategic energy management (SEM)** was a new program subcomponent in 2019. The implementer recruited one customer to participate in the 18-month SEM training and implementation process beginning in 2019 and hopes to enroll at least one additional customer in 2020. Savings from this subcomponent will not be realized until at least 2020.

Table 97 shows the evaluated savings for the 2019 C&I Custom Program. All applications exhibited reasonable savings estimates and calculation methodologies. No application IDs required *ex post* adjustments.

Table 97. 2019 C&I Custom Program Natural Gas Savings

Energy Savings Unit	<i>Ex Ante</i> Savings			Evaluated <i>Ex Post</i> Savings	Realization Rate	NTG Ratio	Evaluated Net Savings
	Reported	Audited	Verified				
Total therms	837,768	837,768	837,768	837,768	100%	92%	770,747

Conclusions and Recommendations

Some of the following conclusions and recommendations may be derived from the process evaluation activities Cadmus conducted for the C&I Custom Program. Process evaluation findings are presented in the *2019 Vectren DSM Portfolio Process and Electric Impacts Evaluation*.

Customer Satisfaction

Participants were satisfied with the C&I Custom Program. All 10 survey respondents reported being satisfied with the program and were very likely to recommend participation to another business.

Project Documentation

Clear and adequate project documentation increased the reliability of estimated savings for the program measures. The documentation provided by the program implementer for all evaluated measures was clear, concise, and easy to verify and was a noticeable improvement over previous years. Nearly all major assumptions were supported by well-organized measurement and verification inspection notes and photos.

Program Delivery

The C&I Custom Program reached its therm savings goal primarily through its new construction subcomponent. In 2018, Vectren incorporated the C&I New Construction Program into the C&I Custom Program. In 2019, the program implementer subcontracted with Weidt Group (now Willdan) to help design teams incorporate program offerings into their new building designs. However, the program did not realize a substantial increase in energy savings from this partnership (new construction projects accounted for 88% of 2019 gross natural gas savings achievement, compared to 84% in 2018).

In 2018, Vectren introduced building tune-ups into the C&I Custom Program. No building tune-up measures were completed in 2018, but projects from two unique customers (according to application ID) were completed in 2019, resulting in nominal therm savings. To encourage additional savings through the C&I Custom Program, the implementer also launched a SEM subcomponent and recruited one customer in 2019, which may realize savings in 2020.

Meetings and communications between Vectren's key account managers and Nexant program staff had declined midyear because of a change in Vectren's team structure. Improving these coordination efforts could help reinforce strategies to deliver program offerings such as building tune-ups or strategic energy management, which require in-depth, technical explanations and a substantial customer participation commitment.

Recommendation: Develop a plan for maintaining regular communications across program teams and coordinating with customers. To support this effort and bolster participation, particularly for more complex program offerings like building tune-ups and strategic energy management, consider reinstating periodic check-in meetings between Vectren key account managers and Nexant outreach staff.

New Construction Installation Practices

New construction trade allies vary in how they apply the building code when installing warehouse heating systems in new construction settings. There is also no strong evidence that code officials always check warehouse heating system installations. The program implementer has historically documented the baseline efficiency of warehouse heating measures as having no setback and 100% outside air ventilation and the efficient condition is with setbacks and controlled outside air use according to building code parameters. However, the baseline assumption does not meet the requirements of ASHRAE 90.1-2007.

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To assess whether trade allies were installing warehouse heating systems to meet the requirements of ASHRAE 90.1-2007 and whether code officials were checking for installation compliance, Cadmus conducted interviews with four trade allies who installed new construction projects through the C&I Custom Program in 2019. All four new construction trade allies said they always install equipment in ways that meet the building code. However, one said half or fewer of their installations use controls. Only two of the four reported always installing equipment that pulls in outside air ventilation. All four said, when their systems bring in outside air, they are equipped with damper shutoff controls. Only two said code officials check the use of temperature setback controls and outside air ventilation with any frequency at all. Two trade allies said they suspected code officials never check these two aspects of installations. However, the small sample size of new construction contractors limits the inference Cadmus can make about true market practices.

Recommendation: Through 2021, to align with Vectren's filed program cycle, maintain the current practice of applying the baseline at no setback and 100% outside air. Beginning in 2021, adopt code as the baseline and begin phasing out warehouse heating unit measures from the program.

Impact Evaluation

Impact Evaluation Methods and Findings

The C&I Custom Program impact evaluation included multiple data collection and analysis tasks:

- Verify that all *ex ante* tracked savings are in alignment with the provided project documentation and calculations
- Review and verify that measure savings calculations and assumptions are supported by the project documentation
- Adjust the *ex post* savings estimations based on the desk review, where applicable

Gross Savings Review

In 2019, 34 customers completed 80 gas measures under 35 application identifiers (IDs) through the C&I Custom Program:⁴⁹

- 26 HVAC controls upgrades
- 20 HVAC equipment-related installations or upgrades
- 12 rack unit heaters
- 2 process upgrades
- 16 building envelope upgrades
- 4 domestic water heating

⁴⁹ An application ID is associated with an organization and may include one or multiple unique measure IDs.



Projects involved these specific technologies:

- Direct fire heaters
- Chiller replacement
- HVAC control system upgrades
- High-efficiency hot water heater
- Rack unit recirculation heater systems

Cadmus reviewed 31 of 35 application IDs, focusing on the largest energy savers that made up 99% of the energy savings. For the projects in the remaining 1%, Cadmus ensured that the underlying methodology was consistent with the rest of the projects in the population and found no clerical issues for nonqualifying products and no double-counting of savings. The aggregated C&I Custom Program evaluation results were in line with the reported therm savings. Cadmus made no *ex post* adjustments to the 35 gas application IDs.

Table 98 lists the reported and evaluated gross savings for each C&I Custom Program gas project. Reported savings come directly from the program tracking database.

Table 98. 2019 C&I Custom Program Per-Unit Gross Savings

Application ID	Annual Gross Savings (therms)	
	Reported	Evaluated
3157	8,157	8,157
3159	7,312	7,312
3174	452	452
3176	7,346	7,346
3189	6,493	6,493
3191	16,546	16,546
3194	89,895	89,895
3196	12,303	12,303
3198	8,775	8,775
3202	165,543	165,543
3203	5,483	5,483
3208	7,247	7,247
3209	28,828	28,828
3213	590	590
3217	6,597	6,597
3223	42,002	42,002
3240	19,052	19,052
3241	91,434	91,434
3253	28,523	28,523
3265	74,249	74,249
3290	7,324	7,324



Application ID	Annual Gross Savings (therms)	
	Reported	Evaluated
3299	27,296	27,296
3356	43,215	43,215
3357	36,020	36,020
3459	1,939	1,939
3481	1,629	1,629
3500	3,482	3,482
3618	529	529
3658	777	777
3707	28,535	28,535
3735	12,614	12,614
3736	7,942	7,942
3739	12,002	12,002
3793	4,864	4,864
3873	22,772	22,772

As shown in Table 99, the 2018 C&I Custom Program had an increase in total program therms savings compared to previous program years. The realization rate for 2019 is 100% compared with previous years at 114% in 2018, 59% in 2017, and 92% in 2016.

Table 99. C&I Custom Program Historical Per-Unit Savings

Program Year	Annual Gross Savings (therms)		
	Reported	Evaluated	Realization Rate
2016	385,381	356,322	92%
2017	521,957	306,654	59%
2018	748,503	852,282	114%
2019	837,768	837,768	100%

Project Verification

During the audit phase for the natural gas project applications, Cadmus determined that the reported savings and installations in the program tracking database correctly matched the 2019 Gas DSM Scorecard. Note that the scorecard reported a total of 80 participants; however, Cadmus discovered that this number matched the number of unique measure IDs. Therefore, Cadmus clarified with the implementer that 80 measures were installed by 34 participants under 35 application IDs.

During interviews with participating customers, Cadmus asked if they had removed or installed additional equipment and if the equipment still worked properly. All 10 respondents (both electric and gas measures) said the equipment installed through the program remained operational and had not been removed.

The 35 verified gas application IDs with measures installed through the C&I Custom Program in 2019 were all still in use, so all received a 100% installation rate. Results in 2019 are consistent with previous years.

Trade Ally New Construction Practices

The Indiana Energy Code, which follows ASHRAE 90.1-2007, states that all commercial heating systems, including warehouse heating, must be equipped with unoccupied temperature setback control and unoccupied outdoor air damper shutoff control. That is, the system's outdoor air intake ducts are installed with motorized dampers that automatically close when the systems or spaces served are not in use.⁵⁰

However, the program implementer assumed from conversations with equipment dealers and contractors that systems were not being installed to meet these criteria and has been documenting the baseline efficiency of warehouse heating measures as having no setback and 100% outside air ventilation. In a 2018 field investigation, the implementer worked with a warehouse unit heater dealer to identify and perform a system review of seven, nonparticipating new construction facilities. It found that all seven sites had controllers that were not able to set back temperatures or cycle fans off during unoccupied hours, even though these systems do not meet the requirements of ASHRAE 90.1-2007.

Based on these findings, Vectren, Cadmus, and the program implementer agreed to the following:

- Through program year 2021, direct-fired heating equipment that runs continually at a constant setpoint will be used as a baseline for new construction warehouse heating measures because this baseline aligns with Vectren's filed plan cycle.⁵¹ The assumptions will be revisited in the 2021 program year, and Vectren, the implementer, and the evaluator will determine if these baseline system assumptions are still appropriate.
- ASHRAE 90.1-2007, exception 6.5.6.1.h, which allows for the installation of 100% outside air equipment without heat recovery as the primary heating source in a warehouse, is valid for this technology. The program implementer will therefore continue to consider 100% outside air direct-fired heating systems for the incentive and use its existing calculation method for determining savings.

To more broadly assess the two code-noncompliant baseline assumptions before 2021 and determine if new construction market practices of trade allies and code officials continue to warrant the code exceptions, Cadmus conducted interviews with 11 participating trade allies.

Four of the participating trade allies install warehouse heating systems. They reported installing an average of 187 warehouse heating units across an average of 11 projects in the last two years. Three of

⁵⁰ ASHRAE 90.1-2007 sections 6.4.3.3.2 – Setback Controls and 6.4.3.4.3 – Shutoff Damper Controls.

⁵¹ The program's baseline assumptions conflict with ASHRAE 90.1-2007 sections 6.4.3.3.2 – Setback Controls and 6.4.3.4.3 – Shutoff Damper Controls.

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the four said every warehouse heating system is equipped with unoccupied temperature setpoint controls. One said only 50% to 25% of systems installed are equipped with controls, and this one trade explained that whether or not a system is equipped with controls depends on what the owner requests. This trade ally said property owners believe that installing temperature setpoint controls make projects more difficult, despite the possible savings.

Cadmus also asked trade allies whether the heating systems they installed in the last two years, both in and out of the program, pull in outside air ventilation, either partially or fully. Two trade allies said all of their projects pull in outside air ventilation. One of these trade allies installed the appropriate number of outdoor air ventilation hoods to comply with code, and for this reason customers preferred this firm's products over other companies.

Of the other two trade allies, one said only 50% to 60% of the warehouse heating systems installed pull in outside air but that, per code, every warehouse heating system installed for large customers (such as big box retailers) pull in outside air. The other trade ally said about 75% of the 200 to 300 units installed bring in outside air. All four trade allies said all systems they installed that bring in outside air are equipped with unoccupied outdoor air damper shutoff control.

Cadmus asked the four trade allies about their experience with code officials. Though all reported installing to code requirements, not all said code officials checked to ensure warehouse heating systems use setback control or bring in outside air. When asked about checking the use of setback controls, one trade ally said code officials check multiple times throughout the project and that the number of checks depends on the county and size of the project. Another trade ally said every job was checked before being verified by Vectren but was unsure which code official completed the check. The two remaining trade allies said code officials checked seldom or never. No trade allies had been asked by a code official to change specified controls to ensure a system used programmable thermostats or other forms of setback control to maintain code compliance.

When asked if code officials check the use of outside air ventilation, only one trade ally said code officials regularly check. Another said code officials probably check only 25% to 30% of the time: "They are not really in tune with checking something like that." Two trade allies said code officials never check the system's use of outside air.

Net-to-Gross Analysis

Cadmus calculated freeridership and spillover for the C&I Custom Program as a whole using findings from interviews conducted with 10 program participants. As shown in Table 100, C&I Custom Program respondents exhibited an overall savings-weighted freeridership average of 8%, and the resulting NTG ratio for the program including spillover is 92%. These findings are described in greater detail in *Appendix B. Net-to-Gross Detailed Findings*.

Table 100. 2019 C&I Custom Program Net-to-Gross Ratio

Project	Freeridership	Spillover	NTG Ratio
Total Program	8%	0%	92% ¹

¹ Absolute precision at 90% confidence interval is $\pm 8\%$.

Table 101 lists historical program-level NTG ratios by year.⁵² NTG results rely completely on self-reported responses and therefore can change considerably from one year to the next, especially when sample sizes are small and there is the potential for large variations in respondents' program energy savings. This has been the case throughout the C&I Custom Program.

In 2019, three respondents had a 0% freeridership estimate and accounted for 65% of the program energy savings in the analysis sample.

Table 101. C&I Custom Program Historical Net-to-Gross Ratios¹

Program Year	Freeridership	Spillover	NTG Ratio
2012	31%	0%	69%
2013	1%	0%	99%
2014	24%	1%	77%
2015	0%	0%	100%
2016	25%	0%	75%
2017	4%	0%	96%
2018	15%	0%	85%
2019	8%	0%	92%

¹ Program years 2013 to 2017 used the standard self-report intention freeridership method. In 2018 and 2019, the evaluation combined the intention questions from the standard self-report intention freeridership method for an intention freeridership score and the influence questions from the Intention/Influence method for an influence freeridership score.

Freeridership and Spillover

Cadmus estimated freeridership by combining two methods—the standard self-report intention method and the intention/influence method. By combining the standard self-report *intention* methodology with an *influence* methodology, Cadmus produced a program freeridership score.⁵³

⁵² 2012 to 2017 used the standard self-report intention freeridership method. The 2018 and 2019 analyses are using a new method: the intention questions from the standard self-report intention freeridership method for an intention freeridership score and the influence questions from the Intention/Influence method for an influence freeridership score.

⁵³ *Intention* and *influence* freeridership scores both have a maximum of 100%.



Cadmus calculated the arithmetic mean of the *intention* and *influence* freeridership components to estimate the final program freeridership of 8%, as shown in Table 102.

Table 102. 2019 C&I Custom Program Freeridership Estimate

Freeridership Metric	Estimate
Intention Score	10% ¹
Influence Score	5% ¹
Final Freeridership Score	8%

¹ Weighted by *ex post* gross program savings

None of the interviewed participants reported that, after participating in the program, they had installed additional high-efficiency equipment for which they did not receive an incentive and that participation in the program was very important in their decision. Therefore, no spillover is attributed to the program.

Evaluated Net Savings Adjustments

Table 103 lists reported *ex ante* savings, evaluated *ex post* savings, realization rates, and evaluated net savings for the C&I Custom Program. The program achieved net savings of 770,747 therms.

**Table 103. 2019 C&I Custom Program Natural Gas Savings**

Project	Ex Ante Savings (therms)			Evaluated Ex Post Savings (therms)	Realization Rate (therms)	NTG Ratio	Evaluated Net Savings (therms)
	Reported	Audited	Verified				
3157	8,157	8,157	8,157	8,157	100%	92%	7,504
3159	7,312	7,312	7,312	7,312	100%	92%	6,727
3174	452	452	452	452	100%	92%	416
3176	7,346	7,346	7,346	7,346	100%	92%	6,758
3189	6,493	6,493	6,493	6,493	100%	92%	5,974
3191	16,546	16,546	16,546	16,546	100%	92%	15,222
3194	89,895	89,895	89,895	89,895	100%	92%	82,703
3196	12,303	12,303	12,303	12,303	100%	92%	11,319
3198	8,775	8,775	8,775	8,775	100%	92%	8,073
3202	165,543	165,543	165,543	165,543	100%	92%	152,300
3203	5,483	5,483	5,483	5,483	100%	92%	5,045
3208	7,247	7,247	7,247	7,247	100%	92%	6,667
3209	28,828	28,828	28,828	28,828	100%	92%	26,521
3213	590	590	590	590	100%	92%	543
3217	6,597	6,597	6,597	6,597	100%	92%	6,069
3223	42,002	42,002	42,002	42,002	100%	92%	38,642
3240	19,052	19,052	19,052	19,052	100%	92%	17,528
3241	91,434	91,434	91,434	91,434	100%	92%	84,120
3253	28,523	28,523	28,523	28,523	100%	92%	26,241
3265	74,249	74,249	74,249	74,249	100%	92%	68,309
3290	7,324	7,324	7,324	7,324	100%	92%	6,738
3299	27,296	27,296	27,296	27,296	100%	92%	25,112
3356	43,215	43,215	43,215	43,215	100%	92%	39,757
3357	36,020	36,020	36,020	36,020	100%	92%	33,138
3459	1,939	1,939	1,939	1,939	100%	92%	1,784
3481	1,629	1,629	1,629	1,629	100%	92%	1,499
3500	3,482	3,482	3,482	3,482	100%	92%	3,203
3618	529	529	529	529	100%	92%	487
3658	777	777	777	777	100%	92%	714
3707	28,535	28,535	28,535	28,535	100%	92%	26,252
3735	12,614	12,614	12,614	12,614	100%	92%	11,605
3736	7,942	7,942	7,942	7,942	100%	92%	7,307
3739	12,002	12,002	12,002	12,002	100%	92%	11,042
3793	4,864	4,864	4,864	4,864	100%	92%	4,475
3873	22,772	22,772	22,772	22,772	100%	92%	20,950
Total	837,768	837,768	837,768	837,768	100%	92%	770,747

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Commercial and Industrial Small Business Direct Install Program

The Small Business Direct Install (SBDI) Program helps qualifying businesses identify energy-saving opportunities and solutions.⁵⁴ To participate, the customer's business must be in Vectren's service territory and have a peak electric demand of 400 kW or less over the past 12 months. Upon preapproval of customer eligibility through a program application, the program offers participants these services and discounts:

- No-cost on-site energy assessment
- No-cost installation of direct install energy-efficient measures
- Energy assessment report detailing recommended site-specific energy-efficient upgrades
- Low-cost pricing for recommended energy-efficient measures

Vectren oversees the program. Nexant, the program implementer, is responsible for day-to-day operations, trade ally outreach, application processing, and technical review. Participating trade allies are responsible for customer outreach, conducting on-site energy assessments, and installing no-cost and low-cost direct install measures.

The no-cost direct install measures include LEDs (screw-in or pin-based lamps), vending machine sensors, Wi-Fi-enabled or programmable thermostats, pre-rinse sprayers, and faucet aerators, which may be installed by the trade ally during the on-site energy assessment. Later, trade allies can install additional measures based on the outcome of the on-site energy assessment. Vectren offers instant rebates, which reduce the out-of-pocket equipment cost for the following measures (referred to as low-cost measures):

- Interior and exterior energy-efficient lighting
- LED refrigerated case lighting
- LED exit signs
- Lighting occupancy sensors
- Refrigerator/freezer efficiency measures
- Electronically commutated motors (ECMs)

The SBDI Program is an integrated dual fuel program for Vectren. Eligible measures primarily contribute electric and demand savings to Vectren's nonresidential portfolio. The only contributors to gas savings in 2019 were Wi-Fi-enabled and programmable thermostat measures.⁵⁵

Accomplishments

In 2019, the SBDI Program achieved 35% of the reported gross savings goal and 180% of the participant goal. Five trade allies contributed savings from thermostats, up from three trade allies in 2018 and three in 2017. Although 65% of participant survey respondents reported using natural gas for water heating,

⁵⁴ Customer-facing branding refers to the program as Small Business Energy Solutions.

⁵⁵ The program offers water-saving measures such as pre-rinse sprayers and faucet aerators at no cost to the customer, but trade allies did not install these measures in 2019.

there were no no-cost aerator and pre-rinse sprayer measures reported through the program in 2019. Table 104 shows the program's achievements against goals in 2019.

Table 104. 2019 Small Business Direct Install Program Goals and Achievements¹

Unit	2019 Actual	2019 Planning Goal	Percentage of Goal
Gross Therms Savings	1,058	3,000	35%
Participants	27	15	180%

¹ Goals and achievements from Vectren's 2019 DSM Scorecard. Actuals represent *ex ante* reported values.

Table 105 lists the evaluated savings summary for the SBDI Program. Overall, the program achieved an 88% realization rate for gas savings. The realization rate is largely attributable to a single project that installed and claimed savings for three thermostats. Based on Cadmus' review, the reported savings appear to overstate the square footage conditioned by the thermostats. This is accounted for in the evaluated savings, and the result is lower savings for this project. Additional detail is provided in the *Gross Savings Review* section.

Table 105. 2019 Small Business Direct Install Program Natural Gas Savings

Energy Savings Unit	<i>Ex Ante Savings</i>			Evaluated <i>Ex Post</i> Savings	Realization Rates	NTG Ratio	Evaluated Net Savings
	Reported	Audited	Verified				
Total Therms	1,058	1,058	1,058	936	88%	96%	900

Conclusions and Recommendations

Some of the following conclusions and recommendations may be derived from the process evaluation activities Cadmus conducted for this program. Process evaluation findings are presented in the *2019 Vectren DSM Portfolio Process and Electric Impacts Evaluation*, submitted as a separate report.

Customer Satisfaction

Participants are satisfied with the program, which is contributing to greater program awareness through word-of-mouth. Participating customers remain highly satisfied with and likely to recommend the program. Strong ratings over time are contributing to program promotion through word-of-mouth; 18% of 2019 respondents learned about the SBDI Program from other participating businesses.

Trade Ally Satisfaction

Trade allies are pleased with the program, which is increasing their businesses' sales. Some trade allies would benefit from accessing site assessment reports following submittal. Through interviews, all trade allies reported being *very satisfied* with their overall program experience and with program staff support. Participation per trade ally is increasing, from 9.5 participants per trade ally in 2017 to 11.6 in 2018 and 17.6 in 2019, and trade allies recognize this increase, reporting an average 21% increase in sales. Five of eight trade allies recommended improving the iPad energy assessment tool so they could reference and possibly edit the report after it is submitted. This may be one of the reasons

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the implementer had struggled in the past to collect site assessment reports from trade allies when the assessment did not immediately result in a project.

Recommendation: Modify the online assessment tool to allow trade allies to reference past assessments. This will assist trade allies in following up with these leads and could result in greater participation.

Program Administration and Delivery

Electric-saving activities increased substantially in 2019, but trade allies continue to refrain from offering or installing no-cost measures that save natural gas. Fourteen trade allies contributed electric savings to the 2019 program, compared to 10 in 2018 and eight in 2017. The program achieved 240% of the 2019 electric savings goal, of which 2019 savings achievement more than doubled over 2018.⁵⁶ However, the program achieved only 35% of its therm savings goal through five trade allies who installed a handful of thermostat measures, and similar to 2017 and 2018, trade allies did not install any no-cost water-saving measures. Although some participants said they did not need or want the no-cost thermostats and water-saving measures, at least half reported not being offered these measures at all. Trade allies said their reasons for refraining from installing no-cost measures—LEDs, thermostats, and water-saving devices—were largely because of how the no-cost measures applied to their customers' business operations (the measures did not apply to the business or were incompatible with existing equipment), and that they were not comfortable installing small lighting, or water- or HVAC-related measures that typically fell outside of their line of business.

Recommendation: To reassure trade allies about installing no-cost measures such as LEDs, thermostats, aerators, and pre-rinse sprayers, incorporate measure-level training and discussion into annual and one-on-one training modules.

Recommendation: Rather than scheduling no-cost measure installations at the same time as the recommended low-cost measures, encourage trade allies to keep an inventory of no-cost measures with them when conducting site assessments to foster immediate savings. Require trade ally staff to keep records through the online assessment tool whether no-cost measures were offered and reasons the measures were declined.

It is unclear whether thermostat measures were installed in facilities that already had a programmable thermostat. Of the four participant survey respondents who received a thermostat and could verify the measure was installed and operational, two said the thermostat settings differed from their previous thermostat and the other two said the thermostat settings were the same. This suggests that some thermostats installed through the program replaced thermostats that were already programmed. Because of the small sample size and possibility that survey respondents either did not

⁵⁶ Electric savings are detailed in a separate report, 2019 Vectren DSM Portfolio Process and Electric Impacts Evaluation.

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understand the question or did not know if settings were different, Cadmus did not adjust evaluated savings based on this finding.

Recommendation: Require that thermostat measures be installed only in facilities or zones where the existing thermostat is a manual thermostat or a programmable thermostat that is not programmed.

Marketing and Outreach

The program implementer's geotargeted marketing campaign to increase participation in the Newburgh, Indiana, community proved highly successful in delivering electric savings. The program sent postcard mailers and emails to Newburgh small business customers and developed a web landing page to promote the benefits of participation with a call to action to request an assessment. Trade allies were enlisted to support the campaign and offered bonus financial incentives for every assessment and project implemented in Newburgh. The number of assessments in Newburgh rose from seven per year in 2017 and 2018 to 46 in 2019, program kWh savings activity increased fivefold from 2018 to 2019, and therm savings increased from none in 2017 and 2018 to 6% in 2019. Although the Newburgh participants who responded to Cadmus' survey did not credit the marketing materials for their program awareness, all five reported hearing about the program through a contractor.

Recommendation: Consider implementing a similar campaign in another dual fuel community. Since trade allies proved crucial to the campaign's success, ensure they are adequately informed and financially motivated to support the effort. To foster greater achievement toward the overall program therm-savings goal, consider additional incentives to encourage trade allies to deliver therm-saving measures to community businesses.

Ex Ante Savings

Ex ante savings for thermostats should be proportional to the size of the conditioned area. *Ex ante* savings are currently calculated based on the size of the facility but should instead be based on the size of the conditioned area. In some facilities, a single thermostat may control the HVAC systems that condition the entire space, whereas other facilities have separate thermostats controlling individual zones in the facility. The savings provided by the thermostat are proportional to the size of the conditioned area served by the thermostat: each project is assigned an area-normalized kWh per-square-foot savings based on the thermostat settings (setback temperature, daily hours at setback temperature, number of days facility is closed), which is then multiplied by the size of the conditioned area.

Recommendation: Update the data collection and *ex ante* savings calculation to account for the size of the conditioned space rather than the size of the entire facility.

Impact Evaluation

Impact Evaluation Methods and Findings

The SBDI Program impact evaluation included multiple data collection efforts and analysis tasks:

- Tracking database review of the number of measures installed and their deemed savings assumptions
- Engineering analysis of *ex ante* gas energy savings for each measure
- Phone survey with 41 program participants to gather measure verification, freeridership, and spillover data

Gross Savings Review

The programmable thermostat measures was the only measure with anticipated evaluated therms savings. Evaluated per-unit savings were largely in line with reported per-unit savings. Table 106 lists the per-unit deemed savings for the thermostat measure. Additional details for measure-level savings can be found in *Appendix A. Impact Evaluation Methodology*.

Table 106. 2019 Small Business Direct Install Program Per-Unit Gross Savings

Measure	Annual Gross Savings (Therms)	
	Reported	Evaluated
Wi-Fi and Programmable Thermostats	36.5	32.3

There were minor deviations between reported and evaluated gross savings assumptions on a per-unit basis for programmable thermostats; these differences are largely attributable to a single project that installed and claimed savings for three thermostats. Savings are proportional to facility size. However, for this project, the reported savings used the square footage of the entire facility to calculate savings for each thermostat rather than the actual area served by each of the three thermostats. The tracking data show a recorded area of 3,000 square feet. Cadmus confirmed through Google Earth that the facility is not a 9,000-square-foot facility, so it appears savings were triple-counted. *Ex post* savings assumed that each thermostat serves one-third of the facility (i.e., 1,000 square feet each instead of 3,000 square feet each).

Table 107 lists the evaluated gross per-unit energy savings for thermostats by year. Per-unit therm savings vary by year largely due to changes in the average square footage of conditioned space, run schedules, and setpoints.

Table 107. Small Business Direct Install Program Historical Per-Unit Savings

Measure	Evaluated Annual Gross Energy Savings ¹				
	2015	2016	2017	2018	2019
Wi-Fi and Programmable Thermostats	N/A	7.0	52.2	35.9	32.3

¹ Cells with no values represent years where no measures were rebated or installed through the program.

Measure Verification

Through a telephone survey, 38 of 41 program participants said the measures installed through the SBDI Program were still installed (three said *don't know*), resulting in an in-service rate of 100% for the thermostats (Table 108). The 2019 in-service rate of 100% is nearly identical to the aggregated in-service rates for the past four program years.

Table 108. 2019 Small Business Direct Install Program Measure Verification Results – In-Service Rates

Measure	Installations			In-Service Rate
	Reported ¹	Audited	Verified	
Wi-Fi and Programmable Thermostats	29	29	29	100%
Total	29	29	29	100%

¹The 2019 DSM Scorecard tracked participation by number of small businesses served (n=27). The reported installations shown here are representative of the measure quantities reported in the 2019 program tracking database and include only those installations for building with gas heating. One participant received three thermostats, bringing the total number of installations to 29. An additional 12 thermostats were installed in locations with electric heat.

Thermostat Programming and Facility Size Verification

In 2019, five participant survey respondents installed thermostats through the SBDI Program, though one was not able to verify that the measure was still installed and operating and was therefore not asked about the measure's settings or application. Of the other four, one used the new thermostat to condition a 1,200-square-foot space. The other three could not estimate conditioned space square footage.

Cadmus then asked about the settings of their new thermostats. Of the four respondents, three programmed their thermostats to operate differently on certain days or at certain times of the day. All three reported that they themselves or someone else at their organization programmed the thermostat. Two of these respondents said the programmed settings differ from their previous thermostat, and one of these two said the thermostat has new temperature settings on every day of the week.

This finding suggests some thermostats installed through the program replaced thermostats that were already programmed. Given the small sample size, and possibility that survey respondents either did not understand the question or did not know if settings were different from their previous thermostat, Cadmus did not adjust evaluated savings based on this finding.

Net-to-Gross Analysis

Cadmus calculated freeridership and spillover for the SBDI Program as a whole using findings from a survey conducted with 36 program participants.^{57,58} Table 109 presents the NTG results for the program.

⁵⁷ NTG values are not separately calculated by fuel type. Electric and gas savings are combined and standardized using MMBTUs and the overall NTG ratio is applied to both fuel types.

⁵⁸ Only 36 of the 41 survey respondents completed the questions relating to freeridership.

After including spillover, the program resulted in an NTG ratio of 96%. These findings are described in greater detail in *Appendix B. Net-to-Gross Detailed Findings*.

Table 109. 2019 Small Business Direct Install Program Net-to-Gross Ratio

Measure	Freeridership	Spillover	NTG Ratio
Overall	4%	0%	96%

Table 110 lists historical program-level NTG ratios by year.⁵⁹ The historical program-level NTG ratios account for both electric and gas measures and are applied uniformly to all measures in the program. NTG results rely completely on self-reported responses and therefore can change from one year to the next, especially when sample sizes are small and when there is the potential for large variations in the program energy savings of respondents. In 2019, the three respondents with the highest program savings accounted for 45% of the analysis sample program energy savings, and all three were estimated at 0% freeridership.

Table 110. Small Business Direct Install Program Historical Net-to-Gross Ratios

Program Year	Freeridership	Spillover	NTG Ratio
2013	0%	0%	100%
2014	4%	0%	96%
2015	5%	0%	95%
2016	23%	0%	77%
2017	21%	7%	86%
2018	0%	1%	101%
2019	4%	0%	96%

Freeridership and Spillover

Cadmus estimated freeridership by combining two methods used in prior evaluations—the standard self-report intention method and the intention/influence method. By combining the standard self-report *intention* methodology with an *influence* methodology, Cadmus produced a program freeridership score.⁶⁰ Cadmus calculated the arithmetic mean of the *intention* and *influence* freeridership components to estimate the final program freeridership of 4%, as shown in Table 111.

⁵⁹ 2013 and 2014 used the standard self-report intention freeridership method. 2015, 2016 and 2017 used two different freeridership methods: the standard self-report intention freeridership method and the Intention/Influence freeridership method. The 2018 and 2019 analyses are using a new method: the intention questions from the standard self-report intention freeridership method for an intention freeridership score and the influence questions from the Intention/Influence method for an influence freeridership score.

⁶⁰ *Intention* and *influence* freeridership scores both have a maximum of 100%.

Table 111. 2019 Small Business Program Freeridership Estimate

Freeridership Metric	Estimate
Intention Score	5%
Influence Score	2%
Final Freeridership Score¹	4%

¹ Weighted by *ex post* gross program savings

After participating in the program, two respondents reported installing a total of 17 LEDs for which the companies did not receive an incentive. The respondents said their participation in the program was very important in the companies' decision to install the additional measures. Cadmus used a per-unit evaluated gross savings estimates for interior lighting (141.75kWh) from the SBDI Program to calculate spillover for the additional equipment attributed to the program. Cadmus then divided the total survey sample spillover savings (8.2 MMBTU) by the gross program savings from the survey sample (2,128 MMBTU) to obtain the spillover estimate of less than 1% for the program, as shown in Table 112; because spillover is minimal, it did not increase the overall program NTG.⁶¹

Table 112. 2019 Small Business Direct Install Program Spillover Estimate

Survey Sample Spillover Savings (MMBTU)	Survey Sample Program Savings (MMBTU)	Spillover Percentage Estimate
8	2,128	<1%

Evaluated Net Savings Adjustments

Table 113 lists evaluated net savings for the SBDI Program. The program achieved 900 therms net savings.

Table 113. 2019 Small Business Direct Install Program Natural Gas Savings

	Ex Ante Savings (Therms)			Evaluated Ex Post Savings (Therms)	Realization Rates (Therms)	NTG Ratio	Evaluated Net Savings (Therms)
	Reported	Audited	Verified				
Wi-Fi and Programmable Thermostats	1,058	1,058	1,058	936	88%	96%	900
Total	1,058	1,058	1,058	936	88%	96%	900

⁶¹ NTG was evaluated at the program-level and Cadmus did not stratify the survey sample by fuel type.

Appendix A. Impact Evaluation Methodology

A.1 Residential Prescriptive Program

Cadmus' impact evaluation of the Residential Prescriptive Program included measures with attributable natural gas impacts, including these:

HVAC measures

- Furnace tune-up
- Natural gas boilers
- Natural gas furnaces

Thermostats

- Nest thermostats
- Smart programmable thermostats
- Wi-Fi thermostats

Weatherization measures

- Attic insulation
- Wall insulation
- Duct sealing

The following sections detail the calculations and assumptions used in Cadmus' estimation of gross savings for the Residential Prescriptive Program. Table A-52 provides per-unit annual gross savings for each program measure.

Table A-1. 2019 Residential Prescriptive Per-Unit Gross Savings

Measure	Annual Gross Savings (Therms)	
	Reported	Evaluated
HVAC		
Furnace Tune-Up	39	69
Natural Gas Boilers - 90%	275	242
Natural Gas Furnaces - 95%	134	132
Natural Gas Furnace - 97%	165	155
Thermostats		
Nest On-Line Store North	59	73
Nest On-Line Store South	55	55
Smart Programmable Thermostat - North	57	64
Smart Programmable Thermostat - South (Gas)	54	48
Wi-Fi Thermostat - North	20	25
Wi-Fi Thermostat - South	18	19
Weatherization		
Attic Insulation - Pre R11, Post R43 North	212	188
Attic Insulation - Pre R11, Post R43 South	198	226
Duct Sealing North	112	103
Duct Sealing South	82	95
Wall Insulation North	67	37
Wall Insulation South	65	61

A.1.1 HVAC Measures

Furnace Tune-Up

Cadmus referred to the Illinois TRM V7 methodology (as there was no applicable savings methodology in the 2015 Indiana TRM v2.2), which used this formula to calculate savings per furnace tune-up:⁶²

$$\Delta Therms = \frac{\left(CAPInput_{Pre} * EFLH * \left(\frac{1}{AFUE * (1 - Derating_{Pre})} - \frac{1}{AFUE * (1 - Derating_{Post})} \right) \right)}{100,000}$$

Where:

CAPInput _{Pre}	=	Gas furnace input capacity pre tune-up (BTUH)
EFLH	=	Equivalent full load hour (EFLH) for furnaces
AFUE	=	Annual fuel utilization efficiency % for the baseline equipment
Derating _{Pre}	=	Furnace AFUE derating before HVAC tune-up
Derating _{Post}	=	Furnace AFUE derating after HVAC tune-up

To determine EFLH, each install was matched to its nearest 2015 Indiana TRM v2.2 reference city using the install location's zip code. The FLH associated with that reference city was then used in the savings calculation for the install. Cadmus used the 2012 Residential Baseline Report to determine heating system efficiency.⁶³ The report summarizes findings from a telephone survey of 400 households and from an on-site energy assessment of 291 single-family and multifamily homes across Indiana. The study sought to document the types and characteristics of energy-consuming equipment in Indiana homes along with residents' awareness, attitudes, and knowledge of energy efficiency and conservation behaviors. Table A-2 shows the other variables used in this evaluation.

Table A-2. 2019 Residential Prescriptive Program Furnace Tune-Up Calculation Variables

Variable	Value	Units	Source
CAPInput _{Pre}	78,004	BTUH	2019 program tracking data; based on average value of furnace measures
AFUE	84.8%	%	Indiana 2012 Baseline Report ¹
Derating _{Pre}	6.4%	%	Illinois TRM V7
Derating _{Post}	0%	%	Illinois TRM V7
Conversion	100,000	BTUH/therm	Constant

¹ TecMarket Works. November 2, 2012. *Residential Baseline Report*.

⁶² Illinois Energy Efficiency Stakeholder Advisory Group. September 28, 2018. *2019 Illinois Statewide Technical Reference Manual for Energy Efficiency Version 7.0*. https://s3.amazonaws.com/ilsag/IL-TRM_Effective_010119_v7.0_Vol_3_Res_092818_Final.pdf

⁶³ TecMarket Works. November 2, 2012. *Residential Baseline Report*.

Natural Gas Boilers

Cadmus assessed natural gas savings for boilers installed in residential settings. Cadmus used the 2015 Indiana TRM v2.2 to calculate space heat savings for each boiler installed, based on the program tracking data. This method follows the Uniform Methods Project's preferred evaluation protocol for calculating boiler savings (excluding ISR).⁶⁴

$$\text{Therms Savings} = \text{EFLH} \times \text{BTUH} * \left(\frac{\text{AFUE}_{\text{eff}}}{\text{AFUE}_{\text{base}}} - 1 \right) / \text{Conversion}$$

To determine EFLH, each install was matched to its nearest 2015 Indiana TRM v2.2 reference city using the install location's zip code. The FLH associated with that reference city was then used in the savings calculation for the install. Table A-3 shows the other variables used in this evaluation.

Table A-3. 2019 Residential Prescriptive Program Natural Gas Boiler Calculation Variables

Variable	Value	Units	Source
AFUE _{eff} = Efficiency of efficient boiler	Varies	%	Program tracking data; verified with AHRI database
BTUH = Boiler capacity	Varies	BTUH	Program tracking data; verified with AHRI database
AFUE _{base} = Baseline unit efficiency	82% for replace-on-burnout; Varies for early replacement	%	Federal standards for boilers (current and historic)
Conversion	100,000	BTUH/therm	Constant

Early Replacement Units

The program tracking data did distinguish between early replacement and replace on burnout units, but the field was not consistently populated. Therefore, Cadmus determined an early replacement proportion using installation data across all three furnace and boiler measures. This grouping is consistent with that used in the Residential Prescriptive Program participant survey. Cadmus further vetted these data by including only the installations with data entries for "equipment age" and "condition of existing unit." Cadmus considered any installation in this final group with an equipment age less than 20 years and an operable condition to be an early replacement installation.

Using this approach, in 2019, 22% of boiler installations qualified as early replacement and 78% as replace-on-burnout. Cadmus then applied these percentages to their corresponding baseline AFUE values to arrive at an average baseline AFUE value, one that accounted for this distribution of retrofit and early replacement and could be applied to all installations.

⁶⁴ National Renewable Energy Laboratory and David Jacobson. September 2017. "Chapter 5: Residential Furnaces and Boilers Evaluation Protocol." *The Uniform Methods Project*.
<https://www.energy.gov/eere/about-us/ump-protocols>

Efficiency metrics of baseline equipment for early replacement cases were based on appropriate federal standard values for AFUE. Table A-4 shows these values.

Table A-4. 2019 Mechanical System Efficiency by Age

Mechanical Systems	Units	1992-2012	2012-2021
Gas Boiler	AFUE	0.80	0.82

Natural Gas Furnaces

Cadmus started with the 2015 Indiana TRM v2.2 methodology, which used this formula to calculate savings per furnace installed:

$$MMBtu\ Savings = Capacity\ (BTUH) \times EFLH \times \left(1 - \frac{AFUE_{base}}{AFUE_{ee}}\right) \times 10^{-6}$$

Where:

Capacity (BTUH)	=	Actual size of equipment in BTUH input capacity
EFLH	=	Equivalent full load hour (EFLH) for furnaces
	=	Values consistent with the 2015 Indiana TRM v2.2

To determine EFLH, each install was matched to its nearest 2015 Indiana TRM v2.2 reference city using the install location's zip code. The FLH associated with that reference city was then used in the savings calculation for the install.

AFUE _{base}	=	Annual fuel utilization efficiency % for the baseline equipment
	=	80% for existing and new construction applications
EFF _{ee}	=	Annual fuel utilization efficiency % for the efficient equipment
	=	Actual installed

The values provided in the 2015 Indiana TRM v2.2 for FLH_{HEAT} were developed using a modeling tool under the assumption that the baseline furnaces were exactly sized to meet peak heating demand. Because residential furnaces are sized in 15,000 to 20,000 Btu increments, furnaces are typically oversized in residential applications to ensure that the unit can supply enough heat to meet a household's peak heating demand. The more oversized a furnace is compared to the heat load of the house, the fewer hours it will run.

Additionally, much of the time, an older standard-efficiency furnace is replaced with a more efficient unit with the same input capacity. Although the TRM full load hours correspond to a perfectly sized furnace, in practice, contractors traditionally oversize furnaces. This disconnect would lead Cadmus to overestimate savings when using the 2015 Indiana TRM v2.2 assumptions. To correct for this, Cadmus developed and applied an oversizing factor of 20% to the 2015 Indiana TRM v2.2 full load hours of the

baseline furnace.⁶⁵ Cadmus also applied an oversizing factor to the efficient furnace that was proportional to the efficiencies of the installed unit and the baseline unit.

$$\text{Efficient Unit Oversizing Factor} = 120\% \times AFUE_{Eff} / AFUE_{Base}$$

Where:

$$120\% = \text{Oversizing factor of baseline unit}$$

Cadmus used the modified equation to determine per-unit savings:

$$\frac{MMBtu \text{ Savings} = FLH_{Heat} \times BTUH \times (AFUE_{Eff} / AFUE_{Base} - 1) \times 10^6}{\text{Efficient Unit Oversizing Factor}}$$

Early Replacement Units

The program tracking data did distinguish between early replacement and replace on burnout units, but the field was not consistently populated. Therefore, Cadmus determined an early replacement proportion using installation data across all three furnace and boiler measures. This grouping is consistent with that used in the Residential Prescriptive Program participant survey. Cadmus further vetted these data by including only the installations with data entries for “equipment age” and “condition of existing unit.” Cadmus considered any installation within this final group with an equipment age less than 20 years and an operable condition to be an early replacement install. Using this approach, in 2019, 22% of furnace installations qualified as early replacement.

Efficiency metrics of baseline equipment in early replacement cases were based on appropriate federal standard values for AFUE, as shown in Table A-5.

Table A-5. 2019 Mechanical System Efficiency by Age

Mechanical Systems	Units	1992-2015	2015-present
Gas Furnace	AFUE	0.78	0.8

A.1.2 Thermostat Measures

Smart Programmable and Nest Online (learning), and Wi-Fi Thermostats (non-learning)

The Residential Prescriptive Program offers three types of Wi-Fi-enabled thermostat measures:

- Nest Online Store (learning)
- Smart programmable thermostats (mostly learning)
- Wi-Fi thermostats (mostly non-learning)

⁶⁵ Based on 2012 JOSB Vectren Evaluation that included communication with Peter Jacobs, who developed building simulations for the Indiana TRM version 1.

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Cadmus calculated smart programmable, Nest Online, and Wi-Fi thermostat savings using the following equation (excluding in-service rate):⁶⁶

$$\text{Annual therm Savings} = \Delta \text{Therms}_{\text{AdjustedBaseline}} * \%_{\text{GAS}} * \text{TStat_Type}_{\text{DiscountRate}}$$

Where:

$\%_{\text{GAS}}$ is 100% for gas heating equipment and 93% for unknown heating equipment

$\text{TStat_Type}_{\text{DiscountRate}}$ is 100% for learning thermostats and 31% for non-learning thermostats^{67,68}

Cadmus used the same savings methodology for all three categories of thermostats, although the savings differ because of differences in the proportion of learning and non-learning thermostats in each category.⁶⁹ The distinction between learning and non-learning thermostats, as well as the implications to the energy savings, are discussed in this section.

Each thermostat category has two measures, one for Vectren South territory and one for Vectren's North territory. The 2013-2014 evaluation of programmable and smart thermostats,⁷⁰ which Cadmus used to derive savings, was conducted in Vectren South territory. The full load hours used in that study were informed by the 2015 Indiana TRM v2.2 for Evansville. To account for regional and location differences, Cadmus performed a full load hours heat adjustment. Each installation was matched to its nearest 2015 Indiana TRM v2.2 reference city. The full load hours associated with that reference city was then used in conjunction with the full load hours of Evansville to account for changes in climate.

2013-2014 Thermostat Evaluation and Adjusted Baseline

The analysis of smart programmable thermostat savings used the results of Cadmus' 2013-2014 evaluation of programmable and Nest Wi-Fi thermostats in Vectren South territory.⁷¹ This evaluation reports household heating energy savings of 30 therms for programmable thermostats and 69 therms Nest Wi-Fi thermostats. This study had a 100% manual thermostat baseline for both programmable and

⁶⁶ This equation modifies the savings reported in this report. Cadmus. January 29, 2015. *Evaluation of the 2013–2014 Programmable and Smart Thermostat Program*.

⁶⁷ The percentage gas ($\%_{\text{GAS}}$) was taken from the 2019 Residential Prescriptive Program participant survey.

⁶⁸ According to a 2015 Cadmus thermostat evaluation for a Midwestern utility, there is a significant difference in savings between Nest Wi-Fi thermostats and other Wi-Fi thermostats. The results of this study yielded a heating savings discount rate of 31% for non-Nest Wi-Fi thermostats. Cadmus' 2016 evaluation for Vectren supported the conclusion of a difference in savings between Nest and non-Nest thermostats.

⁶⁹ Cadmus reviewed thermostat capabilities using model numbers to determine whether each was learning or non-learning.

⁷⁰ Cadmus. January 29, 2015. *Evaluation of the 2013–2014 Programmable and Smart Thermostat Program*.

⁷¹ Ibid.

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Nest Wi-Fi thermostats. However, in 2019, the survey of Residential Prescriptive Program participants found that thermostat equipment saturation was 22% for manual thermostats and 78% for programmable thermostats.

Cadmus used the reported household cooling and heating savings from its study for programmable thermostats and a weighted average to adjust the savings for Nest thermostats from a manual thermostat baseline to a mixed manual and programmable thermostat baseline.

$$\Delta Therms_{AdjustedBaseline} = 22\% * 69.0 + 78\% * (69.0 - 18.5) = 54.6 \text{ therms}$$

Where:

18.5 represents the heating savings (30 therms * 62% correct use factor) for programmable thermostats compared to a manual baseline.⁷²

Learning and Non-Learning Wi-Fi Thermostats

The 2013-2014 thermostat evaluation concerned Nest Wi-Fi thermostats only. In 2019, the Residential Prescriptive Program tracking data recorded many more models of Wi-Fi thermostats. According to a 2015 Cadmus study,⁷³ there is a significant difference in savings between Nest Wi-Fi thermostats and other Wi-Fi thermostats; this study yielded a heating savings discount rate of 31% for non-Nest Wi-Fi thermostats. Results of Cadmus' evaluation of Vectren's 2016 Smart Thermostat Pilot supported this conclusion.⁷⁴

The Vectren 2013-2014 Programmable and Smart Thermostat Program Evaluation indicates that heating savings are highly dependent on the type of thermostat—heating savings are 5% for programmable thermostats and 12.5% for smart Wi-Fi thermostats. Cadmus did not discount specific name brands without direct supporting evidence and instead took a features-based approach by determining if each thermostat in the tracking data exhibited learning features. For the 2019 evaluation, Cadmus applied the 31% discount rate to the heating savings of all non-learning thermostat installations.⁷⁵

Vectren's thermostat offerings for 2019 align with this evaluation approach, segmenting Wi-Fi-enabled thermostats into three separate thermostat measures: Nest, smart programmable, and Wi-Fi thermostats. Nest thermostats are all learning thermostats, so Cadmus did not apply the 31% discount

⁷² The correct use rate is the percentage of homeowners that use their basic programmable or non-learning Wi-Fi thermostat in an energy-saving manner (i.e., by turning the setpoint down in the winter).

⁷³ Cadmus conducted an evaluation of thermostats for a Midwest utility, but the report is not publicly available.

⁷⁴ Cadmus. August 8, 2017. *Vectren Residential Smart Thermostat Program 2016 Energy Savings Analysis*.

⁷⁵ Examples of learning Wi-Fi enabled thermostats are all Nest thermostats, Ecobee3, and Honeywell Lyric, which all have advanced features that Cadmus believes are attributable to higher savings. These features include occupancy detection, heat pump lockout temperature control, upstaging and downstaging, optimal humidity/humidity control/air conditioner overcool, fan dissipation, behavioral features, and free cooling/economizer capability.

rate to the heating savings. Cadmus found that thermostats rebated through the smart programmable thermostats measure were overwhelmingly learning thermostats, which meant applying the 31% discount to only a handful of thermostats determined to be non-learning for this measure.

Cadmus found that thermostats rebated through the Wi-Fi thermostats measure were overwhelmingly non-learning, which meant applying the 31% to all but a handful of thermostats for this measure. All differences in savings between these thermostat variants are because of the proportion of learning thermostats in each thermostat measure.

A.1.3 Weatherization Measures

Attic and Wall Insulation

This algorithm from the 2015 Indiana TRM v2.2 served as the basis to calculate and verify energy saving (excluding ISR):

$$\text{Annual (Energy or Demand) Savings} = kSF \times \frac{(\text{Energy or Demand) Savings}}{kSF}$$

Where:

kSF	=	Area of installed insulation (1,000 square feet)
	=	Actual installed
$\frac{(\text{Energy or Demand) Savings}}{kSF}$	=	Unit energy or demand savings per 1,000 square feet of insulation. Dependent on recorded pre-and post R-value conditions.

Energy savings (MMBTU/kSF) differed based on heating, cooling, and measure type using a series of lookup tables in the 2015 Indiana TRM v2.2. Cadmus used gas furnace with air conditioner lookup tables for these measures. Cadmus based its assumptions on data collected in the 2019 Residential Prescriptive Program participant survey.

Energy savings per installation depended on pre- and post-retrofit insulation R-values, which Cadmus calculated using a three-step process. For the few cases where these R-values were not recorded, Cadmus used the average pre- and post-retrofit value for calculating saving in the following steps:

1. Determine variables to use for insulation compression, R_{ratio} , and void factors.
2. Calculate adjusted pre- and post-retrofit R-values using the inputs from step one.
3. Interpolate the 2015 Indiana TRM v2.2 tables to calculate savings using the adjusted R-values from step two.

Variables to Use for Insulation Compression, R_{ratio} , and Void Factors

Cadmus adjusted R-values to account for compression, void factors, and surrounding building material. To calculate these adjusted pre- and post-retrofit R-values, this formula was used:

$$R \text{ value Adjusted} = R_{nominal} \times F_{compression} \times F_{void}$$

Where:

- $R_{nominal}$ = Actual pre- and post-retrofit R-values per manufacturing specifications.
- $F_{compression}$ = Compression factor dependent on the percentage of insulation compression. Cadmus assumed a value of 1 at 0% compression for the evaluation.
- F_{void} = Void factor, which accounted for insulation coverage and was dependent on installation grade level, pre- and post-retrofit R-values and compression effects.

This equation determined F_{void} :

$$R_{ratio} = (R_{nominal} \times F_{compression}) \times ((R_{nominal} \times R_{framing\ and\ air\ space}))$$

Where:

- $R_{nominal}$ = As stated above.
- $F_{compression}$ = As stated above.
- $R_{framing/airspace}$ = R-value for material, framing, and air space of the installed insulation's surrounding area. Cadmus used R-5 for this evaluation, as recommended in the 2015 Indiana TRM v2.2.

Table A-6 lists the void factor based on the calculated R_{ratio} . Cadmus used a 2% void factor since this information was unknown.

Table A-6. 2015 Indiana TRM v2.2: Insulation Void Factors

R_{ratio}	Void Factor	
	2% Void (Grade II)	5% Void (Grade III)
0.50	0.96	0.90
0.55	0.96	0.90
0.60	0.95	0.88
0.65	0.94	0.87
0.70	0.94	0.85
0.75	0.92	0.83
0.80	0.91	0.79
0.85	0.88	0.74
0.90	0.83	0.66
0.95	0.71	0.49
0.99	0.33	0.16

Adjusted R-values

Applying the formula above ($R_{value\ Adjusted}$), Cadmus used the inputs defined in step one to calculate adjusted R-values for pre- and post-installation. Cadmus calculated adjusted R-values for every installation in the database.

Interpolate 2015 Indiana TRM v2.2 Tables

Cadmus used the pre- and post-installation adjusted R-values from step two to interpolate energy for every 2019 installation. Appendix C of the 2015 Indiana TRM v2.2 defines energy savings for insulation measures by heating and cooling equipment.

Duct Sealing

Cadmus calculated duct sealing gas savings using the following equation (excluding ISR):

$$\text{Annual Heating Therms Savings} = \frac{DE_{AFTER} - DE_{BEFORE}}{DE_{AFTER}} * EFLH_{HEAT} * \frac{Btuh_{HEAT}}{100,000 * \eta_{HEAT}}$$

Because program-specific information was not available regarding pre-existing conditions, to determine the distribution efficiency before (DE_{before}), Cadmus used the average distribution efficiency for cases between no observable leaks and catastrophic leaks. Cadmus used the 2015 Indiana TRM v2.2 to determine the values for distribution efficiency peak before and after ($DEPK_{BEFORE}$ and $DEPK_{AFTER}$) for the appropriate DE_{before} and DE_{after} values.

To determine EFLH, each install was matched to its nearest 2015 Indiana TRM v2.2 reference city using the install location's zip code. The FLH associated with that reference city was then used in the savings calculation for the install. Table A-7 shows the inputs Cadmus used to evaluate impacts for this measure.

Table A-7. 2019 Residential Prescriptive Program Duct Sealing Input Variables

Input	Input Definition	Cadmus Value	Cadmus Source
DE_{AFTER}	Distribution efficiency of ductwork after dealing sealing	87%	Used the following reference (listed in the 2015 Indiana TRM v2.2): http://www.bpi.org/files/pdf/DistributionEfficiencyTable-BlueSheet.pdf Percentage of ducts in conditioned space was unknown. Assumed the average of all potential values under "Connections Sealed with Mastic."
DE_{BEFORE}	Distribution efficiency of ductwork before dealing sealing	76%	Used the following reference (listed in the 2015 Indiana TRM v2.2): http://www.bpi.org/files/pdf/DistributionEfficiencyTable-BlueSheet.pdf Percentage of ducts in conditioned space was unknown. Assumed the average of all potential values under "No Observational Leaks," "Some Observed Leaks," "Significant Leaks," and "Catastrophic Leaks."
$DEPK_{AFTER}$	DE for use in peak demand savings	85%	2015 Indiana TRM v2.2
$DEPK_{BEFORE}$	DE for use in peak demand savings	73%	2015 Indiana TRM v2.2
$Btuh_{HEAT}$	Heating system capacity – gas furnace	78,004 BTUH	Average from 2019 Residential Prescriptive Program gas furnace tracking data
η_{HEAT}	Efficiency of heating system – gas furnace	AFUE = 84%	Indiana 2012 Baseline Report ¹

¹ TecMarket Works. November 2, 2012. *Residential Baseline Report*.

Cadmus used the 2012 Residential Baseline Report to determine heating system efficiency.⁷⁶ Cadmus also used program tracking data to determine average furnace capacity.

⁷⁶ TecMarket Works. November 2, 2012. *Residential Baseline Report*.

A.2 Residential New Construction Program

Cadmus' impact evaluation of the Residential New Construction program included measures with attributable natural gas savings, including these:

- Gold Star Homes (Dual Fuel)
- Gold Star Homes (Gas Only)
- Platinum Star Homes (Dual Fuel)
- Platinum Star Homes (Gas Only)
- Habitat for Humanity kits (Gas Only)
- Habitat for Humanity kits (Dual Fuel)

Table A-8 provides per-unit annual gross savings for each program measure.

Table A-8. 2019 Residential New Construction Per-Unit Gross Savings

Measure	Annual Gross Savings (therms)	
	Reported	Evaluated
New Construction		
Gold Star (Dual Fuel)	336	243
Gold Star (Gas Only)	336	243
Platinum Star (Dual Fuel)	500	361
Platinum Star (Gas Only)	500	361
Habitat for Humanity Kits		
Habitat For Humanity Kit (Dual Fuel)	93	44
Habitat For Humanity Kit (Gas Only)	94	69

A.2.1 New Construction

Cadmus evaluated gross savings for RNC Program homes by drawing a random sample of builder applications from 2019 participants, recording critical home data, such as square footage, insulation levels, and HVAC efficiencies from HERS certificates. Cadmus modeled program home savings for this sample using REM/Rate V16.0 software then applied the sample's realization rate to the overall *ex ante* program savings to estimate *ex post* per-unit and program-level savings.⁷⁷ Cadmus found that 2019 evaluated savings were lower than reported savings (Vectren's reported savings derived from 2017 evaluated savings).

Program homes achieved HERS scores averaging 61 points—two points less than the program requirement of 63—which builders achieved through high-efficiency lighting, high levels of insulation, tight building envelopes, sealed duct systems, and insulated windows.⁷⁸ Smaller homes generally achieve lower energy savings because the baseline and efficient consumption of a smaller home is less. 2019 homes were smaller, averaging 3,000 square feet compared to 3,500 square feet in 2017.

⁷⁷ REM/Rate V16.0 was released in December 2019. The 2017 evaluation used REM/Rate V15.7.1.

⁷⁸ The lower the HERS score, the higher the efficiency of the home.



In 2019, Cadmus reviewed 123 random REM/Rate and Ekotrope-generated HERS reports for home characteristics. Table A-9 shows sample used to generate the average home characteristics in 2019.

Table A-9. 2019 Residential New Construction Program Homes Sample

Measure	2019 Participants	Sample
Gold Star (Gas Only)	559	38
Gold Star (Dual Fuel)	91	29
Platinum Star (Gas Only)	215	23
Platinum Star (Dual Fuel)	99	33

Cadmus compiled characteristics of these 123 HERS reports into a database for energy modeling (REM/Rate V16.0).⁷⁹ Table A-10 presents the average home characteristics from the REM/Rate review in 2015 to 2019 program years.

Table A-10. 2015-2019 Program Home Characteristics

Home Characteristic	Program Year ¹					Changes in Program Home Characteristics from 2018
	2015	2016	2017	2018	2019	
Sample Size	30	30	115	112	123	Higher Sample Size
Participants	927	918	817	845	964	More Participants
Precision at 90% confidence ²	15%	15%	8%	8%	7%	Higher Precision
Home Size	2,431	3,191	3,503	3,257	3,038	Smaller home size
Ceiling R Value	38	40	40	40	40	No change
Walls R Value	15	15	16	16	15	Lower efficiency
Basement Wall R Value	10	11	12	11	12	Higher Efficiency
Crawlspace Wall R Value	11	11	12	11	11	No change
Windows U Factor ³	0.302	0.302	0.302	0.302	0.307	Lower efficiency
Home Tightness ACH50 ³	3.92	3.42	3.13	3.16	3.28	Less air-tight
Duct Tightness CFM25/100 sq.ft. ³	3.42	2.82	2.27	2.19	2.80	Less air-tight
Furnace AFUE	94	93	94	94	94	No change
AirConditioner SEER	14.3	13.5	13.7	13.7	13.8	Higher efficiency
Percentage High-Efficiency Lighting	69%	81%	76%	86%	100%	Higher efficiency
Gas Water Heat Energy Factor	0.9	0.87	0.85	0.88	0.87	Lower efficiency
Electric Water Heat Energy Factor	N/A	0.95	0.95	0.93	0.93	No change

¹ All values rounded.

² Cadmus calculate 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.

³Lower value represents higher efficiency.

⁷⁹ Cadmus requested 132 HERS certificates, but nine certificates were not readable or did not include home characteristics information.



Characteristics for 2015 and 2016 are based on a sample of 30 homes. In 2017 and 2018, Cadmus drew a sample of 115 and 112 homes respectively, to increase the precision of population estimates. In 2019, Cadmus drew a sample of 123 homes. Of these, 37 had electric water heaters.

Since 2015, typical characteristics of program homes have remained relatively constant. Space and water heating efficiencies, for example, are almost identical in 2019 and 2015. However, home and duct tightness, very similar in 2017 and 2018, was less efficient (leaked more air) in 2019.

To evaluate natural gas savings for participating homes, Cadmus developed 13 prototype energy models,⁸⁰ using characteristics of the homes documented in the HERS certificates submitted to the program (Table A-10, above). Models represented typical characteristics of the sampled participants (Table A-11).

Table A-11. Prototype Model Iterations

Foundation Type	Water Heating	Weather Location
Conditioned Basement	Electric Tank	Evansville
Conditioned Basement	Gas Tankless	Evansville
Slab on Grade	Electric Tank	Evansville
Slab on Grade	Gas Tankless	Evansville
Conditioned Crawlspace	Gas Tank	Evansville
Conditioned Crawlspace	Gas Tankless	Evansville
Conditioned Basement	Electric Tank	Indianapolis
Conditioned Basement	Gas Tank	Indianapolis
Conditioned Basement	Gas Tankless	Indianapolis
Slab on Grade	Electric Tank	Indianapolis
Slab on Grade	Gas Tank	Indianapolis
Slab on Grade	Gas Tankless	Indianapolis
Slab on Grade	Gas Tankless	Fort Wayne

Cadmus calculated gas savings as the difference between the baseline energy code model and the modeled home for each of the 13 prototypes. Cadmus established the characteristics in the baseline models using the 2011 Indiana Energy Code and current federal standards.

Cadmus calculated program realization rates as the evaluated savings divided by the reported savings of the modeled homes. The realization rate for gas savings was 72%, shown in Table A-12. Cadmus applied the realization rates to reported savings for Gold Star and Platinum Star homes. Realization rates for therms were driven by reduced efficiencies in wall and window insulation, more homes and ducts that leaked air, more high-efficiency lighting, and smaller home sizes. With more high-efficiency lighting,

⁸⁰ Prototype energy models represent simulated program homes. Prototype iterations did not vary by heating and cooling system, since there were no heat pumps in the sample.

there is less waste heat, which is made up for with higher therms consumption. Smaller homes generally achieve lower energy savings because the baseline and efficient consumption of a smaller home is less.

Table A-12. Modeled Prototypes Realization Rates

Annual Gross Savings Type	Reported (n=123)	Evaluated (n=123)	Realization Rate
Therms	50,566	36,501	72%

A.2.2 Habitat for Humanity Kits

Vectren offered two types of kits to Habitat for Humanity builders. One kit included dual fuel measures; the other kit included only gas only measures. The primary difference between the two types of kits was that lighting measures could be installed in homes with Vectren electric service. Additionally, the Habitat for Humanity builders reported different assumptions about the heating and cooling systems for the homes in which smart thermostats were installed, which resulted in different savings for the smart thermostats in each kit type.

Though each kit contained several individual measures, Vectren provided *ex ante* savings at the kit level. To establish a realization rate for each kit, Cadmus calculated the energy savings for each kit measure and multiplied these savings by the number of measures in the kit. To calculate per-measure savings Cadmus applied engineering algorithms from the 2015 Indiana TRM v2.2. The methods for calculating the gas savings for each kit measure are further discussed below.

Table A-13 shows the evaluated therms savings for each gas only kit measure, the number of measures include in the kit, the *ex ante* kits savings, and the overall realization rate for the kit.

Table A-13. Gas Only Kit Analysis

Measure	Quantity per kit	Evaluated Per-Unit therms
Bathroom Aerator 1 gpm - Gas Water Heater	1	0.36
Kitchen Aerator 1.5 gpm - Gas Water Heater	1	1.70
Low Flow Showerhead - Gas Water Heater	1	6.56
Smart Thermostat	1	60.26
	Measure Quantity	Total Kit therms (Ex Post)
Total Kit Savings	4	68.88
		Ex Ante Kit therms
		94
		Kit Therms Realization Rate
		74%

Table A-14 shows the evaluated therms savings for each dual fuel kit measure, the number of measures include in the kit, the *ex ante* kits savings, and the overall realization rate for the kit.

Table A-14. Dual Fuel Kit Analysis

Measure	Quantity per Kit	Per-Unit therms
Bathroom Aerator 1 gpm - Gas Water Heater	1	0.36
Kitchen Aerator 1.5 gpm - Gas Water Heater	1	1.70
Low Flow Showerhead - Gas Water Heater	1	6.56
Smart Thermostat	1	41.35
	Measure Quantity	Total Kit therms (Ex Post)
Total Kit Savings	4	43.63
		Ex Ante Kit therms
		93
		Kit Therms Realization Rate
		47%

Kitchen and Bathroom Aerators

Cadmus used the following equation to calculate savings per faucet aerator installed:

$$\text{Therm Savings} = \text{ISR} * \% \text{Fuel} * (\text{GPM}_{\text{BASE}} - \text{GPM}_{\text{LOW}}) * \text{MPD} * \frac{\text{PH}}{\text{SH}} * \text{DR} * 8.3 * (T_{\text{MIX}} - T_{\text{IN}}) * \frac{365}{\text{RG} * 100,000}$$

Cadmus calculated savings for kitchen and bathroom faucet aerators distributed through the Habitat for Humanity kits using values from the 2015 Indiana TRM v2.2 and data from Vectren Energy Efficient School Kits Program analysis, as shown in Table A-15.

Table A-15. Kitchen and Bathroom Faucet Aerator Savings Inputs

Input	Kitchen Faucet Assumption	Bathroom Faucet Assumption	Source
Faucet Usage (Minutes/Day/Person)	4.5	1.6	2015 Indiana TRM v2.2
Number of Faucets per Home	1	2	2015 Indiana TRM v2.2 (single-family)
Average Household Size (Number of People)	2.64	2.64	2015 Indiana TRM v2.2 (single-family)
Input Water Temperature to House (°F)	58.9	58.9	2015 Indiana TRM v2.2. Statewide average
Temperature of Water at Faucet (°F)	93	86	2015 Indiana TRM v2.2
Percent of Water Flowing Down Drain	50%	70%	2015 Indiana TRM v2.2
Gallons per Minute of Baseline Faucet Aerator	2.2	1.9	Federal standard/2015 Indiana TRM v2.2
Gallons per Minute of Energy-Efficient Faucet Aerator	1.5	1.0	Provided by Vectren
Recovery Efficiency of Gas Hot Water Heater	0.98	0.98	2015 Indiana TRM v2.2
In-service rate (ISR)	43%	36%	2019 School Kits Analysis
% Gas Fuel	70%	70%	2019 program homes

Low Flow Showerheads

Cadmus used the following equation to calculate savings per energy-efficient showerhead installed:

$$\text{Therm Savings} = \text{ISR} * \% \text{Fuel} * (\text{GPM}_{\text{BASE}} - \text{GPM}_{\text{LOW}}) * \text{MS} * \text{SPD} * \frac{\text{PH}}{\text{SH}} * 8.3 * (T_{\text{MIX}} - T_{\text{IN}}) * \frac{365}{\text{RG} * 100,000}$$

To inform the energy-savings estimate, Cadmus used the 2015 Indiana TRM v2.2 and in-service rates collected through surveys for the Energy Efficient School Kits Program. Table A-16 shows these inputs.

Table A-16. Low-Flow Showerhead Inputs

Input	Assumption	Source
Average Shower Length (Minutes)	7.8	2015 Indiana TRM v2.2
Average Household Size (Number of People)	2.64	2015 Indiana TRM v2.2 (single-family homes)
Number of Showerheads per Home	1.6	2015 Indiana TRM v2.2
Number of Showers per Day per Person	0.6	2015 Indiana TRM v2.2
Input Water Temperature to House (°F)	58.9	2015 Indiana TRM v2.2. Statewide average.
Water Temperature at Showerhead (°F)	101	2015 Indiana TRM v2.2
Gallons per Minute of Baseline Showerhead	2.63	2015 Indiana TRM v2.2
Gallons per Minute of Energy-Efficient Showerhead	1.50	Provided by Vectren
Recovery Efficiency of Gas Hot Water Heater	0.98	2015 Indiana TRM v2.2
In-service rate (ISR)	43%	2019 School Kits Analysis
% Gas Fuel	70%	2019 Program Homes

Smart Thermostats

Cadmus calculated smart thermostat savings using the following equation

$$\text{Annual therm Savings} = \Delta \text{Therms}_{\text{AdjustedBaseline}} * \%_{\text{GAS}} * T_{\text{Stat_TypeDiscountRate}} * \text{ISR}$$

Where:

$\%_{\text{GAS}}$ is 100% for gas heating equipment and 0% for electric heating equipment

$T_{\text{Stat_TypeDiscountRate}}$ is 100% for learning thermostats and 31% for non-learning thermostats.⁸¹

⁸¹ According to a 2015 Cadmus thermostat evaluation for a Midwestern utility, there is a significant difference in savings between Nest Wi-Fi thermostats and other Wi-Fi thermostats. The results of this study yielded a heating savings discount rate of 31% for non-Nest Wi-Fi thermostats. Cadmus' 2016 evaluation of Vectren's Residential Prescriptive Program supported the conclusion of a difference in savings between Nest and non-Nest thermostats.



This methodology allows for the savings to differ significantly depending on whether or not the thermostat is considered to be a learning thermostat. For the RNC Program, Cadmus assumed all savings from smart thermostats in this program came from devices categorized as learning thermostats. Cadmus selected TRM reference cities for each builder based on proximity, enabling EFLH values to be determined from the given values in the 2015 IN TRM v2.2 associated with these reference cities. Based on the builder's locations, the EFLH values between the two thermostat types differed as each builder was mapped to a different TRM reference city.

The gas-only thermostat calculations used an EFLH value of 1,356 while the dual fuel thermostat calculations used an EFLH value of 982. This resulted in the difference in heating savings observed.

To inform other inputs for the savings calculations, Cadmus interviewed the Habitat for Humanity builders who received each kit type. Their responses provided inputs for heating equipment type, saturations, and air conditioner saturation. These interviews revealed a difference in air conditioner saturation. The gas-only thermostats were placed in homes entirely without central air conditioning, while the dual fuel thermostats were installed only in homes that had central air conditioners.

Table A-17 shows the smart programmable thermostat input variables.

Table A-17. Smart Programmable Thermostats Input Variables

Variable	Value	Units	Source
$TStat_Type_{COOLING}DiscountRate$	100%	%	The 2013–2014 Thermostat Evaluation indicates that heating savings are highly dependent on thermostat technology and that cooling savings are not.
$\Delta Therms_{AdjustedBaseline}$	50.5	Therms	Vectren Programmable and Smart Thermostat Program evaluation
$\%_{ER}$	0%	%	2019 RNC Interview Results
Gas-Only $\%_{GAS}$	100%	%	2019 RNC Interview Results
Dual Fuel $\%_{GAS}$	0%	%	2019 RNC Interview Results
Gas-Only $\%_{AC}$	0%	%	2019 RNC Interview Results
Dual Fuel $\%_{AC}$	100%	%	2019 RNC Interview Results
In Service Rate (ISR)	98%	%	2018 Focus on Energy Evaluation Report ¹

¹ Cadmus. May 17, 2019. *Focus on Energy Calendar Year 2018 Evaluation Report*.
https://focusonenergy.com/sites/default/files/WI_FOE_CY_2018_Volume_II.pdf

2013-2014 Thermostat Evaluation and Adjusted Baseline

The analysis of smart thermostat savings used the results of Cadmus' 2013-2014 evaluation of programmable and Nest Wi-Fi thermostats in Vectren South territory.⁸² This evaluation reports household heating energy savings of 30 therms for programmable thermostats and 69 therms Nest Wi-Fi thermostats.

⁸² Cadmus. January 29, 2015. *Evaluation of the 2013–2014 Programmable and Smart Thermostat Program*.

CADMUS

The 2013-2014 thermostat evaluation used a 100% manual thermostat baseline for both programmable and Nest Wi-Fi thermostats. However, the 2019 Residential New Construction Program has a 100% programmable thermostat baseline as state code requires programmable thermostats in new homes.

Cadmus used the reported household cooling and heating savings for programmable thermostats from the 2014 Cadmus thermostat study and adjusted the savings for Nest thermostats from a manual thermostat baseline to a programmable thermostat baseline.

Another important adjustment to the 2013-2014 baseline therms savings is related to EFLH. The 2013-2014 Cadmus thermostat study was exclusively based on thermostats in southern Indiana regions with a correlated TRM reference city EFLH value of 982. A proportional adjustment to this EFLH value is shown in this equation:

$$\Delta Therms_{AdjustedBaseline} = 0\% * 69.0 + 100\% * (69.0 - 18.5) * \left(\frac{EFLH}{982}\right) = 50.5 \text{ therms}$$

Where:

18.5 represents the heating savings from the 2013-2014 thermostat evaluation adjusted to account for the percentage of people who use their programmable thermostat in an energy-saving manner (30 therms * 62% correct use factor).

A.3 Home Energy Assessment (HEA 2.0) Program

Cadmus' impact evaluation of the HEA 2.0 Program included measures with attributable natural gas savings, including these:

Water-saving devices

- Bathroom aerator
- Kitchen aerator
- Efficient showerhead

HVAC and water heating measures

- Filter whistle
- Pipe insulation
- Water heater temperature setback
- Smart thermostat

Table A-18 provides per-unit annual gross savings for each program measure. Cadmus used inputs and algorithms from the 2015 Indiana TRM v2.2 with the following exceptions:

- For the water heater temperature setback measure as well as the thermostatic shower valve, Cadmus used the Illinois TRM Version 8.0 to evaluate savings.⁸³
- For smart thermostats, Cadmus used an evaluation from 2013-2014 of programmable and smart thermostats in Vectren South territory.⁸⁴

⁸³ Illinois Energy Efficiency Stakeholder Advisory Group. October 17, 2019. *Illinois Statewide Technical Reference Manual Version 8.0*. https://www.ilsag.info/technical-reference-manual/il_trm_version_8/

⁸⁴ Cadmus. January 29, 2015. *Evaluation of the 2013-2014 Programmable and Smart Thermostat Program*.

- For pipe insulation, Cadmus found that the 2015 Indiana TRM v2.2 algorithm made assumptions that most likely led to overestimating savings.

Table A-18. 2019 HEA 2.0 Program Per-Unit Gross Savings

Measure	Annual Gross Savings (therms)	
	Reported ¹	Evaluated
Audit Education		
Audit Fee	5.46	4.72
HVAC and Water Heating Measures		
Filter Whistle	17.77	14.72
Pipe Insulation	0.25	3.04
Smart Thermostat	46.87	54.10
Water Heater Setback	3.71	3.59
Water-Saving Devices		
Bathroom Aerator	0.40	0.86
Kitchen Aerator	5.04	6.29
Showerhead	9.05	9.89

¹The 2019 DSM Scorecard did not include per-unit gas savings. These are the audited per-unit gas savings from the 2019 program tracking data.

A.3.1 Audit Recommendations

Energy assessors gave HEA 2.0 Program participants home assessment reports that identified additional energy-efficient actions they could take to further reduce energy consumption. *Ex post* audit savings were specific to participants and based on survey response data from 87 participants in the HEA 2.0 Program. Of these respondents, 69% said they implemented one or more recommendations from the home assessment report. Home assessment reports had two types of recommended measures:

- Behavioral measures, which required homeowners to modify how they used energy in their homes
- Measures that required purchases and installations of equipment

Table A-19 shows household percentages for each recommended measure that HEA 2.0 Program participants reportedly engaged in after receiving a program assessment. Savings primarily came from programming the thermostat correctly and adding additional air sealing and weatherstripping. Although programmable thermostat savings still represent a significant portion of audit education savings, this decreased from 2016 because 67% of participants received a smart thermostat and therefore that component of audit education was not as relevant.

Table A-19. 2019 HEA 2.0 Program Household and Energy Saving Percentages per Recommended Measure

Recommendation	Percentage of Households that Reportedly Took Action
Behavioral Measures	
Turn off lights when not in use	65%
Take shorter showers	38%
Program thermostat with efficient settings (excludes recipients of smart thermostats through program)	58%
Unplug appliances when not in use	39%
Installation Measures	
Air sealing/weatherstripping	5%

Table A-20 shows the assumptions that went into the evaluated savings for each component. For all energy-saving actions, savings were adjusted to account for any efficient equipment that was installed. For taking shorter showerheads, this meant adjusting the baseline showerhead usage to account for the installed efficient equipment. For programming thermostats correctly, this meant not evaluating savings for participants who received thermostats.

Table A-20. 2019 HEA 2.0 Program Audit Education Savings Assumptions

Recommendation	Assumption	Source
Behavioral Measures		
Take shorter showers	5% reduction in time spent in shower. Household showerhead usage was adjusted to account for efficient showerheads installed.	Engineering judgement
Program thermostat with efficient settings (excludes recipients of smart thermostats through program)	Savings are equivalent to the evaluated savings from installing a new programmable thermostat replacing a manual thermostat.	Evaluation of the 2013-2014 Programmable and Smart Thermostat Program
Installation Measures		
Air sealing/weatherstripping	Additional air sealing and weatherstripping will achieve 50% of evaluated air sealing savings.	Engineering judgement

A.3.2 HVAC and Water Heating Measures

Furnace Filter Whistle

Cadmus used the following analysis equation from a Quantec study to calculate savings per filter whistle,⁸⁵ in combination with 2015 Indiana TRM v2.2 assumptions (excluding ISRs):

$$ThermSavings_{GasFurnace} = FLH_{heat} * \frac{\frac{BtuH_{gas}}{\mu_{gas}}}{100,000} * EF_{gas}$$

The savings inputs Cadmus used for its *ex post* calculations are shown in Table A-21.

Table A-21. 2019 HEA 2.0 Program Furnace Whistle Savings Inputs

Input	Assumption	Source
Efficiency savings for gas furnace (EFgas)	0.0185	Quantec analysis: Engineering Review and Savings Estimates for the "Filtertone" Filter Restriction Alarm
Size of gas furnace (BtuHgas)	Varies by customer	2019 HEA 2.0 participant tracking data
Heating efficiency (% μ_{gas})	Varies by customer	2019 HEA 2.0 participant tracking data
Full load heating hours (FLHcool)	982	2015 Indiana TRM v2.2: Evansville

Pipe Insulation

Cadmus used the following equation to calculate savings per water heater with temperature setback, using an energy savings factor from ACEEE Report Number E093:

$$Therm\ savings = ESF * GPD * 8.3 * 365 * (T_{set} - T_{in}) / (100000 * RG)$$

Cadmus did not use the Indiana TRM v2.2 methodology because it assumed that the average temperature difference between water heater-supplied water and ambient air temperature was constant for every foot of pipe. However, hot water does not flow constantly in most domestic residential water heating systems, so this TRM approach likely overestimates energy savings from pipe insulation. Cadmus assumed insulating water heater pipes saved an average 3% of annual hot water energy consumption based on the ACEEE report.⁸⁶ The savings inputs Cadmus used for its *ex post* calculations are shown in Table A-22.

⁸⁵ Reichmuth, Howard. Engineering Review and Savings Estimates for the "Filtertone" Filter Restriction Alarm. White paper prepared for Energy Technology Laboratories. Prepared by Quantec. n.d.

⁸⁶ American Council for an Energy-Efficient Economy. April 2009. ACEEE Report Number E093. *Potential for Energy Efficiency, Demand Response, and Onsite Solar Energy in Pennsylvania*.

Table A-22. 2019 HEA 2.0 Program Pipe Insulation savings Inputs

Input	Assumption	Source
Energy savings factor (ESF)	3%	ACEEE Report Number E093, assumption used in CL&P and UI PSD 2013
Gallons of water used per day (GPD)	56.8	Calculated using 2.47 average home size from 2019 HEA 2.0 survey data to interpolate daily usage, based on the relationship between gallons of water per day, per household vs. the number of people. 2015 Indiana TRM v2.2
Water heater temperature set point (°F, Tsetpoint)	135 / 120	Illinois TRM V7 default value, 120 if the customer received a water heater setback
Input water temperature to house (°F, Tin)	62.8	2015 Indiana TRM v2.2 for Evansville, IN, cold water temperature entering the DWH system
Conversion from Btu to Therms	3412	Conversion factor
Gas water heater recovery efficiency (RG)	76%	2015 Indiana TRM v2.2

Water Heater Temperature Setback

Cadmus used the following Illinois TRM Version 8.0 equations (measure not available in the 2015 Indiana TRM v2.2) to calculate savings per water heater with temperature setback (excluding ISR):⁸⁷

$$\text{Therm Savings} = (U * A * (T_{pre} - T_{post}) * \text{Hours}) / (100,000 * RG)$$

The savings inputs Cadmus used for its *ex post* calculations are shown in Table A-23.

Table A-23. 2019 HEA 2.0 Program Water Heater Temperature Setback Savings Inputs

Input	Assumption	Source
Heat transfer coefficient of tank (U)	0.083	Illinois TRM V7 default value
Surface area of tank (A)	24.99	Illinois TRM V7 default value
Water heater temperature before setback (Tpre)	135	Illinois TRM V7 default value
Water heater temperature before setback (Tpost)	120	2019 program tracking data
Hours in a year (Hours)	8760	2015 Indiana TRM v2.2
Gas water heater recovery efficiency (RG)	76%	2015 Indiana TRM v2.2

⁸⁷ Illinois Energy Efficiency Stakeholder Advisory Group. October 17, 2019. *Illinois Statewide Technical Reference Manual Version 8.0*. https://www.ilsag.info/technical-reference-manual/il_trm_version_8/

Smart Thermostats

Cadmus calculated smart thermostat savings using the following equation.⁸⁸

$$\text{Annual therm Savings} = \Delta\text{Therms}_{\text{AdjustedBaseline}}$$

The savings inputs Cadmus used for its *ex post* calculations are shown in Table A-24.

Table A-24. 2019 HEA 2.0 Program Smart Thermostat Savings Inputs

Cadmus Assumptions	Inputs	Units	Source
Therm Savings – Manual Baseline	69	Therms	Evaluation of the 2013-2014 Programmable and Smart Thermostat Program
Correct Use Factor – electric savings	100%	%	Cadmus assumed that 100% of smart thermostats were working as little user input is required
% Manual Thermostat	49%	%	2019 HEA 2.0 Tracking Data
% Programmable Thermostat	51%	%	2019 HEA 2.0 Tracking Data
$\Delta\text{Therms}_{\text{AdjustedBaseline}}$	59.53	Therms	Calculated

2013-2014 Thermostat Evaluation and Adjusted Baseline

The analysis of smart programmable thermostat savings used the results of Cadmus' 2013-2014 evaluation of programmable and Nest Wi-Fi thermostats in Vectren South territory.⁸⁹ This evaluation reports household heating energy savings of 30 therms for programmable thermostats and 69 therms Nest Wi-Fi thermostats. This study had a 100% manual thermostat baseline for both programmable and Nest Wi-Fi thermostats. However, in 2019, the program tracking data indicated that the thermostat equipment saturation among HEA 2.0 Program participants was 49% for manual thermostats and 51% for programmable thermostats.

Cadmus used the reported household heating savings from the 2013-2014 study for programmable thermostats and a weighted average to adjust the savings for Nest thermostats from a manual thermostat baseline to a mixed manual and programmable thermostat baseline.

$$\Delta\text{Therms}_{\text{AdjustedBaseline}} = 49\% * 69.0 + 51\% * (69.0 - 18.5) = 59.53 \text{ therms}$$

Where:

18.5 represents the heating savings (30 therms * 62% correct use factor) for programmable thermostats compared to a manual baseline

A proper usage factor was not applied to the 2019 evaluation due to the change in technology from programmable to smart (learning) thermostats. The additional features these smart thermostats offer,

⁸⁸ These equations modify savings reported in the Evaluation of the 2013-2014 Programmable and Smart Thermostat Program.

⁸⁹ Cadmus. *Evaluation of the 2013–2014 Programmable and Smart Thermostat Program*. January 29, 2015.

such as optimizing heating and cooling schedules, make it much more likely that the thermostat is operating efficiently.

A.3.3 Water-Saving Devices

Faucet Aerators

Cadmus used the following 2015 Indiana TRM v2.2 equation to calculate savings per faucet aerator installed (excluding ISR):

$$\text{Therm Savings} = (GPM_{BASE} - GPM_{LOW}) * MPD * \frac{PH}{SH} * DR * 8.3 * (T_{MIX} - T_{IN}) * \frac{365}{RG * 100,000}$$

The savings inputs Cadmus used for its *ex post* calculations are shown in Table A-25.

Table A-25. 2019 HEA 2.0 Program Faucet Aerator Savings Inputs

Input	Assumption		Source
	Kitchen Faucet	Bathroom Faucet	
Faucet usage (minutes/day/person) (MPD)	4.5	1.6	2015 Indiana TRM v2.2
Number of faucets per home (FH)	1	2.69	2019 HEA 2.0 Participant survey data for bathroom. 2015 Indiana TRM v2.2 for kitchen
Average household size (PH)	2.47	2.47	2019 HEA participant survey data
Input water temperature to house (°F) (°F, Tin)	62.8	62.8	2015 Indiana TRM v2.2 for Evansville, IN, cold water temperature entering the DWH system
Temperature of water at faucet (°F) (°F, Tmix)	93	86	2015 Indiana TRM v2.2
Percent of water flowing down drain (DR)	0.5	0.7	2015 Indiana TRM v2.2
Gallons per minute of baseline faucet aerator (GPMbase)	2.44	1.9	2015 Indiana TRM v2.2
Gallons per minute of low-flow faucet aerator (GPMlow)	1.5	1.0	2019 program tracking data
Gas water heater recovery efficiency (RG)	0.76	0.76	2015 Indiana TRM v2.2

Efficient Showerhead

Cadmus used the following 2015 Indiana TRM v2.2 equation to calculate savings per efficient showerhead installed:

$$\text{Therm Savings} = ISR * (GPM_{BASE} - GPM_{LOW}) * MS * SPD * \frac{PH}{SH} * 8.3 * (T_{MIX} - T_{IN}) * \frac{365}{RG * 10000}$$

The savings inputs Cadmus used for its *ex post* calculations are shown in Table A-26.

Table A-26. 2019 HEA 2.0 Program Efficient Showerhead Savings Inputs

Input	Assumption	Source
Average shower length (MS)	7.8	2015 Indiana TRM v2.2
Average household size (participants/household, PH)	2.47	2019 HEA 2.0 Program participant survey data
Number of showerheads per home (SH)	2.01	2019 HEA 2.0 Program participant survey data
Number of showers per day per person (SPD)	0.6	2015 Indiana TRM v2.2
Input water temperature to house (°F, Tin)	62.8	2015 Indiana TRM v2.2 for Evansville, IN, cold water temperature entering the DWH system
Water temperature at showerhead (°F, Tmix)	101	2015 Indiana TRM v2.2, average mixed temperature of water used for shower
Gallons per minute of baseline showerhead (GPMbase)	2.63	2015 Indiana TRM v2.2
Gallons per minute of low-flow showerhead (GPMlow)	1.50	2019 program tracking data
Gas water heater recovery efficiency (RG)	0.76	2015 Indiana TRM v2.2

A.4 Income Qualified Weatherization Program

Cadmus' impact evaluation of the Income Qualified Weatherization (IQW) Program included measures with attributable natural gas savings, including these:

Audit education

- Audit (dual fuel, SF/MF)

HVAC and water heating measures

- Filter whistle (SF/MF)
- NG Furnace Tune-Up
- NG Furnace Replacement – 95% AFUE
- Pipe wrap (gas) (per home)
- Smart thermostat (dual fuel, SF/MF)
- Water heater temperature setback (gas)

Water-saving devices

- Bathroom Aerator (SF/MF)
- Kitchen aerator (SF/MF)
- Efficient showerhead (SF/MF)

Weatherization measures

- Air sealing (dual fuel)
- Attic insulation (dual fuel)
- Wall insulation (gas and dual fuel)
- Duct sealing (dual fuel)

Table A-27 provides per-unit annual gross savings for each program measure. Cadmus used inputs and algorithms from the 2015 Indiana TRM v2.2, with the following exceptions:

- For the water heater temperature setback measure, Cadmus used the Illinois TRM V7 to evaluate savings because it was not included as a measure in the 2015 Indiana TRM v2.2.
- For smart thermostats, Cadmus used a 2013-2014 evaluation of programmable and smart thermostats in Vectren South territory.
- For pipe wrap, Cadmus found that the 2015 Indiana TRM v2.2 algorithm made assumptions that most likely led to overestimating savings, and instead used an energy savings factor of 3%.⁹⁰

⁹⁰ American Council for an Energy-Efficient Economy. April 2009. *Potential for Energy Efficiency, Demand Response, and Onsite Solar Energy in Pennsylvania*. ACEEE Report Number E093.

The following sections provide details on Cadmus' equations and assumptions used to calculate evaluated gross savings by measure type.

Table A-27. 2019 Income Qualified Weatherization Per-Unit Gross Savings

Measure	Annual Gross Savings (therms)	
	Reported	Evaluated
Audit Education		
Audit Fee SF (Dual Fuel Single-Family)	8	10
Audit Fee MF (Dual Fuel Multifamily)	9	2
Water-Saving Devices		
Bathroom Aerator (Gas Multifamily)	1	1
Bathroom Aerator (Gas Single-Family)	2	2
Kitchen Aerator (Gas Multifamily)	5	5
Kitchen Aerator (Gas Single-Family)	7	6
Low Flow Showerhead (Gas Multifamily)	12	11
Low Flow Showerhead (Gas Single-Family)	16	14
HVAC and Water Heating Measures		
Filter Whistle (Multifamily)	8	4
Filter Whistle (Single-Family)	15	9
Furnace Tune-Up	54	42
Natural Gas Furnaces - 95%	134	73
Pipe Wrap (Gas)	4	5
Smart Thermostat (Gas Multifamily)	25	30
Smart Thermostat (Dual Fuel Single-Family)	69	67
Water Heater Temperature Setback (Gas)	4	4
Phase 2 Measures		
Air Sealing 20% Infil. Reduction (Dual Fuel)	77	87
Attic Insulation (Dual Fuel)	209	270
Duct 10% Leakage Reduction (Dual Fuel)	93	66
Wall Insulation (Gas)	61	65

A.4.1 Audit Education

Energy auditors gave IQW Program participants home audit reports that identified additional energy-efficient actions they could take to further reduce energy consumption. *Ex post* audit savings were specific to participants and based on survey response data from 71 IQW Program participants. Of these respondents, 76% said they implemented one or more recommendations from the home audit report. Home audit reports had two types of recommended measures:

- **Behavioral measures** that required homeowners to modify how they used energy in their homes. Cadmus evaluated behavioral savings for the following energy-savings actions:
 - Turning off lights when not in use
 - Unplugging unused appliances

- Taking shorter showers
- Programming your thermostat with efficient settings
- **Installation measures** that required purchases and installations of equipment

Table A-28 shows household percentages for each recommended action that IQW Program participants reportedly engaged in after receiving a program audit. The majority of natural gas savings for the audit education measure category came from programming home thermostats with efficient settings (60%).

Table A-28. 2019 IQW Audit Education Action Percentages per Recommended Measure

Recommendation	Percentage of Households that Reportedly Took Action	Average Per-Unit Evaluated Savings for Action (therms)
Behavioral Measures		
Take shorter showers	37%	0.40
Program thermostat with efficient settings (excludes recipients of programmable thermostat through program)	58%	5.34
Installation Measures		
Air Sealing	8%	3.17

Table A-29 shows the assumptions that went into the evaluated savings for each component. For all energy-saving actions, savings were adjusted to account for any efficient equipment that was installed. For taking shorter showerheads, this meant adjusting the baseline showerhead usage to account for the installed efficient equipment. For programming thermostats correctly, this meant not evaluating savings for participants who received smart strips or thermostats.

Table A-29. 2019 IQW Audit Education Savings Assumptions

Recommendation	Assumption	Source
Behavioral Measures		
Take shorter showers	5% reduction in time spent in shower. Household showerhead usage was adjusted to account for	Engineering judgement
Program thermostat with efficient settings (excludes recipients of smart thermostats through program)	Savings are equivalent to the evaluated savings from installing a new programmable thermostat replacing a manual thermostat.	Evaluation of the 2013-2014 Programmable and Smart Thermostat Program
Installation Measures		
Air sealing/weather-stripping	Additional air sealing and weather-stripping will achieve 50% of evaluated air sealing savings.	Engineering judgement

A.4.2 Water-Saving Devices

Faucet Aerators

Cadmus used the following 2015 Indiana TRM v2.2 equation to calculate savings per faucet aerator installed (excluding in-service rate [ISR]):

$$\text{Therm Savings} = (GPM_{BASE} - GPM_{LOW}) * MPD * \frac{PH}{FH} * DR * 8.3 * (T_{MIX} - T_{IN}) * \frac{365}{RG * 100,000}$$

The savings inputs Cadmus used for its *ex post* calculations are shown in Table A-30.

Table A-30. Faucet Aerator Savings Inputs

Input	Assumption		Source
	Kitchen Faucet	Bathroom Faucet	
Faucet usage (minutes/day/person) (MPD)	4.5	1.6	2015 Indiana TRM v2.2
Number of faucets per home (FH) – Single-Family	1	1.46	2019 IQW Participant survey data, 2015 Indiana TRM v2.2 for kitchen
Number of faucets per home (FH) – Multi Family	1	1.47	2019 MFDI Participant survey data, ¹ 2015 Indiana TRM v2.2 for kitchen
Average household size (participants/household, PH) – Single-Family	2.44	2.44	2019 IQW Participant survey data
Average household size (participants/household, PH) – Multi Family	1.92	1.92	2019 MFDI Participant survey data ¹
Input water temperature to house (°F) (°F, Tin)	62.8	62.8	2015 Indiana TRM v2.2 for Evansville, Indiana, cold water temperature entering the DWH system
Temperature of water at faucet (°F) (°F, Tmix)	93	86	2015 Indiana TRM v2.2
Percent of water flowing down drain (DR)	0.5	0.7	2015 Indiana TRM v2.2
Gallons per minute of baseline faucet aerator (GPMbase)	2.44	1.9	2015 Indiana TRM v2.2
Gallons per minute of low-flow faucet aerator (GPMlow)	1.5	1.5	Implementer tracking data
Gas water heater recovery efficiency (RG)	0.76	0.76	2015 Indiana TRM v2.2

¹ Cadmus used Multifamily Direct Install Program survey data because there were no multifamily specific responses in the IQW survey data.

Efficient Showerhead

Cadmus used the following 2015 Indiana TRM v2.2 equation to calculate savings per efficient showerhead installed (excluding ISR):

$$\text{Therm Savings} = (GPM_{BASE} - GPM_{LOW}) * MS * SPD * \frac{PH}{SH} * 8.3 * (T_{MIX} - T_{IN}) * \frac{365}{RG * 10000}$$

The savings inputs Cadmus used for its *ex post* calculations are shown in Table A-31.

Table A-31. Efficient Showerhead Savings Inputs

Input	Assumption	Source
Average shower length in minutes (MS)	7.8	2015 Indiana TRM v2.2
Average household size (participants/household, PH) – Single-Family	2.44	2019 IQW Participant survey data
Average household size (participants/household, PH) – Multi Family	1.92	2019 MFDI Participant survey data ¹
Number of showerheads per home (SH) – Single-Family	1.39	2019 IQW Participant survey data
Number of showerheads per home (SH) – Multi Family	1.42	2019 MFDI Participant survey data ¹
Number of showers per day per person (SPD)	0.6	2015 Indiana TRM v2.2
Input water temperature to house (°F, Tin)	62.8	2015 Indiana TRM v2.2 for Evansville, Indiana, cold water temperature entering the DWH system
Water temperature at showerhead (°F, Tmix)	101	2015 Indiana TRM v2.2, average mixed temperature of water used for shower
Gallons per minute of baseline showerhead (GPMbase)	2.63	2015 Indiana TRM v2.2
Gallons per minute of low-flow showerhead (GPMlow)	1.50	Implementer tracking data
Gas water heater recovery efficiency (RG)	0.76	2015 Indiana TRM v2.2

¹ Cadmus used MFDI survey data because there were no multifamily specific responses in the IQW survey data

A.4.3 HVAC and Water Heating Measures

Furnace Filter Whistle

Cadmus used the following analysis equation from a Quantec study to calculate savings per filter whistle,⁹¹ in combination with 2015 Indiana TRM v2.2 assumptions (excluding ISR):

$$ThermSavings_{GasFurnace} = FLH_{heat} * \frac{BtuH_{gas}}{100,000} * \frac{\mu_{gas}}{100,000} * EF_{gas} * SqFt_{Adjust}$$

The savings inputs Cadmus used for its *ex post* calculations are shown in Table A-32. The evaluation report, from which savings were derived, was based on single-family homes. To account for savings differences by home type due to lower heating and cooling load for multifamily homes compared to single-family homes, Cadmus applied a square footage adjustment.

⁹¹ Reichmuth, Howard. n.d. *Engineering Review and Savings Estimates for the "Filtertone" Filter Restriction Alarm*. White paper prepared for Energy Technology Laboratories. Prepared by Quantec.

Table A-32. Furnace Whistle Savings Inputs

Input	Assumption	Source
Efficiency savings for gas furnace (EFgas)	0.0185	Quantec analysis: Engineering Review and Savings Estimates for the "Filtertone" Filter Restriction Alarm
Size of gas furnace (BTUHgas)	53,273	2019 program tracking data
Full load heating hours (FLHcool)	982	2015 Indiana TRM v2.2: Evansville
Square Footage Adjustment for MF	45%	2009 RECS square footage by building type

Furnace Tune-Up

Cadmus used the following analysis equation from the 2015 Indiana TRM v2.2 to evaluate savings for Furnace tune-ups:

$$ThermSavings = FLH_{heat} * \frac{BTUH_{Gas}}{100,000} * ESF_{gas}$$

The savings inputs Cadmus used for its *ex post* calculations are shown in Table A-33.

Table A-33. Furnace Tune-Up Savings Inputs

Input	Assumption	Source
Efficiency Savings Factor for Furnace Tune-Up (ESFgas)	0.05	2015 Indiana TRM v2.2
Size of Gas Furnace (BTUHgas)	53,273	2019 program tracking data
Full Load Heating Hours (FLHheat)	982	2015 Indiana TRM v2.2: Evansville

Furnace Replacement

Cadmus used the following analysis equation from the 2015 Indiana TRM v2.2 to evaluate savings for natural gas furnace replacements:

$$ThermSavings = BTUH_{Gas} \times FLH_{heat} \times \left(1 - \frac{AFUE_{base}}{AFUE_{ee}}\right) \times 10^{-6}$$

The savings inputs Cadmus used for its *ex post* calculations are shown in Table A-34. Cadmus considered that all furnace installations replaced failed units based on information from the program implementer.

Table A-34. Furnace Savings Inputs

Input	Assumption	Source
Efficiency savings factor for furnace tune-up (ESFgas)	0.05	2015 Indiana TRM v2.2
AFUEbase	80%	Federal standard for NG furnaces
AFUEee	Actual	2019 program tracking data
Size of gas furnace (BTUHgas)	Actual	2019 program tracking data
Full load heating hours (FLHheat)	982	2015 Indiana TRM v2.2: Evansville

Pipe Wrap

Cadmus used the following equation to calculate savings per water heater with pipe wrap (excluding ISR):

$$\text{Therm savings} = \text{ESF} * \text{GPD} * 8.3 * 365 * (T_{\text{set}} - T_{\text{in}}) / (100000 * \text{RG})$$

Cadmus did not use the 2015 Indiana TRM v2.2 methodology because it assumed that the average temperature difference between water heater-supplied water and ambient air temperature was constant for every foot of pipe. However, hot water does not flow constantly in most domestic residential water heating systems, so this TRM approach likely overestimates energy savings from pipe wrap. Cadmus assumed insulating water heater pipes saved an average 3% of annual hot water energy consumption, based on ACEEE Report Number E093.⁹² The savings inputs Cadmus used for its *ex post* calculations are shown in Table A-35.

Table A-35. Pipe Wrap savings Inputs

Input	Assumption	Source
Energy savings factor (ESF)	3%	ACEEE Report Number E093, assumption used in CL&P and UI PSD 2013
Gallons of water used per day (GPD)	52.8 / 44.2	Calculated using average home size from 2019 IQW survey data and from 2019 MFDI Survey Data to interpolate daily usage, based on the relationship between gallons of water per day, per household vs. the number of people. 2015 Indiana TRM v2.2
Water heater temperature set point (°F, Tsetpoint)	135 / 120	Illinois TRM v7 default value or 120 if the participant received a water heater setback
Input water temperature to house (°F, Tin)	62.8	2015 Indiana TRM v2.2 for Evansville, Indiana, cold water temperature entering the DWH system
Conversion from Btu to Therms	3412	Conversion factor
Gas water heater recovery efficiency (RG)	76%	2015 Indiana TRM v2.2

Smart Thermostats

Cadmus calculated smart thermostat savings using the following equation (excluding ISR).

$$\text{Annual therm Savings} = \Delta \text{Therms}_{\text{AdjustedBaseline}} * \text{SqFt}_{\text{Adjust}}$$

The savings inputs Cadmus used for its *ex post* calculations are shown in Table A-36. These inputs were primarily derived from results of a 2013-2014 evaluation of programmable and smart thermostats in Vectren's South Indiana territory.⁹³ Because smart thermostats have a learning function, it is assumed

⁹² American Council for an Energy-Efficient Economy. April 2009. ACEEE Report Number E093. *Potential for Energy Efficiency, Demand Response, and Onsite Solar Energy in Pennsylvania.*

⁹³ Cadmus. January 29, 2015. *Evaluation of the 2013-2014 Programmable and Smart Thermostat Program.*

that 100% were auto-adjusting temperature appropriately. The results from the 2013-2014 smart thermostat evaluation were based on replacing manual thermostats only.

Table A-36. Smart Thermostat Savings Inputs

Cadmus Assumptions	Inputs	Units	Source
Manual thermostat saturation	89%	%	2019 IQW Program participant survey
Programmable thermostat saturation	11%	%	2019 IQW Program participant survey
ThermsAdjustedBaseline	67	Therms	Evaluation of the 2013-2014 Programmable and Smart Thermostat Program
Square Footage Adjustment for MF	45%	%	2009 RECS square footage by building type

2013-2014 Thermostat Evaluation and Adjusted Baseline

The analysis of smart programmable thermostat savings used the results of Cadmus' 2013-2014 evaluation of programmable and Nest Wi-Fi thermostats in Vectren South territory.⁹⁴ This evaluation reports household heating energy savings of 30 therms for programmable thermostats and 69 therms Nest Wi-Fi thermostats. This study had a 100% manual thermostat baseline for both programmable and Nest Wi-Fi thermostats. However, in 2019, the survey indicated that the thermostat equipment saturation among IQW participants (n= 13) was 89% for manual thermostats and 11% for programmable thermostats.

Cadmus used the reported household cooling and heating savings from its study for programmable thermostats and a weighted average to adjust the savings for Nest thermostats from a manual thermostat baseline to a mixed manual and programmable thermostat baseline.

$$\Delta Therms_{AdjustedBaseline} = 89\% * 69.0 + 11\% * (69.0 - 19.6) = 67 \text{ therms}$$

Where:

19.6 represents the cooling savings (30 therms * 65% correct use factor) for programmable thermostats compared to a manual baseline

Home Type Adjustment

The evaluation report, on which savings were derived, was based on single-family homes. To account for savings differences by home type, due to reduced heating and cooling load for multifamily homes compared to single-family homes, Cadmus applied a square footage adjustment.

⁹⁴ Cadmus. *Evaluation of the 2013–2014 Programmable and Smart Thermostat Program*. January 29, 2015.

Water Heater Temperature Setback

Cadmus used the following Illinois TRM V7 equations (measure not available in the 2015 Indiana TRM v2.2) to calculate savings per water heater with temperature setback (excluding ISR):

$$\text{Therm Savings} = (U * A * (T_{pre} - T_{post}) * \text{Hours}) / (100,000 * RG)$$

During the on-site assessment, water heater temperatures were set back to a lower temperature to achieve energy savings. Table A-37 shows the savings inputs Cadmus used for its *ex post* calculations.

Table A-37. Water Heater Temperature Setback Savings Inputs

Input	Assumption	Source
Heat transfer coefficient of tank (U)	0.083	Illinois TRM V7 default value
Surface area of tank (A)	24.99	Illinois TRM V7 default value
Water heater temperature before setback (T _{pre})	135	Illinois TRM V7 default value
Water heater temperature before setback (T _{post})	120	Illinois TRM V7 default value
Hours in a year (Hours)	8760	2015 Indiana TRM v2.2
Gas water heater recovery efficiency (RG)	76%	2015 Indiana TRM v2.2

A.4.4 Weatherization Measures

Air Sealing/Infiltration Reduction

Cadmus used this equation to calculate savings per infiltration reduction retrofit (excluding ISR):

$$\text{Therms savings} = \frac{CFM50_{EXIST} - CFM50_{NEW}}{N - factor} * \frac{\Delta MMBtu}{CFM} * 10$$

Cadmus calculated each site on an individual basis with different blower door measurements and heating types. The savings inputs Cadmus used for its *ex post* calculations are shown in Table A-38.

Table A-38. IQW Program Air Sealing Savings Inputs

Description	Assumption	Source
CFM50_exist	Actual	2019 program tracking data
CFM50_new	Actual	2019 program tracking data
N-Factor	16.3	2015 Indiana TRM v2.2
CF	0.88	2015 Indiana TRM v2.2
MMBTU/CFM - Gas Furnace, CAC (MMBTU/CFM)	0.16	2015 Indiana TRM v2.2
MMBTU/CFM - Gas Furnace, no CAC (MMBTU/CFM)	0.17	2015 Indiana TRM v2.2

Attic and Wall Insulation

Cadmus applied this algorithm from the 2015 Indiana TRM v2.2 to calculate and verify natural gas energy savings (excluding ISR):

$$\text{Annual Therms Savings} = kSF * \frac{(\text{Energy}) \text{ Savings}}{kSF}$$

Table A-39. IQW Program Insulation Savings Inputs

Description	Assumption	Source
Area of Installed Insulation (kSF)	Actual	2019 program tracking data
Energy Savings	Dependent on recorded pre- and post-retrofit R-values	2019 program tracking data

Energy savings per installation depended on pre- and post-retrofit insulation R-values, which Cadmus calculated using a three-step process:

1. Determine variables to use for insulation compression, R_{ratio} , and void factors.
2. Calculate adjusted pre- and post-retrofit R-values using the inputs from step one.
3. Interpolate the 2015 Indiana TRM v2.2 tables to calculate savings using the adjusted R-values from step two.

Variables to Use for Insulation Compression, R_{ratio} , and Void Factors

Cadmus adjusted R-values to account for compression, void factors, and surrounding building material. To calculate these adjusted pre- and post-R-values, Cadmus used this formula:

$$R \text{ value Adjusted} = R_{nominal} \times F_{compression} \times F_{void}$$

The following equation determined F_{void} :

$$R_{ratio} = (R_{nominal} \times F_{compression}) \times ((R_{nominal} \times R_{framing \text{ and air space}}))$$

The inputs used for these formulas are shown in Table A-40.

Table A-40. Insulation Compression, R_{ratio} , and Void Factors

Description	Assumption	Source
Actual pre- and post-R-values per manufacturing specifications ($R_{nominal}$)	Actual	2019 program tracking data
Compression factor dependent on the percentage of insulation compression ($F_{compression}$)	1	Assumed a value of 1 at 0% compression for the evaluation
Void Factor (F_{void})	Varied	Void factors accounted for insulation coverage and were dependent on installation grade level, pre- and post-R-values and compression effects
R-value for material ($R_{framing \text{ and air space}}$)	5	2015 Indiana TRM v2.2
Area of installed insulation in thousand square feet (kSF)	Varies by participant	2019 program tracking data for heating/cooling combination for each participant

Table A-41 lists the void factor based on the calculated R_{ratio} . Cadmus used a 2% void for the evaluation since this information was unknown, and 2% is common in most households.

Table A-41. 2015 Indiana TRM v2.2: Insulation Void Factors

R_{ratio}	Void Factor	
	2% Void (Grade II)	5% Void (Grade III)
0.50	0.96	0.90
0.55	0.96	0.90
0.60	0.95	0.88
0.65	0.94	0.87
0.70	0.94	0.85
0.75	0.92	0.83
0.80	0.91	0.79
0.85	0.88	0.74
0.90	0.83	0.66
0.95	0.71	0.49
0.99	0.33	0.16

Adjusted R-Values

Applying the formula above (R_{value} Adjusted), Cadmus used the inputs defined in step one to calculate adjusted R-values for pre- and post-installation and calculated adjusted R-values for every installation in the database.

Interpolate 2015 Indiana TRM v2.2 Tables

Cadmus used the pre- and post-adjusted R-values from step two to interpolate savings for every 2019 installation based on the reported heating and cooling types. Appendix C of the 2015 Indiana TRM v2.2 defines energy savings for insulation measures by heating and cooling equipment.

Duct Sealing

Cadmus used this equation to calculate savings per duct sealing retrofit (excluding ISR):

$$\text{Annual Heating Therms Savings} = \frac{DE_{AFTER} - DE_{BEFORE}}{DE_{AFTER}} * EFLH_{HEAT} * \frac{Btuh_{HEAT}}{100,000 * \eta_{HEAT}}$$

The savings inputs Cadmus used for its *ex post* calculations are shown in Table A-42.

Table A-42. IQW Program Duct Sealing Savings Inputs

Description	Assumption	Source
Distribution efficiency of ductwork after dealing sealing (DE_{AFTER})	87%	Used the following reference (listed in the 2015 Indiana TRM v2.2): http://www.bpi.org/files/pdf/DistributionEfficiencyTable-BlueSheet.pdf Percentage of ducts within conditioned space was unknown. Assumed the average of all potential values under: "Connections Sealed with Mastic."
Distribution efficiency of ductwork before dealing sealing (DE_{BEFORE})	76%	Used the following reference (listed in the 2015 Indiana TRM v2.2): http://www.bpi.org/files/pdf/DistributionEfficiencyTable-BlueSheet.pdf Percentage of ducts within conditioned space was unknown. Assumed the average of all potential values under: "No Observational Leaks," "Some Observed Leaks," "Significant Leaks," and "Catastrophic Leaks."
Full-load heating hours ($EFLH_{HEAT}$)	982	2015 Indiana TRM v2.2 for Evansville
Size of gas furnace ($BTUH_{gas}$)	53,273	2019 IQW NG Furnace Installation Data
Efficiency of cooling system (η_{HEAT})	80%	2015 Indiana TRM v2.2

A.5 Energy Efficient Schools Program

Cadmus' impact evaluation of the Energy Efficient Schools Program included measures with attributable natural gas savings, including these:

- Kitchen faucet aerator (1.5 gpm)
- Two bathroom faucet aerators (1.0 gpm)
- Energy-efficient showerhead (1.5 gpm)
- Furnace filter whistle

Table A-43 provides per-unit annual gross savings for each program measure.

Table A-43. 2019 Energy Efficient Schools Program Per-Unit Gross Savings¹

Measure	Annual Gross Savings (Therms)	
	Reported	Evaluated
Energy-Efficient Bathroom Aerator (one unit only) ²	0.46	0.31
Energy-Efficient Kitchen Aerator	2.40	2.41
Energy-Efficient Showerhead	5.55	3.90
Furnace Filter Whistle	4.85	1.62

¹ Reported and evaluated savings include in-service rates

² There are two bathroom aerators in each kit; however, the evaluated savings are for one unit only.

A.5.1 Energy-Efficient Faucet Aerator

Cadmus used the following equation to calculate savings per faucet aerator installed:

$$\text{Therm Savings} = \text{ISR} * \% \text{Fuel} * (\text{GPM}_{\text{BASE}} - \text{GPM}_{\text{LOW}}) * \text{MPD} * \frac{\text{PH}}{\text{SH}} * \text{DR} * 8.3 * (T_{\text{MIX}} - T_{\text{IN}}) * \frac{365}{\text{RG} * 100,000}$$

Cadmus calculated savings for kitchen and bathroom faucet aerators installed through the EES Program using values from the 2015 Indiana TRM v2.2 and the 2019 participant survey and Home Energy Worksheets (HEWs) to determine household characteristics, as shown in Table A-44.

Table A-44. 2019 Energy Efficient Schools Program Faucet Aerator Savings Inputs

Input	Kitchen Faucet Assumption	Bathroom Faucet Assumption	Source
Faucet Usage (Minutes/Day/Person)	4.5	1.6	2015 Indiana TRM v2.2
Number of Faucets per Home	1	2.36	2019 Participant Survey
Average Household Size (Number of People)	4.83	4.83	2019 Indiana School Kit Home Energy Worksheet
Input Water Temperature to House (°F)	62.8	62.8	2015 Indiana TRM v2.2 for Evansville, Indiana, cold water temperature entering the DHW system
Temperature of Water at Faucet (°F)	93	86	2015 Indiana TRM v2.2
Percent of Water Flowing Down Drain	50%	70%	2015 Indiana TRM v2.2
Gallons per Minute of Baseline Faucet Aerator	2.44	1.9	2015 Indiana TRM v2.2
Gallons per Minute of Energy-Efficient Faucet Aerator	1.5	1.0	Provided by Vectren
Recovery Efficiency of Gas Hot Water Heater	0.76	0.76	2015 Indiana TRM v2.2
In-Service Rate	43%	36%	2019 Participant Survey
% Fuel	46%	46%	2019 Indiana School Kit Home Energy Worksheet

A.5.2 Energy-Efficient Showerhead

Cadmus used the following equation to calculate savings per energy-efficient showerhead installed:

$$\text{Therm Savings} = \text{ISR} * \% \text{Fuel} * (\text{GPM}_{\text{BASE}} - \text{GPM}_{\text{LOW}}) * \text{MS} * \text{SPD} * \frac{\text{PH}}{\text{SH}} * 8.3 * (T_{\text{MIX}} - T_{\text{IN}}) * \frac{365}{\text{RG} * 100,000}$$

To inform this energy-savings estimate, Cadmus used the 2015 Indiana TRM v2.2 and data collected from the 2019 participant survey and HEWs to determine household characteristics. Table A-45 shows these inputs.

Table A-45. 2019 Energy Efficient Schools Program Showerhead Savings Inputs

Input	Assumption	Source
Average Shower Length (Minutes)	7.8	2015 Indiana TRM v2.2
Average Household Size (Number of People)	4.83	2019 Indiana School Kit Home Energy Worksheet data
Number of Showerheads per Home	1.95	2019 Participant Survey
Number of Showers per Day per Person	0.6	2015 Indiana TRM v2.2
Input Water Temperature to House (°F)	62.8	2015 Indiana TRM v2.2 for Evansville, Indiana, cold water temperature entering the DHW system
Water Temperature at Showerhead (°F)	101	2015 Indiana TRM v2.2, average mixed temperature of water used for shower
Gallons per Minute of Baseline Showerhead	2.63	2015 Indiana TRM v2.2
Gallons per Minute of Energy-Efficient Showerhead	1.50	Provided by Vectren
Recovery Efficiency of Gas Hot Water Heater	0.76	2015 Indiana TRM v2.2
In-Service Rate	43%	2019 Participant Survey
% Fuel	46%	2019 Indiana School Kit Home Energy Worksheet

A.5.3 Furnace Filter Whistle

Cadmus used the following equation to calculate savings per furnace filter whistle installed:

$$Therm\ Savings = ISR * FLH_{heat} * \%Furnace * \frac{BtuH_{gas}}{100,000} * \frac{\eta_{gas}}{100} * EF_{gas}$$

As shown in Table A-46, Cadmus calculated savings for the furnace filter whistles installed through the program using values from the 2015 Indiana TRM v2.2, 2019 participant survey data, prior evaluation results, the 2012 Indiana residential baseline study, and an engineering review conducted by Quantec detailing algorithms for the measure.⁹⁵

Table A-46. 2019 Energy Efficient Schools Program Furnace Filter Whistle Savings Inputs

Input	Assumption	Source
Efficiency Savings for Gas Furnace	0.0185	Quantec analysis: Engineering Review and Savings Estimates for the "Filtertone" Filter Restriction Alarm
Size of Gas Heating System in BTUH	78,236	2012 Indiana Residential Baseline Study, average capacity of furnace
Full Load Heating Hours	982	2015 Indiana TRM v2.2 for Evansville
Annual Fuel Utilization Efficiency Percentage	0.8	2015 Indiana TRM v2.2
In-Service Rate	28%	2019 Participant Survey
% Furnace	40%	2019 Indiana School Kit Home Energy Worksheet

⁹⁵ Reichmuth, Howard. *Engineering Review and Savings Estimates for the "Filtertone" Filter Restriction Alarm*. White paper prepared for Energy Technology Laboratories. Prepared by Quantec. n.d.

A.6 Residential Behavioral Savings Program

Cadmus' impact evaluation of the RBS Program included a billing analysis to evaluate the effect of home energy reports on the behavior of treated customers. The evaluation of the RBS Program savings and efficiency program uplift consisted of these tasks:

- Data collection, review, and preparation
- Equivalency checks on treatment and control groups
- Billing analysis
- Energy-savings estimations
- Energy efficiency program channeling analysis

A.6.1 Data Collection, Review, and Preparation

Vectren provided data from monthly utility bills for dual fuel homes for treatment and control group customers between January 2011 and January 2020 (approximately 13 months of bills prior to the beginning of the RBS Program in 2012 and 96 months of bills after the program began). Billing data included energy use during the monthly billing cycle, the last day of the billing cycle, and these fields:

- Customer segment (dual fuel)
- Assignment to treatment or control groups
- First report date
- Opt-out date for customers choosing not to participate in the program
- Move-out date for customers who have moved
- Natural gas account numbers for linking to billing data

Cadmus collected National Oceanic and Atmospheric Administration (NOAA) daily temperature data from the municipal airport weather stations near Henderson, Kentucky, Lawrenceville, Illinois, and Evansville, Indiana, the three stations nearest to all RBS Program treatment and control homes.

Vectren provided participation and measure savings data for its 2019 DSM programs. For each program and measure, these data included the account number, the number and description of measures installed, measure installation dates, and verified savings. Cadmus used these data to estimate the RBS Program's participation and savings effects on other efficiency programs (uplift).

Data Preparation

Cadmus worked with Vectren and the Oracle to acquire the data necessary for the RBS Program evaluation in 2019. Major data preparation steps included cleaning and compiling the program tracking data, billing consumption and weather data, and testing for significant differences in annual pretreatment consumption between treatment and control customers, by customer segment. This section describes the steps Cadmus took to process the data and verify customers in the tracking and billing data.

Program Tracking Data

Cadmus received RBS Program tracking data from Oracle at the close of 2019. These data included treatment group customers who received home energy reports in the current or a previous year and control group customers tracked since the program's inception. Because the RBS Program was implemented as a randomized control trial, Cadmus included all of the possible customers in its evaluation, adopting a "once in, always in" policy for customers originally randomized into either the treatment or control group prior to the launch of the home energy reports.

Table A-47 shows customer attrition through 2019, by treatment and control groups, as originally randomized and active at the beginning of treatment in 2019. The attrition process captures customers whose accounts closed (became inactive) since the launch of the program and accounts who stopped receiving home energy reports.

Table A-47. RBS Program Customer Attrition through 2019

Customer Segment	Originally Randomized		Active at the Beginning of Treatment in 2019	
	Treatment	Control	Treatment	Control
Dual Fuel	51,428	5,590	29,130	3,237
Program Total	51,428	5,590	29,130	3,237

Billing Data

Cadmus collected customer billing data for each wave from Oracle. To clean the billing data, Cadmus followed these steps:

1. Drop customers whose accounts went inactive before the delivery of the first energy reports
2. Clean and calendarize bills, which included dropping bills that covered more than 100 days, dropping bills with negative consumption, dropping bills earlier than one year prior to the delivery of the first energy reports, and truing up bills with estimated reads
3. Drop customers with less than 11 months of pretreatment bills

Table A-48 provides the attrition in the 2019 analysis sample from data cleaning steps. The final modeling sample included customers in Cadmus' final tracking data who were not dropped during the billing data cleaning process and were included in the billing analysis. These customers were not necessarily active at the beginning of treatment in 2019.

Table A-48. 2019 RBS Program Analysis Sample¹

Step in Attrition	Dual Fuel	
	Treatment	Control
Originally Randomized Customers	51,428 (100%)	5,590 (100%)
Included in Billing Data	51,309 (100%)	5,576 (100%)
Active at Program Launch	50,776 (99%)	5,528 (99%)
Less than 11 Months of Pretreatment Data	47,770 (93%)	5,200 (93%)
Final Modeling Sample	47,770 (93%)	5,200 (93%)

¹ The billing data analysis sample includes customers who were randomized into the program and active when treatment began in 2012. These customers were not necessarily active in 2019.

Weather Data

Cadmus collected weather data from the weather station closest to each home and estimated the heating degree days (HDDs) for each customer billing cycle. After merging the weather and billing data, Cadmus allocated the billing cycle electricity consumption and HDDs to calendar months.

Verification of Balanced Treatment and Control Groups

Cadmus verified that subjects in the randomized treatment and control groups were equivalent in their annual pretreatment energy consumption. Cadmus verified the equivalence of waves using the cleaned billing data, comparing preprogram average annual consumption from before the launch of the program.

Table A-49 provides the 2019 results of the tests for significant differences in treatment and control group pretreatment consumption. Cadmus found that all waves were balanced. No statistically significant differences existed between the pretreatment consumption of treatment and control groups in any wave.

Table A-49. 2019 RBS Program Analysis Sample

Wave	Average Annual Electricity Use per Customer (therms/yr)			p-value ¹
	Treatment Group	Control Group	Difference	
Dual Fuel	647	653	6	0.1816

¹ A p-value >0.05 indicates an insignificant difference at the 5% significance level.

A.6.2 Regression Analysis

Cadmus used regression analyses of monthly billing data from customers in the treatment and control groups to estimate the RBS Program's energy savings. The billing analysis conformed to IPMVP Option C, whole facility,⁹⁶ and the approach described in the Uniform Methods Project.^{97,98}

More specifically, Cadmus used a multivariate regression to analyze the energy use of customers who had been randomly assigned to treatment and control groups. Cadmus tested and compared two general model specifications to check the robustness of savings results:

- The **post-only** model regresses customer average daily consumption on a treatment indicator variable and includes as regressors customers' pretreatment energy use, month-by-year fixed effects and weather.⁹⁹ The model is estimated only with posttreatment customer bills.
- The **difference-in-differences (D-in-D) fixed effects** model regresses average daily consumption on a treatment indicator variable, month-by-year fixed effects, customer fixed effects, and weather. The model is estimated with pretreatment and posttreatment customer bills.

Both models yielded savings estimates that were within each other's confidence intervals, meaning that their results were not statistically different. In 2019, Cadmus reported the results of the post-only model, consistent with previous program years.

The error terms of the post-only model and D-in-D fixed effects model should be uncorrelated with program participation ($PART_i$) and other observable variables because of the random assignment of homes to treatment and control groups, and therefore Ordinary Least Squares (OLS) regression should result in an unbiased estimate of the average daily savings per customer. Cadmus clustered the standard errors on customers to account for arbitrary correlation in customer consumption over the analysis period.

⁹⁶ Efficiency Valuation Organization. *International Performance Measurement and Verification Protocol, Concepts and Options for Determining Energy and Water Savings, Volume 1*. January 2012. Page 25. (EVO 10000 – 1:2012) Available online: <http://www.evo-world.org/>

⁹⁷ Agnew, K., and M. Goldberg. *Uniform Methods Project: Methods for Determining Energy Efficiency Savings for Specific Measures, Chapter 8: Whole-Building Retrofit with Consumption Data Analysis Evaluation Protocol*. U.S. Department of Energy, National Renewable Energy Laboratory. April 2013. (NREL/SR-7A30-53827) Available online: http://www1.eere.energy.gov/office_eere/de_ump_protocols.html

⁹⁸ Stewart, J., and A. Todd. *Uniform Methods Project: Methods for Determining Energy Efficiency Savings for Specific Measures, Chapter 17: Residential Behavior Protocol*. U.S. Department of Energy, National Renewable Energy Laboratory. August 2014. (NREL/SR-7A40-62497) Available online: http://www1.eere.energy.gov/office_eere/de_ump_protocols.html

⁹⁹ Allcott, H., and T. Rogers. "The Short-Run and Long-Run Effects of Behavioral Interventions: Experimental Evidence from Energy Conservation." *American Economic Review* 104 (10), 3003-3037. 2014.

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The following sections provide additional details about each modeling approach.

Post-Only Model

Cadmus specified the post-only model assuming the average daily consumption (ADC_{it}) of natural gas of home 'i' in month 't' as given by the following equation:

$$ADC_{it} = \sum_{t=1}^T \beta_{1t} PART_i * PY_t + \beta_2 Pre-ADC_{im} \times M_m + W'\gamma + \tau_t + \varepsilon_{it}$$

Where:

- β_{1t} = Coefficient representing the conditional average treatment effect of the program on electricity use (therms per customer per day).
- $PART_i$ = Indicator variable for program participation (which equals 1 if customer 'i' was in the treatment group and 0 otherwise).
- PY_t = Indicator variable for each program year (which equals 1 if the month 't' was in the program year and 0 otherwise).
- β_2 = Coefficient representing the conditional average effect of pre-treatment electricity use on post-treatment average daily consumption (therms per customer per day).
- $Pre-ADC_{im}$ = Mean household energy consumption of customer 'i' in month 'm' in the pre-treatment period.
- M_m = Variable indicating the month of the calendar year for months $m = 1, 2, \dots, 12$.
- W = Vector using HDD variables to control for weather impacts on energy use.
- γ = Vector of coefficients representing the average impact of weather variables on energy use.
- τ_t = Average energy use in month 't' reflecting unobservable factors specific to the month. The analysis controls for these effects with month-by-year fixed effects.
- ε_{it} = Error term for customer 'i' in month 't.'

The D-in-D fixed effects model was specified, assuming average daily consumption (ADC_{it}) of natural gas of customer 'i' in month 't', as given by the following equation:

$$ADC_{it} = \alpha_i + \tau_t + W'\gamma + \beta_1 PART_i \times POST_t + \varepsilon_{it}$$

Where:

- β_1 = Coefficient representing the program's conditional average treatment effect on natural gas consumption (therms/customer per day).
- $PART_i$ = Indicator variable for program participation (which equals 1 if customer 'i' was in the treatment group and 0 otherwise).
- $POST_t$ = Indicator variable for whether month 't' is pre- or post-treatment (which equals 1 if month 't' was in the treatment period and 0 otherwise).
- W = Vector using HDD variables to control for weather impacts on energy use.

γ	=	Vector of coefficients representing the average impact of weather variables on energy use.
α_i	=	Average energy use in customer 'i' reflecting unobservable, non-weather-sensitive, and time-invariant factors specific to the customer. The analysis controlled for these effects with customer fixed effects.
τ_t	=	Average energy consumption in month 't' reflecting unobservable factors specific to the month. The analysis controlled for these effects with month-by-year fixed effects.
ϵ_{it}	=	Error term for customer 'i' in month 't'

Regression Analysis Estimates

Cadmus estimated separate treatment effects for each wave and program year. Table A-50 shows both the D-in-D fixed effects model and post-only model estimates of average daily savings per customer, by wave and program year. All of the models were estimated by OLS, and Huber-White robust clustered standard errors were adjusted for correlation over time in a customer's consumption.

Table A-50. RBS Program Historical Model Comparison of Savings¹

Treatment Year	Dual Fuel	
	Post-Only	D-in-D Fixed Effects
2012	0.012 *** (0.003)	0.016 *** (0.004)
2013	0.021 *** (0.006)	0.024 *** (0.006)
2014	0.029 *** (0.008)	0.032 *** (0.007)
2015	0.031 *** (0.007)	0.036 *** (0.007)
2016	0.024 *** (0.007)	0.030 *** (0.007)
2017	0.030 *** (0.008)	0.037 *** (0.008)
2018	0.031 *** (0.010)	0.038 *** (0.009)
2019	0.028 *** (0.010)	0.038 *** (0.010)

¹ Standard errors clustered on customers are presented below the estimated treatment effect in parentheses (***) Significant at 1%; ** Significant at 5%; * Significant at 10%). The treatment effects represent the average daily savings per treatment group customer.

A.6.3 Program Total Savings Estimation

Cadmus estimated program savings in 2019 for each wave's population of treated customers as the product of average daily savings per participant and the number of days these customers were treated in 2019, shown in Equation A-1. Cadmus assumed that Oracle intended to treat all eligible customers at least once in 2019 and included treatment days for customers who should have received treatment in 2019 (i.e., those who were still active and randomized as a treatment customer), even when customers were not explicitly flagged as receiving 2019 treatment.

Equation A-1

$$Savings_h = -\hat{\beta}_{1,h} * \sum_{i=1}^N Treatment\ Days_{i,h}$$

Where:

- $\hat{\beta}_{1,h}$ = Average daily savings (therms) per treatment group customer in wave 'h', estimated from the post-only regression model.
- $Treatment\ Days_{i,h}$ = The number of days customer 'i' in wave 'h' was treated in 2019.

Cadmus estimated realization rates for each wave as the ratio of verified program savings to reported program savings (estimated by the program implementor).

A.6.4 Energy Efficiency Program Channel (Uplift) Analysis

Analysis of efficiency program uplift proved important for two reasons:

- Vectren sought to learn whether and to what extent the RBS Program caused participation in Vectren's other programs.
- To the extent the RBS Program caused participation in other efficiency programs, energy savings resulting from this participation would be counted twice—once in the regression estimate of RBS Program savings and once in the other programs' savings. (Thus, Vectren should subtract the double-counted savings from its portfolio savings.)

The uplift analysis yielded estimates of the percentage of the RBS Program's effect on other efficiency program participation and on the double-counted savings. Cadmus limited the analysis, however, to program measures that Vectren tracked at the customer level. Cadmus performed participation and savings uplift analyses for these residential efficiency programs:

- Income Qualified Weatherization (IQW) Program
- Home Energy Assessment (HEA) 2.0 Program
- Residential Prescriptive Program
- Smart Cycle Program

Cadmus did not perform channeling analyses for these residential efficiency programs:

- The Energy Efficient Schools Program targeted school children and their families. Participation was not voluntary.
- The Residential New Construction Program targeted builders of new homes, which the RBS Program did not target.

- The Multifamily Direct Install Program targeted multifamily property managers, which the RBS Program did not target.¹⁰⁰

As with the energy-savings analysis, the uplift analysis followed the logic of the program's experimental design. Cadmus collected efficiency program participation and savings data in 2019, matching the data to RBS Program treatment and control homes, and applied a simple differences analysis to each customer-energy segment and wave. Because customers in the treatment and control groups are expected to be identical, except for having participated in the RBS Program, the difference between these groups in other efficiency program participation would equal the RBS Program uplift.

In homes matching the 2019 efficiency program data, Cadmus excluded measures installed after an account became inactive or measures installed before the first energy report date. When calculating energy uplift, Cadmus prorated a measure's savings based on the installation date, so that a measure installed halfway through the year was only credited half a year of savings. Additionally, Cadmus prorated a measure's savings based on weather sensitivity. For demand uplift, Cadmus included full demand savings for any measure installed prior to the end of September 2019.

Let ρ_m be the participation rate (defined as the number of participants to the number of potential participants) in a program in 2019 for group m (as before, $m=1$, for treated homes, and $m=0$ for control homes) in period t (t in $\{0,1\}$), as illustrated in this equation:

$$\text{Participation uplift} = \rho_1 - \rho_0$$

Cadmus used this method to express participation uplift relative to the participation rate of control homes in 2019, which yielded an estimate of the percentage uplift, as in this equation:

$$\% \text{Participation Uplift} = \text{Program Uplift} / \rho_0$$

Cadmus estimated RBS Program savings from participation in other efficiency programs the same way, by replacing the program participation rate with the program net savings per home, as illustrated in this equation:

$$\text{Net savings per home from participation uplift} = \sigma_1 - \sigma_0^{101}$$

Multiplying net savings per home by the number of program homes yielded an estimate for a customer segment and wave of total RBS net savings counted in Vectren's other efficiency programs.

¹⁰⁰ Cadmus did not conduct the uplift analysis for the Multifamily Direct Install Program because the RBS Program is a behavioral program targeting residents of single-family and multifamily housing units. The Multifamily Direct Install Program targets property managers who did not receive home energy reports and did not make decisions about electricity use in multifamily tenant units.

¹⁰¹ Cadmus obtained net savings by multiplying measure-verified gross savings by the estimated measure NTG ratio.

A.7 Smart Cycle Program

Cadmus' impact evaluation of the Smart Cycle Program included thermostats with attributable gas savings. Table A-51 provides per-unit annual gross savings for each program measure.

Table A-51. 2019 Smart Cycle Program Per-Unit Gross Savings

Measure	Annual Gross Savings (therms)	
	Reported	Evaluated
Smart Cycle Thermostat - Dual Fuel	N/A ¹	56

¹ Vectren's 2019 gas scorecard did not include Smart Cycle Program thermostats.

A.7.1 Smart Cycle

Using the same savings methodology used to calculate smart thermostat savings in the 2019 Residential Prescriptive Program, Cadmus calculated Nest thermostat savings using the following equation (excluding in-service rate):¹⁰²

$$\text{Annual therm Savings} = \Delta\text{Therms}_{\text{AdjustedBaseline}} * \%_{\text{GAS}} * \text{TStat_Type}_{\text{DiscountRate}}$$

Where:

$\%_{\text{GAS}}$ is 100% for gas heating equipment

$\text{TStat_Type}_{\text{DiscountRate}}$ is 100% for learning thermostats¹⁰³

2013-2014 Thermostat Evaluation and Adjusted Baseline

The analysis of the Smart Cycle Program savings used the results of Cadmus' 2013-2014 evaluation of programmable and Nest Wi-Fi thermostats in Vectren South territory.¹⁰⁴ This evaluation reports household heating energy savings of 30 therms for programmable thermostats and 69 therms Nest Wi-Fi thermostats. This study had a 100% manual thermostat baseline for both programmable and Nest Wi-Fi thermostats.

¹⁰² This equation modifies the savings reported in the Evaluation of the 2013-2014 Programmable and Smart Thermostat Program. Cadmus. January 29, 2015. *Evaluation of the 2013-2014 Programmable and Smart Thermostat Program*.

¹⁰³ According to a 2015 Cadmus thermostat evaluation for a Midwestern utility, there is a significant difference in savings between Nest Wi-Fi thermostats and other Wi-Fi thermostats. The results of this study yielded a heating savings discount rate of 31% for non-Nest Wi-Fi thermostats. Cadmus' 2016 evaluation for Vectren supported the conclusion of a difference in savings between Nest and non-Nest thermostats. All Nest thermostats are learning thermostats.

¹⁰⁴ Cadmus. January 29, 2015. *Evaluation of the 2013-2014 Programmable and Smart Thermostat Program*.

However, the 2019 Smart Cycle Program did not exclude participants based on their existing thermostat type. Therefore, Cadmus used the 2019 Smart Cycle Program participant survey to inform methodology inputs; the saturation was 38% for manual thermostats and 62% for programmable thermostats. Cadmus used the reported household heating savings from its study for programmable thermostats from its 2013-2014 thermostat study and a weighted average to adjust the savings for Nest thermostats from a manual thermostat baseline to a mixed manual and programmable thermostat baseline.

$$\Delta ThermS_{AdjustedBaseline} = 28\% * 69.0 + 62\% * (69.0 - 18.5) = 57.6 \text{ therms}$$

Where:

18.5 represents the heating savings (30 therms * 62% correct use factor) for programmable thermostats compared to a manual baseline¹⁰⁵

A.8 Targeted Income Program

Cadmus' impact evaluation of the Targeted Income Program included measures with attributable natural gas savings.

Water saving measures

- Bathroom aerator
- Kitchen aerator
- Low-flow showerhead

Weatherization measures

- Air sealing
- Ceiling insulation
- Sidewall insulation

Equipment replacement

- Natural gas furnaces
- Natural gas water heaters

Table A-52 provides per-unit annual gross savings for each program measure.

¹⁰⁵ The 62% heating correct use factor is from the 2019 Residential Prescriptive program participant survey, which asks homeowners with programmable thermostats about their thermostat usage habits related to heating.

Table A-52. 2019 Targeted Income Program Per-Unit Gross Savings

Measure	Annual Gross Savings (Therms)	
	Reported	Evaluated
Water Saving Direct Installs		
Bathroom Aerator	0.53	1.53
Kitchen Aerator	5.28	7.02
Showerhead	13.19	15.24
Weatherization Measures		
Air Infiltration Reduction	141.41	189.21
Ceiling Insulation (Pre R8 to Post R38)	73.34	117.23
Ceiling Insulation (Pre R0 to Post R38)	73.34	569.01
Sidewall Insulation	120.71	76.96
Equipment Replacement		
Natural Gas Furnaces (≥ 92% AFUE)	139.41	82.14
Natural Gas Water Heaters (≥ .67 EF)	25.00	51.01

A.8.1 Faucet Aerators

Cadmus used the following 2015 Indiana TRM v2.2 equation to calculate savings per faucet aerator installed:

$$Therm\ Savings = ISR * (GPM_{BASE} - GPM_{LOW}) * MPD * \frac{PH}{SH} * DR * 8.3 * (T_{MIX} - T_{IN}) * \frac{365}{RG * 100,000}$$

The savings inputs Cadmus used for its *ex post* calculations are shown in Table A-53.

Table A-53. Faucet Aerator Savings Inputs

Input	Assumption		Source
	Kitchen Faucet	Bathroom Faucet	
Faucet usage (minutes/day/person) (MPD)	4.5	1.6	2015 Indiana TRM v2.2
Number of faucets per home (FH)	1	1.63	2019 participant survey data for bathroom. 2015 Indiana TRM v2.2 for kitchen
Average household size (PH)	2.22	2.22	2019 participant survey data
Input water temperature to house (°F) (°F, Tin)	Varies	Varies	2015 Indiana TRM v2.2. Varies by nearest reference city
Temperature of water at faucet (°F) (°F, Tmix)	93	86	2015 Indiana TRM v2.2
Percent of water flowing down drain (DR)	0.5	0.7	2015 Indiana TRM v2.2
Gallons per minute of baseline faucet aerator (GPMbase)	2.44	1.9	2015 Indiana TRM v2.2
Gallons per minute of low-flow faucet aerator (GPMlow)	1.5	1.0	2019 program tracking data
Gas water heater recovery efficiency (RG)	0.76	0.76	2015 Indiana TRM v2.2

A.8.2 Efficient Showerhead

Cadmus used the following 2015 Indiana TRM v2.2 equation to calculate savings per efficient showerhead installed:

$$\text{Therm Savings} = \text{ISR} * (\text{GPM}_{\text{BASE}} - \text{GPM}_{\text{LOW}}) * \text{MS} * \text{SPD} * \frac{\text{PH}}{\text{SH}} * 8.3 * (\text{T}_{\text{MIX}} - \text{T}_{\text{IN}}) * \frac{365}{\text{RG} * 10000}$$

Efficient showerheads provided through the program replaced participants' existing showerheads, reducing water flow rates. The savings inputs Cadmus used for its *ex post* calculations are shown in Table A-54.

Table A-54. Efficient Showerhead Savings Inputs

Input	Assumption	Source
Average shower length (MS)	7.8	2015 Indiana TRM v2.2
Average household size (participants/household, PH)	2.22	2019 participant survey data
Number of showerheads per home (SH)	1.33	2019 participant survey data
Number of showers per day per person (SPD)	0.6	2015 Indiana TRM v2.2
Input water temperature to house (°F, Tin)	Varies	2015 Indiana TRM v2.2. Varies by nearest reference city.
Water temperature at showerhead (°F, Tmix)	101	2015 Indiana TRM v2.2, average mixed temperature of water used for shower
Gallons per minute of baseline showerhead (GPMbase)	2.63	2015 Indiana TRM v2.2
Gallons per minute of low-flow showerhead (GPMlow)	1.50	2019 program tracking data
Gas water heater recovery efficiency (RG)	0.76	2015 Indiana TRM v2.2

A.8.3 Air Sealing/Infiltration Reduction

Cadmus used this equation to calculate savings per infiltration reduction job:

$$\text{Therms savings} = \frac{\text{CFM50}_{\text{EXIST}} - \text{CFM50}_{\text{NEW}}}{\text{N} - \text{factor}} * \frac{\Delta \text{MMBtu}}{\text{CFM}} * 10$$

Cadmus calculated each site on an individual basis with different blower door measurements and heating types. The savings inputs Cadmus used for its *ex post* calculations are shown in Table A-55.

Table A-55. Targeted Income Program Air Sealing Savings Inputs

Description	Assumption	Source
CFM50_exist	Actual	2019 program tracking data
CFM50_new	Actual	2019 program tracking data
N-Factor	16.3	2015 Indiana TRM v2.2
Coincidence Factor	0.88	2015 Indiana TRM v2.2
MMBTU/CFM - Gas Furnace, CAC (MMBTU/CFM)	Varies	2015 Indiana TRM. Varies by nearest reference city.
MMBTU/CFM - Gas Furnace, no CAC (MMBTU/CFM)	Varies	2015 Indiana TRM. Varies by nearest reference city.

A.8.4 Ceiling and Sidewall Insulation

Cadmus applied this algorithm from the 2015 Indiana TRM served to calculate and verify natural gas energy savings:

$$\text{Annual Therms Savings} = kSF \times \frac{(\text{Energy}) \text{ Savings}}{kSF}$$

Cadmus calculated each site on an individual basis with different pre- and post-retrofit R-values as well as different square footages of insulation installed. The savings inputs Cadmus used for its *ex post* calculations are shown in Table A-56.

Table A-56. Targeted Income Program Insulation Savings Inputs

Description	Assumption	Source
Area of Installed Insulation (kSF)	Actual	2019 program tracking data
Energy Savings	Dependent on recorded pre- and post-retrofit R-values	2019 program tracking data

Energy savings per installation depended on pre- and post-retrofit insulation R-values, which Cadmus calculated using a three-step process:

4. Determine variables to use for insulation compression, R_{ratio} , and void factors
5. Calculate adjusted pre- and post-retrofit R-values using the inputs from step one
6. Interpolate the 2015 Indiana TRM tables to calculate savings using the adjusted R-values from step two

Variables to Use for Insulation Compression, R_{ratio} , and Void Factors

Cadmus adjusted R-values to account for compression, void factors, and surrounding building material. To calculate these adjusted pre- and post-retrofit R-values, Cadmus used this formula:

$$R \text{ value Adjusted} = R_{nominal} \times F_{compression} \times F_{void}$$

The following equation determined F_{void} :

$$R_{ratio} = (R_{nominal} \times F_{compression}) \times ((R_{nominal} \times R_{framing \text{ and air space}}))$$

The inputs used for these formulas are shown in Table A-57.

Table A-57. Insulation Compression, RRatio, and Void Factors

Description	Assumption	Source
Actual Pre- and Post-Retrofit R-Values per Manufacturing Specifications (Rnominal)	Actual	2019 program tracking data
Compression Factor Dependent on the Percentage of Insulation Compression (Fcompression)	1	Cadmus assumed a value of 1 at 0% compression for the evaluation
Void Factor (Fvoid)	Varied	Void factors accounted for insulation coverage and were dependent on installation grade level, pre- and post-R-values and compression effects
R-value for material (Rframing and air space)	5	2015 Indiana TRM
Area of Installed Insulation in thousand Square Feet (kSF)	Varies by participant	2019 program tracking data for heating/cooling combination for each participant

Table A-58 lists the void factor based on the calculated R_{ratio} . Cadmus used a 2% void for the evaluation since this information was unknown, and 2% is common in most households.

Table A-58. 2015 Indiana TRM: Insulation Void Factors

R_{ratio}	Void Factor	
	2% Void (Grade II)	5% Void (Grade III)
0.5	0.96	0.9
0.55	0.96	0.9
0.6	0.95	0.88
0.65	0.94	0.87
0.7	0.94	0.85
0.75	0.92	0.83
0.8	0.91	0.79
0.85	0.88	0.74
0.9	0.83	0.66
0.95	0.71	0.49
0.99	0.33	0.16

Adjusted R-Values

Applying the formula above (R_{value} Adjusted), Cadmus used the inputs defined in step one to calculate adjusted R-values for pre- and post-installation and calculated adjusted R-values for every installation in the database.

Interpolate Indiana TRM Tables

Cadmus used the pre- and post-installation adjusted R-values from step two to interpolate energy and demand for every 2019 installation based on the reported heating and cooling types. Appendix C of the 2015 Indiana TRM defines energy and demand savings for insulation measures by heating and cooling equipment as well as nearest reference city.

A.8.5 Natural Gas Furnaces

Cadmus started with the 2015 Indiana TRM methodology, which used this formula to calculate savings per furnace installed:

$$MMBtu\ Savings = Capacity\ (BTUH) \times EFLH \times \left(1 - \frac{AFUE_{base}}{AFUE_{ee}}\right) \times 10^{-6}$$

Where:

- Capacity (BTUH) = Actual size of equipment in BTUH input capacity
- EFLH = Equivalent full load hour (EFLH) for furnaces
= Values consistent with the 2015 Indiana TRM, as shown in Table A-59.

Table A-59. Indiana Equivalent Full Load Hours

Location	EFLH
Indianapolis	1,341
South Bend	1,427
Evansville	982
Fort Wayne	1,356
Terre Haute	804

- AFUE_{base} = Annual fuel utilization efficiency (AFUE) % for the baseline equipment
= 80% for existing and new construction applications
- EFF_{ee} = Annual fuel utilization efficiency % for the efficient equipment
= Actual installed

The values provided in the 2015 Indiana TRM for FLH_{HEAT} were developed using a modeling tool under the assumption that the baseline furnaces were exactly sized to meet peak heating demand. Because residential furnaces are sized in 15,000 Btu to 20,000 Btu increments, furnaces are typically oversized in residential applications to ensure that the unit can supply enough heat to meet a household's peak heating demand. The more oversized a furnace is compared to the heat load of the house, the fewer hours it will run.

Additionally, much of the time, an older standard-efficiency furnace is replaced with a more efficient unit with the same input capacity. Although the TRM full load hours correspond to a perfectly sized furnace, in practice, contractors traditionally install oversized furnaces. Cadmus would then overestimate savings when using the 2015 Indiana TRM assumptions. To correct for this, Cadmus developed and applied an oversizing factor of 20% to the 2015 Indiana TRM full load hours of the

baseline furnace.¹⁰⁶ Cadmus also applied an oversizing factor to the efficient furnace that was proportional to the efficiencies of the installed unit and the baseline unit.

$$\text{Efficient Unit Oversizing Factor} = 120\% \times AFUE_{Eff} / AFUE_{Base}$$

Where:

$$120\% = \text{Oversizing factor of baseline unit}$$

Cadmus used the modified equation to determine per-unit savings:

$$\frac{MMBtu \text{ Savings}}{\text{Efficient Unit Oversizing Factor}} = FLH_{Heat} \times BTUH \times (AFUE_{Eff} / AFUE_{Base} - 1) \times 10^6 - 6$$

To evaluate the 2019 Targeted Income Program, Cadmus confirmed with the implementer that all furnace replacements were replaced due to failure of the unit. Therefore, Cadmus used the federal baseline efficiency as the baseline AFUE for all furnace replacements. There are no early replacements furnaces through this program.

A.8.6 Natural Gas Water Heaters

Cadmus started with the 2015 Indiana TRM methodology, which used this formula to calculate savings per water heater:

$$MMBtu \text{ Savings} = GPD \times 365 \times 8.3 \times \frac{T_{MIX} - T_{IN}}{1,000,000} \times \left(\frac{1}{UEF_{Base}} - \frac{1}{UEF_{Eff}} \right)$$

The savings inputs Cadmus used for its *ex post* calculations are shown in Table A-60.

Table A-60. Targeted Income Program Water Heater Savings Inputs

Description	Assumption	Source
Gallons per day (GPD)	53.1	Using 2015 Indiana TRM and linear extrapolating to average people per home from TI Survey Data
Tin	130	2015 Indiana TRM
Tmix	Varies	2015 Indiana TRM. Varies by nearest reference city.
UEF_Eff	Actual	2019 program tracking data
UEF_Base	Varies by Water Heater	Electronic Code of Federal Regulations (e-CFR), available online: https://www.ecfr.gov/cgi-bin/text-idx?SID=a9921a66f2b4f66a32ec851916b7b9d9&mc=true&node=se10.3.430_132&rgn=div8

As with furnaces, Cadmus considered all replacements to be due to failure of the unit, based on information from the implementer. For instantaneous water heaters, Cadmus assumed a baseline of a

¹⁰⁶ Based on 2012 JOSB Vectren Evaluation that included communication with Peter Jacobs, who developed building simulations for the Indiana TRM version 1.

storage water heater given that it is a low income program, and it is less likely an instantaneous water heater would have been installed absent the program. There are no early replacements water heaters through this program.

A.9 Multifamily Direct Install Program

Cadmus' impact evaluation of the MFDI Program included these measures with attributable natural gas savings:

- Energy-efficient bathroom and kitchen faucet aerators
- Energy-efficient showerheads
- Smart thermostats (Nest E learning thermostat)

New to the program in 2019 are:

- Furnace filter whistle
- Pipe wrap (6 feet)

Table A-61 provides per-unit annual gross savings for each program measure.

Table A-61. 2019 MFDI Program Per-Unit Gross Savings

Measure	Annual Gross Savings (therms)	
	Reported	Evaluated
Energy-Efficient Bathroom Aerator	1.41	1.46
Energy-Efficient Kitchen Aerator	5.26	5.64
Energy-Efficient Showerhead	12.25	12.22
Furnace Filter Whistle	7.72	8.76
Pipe Wrap	3.65	3.55
Smart Thermostat	25.00	42.51

A.9.1 Faucet Aerators

Cadmus used the following equation to calculate savings per faucet aerator:

$$\text{Therm Savings} = \text{ISR} * (\text{GPM}_{\text{BASE}} - \text{GPM}_{\text{LOW}}) * \text{MPD} * \frac{\text{PH}}{\text{SH}} * \text{DR} * 8.3 * (\text{T}_{\text{MIX}} - \text{T}_{\text{IN}}) * \frac{365}{\text{RG} * 100,000}$$

Cadmus calculated savings using inputs from the 2015 Indiana TRM v2.2 and 2019 participant tenant survey data, as shown in Table A-62. Per-unit *ex ante* savings reported by Vectren were derived from 2017 evaluated MFDI Program faucet aerator savings (for bath and kitchen aerators).

Table A-62. 2019 MFDI Program Faucet Aerator Savings Inputs

Input	Kitchen Faucet Assumption	Bathroom Faucet Assumption	Source
Faucet Usage (Minutes/Day/Person)	4.5	1.6	2015 Indiana TRM v2.2
Number of Faucets per Home	1	1.5	2019 participant tenant survey
Average Household Size (Number of People)	1.9	1.9	2019 participant tenant survey
Input Water Temperature to House (°F)	58.1	58.1	Customer locations (tracking data) and 2015 Indiana TRM v2.2
Temperature of Water at Faucet (°F)	93	86	2015 Indiana TRM v2.2
Percentage of Water Flowing down Drain	0.5	0.7	2015 Indiana TRM v2.2
Gallons per Minute of Baseline Faucet Aerator	2.44	1.9	2015 Indiana TRM v2.2
Gallons per Minute of Energy-Efficient Faucet Aerator	1.5	1.0	Provided by Vectren
Recovery Efficiency of Gas Hot Water Heater	0.76	0.76	2015 Indiana TRM v2.2
In-Service Rate	98.3%	98.3%	2019 participant tenant survey

A.9.2 Energy-Efficient Showerhead

Cadmus used the following equation to calculate savings per energy-efficient showerhead:

$$Therm\ Savings = ISR * (GPM_{BASE} - GPM_{LOW}) * MS * SPD * \frac{PH}{SH} * 8.3 * (T_{MIX} - T_{IN}) * \frac{365}{RG * 100,000}$$

Energy-efficient showerheads installed through the MFDI Program replaced residents' existing showerheads, reducing water flow rates. Cadmus calculated savings using inputs from the 2015 Indiana TRM v2.2 and participant tenant survey data, as shown in Table A-63. Per-unit *ex ante* savings reported by Vectren were derived from 2017 evaluated MFDI Program showerhead savings.

Table A-63. 2019 MFDI Program Showerhead Savings Inputs

Input	Assumption	Source
Average Shower Length (Minutes)	7.8	2015 Indiana TRM v2.2
Average Household Size (Number of People)	1.9	2019 participant tenant survey
Number of Showerheads per Home	1.4	2019 participant tenant survey
Number of Showers per Day per Person	0.6	2015 Indiana TRM v2.2
Input Water Temperature to House (°F)	58.1	Customer locations (tracking data) and 2015 Indiana TRM v2.2
Water Temperature at Showerhead (°F)	101	2015 Indiana TRM v2.2
Gallons per Minute of Baseline Showerhead	2.63	2015 Indiana TRM v2.2
Gallons per Minute of Energy-Efficient Showerhead	1.50	Provided by Vectren
Recovery Efficiency of Gas Hot Water Heater	0.76	2015 Indiana TRM v2.2
In-Service Rate	94.8%	2019 participant tenant survey

A.9.3 Smart Thermostat

Cadmus calculated smart thermostat savings using the following equation and the savings reported in the 2013-2014 evaluation of programmable and smart thermostats in Vectren's Indiana territory, conducted in 2015.¹⁰⁷

$$\text{Annual therm savings} = \text{ISR} * \Delta\text{therms} * \text{MF Adjustment} * \frac{\text{Average FLH}_{\text{HEAT}}}{\text{Evansville FLH}_{\text{HEAT}}}$$

Cadmus calculated savings using inputs from the 2015 Indiana TRM v2.2 (Table A-64) and other data sources. The 2013-2014 thermostat evaluation reports natural gas savings of 69 therms for smart thermostats; however, Cadmus used RECS 2009 housing square footage data to adjust smart thermostat savings proportionally to smaller multifamily residences.¹⁰⁸ Savings were also adjusted to reflect the increased need for heating in Vectren North territory. Cadmus used customer zip codes from the tracking data to map MFDI Program participants to the appropriate 2015 Indiana TRM v2.2 climate zone and assign full load heating hours. Savings is adjusted by the ratio of full load heating hours from the tracking data to Evansville where units were metered for the 2013-2014 thermostat study.

Table A-64. 2019 MFDI Program Smart Thermostat Savings Inputs

Input	Assumption	Source
Δ therms	69	Evaluation of Vectren's 2013-2014 Programmable and Smart Thermostat Program (single-family)
Multifamily Adjustment	0.45	Average multifamily square footage of 1,200 vs. single-family square footage of 2,660 from RECS 2009
Average FLH heat	1,341	2015 Indiana TRM v2.2 and 2019 program tracking data
Evansville FLH heat	982	2015 Indiana TRM v2.2
In-Service Rate	89.1%	2019 participant tenant survey

A.9.4 Pipe Wrap

Cadmus used the following equation to calculate savings for pipe wrap:

$$\text{Therm savings} = \text{ISR} * \text{ESF} * \text{GPD} * 8.3 * 365 * (T_{\text{set}} - T_{\text{in}}) / (100000 * \text{RG})$$

Cadmus did not use the 2015 Indiana TRM v2.2 methodology because the TRM assumed that the average temperature difference between water heater-supplied water and ambient air temperature was constant for every foot of pipe. However, hot water does not flow constantly in most domestic residential water heating systems, so using the TRM likely overestimates energy savings from pipe wrap.

¹⁰⁷ Cadmus. January 29, 2015. *Evaluation of the 2013-2014 Programmable and Smart Thermostat Program*.

¹⁰⁸ Residential Energy Consumption Survey. "2009 RECS data."
<https://www.eia.gov/consumption/residential/data/2009/>

Based on results from an ACEEE report, Cadmus assumed insulating water heater pipes saved an average 3% of annual hot water energy consumption.¹⁰⁹ The savings inputs Cadmus used for its *ex post* calculations are shown in Table A-65. Per-unit *ex ante* savings reported by Vectren were derived from 2017 evaluated Home Energy Assessment Program pipe wrap savings.

Table A-65. 2019 MFDI Program Pipe Wrap savings Inputs

Input	Assumption	Source
Energy savings factor (ESF)	3%	ACEEE Report Number E093, assumption used in CL&P and UI PSD 2013
Gallons of water used per day (GPD)	44.2	Calculated using 1.9 average home size from 2019 participant survey data to interpolate daily usage, based on the relationship between gallons of water per day, per household vs. the number of people. 2015 Indiana TRM v2.2
Water heater temperature set point (°F, T _{set})	125	Assumed water heater temperature set point consistent with Home Energy Assessment Program.
Input water temperature to house (°F, T _{in})	58.1	2015 Indiana TRM v2.2 and 2019 program tracking data
Conversion from gallons to pounds (lbs)	8.3	Conversion factor
Conversion from Btu to therms	100,000	Conversion factor
Gas water heater recovery efficiency (RG)	76%	2015 Indiana TRM v2.2
in-Service Rate	100%	2019 participant tenant survey

A.9.5 Furnace Filter Whistle

Cadmus used the following equation to calculate savings per furnace filter whistle:

$$Therm\ Savings = ISR * FLH_{heat} * MF\ Adjustment * \frac{BtuH_{gas}}{\eta_{gas}} * EF_{gas}$$

As shown in Table A-66, Cadmus calculated savings for the furnace filter whistles installed through the program using values from the 2015 Indiana TRM v2.2, prior evaluation results, the Indiana residential baseline study, and an engineering review conducted by Quantec detailing algorithms for the measure.¹¹⁰ Cadmus also used housing square footage data from the Residential Energy Consumption Survey (RECS) 2009 to adjust furnace filter whistle savings proportionally to smaller multifamily

¹⁰⁹ American Council for an Energy-Efficient Economy. April 2009. ACEEE Report Number E093. *Potential for Energy Efficiency, Demand Response, and Onsite Solar Energy in Pennsylvania*.

¹¹⁰ Reichmuth, Howard. n.d. *Engineering Review and Savings Estimates for the "Filtertone" Filter Restriction Alarm*. White paper prepared for Energy Technology Laboratories. Prepared by Quantec.

residences.¹¹¹ Per-unit *ex ante* savings reported by Vectren were derived from 2017 evaluated Energy Efficient Schools Program furnace filter whistle savings.

Table A-66. 2019 MFDI Program Furnace Filter Whistle Savings Inputs

Input	Assumption	Source
Efficiency savings for gas furnace	0.0185	Quantec analysis: Engineering Review and Savings Estimates for the "Filtertone" Filter Restriction Alarm
Size of gas heating system in BTUH	78,236	2012 Indiana Residential Baseline Study, average capacity of heat pump
Full load heating hours	982	2015 Indiana TRM v2.2 for Evansville
Annual fuel utilization efficiency percentage	0.8	2015 Indiana TRM v2.2
Multifamily Adjustment	0.45	Average multifamily square footage of 1,200 vs. single-family square footage of 2,660 from RECS 2009 ¹
In-Service Rate	95.7%	Weighted average of other measures from 2019 participant tenant survey

¹ U.S. Energy Information Administration. 2009 Residential Energy Consumption Survey.

<https://energy.gov/sites/prod/files/2015/02/f19/UMPCChapter21-residential-lighting-evaluation-protocol.pdf>

A.10 Commercial and Industrial Prescriptive Program

Cadmus' impact evaluation of the C&I Prescriptive Program included measure categories with attributable natural gas savings, including these:

- Boilers
- Boiler tune-ups
- Furnaces
- Steam traps
- Tankless water heaters
- Thermostats (Wi-Fi and programmable)

Table A-67 provides per-unit annual gross savings for each program measure.

Table A-67. 2019 C&I Prescriptive Program Per-Unit Gross Savings

Measure	Annual Gross Savings (therms)	
	Reported	Evaluated
Boiler	3,100	2,784
Boiler Tune-up	425	425
Furnace	102	160
Tankless Water Heater	167	209
Thermostat	81	81
Steam Trap	392	393

¹¹¹ Residential Energy Consumption Survey. "2009 RECS data."

<https://www.eia.gov/consumption/residential/data/2009/>

A.10.1 Boiler

Cadmus based the savings from the algorithm in the 2015 Indiana TRM v2.2 for commercial boilers:

$$\Delta Therms = \frac{CAP \times EFLH_H \times \frac{n_{EE}}{n_{BASE}} - 1}{100}$$

Where:

CAP	=	Heating input capacity of installed equipment in kBtuh
EFLH _H	=	Equivalent full load heating hours selected based upon city and building type
n _{EE}	=	Installed equipment efficiency, in units of AFUE, thermal efficiency, or combustion efficiency
n _{BASE}	=	Baseline equipment efficiency, depends on application type and system size
1	=	Constant, based on algebraic manipulation of efficiency ratios
100	=	Conversion to therms

Because the 2015 Indiana TRM v2.2 has outdated baseline efficiencies, Cadmus compared its values with the current federal standard for commercial hot water boilers,¹¹² as shown in Table A-68.

Table A-68. Commercial Boiler Baseline Efficiency Comparison

Boiler Type	Size Category	2015 Indiana TRM v2.2 Efficiencies ¹	Federal Standard ²	Efficiency Type
Natural Gas Fired, Hot Water	< 300,000 BTUH	80%	82%	AFUE
	≥300,000 Btu/h and ≤2,500,000 Btu/h	75%	80%	Thermal Efficiency
	>2,500,000 Btu/h	80%	82%	Combustion Efficiency

¹ Cadmus used these values as the early replacement efficiencies.

² Code of Federal Regulations. Boilers: 10 CFR §431.87. https://www.ecfr.gov/cgi-bin/text-id.x?SID=7cc7e61cad1f0a474009880d24a8d553&mc=true&node=se10.3.431_187&rgn=div8.

A.10.2 Boiler Tune-up

Cadmus used this evaluated savings algorithm from the 2015 Indiana TRM v2.2 for boiler tune-ups:

$$\Delta Therms = CAP \times EFLH_H \times ESF$$

Here, CAP is the capacity of the boiler in therms, EFLH is the estimated full-load hours (which depend on the building type and location recorded in the program tracking data and confirmed in the participant survey), and ESF is a 2% energy savings factor.

¹¹² In 2019, of 65 boilers, 64 were hot water boilers and one was a steam boiler.

A.10.3 Furnace

Cadmus used this evaluated savings algorithm from the 2015 Indiana TRM v2.2 for efficient furnaces installed with ECM fans:

$$\Delta Therms = CAP \times EFLH_H \times \left(\frac{n_{BASE}}{n_{EE}} - 1 \right) / 100 - Therms_{ECM}$$

$$Therms_{ECM} = 0.019 \times CAP \times EFLH_H \times \frac{n_{BASE}}{n_{EE}} / 100$$

Where:

CAP	=	Heating input capacity of installed equipment in kBtuh
EFLH _H	=	Equivalent full load heating hours selected based upon city and building type
n _{EE}	=	Installed equipment efficiency, in units of AFUE
n _{BASE}	=	Baseline equipment efficiency, in AFUE
1	=	Constant, based on algebraic manipulation of efficiency ratios
100	=	Conversion to therms
Therms _{ECM}	=	Increased heating fuel consumption due to fan motor waste heat, if no ECM, set to 0
0.019	=	Conversion factor

The tracking database provided Cadmus with the capacity, installed efficiency, and if an ECM fan was present. The baseline AFUE, n_{BASE}, was the federal standard of 80%. The existing AFUE was 64.4%, which Cadmus used when projects were indicated to be replacing working equipment.¹¹³

A.10.4 Steam Trap

To estimate steam trap replacement savings, Cadmus used the algorithm in the 2019 Illinois TRM V7.¹¹⁴

$$\Delta Therms = Sa \times \frac{H_v}{B} \times Hours \times L / 100,000$$

Where:

Sa	=	Steam loss per leaking trap, varies, using deemed value based on building type
H _v	=	Heat of vaporization of steam, varies based on building type
B	=	Boiler efficiency, assumed to be 80.7%

¹¹³ Illinois Energy Efficiency Stakeholder Advisory Group. *2019 Illinois Statewide Technical Reference Manual for Energy Efficiency Version 7.0—Volume 2: Commercial and Industrial Measures*. September 28, 2018. Section 4.4.11. https://s3.amazonaws.com/ilsag/IL-TRM_Effective_010119_v7.0_Vol_2_C_and_I_092818_Final.pdf.

¹¹⁴ Ibid. Section 4.4.16.

Hours	=	Annual operating hours, based on building type
L	=	Leakage and blow-thru factor, assumed to be 1.0 because the program only gives rebates for failed steam straps
100,000	=	Conversion to therms

A.10.5 Tankless Water Heaters

To estimate savings for tankless water heaters, Cadmus primarily followed the 2015 Indiana TRM v2.2, but adjusted the requirements based on updated efficiency standards.

$$\Delta Therms = \frac{GPD \times 365 \times 8.33 \times (T_{out} - T_{in})}{100,000} \times \left(\frac{1}{n_{BASE}} - \frac{1}{n_{EE}} \right) + \frac{8,760 \times STBY_{BASE}}{100,000}$$

$$STBY_{BASE} = \left(\frac{Q}{800} \right) + 110\sqrt{V}$$

Where:

GPD	=	Water use for equipment in gallons per day, depends on building type
365	=	Days per year
8.33	=	Specific weight of water (8.33 lbs/gal) multiplied by the specific heat of water (1.0 Btu/(lb·F))
T _{out}	=	Water heater set point in degrees Fahrenheit, actual from tracking database
T _{in}	=	Cold water temperature entering the DWH system, depends on city
100,00	=	Conversion to therms
n _{BASE}	=	Baseline water heater, in uniform energy factor (81% UEF, if < 200,000 BTUH) or thermal efficiency (80% TE, ≥ 200,000 BTUH)
n _{EE}	=	Rated efficiency of installed water heater, in UEF or TE
8,760	=	Hours per year
STBY _{BASE}	=	Rated standby loss of baseline gas storage water heater, 0 if BTUH < 75,000 BTUH
Q	=	Input capacity of installed equipment, BTUH
V	=	Volume of replaced tanks

Table A-69 lists the baseline standards in the 2015 Indiana TRM v2.2 and the updated baselines based on federal standards.

Table A-69. Commercial Tankless Gas Water Heater Baseline Comparison

Water Heater Type	Size Category	2015 Indiana TRM v2.2 Efficiencies		Updated Federal Standards	
		η_{BASE}	STBY _{BASE}	η_{BASE}	STBY _{BASE}
Natural Gas Fired, Tankless	≤ 75,000 BTUH	80% EF	$(Q/800) + 110(V)^{1/2}$	81% UEF	N/A
	> 75,000 BTUH and ≤ 200,000 BTUH	80% EF or TE ¹		81% UEF	$Q/800 + 110(V)^{1/2}$
	>200,000 BTUH	80% TE		80% TE	

¹ The 2015 Indiana TRM v2.2 sets the cutoff for energy factor (EF) and thermal efficiency (TE) at 155,000 BTUH. Both measures of efficiency are equal to 80%.

A.10.6 Thermostats

The program implementer currently uses an energy modeling tool for determining savings for Wi-Fi and programmable thermostat measures because the 2015 Indiana TRM v2.2 does not provide savings algorithms for thermostats in commercial applications. In 2019, as in the previous three program years, the implementer used energy savings intensity factors (which estimate energy savings per square foot of building served by the thermostat) based on an eQuest model of a 15,000-square-foot office building. The eQuest model simulates the heating, cooling, and ventilation savings for 360 different thermostat configurations for two different weather locations: Indianapolis and Evansville.

Configurations varied by degree heating/cooling setback, hours of setback per day, and days the business was closed per week. Savings are assigned on a project-by-project basis according to the project's reported thermostat setback schedule and facility square footage.

Cadmus performed an in-depth review of the implementer's model as part of the 2017 and 2018 evaluations. Through this review, Cadmus determined that the implementer's approach was reasonable considering the available data and found no reason to adjust thermostat savings based on the *ex ante* model. Thus, consistent with 2018, reported thermostat savings equal evaluated savings.

A.11 Commercial and Industrial Custom Program

In 2019, the Commercial and Industrial (C&I) Custom Program had 35 application IDs with attributable natural gas savings. Cadmus performed desk reviews of all available project documentation for 31 program application IDs, representing 99% of the program savings. Table A-70 lists the results of the evaluation methodology.

Table A-70. 2019 Summary of C&I Custom Program Data Collection Methodology

Evaluation Methodology	Total Application IDs	Application IDs Requiring Update
Desk Review	31	0
Total	31	0

A.11.1 Impact Evaluation Methods and Findings

The C&I Custom Program impact evaluation included multiple data collection efforts and analysis tasks:

- Verify that all *ex ante* tracked savings are in alignment with the provided project documentation and calculations
- Review and verify that measure savings calculations and assumptions are supported by the project documentation
- Adjust the *ex post* savings estimations based on the desk review, where applicable

Each customer (or participating contractor) provided initial documentation of the project's energy savings, which the program implementer reviewed and finalized. The implementer then supplied the documentation and project analysis workbook to Cadmus.

Cadmus evaluated the reasonableness of savings calculations by reviewing all project documentation, including invoices, technical specifications, and verification reports (if applicable). Cadmus then performed a desk review of each project's analysis workbook, upon which the project's incentives were based, to verify these items:

- Calculation assumptions matched equipment specifications and supporting project documentation (including verification reports)
- Reported savings calculations followed accepted engineering methodologies
- All assumed baselines were appropriate for project type (new construction, retrofit, etc.)
- All calculation assumptions were reasonable, justified, and properly cited
- Reported savings fell within a reasonable range given the project's scope

Cadmus also calculated installation rates for projects confirmed through telephone interviews with 10 program participants. These interviews also provided data for NTG adjustments.

A.11.2 Desk Reviews

Each participating customer (or participating contractor) provided initial documentation of the project's energy reduction, which the program implementer reviewed, adjusted where necessary, and finalized. The program implementer supplied Cadmus with project documentation and analysis workbooks, upon which each project's incentives were based.

To evaluate the reasonableness of the savings calculations, Cadmus reviewed all project documentation, including invoices, technical specifications, and verification reports (if applicable), and reviewed each project's analysis workbook, verifying the following items:

- Calculation assumptions matched equipment specifications and supporting project documentation (including verification reports)
- Reported savings calculations follow accepted engineering methodologies
- All assumed baselines are appropriate for project type (new construction, retrofit, etc.)

- All calculation assumptions were reasonable, justified, and properly cited
- Reported savings fell within a reasonable range given the project's scope

Cadmus performed desk reviews (no on-site verification) on 31 of the 35 application IDs, and none of these required an update.

A.12 Commercial and Industrial Small Business Direct Install Program

Cadmus' impact evaluation of the SBDI Program included measures with attributable natural gas savings (i.e., Wi-Fi-enabled or programmable thermostats). Table A-71 provides per-unit annual gross savings for the thermostats.

Table A-71. 2019 Small Business Direct Install Program Per-Unit Gross Savings

Measure	Annual Gross Savings (therms)	
	Reported	Evaluated
Wi-Fi and Programmable Thermostats	36.5	32.3

A.12.1 Wi-Fi and Programmable Thermostats

The program implementer currently uses an energy modeling tool for determining savings for thermostat measures because the 2015 Indiana TRM v2.2 does not provide savings algorithms for thermostats in commercial applications.¹¹⁵ In 2019, as in the previous three program years, the implementer used energy savings intensity factors (which estimate energy savings per square foot of building served by the thermostat) based on an eQuest model of a 15,000-square-foot office building. The eQuest model simulates the heating, cooling, and ventilation savings for 360 different thermostat configurations for two different weather locations: Indianapolis and Evansville. Configurations varied by degree heating/cooling setback, hours of setback per day, and days the business was closed per week. Savings are assigned on a project-by-project basis according to the project's reported thermostat setback schedule and facility square footage.

Cadmus performed an in-depth review of the implementer's model as part of the 2017 and 2018 evaluations and determined that the implementer's approach was reasonable considering the available data and found no reason to adjust thermostat savings based on the *ex ante* model.

Thermostats resulted in a realization rate of 88%. The realization rate deviates from 100% largely due to the influence of a single project that installed and claimed savings for three thermostats. Savings are proportional to facility size, and in the case of this project, the *ex ante* savings use the square footage of the entire facility to calculate savings for each thermostat, rather than the actual area served by the thermostat. Evaluated savings assume that each thermostat serves one third of the facility.

¹¹⁵ The same eQuest model is used for both programmable and smart wi-fi thermostats. Approximately 47% of the thermostats rebated in 2019 were programmable and the balance (53%) were smart wi-fi thermostats.

Appendix B. Net-to-Gross Detailed Findings

B.1 Residential Prescriptive Program

Cadmus calculated freeridership for the Residential Prescriptive Program as a whole using findings from a quarterly freeridership surveys conducted with 1,348 program participants, of which 1,334 answered the freeridership questions. Cadmus calculated spillover for the Residential Prescriptive Program as a whole using findings from an annual survey conducted with 323 program participants who answered the spillover questions. After including spillover, the program resulted in a 58% NTG ratio.

Table B-1 summarizes the freeridership, spillover, and NTG estimates by measure category. The overall program NTG of 58% is weighted by the combination of electric and gas gross evaluated program population savings. However, the gas-specific NTG ratio of 58% presented in Table B-1 is weighted specifically to gas savings due to the application of measure category level NTG estimates to evaluated gross population gas savings. The overall program NTG of 58% is heavily weighted toward the gas-specific NTG estimate of 58% because *ex post* gross gas savings account for 94% of the total 2019 Residential Prescriptive Program energy savings.

Table B-1. 2019 Residential Prescriptive Program Net-to-Gross Ratio

Survey Measure Category	Freeridership	Spillover	NTG Ratio	Total Program <i>Ex Post</i> MMBTU Savings
Furnace (n=576 for FR; n=112 for SO)	47%	1%	54%	118,052
Heat Pump/CAC (n=88 for FR; n=18 for SO)	32%	0%	68%	5,424
Smart Thermostat (n=454 for FR; n=122 for SO)	33%	3%	70%	25,338
Wi-Fi Enabled Thermostat (n=135 for FR; n=27 for SO)	27%	3%	76%	2,997
Weatherization (n=33 for FR; n=12 for SO)	24%	1%	77%	7,950
Other (n=48 for FR; n=17 for SO)	25%	10%	85%	1,016
Total Program (n=1,642)²	43%¹	1%¹	58%¹	160,776³
Electric-Specific NTG			71%	9,439
Demand-Specific NTG			72%	5.59⁴
Gas-Specific NTG			58%	151,338

¹ Weighted by evaluated *ex post* program population MMBTU savings

² 1,334 respondents answered the freeridership (FR) questions through the quarterly freeridership surveys. 308 respondents answered the spillover (SO) questions through the annual spillover specific survey. Not all respondents surveyed answered the freeridership and spillover questions.

³ MMBTU savings do not sum due to rounding.

⁴ MMBTU/hour savings.

B.1.1 Detailed Freeridership Findings

Cadmus estimated freeridership by combining two methods—the standard self-report intention method and the intention/influence method. By combining the standard self-report *intention* methodology with an *influence* methodology, Cadmus produced a program freeridership score.¹¹⁶

Cadmus calculated the arithmetic mean of the savings weighted *intention* and *influence* freeridership components to estimate measure category freeridership estimates,¹¹⁷ as shown in this equation:

$$\text{Final Freeridership \%} = \frac{\text{Intention FR Score(0\% to 100\%)} + \text{Influence FR Score(0\% to 100\%)}}{2}$$

Intention Freeridership Score

Cadmus estimated *intention* freeridership scores for all participants based on their responses to the *intention*-focused freeridership questions. As part of past Vectren evaluations, Cadmus developed a transparent, straightforward matrix approach to assign a single score to each participant based on their objective responses.

Determining *intention* freeridership estimates from a series of questions rather than using a single question helps to form a picture of the program's influence on the participant and checks consistency. For example:

- “Did the program affect the timing of your decision and, if so, by how many months/years?”
- “Did the program affect the efficiency of equipment installed and, if so, by how much?”
- “Did the program affect the quantity of technology installed and, if so, by how much?”

Not all questions are weighted equally. For example, if respondents would not have installed measures at the same efficiency level without the program, they automatically become a 0% *intention* freerider. If they would not have installed the measures within one year without the program, they also automatically become a 0% *intention* freerider. Other questions included in the *intention* freeridership analysis are assigned partial weights for responses indicative of a non-freerider.

After assigning an *intention* freeridership score to every survey respondent, Cadmus calculated a savings-weighted average *intention* freerider score for each measure category.

Table B-2 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 Cadmus then decrement based on their responses to the eight questions.

¹¹⁶ *Intention* and *influence* freeridership scores both have a maximum of 100%.

¹¹⁷ *Ex post* gross program savings.



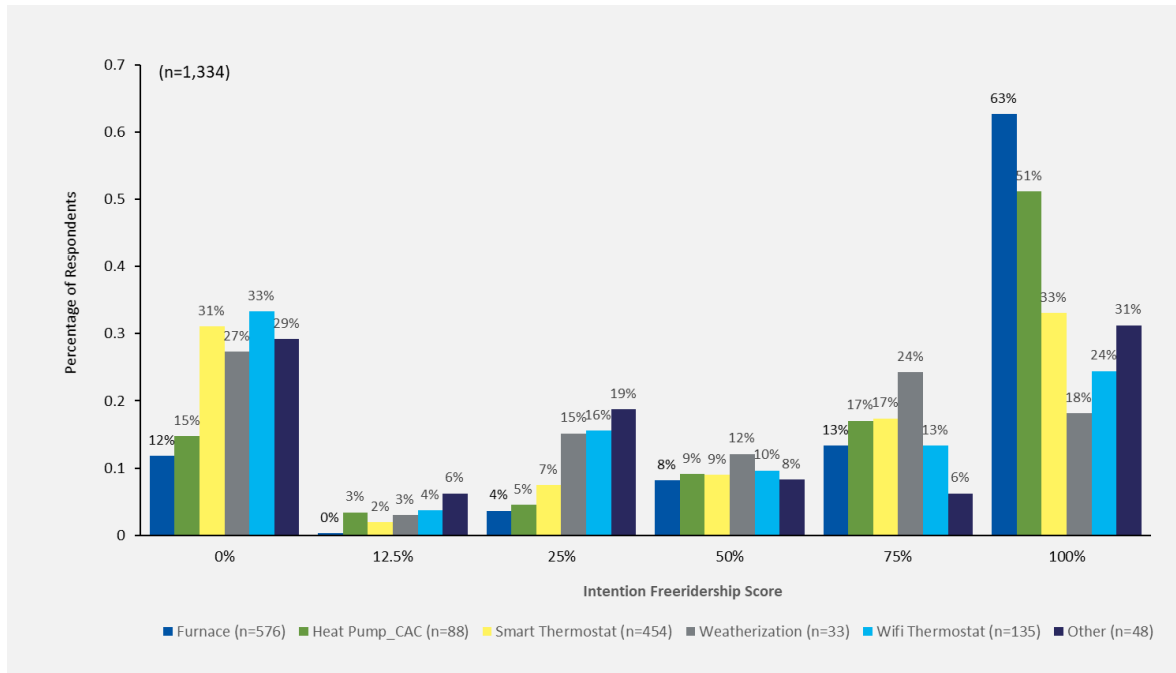
Table B-2. Residential Prescriptive Program Raw Survey Responses Translation to Intention Freeridership Scoring Matrix Terminology and Scoring

BEFORE you heard about the Vectren Residential Efficient Products Rebate Program, had you already planned to purchase the [MEASURE 1]?	BEFORE you heard anything about the Vectren Residential Efficient Products Rebate program, had you already purchased or installed your [MEASURE 1]?	So, just to be clear, you installed your new [MEASURE 1] before you heard anything about the Vectren Residential Efficient Products Rebate Program, correct?	Would you have installed the same [MEASURE 1] without the rebate from Vectren?	Just so I understand, would you have installed a different [MEASURE 1] without the Vectren rebate or would you have decided not to purchase it? NOT READ RESPONSES]	When you say you would have installed a [MEASURE 1] without the rebate from Vectren, would you still have purchased and installed [MEASURE 1] that was just as efficient, less efficient or more efficient than what you purchased?	When you say you would have installed a thermostat without the rebate from Vectren, what kind of thermostat would you have installed?	And would you have installed the same quantity of [MEASURE 1] without the incentive from Vectren?	And, thinking about timing, without the Vectren rebate, would you have installed the [MEASURE 1]...
Yes (Yes) [-0%]	Yes (Yes) [-0%]	Yes, that is correct (Yes) [100% FR Assigned]	Yes (Yes) [-0%]	Yes, I would have installed a different MEASURE_1 (Yes) [-0%]	Just as efficient (Yes) [-0%]	A smart or learning thermostat (Yes) [-0%]	Yes, the same quantity (No) [-0%]	At the same time (No) [-0%]
No (No) [-50%]	No (No) [-0%]	No, that's not correct (No) [-0%]	No (No) [-25%]	I would have decided not to replace it (No) [-25%]	Less efficient (No) [-100%]	A Wi-Fi thermostat (non-learning) (Yes) [-0%]	No, would have installed fewer (No) [-50%]	Within the same year (No) [-50%]
DK/RF (Partial) [-25%]	DK/RF (No) [-0%]	DK/RF (No) [-0%]	DK/RF (Partial) [-0%]	DK/RF (Partial) [-25%]	More efficient (Yes) [-0%]	A programmable thermostat (No) [-100%]	No, would have installed more (No) [-0%]	One to two years out (No) [-100%]
					DK/RF (Partial) [-25%]	A manual thermostat (Yes) [-100%]	DK/RF (Partial) [-25%]	More than two years out (No) [-100%]
						Would not have installed a new thermostat (Yes) [-100%]		Never (No) [-100%]
						DK/RF (Partial) [-25%]		DK/RF (Partial) [-25%]



Figure B-1 shows the distribution of *intention* freeridership estimates Cadmus assigned to participant responses to the pure intention-based freeridership method.

**Figure B-1. Residential Prescriptive Program Self-Report
Intention Freeridership Distribution by Estimate**



Influence Freeridership Score

Table B-3 shows the distribution of responses to the question: "Please rate the influence of the following program elements on your decision to purchase and install [the product]. Please use a scale from 1, meaning *not at all influential*, to 4, meaning the item was *very influential* to your decisions." From responses to this question, Cadmus obtained data about how participants learned about the program from their contractor, rebates for the equipment, and information about energy efficiency from Vectren. Cadmus assessed influence freeridership from participants' ratings to how important various program elements were in their decision to purchase energy-efficient products.

**Table B-3. Residential Prescriptive Program Freeridership *Influence* Responses by Measure Category (n=1,334)**

Response Options	Influence Score	Information about the program from your contractor						Rebates for the equipment						Information about energy efficiency that Vectren provided						Previous participation in a Vectren energy efficiency program					
		Furnace	Heat Pump/CAC	Smart Thermostat	Wi-Fi Thermostat	Weatherization	Other	Furnace	Heat Pump/CAC	Smart Thermostat	Wi-Fi Thermostat	Weatherization	Other	Furnace	Heat Pump/CAC	Smart Thermostat	Wi-Fi Thermostat	Weatherization	Other	Furnace	Heat Pump/CAC	Smart Thermostat	Wi-Fi Thermostat	Weatherization	Other
1 - Not at all influential	100%	40	9	6	2	0	1	42	9	16	4	0	1	42	9	16	4	0	1	42	9	16	4	0	1
2 - Not too influential	75%	21	1	2	2	0	0	22	1	16	2	0	2	22	1	16	2	0	2	22	1	16	2	0	2
3 - Somewhat influential	25%	123	19	23	20	3	6	128	19	108	23	3	6	128	19	108	23	3	6	128	19	108	23	3	6
4 - Very influential	0%	365	54	85	93	30	29	368	56	307	103	30	39	368	56	307	103	30	39	368	56	307	103	30	39
Not Applicable	50%	14	3	3	3	0	0	16	3	7	3	0	0	16	3	7	3	0	0	16	3	7	3	0	0
Average Rating		3.5	3.4	3.6	3.7	3.9	3.8	3.5	3.4	3.6	3.7	3.9	3.7	3.5	3.4	3.6	3.7	3.9	3.7	3.5	3.4	3.6	3.7	3.9	3.7



Cadmus used the maximum rating given by each participant for any factor in Table B-3 to determine the participant's influence score, presented in Table B-4. Cadmus weighted individual influence scores by their respective total survey sample *ex post* gross savings to arrive at savings-weighted average influence scores by measure category.

Table B-4. Residential Prescriptive Program Influence Freeridership Score (n=1,334)

Maximum Influence Rating	Influence Score	Furnace	Heat Pump/ Central Air Conditioner	Smart Thermostat	Wi-Fi Thermostat	Weatherization	Other
1 – Not at all influential	100%	42	9	16	4	0	1
2 – Not too influential	75%	22	1	16	2	0	2
3 – Somewhat influential	25%	128	19	108	23	3	6
4 – Very influential	0%	368	56	307	103	30	39
Not Applicable	50%	16	3	7	3	0	0
Average Maximum Influence Rating - Simple Average		3.5	3.4	3.6	3.7	3.9	3.7
Average Influence Score - Weighted by Ex Post Savings		17%	7%	13%	9%	1%	7%

Final Freeridership Score

Cadmus then calculated the arithmetic mean of the intention and influence freeridership components to estimate final freeridership by measure category, weighted by *ex post* gross program savings. The higher the freeridership score, the more savings are deducted from the gross savings estimates. Table B-5 summarizes the intention, influence, and overall freeridership scores for each measure category.

Table B-5. Residential Prescriptive Program Intention, Influence and Overall Freeridership Scores by Measure Category

Measure Category	n	Intention Score	Influence Score	Freeridership Score
Furnace	576	77%	17%	47%
Heat Pump/CAC	88	57%	7%	32%
Smart Thermostat	454	53%	13%	33%
Wi-Fi Enabled Thermostat	135	45%	9%	27%
Weatherization	33	47%	1%	24%
Other	48	42%	7%	25%

B.1.2 Detailed Spillover Findings

Sixteen participants reported installing a total of 17 high-efficiency measures after participating in the program. These respondents did not receive an incentive and said participation in the program was very influential on their decision to install additional measures. Cadmus attributed spillover savings to measures including a high-efficiency clothes washer, dishwashers, refrigerator, water heaters, insulation, windows, duct sealing, smart thermostats, and HVAC equipment.

Cadmus used *ex post* savings estimated for the 2019 evaluation in combination with the 2015 Indiana TRM v2.2 to estimate savings for all spillover measures attributed to the program. Cadmus divided the total survey sample spillover savings for each measure category by the gross program savings from the survey sample to obtain the measure category spillover estimates in Table B-6.

Table B-6. Residential Prescriptive Spillover Estimates by Measure Category

Measure Category	Survey Sample Spillover MMBTU Savings	Survey Sample Program MMBTU Savings	Percentage Spillover Estimate
Furnace	10.6	1,499.5	1%
Heat Pump/CAC	0.0	29.4	0%
Smart Thermostat	19.6	772.5	3%
Wi-Fi Enabled	1.5	54.3	3%
Weatherization	2.0	189.4	1%
Other	8.7	90.5	10%

B.2 Residential New Construction Program

Cadmus analyzed NTG for the 2019 Residential New Construction (RNC) Program through interviews with 10 participating builders.¹¹⁸ Cadmus calculated a freeridership score from these builders' responses about how their organization's building practices would have differed in the absence of the program. Respondents were also asked to rate the influence of program elements on their building practices. Table B-7 presents the freeridership, spillover, and NTG results for the 2019 RNC Program.

Table B-7. 2019 Residential New Construction Program Net-to-Gross Ratio

Measure	Freeridership	Spillover	NTG Ratio
New Construction Incentives	36%	0%	64% ¹
Habitat For Humanity Kit Incentives	0%	0%	100%

¹Absolute precision at 90% confidence interval is $\pm 10\%$.

¹¹⁸ Eight interviewed builders received new construction incentives. One of these eight builders also installed Habitat For Humanity Kits in homes. Two additional interviewed participants only installed Habitat For Humanity Kits in homes. All three participants interviewed that installed Habitat For Humanity Kits answered "No" to the question "Would you have purchased and installed any of the Habitat for Humanity Kit items in homes if you had not received them in your kits from Vectren?". Cadmus estimates 0% freeridership, 0% spillover and 100% NTG for the Habitat for Humanity Kits.

B.2.1 Detailed Freeridership Findings

Intention Method – New Construction Incentives

The initial intention freeridership questions and answers are shown in Table B-8. The table also contains the analysis of responses to the follow-up questions associated with each response option (which Cadmus used to determine each builder's final intention score). To calculate intention-based freerider savings, Cadmus multiplied each builder's intention score by the respective verified gross program savings. In the table, the sum of the intention score MMBTU savings divided by the evaluated *ex post* MMBTU savings of the total survey sample produces a weighted MMBTU savings intention score of 35%.

Table B-8. 2019 Residential New Construction Program Evaluated Net Savings

Intention Question/Response Options	Intention Score	Count	Total Survey Sample <i>Ex Post</i> MMBTU Savings	Intention Score MMBTU Savings
Thinking about the Vectren Residential New Construction Program homes you built in 2019, which of the following would have happened if you had not received incentives and assistance from Vectren?				
<i>Adopted some of the Residential New Construction Program building practices but not enough to meet the HERS 63 standards. Just to confirm, would your company have adopted most, some or a few of the building practices required to meet the HERS 63 standards?</i>				
Most	37.5%	0	0	0
Some	25%	1	2,230	558
A few	12.5%	0	0	0
<i>Continued with current practices, which were not Residential New Construction Program standards. Would your company have adopted some of the Vectren Residential New Construction Program building practices in the last 12 months?</i>				
Yes, within the last 12 months	25%	0	0	0
No, but within one to two years	0%	0	1,083	0
No, not in the near future	0%	0	0	0
Don't know	12.5%	0	0	0
<i>Continued with current practices, which were a mix of Residential New Construction Program standards and less efficient than the program standards. Would your firm have continued to build some of your homes to the New Construction Program standards of at least a HERS 63 without any incentives or assistance from Vectren?</i>				
Yes, would have adopted 100% of New Construction Program standards for some homes within the last 12 months	35%	2	5,497	1,945
Yes, would have adopted 100% of New Construction Program standards for some homes within one to two years	25%	1	397	99
No, not in the near future for any homes	0%	0	0	0
Don't know	12.5%	0	0	0
<i>Continued with current practices, the Residential New Construction program standards are my standard practices and I build to HERS 63 and below. Would your firm have built all of your homes to the HERS 63 standards without the incentives or assistance from Vectren?</i>				
Yes	50%	3	3,931	1,966
No	0%	0	0	0
Total		8	13,139	4,567
Intention Score - Weighted by <i>Ex Post</i> MMBTU Savings (Intention Score MMBTU Savings Divided by Total Survey Sample <i>Ex Post</i> MMBTU Savings)	35%			

Influence Method – New Construction Incentives

Table B-9 shows the distribution of responses to the influence question: "Please rate each item on how influential it was to your decision to build homes to Vectren RNC Program standards of at least a HERS 63 or below. Please use a scale from 1, meaning *not influential*, to 4, meaning the item was *very influential* to your decisions."

Cadmus assessed influence freeridership from participants' ratings to determine how important various program elements were in their decision to purchase the home, such as the information about energy-efficient practices that Vectren provided, incentives for the homes, program marketing, information from HERS raters, and previous participation in a Vectren energy efficiency program. The table shows the program elements that participants rated for influence, along with a count and average rating for each factor.

Table B-9. 2019 Residential New Construction Program Freeridership Influence Responses (n=8)

Response Options	Influence Score	Vectren Program Incentives	Vectren Program Marketing	Information about energy-efficient building practices that Vectren provided	Obtaining information from HERS rater who rates homes	Previous participation in a Vectren energy efficiency program
1 - Not at all influential	50%	1	4	1	1	0
2 – Not too influential	37.5%	1	3	5	0	0
3 – Somewhat influential	12.5%	0	0	2	3	0
4 – Very influential	0%	6	0	0	4	0
Don't Know	25%	0	0	0	0	8
Average		3.4	1.4	2.1	3.3	N/A

Cadmus used the maximum rating given by each participant for any factor in Table B-9 to determine their influence score, which is presented in Table B-10. The counts refer to the number of responses for each factor/influence score response option. Cadmus weighted individual influence scores by their respective total survey sample *ex post* gross savings to arrive at a savings-weighted average influence score of 1% for the RNC Program.

Table B-10. 2019 Residential New Construction Program Influence Freeridership Score (n=8)

Maximum Influence Rating	Influence Score	Count	Total Survey Sample <i>Ex Post</i> MMBTU Savings	Influence Score MMBTU Savings
1 - Not at all influential	50%	0	0	0
2 – Not too influential	37.5%	0	0	0
3 – Somewhat influential	12.5%	1	781	98
4 – Very influential	0%	7	12,358	0
Average Maximum Influence Rating - Simple Average		3.8		
Average Influence Score - Weighted by Ex Post MMBTU Savings			1%	

Next, Cadmus summed the intention and influence components to estimate the total intention/influence method freeridership of 36% for new construction incentives, weighted by *ex post* gross program savings. The higher the freeridership score, the more savings are deducted from the gross savings estimates.

B.2.2 Detailed Spillover Findings

The 2019 RNC Program spillover estimate is 0%. None of the surveyed builders reported voluntarily raising the energy efficiency standard of the appliances or materials they used to build homes that were not eligible for the Vectren program.

B.3 Home Energy Assessment (HEA 2.0) Program

Cadmus calculated freeridership and spillover for the HEA 2.0 Program as a whole using findings from a survey conducted with 87 program participants. The overall program NTG of 87% is weighted by the combination of electric and gas gross evaluated program population savings. However, the gas-specific NTG ratio of 91% is weighted specifically to gas savings due to the application of measure-level NTG estimates. Table B-11 lists the presents the NTG results for the program.

Table B-11. 2019 HEA 2.0 Program NTG by Measure

Measure	Freeridership	Spillover	NTG Ratio	Total Program <i>Ex Post</i> MMBTU Savings
Total Program	16% ¹	3% ¹	87% ¹	3,703
Electric-Specific NTG			85%	1,825
Demand-Specific NTG			82%	0.16 ²
Gas-Specific NTG			91%	1,878

¹ Weighted by evaluated *ex post* program population MMBTU savings.

² MMBTU/hour savings.

B.3.1 Detailed Freeridership Findings

Cadmus estimated freeridership using a pure intentions-based method for all measures except smart thermostats.¹¹⁹ Smart thermostats, the highest impact measure in 2019, used an intention and influence freeridership method that aligns with methods used for smart thermostat measures in the Residential Prescriptive Program and Smart Cycle Program. Most survey respondents had multiple measures installed through the program and were asked freeridership questions about each measure. Cadmus then weighted the measure-level freeridership estimates by the evaluated gross population savings for

¹¹⁹ An *influence* score component is not included in the freeridership methodology of non-smart thermostat direct install measures.

each measure. The resulting program freeridership estimate is 16%. Table B-12 lists the freeridership results by measure.

Table B-12. 2019 HEA 2.0 Program Freeridership by Measure

Measure	n	Freeridership	Evaluated Ex Post Population Savings (MMBTU)
Audit Fee ¹	0	0%	253
Bathroom Aerator	44	16%	27
Filter Whistle	2	0%	18
Kitchen Aerator	36	16%	74
LED Light Bulbs	64	24%	1,112
LED Nightlight ¹	0	0%	45
Pipe Insulation	31	12%	51
Showerhead	28	26%	189
Smart Strips	56	13%	22
Smart Thermostat	50	13%	1,862
Water Heater Setback ¹	0	0%	51
Overall	N/A	16%²	3,703

¹ No NTG surveys completed, assuming 0% freeridership.

² Weighted by evaluated ex post program population MMBTU savings.

Freeridership Scoring – Non-Smart Thermostat Measures

Table B-13 shows three items under each of the freeridership questions in the participant survey. All respondents start with a freeridership score of 100% and show they are not freeriders through answers to the survey questions. The value *in parentheses* represents whether the response option is coded as “yes,” “no,” or “partially” as indicative of freeridership. The value *in brackets* is the discount applied to a respondent’s freeridership score if they answer with the specific response.

Table B-13. 2019 HEA 2.0 Program Freeridership Scoring – Non-Smart Thermostat Measures

If you had not received the [MEASURE] that the program gave you during the assessment, would you have...?	When would you have purchased them on your own?
Purchased the same amount at the same time (Yes) [-0%]	Within a few months (Yes) [-50%]
Purchased fewer at the same time (No) [-50%]	Within a year (Partial) [-75%]
Purchased the same amount at a later time (Yes) [-0%]	More than a year (No) [-100%]
Purchased fewer at a later time (Partial) [-50%]	Don't know/refused (Partial) [-25%]
Not purchased [MEASURE] at all (No) [-100%]	
DK/RF (Partial) [-75%]	

CADMUS

Freeridership Scoring – Smart Thermostats

Cadmus estimated freeridership for smart thermostats by combining two methods—the standard self-report intention method and the intention/influence method. By combining the standard self-report *intention* methodology with an *influence* methodology, Cadmus produced a smart thermostat freeridership score.¹²⁰

Cadmus calculated the arithmetic mean of the savings weighted *intention* and *influence* freeridership components to estimate smart thermostat freeridership,¹²¹ as shown in this equation:

$$\text{Final Freeridership \%} = \frac{\text{Intention FR Score(0\% to 100\%)} + \text{Influence FR Score(0\% to 100\%)}}{2}$$

Intention Freeridership Score

Cadmus estimated *intention* freeridership scores for all participants based on their responses to the *intention*-focused freeridership questions. Cadmus developed a transparent, straightforward matrix approach to assign a single score to each participant based on their objective responses.

Determining *intention* freeridership estimates from a series of questions rather than using a single question helps to form a picture of the program's influence on the participant and checks consistency, as in these example questions:

- “Did the program affect the timing of your decision and, if so, by how many months/years?”
- “Did the program affect the efficiency of equipment installed and, if so, by how much?”
- “Did the program affect the quantity of technology installed and, if so, by how much?”).

Not all questions are weighted equally. For example, if respondents would not have installed the thermostat at the same efficiency level without the program, they automatically become a 0% *intention* freerider. If they would not have installed the thermostat within one year without the program, they also automatically become a 0% *intention* freerider. Other questions included in the *intention* freeridership analysis are assigned partial weights for responses indicative of a non-freerider.

After assigning an *intention* freeridership score to every survey respondent, Cadmus calculated a savings-weighted average *intention* freerider score of 16% for the program.

Table B-14 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 Cadmus then decrement based on their responses to the nine questions.

¹²⁰ *Intention* and *influence* freeridership scores both have a maximum of 100%.

¹²¹ *Ex post* gross program savings.

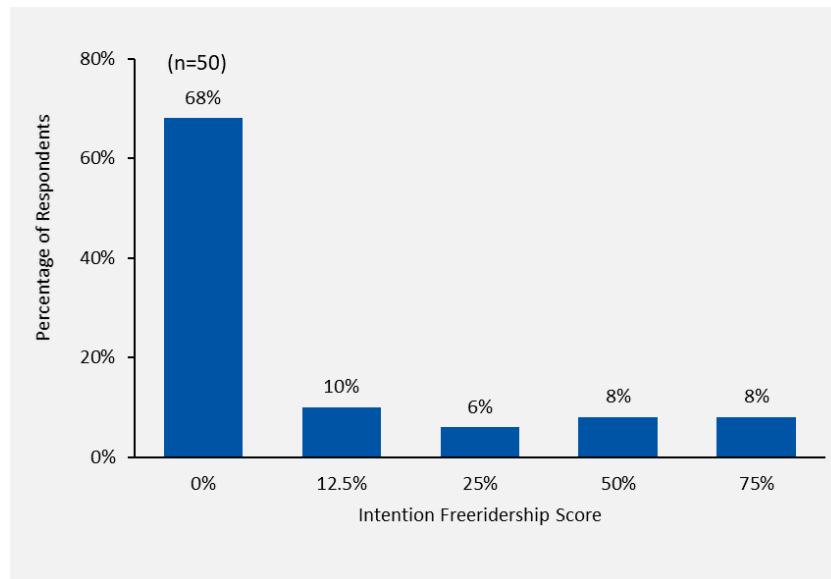


Table B-14. 2019 HEA 2.0 Program Smart Thermostat Raw Survey Responses Translation to Intention Freeridership Scoring Matrix Terminology and Scoring

Before you heard about the Vectren's Home Energy Assessment Program, had you already planned to purchase a thermostat?	Would you have purchased and installed the same type of thermostat if the Vectren's Home Energy Assessment Program did not exist?	Would you have purchased and installed a different type of thermostat if the Vectren's Home Energy Assessment Program did not exist or would you not have purchased a thermostat on your own?	If the Vectren's Home Energy Assessment Program did not exist, what kind of thermostat would you have purchased and installed?	Would you have purchased and installed the same quantity of [THERMOSTAT TYPE] thermostats if the Vectren's Home Energy Assessment Program did not exist?	Thinking about timing, if the Vectren's Home Energy Assessment Program did not exist, when would you have installed the [THERMOSTAT TYPE] thermostat?
Yes (Yes) [-0%]	Yes (Yes) [-0%]	Yes, I would have installed a different MEASURE_1 (Yes) [-0%]	A smart or learning thermostat (Yes) [-0%]	Yes, the same quantity (No) [-0%]	At the same time (No) [-0%]
No (No) [-50%]	No (No) [-25%]	I would have decided not to replace it (No) [-100%]	A Wi-Fi thermostat (non-learning) (Yes) [-0%]	No, would have installed fewer (No) [-50%]	Within the same year (No) [-50%]
DK/RF (Partial) [-25%]	DK/RF (Partial) [-0%]	DK/RF (Partial) [-25%]	A programmable thermostat (No) [-100%]	No, would have installed more (No) [-0%]	One to two years out (No) [-100%]
			A manual thermostat (Yes) [-100%]	DK/RF (Partial) [-25%]	More than two years out (No) [-100%]
			Would not have installed a new thermostat (Yes) [-100%]		Never (No) [-100%]
			DK/RF (Partial) [-25%]		DK/RF (Partial) [-25%]

Figure B-2 shows the distribution of *intention* freeridership estimates Cadmus assigned to participant responses to the pure intention-based freeridership method.

**Figure B-2. 2019 HEA 2.0 Program Smart Thermostat Self-Report
Intention Freeridership Distribution by Estimate**



Influence Freeridership Score

Table B-15 shows the distribution of responses to the influence question: "Please rate the influence of the following program elements on your decision to have the energy efficiency technician install a thermostat on a scale from 1 to 4, where 1 means *not at all important* and 4 means *very important*. This question pertains to information from the installation contractor that the thermostat was free from Vectren, about energy efficiency information that Vectren provided, and about previous participation in a Vectren energy efficiency program.

Cadmus assessed influence freeridership from participants' ratings to the relative importance of various program elements in their purchasing decisions. Table B-15 shows the program elements that participants rated for influence, along with a count and average rating for each factor.

Cadmus used the maximum rating given by each participant for any factor in Table B-15 to determine the participant's influence score presented in Table B-16. The counts refer to the number of responses for each factor/influence score response option. Cadmus weighted individual influence scores by each participant's respective total survey sample *ex post* gross savings to arrive at a savings-weighted average influence score of 9% for HEA 2.0 smart thermostat participants.

Table B-15. 2019 HEA 2.0 Program Smart Thermostat Freeridership Influence Responses (n=50)

Question G5 Response Options	Influence Score	Information from your Energy Efficiency Technician	That the thermostat was free from Vectren	Information about energy efficiency that Vectren provided	Previous participation in a Vectren energy efficiency program
1 – Not at all important	100%	3	2	3	7
2 – Not too important	75%	4	2	4	3
3 – Somewhat important	25%	16	6	13	5
4 - Very important	0%	26	37	29	19
Don't Know	50%	1	1	0	14
Not Applicable	50%	0	2	1	2
Average Rating		3.3	3.7	3.4	3.1

Table B-16. 2019 HEA 2.0 Program Smart Thermostat Influence Freeridership Score (n=50)

Maximum Influence Rating	Influence Score	Count	Total Survey Sample Ex Post MMBTU Savings	Influence Score MMBTU Savings
1 – Not at all important	100%	2	23	23
2 – Not too important	75%	0	0	0
3 – Somewhat important	25%	10	93	23
4 - Very important	0%	38	382	0
Average Maximum Influence Rating - Simple Average		3.7		
Average Influence Score - Weighted by Ex Post Savings			9%	

Next, Cadmus calculated the arithmetic mean of the intention and influence freeridership components to estimate a final freeridership value of 13% for smart thermostats, weighted by *ex post* gross program savings. The higher the freeridership score, the more savings are deducted from the gross savings estimates. Table B-17 presents the intention, influence, and freeridership scores for HEA 2.0 smart thermostats.

Table B-17. 2019 HEA 2.0 Program Smart Thermostat Intention/Influence Freeridership Score

n	Intention Score	Influence Score	Freeridership Score
50	16%	9%	13%

B.3.2 Detailed Spillover Findings

Three participants reported that after participating in the HEA 2.0 Program they installed additional high-efficiency measures for which they did not receive an incentive.¹²² These respondents said participation in the program was very important in their decision.

Cadmus used *ex post* savings estimated from the 2019 Residential Prescriptive Program along with the 2015 Indiana TRM v2.2 to estimate savings for all spillover measures attributed to the HEA 2.0 Program. Cadmus divided the total survey sample spillover savings by the gross program savings from the survey sample to obtain the 4% spillover estimate for the program measures with valid freeridership response data,¹²³ as shown in Table B-18.

Table B-18. 2019 HEA 2.0 Program Spillover Estimate

Survey Sample Spillover MMBTU Savings	Survey Sample Program MMBTU Savings	Spillover Percentage Estimate (from Surveys)	Spillover Percentage Estimate (Overall Program)
33	889 ¹	4%	3%

¹ 2019 evaluated gross energy savings.

B.4 Smart Cycle Program

Cadmus calculated freeridership and spillover for Smart Cycle Program dual fuel smart thermostats using findings from a survey conducted with 162 dual fuel smart thermostat program participants.¹²⁴ After including spillover, the program resulted in a 96% NTG ratio for gas savings. Table B-19 lists the presents the NTG results for the program.

Table B-19. 2019 Smart Cycle Program Net-to-Gross Ratio

Measure	Freeridership ¹	Spillover	NTG Ratio
Smart Cycle Thermostat - Dual Fuel	9%	5%	96%
Total Program	9%	5%	96%

¹ Weighted by evaluated *ex post* program MMBTU savings

¹²² These measures were a gas tank-less water heater, attic insulation, duct sealing, clothes washers, a refrigerator, a central air conditioner and a dehumidifier.

¹²³ The survey data resulted in a 4% spillover estimate. The 4% survey-based spillover estimate was only applied to measures that had freeridership response data from the survey. For measures that did not have freeridership response data Cadmus applied a 100% NTG ratio and did not apply the 4% survey-based spillover estimate to the measures. The overall program-level spillover estimate of 3% is the evaluated *ex post* program population MMBTU savings weighted average of all spillover estimates in the table.

¹²⁴ The Smart Cycle survey collected 251 total responses, but only 246 respondents answered freeridership and spillover questions and 162 of the 246 were classified as dual fuel Smart Cycle thermostat recipients.

B.4.1 Detailed Freeridership Findings

Cadmus estimated freeridership by combining two methods—the standard self-report intention method and the intention/influence method. By combining the standard self-report *intention* methodology with an *influence* methodology, Cadmus produced a program freeridership score.¹²⁵

Cadmus calculated the arithmetic mean of the savings weighted *intention* and *influence* freeridership components to estimate measure category freeridership estimates,¹²⁶ as shown in this equation:

$$\text{Final Freeridership \%} = \frac{\text{Intention FR Score}(0\% \text{ to } 100\%) + \text{Influence FR Score}(0\% \text{ to } 100\%)}{2}$$

Intention Freeridership Score

Cadmus estimated *intention* freeridership scores for all participants based on their responses to the *intention*-focused freeridership questions. As part of past Vectren evaluations, Cadmus developed a transparent, straightforward matrix approach to assign a single score to each participant based on his or her objective responses.

Determining *intention* freeridership estimates from a series of questions rather than using a single question helps to form a picture of the program's influence on the participant. (For example, "Did the program affect the timing of your decision and, if so, by how many months/years?" "Did the program affect the efficiency of equipment installed and, if so, by how much?" "Did the program affect the quantity of technology installed and, if so, by how much?") Use of multiple questions also checks consistency.

Not all questions are weighted equally. For example, if respondents would not have installed measures at the same efficiency level without the program, they automatically become a 0% *intention* freerider. If they would not have installed the measures within one year without the program, they also automatically become a 0% *intention* freerider. Other questions included in the *intention* freeridership analysis are assigned partial weights for responses indicative of a non-freerider.

After assigning an *intention* freeridership score to every survey respondent, the Cadmus calculated a savings-weighted average *intention* freerider score of 14% for the program.

Table B-20 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 Cadmus then decrement based on their responses to the nine questions.

¹²⁵ *Intention* and *influence* freeridership scores both have a maximum of 100%.

¹²⁶ *Ex post* gross program savings.



**Table B-20. 2019 Raw Survey Responses Translation to *Intention* Freeridership Scoring Matrix Terminology
 Smart Cycle Program and Scoring**

Before you heard about Vectren's Smart Cycle Program, had you already planned to purchase a [THERMOSTAT TYPE]?	Would you have purchased and installed a Nest thermostat if Vectren's Smart Cycle Program did not exist?	Would you have purchased and installed a different type of thermostat if Vectren's Smart Cycle Program did not exist or would you not have purchased a thermostat on your own?	If Vectren's Smart Cycle Program did not exist, what kind of thermostat would you have purchased and installed?	Would you have purchased and installed the same quantity of [THERMOSTAT TYPE]s if Vectren's Smart Cycle Program did not exist?	Thinking about timing, if Vectren's Smart Cycle Program did not exist, when would you have installed a Nest Thermostat?
Yes (Yes) [-0%]	Yes (Yes) [-0%]	Yes, I would have installed a different MEASURE_1 (Yes) [-0%]	A smart or learning thermostat (Yes) [-0%]	Yes, the same quantity (No) [-0%]	At the same time (No) [-0%]
No (No) [-50%]	No (No) [-25%]	I would have decided not to replace it (No) [-100%]	A Wi-Fi thermostat (non-learning) (Yes) [-0%]	No, would have installed fewer (No) [-50%]	Within the same year (No) [-50%]
DK/RF (Partial) [-25%]	DK/RF (Partial) [-0%]	DK/RF (Partial) [-25%]	A programmable thermostat (No) [-100%]	No, would have installed more (No) [-0%]	One to two years out (No) [-100%]
			A manual thermostat (Yes) [-100%]	DK/RF (Partial) [-25%]	More than two years out (No) [-100%]
			Would not have installed a new thermostat (Yes) [-100%]		Never (No) [-100%]
			DK/RF (Partial) [-25%]		DK/RF (Partial) [-25%]

Figure B-3 shows the distribution of *intention* freeridership estimates Cadmus assigned to participant responses to the pure intention-based freeridership method.

**Figure B-3. 2019 Smart Cycle Program Self-Report
Intention Freeridership Distribution by Estimate**

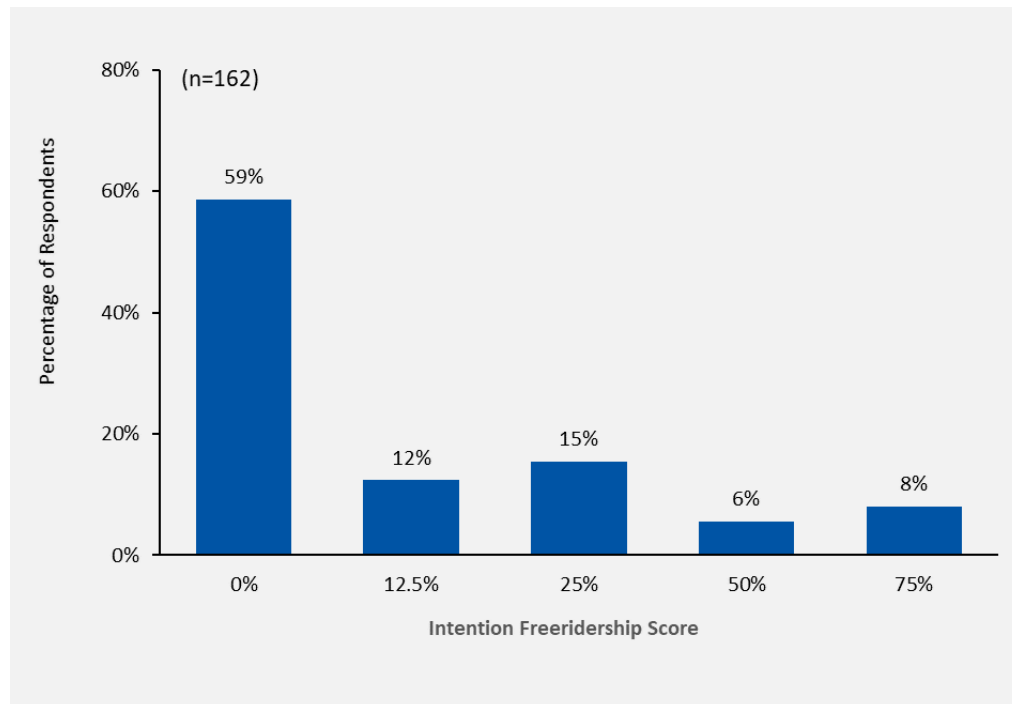


Table B-21 shows the distribution of responses to the influence question: "Please rate the influence of the following program elements on your decision to have the energy efficiency technician install a thermostat on a scale from 1 to 4, where 1 means *not at all important* and 4 means *very important*. This question pertains to information about the program from the participants' contractor, that the thermostat was free from Vectren, about energy efficiency information that Vectren provided, and if the respondent had previously participated in a Vectren energy efficiency program.

Cadmus assessed influence freeridership from participants' ratings to the relative importance of various program elements in their purchasing decisions. Table B-21 shows the program elements that participants rated for influence, along with a count and average rating for each factor.

Cadmus used the maximum rating given by each participant for any factor in Table B-21 to determine the participant's influence score presented in Table B-22. The counts refer to the number of responses for each factor/influence score response option. Cadmus weighted individual influence scores by each participant's respective total survey sample *ex post* gross savings to arrive at a savings-weighted average influence score of 4% for Smart Cycle Program dual fuel smart thermostat participants.

Table B-21. 2019 Smart Cycle Program Freeridership Influence Responses (n=162)

Question G5 Response Options	Influence Score	Information from the Installation Contractor	That the Thermostat was Free from Vectren	Information about Energy Efficiency that Vectren Provided	Previous Participation in a Vectren Energy Efficiency Program
1 – Not at all important	100%	23	2	7	15
2 – Not too important	75%	29	2	11	16
3 – Somewhat important	25%	43	19	62	40
4 - Very important	0%	53	138	80	78
Don't Know	50%	5	0	0	2
Not Applicable	50%	9	1	2	11
Average Rating		2.9	2.9	3.8	3.3

Table B-22. 2019 Smart Cycle Program Influence Freeridership Score (n=162)

Maximum Influence Rating	Influence Score	Count	Total Survey Sample <i>Ex Post</i> MMBTU Savings	Influence Score MMBTU Savings
1 – Not at all important	100%	0	0	1
2 – Not too important	75%	3	20	15
3 – Somewhat important	25%	15	106	26
4 - Very important	0%	143	1,098	0
Not Applicable	50%	1	7	3
Average Maximum Influence Rating - Simple Average		3.9		
Average Influence Score - Weighted by <i>Ex Post</i> Savings			4%	

Next, Cadmus calculated the arithmetic mean of the intention and influence freeridership components to estimate a final freeridership value of 9% for dual fuel smart thermostat program participants, weighted by *ex post* gross program savings. The higher the freeridership score, the more savings are deducted from the gross savings estimates. Table B-23 presents the intention, influence, and freeridership scores for the Smart Cycle Program.

Table B-23. 2019 Smart Cycle Program Intention/Influence Freeridership Score

n	Intention Score	Influence Score	Freeridership Score
162	14%	4%	9%

B.4.2 Detailed Spillover Findings

Six dual fuel smart thermostat participants reported that after receiving the Nest thermostat(s) they installed additional high-efficiency measures for which they did not receive an incentive.¹²⁷ These respondents said participation in the program was very important in their decision.

Cadmus used *ex post* savings estimated from the 2019 Residential Prescriptive Program along with the 2015 Indiana TRM v2.2 to estimate savings for all spillover measures attributed to the Smart Cycle Program. Cadmus divided the total survey sample spillover savings by the gross program savings from the survey sample to obtain the 5% spillover estimate for the dual fuel smart thermostat program participants, as shown in Table B-24.

Table B-24. 2019 Smart Cycle Program Spillover Estimate

Survey Sample Spillover MMBTU Savings	Survey Sample Program MMBTU Savings	Spillover Percentage Estimate
60	1,230 ¹	5%

¹ 2019 evaluated gross energy savings.

B.5 Commercial and Industrial Prescriptive Program

Cadmus calculated freeridership and spillover for the C&I Prescriptive Program as a whole using findings from a survey conducted with 58 program participants.¹²⁸ The program resulted in an 83% NTG ratio. Table B-25 presents the NTG results for the program.

Table B-25. 2019 C&I Prescriptive Program Net-to-Gross Ratio

Measure	Freeridership	Spillover	NTG Ratio
Total Program	17% ¹	0%	83% ¹

¹ Absolute precision at 90% confidence interval is $\pm 5\%$.

B.5.1 Detailed Freeridership Findings

Cadmus estimated freeridership by combining two methods—the standard self-report intention method and the intention/influence method. By combining the standard self-report *intention* methodology with an *influence* methodology, Cadmus produced a program freeridership score.¹²⁹

¹²⁷ These measures were clothes washers, dishwashers, gas furnaces, central air conditioners, duct sealing, windows and attic insulation.

¹²⁸ Only 58 of the 69 survey respondents completed the questions relating to freeridership.

¹²⁹ *Intention* and *influence* freeridership scores both have a maximum of 100%.

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Cadmus calculated the arithmetic mean of the savings weighted *intention* and *influence* freeridership components to estimate measure category freeridership estimates,¹³⁰ as shown in this equation:

$$\text{Final Freeridership \%} = \frac{\text{Intention FR Score}(0\% \text{ to } 100\%) + \text{Influence FR Score}(0\% \text{ to } 100\%)}{2}$$

Intention Freeridership Score

Cadmus estimated *intention* freeridership scores for all participants based on their responses to the *intention*-focused freeridership questions. As part of past Vectren evaluations, Cadmus developed a transparent, straightforward matrix approach to assign a single score to each participant based on his or her objective responses.

Determining *intention* freeridership estimates from a series of questions rather than using a single question helps to form a picture of the program's influence on the participant and checks consistency, as in these example questions:

- “Did the program affect the timing of your decision and, if so, by how many months/years?”
- “Did the program affect the efficiency of equipment installed and, if so, by how much?”
- “Did the program affect the quantity of technology installed and, if so, by how much?”

Not all questions are weighted equally. For example, if respondents would not have installed measures at the same efficiency level without the program, they automatically become a 0% *intention* freerider. If they would not have installed the measures within two years without the program, they also automatically become a 0% *intention* freerider. Other questions included in the *intention* freeridership analysis are assigned partial weights for responses indicative of a non-freerider.

After assigning an *intention* freeridership score to every survey respondent, Cadmus calculated a savings-weighted average *intention* freerider score of 31% for the program.

Table B-26 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 Cadmus then decrement based on their responses to the eight questions.

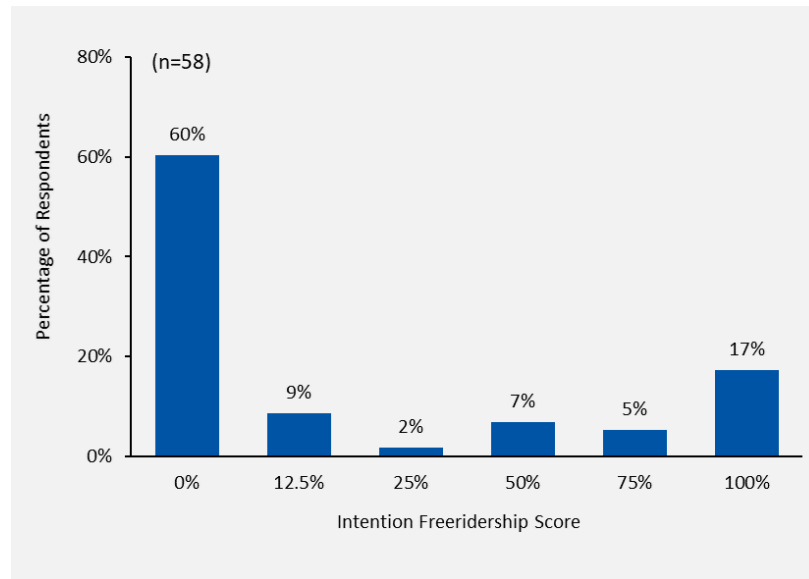
¹³⁰ *Ex post* gross program savings.

**Table B-26. C&I Prescriptive Program Raw Survey Response Translation to
Intention Freeridership Scoring Matrix Terminology and Scoring**

Did your organization have specific plans to install the [MEASURE 1] before learning about the Business Rebate Program?	Had you already purchased or installed the [MEASURE 1] before you learned about the program?	Just to be clear, you installed the [MEASURE] before you heard anything about the Vectren program, correct?	Would you have installed a [MEASURE] that (was/were) just as energy-efficient without the Vectren program and rebates?	And would you have installed the same quantity of [MEASURE] in absence of the Vectren program and rebates?	Without the Vectren program and rebates, would you have installed the [MEASURE] ...	Did the incentive help the [MEASURE] project receive implementation approval from your organization?	Prior to participating in the Business Rebate Program, was the purchase and installation of the [MEASURE] included in your organization's capital budget?
Yes (Yes) [-0%]	Yes (Yes) [-0%]	Yes, that is correct (Yes) [100% FR Assigned]	Yes, just as energy-efficient (Yes) [-0%]	Yes, same quantity (Yes) [-0%]	Within the same year? (Yes) [-0%]	Yes (No) [-50%]	Yes (No) [-50%]
No (No) [-50%]	No (No) [-0%]	No, that's not correct (No) [-0%]	No, less energy efficient (No) [-50%]	No, I would have installed less (No) [-50%]	Within one to two years? (Partial) [-25%]	No (Yes) [-0%]	No (Yes) [-0%]
DK/RF (Partial) [-25%]	DK/RF (No) [-0%]	DK/RF (No) [-0%]	No, more energy efficient (Yes) [-0%]	No, I would have installed more (Yes) [-0%]	Within three to five years? (No) [-100%]	DK/RF (Partial) [-25%]	DK/RF (Partial) [-25%]
				DK/RF (Partial) [-25%]	In more than five years? (No) [-100%]		
					DK/RF (Partial) [-25%]		

Figure B-4 shows the distribution of *intention* freeridership estimates Cadmus assigned to participant responses to the pure intention-based freeridership method.

**Figure B-4. C&I Prescriptive Program Self-Report
Intention Freeridership Distribution by Estimate**



Influence Freeridership Score

Table B-27 shows the distribution of responses to the influence question: "Please rate each item on how important it was to your decision to complete the project the way it was done. Please use a scale from 1, meaning *not at all important*, to 4, meaning the item was *very important* to your decisions." This question pertains to information about the program from the participants' contractor, incentives for the equipment, energy efficiency information that Vectren provided, the free energy assessment for the business, and previous participation in a Vectren energy efficiency program.

Cadmus assessed influence freeridership from participants' ratings to the relative importance of various program elements in their purchasing decisions. Table B-27 shows the program elements that participants rated for influence, along with a count and average rating for each factor.

Table B-27. C&I Prescriptive Program Freeridership Influence Responses (n=58)

Response Options	Influence Score	Vectren or Nexant staff	Rebates for the equipment	Information about energy efficiency provided by Vectren.	Information about energy efficiency from program staff or my contractor provided	Previous participation in a Vectren energy efficiency program
1 – Not at all important	100%	4	4	6	2	2
2 – Not too important	75%	5	17	15	12	11
3 – Somewhat important	25%	13	28	21	26	12
4 - Very important	0%	12	2	8	8	16
Not Applicable	50%	24	7	8	10	17
Average		3.0	2.5	2.6	2.8	3.0

Cadmus used the maximum rating given by each participant for any factor in Table B-27 to determine the participant's influence score presented in Table B-28. The counts refer to the number of responses for each factor/influence score response option. Cadmus weighted individual influence scores by each participant's respective total survey sample *ex post* gross savings to arrive at a savings-weighted average influence score of 3% for C&I Prescriptive Program participants.

Table B-28. C&I Prescriptive Program Influence Freeridership Score (n=58)

Maximum Influence Rating	Influence Score	Count	Total Survey Sample <i>Ex Post</i> MMBtu Savings	Influence Score MMBtu Savings
1 – Not at all important	100%	1	14	14
2 – Not too important	75%	2	43	32
3 – Somewhat important	25%	12	419	105
4 - Very important	0%	43	4,822	0
Not Applicable	50%	1	14	14
Average Maximum Influence Rating - Simple Average		3.7		
Average Influence Score - Weighted by <i>Ex Post</i> Savings			3%	

Final Freeridership Score

Next, Cadmus calculated the arithmetic mean of the intention and influence freeridership components to estimate a final freeridership value of 17%, weighted by *ex post* gross program savings. The higher the freeridership score, the more savings are deducted from the gross savings estimates. Table B-29 presents the intention, influence, and freeridership scores for the C&I Prescriptive Program.

Table B-29. C&I Prescriptive Program Intention/Influence Freeridership Score

n	Intention Score	Influence Score	Freeridership Score
58	31%	3%	17%

B.5.2 Detailed Spillover Findings

None of the interviewed participants reported that after participating in the program they had installed additional high-efficiency equipment for which they did not receive an incentive and that participation in the program was very important in their decision. Therefore, there is no spillover attributed to the program.

B.6 Commercial and Industrial Custom Program

Cadmus calculated freeridership and spillover for the C&I Custom Program as a whole using findings from a survey conducted with 10 program participants. After including spillover, the program resulted in an 92% NTG ratio. Table B-30 lists the presents the NTG results for the program.

Table B-30. 2019 C&I Custom Program Net-to-Gross Ratio

Program	Freeridership	Spillover	NTG Ratio
C&I Custom Program	8%	0%	92% ¹

¹ Absolute precision at 90% confidence interval is $\pm 8\%$.

B.6.1 Detailed Freeridership Findings

Cadmus estimated freeridership by combining two methods—the standard self-report intention method and the intention/influence method. By combining the standard self-report *intention* methodology with an *influence* methodology, Cadmus produced a program freeridership score.¹³¹

Cadmus calculated the arithmetic mean of the savings weighted *intention* and *influence* freeridership components to estimate measure category freeridership estimates,¹³² as shown in this equation:

$$\text{Final Freeridership \%} = \frac{\text{Intention FR Score}(0\% \text{ to } 100\%) + \text{Influence FR Score}(0\% \text{ to } 100\%)}{2}$$

Intention Freeridership Score

Cadmus estimated *intention* freeridership scores for all participants based on their responses to the *intention*-focused freeridership questions. As part of past Vectren evaluations, Cadmus developed a

¹³¹ *Intention* and *influence* freeridership scores both have a maximum of 100%.

¹³² *Ex post* gross program savings.

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transparent, straightforward matrix approach to assign a single score to each participant based on his or her objective responses.

Determining *intention* freeridership estimates from a series of questions rather than using a single question helps form a picture of the program's influence on the participant and checks consistency; for example:

- "Did the program affect the timing of your decision and, if so, by how many months/years?"
- "Did the program affect the efficiency of equipment installed and, if so, by how much?"
- "Did the program affect the quantity of technology installed and, if so, by how much?"

Not all questions are weighted equally. For example, if respondents would not have installed measures at the same efficiency level without the program, they automatically become a 0% *intention* freerider. If they would not have installed the measures within two years without the program, they also automatically become a 0% *intention* freerider. Other questions included in the *intention* freeridership analysis are assigned partial weights for responses indicative of a non-freerider.

After assigning an *intention* freeridership score to every survey respondent, the Cadmus calculated a savings-weighted average *intention* freerider score of 10% for the program.

Table B-31 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 Cadmus then decrement based on their responses to the nine questions.

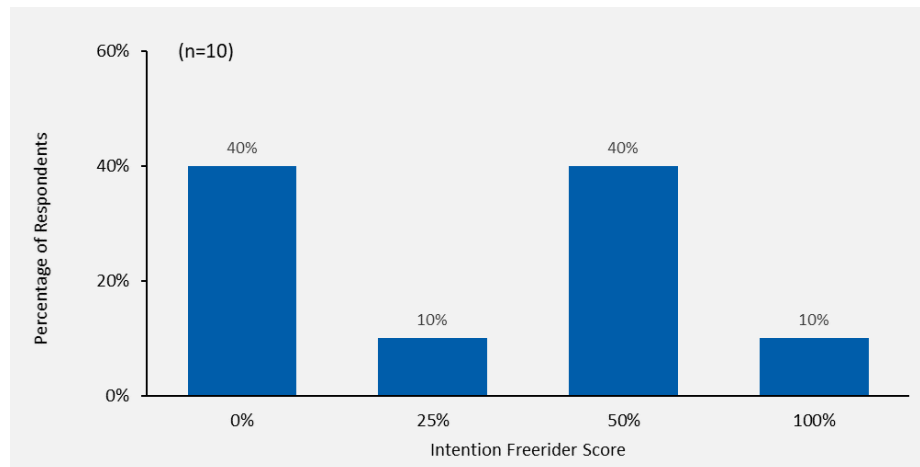


**Table B-31. 2019 Raw Survey Responses Translation to *Intention* Freeridership Scoring Matrix Terminology
 C&I Custom Program and Scoring**

First, did your organization have specific plans to install the [MEASURE] BEFORE learning about Vectren's Commercial Custom Program rebate?	Had you already purchased or installed the new [MEASURE] before you learned about the program?	Just to be clear, you installed the [MEASURE] before you heard anything about the Vectren program, correct?	Would you have installed a [MEASURE] that (was/were) just as energy-efficient without the Vectren program and rebates? [READ LIST IF NECESSARY]	And would you have installed the same quantity of [MEASURE] in absence of the Vectren program and rebates? [READ LIST IF NECESSARY]	Without the Vectren program and rebates, would you have installed the [MEASURE] ... [READ LIST]?	Did the incentive help the [MEASURE] project receive implementation approval from your organization?	Prior to participating in the Commercial Custom Program, was the purchase and installation of the [MEASURE] included in your organization's capital budget?
Yes (Yes) [-0%]	Yes (Yes) [-0%]	Yes, that is correct (Yes) [100% FR Assigned]	Yes, just as energy-efficient (Yes) [-0%]	Yes, same quantity (Yes) [-0%]	Within the same year? (Yes) [-0%]	Yes (No) [-50%]	Yes (Yes) [-0%]
No (No) [-50%]	No (No) [-0%]	No, that's not correct (No) [-0%]	No, less energy efficient (No) [-100%]	No, I would have installed less (No) [-50%]	Within one to two years? (Partial) [-25%]	No (Yes) [-0%]	No (No) [-50%]
DK/NA (Partial) [-25%]	DK/NA (No) [-0%]	DK/NA (No) [-0%]	No, more energy efficient (Yes) [-0%]	No, I would have installed more (Yes) [-0%]	Within three to five years? (No) [-100%]	DK/NA (Partial) [-25%]	DK/NA (Partial) [-25%]
			DK/NA (Partial) [-25%]	DK/NA (Partial) [-25%]	In more than five years? (No) [-100%]		
					DK/NA (Partial) [-25%]		

Figure B-5 shows the distribution of *intention* freeridership estimates Cadmus assigned to participant responses using the pure intention-based freeridership method.

**Figure B-5. 2019 C&I Custom Program Self-Report
Intention Freeridership Distribution by Estimate**



Influence Freeridership Score

Table B-32 shows the distribution of responses to the influence question: “Please rate each item on how influential it was to your decision to complete the project the way it was done. Please use a scale from 1, meaning ‘not at all influential’, to 4, meaning the item was ‘very influential’ to your decisions.” This question was asked with respect to Vectren and Nexant staff, rebates for the equipment, information about energy efficiency provided by Vectren, information about energy efficiency provided by the participant’s contractor, and previous participation in a Vectren energy efficiency program.

Cadmus assessed influence freeridership from participants’ ratings to the relative importance of various program elements in their purchasing decisions. Table B-32 shows the program elements that participants rated for influence, along with a count and average rating for each factor.

Table B-32. 2019 C&I Custom Program Freeridership Influence Responses (n=10)

Response Options	Influence Score	Vectren or Nexant Staff	Rebates for the Equipment	Information about Energy Efficiency Provided by Vectren	Information about Energy Efficiency from Program Staff or My Contractor Provided	Previous Participation in a Vectren Energy Efficiency Program
1 – Not at all influential	100%	1	0	0	0	0
2 – Not too influential	75%	2	0	1	3	0
3 – Somewhat influential	25%	3	3	4	3	2
4 - Very influential	0%	3	7	4	4	7
Don’t Know	50%	0	0	0	0	0
Not Applicable	50%	1	0	1	0	1
Average		2.6	3.7	3.0	3.1	3.4



Cadmus used the maximum rating given by each participant for any factor in Table B-32 to determine the participant's influence score presented in Table B-33. The counts refer to the number of responses for each factor/influence score response option. Cadmus weighted individual influence scores by each participant's respective total survey sample *ex post* gross savings to arrive at a savings-weighted average influence score of 5% for C&I Custom Program participants.

Table B-33. 2019 C&I Custom Program Influence Freeridership Score (n=10)

Maximum Influence Rating	Influence Score	Count	Total Survey Sample <i>Ex Post</i> MMBTU Savings	Influence Score MMBTU Savings
1 – Not at all influential	100%	0	0	0
2 – Not too influential	75%	0	0	0
3 – Somewhat influential	25%	2	2,398	599
4 - Very influential	0%	8	8,963	0
Average Maximum Influence Rating - Simple Average		3.8		
Average Influence Score - Weighted by <i>Ex post</i> Savings			5%	

Final Freeridership Score

Cadmus calculated the arithmetic mean of the intention and influence freeridership components to estimate a final freeridership value of 8%, weighted by *ex post* gross program savings. The higher the freeridership score, the more savings are deducted from the gross savings estimates. Table B-34 presents the intention, influence, and freeridership scores for the C&I Custom Program.

Table B-34. 2019 C&I Custom Program Intention/Influence Freeridership Score

n	Intention Score	Influence Score	Freeridership Score
10	10%	5%	8%

B.6.2 Detailed Spillover Findings

None of the interviewed participants reported that, after participating in the program, they had installed additional high-efficiency equipment for which they did not receive an incentive and that participation in the program was very important in their decision. Therefore, no spillover is attributed to the program.

B.7 Commercial and Industrial Small Business Direct Install Program

Cadmus calculated freeridership and spillover for the Small Business Direct Install (SBDI) Program as a whole using findings from a survey conducted with 36 program participants. After including spillover, the program resulted in a 96% NTG ratio. Table B-35 lists the NTG results for the program.

Table B-35. 2019 Small Business Direct Program Install Net-to-Gross Ratio

Measure	Freeridership	Spillover	NTG Ratio
Total Program	4% ¹	0%	96%

¹ Weighted by evaluated *ex post* program MMBTU savings

B.7.1 Detailed Freeridership Findings

Cadmus estimated freeridership by combining two methods used in prior evaluations—the standard self-report intention method and the intention/influence method. By combining savings, the standard self-report *intention* methodology with an *influence* methodology, Cadmus produced a program freeridership score.¹³³

Cadmus calculated the arithmetic mean of the savings weighted *intention* and *influence* freeridership components to estimate measure category freeridership estimates,¹³⁴ as shown in this equation:

$$\text{Final Freeridership \%} = \frac{\text{Intention FR Score}(0\% \text{ to } 100\%) + \text{Influence FR Score}(0\% \text{ to } 100\%)}{2}$$

Intention Freeridership Score

Cadmus estimated *intention* freeridership scores for all participants based on their responses to *intention*-focused freeridership questions. As part of past Vectren evaluations, Cadmus developed a transparent, straightforward matrix approach to assign a single score to each participant based on his or her objective responses.

Determining *intention* freeridership estimates from a series of questions rather than using a single question helps form a picture of the program's influence on the participant and; for example:

- “Did the program affect the timing of their decision and, if so, by how many months/years?”
- “Did the program affect the efficiency of equipment installed and, if so, by how much?”
- “Did the program affect the quantity of technology installed and, if so, by how much?”

Not all questions are weighted equally. For example, if respondents would not have installed measures at the same efficiency level without the program, they automatically become a 0% *intention* freerider. If they would not have installed the measures within one year without the program, they also

¹³³ *Intention* and *influence* freeridership scores both have a maximum of 100%.

¹³⁴ *Ex post* gross program savings.



automatically become a 0% *intention* freerider. Other questions included in the *intention* freeridership analysis are assigned partial weights for responses indicative of a non-freerider.

After assigning an *intention* freeridership score to every survey respondent, the Cadmus calculated a savings-weighted average *intention* freerider score for the program.

Table B-36 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 Cadmus then decrement based on their responses to the eight questions.

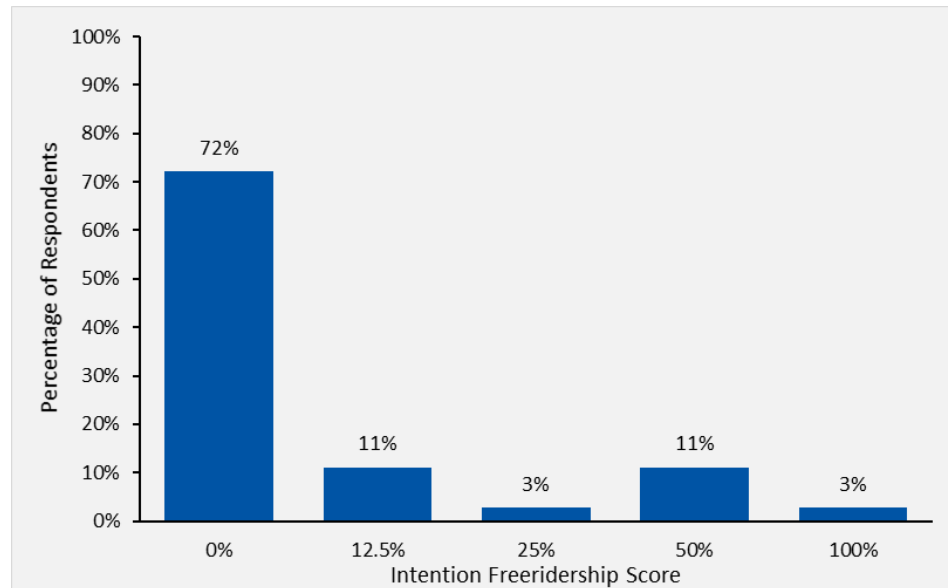


**Table B-36. Raw Survey Responses Translation to *Intention* Freeridership Scoring Matrix Terminology
 Small Business Direct Install Program and Scoring**

Did you have specific plans to install any additional energy efficient measures BEFORE learning about the program?	Would you have installed the same [MEASURE] if the equipment had not been recommended to you in the Small Business Energy Solutions assessment report?	Would you have installed the same [MEASURE] without the instant discount?	In absence of the program, would you have installed the equipment to at least the same level of efficiency? [READ LIST]	In absence of the program, would you have installed the same quantity of [MEASURE]?	In absence of the program, would you have installed the [MEASURE]...	Prior to participating in this program, was the purchase and installation of the [MEASURE] included in your organization's most recent capital budget?
Yes (Yes) [-0%]	Yes (Yes) [-0%]	Yes (Yes) [-0%]	Yes, just as energy efficient (Yes) [-0%]	Yes (Yes) [-0%]	At the same time (No) [-0%]	Yes (Yes) [-0%]
No (No) [-50%]	No (No) [-25%]	No (No) [-25%]	No, less energy efficient (No) [-100%]	No (No) [-50%]	Later but within the same year (No) [-50%]	No (No) [-50%]
DK/RF (Partial) [-25%]	DK/RF (No) [-0%]	DK/RF (No) [-0%]	No, more energy efficient (Yes) [-0%]	DK/RF (Partial) [-25%]	Within one to two years (No) [-100%]	DK/RF (Partial) [-25%]
			DK/RF (Partial) [-25%]		Within three to five years (No) [-100%]	
					In more than five years (No) [-100%]	
					DK/RF (Partial) [-25%]	

Figure B-6 shows the distribution of *intention* freeridership estimates Cadmus assigned to participant responses to the pure intention-based freeridership method.

**Figure B-6. 2019 Small Business Direct Install Program Self-Report
Intention Freeridership Distribution by Estimate**



Influence Freeridership Score

Cadmus assessed influence freeridership from participants' ratings to the relative importance of various program elements in their purchasing decisions. Table B-37 shows the distribution of responses to the influence question: "Please rate each item on how influential it was to your decision to complete the project the way it was done. Please use a scale from 1, meaning *not at all influential*, to 4, meaning the item was *very influential* to your decisions." This question pertains to information about the program from the participants' contractor, incentives for the equipment, energy efficiency information that Vectren provided, the free energy assessment for the business, and previous participation in a Vectren energy efficiency program.

Table B-37. 2019 Small Business Direct Install Program Freeridership Influence Responses (n=36)

Response Options	Influence Score	Vectren Staff or Trade Ally	Instant Discount for Equipment	Information About Energy Efficiency Provided by Vectren	Free Energy Assessment for your Business	Previous Participation in a Vectren Energy Efficiency Program
1 – Not at all influential	100%	0	0	0	0	3
2 – Not too influential	75%	0	0	4	1	3
3 – Somewhat influential	25%	10	5	12	10	6
4 – Very influential	0%	24	30	18	22	11
Don't Know	50%	2	1	2	3	1
Not Applicable	50%	0	0	0	0	12
Average		3.7	3.9	3.4	3.6	3.1

Cadmus used the maximum rating given by each participant for any factor in Table B-37 to determine their influence freeridership score presented in Table B-38. The counts refer to the number of responses for each factor/influence freeridership score response option. Cadmus weighted individual influence freeridership scores by their respective total survey sample *ex post* gross savings to arrive at a savings-weighted average influence freeridership score of 2% for SBDI Program participants.

Table B-38. 2019 Small Business Direct Install Program Influence Freeridership Score (n=36)

Maximum Influence Rating	Influence Score	Count	Total Survey Sample <i>Ex Post</i> MMBTU Savings	Influence Score MMBTU Savings
1 – Not at all influential	100%	0	0	0
2 – Not too influential	75%	0	0	0
3 – Somewhat influential	25%	1	141	18
4 – Very influential	0%	34	1,952	53
Don't Know	50%	1	35	11
Average Maximum Influence Rating - Simple Average		4.0		
Average Influence Score - Weighted by <i>Ex Post</i> Savings			2%	

Final Freeridership Score

Cadmus calculated the arithmetic mean of the intention and influence freeridership components to estimate a final freeridership value of 0%, weighted by *ex post* gross program savings. The higher the freeridership score, the more savings are deducted from the gross savings estimates. Table B-39 summarizes the intention, influence, and freeridership scores for the SBDI Program.

Table B-39. 2019 Small Business Direct Install Program Intention/Influence Freeridership Score

n	Intention Score	Influence Score	Freeridership Score
36	5%	2%	4%

B.7.2 Detailed Spillover Findings

After participating in the program, two respondents reported installing a total of 17 LEDs for which the companies did not receive an incentive. The respondents said their participation in the program was very important in the companies' decision to install the additional measures. Cadmus used a per-unit evaluated gross savings estimates for interior lighting (141.75 kWh) from the SBDI Program to calculate spillover for the additional equipment attributed to the program. Cadmus then divided the total survey sample spillover savings (8.2 MMBTU) by the gross program savings from the survey sample (2,128 MMBTU) to obtain the a spillover estimate of less than 1% for the program, as shown in Table B-40.¹³⁵

Table B-40. 2019 Small Business Direct Install Program Spillover Estimate

Survey Sample Spillover Savings (MMBTU)	Survey Sample Program Savings (MMBTU)	Spillover Percentage Estimate
8	2,128	<1%

¹³⁵ NTG was evaluated at the program-level and Cadmus did not stratify the survey sample by fuel type.



prepared for

VECTREN ENERGY DELIVERY OF INDIANA

*2020-2025 Integrated **Natural** Gas DSM Market Potential Study & Action Plan*

January

2019

FINAL REPORT

prepared by
GDS ASSOCIATES INC
EMI CONSULTING

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Executive Summary

OBJECTIVES & SCOPE

This project included a demand-side management (DSM) market potential study and Action Plan for Vectren Energy Delivery of Indiana (“Vectren”). The study included assessments of natural gas energy efficiency potential. The results of the potential study were leveraged to develop a DSM Action Plan for Vectren’s 2020-2025 planning horizon. This report provides the results of the natural gas energy efficiency potential analysis.

The energy efficiency potential study assessed potential by customer segment (residential and commercial).¹ The effort included several preliminary tasks to assess the Vectren market and develop foundational assumptions about the customer base, sales forecasts, and savings opportunities to order to then assess the overall energy efficiency potential in the Vectren services territories.

APPROACH SUMMARY

The GDS team used a bottom-up approach to estimate energy efficiency potential in the residential sector. Bottom-up approaches begin with characterizing the eligible equipment stock, estimating savings and screening for cost-effectiveness first at the measure level, then summing savings at the end-use and service area levels. In the commercial sector, GDS utilized the bottom-up modeling approach to first estimate measure-level savings and costs as well as cost-effectiveness, and then applied cost-effective measure savings to all applicable shares of energy load. Below is the summary of the Maximum Achievable Potential (MAP), Realistic Achievable Potential (RAP) and Program Potential. More detail can be found in Volume I of the report.

- **Achievable Potential** is the amount of energy that can realistically be saved given various market barriers. Achievable potential considers real-world barriers to encouraging end users to adopt efficiency measures; the non-measure costs of delivering programs (for administration, marketing, analysis, and EM&V); and the capability of programs and administrators to boost program activity over time. Barriers include financial, customer awareness and willingness to participate in programs, technical constraints, and other barriers the “program intervention” is modeled to overcome. Additional considerations include political and/or regulatory constraints. The potential study evaluated two achievable potential scenarios:
- **Maximum Achievable Potential** estimates achievable potential on paying incentives equal to 100% of measure incremental costs and aggressive adoption rates.
- **Realistic Achievable Potential** estimates achievable potential with Vectren paying incentive levels (as a percent of incremental measure costs) closely calibrated to historical levels but is not constrained by any previously determined spending levels.
- **Program Potential** refers to the efficiency potential possible given specific program funding levels and designs; in this study program potential is addressed by the DSM Action Plan, which further addresses issues such as market dynamics (net versus gross impacts), timeframe differences, proxy versus specific program delivery approaches, and budget realities.

RESULTS

Table ES-1 summarizes the gas energy-efficiency savings for all measures at the different levels of potential relative to the baseline forecast. This provides cumulative annual technical, economic, MAP and RAP and program potential energy savings, in total therms and as a percentage of the sector-level sales forecast. Note that the steps of measure bundling, program design and program delivery refine the RAP results later into the Program Potential. The cumulative RAP increases to nearly 9% cumulative annual savings over the next six years. The RAP savings estimates have a large

¹ Industrial sector not included in the analysis. Industrial gas customers, including transportation and pooling customers, are not eligible to participate in programs.

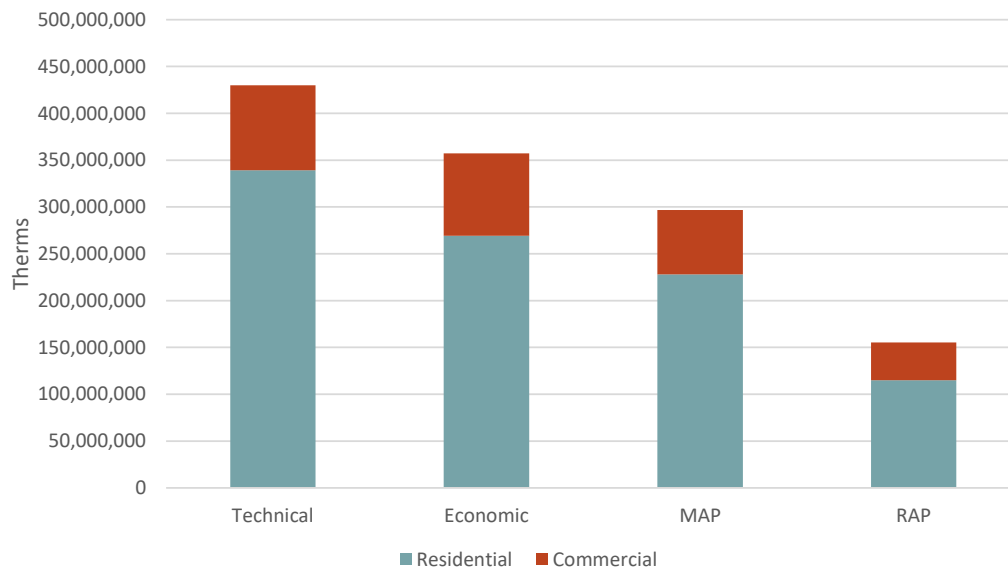
residential sector low-income component.² Approximately 80% of the residential sector budget addresses the low-income market segment, with about 43% of the RAP savings are attributable to this segment.

TABLE ES-1 INCREMENTAL ANNUAL ENERGY EFFICIENCY POTENTIAL SUMMARY

	2020	2021	2022	2023	2024	2025
Therms						
Technical	55,405,298	59,702,054	55,071,673	49,388,320	44,180,343	39,260,874
Economic	43,944,408	47,222,846	43,762,898	39,546,502	35,155,828	31,175,242
MAP	17,510,408	36,534,163	34,140,189	31,171,984	28,095,709	25,393,808
RAP	11,829,170	14,615,827	14,769,258	14,644,077	14,427,215	14,178,559
Program	3,290,694	3,495,441	2,744,676	2,840,888	2,957,226	3,068,690
Forecasted Sales	749,114,967	753,244,873	757,941,731	762,674,784	767,444,327	772,250,654
Energy Savings (as % of Forecast)						
Technical	7.4%	7.9%	7.3%	6.5%	5.8%	5.1%
Economic	5.9%	6.3%	5.8%	5.2%	4.6%	4.0%
MAP	2.3%	4.9%	4.5%	4.1%	3.7%	3.3%
RAP	1.6%	1.9%	1.9%	1.9%	1.9%	1.8%
Program	0.4%	0.5%	0.4%	0.4%	0.4%	0.4%

Figure ES-1 provides the natural gas technical, economic, and achievable potential, by sector, by the end of the 20-year timeframe for the study (2020-2039). The residential sector accounts for a significant majority of the overall potential. Program potential only extends through 2025 and is not included in the figure below.

FIGURE ES-1 TWENTY (20)-YEAR CUMULATIVE ANNUAL NATURAL GAS ENERGY EFFICIENCY POTENTIAL – ALL SECTORS COMBINED



² Low income households were characterized as homes that have household incomes at or below 200% of federal poverty guidelines. Based on data from the American Community 5-Year Public Use Microdata Set (PUMS), GDS used household income and number of people per household to identify the percent of the population at or below 200% of federal poverty guidelines for the Vectren South and Vectren North service areas. 21% of single-family households and 48% of multifamily households were identified to meet the criteria in the Vectren South service area. 22% and single-family households and 47% of households were identified in the Vectren North service area.

Table ES-2 provides the incremental realistic achievable potential for each year across the 2020-2025 timeframe. The incremental annual savings potential rises from 11.8 million therms to 14.2 million therms.

TABLE ES-2 INCREMENTAL NATURAL GAS MEASURE LEVEL REALISTIC ACHIEVABLE POTENTIAL – BY SECTOR (2020-2025)

Incremental Annual Therms	2020	2021	2022	2023	2024	2025
Sector						
Residential	10,373,225	12,908,398	12,813,800	12,464,182	12,066,813	11,606,853
Commercial	1,455,945	1,707,429	1,955,459	2,179,894	2,360,402	2,571,706
Total	11,829,170	14,615,827	14,769,258	14,644,077	14,427,215	14,178,559
Forecasted Sales	749,114,967	753,244,873	757,941,731	762,674,784	767,444,327	772,250,654
Incremental Annual Savings %						
Sector						
Residential	2.0%	2.5%	2.5%	2.4%	2.3%	2.2%
Commercial	0.6%	0.7%	0.8%	0.9%	1.0%	1.0%
% of Forecasted Sales	0.7%	0.8%	0.8%	0.8%	0.8%	0.7%

Table ES-3 provides the cumulative realistic achievable potential for each year across the 2020-2025 timeframe. The incremental annual savings potential rises from 11.8 million therms to 67.2 million therms.

TABLE ES-3 CUMULATIVE NATURAL GAS MEASURE LEVEL REALISTIC ACHIEVABLE POTENTIAL – BY SECTOR (2020-2025)

Cumulative Annual Therms	2020	2021	2022	2023	2024	2025
Sector						
Residential ³	10,373,225	20,169,900	29,584,797	38,527,750	47,027,576	55,031,308
Commercial	1,455,945	3,163,374	5,118,832	7,287,941	9,637,700	12,130,006
Total	11,829,170	23,333,274	34,703,630	45,815,691	56,665,276	67,161,314
Forecasted Sales	749,114,967	753,244,873	757,941,731	762,674,784	767,444,327	772,250,654
Cumulative Annual Savings %						
Sector						
Residential	2.0%	3.9%	5.7%	7.4%	9.0%	10.4%
Commercial	0.6%	1.3%	2.1%	3.0%	3.9%	4.9%
% of Forecasted Sales	0.7%	1.3%	1.9%	2.4%	3.0%	3.5%

Table ES-4 provides the annual budgets in the RAP scenario. The total RAP budgets across all sectors ranges from \$58 million to \$97 million during the 2020-2025 timeframe.

TABLE ES-4 ANNUAL BUDGETS (2020-2025) IN THE RAP SCENARIO (\$ IN MILLIONS)

RAP Budgets	2020	2021	2022	2023	2024	2025
Incentives	\$45.7	\$79.1	\$80.6	\$79.5	\$76.5	\$71.2
Admin	\$9.6	\$12.8	\$13.2	\$13.3	\$13.3	\$13.2
Indirect	\$2.6	\$3.4	\$3.6	\$3.7	\$3.9	\$4.0
Total	\$57.9	\$95.2	\$97.4	\$96.5	\$93.7	\$88.4

³ Approximately 43% of the RAP potential in the residential sector is the result of measures targeting low-income customers directly. These measures are not subject to cost-effectiveness requirements, and the analysis assumes that 100% of measure cost is paid by Vectren.

ACTION PLAN

The results of the potential study were leveraged to develop a DSM Action Plan for the 2020-2025 timeframe. The achievable potential identified by the potential study formed the basis of the development of program potential, which further accounts for budgetary and market considerations. Furthermore, the Vectren Gas DSM Action Plan was developed as an integrated effort with the Vectren Electric DSM Action Plan, in order to optimize program design, budget, and cost-effectiveness considerations.

Table ES-5 provides the incremental program potential for each year across the 2020-2025 timeframe. The incremental annual savings potential ranges between 2.7 million therms to 3.5 million therms.

TABLE ES-5 INCREMENTAL NATURAL GAS PROGRAM POTENTIAL – BY SECTOR (2020-2025)

Incremental Annual Therms	2020	2021	2022	2023	2024	2025
Sector						
Residential	2,502,868	2,688,619	1,911,720	1,977,090	2,054,181	2,125,438
Commercial	787,826	806,822	832,956	863,798	903,045	943,252
Total	3,290,694	3,495,441	2,744,676	2,840,888	2,957,226	3,068,690
Forecasted Sales	749,114,967	753,244,873	757,941,731	762,674,784	767,444,327	772,250,654
Incremental Annual Savings %						
Sector						
Residential	0.5%	0.5%	0.4%	0.4%	0.4%	0.4%
Commercial	0.3%	0.3%	0.3%	0.4%	0.4%	0.4%
% of Forecasted Sales	0.4%	0.5%	0.4%	0.4%	0.4%	0.4%

Table ES-6 provides the cumulative Program Potential for each year across the 2020-2025 timeframe. The cumulative annual savings potential rises from 3.3 million therms to 18.4 million therms.

TABLE ES-6 CUMULATIVE GAS PROGRAM POTENTIAL – BY SECTOR (2020-2025)

Cumulative Annual Therms	2020	2021	2022	2023	2024	2025
Sector						
Residential	2,502,868	5,191,487	7,103,207	9,080,296	11,134,478	13,259,916
Commercial	787,826	1,594,648	2,427,604	3,291,402	4,194,447	5,137,699
Total	3,290,694	6,786,135	9,530,811	12,371,698	15,328,925	18,397,615
Forecasted Sales	749,114,967	753,244,873	757,941,731	762,674,784	767,444,327	772,250,654
Incremental Annual Savings %						
Sector						
Residential	0.5%	1.0%	1.4%	1.7%	2.1%	2.5%
Commercial	0.3%	0.7%	1.0%	1.4%	1.7%	2.1%
% of Forecasted Sales	0.4%	0.9%	1.3%	1.6%	2.0%	2.4%

Table ES-7 provides the annual budgets in the DSM Action Plan. The portfolio-level budgets range from \$8.3 million to \$10.5 million during the 2020-2025 timeframe.

TABLE ES-7 DSM ACTION PLAN ANNUAL BUDGETS (2020-2025), (\$ IN MILLIONS)

Annual Budgets	2020	2021	2022	2023	2024	2025
Residential						
Incentives	\$2.8	\$2.9	\$1.4	\$1.5	\$1.6	\$1.7
Admin	\$0.2	\$0.2	\$0.2	\$0.2	\$0.2	\$0.2
Implementation	\$3.4	\$3.6	\$3.2	\$3.4	\$3.5	\$3.7
Residential Sub-total	\$6.5	\$6.8	\$4.8	\$5.1	\$5.4	\$5.6
Commercial						
Incentives	\$0.7	\$0.8	\$0.8	\$0.8	\$0.8	\$0.9
Admin	\$0.1	\$0.1	\$0.1	\$0.2	\$0.2	\$0.2
Implementation	\$0.9	\$1.0	\$1.1	\$1.1	\$1.1	\$1.3
Commercial Sub-total	\$1.8	\$1.9	\$2.0	\$2.1	\$2.1	\$2.3
Non-Sector Specific Costs						
Indirect	\$0.9	\$0.9	\$0.9	\$0.9	\$0.9	\$0.9
Evaluation	\$0.5	\$0.5	\$0.4	\$0.4	\$0.4	\$0.5
Other	\$0.2	\$0.5	\$0.2	\$0.2	\$0.5	\$0.2
Total						
DSM Portfolio Total	\$9.8	\$10.5	\$8.3	\$8.7	\$9.4	\$9.5

COST-EFFECTIVENESS

For planning purposes, each of the recommended programs must pass the Utility Cost Test (UCT) and the Total Resource Cost (TRC) tests, except for Income-Qualified Programs which do not need to meet cost-effectiveness tests in order to promote a greater social good. The cost-effectiveness results are reported for the UCT and the TRC tests. Each program is assessed separately to determine relative benefits and costs (in contrast to assessing each individual measure). The definitions for the four standard tests most commonly used in EE program design are described below.

- **Total Resource Cost test (TRC).** The benefits in this test are the lifetime avoided energy costs and avoided capacity costs. The costs in this test are the incremental measure costs plus all administrative costs spent by the program administrator.
- **Utility Cost Test (UCT).** The benefits in this test are the lifetime avoided energy costs and avoided capacity costs, the same as the TRC benefits. The costs in this test are the program administrator's incentive costs and administrative costs.
- **Participant Cost Test (PCT).** The benefits in this test are the lifetime value of retail rate savings (which is another way of saying "lost utility revenues"). The costs in this test are those seen by the participant; in other words: the incremental measure costs minus the value of incentives paid out.
- **Rate Impact Measure test (RIM).** The benefits of the RIM test are the same as the TRC benefits. The RIM costs are the same as the UCT, except for the addition of lost revenue. This test attempts to show the effects that EE programs will have on rates, which is almost always to raise them on a per unit basis. Thus, costs typically outweigh benefits from the point of view of this test, but the assumption is that absolute energy use decreases to a greater extent than per-unit rates are increased — resulting in lower average utility bills.

Table ES-8 provides the cost-benefit ratios for each of the major cost-effectiveness tests as well as the TRC Net Benefits by program and sector. Cost-benefit screening was performed using DSMore.

TABLE ES-8 VECTREN RECOMMENDED ACTION PLAN COST-EFFECTIVENESS SUMMARY

Program	TRC Ratio	TRC NET Benefits	UCT Ratio	PCT Ratio	RIM Ratio
Res HEA	1.15	\$116,113	3.02	1.58	0.68
Res IQW	0.45	(\$2,861,173)	0.45	38.60	0.30
Res Schools	3.61	\$731,417	3.61		0.70
Res Behavior	1.57	\$397,929	1.57		0.52
Res Food Bank	3.29	\$237,769	4.14	17.34	0.70
Res HEMS	1.17	\$142,144	1.17		0.50
MultiFamily	1.75	\$1,619,989	1.75		0.61
Res Targeted Income	1.02	\$13,129	1.02		0.48
Res HEHC	1.66	\$727,883	1.67	242.48	0.58
Res Neighbor Program	4.41	\$3,865,521	4.41		0.74
Res New Construction	1.78	\$8,834,713	3.88	1.24	1.09
Res Prescriptive	1.09	\$1,759,278	1.82	1.70	0.60
Res Portfolio	1.36	\$15,584,712	2.03	1.89	0.69
CI Prescriptive	1.61	\$4,013,216	2.18	3.18	0.68
CI Custom	2.28	\$13,314,515	4.34	2.52	0.81
CI Small Business	11.91	\$756,023	11.98	21.13	0.92
CI Portfolio ALL	2.06	\$18,083,754	3.38	2.79	0.77
Total Portfolio ALL	1.37	\$25,594,954	1.98	2.11	0.68

VOLUME I

2020-2025 Integrated Natural Gas DSM Market Potential Study

prepared for



VECTREN
Live Smart

JANUARY 2019

1 Introduction

1.1 BACKGROUND & STUDY SCOPE

This Market Potential Study was conducted to support the development of a DSM Action Plan for Vectren. The study included primary market research and a comprehensive review of current programs, historical savings, and projected energy savings opportunities to develop estimates of technical, economic, and achievable potential. The effort was highly collaborative, as the GDS Team worked closely alongside Vectren, as well as the Vectren Oversight Board, to produce reliable estimates of future saving potential, using the best available information and best practices for developing market potential saving estimates.

1.2 TYPES OF POTENTIAL ESTIMATED

The scope of this study distinguishes three types of energy efficiency potential: (1) technical, (2) economic, and (3) achievable.

- **Technical Potential** is the theoretical maximum amount of energy use that could be displaced by efficiency, disregarding all non-engineering constraints such as cost-effectiveness and the willingness of end users to adopt the efficiency measures. Technical potential is constrained only by factors such as technical feasibility and applicability of measures.
- **Economic Potential** refers to the subset of the technical potential that is economically cost-effective as compared to conventional supply-side energy resources. Economic potential follows the same adoption rates as technical potential. Like technical potential, the economic scenario ignores market barriers to ensuring actual implementation of efficiency. Finally, economic potential only considers the costs of efficiency measures themselves, ignoring any programmatic costs (e.g., marketing, analysis, administration) that would be necessary to capture them. This study uses the Utility Cost Test (UCT) to assess cost-effectiveness.
- **Achievable Potential** is the amount of energy that can realistically be saved given various market barriers. Achievable potential considers real-world barriers to encouraging end users to adopt efficiency measures; the non-measure costs of delivering programs (for administration, marketing, analysis, and EM&V); and the capability of programs and administrators to boost program activity over time. Barriers include financial, customer awareness and willingness to participate in programs, technical constraints, and other barriers the “program intervention” is modeled to overcome. Additional considerations include political and/or regulatory constraints. The potential study evaluated two achievable potential scenarios:
 - **Maximum Achievable Potential** estimates achievable potential on paying incentives equal to 100% of measure incremental costs and aggressive adoption rates.
 - **Realistic Achievable Potential** estimates achievable potential with Vectren paying incentive levels (as a percent of incremental measure costs) closely calibrated to historical levels but is not constrained by any previously determined spending levels.
 - **Program Potential** refers to the efficiency potential possible given specific program funding levels and designs; in this study program potential is addressed by the DSM Action Plan, which further addresses issues such as market dynamics (net versus gross impacts), timeframe differences, proxy versus specific program delivery approaches, and budget realities.

1.3 STUDY LIMITATIONS

As with any assessment of energy efficiency potential, this study necessarily builds on various assumptions and data sources, including the following:

- Energy efficiency measure lives, savings, and costs
- Projected penetration rates for energy efficiency measures
- Projections of electric and natural gas avoided costs
- Future known changes to codes and standards
- Vectren load forecasts and assumptions on their disaggregation by sector, segment, and end use

- End-use saturations and fuel shares

While the GDS team has sought to use the best and most current available data, there are often reasonable alternative assumptions which would yield slightly different results.

1.4 ORGANIZATION OF REPORT

The remainder of this report is organized in seven sections as follows:

Section 2 Methodology details the methodology used to develop the estimates of technical, economic, and achievable energy efficiency potential savings.

Section 3 Market Characterization provides an overview of the Vectren service areas and a brief discussion of the forecasted energy sales by sector.

Section 4 Residential Energy Efficiency Potential provides a breakdown of the technical, economic, and achievable potential in the residential sector.

Section 5 Commercial Energy Efficiency Potential provides a breakdown of the technical, economic, and achievable potential in the commercial sector.

Appendices provide measure level assumptions; data source descriptions, and DSM Action Plan details. See Volume III for the appendices.

2 Methodology

This section describes the overall methodology utilized to assess the natural gas energy efficiency potential in the Vectren service area. The main objectives of this Market Potential Study were to estimate the technical, economic, MAP and RAP of energy efficiency in the Vectren gas (Vectren South and Vectren North) service territories; and to quantify these estimates of potential in terms of therm savings, for each level of energy efficiency potential.

The development of the DSM Action Plan, and associated savings during the 2020-2025 timeframe, are discussed in Volume II of this report.

2.1 OVERVIEW OF APPROACH

For the residential sector, GDS took a bottom-up approach to the modeling, whereby measure-level estimates of costs, savings, and useful lives were used as the basis for developing the technical, economic, and achievable potential estimates. The measure data was used to build-up the technical potential, by applying the data to each relevant market segment. The measure data allowed for benefit-cost screening to assess economic potential, which was in turn used as the basis for achievable potential, which took into consideration incentives and estimates of annual adoption rates.

For the commercial sector, GDS took a bottom-up modeling approach to first estimate measure-level savings and costs as well as cost-effectiveness, and then applied cost-effective measure savings to all applicable shares of energy load. Disaggregated forecast data served as the foundation for the development of the energy efficiency potential estimates. The creation of the disaggregation involved two steps. First, GDS looked at actual customer groupings based on NAICS code and then calibrated our top down load allocation based these codes to determine whether the customer was captured in the load forecast. Second, GDS determined the appropriate building type for commercial customers.

2.2 MARKET CHARACTERIZATION

The initial step in the analysis was to gather a clear understanding of the current market segments by fuel type in the Vectren service area. The GDS team coordinated with Vectren to gather utility sales and customer data and existing market research to define appropriate market sectors, market segments, vintages, saturation data and end uses for each fuel type. This information served as the basis for completing a forecast disaggregation and market characterization of both the residential and nonresidential sectors.

2.2.1 Forecast Disaggregation

In the residential sector, GDS calibrated its building energy modeling simulations with Vectren's sales forecasts.⁴ This process began with the construction of building energy models, using the BEopt™ (Building Energy Optimization)⁵ software, which were specified in accordance with the most currently available data describing the residential building stock in the Vectren South and Vectren North service areas. Models were constructed for both single-family and multifamily homes, as well as various types of heating and cooling equipment and fuel types. Key characteristics defining these models include conditioned square footage, typical building envelope conditions such as insulation levels and representative appliance and HVAC efficiency levels. The simulations yielded estimated energy consumption for each building prototype, including estimates of each key end use. These end use estimates were multiplied by the estimated proportion of customers that applied to each end use, to calculate an estimated service territory total consumption for each end use. For example, when completing this process for the Vectren North natural gas potential analysis, the simulated natural gas heating consumption was multiplied by the proportion of homes that heat with natural gas furnaces or boilers, to calculate the total natural gas heating load in the Vectren North territory.

⁴ Vectren's sales forecast in all sectors excludes the impact of future DSM savings. Excluding future DSM savings prevents under-estimating energy efficiency savings potential.

⁵BEopt can be used to analyze both new construction and existing home retrofits, as well as single-family detached and multi-family buildings, through evaluation of single building designs, parametric sweeps, and cost-based optimizations.

The simulation process required several iterations. GDS collaborated with Vectren to verify and modify certain assumptions about the market characteristics, such as the heating fuel and equipment types. GDS adjusted its assumptions about key market characteristics and revised its BEopt models to calibrate its building energy models to within 1% of forecasted sales in 2020.

In the commercial sector, disaggregated forecast data provides the foundation for the development of energy efficiency potential estimates. GDS disaggregated the nonresidential sector for Vectren into building type using Vectren's commercial customer database and 2017 monthly sales data. GDS supplemented the Vectren customer database with a third-party dataset (purchased from InfoUSA) that provided additional SIC/NAICS code data by business.⁶ This disaggregation involved two steps. First, the GDS team used rate codes to determine whether the customer was captured in Vectren commercial load forecast. Next, GDS determined the appropriate building type for commercial customers. We used the following information, either from Vectren's customer data or third-party dataset, to determine the appropriate building type. Using these fields, GDS assigned customers Vectren's non-residential data sets to one of the commercial segments listed in Table 2-1.

TABLE 2-1 NON-RESIDENTIAL SEGMENTS

Assembly	Hospital	Office
Education	Large Hospital	Retail
Grocery	Large Retail	Restaurant
Health Care	Lodging	Warehouse

GDS further disaggregated sales for each of the segments into end uses. For commercial segments, GDS primarily used Vectren's 2016 end-use forecast planning models supplemented with updated EIA 2012 Commercial Building Energy Consumption Survey (CBECS) data for the East South-Central Census region. This information was used to determine energy use intensities, expressed in therms per square foot, for each end use within each segment.⁷ We then used data compiled from metering studies, Evaluation, Measurement and Verification (EM&V), and engineering algorithms to further disaggregate energy intensities into more granular end uses and technologies.

Table 2-2 lists the natural gas end-uses, respectively, considered in the forecast disaggregation and subsequent potential assessment.

TABLE 2-2 NATURAL GAS END USES

RESIDENTIAL	COMMERCIAL
<input checked="" type="checkbox"/> Behavioral	<input checked="" type="checkbox"/> Cooking
<input checked="" type="checkbox"/> Clothes Washer/Dryer	<input checked="" type="checkbox"/> Space Heating
<input checked="" type="checkbox"/> Dishwasher	<input checked="" type="checkbox"/> Water Heating
<input checked="" type="checkbox"/> Hot Water	
<input checked="" type="checkbox"/> HVAC Equipment	
<input checked="" type="checkbox"/> HVAC Shell	

⁶ The Vectren dataset classifies businesses by Standard Industrial Classification (SIC) code, a four-digit standardized code, that has largely been replaced by the North American Industry Classification System (NAICS) code. The GDS Team converted the Vectren SIC codes to NAICS codes, then mapped NAICS/SIC codes to building types considered in this study.

⁷U.S. Energy Information Agency. *Commercial Buildings Energy Consumption Survey (CBECS)*. May 20, 2016. <https://www.eia.gov/consumption/commercial/>. Although the Vectren service area officially resides in the East-North Central Census region, Vectren's long-term load forecast uses the East-South Central Census region as a more accurate representation of the Vectren service area.

2.2.2 Eligible Customers

Natural gas energy efficiency programs are available to Residential and Commercial customers on the following rate codes:

- Rate 110 - Residential Sales
- Rate 120 - General Sales
- Rate 125 - School/Government Transportation Service

Industrial gas customers, including transportation and pooling customers, are not eligible to participate in programs.⁸ As a result, estimates of natural gas efficiency potential include all Vectren residential and commercial natural gas customers and sales, but not industrial.

2.2.3 Building Stock/Equipment Saturation

To assess the potential natural gas energy efficiency savings available, estimates of the current saturation of baseline equipment and energy efficiency measures are necessary.

2.2.3.1 Residential Sector

For the residential sector, GDS relied on several primary research efforts. The gas measure analysis was informed by a robust primary research effort of Vectren customers. This effort was a 2014 appliance saturation survey of Vectren gas customers (Vectren South and Vectren North), which helped inform the gas measure baseline and efficient saturation estimates.

EIA Residential Energy Consumption Survey (RECS) data from 2015 helped fill in data gaps that could not be directly informed by Vectren primary research. Other data sources included ENERGY STAR unit shipment data, Vectren evaluation reports, and baseline studies from other states. The ENERGY STAR unit shipment data filled data gaps related to the increased saturation of energy efficient equipment across the U.S. in the last decade.

2.2.3.2 Commercial Sector

For the **commercial sector**, data collected through on-site visits as part of this study was leveraged to develop remaining factors for many of the measures in the study. GDS coordinated with Vectren and the Oversight Board to develop a research plan, sampling plan, and a survey questionnaire used to collect data.

The study included primary onsite research with 38 of Vectren's commercial customers across all building types considered in the study.⁹ The on-site data collection included facility operation schedules and building characteristics, HVAC equipment type and efficiency levels, control systems and strategies, and related natural gas consuming equipment characteristics.

The survey data was used to inform two main assumptions for the potential study, the Base Case and the Remaining factors. The Base Case Factor is the fraction of the end use energy that is applicable for the efficient technology in a given market segment. Survey data was used to determine fractional energy use for most measures in the study. The survey data provided counts for equipment and energy usage levels for several end-uses. In total, 39% of the base case allocations came directly from the survey data and the other 61% came from regional potential study data from other Indiana Utilities or from GDS estimates based upon past study experience.

The remaining factor is the fraction of applicable therm sales that are associated with equipment that has not yet been converted to the energy efficiency measure. It can also be defined as one minus the fraction of the market segment that already have the energy-efficiency measure installed, or one minus the market saturation for the measures. The

⁸ Industrial sales are not included. See section 3.2 for load forecast.

⁹ The full survey dataset was provided to Vectren as a deliverable.

commercial survey data was used to determine the remaining factors for 39% of all measures in the study. The remaining factor for this measure is 76%. The latest ENERGY STAR shipment data report also provided remaining factors for several measures. The other remaining factors are either 100% for emerging technologies measures or estimates are based on GDS past study experience.

2.2.4 Remaining Factor

The remaining factor is the proportion of a given market segment that is not yet efficient and can still be converted to an efficient alternative. It is by definition, the inverse of the saturation of an energy efficient measure, prior to any adjustments. For this study we made two key adjustments to recognize that the energy efficient saturation does not necessarily always fully represent the state of market transformation. In other words, while a percentage of installed measures may already be efficient, this does not preclude customers from backsliding, or reverting to standard technologies, or otherwise less efficient alternatives in the future, based on considerations like measure cost and availability and customer preferences (e.g. customers may have an efficient furnace but elect to purchase a standard efficiency unit in the future, in the absence of program intervention).

For measures categorized as market opportunity (i.e. replace-on-burnout), we assumed that 50% of the instances in which an efficient measure is already installed, the burnout or failure of those measures would be eligible for inclusion in the estimate of future savings potential. Essentially this adjustment implies that we are assuming that 50% of the market is transformed, and no future savings potential exists, whereas the remaining 50% of the market is not transformed and could backslide without the intervention of a Vectren program and an incentive. Similarly, for retrofit measures, we assumed that only 10% of the instances in which an efficient measure is already installed, the burnout or failure of those measures would be eligible for inclusion in the estimate of future savings potential. This recognizes the more proactive nature of retrofit measures, as the implementation of these measures are more likely to be elective in nature, compared to market opportunity measures, which are more likely to be needs-based. We recognize the uncertainty in these assumptions, but we believe these are appropriate assumptions, as they recognize a key component of the nature of customer decision making.

2.3 MEASURE CHARACTERIZATION

2.3.1 Measure Lists

The study's sector-level energy efficiency measure lists were informed by a range of sources including the Indiana TRM, current Vectren program offerings, and commercially viable emerging technologies, among others. Measure list development was a collaborative effort in which GDS developed draft lists that were shared with Vectren and the Stakeholders. The final measure lists ultimately included in the study reflected the informed comments and considerations from the parties that participated in the measure list review process.

In total, GDS analyzed 118 measure types for each of the Vectren gas territories. Some measures save both electric and natural gas. For those measures, the savings of both fuels were included in the benefit-cost screening.¹⁰ Many measures were included in the study as multiple permutations to account for different specific market segments, such as different building types, efficiency levels, and replacement options. GDS developed a total of 2,055 measure permutations for this study (accounting for each territory separately). Each permutation was screened for cost-effectiveness according to the Utility Cost Test (UCT). The parameters for cost-effectiveness under the UCT are discussed in detail later in Section 2.4.3.

¹⁰ Because electric and natural gas results are presented in separate reports, costs were apportioned between electric and gas based on the relative amount of savings from each fuel type.

TABLE 2-3 NUMBER OF MEASURES EVALUATED

	# of Measures	Total # of Measure Permutations	# with UCT ≥ 1
Vectren South – Gas			
Residential	60	360	167
Commercial	69	690	570
Total	129	1,150	737
Vectren North – Gas			
Residential	60	225	95
Commercial	69	690	570
Total	129	905	665

2.3.2 Emerging Technologies

GDS considered several specific emerging technologies as part of analyzing future potential. In the residential sector, these technologies include several smart technologies, including smart appliances, smart water heater (WH) tank controls, smart window coverings, smart ceiling fans, heat pump dryers and home automation/home energy management systems. In the non-residential sector, specific emerging technologies that were considered as part of the analysis include strategic energy management and cloud-based energy information systems (“EIS. While this is likely not an exhaustive list of possible emerging technologies over the next twenty years it does consider many of the known technologies that are available today but may not yet have widespread market acceptance and/or product availability.

In addition to these specific technologies, GDS acknowledges that there could be future opportunities for new technologies as equipment standards improve and market trends occur. While this analysis does not make any explicit assumption about unknown future technologies, the methodology assumes that subsequent equipment replacement that occurs over the course of the 20-year study timeframe, and at the end of the initial equipment’s useful life, will continue to achieve similar levels of energy savings, relative to improved baselines, at similar incremental costs.

2.3.3 Assumptions and Sources

A significant amount of data is needed to estimate the natural gas savings potential for individual energy efficiency measures or programs across the residential and nonresidential customer sectors. GDS utilized data specific to Vectren when it was available and current. GDS used the most recent Vectren evaluation report findings (as well as Vectren program planning documents), 2015 Indiana Technical Reference Manual (IN TRM), the Illinois TRM, and the Michigan Energy Measures Database (MEMD) to a large amount of the data requirements. Evaluation report findings and the Indiana TRM were leveraged to the extent feasible – additional data sources were only used if these first two sources either did not address a certain measure or contained outdated information. The BEopt simulation modeling results formed the basis for most heating end use measure savings. The National Renewable Energy Laboratory (NREL) Energy Measures Database also served as a key data source in developing measure cost estimates. Additional source documents included American Council for an Energy-Efficient Economy (ACEEE) research reports covering topics like emerging technologies.

Measure Savings: GDS relied on existing Vectren evaluation report findings and the 2015 IN TRM to inform calculations supporting estimates of annual measure savings as a percentage of base equipment usage. For custom measures and measures not included in the IN TRM, GDS estimated savings from a variety of sources, including:

- Illinois TRM, MEMD, and other regional/state TRMs
- Building energy simulation software (BEopt) and engineering analyses
- Secondary sources such as the ACEEE, Department of Energy (DOE), Energy Information Administration (EIA), ENERGY STAR®, and other technical potential studies

Measure Costs: Measure costs represent either incremental or full costs. These costs typically include the incremental cost of measure installation, when appropriate based on the measure definition. For purposes of this study, nominal measure costs held constant over time.¹¹

GDS obtained measure cost estimates primarily from the Vectren program planning databases, and the 2015 IN TRM. GDS used the following data sources to supplement the IN TRM:

- Illinois TRM, MEMD, and other regional/state TRMs
- Secondary sources such as the ACEEE, ENERGY STAR, and National Renewable Energy Lab (NREL)
- Program evaluation and market assessment reports completed for utilities in other states

Measure Life: Measure life represents the number of years that energy using equipment is expected to operate. GDS obtained measure life estimates from the 2015 IN TRM and Vectren program planning databases, and used the following data sources for measures not in the IN TRM:

- Illinois TRM, MEMD, and other regional/state TRMs
- Manufacturer data
- Savings calculators and life-cycle cost analyses

All measure savings, costs, and useful life assumption sources are documented in Appendix B and Appendix C.

2.3.4 Net to Gross (NTG)

All estimates of technical, economic, and achievable potential, as well as measure level cost-effectiveness screening were conducted in terms of gross savings to reflect the absence of program design considerations in these phases of the analysis. The impacts of free-riders (participants who would have installed the high efficiency option in the absence of the program) and spillover customers (participants who install efficiency measures due to program activities, but never receive a program incentive) are considered in the DSM Action Plan component of this study.

2.4 ENERGY EFFICIENCY POTENTIAL

This section reviews the types of potential analyzed in this report, as well as some key methodological considerations in the development of technical, economic, and achievable potential.

2.4.1 Types of Potential

Potential studies often distinguish between several types of energy efficiency potential: technical, economic, achievable, and program. However, because there are often important definitional issues between studies, it is important to understand the definition and scope of each potential estimate as it applies to this analysis.

The first two types of potential, technical and economic, provide a theoretical upper bound for energy savings from energy efficiency measures. Still, even the best-designed portfolio of programs is unlikely to capture 100% of the technical or economic potential. Therefore, achievable potential attempts to estimate what savings may realistically be achieved through market interventions, when it can be captured, and how much it would cost to do so. Figure 2-1 illustrates the types of energy efficiency potential considered in this analysis. Program potential, in the form of the DSM Action Plan, is discussed in Volume II of the report.

¹¹ GDS reviewed the deemed measure cost assumptions included in the Illinois TRM from 2012 (v1) through 2018 (v7). Where a direct comparison of cost was applicable, GDS found no change in measure cost across 80% of residential and nonresidential measures. In a similar search of the Michigan Energy Measure Database (MEMD) from 2011 to 2018, GDS again found that most of incremental measure costs in 2018 were either the same or higher than the recorded incremental measure cost in 2011.

FIGURE 2-1 TYPE OF ENERGY EFFICIENCY POTENTIAL¹²

Not Technically Feasible	TECHNICAL POTENTIAL			
Not Technically Feasible	Not Cost-Effective	ECONOMIC POTENTIAL		
Not Technically Feasible	Not Cost-Effective	Market Barriers	MAXIMUM ACHIEVABLE POTENTIAL	
Not Technically Feasible	Not Cost-Effective	Market Barriers	Partial Incentives	REALISTIC ACHIEVABLE POTENTIAL

2.4.2 Technical Potential

Technical potential is the theoretical maximum amount of energy use that could be displaced by efficiency, disregarding all non-engineering constraints such as cost-effectiveness and the willingness of end users to adopt the efficiency measures. Technical potential is only constrained by factors such as technical feasibility and applicability of measures. Under technical potential, GDS assumed that 100% of new construction and market opportunity measures are adopted as those opportunities become available (e.g., as new buildings are constructed they immediately adopt efficiency measures, or as existing measures reach the end of their useful life). For retrofit measures, implementation was assumed to be resource constrained and that it was not possible to install all retrofit measures all at once. Rather, retrofit opportunities were assumed to be replaced incrementally until 100% of stock was converted to the efficient measure over a period of no more than 15 years.

2.4.2.1 Competing Measures and Interactive Effects Adjustments

GDS prevents double-counting of savings, and accounts for competing measures and interactive savings effects, through three primary adjustment factors:

Baseline Saturation Adjustment. Competing measure shares may be factored into the baseline saturation estimates. For example, nearly all homes can receive insulation, but the analysis has created multiple measure permutations to account for varying impacts of different heating/cooling combinations and have applied baseline saturations to reflect proportions of households with each heating/cooling combination.

Applicability Factor Adjustment. Combined measures into measure groups, where total applicability factor across measures is set to 100%. For example, homes cannot receive a programmable thermostat, connected thermostat, and smart thermostat. In general, the models assign the measure with the most savings the greatest applicability factor in the measure group, with competing measures picking up any remaining share.

Interactive Savings Adjustment. As savings are introduced from select measures, the per-unit savings from other measures need to be adjusted (downward) to avoid over-counting. The analysis typically prioritizes market opportunity equipment measures (versus retrofit measures that can be installed at any time). For example, the savings from a smart thermostat are adjusted down to reflect the efficiency gains of installing an efficient gas furnace. The analysis also prioritizes efficiency measures relative to conservation (behavioral) measures.

2.4.3 Economic Potential

Economic potential refers to the subset of the technical potential that is economically cost-effective (based on screening with the Utility Cost Test) as compared to conventional supply-side energy resources.

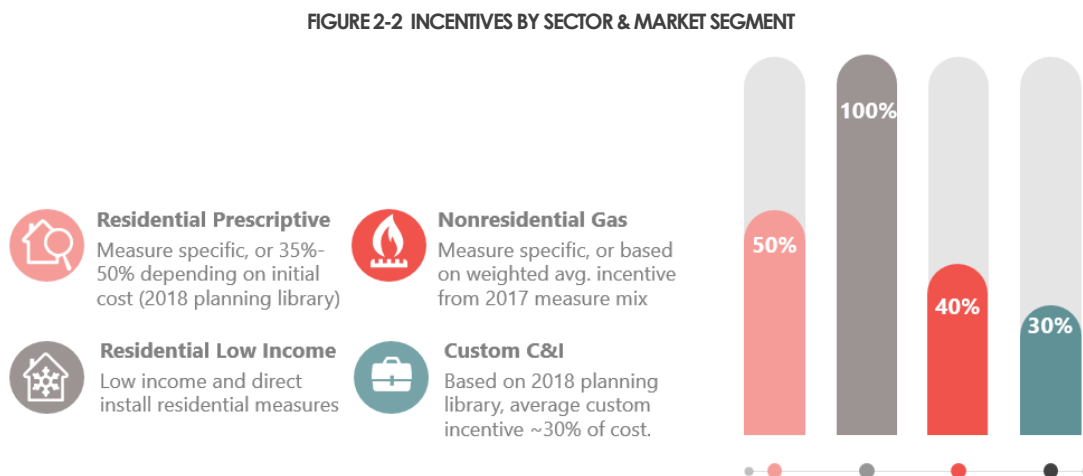
¹² Reproduced from "Guide to Resource Planning with Energy Efficiency," November 2007. US Environmental Protection Agency (EPA). Figure 2-1.

2.4.3.1 Utility Cost Test and Incentive Levels

The economic potential assessment included a screen for cost-effectiveness using the Utility Cost Test (UCT) at the measure level. In the Vectren South territory, the UCT considers both electric and natural gas savings as benefits, and utility incentives and direct install equipment expenses as the cost. In the Vectren North service area, only gas savings are considered benefits in the UCT. Consistent with application of economic potential according to the National Action Plan for Energy Efficiency, the measure level economic screening does not consider non-incentive/measure delivery costs (e.g. admin, marketing, evaluation etc.) in determining cost-effectiveness.¹³

Apart from the low-income segment of the residential sector, all measures were required to have a UCT benefit-cost ratio greater than 1.0 to be included in economic potential and all subsequent estimates of energy efficiency potential. Low-income measures were not required to be cost-effective; all low-income specific measures are included in the economic and achievable potential estimates.

For both the calculation of the measure-level UCT, as well as the determination of RAP, historical incentive levels (as a % of incremental measure cost) were calculated for current measure offerings. Figure 2-2 describes the incentive levels by key market segment within the residential and nonresidential sectors.



GDS relied on Vectren's measure planning library and supporting DSM Operating Plan appendices to map current measure offerings to their historical incentive levels.¹⁴ For study measures that did not map directly to a current offering, GDS calculated the weighted average incentive level (based on 2017 participation) by sector and/or program and applied these "typical" incentive levels to the new measures.

- In the residential sector, remaining residential incentive levels were either 50% of the incremental measure cost, or 35% of the measure cost (for more expensive measures).
- Low income and direct install measures received incentives equal to 100% of the measure cost.
- In the non-residential sector, prescriptive incentives were 50% of the measure cost, and custom measures received incentives equal to 30% of the measure cost.
- In the MAP scenario, all incentives were set to 100% of the incremental measure cost.

¹³ National Action Plan for Energy Efficiency: Understanding Cost-Effectiveness of Energy Efficiency Programs. Note: Non-incentive delivery costs are included in the assessment of achievable potential and the DSM Action Plan.

¹⁴ The measure planning library was leveraged primarily for determining current incentive levels rather than for developing estimates of future costs or savings potential.

2.4.3.2 Avoided Costs

Avoided energy supply costs are used to assess the value of energy savings. Avoided cost values for electric energy, electric capacity, avoided transmission and distribution (T&D), and avoided natural gas were provided by Vectren as part of an initial data request. Electric energy is based on an annual system marginal cost. Natural gas avoided costs are calculated using EIA Annual Outlook reference tables combined with demand rates and basis differentials provided by Vectren Gas Supply. For years outside of the avoided cost forecast timeframe, future year avoided costs are escalated by the rate of inflation.

2.4.4 Achievable Potential

Achievable potential is the amount of energy that can realistically be saved given various market barriers. Achievable potential considers real-world barriers to encouraging end users to adopt efficiency measures; the non-measure costs of delivering programs (for administration, marketing, analysis, and EM&V); and the capability of programs and administrators to boost program activity over time. Barriers include financial, customer awareness and willingness to participate in programs, technical constraints, and other barriers the “program intervention” is modeled to overcome. Additional considerations include political and/or regulatory constraints. The potential study evaluated two achievable potential scenarios:

- **Maximum Achievable Potential** estimates achievable potential on paying incentives equal to 100% of measure incremental costs and aggressive adoption rates.
- **Realistic Achievable Potential** estimates achievable potential with Vectren paying incentive levels (as a percent of incremental measure costs) closely calibrated to historical levels but is not constrained by any previously determined spending levels.

2.4.4.1 Market Adoption Rates

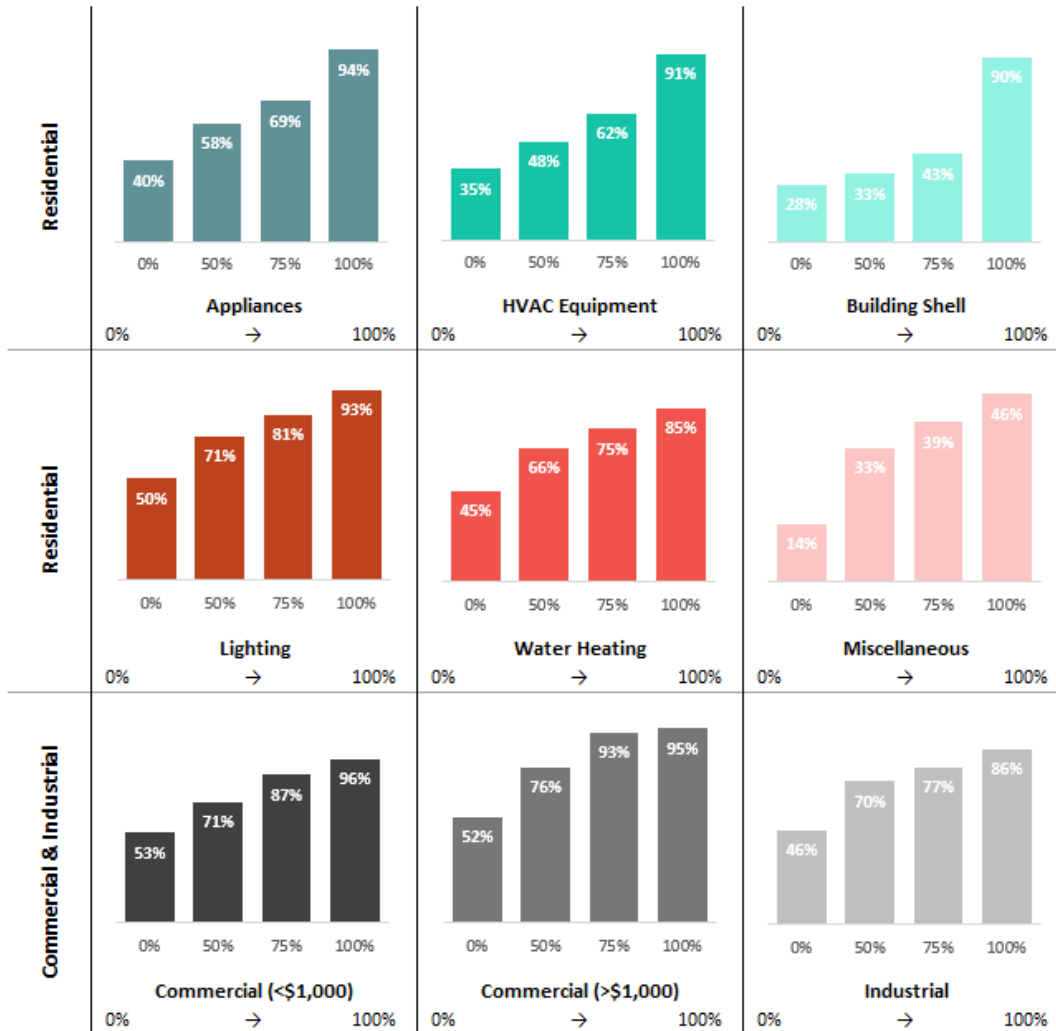
GDS assessed achievable potential on a measure-by-measure basis. In addition to accounting for the natural replacement cycle of equipment in the achievable potential scenario, GDS estimated measure specific maximum adoption rates that reflect the presence of possible market barriers and associated difficulties in achieving the 100% market adoption assumed in the technical and economic scenarios.

The initial step was to assess the long-term market adoption potential for energy efficiency technologies. Due to the wide variety of measures across multiple end-uses, GDS employed varied measure and end-use-specific ultimate adoption rates versus a singular universal market adoption curve. These long-term market adoption estimates were based on either Vectren-specific Willingness to Participate (WTP) market research or publicly available DSM research including market adoption rate surveys and other utility program benchmarking. These surveys included questions to residential homeowners and nonresidential facility managers regarding their perceived willingness to purchase and install energy efficient technologies across various end uses and incentive levels.

GDS utilized likelihood and willingness-to-participate data to estimate the long-term (20-year) market adoption potential for both the maximum and realistic achievable scenarios.¹⁵ Figure 2-3 presents the long-term market adoption rates at varied incentive levels used for both the residential and nonresidential sectors. When incentives are assumed to represent 100% of the measure cost (maximum achievable), the long-term market adoption ranged by sector and end-use from 46% to 96%. For the RAP scenario, the incentive levels also varied by measure resulting in measure-specific market adoption rates.

¹⁵ For the MAP Scenario, the long-term adoption rate was reached by Year15 (or earlier) and annual participation remained flat in the final five years of the analysis. In the RAP scenario, the analysis assumes the maximum adoption rate is reached over a period of 20-years or less.

FIGURE 2-3 LONG-TERM MARKET ADOPTION RATES AT DISCRETE INCENTIVE LEVELS
(based on Willingness-to-Participate Survey Results)



GDS then estimated initial year adoption rates by reviewing the current saturation levels of efficient technologies and (if necessary) calibrating the estimates of 2020 annual potential to recent historical levels achieved by Vectren’s current DSM portfolio. This calibration effort ensures that the forecasted achievable potential in 2020 is realistic and attainable. GDS then assumed a non-linear ramp rate from the initial year market adoption rate to the various long-term market adoption rates for each specific end-use.

One caveat to this approach is that the ultimate long-term adoption rate is generally a simple function of incentive levels and payback. There are other factors that may influence a customer’s willingness to purchase an energy efficiency measure. For example, increased marketing and education programs can have a critical impact on the success of energy efficiency programs. Other benefits, such as increased comfort or safety and reduced maintenance costs could also factor into a customer’s decision to purchase and install energy efficiency measures. To acknowledge these impacts, GDS considered the participant spillover and non-participant spillover rates (identified in prior Vectren evaluations) that demonstrate the impacts that efficiency program and their marketing/education components can have on increased technology adoption. GDS used these spillover rates to increase the long-term adoption rates (typically by 5%-7%) at each incentive level.

2.4.4.2 Non-Incentive Costs

Consistent with National Action Plan for Energy Efficiency (NAPEE) guidelines¹⁶, utility non-incentive costs were included in the overall assessment of cost-effectiveness at the realistic achievable potential scenario. 2020 direct measure/program non-incentive costs were calibrated to recent 2016-2018 historical levels and set at \$1.00 per first year therm saved for residential and non-residential measures. Non-incentive costs were then escalated annually at the rate of inflation%.¹⁷

In addition to non-incentive costs attributed directly to programs and measures, the analysis also included indirect program delivery that are not specifically attributed to individual programs and can include additional outreach, evaluation, and program planning activities. GDS assumed an indirect cost of of \$0.22 per first year therm, escalated 5% annually.¹⁸

¹⁶ National Action Plan for Energy Efficiency (2007). Guide for Conducting Energy Efficiency Potential Studies. Prepared by Optimal Energy. This study notes that economic potential only considers the cost of efficiency measures themselves, ignoring programmatic costs. Conversely, achievable potential should consider the non-measures costs of delivering programs. Pg. 2-4.

¹⁷ As noted earlier in the report, measure costs and utility incentives were not escalated over the 20-year analysis timeframe to keep those costs constant in nominal dollars.

¹⁸ The 2018 filed plan portfolio costs for gas are \$0.34/therm. GDS lowered this value, on a cost per therm basis, to produce total indirect costs consistent with the filed plan. GDS escalated indirect costs by 5% to be consistent with the electric analysis.

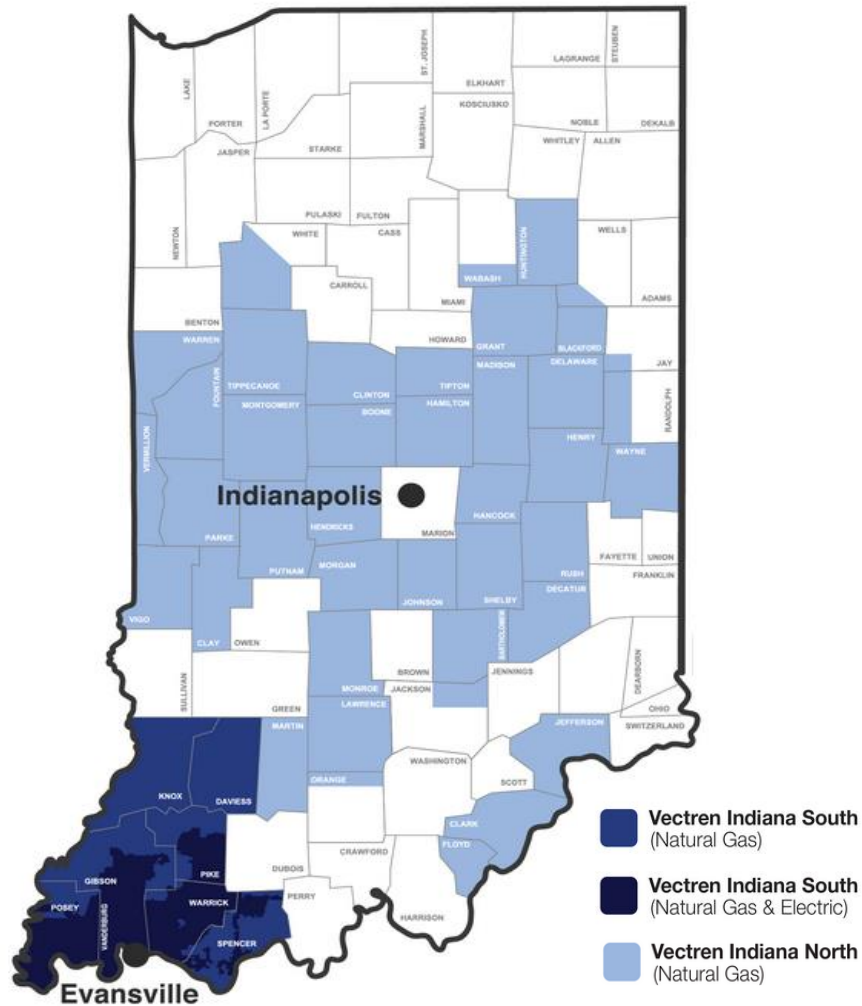
3 Market Characterization

Developing a market characterization in the context of utility natural gas consumption among each sector is a key foundational element to market potential studies. A market characterization describes how energy is used among the various end-uses and building types that are the subject of the potential study. This section provides a brief overview of the sales and customer forecasts for Vectren’s gas customers. It also includes a more detailed breakdown of the end-use and building type consumption, along with an overview of how these segmentations were developed.

3.1 VECTREN INDIANA SERVICE AREAS

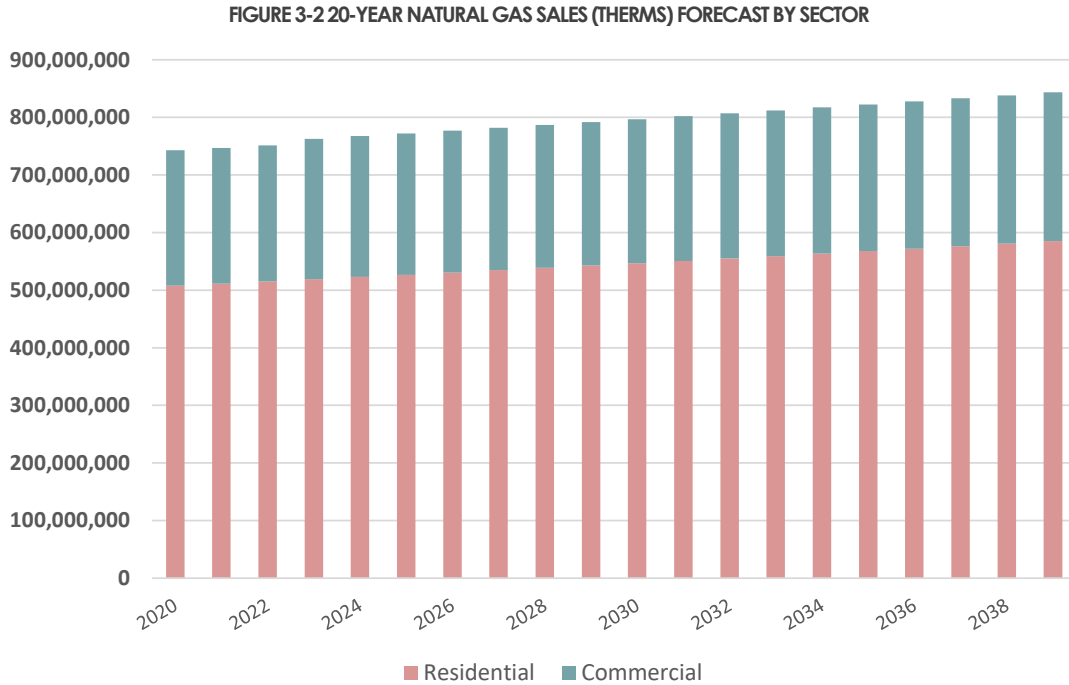
This study assessed the natural gas energy efficiency potential for both Vectren South and Vectren North. The natural gas potential was assessed for each territory individually, and the results are aggregated in this report. Figure 3-1 provides the overall Vectren South and Vectren North territories in Indiana.

FIGURE 3-1 VECTREN SERVICE TERRITORY MAP



3.2 LOAD FORECASTS

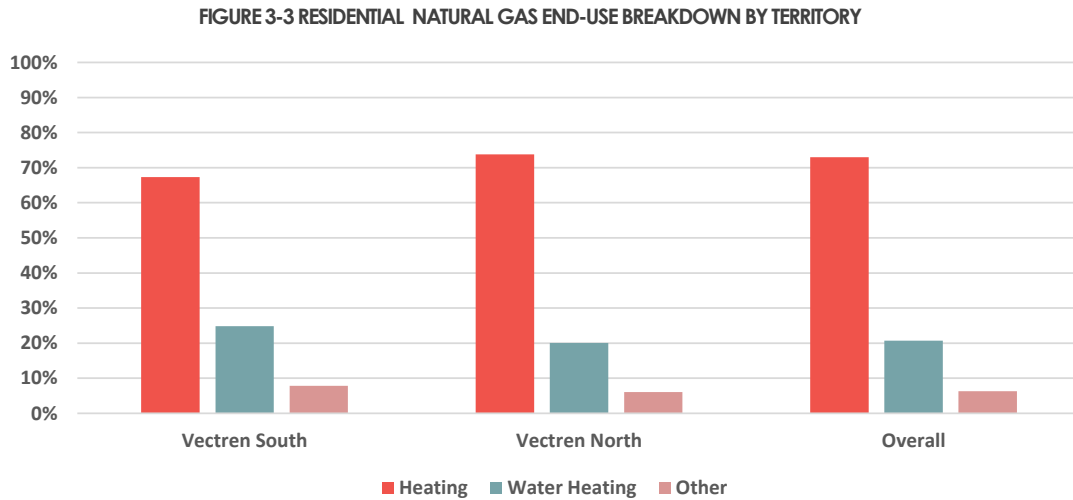
Figure 3-2 shows the natural gas sales (therms) forecast Vectren South and Vectren North combined. Total sales rise from 740 million therms to 840 million therms across the 2020-2039 timeframe.



3.3 SECTOR LOAD DETAIL

3.3.1 Residential Sector

The residential natural gas calibration effort led to Vectren territory-specific end-use load share breakdowns as shown below in Figure 3-3. Heating is the leading end-use in both territories, followed by water heating. “Other” includes gas dryers, cooking, grills, fireplaces, gas lighting, and pool heaters.



3.3.2 Commercial Sector

Figure 3-4 provides a breakdown of commercial natural gas sales (South and North) by building type. Retail (19%) and Office (20%) are the leading contributors of stand-alone building types.

FIGURE 3-4 COMMERCIAL NATURAL GAS SALES BREAKDOWN BY BUILDING TYPE¹⁹

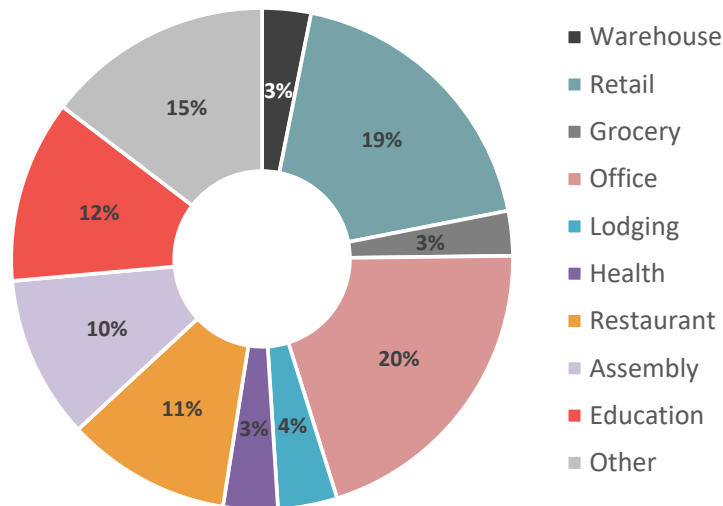
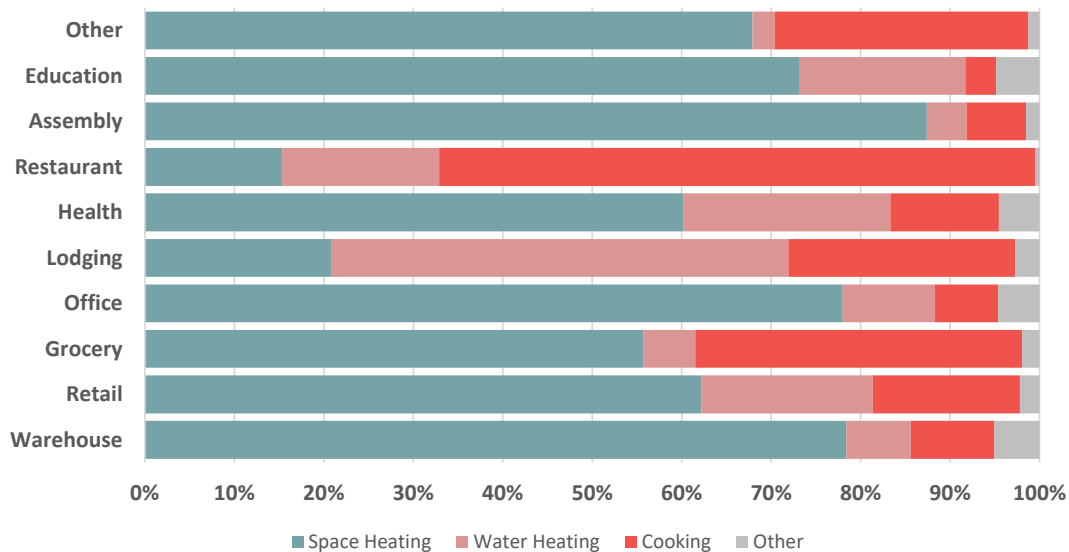


Figure 3-5 provides an illustration of the leading natural gas end-uses across all building types in the commercial sector. Space Heating is generally the leading end-use across most of the building types.

FIGURE 3-5 COMMERCIAL NATURAL GAS END-USE BREAKDOWN BY BUILDING TYPE



¹⁹ "Other" building types include buildings that engage in several different activities, a majority of which are commercial (e.g. retail space), though the single largest activity may be industrial or agricultural; "other" also includes miscellaneous buildings that do not fit into any other category.

4 Residential Energy Efficiency Potential

This section provides the potential results for technical, economic, MAP and RAP for the residential sector. Results are broken down by fuel type as well as end use. The cost-effectiveness results and budgets for the RAP scenario are also provided.

4.1 SCOPE OF MEASURES AND END USES ANALYZED

There were 60 unique natural gas measures included in the analysis. Some measures save both electricity and natural gas, but the designation here is made based on which the primary fuel type for each measure. Table 4-1 provides the number of measures by end-use (the full list of residential measures is provided in Appendix B). The measure list was developed based on a review of current Vectren programs, the Indiana TRM, other regional TRMs, and industry documents related to emerging technologies. Data collection activities to characterize measures formed the basis of the assessment of incremental costs, natural gas savings, and measure life.

TABLE 4-1 RESIDENTIAL ENERGY EFFICIENCY MEASURES – BY END USE & FUEL TYPE

End-Use	Number of Unique Measures
Appliances	10
Audit	3
Behavioral	3
HVAC Equipment	13
New Construction	2
HVAC Shell	17
Water Heating	12

4.2 RESIDENTIAL NATURAL GAS POTENTIAL

Figure 4-1 provides the technical, economic, MAP and RAP results for the 6-year, 10-year, and 20-year timeframes. The 6-year technical potential is 40.2% of forecasted sales, and the economic potential is 31.4% of forecasted sales. The 6-year MAP is 23.2% and the RAP is 10.4%.

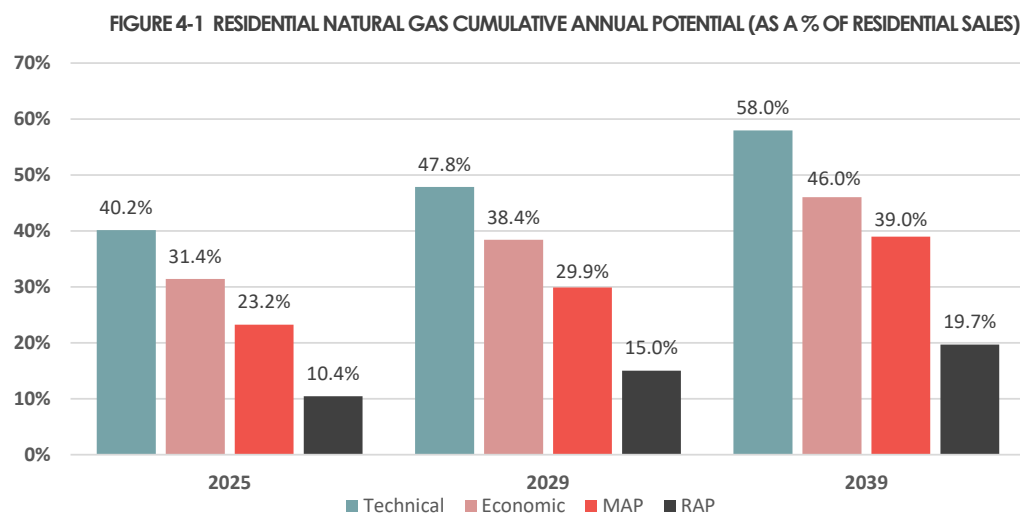


Table 4-2 provides cumulative annual technical, economic, MAP and RAP natural gas savings, in total therms and as a percentage of the sector-level sales forecast. The RAP starts at 2.0% in 2020 and rises to 10.4% after 2025.

TABLE 4-2 RESIDENTIAL CUMULATIVE ANNUAL NATURAL GAS EFFICIENCY POTENTIAL SUMMARY

	2020	2021	2022	2023	2024	2025
Therms						
Technical	47,773,089	94,685,411	133,808,602	164,957,359	190,504,368	211,476,419
Economic	36,610,513	72,164,541	102,862,863	127,783,017	148,419,388	165,405,553
MAP	13,806,892	42,739,789	68,132,943	89,522,039	107,467,224	122,455,031
RAP	10,373,225	20,169,900	29,584,797	38,527,750	47,027,576	55,031,308
Baseline Forecast	507,965,079	511,277,176	515,085,933	518,927,159	522,801,134	526,708,136
Energy Savings (as % of Baseline)						
Technical	9.4%	18.5%	26.0%	31.8%	36.4%	40.2%
Economic	7.2%	14.1%	20.0%	24.6%	28.4%	31.4%
MAP	2.7%	8.4%	13.2%	17.3%	20.6%	23.2%
RAP	2.0%	3.9%	5.7%	7.4%	9.0%	10.4%

Table 4-3 provides the incremental annual technical, economic, MAP and RAP natural gas savings, in total therms and as a percentage of the sector-level sales forecast. The incremental RAP ranges from 2.0% to 2.5% over the next six years.

TABLE 4-3 RESIDENTIAL INCREMENTAL ANNUAL ENERGY EFFICIENCY POTENTIAL SUMMARY

	2020	2021	2022	2023	2024	2025
Therms						
Technical	47,773,089	51,531,138	46,552,666	40,766,447	35,797,967	31,227,231
Economic	36,610,513	39,336,976	35,509,596	31,170,154	27,001,477	23,356,129
MAP	13,806,892	32,151,443	29,186,044	25,821,871	22,616,038	19,879,405
RAP	10,373,225	12,908,398	12,813,800	12,464,182	12,066,813	11,606,853
Baseline Forecast	507,965,079	511,277,176	515,085,933	518,927,159	522,801,134	526,708,136
Energy Savings (as % of Baseline)						
Technical	9.4%	10.1%	9.0%	7.9%	6.8%	5.9%
Economic	7.2%	7.7%	6.9%	6.0%	5.2%	4.4%
MAP	2.7%	6.3%	5.7%	5.0%	4.3%	3.8%
RAP	2.0%	2.5%	2.5%	2.4%	2.3%	2.2%

Technical & Economic Potential

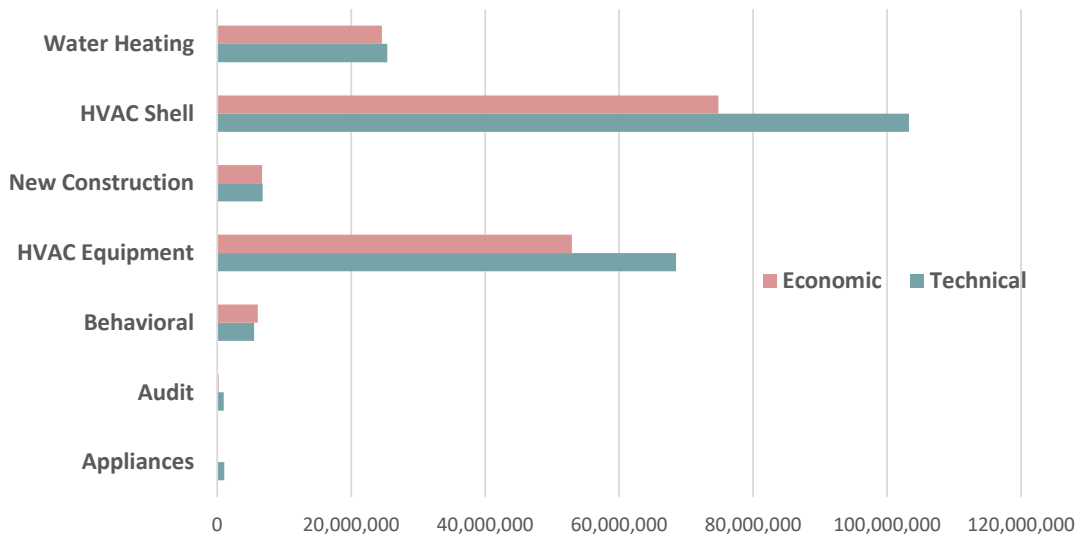
Table 4-4 provides cumulative annual technical and economic potential results from 2020-2025.

TABLE 4-4 TECHNICAL & ECONOMIC RESIDENTIAL NATURAL GAS POTENTIAL

	2020	2021	2022	2023	2024	2025
Energy (Therms)						
Technical	47,773,089	94,685,411	133,808,602	164,957,359	190,504,368	211,476,419
Economic	36,610,513	72,164,541	102,862,863	127,783,017	148,419,388	165,405,553

Figure 4-2 shows a comparison of the technical and economic potential (6-year) by end use. The HVAC Shell and HVAC Equipment are by far the leading end-uses among technical and economic potential.

FIGURE 4-2 6-YEAR TECHNICAL & ECONOMIC RESIDENTIAL NATURAL GAS POTENTIAL – BY END-USE



Maximum Achievable Potential (MAP)

Figure 4-3 illustrates the cumulative annual MAP results by end use across the 2020-2025 timeframe. Like technical and economic potential, HVAC Shell and HVAC Equipment are the leading end uses. Water Heating also has significant MAP.

FIGURE 4-3 RESIDENTIAL NATURAL GAS (CUMULATIVE ANNUAL THERMS) MAP POTENTIAL BY END-USE

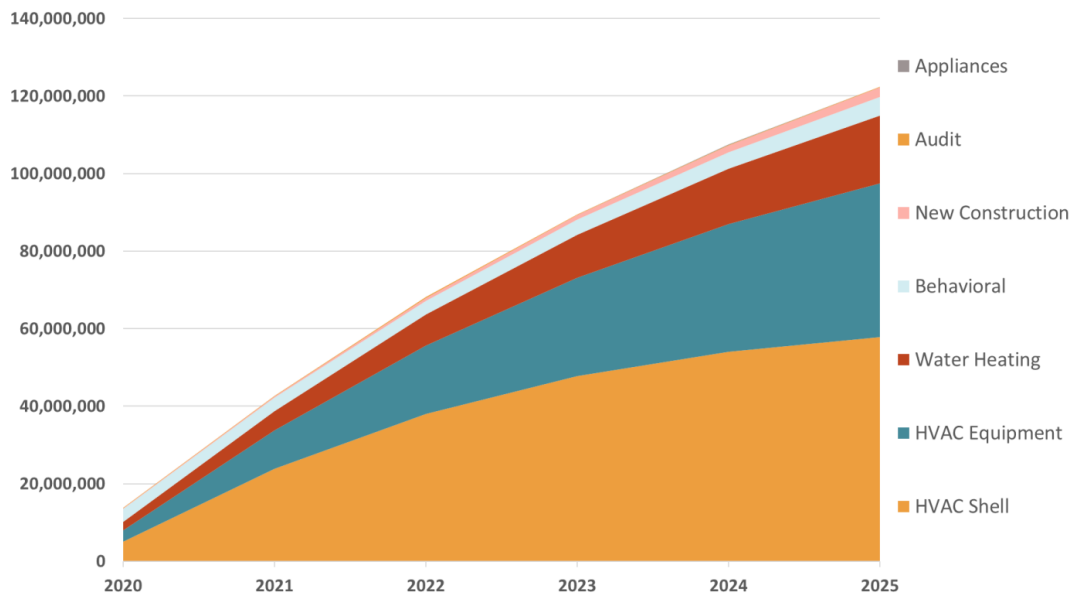


Table 4-5 provides the incremental and cumulative annual MAP across the 2020-2025 timeframe. The incremental MAP potential peaks in 2021 and declines slightly from 2022-2025 as the HVAC Shell end use declines after much of the retrofit measures have been exhausted quickly in the MAP scenario.

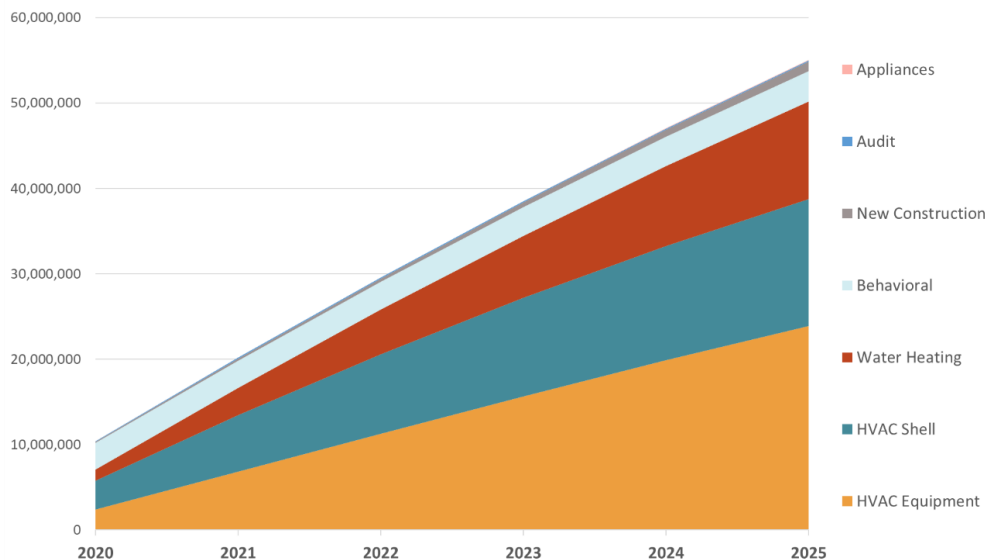
TABLE 4-5 RESIDENTIAL NATURAL GAS MAP BY END-USE

End Use	2020	2021	2022	2023	2024	2025
Incremental Annual Therms						
Appliances	2,796	3,594	5,422	5,661	7,731	8,414
Audit	71,684	140,344	172,459	197,167	212,490	221,725
Behavioral	3,348,896	3,071,026	3,028,625	3,038,546	3,083,806	3,374,884
HVAC Equipment	2,800,042	7,027,650	7,922,608	8,184,468	7,959,353	7,246,926
New Construction	151,396	226,651	340,533	460,945	590,517	718,706
HVAC Shell	5,112,243	18,931,265	14,712,695	10,785,398	7,542,516	5,092,145
Water Heating	2,319,835	2,750,912	3,003,701	3,149,687	3,219,625	3,216,605
Total	13,806,892	32,151,443	29,186,044	25,821,871	22,616,038	19,879,405
% of Forecasted Sales	2.7%	6.3%	5.7%	5.0%	4.3%	3.8%
Cumulative Annual Therms²⁰						
Appliances	2,796	6,391	9,867	13,223	17,455	22,989
Audit	71,684	140,344	172,459	197,167	212,490	221,725
Behavioral	3,348,896	3,420,307	3,608,198	3,876,245	4,269,434	4,766,382
HVAC Equipment	2,800,042	9,819,122	17,605,860	25,382,512	32,898,057	39,724,354
New Construction	151,396	378,047	718,580	1,179,526	1,770,042	2,488,748
HVAC Shell	5,112,243	23,921,964	37,996,079	47,756,451	54,039,416	57,825,348
Water Heating	2,319,835	5,053,614	8,021,900	11,116,915	14,260,330	17,405,485
Total	13,806,892	42,739,789	68,132,943	89,522,039	107,467,224	122,455,031
% of Forecasted Sales	2.7%	8.4%	13.2%	17.3%	20.6%	23.2%

Realistic Achievable Potential (RAP)

Figure 4-4 illustrates the cumulative annual RAP results by end use across the 2020-2025 timeframe. Like MAP, HVAC Shell and HVAC Equipment are the leading end uses. Water Heating also has significant RAP.

FIGURE 4-4 RESIDENTIAL NATURAL GAS (CUMULATIVE ANNUAL THERMS) RAP POTENTIAL BY END-USE



²⁰ Audit measures and most Behavioral measures have a one-year assumed measure life. For this reason, Audit savings are the same for both incremental and cumulative annual, and there is only a minor difference between incremental and cumulative annual savings for Behavioral measures.

Table 4-6 provides the incremental and cumulative annual RAP across the 2020-2025 timeframe. The incremental RAP ranges from 2.0% to 2.5% over the 2020-2025 timeframe. HVAC Shell and Behavioral are the leading end uses of incremental annual potential in the first year. HVAC Equipment and Behavioral are the leading end uses of incremental annual potential by 2025, while HVAC Equipment and HVAC Shell provide the greatest amount of cumulative annual potential by 2025.

TABLE 4-6 RESIDENTIAL NATURAL GAS RAP BY END-USE

End Use	2020	2021	2022	2023	2024	2025
Incremental Annual Therms						
Appliances	1,511	2,391	3,604	3,572	4,852	4,906
Audit	45,802	91,846	109,987	127,363	142,682	155,309
Behavioral	3,130,021	3,043,259	3,022,271	3,015,480	3,021,596	3,113,806
HVAC Equipment	2,376,599	4,471,688	4,686,654	4,665,427	4,564,604	4,280,113
New Construction	105,754	132,893	169,884	199,992	229,199	257,210
HVAC Shell	3,358,577	3,276,045	2,811,698	2,374,343	1,990,424	1,672,880
Water Heating	1,354,960	1,890,276	2,009,702	2,078,005	2,113,457	2,122,628
Total	10,373,225	12,908,398	12,813,800	12,464,182	12,066,813	11,606,853
% of Forecasted Sales	2.0%	2.5%	2.5%	2.4%	2.3%	2.2%
Cumulative Annual Therms²¹						
Appliances	1,511	3,902	6,687	8,786	11,243	14,143
Audit	45,802	91,846	109,987	127,363	142,682	155,309
Behavioral	3,130,021	3,173,301	3,250,281	3,320,522	3,427,744	3,578,049
HVAC Equipment	2,376,599	6,837,460	11,274,605	15,633,559	19,870,631	23,874,784
New Construction	105,754	238,647	408,532	608,524	837,722	1,094,932
HVAC Shell	3,358,577	6,583,830	9,296,600	11,533,792	13,358,971	14,851,403
Water Heating	1,354,960	3,240,915	5,238,106	7,295,203	9,378,583	11,462,688
Total	10,373,225	20,169,900	29,584,797	38,527,750	47,027,576	55,031,308
% of Forecasted Sales	2.0%	3.9%	5.7%	7.4%	9.0%	10.4%

Figure 4-5 illustrates a market segmentation of the RAP in the residential sector by 2025. Single-family existing non-income and low-income homes provide more than 90% of the RAP collectively.

Low-income accounts for 43% of the RAP. These measures are often not cost-effective, and while they do contribute significantly towards the potential, the cost of achieving these savings is much greater than the non-low-income measures.

²¹ Audit measures and most Behavioral measures have a one-year assumed measure life. For this reason, Audit savings are the same for both incremental and cumulative annual, and there is only a minor difference between incremental and cumulative annual savings for Behavioral measures.

FIGURE 4-5 2025 RESIDENTIAL NATURAL GAS (CUMULATIVE ANNUAL) RAP POTENTIAL BY MARKET SEGMENT

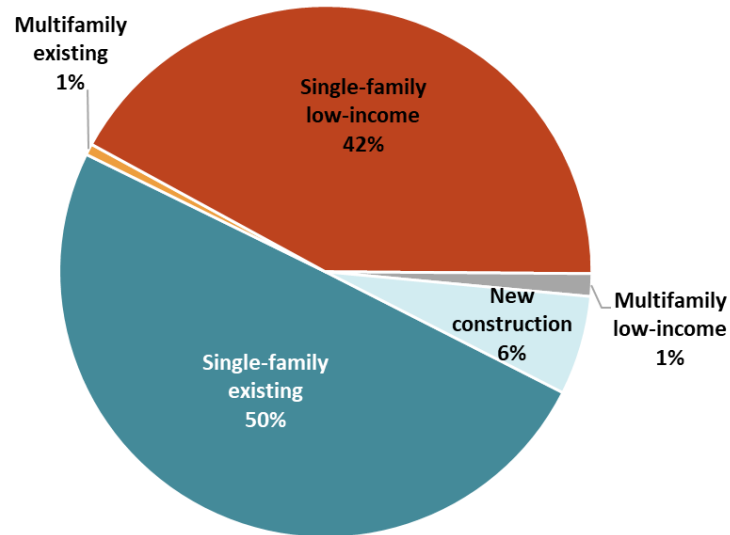
**RAP Benefits & Costs**

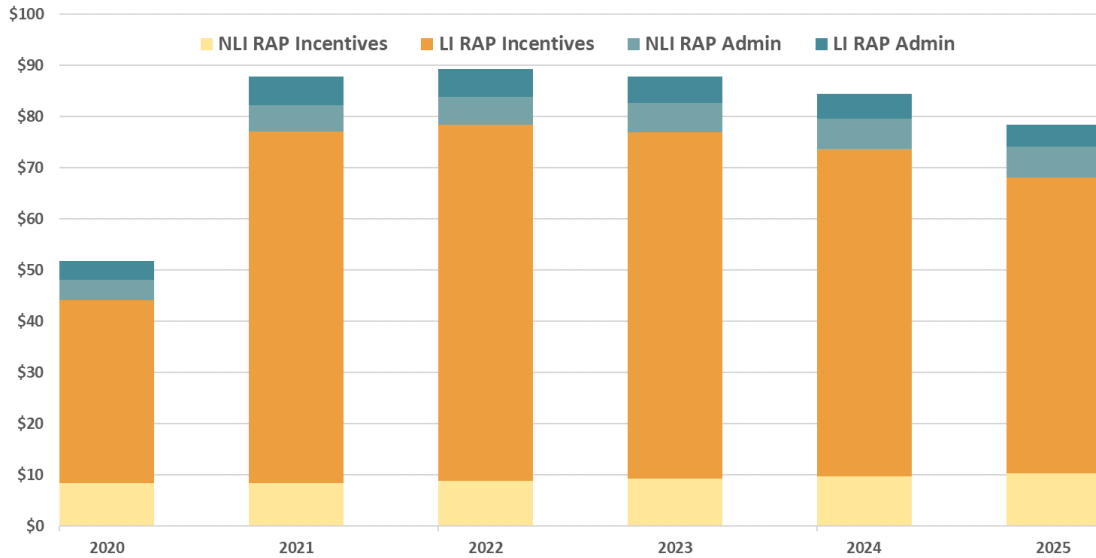
Table 4-7 provides the net present value benefits and cost, as calculated using the UCT, across the 2020-2025 timeframe for the RAP scenario. The overall UCT ratio is less than 0.9. However, if low-income measures were removed, the overall UCT is 2.1.

TABLE 4-7 RESIDENTIAL NPV BENEFITS & COSTS RAP BY END-USE (\$ IN MILLIONS)

End Use	NPV Benefits	NPV Costs	UCT Ratio
Overall Results			
Appliances	\$0.3	\$2.6	0.12
Audit	\$1.2	\$17.7	0.07
Behavioral	\$30.4	\$16.7	1.82
HVAC Equipment	\$267.6	\$344.9	0.78
New Construction	\$29.3	\$7.1	4.12
HVAC Shell	\$127.1	\$214.9	0.59
Water Heating	\$135.5	\$85.2	1.59
Total	\$591.3	\$689.2	0.86
Excluding Low-Income			
Appliances	\$0.3	\$0.2	1.38
Audit	\$0.0	\$0.0	0.00
Behavioral	\$30.4	\$16.7	1.82
HVAC Equipment	\$171.5	\$61.8	2.77
New Construction	\$29.3	\$7.1	4.12
HVAC Shell	\$31.6	\$15.1	2.09
Water Heating	\$127.4	\$82.7	1.54
Total	\$390.5	\$183.6	2.13

Figure 4-6 provide the budget for the RAP scenario. The budget is broken into incentive and admin budgets for each year of the 2020-2025 timeframe. These budgets are further divided into low-income ("LI") and not low-income ("NLI") components. The low-income incentive portion of the budget ranges from 69% to 78% of the total budget from 2020 to 2025. Annual budgets range from \$51 million to \$89 million.

FIGURE 4-6 ANNUAL BUDGETS FOR RESIDENTIAL RAP (\$ IN MILLIONS)



5 Commercial Energy Efficiency Potential

This section provides the potential results for technical, economic, MAP and RAP for the commercial sector. Results are broken down by end use. The cost-effectiveness results and budgets for the RAP scenario are also provided.

5.1 SCOPE OF MEASURES AND END USES ANALYZED

There were total 70 natural gas measures included in the analysis. Table 5-1 provides the number of measures by end-use (the full list of commercial measures is provided in Appendix C). The measure list was developed based on a review of current Vectren programs, the Indiana TRM, other regional TRMs, and industry documents related to emerging technologies. Data collection activities to characterize measures formed the basis of the assessment of incremental costs, natural gas savings, and measure life.

TABLE 5-1 COMMERCIAL ENERGY EFFICIENCY MEASURES – BY END USE & FUEL TYPE

End-Use	Number of Unique Measures
Space Heating	37
Water Heating	20
Cooking	7
Other	3

5.2 COMMERCIAL NATURAL GAS POTENTIAL

Figure 5-1 provides the technical, economic, MAP and RAP results for the 6-year, 10-year, and 20-year timeframes. The 6-year technical potential is 19.8% of forecasted sales, and the economic potential is 19.3% of forecasted sales. The 6-year MAP is 11.9% and the RAP is 4.9%.

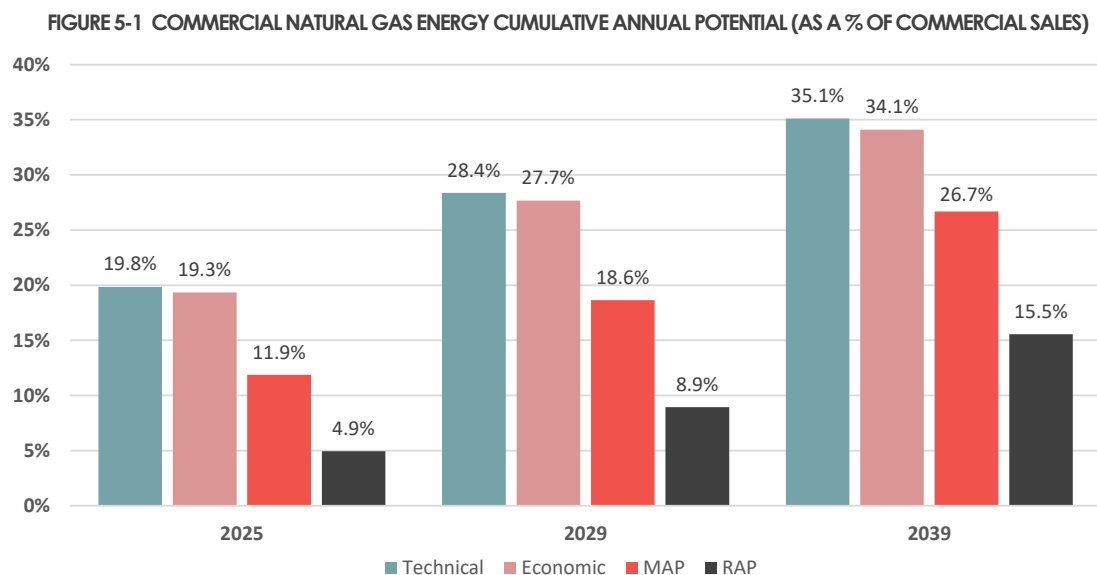


Table 5-2 provides cumulative annual technical, economic, MAP and RAP energy savings, in total therms and as a percentage of the sector-level sales forecast. The RAP starts at 0.6% in 2020 and rises to 4.9% after 2025.

TABLE 5-2 COMMERCIAL CUMULATIVE ANNUAL ENERGY EFFICIENCY POTENTIAL SUMMARY

	2020	2021	2022	2023	2024	2025
Therms						
Technical	7,632,209	15,803,125	24,245,705	32,732,187	40,982,318	48,735,429
Economic	7,333,894	15,219,764	23,473,067	31,790,450	39,888,984	47,503,991
MAP	3,703,516	8,086,236	13,040,380	18,345,466	23,782,514	29,128,030
RAP	1,455,945	3,163,374	5,118,832	7,287,941	9,637,700	12,130,006
Baseline Forecast	241,149,887	241,967,696	242,855,798	243,747,625	244,643,193	245,542,518
Energy Savings (as % of Baseline)						
Technical	3.2%	6.5%	10.0%	13.4%	16.8%	19.8%
Economic	3.0%	6.3%	9.7%	13.0%	16.3%	19.3%
MAP	1.5%	3.3%	5.4%	7.5%	9.7%	11.9%
RAP	0.6%	1.3%	2.1%	3.0%	3.9%	4.9%

Table 5-3 provides the incremental annual technical, economic, MAP and RAP energy savings, in total therms and as a percentage of the sector-level sales forecast. The incremental RAP ranges from 0.6% to 1.0% over the next six years.

TABLE 5-3 COMMERCIAL INCREMENTAL ANNUAL ENERGY EFFICIENCY POTENTIAL SUMMARY

	2020	2021	2022	2023	2024	2025
Therms						
Technical	7,632,209	8,170,916	8,519,007	8,621,873	8,382,376	8,033,643
Economic	7,333,894	7,885,869	8,253,303	8,376,348	8,154,351	7,819,113
MAP	3,703,516	4,382,720	4,954,145	5,350,113	5,479,672	5,514,403
RAP	1,455,945	1,707,429	1,955,459	2,179,894	2,360,402	2,571,706
Baseline Forecast	241,149,887	241,967,696	242,855,798	243,747,625	244,643,193	245,542,518
Energy Savings (as % of Baseline)						
Technical	3.2%	3.4%	3.5%	3.5%	3.4%	3.3%
Economic	3.0%	3.3%	3.4%	3.4%	3.3%	3.2%
MAP	1.5%	1.8%	2.0%	2.2%	2.2%	2.2%
RAP	0.6%	0.7%	0.8%	0.9%	1.0%	1.0%

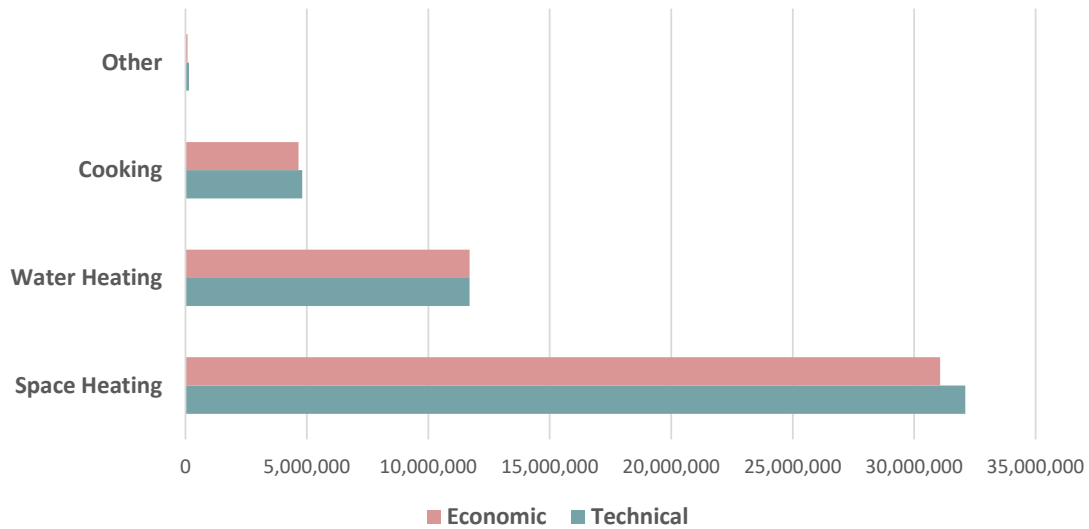
Technical & Economic Potential

Table 5-4 provides cumulative annual technical and economic potential results from 2020-2025. Table 5-2 shows a comparison of the technical and economic potential (6-year) by end use. Space heating is the leading end-use among technical and economic potential.

TABLE 5-4 TECHNICAL & ECONOMIC COMMERCIAL NATURAL GAS POTENTIAL

	2020	2021	2022	2023	2024	2025
Energy (Therms)						
Technical	7,632,209	15,803,125	24,245,705	32,732,187	40,982,318	48,735,429
Economic	7,333,894	15,219,764	23,473,067	31,790,450	39,888,984	47,503,991

FIGURE 5-2 6-YEAR TECHNICAL & ECONOMIC COMMERCIAL NATURAL GAS POTENTIAL – BY END-USE



Maximum Achievable Potential (MAP)

Figure 5-3 illustrates the cumulative annual MAP results by end use across the 2020-2025 timeframe. Like technical and economic potential, Space Heating and Water Heating are the leading end uses.

FIGURE 5-3 COMMERCIAL NATURAL GAS ENERGY (CUMULATIVE ANNUAL GWH) MAP POTENTIAL BY END-USE

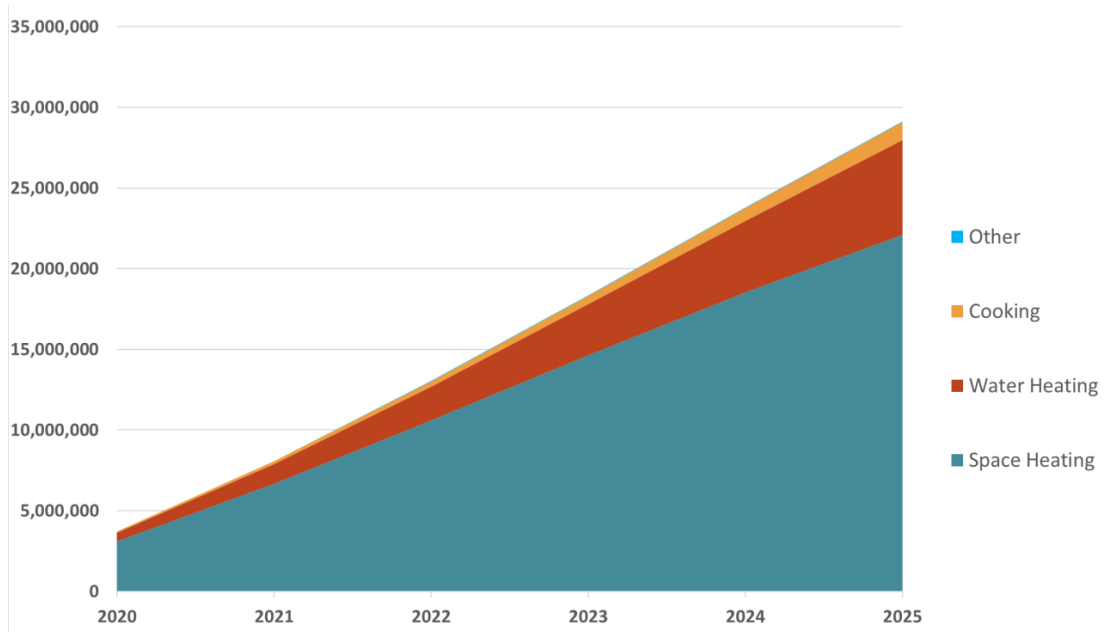


Table 5-5 provides the incremental and cumulative annual MAP across the 2020-2025 timeframe. The incremental MAP ranges from 1.5% to 2.2% of forecasted sales.

TABLE 5-5 COMMERCIAL NATURAL GAS MAP BY END-USE

End Use	2020	2021	2022	2023	2024	2025
Incremental Annual Therms						
Space Heating	3,101,837	3,579,834	3,922,884	4,026,323	3,903,056	3,657,325
Water Heating	527,994	693,114	877,897	1,117,904	1,306,804	1,513,485
Cooking	65,666	103,415	148,295	201,696	266,020	339,756
Other	8,018	6,357	5,069	4,191	3,792	3,837
Total	3,703,516	4,382,720	4,954,145	5,350,113	5,479,672	5,514,403
% of Forecasted Sales	1.5%	1.8%	2.0%	2.2%	2.2%	2.2%
Cumulative Annual Therms						
Space Heating	3,101,837	6,681,671	10,604,555	14,630,878	18,533,934	22,115,885
Water Heating	527,994	1,221,108	2,099,005	3,171,881	4,436,062	5,856,033
Cooking	65,666	169,082	317,376	519,072	785,092	1,124,848
Other	8,018	14,375	19,444	23,635	27,426	31,263
Total	3,703,516	8,086,236	13,040,380	18,345,466	23,782,514	29,128,030
% of Forecasted Sales	1.5%	3.3%	5.4%	7.5%	9.7%	11.9%

Realistic Achievable Potential (RAP)

Figure 5-4 illustrates the cumulative annual RAP results by end use across the 2020-2025 timeframe.

FIGURE 5-4 COMMERCIAL NATURAL GAS ENERGY (CUMULATIVE ANNUAL GWH) RAP POTENTIAL BY END-USE

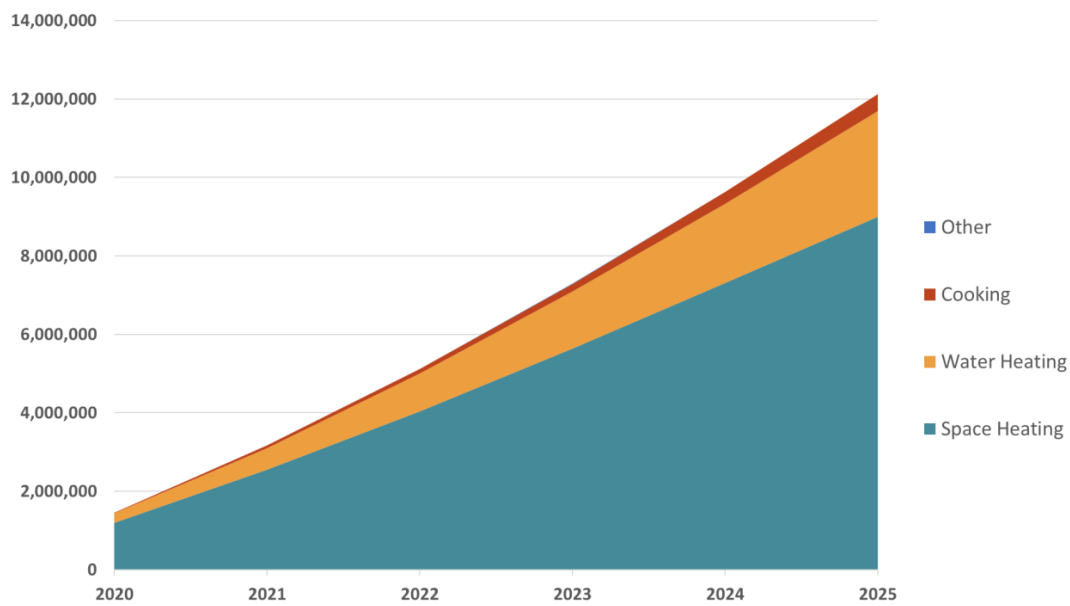


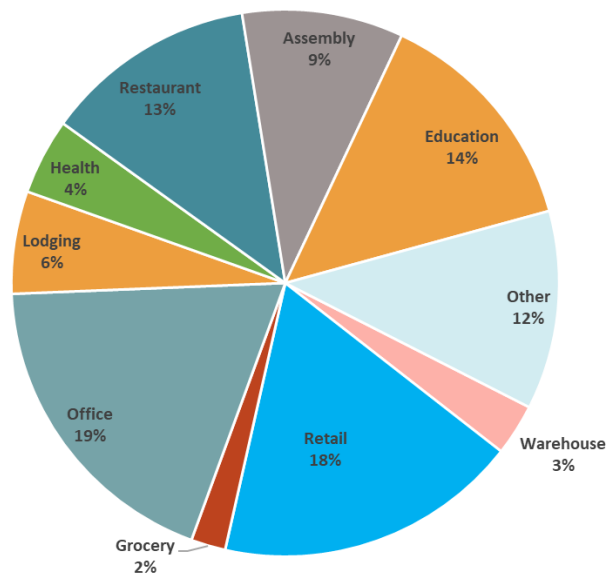
Table 5-6 provides the incremental and cumulative annual RAP across the 2020-2025 timeframe. The incremental RAP ranges from 0.6% to 1.0% over the 2020-2025 timeframe. Cumulative annual RAP increases to 4.9% by 2025.

TABLE 5-6 COMMERCIAL NATURAL GAS RAP BY END-USE

End Use	2020	2021	2022	2023	2024	2025
Incremental Annual Therms						
Space Heating	1,190,671	1,352,233	1,498,058	1,600,494	1,663,005	1,722,087
Water Heating	240,941	316,628	400,703	500,328	591,519	712,597
Cooking	23,952	38,076	56,082	78,328	105,005	136,025
Other	381	492	615	744	873	997
Total	1,455,945	1,707,429	1,955,459	2,179,894	2,360,402	2,571,706
% of Forecasted Sales	0.6%	0.7%	0.8%	0.9%	1.0%	1.0%
Cumulative Annual Therms						
Space Heating	1,190,671	2,542,905	4,040,963	5,641,457	7,304,462	8,989,424
Water Heating	240,941	557,569	958,273	1,447,815	2,028,691	2,699,013
Cooking	23,952	62,027	118,110	196,438	301,443	437,468
Other	381	873	1,487	2,231	3,104	4,101
Total	1,455,945	3,163,374	5,118,832	7,287,941	9,637,700	12,130,006
% of Forecasted Sales	0.6%	1.3%	2.1%	3.0%	3.9%	4.9%

Figure 5-5 illustrates a market segmentation of the RAP in the commercial sector by 2025. Offices, Retail, and Education are the three leading building types in the RAP scenario.

FIGURE 5-5 2025 COMMERCIAL NATURAL GAS ENERGY (CUMULATIVE ANNUAL) RAP POTENTIAL BY MARKET SEGMENT



RAP Benefits & Costs

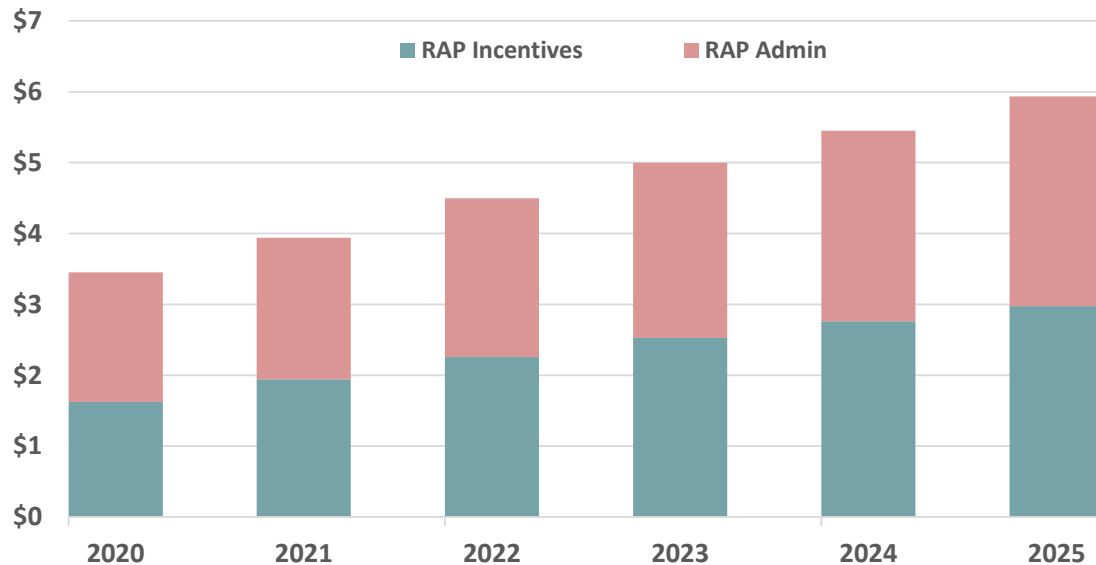
Table 5-7 provides the net present value benefits and cost, as calculated using the UCT, across the 2020-2025 timeframe for the RAP scenario.

TABLE 5-7 COMMERCIAL NPV BENEFITS & COSTS RAP BY END-USE (\$ IN MILLIONS)

End Use	NPV Benefits	NPV Costs	UCT Ratio
Space Heating	\$46.6	\$16.3	2.85
Water Heating	\$8.8	\$5.1	1.73
Cooking	\$1.7	\$0.7	2.37
Other	\$0.02	\$0.03	0.59
Total	\$57.1	\$22.1	2.58

Figure 5-6 provides the budget for the RAP scenario. The budget is broken into incentive and admin budgets for each year of the 2020-2025 timeframe. The total RAP budget rises to nearly \$6 million by 2025.

FIGURE 5-6 ANNUAL BUDGETS FOR COMMERCIAL RAP (\$ IN MILLIONS)



VOLUME II

2020-2025 Integrated Natural Gas Action Plan

prepared for



VECTREN
Live Smart

JANUARY 2019

1.1 VECTREN'S ACTION PLAN

The Market Potential Study serves as the basis for developing Vectren's Action Plan. The Action Plan is designed to extract the insights and data from the Market Potential Study and translate them into opportunities to deliver to customers. The Action Plan provides guidance to mobilize the results of the Market Potential Study research and design program initiatives that provide a pathway to advance efforts that are reasonable and relevant in developing Vectren's portfolio. The following section lays out the process, principles, and elements of Vectren's portfolio of programs. A summary of the results for the proposed portfolio is also provided.

1.2 GUIDING PLANNING PRINCIPLES IN DEVELOPING ACTION PLAN OFFERINGS

Vectren's Energy Efficiency Action Plan was developed in accordance with a number of guiding principles and considerations. The process was built on using the most recent Market Potential Study as the foundation, and was then designed to incorporate industry best standards, implementer experiences, and projected changes in the market (such as codes and standards) in order to translate the insights and knowledge from the Market Potential Study into actionable energy efficiency programs for Vectren's planning purposes and customers.

A review of the key planning guidelines and considerations used to frame the Action Plan follows:

TABLE 1-1 KEY PLANNING GUIDELINES IN DEVELOPING THE ACTION PLAN

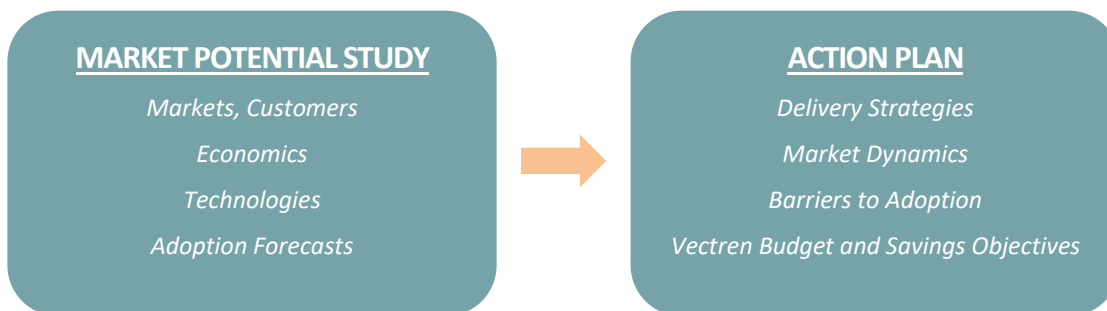
Plan Consideration	Description
Market Coverage	Consideration was given to crafting a portfolio of programs that offers opportunities for savings across all of Vectren's customer groups. This includes residential (single, multifamily and income-qualified) as well as commercial and industrial markets.
Direct Link to the Market Potential Study	The Action Plan is directly linked to the Market Potential Study by using its market and cost data. It is acknowledged that there are differences between market and achievable potential due to market dynamics (net versus gross impacts), timeframe differences, proxy versus specific program delivery approaches, and budget realities. Wherever possible, the Market Potential Study serves as a primary reference source making it easier for Vectren to return to the Market Potential Study for added insights as conditions in the market change.
Leveraging Current Program Efforts	Efforts were directed at leveraging existing Vectren offerings to take advantage of market and trade ally understanding, to utilize existing market relationships, retain the relevant elements of programs already working well, and to continue promotional efforts (where relevant).
Introduce New Measures and Concepts	The approach actively looked at incorporating new, applicable measures deemed cost effective and suitable for Vectren's portfolio. This included the introduction of selected new measures in the existing prescriptive-type programs.
Cost Effectiveness Analysis	For planning purposes, each of the recommended programs must pass the Utility Cost Test (UCT) and the Total Resource Cost (TRC) tests, except for Income-Qualified Programs which do not need to meet cost-effectiveness tests in order to promote a greater social good. The cost-effectiveness results are reported for the UCT and the TRC tests. Each program is assessed separately to determine relative benefits and costs (in contrast to assessing each individual measure).
Income-Qualified Programs	Because income-qualified programs are not required to be cost-effective, the Market Potential Study did not screen out measures for income-qualified programs based on any cost-effectiveness tests. The team used alternate guidelines for determining which measures would be included in the program. The team chose a "quality over quantity" approach and provided more services to each individual customer than in previous program years. To ensure that income-qualified programs did not overwhelm other energy efficiency program priorities, the team ensured that the overall program budget did not vastly exceed previous program budgets.
C&I Custom Program	Because the C&I Custom program utilizes engineering estimates for each project, customers can submit a wide range of projects through the program. Typically, C&I customers submit large projects through the program to provide an economy of scale for the company taking the time to complete program paperwork. The Market Potential Study, however, includes all measures that C&I customers may submit through the program no matter the size of the project. Due to this project sizing difference, the Market Potential Study estimates significantly higher savings than the team believed was achievable through the program. The team adjusted C&I Custom program participation and savings based on feedback from implementers and historical program participation.

Plan Consideration	Description
Adoption Forecasts	Forecasts of customer adoption were reviewed and applied from the Market Potential Study in combination with the historical participation from Vectren's programs. Information was also captured from actual VEDI program experience from evaluation reporting, reliance on "like-utility" estimates in offering similar programs and discussions with implementers.
Program Costs and Budgets	A budget that characterizes the estimated costs for delivering programs to customers is presented for each program. The costs include all participant incentive, planning, evaluation and implementation costs forecast for each year of program operation.
Electric and Natural Gas Integration	As a combination utility, some of Vectren's programs offer savings addressing both electric and natural gas reductions. Programs such as new construction, behavioral savings, multifamily, and income-qualified weatherization all include electric and gas savings. These programs follow the need to split program costs across fuel types while the cost-effectiveness results include benefits of electric and gas reductions. This effort was directed at areas of the Vectren service territory which offer both fuel types to customers. The specific impacts of these programs are provided in the individual program write-ups.

1.3 VECTREN ENERGY EFFICIENCY ACTION PLAN BACKGROUND

The development of the Action Plan is designed to translate the insights and information from the broader Market Potential Study analysis into discrete and specific offerings for Vectren's customers. The Market Potential Study and the Action Plan are related and share common values, but the Action Plan provides more detail, specificity and mobilization strategies.

The Action Plan outlines recommended gas programs for 2020-2025, a shorter timeframe than the potential research. The Action Plan lays out how to achieve the savings uncovered in the potential study research, shifting the broad and high-level forecast of savings opportunities in the Market Potential Study results into specific and actionable savings opportunities. An illustrative view between the Market Potential Study and the Action Plan elements follows:

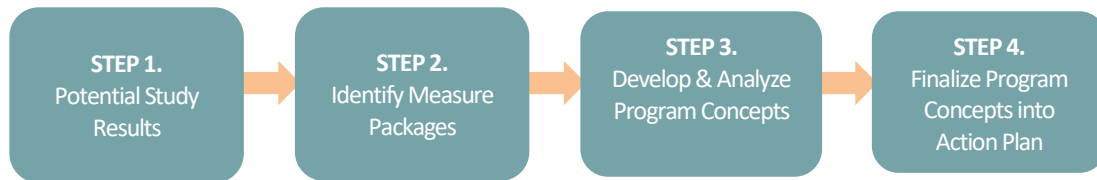


1.4 VECTREN ENERGY EFFICIENCY ACTION PLAN FRAMEWORK

The effort to develop Vectren's energy efficiency programs follows a grounded and sequential process. The process was built on applying the recent market potential analytics as a starting point and, from there, developing program offerings that cost-effectively meet Vectren's planning and program objectives. An illustrative review of the process follows.

1.4.1 Approach

Our approach was based on conducting a series of sequential activities that take the top measures from the potential analyses and develop more detailed and defined concepts to better reflect likely delivery strategies and actual experience. This included packaging measures into programs to analyze and forecast adoption, economic impacts, and savings estimates. This approach is consistent with similar energy efficiency potential efforts and is detailed in the Guide for Conducting Energy Efficiency Potential Studies, prepared by the National Action Plan for Energy Efficiency (2007). These activities are discussed in more detail below.



1.4.2 Action Plan Activities

Step 1. Potential Study Results

The starting point for developing the programs in the Vectren Action Plan was the recently-completed MPS. This study provided a current assessment of the energy efficiency opportunities available in Vectren service territory and was built on the utility's most recent sales information, market characterization, and forecast of adoption using a number of scenarios and data on measure penetration, costs, energy savings, and overall economics. A key input used for the Action Plan was the identification of the relative savings impacts and cost and benefits for a large array of possible measures that were considered for the Vectren portfolio.

The focus on identifying relevant measures for further consideration in the Vectren portfolio was based on looking at the forecast impacts from both the Total Resource Cost (TRC) and the Utility Cost Test (UCT). Measures which passed either test were reviewed and screened to determine their applicability, market rationale, and viability to be packaged into programs for subsequent examination. The project team, working with Vectren, coordinated multiple meetings with staff and implementers to assist in our understanding of current and proposed DSM initiatives, details of Indiana and Vectren-specific markets, and the suitability of efficiency measures given the utility's customer base. The result was a list of 145 measures, deemed to be the most reasonable and relevant for further consideration by Vectren.

Step 2. Identify Measure Packages

Using the data and results of the MPS, relevant measures were bundled into packages to better reflect targeted end uses, typical trade ally involvement in customer transactions, and common delivery strategies. The combined packages of measures were designed to advance the analysis efforts and optimally spread delivery costs across a range of technologies. The packages were developed through discussions with Vectren staff, review of prior utility offerings and discussions with Vectren's implementors.

Step 3. Develop and Analyze Program Concepts

Measure packages were then combined into program concepts, designed to reflect program implementation. The concepts were developed through a series of interviews with Vectren's program implementors. These discussions were designed to capture their insights and suggestions as what works best in Vectren's market based on their experiences. Discussions were also conducted with Vectren staff to get a sense of prior offerings, to better understand program delivery experiences. Finally, effort was also directed at incorporating practices and findings from other utility experiences in Indiana and in the region. The results of this step provided inputs to the Action Plan modeling including: energy savings, program costs, participation and incentives. These elements are all key inputs into modeling the stream of benefits and costs and determine cost effectiveness.

Step 4. Finalize Offerings in Action Plan

The final program concepts and relevant information were incorporated into Vectren's Action Plan document. The Action Plan provides the key information for required to implement desired programs.

A review of the key Action Plan data elements and sources follows:

TABLE 1-2 ACTION PLAN DATA ELEMENTS

Action Plan Content	Description
Energy Savings	Each program contains savings estimates for kWh, kW, and therms developed from the Market Potential Study analysis. Additional sources for the savings estimates include: the Indiana TRM, prior evaluation results from VEDI, prior DSM filings, and discussions with relevant implementers.
Technology Costs	Technology cost was obtained from the Market Potential Study analysis. Additional sources included prior evaluation results from VEDI and prior DSM filings.
Estimated Useful Lifetime	Estimates of useful lifetime (EUL) were based on the Market Potential Study analytics and the Indiana Measure Library. For programs with multiple measures, the program EUL was calculated using a weighted average of the number of each measure implemented.
Incentive Strategy	The specific incentive strategy including type (rebate, loan, POS reduction, manufacturer payment), and amount was determined from discussions with Vectren. There is a good history from prior VEDI DSM efforts to detail incentive strategy and amounts to move the market. The cost economics from the Participant Test were also used to gauge impacts.
Annual Adoption	Forecasts of customer adoption from the Market Potential Study were reviewed and adjustments were applied based on historical participation in Vectren's programs, upcoming changes in codes and standards, actual performance reported in VEDI evaluation reporting, and "like-utility" estimates in offering similar programs.
Net-To-Gross Impacts	Net-to-gross (NTG) estimates from past evaluation studies were used for existing programs. Benchmarking against other Indiana utilities or "like utilities" was used for new initiatives. Discussions with implementers were also included.
Program Costs	Program budgets were developed using historical program cost data and past VEDI evaluations. Discussions with relevant implementation contractors also provided insight regarding typical utility management requirements and related costs.
Benefit-Cost Impacts	Each program concept also includes the impact of the relative costs and benefits for each initiative. The results include the forecast of benefit-costs from various perspectives: Participant test, Rate Impact test, Utility Cost test, and Total Resource Cost test.

2 Overview of Vectren's Energy Efficiency Portfolio

The following section outlines the portfolio of programs developed by Vectren, EMI Consulting, and GDS Associates (referred to hereafter as “the team”). The section begins with a high-level summary of the recommended programs and then provides detailed participation estimates for each year of the Action Plan.

2.1 RECOMMENDED VECTREN ENERGY EFFICIENCY PROGRAM PORTFOLIO

The following table presents the recommended Vectren proposed portfolio. A more detailed program-by-program write-up is also provided in Section 3 to define each program’s overall design and incorporate relevant technology and market data to permit modeling of load impacts, budgets, and cost-effectiveness.

TABLE 2-1 SUMMARY OF DRAFT 2020-2025 ENERGY EFFICIENCY PROGRAMS

Programs	Continuation from Previous Plan	New or Expanded Offering	Pilot Program	Participant Unit	Gas/Electric Integrated Savings
Residential Prescriptive	X			Equipment/ Appliance/ Service	X
Residential New Construction	X			Home	X
Income-Qualified Weatherization	X			Home	X
Energy-Efficient Schools	X			Kit	X
Residential Behavioral Savings	X			Account	X
Multi-Family Direct Install	X			Home	
Targeted Income	X			Home	
Home Energy House Call	X			Home	
Neighborhood Program	X			Home	
Home Energy Assessment	X			Home	X
Food Bank		X		Showerhead	X
Home Energy Management Systems		X	X	Home	X
Commercial Prescriptive	X	X		Equipment/ Appliance/ Service	X
Commercial Custom	X	X		Project	X
Small Business	X	X		Project	X

2.2 SUMMARY OF ENERGY EFFICIENCY IMPACTS

An overall summary of results reflecting savings and costs is shown in Table 2-2 below. These results present an aggregation of all the programs, as well as the results by portfolio (Residential and Commercial/Industrial).

TABLE 2-2 VECTREN INDIANA GAS DSM 2020-2025 SAVINGS – ALL PROGRAMS

Year	Participants in Year	Energy Savings in Therms Savings in Year	Incentives, 000\$	Program Costs, 000\$	Indirect and Other Costs, 000\$	Budget, 000\$
2020	60,288	3,290,694	3,583	4,716	1,550	9,849
2021	68,613	3,495,441	3,707	4,948	1,889	10,544
2022	62,657	2,744,676	2,202	4,632	1,511	8,345
2023	60,125	2,840,888	2,318	4,864	1,541	8,723
2024	60,689	2,957,226	2,435	5,071	1,871	9,376
2025	61,252	3,068,690	2,544	5,356	1,604	9,504
Total	373,624	18,397,615	16,788	29,587	9,965	56,341

TABLE 2-3 VECTREN INDIANA GAS DSM 2020-2025 SAVINGS – RESIDENTIAL

Year	Participants in Year	Energy Savings in Therms Savings in Year	Incentives, 000\$	Program Costs, 000\$	Indirect and Other Costs, 000\$	Budget, 000\$
2020	58,513	2,502,868	2,836	3,633	1,179	7,648
2021	66,324	2,688,619	2,945	3,809	1,453	8,207
2022	60,139	1,911,720	1,420	3,428	1,052	5,901
2023	57,315	1,977,090	1,514	3,592	1,073	6,179
2024	57,537	2,054,181	1,603	3,776	1,299	6,678
2025	57,738	2,125,438	1,684	3,924	1,111	6,719
Total	357,566	13,259,916	12,002	22,163	7,167	41,332

TABLE 2-4 VECTREN INDIANA GAS DSM 2020-2025 SAVINGS – COMMERCIAL & INDUSTRIAL

Year	Participants in Year	Energy Savings in Therms Savings in Year	Incentives, 000\$	Program Costs, 000\$	Indirect and Other Costs, 000\$	Budget, 000\$
2020	1,775	787,826	747	1,083	371	2,201
2021	2,289	806,822	762	1,139	436	2,337
2022	2,518	832,956	782	1,203	459	2,444
2023	2,810	863,798	804	1,271	469	2,544
2024	3,152	903,045	832	1,295	571	2,698
2025	3,514	943,252	860	1,432	493	2,785
Total	16,058	5,137,699	4,786	7,424	2,798	15,009

2.3 PORTFOLIOTARGETS BY YEAR

The following tables present the portfolio participation, savings, and costs targets by each program year.

TABLE 2-5 2020 PORTFOLIO TARGETS

	Number of Participants	Total Therms Savings	Admin.	Implementation	Incentives	Total Budget
Residential						
Residential Prescriptive	15,750	1,438,213	\$29,600	\$1,090,398	\$2,456,695	\$3,576,693
Residential New Construction	704	305,150	\$3,700	\$286,083	\$379,375	\$669,158
Home Energy Assessment	300	20,924	\$3,700	\$55,000	-	\$58,700
Income-Qualified Weatherization	513	56,971	\$14,800	\$872,202	-	\$887,002
Energy-Efficient Schools	2,600	38,480	\$22,200	\$28,397	-	\$50,597
Residential Behavioral Savings	34,778	375,933	\$37,000	\$108,182	-	\$145,182
Food Bank	-	-	-	-	-	-
Home Energy Management Systems	-	-	\$11,100	\$130,000	-	\$141,100
Multi-Family Direct Install	1,700	68,591	\$14,800	\$397,115	-	\$411,915
Targeted Income	46	15,022	\$29,600	\$74,470	-	\$104,070
Home Energy House Call- Integrated	1,122	49,144	\$29,600	\$179,527	-	\$209,127
Neighborhood Program- Integrated	1,000	134,440	\$29,600	\$185,910	-	\$215,510
Residential Subtotal	58,513	2,502,868	\$225,700	\$3,407,285	\$2,836,070	\$6,469,055
Commercial & Industrial (C&I)						
C&I Prescriptive	1,112	298,228	\$66,600	\$442,240	\$251,057	\$759,897
C&I Custom	71	472,810	\$74,000	\$493,803	\$489,600	\$1,057,403
Small Business	592	16,788	\$3,700	\$3,096	\$5,886	\$12,682
C&I Subtotal	1,775	787,826	\$144,300	\$939,139	\$746,543	\$1,829,982
Indirect Costs						
Contact Center						\$132,080
Online Audit						\$200,564
Outreach						\$534,863
Portfolio Costs Subtotal						\$867,508
Subtotal (Before Evaluation)						\$9,166,544
Evaluation						\$482,414
DSM Portfolio Total						\$9,648,958
Other Costs						
Emerging Markets						\$200,000
Market Potential Study						-
Other Costs Subtotal						\$200,000
DSM Portfolio Total including Other Costs						\$9,848,958
<i>Note: The team assumed that Vectren would continue to pilot the Home Energy Management Systems program through 2020.</i>						

TABLE 2-6 2021 PORTFOLIO TARGETS

	Number of Participants	Total Therms Savings	Admin.	Implementation	Incentives	Total Budget
Residential						
Residential Prescriptive	16,021	1,456,999	\$30,074	\$1,107,845	\$2,491,995	\$3,629,913
Residential New Construction	857	369,380	\$3,759	\$342,221	\$452,875	\$798,855
Home Energy Assessment	350	24,412	\$3,759	\$55,880	-	\$59,639
Income-Qualified Weatherization	538	60,190	\$15,037	\$885,268	-	\$900,304
Energy-Efficient Schools	2,600	38,480	\$22,555	\$29,313	-	\$51,868
Residential Behavioral Savings	34,778	375,933	\$22,555	\$109,913	-	\$132,468
Food Bank	6,312	41,628	\$15,037	\$4,626	-	\$19,663
Home Energy Management Systems	1,000	54,400	\$11,278	\$194,100	-	\$205,378
Multi-Family Direct Install	1,700	68,591	\$15,037	\$403,469	-	\$418,506
Targeted Income	46	15,022	\$30,074	\$75,662	-	\$105,735
Home Energy House Call- Integrated	1,122	49,144	\$30,074	\$182,399	-	\$212,473
Neighborhood Program- Integrated	1,000	134,440	\$30,074	\$188,885	-	\$218,959
Residential Subtotal	66,324	2,688,619	\$229,311	\$3,579,580	\$2,944,870	\$6,753,761
Commercial & Industrial (C&I)						
C&I Prescriptive	1,193	315,496	\$67,666	\$487,528	\$266,357	\$821,550
C&I Custom	71	472,810	\$75,184	\$501,704	\$489,600	\$1,066,488
Small Business	1,025	18,516	\$3,759	\$3,209	\$6,006	\$12,975
C&I Subtotal	2,289	806,822	\$146,609	\$992,441	\$761,963	\$1,901,012
Indirect Costs						
Contact Center						\$134,193
Online Audit						\$203,774
Outreach						\$543,421
Portfolio Costs Subtotal						\$881,388
Subtotal (Before Evaluation)						\$9,536,161
Evaluation						\$507,425
DSM Portfolio Total						\$10,043,586
Other Costs						
Emerging Markets						\$200,000
Market Potential Study						\$300,000
Other Costs Subtotal						\$500,000
DSM Portfolio Total including Other Costs						\$10,543,586
<i>Note: Participation and savings spike in 2021 due to: high Residential Prescriptive participation estimated by the Market Potential Study, the start of the Home Energy Management Systems program, and new gas measures in the Energy Efficient Schools program (high-efficiency showerheads).</i>						

TABLE 2-7 2022 PORTFOLIO TARGETS

	Number of Participants	Total Therms Savings	Admin.	Implementation	Incentives	Total Budget
Residential						
Residential Prescriptive	9,522	579,226	\$30,555	\$535,505	\$858,470	\$1,424,530
Residential New Construction	1,075	462,060	\$3,819	\$424,689	\$561,725	\$990,233
Home Energy Assessment	420	29,294	\$3,819	\$56,774	-	\$60,593
Income-Qualified Weatherization	564	63,502	\$15,277	\$980,165	-	\$995,443
Energy-Efficient Schools	2,600	38,480	\$22,916	\$30,743	-	\$53,659
Residential Behavioral Savings	34,778	375,933	\$22,916	\$111,671	-	\$134,587
Food Bank	6,312	41,628	\$15,278	\$4,700	-	\$19,977
Home Energy Management Systems	1,000	54,400	\$11,458	\$187,100	-	\$198,558
Multi-Family Direct Install	1,700	68,591	\$15,277	\$409,925	-	\$425,202
Targeted Income	46	15,022	\$30,555	\$76,872	-	\$107,427
Home Energy House Call- Integrated	1,122	49,144	\$30,555	\$185,318	-	\$215,872
Neighborhood Program- Integrated	1,000	134,440	\$30,555	\$191,907	-	\$222,462
Residential Subtotal	60,139	1,911,720	\$232,980	\$3,195,369	\$1,420,195	\$4,848,544
Commercial & Industrial (C&I)						
C&I Prescriptive	1,312	338,606	\$68,748	\$541,210	\$286,137	\$896,095
C&I Custom	71	472,810	\$76,387	\$509,731	\$489,600	\$1,075,718
Small Business	1,135	21,540	\$3,819	\$3,375	\$6,216	\$13,410
C&I Subtotal	2,518	832,956	\$148,955	\$1,054,315	\$781,953	\$1,985,223
Indirect Costs						
Contact Center						\$136,340
Online Audit						\$207,034
Outreach						\$552,116
Portfolio Costs Subtotal						\$895,490
Subtotal (Before Evaluation)						\$7,729,257
Evaluation						\$415,538
DSM Portfolio Total						\$8,144,795
Other Costs						
Emerging Markets						\$200,000
Market Potential Study						-
Other Costs Subtotal						\$200,000
DSM Portfolio Total including Other Costs						\$8,344,795

Note: Participation and savings decline in 2022 due in large part to end of incentives for 95% AFUE furnaces. Previous program evaluations found declining net-to-gross estimates for this measure and the team estimated that the measure will not be a viable program measure by 2022.

TABLE 2-8 2023 PORTFOLIO TARGETS

	Number of Participants	Total Therms Savings	Admin.	Implementation	Incentives	Total Budget
Residential						
Residential Prescriptive	9,565	580,541	\$31,044	\$544,073	\$863,520	\$1,438,637
Residential New Construction	1,253	537,581	\$3,880	\$491,921	\$650,275	\$1,146,077
Home Energy Assessment	504	35,153	\$3,880	\$57,682	-	\$61,563
Income-Qualified Weatherization	591	66,991	\$15,522	\$1,060,825	-	\$1,076,347
Energy-Efficient Schools	2,600	38,480	\$23,283	\$32,758	-	\$56,041
Residential Behavioral Savings	34,778	375,933	\$23,283	\$113,458	-	\$136,741
Food Bank	3,156	20,814	\$15,522	\$4,775	-	\$20,297
Home Energy Management Systems	1,000	54,400	\$11,641	\$172,100	-	\$183,741
Multi-Family Direct Install	1,700	68,591	\$15,522	\$416,484	-	\$432,005
Targeted Income	46	15,022	\$31,044	\$78,102	-	\$109,146
Home Energy House Call- Integrated	1,122	49,144	\$31,044	\$188,283	-	\$219,326
Neighborhood Program- Integrated	1,000	134,440	\$31,044	\$194,978	-	\$226,021
Residential Subtotal	57,315	1,977,090	\$236,708	\$3,355,439	\$1,513,795	\$5,105,942
Commercial & Industrial (C&I)						
C&I Prescriptive	1,479	365,992	\$69,848	\$598,626	\$307,777	\$976,251
C&I Custom	71	472,810	\$77,609	\$517,886	\$489,600	\$1,085,096
Small Business	1,260	24,996	\$3,880	\$3,561	\$6,456	\$13,898
C&I Subtotal	2,810	863,798	\$151,338	\$1,120,073	\$803,833	\$2,075,244
Indirect Costs						
Contact Center						\$138,522
Online Audit						\$210,346
Outreach						\$560,949
Portfolio Costs Subtotal						\$909,818
Subtotal (Before Evaluation)						\$8,091,004
Evaluation						\$431,543
DSM Portfolio Total						\$8,522,547
Other Costs						
Emerging Markets						\$200,000
Market Potential Study						-
Other Costs Subtotal						\$200,000
DSM Portfolio Total including Other Costs						\$8,722,547
<i>Note: No notable changes from 2022.</i>						

TABLE 2-9 2024 PORTFOLIO TARGETS

	Number of Participants	Total Therms Savings	Admin.	Implementation	Incentives	Total Budget
Residential						
Residential Prescriptive	9,584	579,541	\$31,540	\$552,778	\$864,995	\$1,449,314
Residential New Construction	1,428	612,092	\$3,943	\$558,080	\$737,775	\$1,299,797
Home Energy Assessment	504	35,153	\$3,943	\$58,605	-	\$62,548
Income-Qualified Weatherization	619	70,571	\$15,770	\$1,120,207	-	\$1,135,977
Energy-Efficient Schools	2,600	38,480	\$23,655	\$35,464	-	\$59,119
Residential Behavioral Savings	34,778	375,933	\$23,655	\$115,273	-	\$138,929
Food Bank	3,156	20,814	\$15,770	\$4,851	-	\$20,622
Home Energy Management Systems	1,000	54,400	\$11,828	\$198,260	-	\$210,088
Multi-Family Direct Install	1,700	68,591	\$15,770	\$423,147	-	\$438,918
Targeted Income	46	15,022	\$31,540	\$79,352	-	\$110,892
Home Energy House Call- Integrated	1,122	49,144	\$31,540	\$191,295	-	\$222,835
Neighborhood Program- Integrated	1,000	134,440	\$31,540	\$198,097	-	\$229,638
Residential Subtotal	57,537	2,054,181	\$240,495	\$3,535,411	\$1,602,770	\$5,378,676
Commercial & Industrial (C&I)						
C&I Prescriptive	1,712	402,215	\$70,966	\$611,299	\$335,962	\$1,018,227
C&I Custom	71	472,810	\$78,851	\$526,173	\$489,600	\$1,094,624
Small Business	1,369	28,020	\$3,943	\$3,736	\$6,666	\$14,344
C&I Subtotal	3,152	903,045	\$153,759	\$1,141,208	\$832,228	\$2,127,195
Indirect Costs						
Contact Center						\$140,738
Online Audit						\$213,712
Outreach						\$569,925
Portfolio Costs Subtotal						\$924,375
Subtotal (Before Evaluation)						\$8,430,246
Evaluation						\$446,225
DSM Portfolio Total						\$8,876,471
Other Costs						
Emerging Markets						\$200,000
Market Potential Study						\$300,000
Other Costs Subtotal						\$500,000
DSM Portfolio Total including Other Costs						\$9,376,471
<i>Note: Costs increase due to the market potential study.</i>						

TABLE 2-10 2025 PORTFOLIO TARGETS

	Number of Participants	Total Therms Savings	Admin.	Implementation	Incentives	Total Budget
Residential						
Residential Prescriptive	9,591	577,456	\$32,045	\$561,623	\$864,845	\$1,458,513
Residential New Construction	1,592	681,668	\$4,006	\$620,174	\$819,500	\$1,443,680
Home Energy Assessment	504	35,153	\$4,006	\$59,543	-	\$63,549
Income-Qualified Weatherization	649	74,337	\$16,022	\$1,156,992	-	\$1,173,014
Energy-Efficient Schools	2,600	38,480	\$24,034	\$39,008	-	\$63,041
Residential Behavioral Savings	34,778	375,933	\$24,034	\$117,118	-	\$141,151
Food Bank	3,156	20,814	\$16,023	\$4,929	-	\$20,952
Home Energy Management Systems	1,000	54,400	\$12,017	\$214,420	-	\$226,437
Multi-Family Direct Install	1,700	68,591	\$16,022	\$429,918	-	\$445,940
Targeted Income	46	15,022	\$32,045	\$80,621	-	\$112,666
Home Energy House Call- Integrated	1,122	49,144	\$32,045	\$194,356	-	\$226,401
Neighborhood Program- Integrated	1,000	134,440	\$32,045	\$201,267	-	\$233,312
Residential Subtotal	57,738	2,125,438	\$244,343	\$3,679,968	\$1,684,345	\$5,608,656
Commercial & Industrial (C&I)						
C&I Prescriptive	1,964	439,398	\$72,101	\$737,459	\$363,357	\$1,172,917
C&I Custom	71	472,810	\$80,112	\$534,591	\$489,600	\$1,104,304
Small Business	1,479	31,044	\$4,006	\$3,915	\$6,876	\$14,797
C&I Subtotal	3,514	943,252	\$156,219	\$1,275,965	\$859,833	\$2,292,017
Indirect Costs						
Contact Center						\$142,990
Online Audit						\$217,131
Outreach						\$579,043
Portfolio Costs Subtotal						\$939,165
Subtotal (Before Evaluation)						\$8,839,838
Evaluation						\$464,552
DSM Portfolio Total						\$9,304,390
Other Costs						
Emerging Markets						\$200,000
Market Potential Study						-
Other Costs Subtotal						\$200,000
DSM Portfolio Total including Other Costs						\$9,504,390
<i>Note: No notable changes.</i>						

3 Program Concepts

This section provides an overview of each program, organized by the following topic areas: 1) Background, 2) Relationship to Vectren's Market Potential Study, 3) Program Considerations, and 4) Technology and Program Data.

3.1 RESIDENTIAL PRESCRIPTIVE

3.1.1 Background

The Residential Prescriptive Program is designed to incent customers to purchase energy efficient equipment by covering part of the incremental cost. The program also offers home weatherization rebates to residential customers for attic and wall insulation. If a product vendor or contractor chooses to do so, they can present rebates as an "instant discount" to Vectren's residential customers on their invoice. Vectren will oversee the program and work with an implementation partner on delivery.

Any residential customer located in the Vectren's natural gas service territory is eligible to participate in the program. For the equipment rebates, the applicant must reside in a single-family home or multi-family complex with up to 12 units. Only single-family homes are eligible for insulation measures.

Measures included in the program will change over time as baselines change, new technologies become available, and customer needs are identified. Measures include:

- Attic Insulation
- Duct Sealing
- Dual Fuel Air Source Heat Pumps
- Energy-Efficient Natural Gas Water Heaters and Tankless Water Heaters (new in 2020)
- Natural Gas Boilers and Furnaces
- Nest On-Line Store Thermostats
- Wifi Thermostats
- Smart Programmable Thermostats
- Wall Insulation
- Furnace Tune Ups

3.1.2 Relationship to Vectren's Market Potential Study

The team cross-referenced measures from the Market Potential Study with measures included in the existing Residential Prescriptive Program. As measures from the Residential Prescriptive Program also appear in other Vectren residential programs, the team also compared the rate of sales in other programs to the Residential Prescriptive Program. From this analysis, the team found that several Residential Prescriptive Program measures had already reached the full RAP estimated in the Market Potential Study (such as attic insulation), and the team capped future participation at the rates estimated by the potential study.

3.1.3 Program Considerations

A major change to the gas Residential Prescriptive program is the removal of 95% AFUE natural gas furnaces beginning in 2022. These are being removed due to decreasing net-to-gross (NTG) estimates over the last several years, indicating market transformation.

There are many measures are new to the program, including water heaters and tankless water heaters. The team provided escalating estimates for participation for these measures over the duration of the Action Plan.

3.1.4 Technology and Program Data

The following table provides summary of the Residential Prescriptive Program energy impacts and budget.

TABLE 3-1 RESIDENTIAL PRESCRIPTIVE – IMPACTS AND BUDGET

	2020	2021	2022	2023	2024	2025
Number of Participants	15,750	16,021	9,522	9,565	9,584	9,591
Energy Savings (Therms)	1,438,213	1,456,999	579,226	580,541	579,541	577,456
Total Program Budget	\$3,576,693	\$3,629,913	\$1,424,530	\$1,438,637	\$1,449,314	\$1,458,513
Per Participant Energy Savings (Therms)	91	91	61	61	60	60
Per Participant Average Incentive	\$156	\$156	\$90	\$90	\$90	\$90
Average Useful Life	18	18	16	16	16	16
Incremental Technology Cost	\$397	\$393	\$243	\$245	\$247	\$249
Net-to-Gross Ratio	57%	58%	63%	63%	63%	63%

Note: Number of participants and energy savings estimates based primarily on Market Potential Study results. Program budget estimate based on current schedule of work and projected rising costs from Vectren Program Cost and Measure Data spreadsheet. Per unit savings estimates based on the Market Potential Study results. Per participant energy savings and incremental technology cost weighted by participant. Weighted average measure life and net to gross ratio weighted by therms.

3.2 RESIDENTIAL NEW CONSTRUCTION

3.2.1 Background

The Residential New Construction (RNC) program will produce long-term electric and gas savings by encouraging the construction of single-family homes, duplexes, or end-unit townhomes with only one shared wall that are inspected and evaluated through the Home Efficiency Rating System (HERS). Two incentive levels have been defined by the HERS Index score the house achieves. As of 2018, Gold Star homes must achieve a HERS rating of 61 to 63. Platinum Star homes must meet a HERS rating of 60 or less.

Any customer or home builder constructing a home and meeting the program specifications in the Vectren gas service territory is eligible to participate in the program. Program incentives are designed to be paid to both gas service-only homes in the Vectren North service area and combination homes that have natural gas heating in the Vectren South service area. It is important to note that the program is structured such that an incentive will not be paid for an all-electric home that has natural gas available to the home site. Incentives can be paid to either the home builder or the customer/account holder. Incentives are based on the rating tier qualification. As part of the Quality Assurance/Quality Control process, the HERS Assessment is completed by a certified third party HERS Rater. As part of the Quality Assurance/Quality Control process, the vendor provided 100% paper verification that the equipment/products purchased meet the program efficiency standards.

3.2.2 Relation to Vectren's Market Potential Study

The Market Potential Study indicated that the market for the Residential New Construction Program is shrinking in Vectren South and is expanding in Vectren North. The team used previous program participation to calibrate rates from the Market Potential Study.

3.2.3 Program Considerations

The housing market is sensitive to market conditions and unforeseen economic circumstances may impact this program in the future.

3.2.4 Technology and Program Data

The following table provides summary of the Residential New Construction Program energy impacts and budget.

TABLE 3-2 RESIDENTIAL NEW CONSTRUCTION – IMPACTS AND BUDGET

	2020	2021	2022	2023	2024	2025
Number of Homes	704	857	1,075	1,253	1,428	1,592
Energy Savings (Therms)	305,150	369,380	462,060	537,581	612,092	681,668
Total Program Budget	\$669,158	\$798,855	\$990,233	\$1,146,077	\$1,299,797	\$1,443,680
Per Participant Energy Savings (Therms)	433	431	430	429	429	428
Per Participant Average Incentive	\$539	\$528	\$523	\$519	\$517	\$515
Weighted Average Measure Life	25	25	25	25	25	25
Incremental Technology Cost	\$2,813	\$2,856	\$2,885	\$2,900	\$2,913	\$2,920
Net-to-Gross Ratio	50%	50%	50%	50%	50%	50%

Note: Number of participants and energy savings estimates based on the Market Potential Study results and 2018 operating plan estimates. Program budget estimate based on current schedule of work and projected rising costs from Vectren Program Cost and Measure Data spreadsheet. Per unit savings estimates divide total energy savings by total participants. Per participant energy savings and incremental technology cost weighted by participant. Weighted average measure life and net to gross ratio weighted by therms.

3.3 HOME ENERGY ASSESSMENT

3.3.1 Background

The Home Energy Assessment (HEA) Program is offered jointly by Vectren South Gas and Electric. This program provides customers with an on-site energy assessment, providing direct installation of energy-efficient measures including high efficiency water fixtures and smart thermostats. Assessors will perform a walk-through assessment of the home, collecting data for use in identifying cost-effective energy-efficient improvements and appropriate direct install measures. Assessors will then provide an audit report to the customer while assessors are onsite to outline other retrofit opportunities within the home.

Vectren South residential customers with electric service at a single-family residence, provided the home was not built within the past five years and has not had an audit within the last three years, are eligible to participate in the program. Additionally, the home should either be owner-occupied or, if renter-occupied, where occupants have the electric service in their name.

The direct install measures available for installation at no cost include:

- Audit & Education
- Kitchen & Bathroom Aerators
- Filter Whistle
- High efficiency Showerhead
- Pipe Wrap
- Water Heater Temperature Setback
- Smart Thermostat

3.3.2 Relation to Vectren's Market Potential Study

The team cross-referenced measures from the Market Potential Study with measures included in the Home Energy Assessment Program. As measures from the Home Energy Assessment program also appear in other Vectren residential programs, the team also compared the rate of sales in other programs to the Home Energy Assessment Program. From this analysis, the team estimated that measures from the Home Energy Assessment Program have market potential well above Action Plan participation estimates.

3.3.3 Program Considerations

The team considered the inclusion of additional measures in the program and included those measures that passed cost-effectiveness testing or could be bundled within the program to produce an overall cost-effective program.

3.3.4 Technology and Program Data

The following table provides summary of the Home Energy Assessment Program energy impacts and budget.

TABLE 3-3 HOME ENERGY ASSESSMENT – IMPACTS AND BUDGET

	2020	2021	2022	2023	2024	2025
Number of Participants	300	350	420	504	504	504
Energy Savings (Therms)	20,924	24,412	29,294	35,153	35,153	35,153
Total Program Budget	\$58,700	\$59,639	\$60,593	\$61,563	\$62,548	\$63,549
Per Participant Energy Savings (Therms)	70	70	70	70	70	70
Weighted Average Measure Life	12	12	12	12	12	12
Net-to-Gross Ratio	105%	105%	105%	105%	105%	105%

Note: Number of participants estimated based on interview with the current program implementer, JE Shekell. Per unit savings estimated based on 2018 Operating Plan. Program costs estimated based on current SOW and projected rising costs described by JE Shekell. Therm savings estimated by dividing total savings by total participants. Incremental technology cost estimated by summing the incremental cost of each piece of equipment and divided by number of participants. Weighted average measure life and net to gross ratio weighted by therms.

3.4 INCOME-QUALIFIED WEATHERIZATION

3.4.1 Background

The Income-Qualified Weatherization Program (IQW) is designed to provide direct install measures and weatherization upgrades to low-income homes that otherwise would not have been able to afford the energy saving measures. The program provides direct installation of energy-saving measures and educates consumers on ways to reduce energy consumption. Eligible customers will have opportunity to receive deeper retrofit measures including attic insulation, duct sealing, and air infiltration reduction. Vectren will oversee the program and partner with an implementation contractor to deliver the program. A list of high consumption customers who have received Energy Assistance Program (EAP) funds within the past 12 months will be used to help prioritize those customers who will benefit most from the program. In addition to utilizing the EAP List, implementers will utilize census data to target low-income areas within Vectren territory.

In future years, the IQW program will shift focus to providing a more quality and in-depth approach. The focus will be to provide deeper retrofit measures where needed to fewer participants, thus reaping higher savings and more benefit to the customer.

Collaboration and coordination between gas and electric low-income programs along with state and federal funding is recommended to provide the greatest efficiencies among all programs. The challenge of meeting the goals set for this

program have centered on health and safety as well as customer cancellations and scheduling. Vectren is committed to finding innovative solutions to these areas. A health and safety (H&S) budget has been established and we continue to work on improving methods of customer engagement with various confirmations via phone and email reminders prior to the appointment. Vectren will look for ways to do more of a qualitative approach within this program to ensure the maximum savings is reached and H&S issues are addressed appropriately.

Measures available for installation will vary based on the home and include:

- High efficiency kitchen and bath aerators
- High Efficiency Showerheads (Standard or Handheld)
- Pipe wrap
- Filter whistles
- Infiltration reduction
- Attic insulation
- Duct repair, seal and insulation
- Smart thermostats
- Water Heater Temperature Setback

3.4.2 Relation to Vectren's Market Potential Study

The team cross-referenced measures from the Market Potential Study with measures included in IQW. As measures from IQW also appear in other Vectren residential programs, the team also compared the rate of sales in other programs to IQW. From this analysis, the team estimated that measures from IQW have market potential well above Action Plan participation estimates.

3.4.3 Program Considerations

Measures for the Income-Qualified Weatherization Program do not need to be cost-effective at the program level and therefore the Market Potential Study did not screen measures based on a cost-effectiveness test. The team chose measures that they felt would provide the most value to customers. The team chose a "quality over quantity" approach and provided more services to each individual customer than in previous program years. To ensure that the program did not overwhelm other energy efficiency program priorities, the team ensured that the overall program budget did not vastly exceed previous program budgets.

3.4.4 Technology and Program Data

The following table provides summary of IQW energy impacts and budget.

TABLE 3-4 INCOME-QUALIFIED WEATHERIZATION – IMPACTS AND BUDGET

	2020	2021	2022	2023	2024	2025
Number of Participants	513	538	564	591	619	649
Energy Savings (Therms)	56,971	60,190	63,502	66,991	70,571	74,337
Total Program Budget	\$887,002	\$900,304	\$995,443	\$1,076,347	\$1,135,977	\$1,173,014
Per Participant Energy Savings (Therms)	111	112	113	113	114	115
Weighted Average Measure Life	15	15	15	15	15	15
Incremental Technology Cost	\$301	\$304	\$305	\$307	\$309	\$310
Net-to-Gross Ratio	100%	100%	100%	100%	100%	100%

Note: Energy savings estimates based on the Market Potential Study results and 2018 Operating Plan estimates and projected rising costs from 2018-20 filed Energy Efficiency Plan and Vectren Program Cost and Measure Data spreadsheet.

	2020	2021	2022	2023	2024	2025
<i>Per participant energy savings calculated by dividing total savings by participation. Number of participants based on historical program participation. Weighted average measure life and net to gross weighted by therms. Incremental cost calculated by summing the incremental cost of each piece of equipment and divided by number of participants.</i>						

3.5 ENERGY-EFFICIENT SCHOOLS

3.5.1 Background

The Energy-Efficient Schools Program is designed to produce cost-effective electric and gas savings by educating students and their families about conservation and the efficient use of energy. The program consists of a school education program for fifth grade students attending schools served by Vectren South. To help in this effort, each child that participates will receive a take-home energy kit with various energy-saving measures for their parents to install in the home. The kits, along with the in-school teaching materials, are designed to make a lasting impression on the students and help them learn ways to conserve energy. Selected fifth grade students/schools in the Vectren South service territory are eligible for the program.

The kits for students will include:

- High efficiency showerheads
- High efficiency kitchen aerators
- High efficiency bathroom aerators
- Filter whistles

3.5.2 Relation to Vectren's Market Potential Study

Though the Market Potential Study estimated savings, only customers with enrolled fifth grade students will participate in the program. As such, the Market Potential Study did not serve as a useful estimate for future Energy-Efficient Schools Program participation. The team relied on previous participation and discussions with the implementer to arrive at useful estimates.

3.5.3 Program Considerations

The team assumed that previous participation is a good indicator of future participation and, in consultation with the implementer, assumed that the program had a little room to grow from the 2018-2020 filed Energy Efficiency plan.

3.5.4 Technology and Program Data

The following table provides summary of the Energy-Efficient Schools Program energy impacts and budget.

TABLE 3-5 ENERGY-EFFICIENT SCHOOLS – IMPACTS AND BUDGET

	2020	2021	2022	2023	2024	2025
Number of Participants	2,600	2,600	2,600	2,600	2,600	2,600
Energy Savings (Therms)	38,480	38,480	38,480	38,480	38,480	38,480
Total Program Budget	\$50,597	\$51,868	\$53,659	\$56,041	\$59,119	\$63,041
Per Participant Energy Savings (Therms)	15	15	15	15	15	15
Weighted Average Measure Life	10	10	10	10	10	10
Net-to-Gross Ratio	100%	100%	100%	100%	100%	100%

Note: Number of participants and energy savings estimates primarily based on the 2018-20 filed Energy Efficiency Plan. and the 2018 Operating Plan. Program costs primarily based on current SOW and projected rising costs from 2018-20 filed Energy Efficiency Plan and Vectren Program Cost and Measure Data spreadsheet. Per participant energy savings calculated by dividing total savings by total participation. Weighted measure life and net to gross ratio are weighted by therms.

3.6 RESIDENTIAL BEHAVIOR SAVINGS

3.6.1 Background

The Residential Behavioral Savings Program (RBS) motivates behavior change and provides relevant, targeted information to the consumer through regularly scheduled, direct contact via mailed and emailed home energy reports. The measures for this program consist of a Home Energy Report and web portal, which anonymously compares customers' energy use with that of other customers with similar-sized home and demographics, usage history comparisons, goal setting tools, and progress trackers. Customers can view the past twelve months of their energy usage and compare their energy consumption and costs with others in the same neighborhood. The logic for the program is that once a consumer understands better how they use energy, they can then start conserving energy. Residential customers who receive electric service from Vectren South are eligible for this integrated natural gas and electric EE program.

The program will be delivered by an implementation vendor and include energy reports and a web portal. Customers typically receive between 4-6 reports annually. Additionally, customers receive monthly emails. These reports provide updates on energy consumption patterns compared to similar homes and provide energy savings strategies to reduce energy use. These reports can also promote other Vectren programs to interested customers. The web portal is an interactive system for customers to perform a self-audit, monitor energy usage over time, access energy saving tips, and be connected to other Vectren South gas and electric programs. A third-party evaluator will complete the evaluation of this program.

In 2021, Vectren plans on introducing a new targeted income cohort of participants into the program. Vectren will work with the implementation contractor and the third-party evaluator to determine a participant and non-participant group for this new cohort.

3.6.2 Relation to Vectren's Market Potential Study

The team assumed that restrictions stipulated within the current RBS implementation contract would continue through the timeframe of the Action Plan. As specified by the contract, Vectren can increase the number of treatment customers to the original contracted amount (49,000). The team ensured that this 49,000-participant estimate was below the estimate provided by the Market Potential Study. The team assumed only a portion of participants had both electric and gas service from Vectren.

3.6.3 Program Considerations

The team assumed that past program performance is a reasonable indicator of future performance. As the third-party evaluator estimates savings for RBS using a billing analysis, the savings resulting from the program may shift from year to year, depending on the behavior of the program participants in any given year. The program also faces the risk of customers losing interest in the program and no longer attempting to curb their energy usage.

3.6.4 Technology and Program Data

The following table provides summary of RBS energy impacts and budget.

TABLE 3-6 RESIDENTIAL BEHAVIOR SAVINGS – IMPACTS AND BUDGET

	2020	2021	2022	2023	2024	2025
Number of Participants	34,778	34,778	34,778	34,778	34,778	34,778
Energy Savings (Therms)	375,933	375,933	375,933	375,933	375,933	375,933
Total Program Budget	\$145,182	\$132,468	\$134,587	\$136,741	\$138,929	\$141,151
Per Participant Energy Savings (Therms)	11	11	11	11	11	11
Weighted Average Measure Life	1	1	1	1	1	1
Net-to-Gross Ratio	100%	100%	100%	100%	100%	100%

Note: Number of participants and energy savings estimates primarily based on the 2018-20 filed Energy Efficiency Plan, and the 2018 Operating Plan. Program costs primarily based on current SOW and projected rising costs from 2018-20 filed Energy Efficiency Plan and Vectren Program Cost and Measure Data spreadsheet. Per participant energy savings calculated by dividing total savings by total participation. Weighted measure life and net to gross ratio are weighted by therms.

3.7 MULTI-FAMILY DIRECT INSTALL

3.7.1 Background

The Multi-Family Direct Install Program is a program supporting residents of multi-family properties with easy-to-install upgrades of energy-efficient measures. The program provides customers with about energy-efficiency best practices and installs energy-efficient technologies.

Multi-family properties with active residential or general service natural gas service within the Vectren North territory are eligible to participate in the program. The target market is multi-family properties of more than four units, on residential or general service rates.

Measures include:

- Bathroom Aerators
- Kitchen Flip Aerators
- High efficiency Showerheads
- Smart Thermostats
- Site Visit and Education

3.7.2 Relation to Vectren's Market Potential Study

The team cross-referenced measures from the Market Potential Study with measures included in the Multi-Family Direct Install Program. Results from the Market Potential Study suggest that historic program participation may not be sustainable; therefore, the team estimated a lower participation rate for the program through the timeframe of the Action Plan.

3.7.3 Program Considerations

The team assumed that historic participation rates would decrease from current rates and stay constant through the Action Plan timeline.

3.7.4 Technology and Program Data

The following table provides summary of the Multi-Family Direct Install Program energy impacts and budget.

TABLE 3-7 MULTI-FAMILY DIRECT INSTALL – IMPACTS AND BUDGET

	2020	2021	2022	2023	2024	2025
Number of Participants	1,700	1,700	1,700	1,700	1,700	1,700
Energy Savings (Therms)	68,591	68,591	68,591	68,591	68,591	68,591
Total Program Budget	\$411,915	\$418,506	\$425,202	\$432,005	\$438,918	\$445,940
Per Participant Energy Savings (Therms)	40	40	40	40	40	40
Weighted Average Measure Life	12	12	12	12	12	12
Net-to-Gross Ratio	100%	100%	100%	100%	100%	100%

Note: Number of participants estimated primarily based on the 2018 Operating Plan and calibrated using the Market Potential Study. Energy savings estimates based on per unit estimates from 2017 Annual Report and 2018 Operating Plan. Program costs were estimated from current SOW and projected rising costs from Vectren Program Cost and Measure Data spreadsheet. Per unit therm savings estimated by dividing total savings by total participants. Weighted average measure life and net to gross ratio weighted by therms. Incremental technology costs estimated by summing the incremental cost of each piece of equipment and dividing by the number of participants.

3.8 TARGETED INCOME

3.8.1 Background

The Targeted Income Program provides a comprehensive home energy audit and energy efficiency upgrades to consumers with qualifying incomes, at or below 200% of Federal Poverty Guidelines. The audit identifies cost-effective opportunities to reduce energy consumption through the installation of energy-efficient mechanical equipment and shell measures. The program provides financial assistance to cover the cost to retrofit homes and educate customers on ways to reduce their energy use and manage their utility costs through behavior modification. These services are delivered in conjunction with the Weatherization Assistance Program through local weatherization assistance providers (e.g., Community Action Agencies (CAA) and Housing Rehabilitation Organizations), where possible, to minimize administrative costs by supplementing and leveraging existing funding sources and convenient opportunities to recruit targeted customers.

Indiana Housing & Community Development Authority (IHCD) will receive rebate applications via the State of Indiana's Weatherization reporting system. Those rebates are aggregated and sent to the implementer for review, verification, and processing every month.

The target market for the Program is Vectren residential customers that meet the following eligibility requirements:

- Customers must be Vectren North natural gas residential customers.
- Household incomes must be at or below 200% of the Federal Poverty Guidelines.
- The program is only available to single-family homes and duplexes.
- Equipment must meet the specifications and installation standards defined in the Indiana State Weatherization Guidelines.

The direct install measures available for installation at no cost to the customer include:

- Air Sealing
- Bath and Kitchen Aerators
- Ceiling Insulation
- Furnace 92% AFUE
- Water Heaters
- Showerheads
- Wall Insulation

3.8.2 Relation to Vectren's Market Potential Study

The team cross-referenced measures from the Market Potential Study with measures included in the Targeted Income Program. As measures from Targeted Income Program also appear in other Vectren residential programs, the team also compared the rate of sales in other programs to the Targeted Income Program. From this analysis, the team estimated that measures from the Targeted Income Program have market potential well above Action Plan participation estimates.

3.8.3 Program Considerations

As the program is administered in partnership with the IHCD, the program faces risks from changes in the state political landscape.

3.8.4 Technology and Program Data

The following table provides summary of the Targeted Income Program energy impacts and budget.

TABLE 3-8 TARGETED INCOME – IMPACTS AND BUDGET

	2020	2021	2022	2023	2024	2025
Number of Participants	46	46	46	46	46	46
Energy Savings (Therms)	15,022	15,022	15,022	15,022	15,022	15,022
Total Program Budget	\$104,070	\$105,735	\$107,427	\$109,146	\$110,892	\$112,666
Per Participant Energy Savings (Therms)	327	327	327	327	327	327
Weighted Average Measure Life	16	16	16	16	16	16
Net-to-Gross Ratio	100%	100%	100%	100%	100%	100%

Note: Number of participants estimated primarily based on the 2018 Operating Plan. Energy savings estimates based on per unit estimates from 2018 Operating Plan. Program costs were estimated from current SOW and projected rising costs from Vectren Program Cost and Measure Data spreadsheet. Per unit therm savings estimated by dividing total savings by total participants. Weighted average measure life and net to gross ratio weighted by therms. Incremental technology costs estimated by summing the incremental cost of each piece of equipment and dividing by the number of participants.

3.9 HOME ENERGY HOUSE CALL

3.9.1 Background

This program works jointly with Duke Energy's Home Energy House Call (HEHC) program in the Vectren North territory. The in-home energy assessment is provided to customers at no additional cost. A Building Performance Institute (BPI)-certified energy specialist completes a 60- to 90-minute walk-through assessment of the home and analyzes energy usage to identify energy saving opportunities. The BPI specialist provides and discusses a customized report to the customer that identifies actions the customer can take to increase energy efficiency in their home. The recommendations will range from behavioral changes to equipment modifications that can save energy and reduce cost. The primary goal is to empower customers to better manage their energy usage. Example recommendations might include the following:

- Using a programmable thermostat to better manage heating and cooling usage
- Replacing older equipment and adding insulation and sealing the home

Customers also receive an Energy Efficiency Kit with a variety of measures that can be directly installed by the energy specialist at the time of the assessment. The direct install measures available for installation at the home include:

- Bathroom and Kitchen Aerators
- High efficiency showerheads
- Smart Thermostats

To be eligible for this program, the customer must be a Duke Energy electric customer. Vectren claims savings only from customers that have Vectren gas service. The customer must own a single-family home and have lived there for at least four months. Duke Energy oversees the program and may partner with an implementation provider to deliver the program.

3.9.2 Relation to Vectren's Market Potential Study

The team cross-referenced measures from the Market Potential Study with measures included in the HEHC program. As measures from HEHC also appear in other Vectren residential programs, the team also compared the rate of sales in other programs to HEHC. From this analysis, the team estimated that measures from HEHC have market potential well above Action Plan participation estimates.

3.9.3 Program Considerations

Duke Energy Indiana indicated during interviews that they would like to continue the HEHC program even after implementation of the EISA backstop, though the costs borne by Vectren may rise slightly to ensure that the program is still viable for Duke Energy Indiana. Based on this conversation, the team assumed that the program would continue past implementation of the EISA backstop with a slightly higher per unit cost.

3.9.4 Technology and Program Data

The following table provides summary of the HEHC energy impacts and budget.

TABLE 3-9 HOME ENERGY HOUSE CALL – IMPACTS AND BUDGET

	2020	2021	2022	2023	2024	2025
Number of Participants	1,122	1,122	1,122	1,122	1,122	1,122
Energy Savings (Therms)	49,144	49,144	49,144	49,144	49,144	49,144
Total Program Budget	\$209,127	\$212,473	\$215,872	\$219,326	\$222,835	\$226,401
Per Participant Energy Savings (Therms)	44	44	44	44	44	44
Weighted Average Measure Life	16	16	16	16	16	16
Net-to-Gross Ratio	100%	100%	100%	100%	100%	100%

Note: Number of participants, energy savings estimates, and program costs estimated primarily based on the 2018 Operating Plan and based on interview with Duke Energy Indiana. Per unit therm savings estimated by dividing total savings by total participants. Weighted average measure life and net to gross ratio weighted by therms. Incremental technology costs estimated by summing the incremental cost of each piece of equipment and dividing by the number of participants.

3.10 NEIGHBORHOOD PROGRAM

3.10.1 Background

This program works jointly with Duke Energy's Neighborhood Program (NP) in the Vectren North territory. This program is designed to provide customized weatherization upgrades to low-income homes in the Vectren North gas and Duke Energy electric overlap territory for customers that otherwise would not be able to afford the energy saving measures.

The Neighborhood Program assists low-income customers in reducing energy costs through energy education and installation of energy-efficient measures. The primary goal of the program is to empower low-income customers to better manage their energy usage. Customers participating in the program will receive a walk-through energy assessment and one-on-one education. Additionally, the customer receives a comprehensive package of energy efficient measures.

Measures include:

- Air Filtration Reduction Measures
- High efficiency Showerheads
- Faucet Aerators
- Pipe Wrap

Residential customers living in select, census-defined communities identified by Duke Energy are eligible to participate in the program. Customers must be Duke Energy electric customers. Vectren claims savings only from customers that have Vectren gas service. Both homeowners and renters are eligible to participate. However, renters must obtain landlord approval before an energy assessment can take place. Vectren will work closely with Duke Energy in marketing the program. Duke Energy oversees the program and may partner with an implementation provider to deliver the program.

3.10.2 Relation to Vectren's Market Potential Study

The model of the Neighborhoods Program varies from the modeling methods used in the Market Potential Study. As such, the team relied on estimates from Duke Energy Indiana staff that current participation could continue through the Action Plan timeline.

3.10.3 Program Considerations

Duke Energy Indiana indicated during interviews that they would like to continue the Neighborhoods program even after implementation of the EISA backstop, but that the costs borne by Vectren may rise slightly to ensure that the program is still viable for Duke Energy Indiana. Based on this conversation, the team assumed that the program would continue past implementation of the EISA backstop with a slightly higher per unit cost.

3.10.4 Technology and Program Data

The following table provides summary of the Neighborhood Program energy impacts and budget.

TABLE 3-10 NEIGHBORHOOD PROGRAM – IMPACTS AND BUDGET

	2020	2021	2022	2023	2024	2025
Number of Participants	1,000	1,000	1,000	1,000	1,000	1,000
Energy Savings (Therms)	134,440	134,440	134,440	134,440	134,440	134,440
Total Program Budget	\$215,510	\$218,959	\$222,462	\$226,021	\$229,638	\$233,312
Per Participant Energy Savings (Therms)	134	134	134	134	134	134
Weighted Average Measure Life	16	16	16	16	16	16
Net-to-Gross Ratio	100%	100%	100%	100%	100%	100%

Note: Number of participants, energy savings estimates, and program costs estimated primarily based on the 2018 Operating Plan and based on interview with Duke Energy Indiana. Per unit therm savings estimated by dividing total savings by total participants. Weighted average measure life and net to gross ratio weighted by therms. Incremental technology costs estimated by summing the incremental cost of each piece of equipment and dividing by the number of participants.

3.11 FOOD BANK

3.11.1 Background

The Food Bank Program provides LED bulbs and high efficiency showerheads to food pantries in Vectren South's electric service territory. This program targets hard-to-reach, low-income customers in the Vectren South electric territory. All food pantry recipients must provide proof of income qualification to receive the food baskets.

Each participating food pantry will place a bundle of four LED bulbs and a single high efficiency showerhead in food packages. The program implementer purchases equipment from a manufacturer and the equipment is shipped in bulk to the partner food bank. Food banks then distribute the equipment to the respective food pantries in its network. Pantries include equipment when assembling food packages and equipment is provided to food recipients. Any customer visiting a food pantry in Vectren South's electric territory is eligible to participate in the program.

Relevant gas measures include:

- High efficiency showerheads (new in 2021)

3.11.2 Relation to Vectren's Market Potential Study

Though the Market Potential Study estimated savings resulting from income-qualified measures, only a small portion of income-qualified customers will become food pantry recipients. As such, the Market Potential Study did not serve as a useful estimate for future Food Bank Program participation.

3.11.3 Program Considerations

Vectren expressed interest in continuing a Food Bank program after the EISA backstop was implemented. The team examined possible new measures and determined that showerheads could provide significant energy savings for food pantry recipients. The team used savings values from other income-qualified programs as a proxy for savings from the Food Bank Program.

3.11.4 Technology and Program Data

The following table provides summary of the Food Bank Program energy impacts and budget.

TABLE 3-11 FOOD BANK – IMPACTS AND BUDGET

	2020	2021	2022	2023	2024	2025
Number of Participants	-	6,312	6,312	3,156	3,156	3,156
Energy Savings (Therms)	-	41,628	41,628	20,814	20,814	20,814
Total Program Budget	-	\$19,663	\$19,977	\$20,297	\$20,622	\$20,952
Per Participant Energy Savings (Therms)	-	7	7	7	7	7
Weighted Average Measure Life	-	5	5	5	5	5
Net-to-Gross Ratio	-	100%	100%	100%	100%	100%

Note: Number of participants and energy savings estimated based on 2018 Operating Plan. Program costs estimated based on current SOW, projected rising costs from 2018-20 filed Energy Efficiency Plan, and Vectren Program Cost and Measure Data spreadsheet. Per unit energy savings calculated by dividing total savings by the total number of participants. Weighted average measure life and net to gross ratio weighted by therms. Incremental technology cost calculated by summing the incremental cost of each piece of equipment and dividing by the total number of participants.

3.12 HOME ENERGY MANAGEMENT SYSTEMS

3.12.1 Background

The Home Energy Management Systems (HEMS) program is a behavioral program that provides real time energy usage data to encourage customers to take action to reduce energy consumption. The objectives of this program include:

- Motivate customers to save energy by increasing customer awareness and engagement around energy consumption and their utility bill
- Increase customer knowledge of and participation in Company programs including, but not limited to, energy efficiency programs and advanced data analytics
- Deliver energy and demand savings

The HEMS program will be piloted using advanced metering infrastructure (AMI) data to communicate energy usage to customers. The platform will utilize a smart phone application to communicate with customers about their home energy usage and provide suggestions for ways customers can save energy. To enhance customer engagement, participants in the program will receive a smart thermostat at no cost, if they do not currently have one installed in their home. Pending EM&V Report results, the program will potentially be rolled out to additional participants.

Given a successful pilot and positive EM&V Report results of the HEMS program, Vectren plans to scale the program to include additional features. The additional features would allow customers to install a device that provides real-time home energy usage data.

All Vectren South electric customers are eligible to participate in this program.

3.12.2 Relation to Vectren's Market Potential Study

The Market Potential Study provided estimates on various smart home technologies including home energy management systems. The program model is very specific and initially only relies on a phone application, the energy management systems estimate in the Market Potential Study may not accurately reflect the total market size available to the Home Energy Management Systems Program.

The team relied on savings estimates from the implementation contractor. The team compared estimates provided by the implementation contractor to the estimated savings presented in the Market Potential Study and found that the implementation contractor estimates were well within the bounds of the Market Potential Study estimates.

3.12.3 Program Considerations

The team utilized savings estimates provided by a HEMS vendor as well as publicly available evaluation documents of home energy management systems. The vendor indicated that they had evaluation-verified savings estimates, although the evaluation results were not currently public. The team acknowledges that savings estimates provided by the implementing contractor are susceptible to bias and, thus, chose a conservative estimate to provide counterbalance.

3.12.4 Technology and Program Data

The following table provides summary of the Home Energy Management Systems Program energy impacts and budget.

TABLE 3-12 HOME ENERGY MANAGEMENT SYSTEMS – IMPACTS AND BUDGET

	2020	2021	2022	2023	2024	2025
Number of Participants	-	1,000	1,000	1,000	1,000	1,000
Energy Savings (Therms)	-	54,400	54,400	54,400	54,400	54,400
Total Program Budget	\$141,100	\$205,378	\$198,558	\$183,741	\$210,088	\$226,437
Per Participant Energy Savings (Therms)	-	54	54	54	54	54
Weighted Average Measure Life	-	8	8	8	8	8
Net-to-Gross Ratio	-	100%	100%	100%	100%	100%

Note: Number of participants, energy savings, and program costs estimated based on interviews with the implementer. The team assumed the same weighted average measure life as the current behavioral program. The net to gross ratio is weighted by therms.

The following table provides summary of the cumulative participants in the Home Energy Management Systems Program over the course of the Action Plan.

TABLE 3-12 HOME ENERGY MANAGEMENT SYSTEMS – PARTICIPANTS AND CUMULATIVE PARTICIPANTS

	2020	2021	2022	2023	2024	2025
Number of Participants	-	1,000	1,000	1,000	1,000	1,000
Cumulative Number of Participants	-	1,000	2,000	3,000	4,000	5,000

3.13 COMMERCIAL AND INDUSTRIAL PRESCRIPTIVE

3.13.1 Background

The Commercial & Industrial (C&I) Prescriptive Program is designed to provide financial incentives on qualifying products to produce greater energy savings in the C&I market. The rebates are designed to promote lower natural gas energy consumption, assist customers in managing their energy costs, and build a sustainable market around energy efficiency (EE). Program participation is achieved by offering incentives structured to cover a portion of the customer's incremental cost of installing prescriptive efficiency measures. Any participating commercial or industrial customer receiving natural gas service from Vectren South or Vectren North is eligible to participate in the program.

Top performing measures include HVAC equipment, such as:

- Natural gas Furnaces
- Natural gas boilers

New measures will include:

- Smart thermostats
- Duct sealing

The full list of measures can be found in the measure library in Appendix G.

The program is delivered primarily through trade allies. Vectren and its implementation partners work with the trade allies to make them aware of the offerings and help them promote the program to their customers. The implementation partner will provide training and technical support to the trade allies to become familiar with the EE technologies offered through the program. The program will be managed by the same implementation provider as the C&I Custom Program so that customers can seamlessly receive assistance and all incentives can be efficiently processed through a single procedure.

Incentives are provided to customers to reduce the difference in first cost between the lower-efficiency technology and the high-efficiency option. There is no fixed incentive percentage amount based on the difference in price because some technologies are newer and need higher amounts. Others have been available in the marketplace longer and do not need as much incentive to motivate customers. To verify the correct equipment was installed, site visits will be made on 5% of the installations, as well as all projects receiving incentive greater than \$20,000.

3.13.2 Relation to Vectren's Market Potential Study

The team cross-referenced measures from the Market Potential Study with measures included in the C&I Prescriptive Program. As measures from the C&I Prescriptive Program also appear in the Small Business Program, the team also compared the rate of sales in this program to the C&I Prescriptive Program. From this analysis, the team estimated that most measures from the C&I Prescriptive Program have market potential well above Action Plan participation estimates.

3.13.3 Program Considerations

Advances in technology pose a risk to estimates for the C&I Prescriptive Program, although the size, scope, and directionality of that impact are difficult to define. The team developed estimates to address the largest risks to program savings: overall participation and NTG. The team modeled previous NTG estimates and tried to fit Action Plan NTGs to the trend of these historical NTG estimates.

Due to low cost-effectiveness scores in the Market Potential Study, the team dropped window film, 90% AFUE boilers sized at less than 400 MBH, gas convection ovens, gas griddles, and steam boilers.

3.13.4 Technology and Program Data

The following table provides summary of the C&I Prescriptive Program energy impacts and budget.

TABLE 3-13 COMMERCIAL AND INDUSTRIAL PRESCRIPTIVE – IMPACTS AND BUDGET

	2020	2021	2022	2023	2024	2025
Number of Participants	1,112	1,193	1,312	1,479	1,712	1,964
Energy Savings (Therms)	298,228	315,496	338,606	365,992	402,215	439,398
Total Program Budget	\$759,897	\$821,550	\$896,095	\$976,251	\$1,018,227	\$1,172,917
Per Participant Energy Savings (Therms)	268	264	258	247	235	224
Per Participant Average Incentive	\$226	\$223	\$218	\$208	\$196	\$185
Weighted Average Measure Life	10	11	11	12	12	13
Incremental Technology Cost	\$583	\$570	\$554	\$531	\$504	\$482
Net-to-Gross Ratio	75%	75%	75%	75%	75%	75%

Note: Number of participants and energy savings estimates based primarily on Market Potential Study results. Program budget estimate based on current schedule of work and projected rising costs from Vectren Program Cost and Measure Data spreadsheet. Per unit savings estimates based on the Market Potential Study results. Per participant energy savings and incremental technology cost weighted by participant. Weighted average measure life and net to gross ratio weighted by therms.

3.14 COMMERCIAL AND INDUSTRIAL CUSTOM

3.14.1 Background

The C&I Custom Program promotes the implementation of customized energy-saving projects at qualifying customer facilities. Incentives promoted through this program serve to reduce the cost of implementing energy-reducing projects and upgrading to high-efficiency equipment. Due to the nature of Vectren's custom program, a wide variety of projects are eligible, including conventional custom retrofit projects, new construction (Commercial New Construction) projects, and major renovation (Building Tune-Up) projects. Beginning in 2020, Vectren will pilot a Strategic Energy Management component and a Midstream HVAC component. Program savings and incentives are rolled up within Commercial Custom.

Participants are required to be active natural gas General Service customers of Vectren on Rate 120, 125 Vectren South or 220, 225 Vectren North at the location of installation. Building Tune Up also requires applicants to be both an active Vectren South electric customer on a qualifying commercial rate and an active natural gas General Service customer on Rate 120 or 125. For the pilot components, the implementer will target a small group of participants to test the viability of the concept in Vectren territory.

3.14.1.1 Conventional Custom Projects

Similar to previous program years, customers may propose new custom retrofit projects. Customers or trade allies with a proposed project complete an application form with the energy savings calculations for the project. The implementation team reviews all calculations and, where appropriate, completes site visits to assess and document pre-installation conditions. The implementer then informs that their project has been pre-approved and their funds are reserved for the project. Implementation engineering staff review the final project information as installed and verify the energy savings. Incentives are then paid on the verified savings. Given the variability and uniqueness of each project, all projects are pre-approved. Pre- and post-installation visits to the site to verify installation and savings are performed as defined by the program implementation partner. Monitoring and verification may occur on the largest projects. This component provides incentives based on the kWh saved as calculated by the engineering analysis.

3.14.1.2 Commercial New Construction

The Commercial New Construction (CNC) component promotes energy-efficient designs with the goal of developing projects that are more energy efficient than current Indiana building code. This program applies to new construction and major renovation projects. Major renovation is defined as the replacement of at least two systems within an existing space (e.g., HVAC, controls, building envelope). The program provides incentives as part of the facility design process to explore opportunities in modeling EE options to craft an optimal package of investments. The program also offers customers the opportunity to receive prescriptive or custom rebates toward eligible equipment in order to reduce the higher capital cost for an energy efficient solution.

To help overcome financial challenge of designing energy-efficient new construction projects, Vectren offers a Standard Energy Design Assistance ("EDA"). This provides additional engineering expertise during the design phase to identify energy-saving opportunities. C&I projects for buildings greater than 100,000 square feet still in the conceptual design phase qualify for Vectren South's Enhanced EDA incentives which include energy modeling. The Vectren South implementation partner staff expert works with the design team through the conceptual design, schematic design, and design development processes, providing advice and counsel on measures that should be considered and EE modeling issues. Incentives are paid after the design team submits completed construction documents for review to verify that the facility design reflects the minimum energy savings requirements.

CNC provides incentives to help offset some of the expenses for the design team's participation in the EDA process with the design team incentive. The design team incentive is a fixed amount based on the new/renovated conditioned square footage and is paid when the proposed EE projects associated with the construction documents exceed a minimum energy savings threshold. The program also offers customers the opportunity to receive prescriptive or custom rebates toward eligible equipment in order to reduce the higher capital cost for the EE solutions.

3.14.1.3 Building Tune-Up (BTU)

The BTU component provides a targeted, turnkey, and cost-effective retro-commissioning solution for small- to mid-sized customer facilities. It is designed as a comprehensive customer solution that will identify, validate, quantify, and encourage the installation of both operational and capital measures. The majority of these measures will be no- or low-cost with low payback periods and will capture energy savings from a previously untapped source: building automation systems.

The BTU component is designed to encourage high levels of implementation by customers seeking to optimize the operation of their existing HVAC system. BTU typically targets customers with buildings between 50,000 square feet and 150,000 square feet. Facility energy assessments are offered to customers who are eligible and motivated to implement multiple energy efficiency measures. BTU specifically targets measures that provide no- and low-cost operational savings. Most measures involve optimizing the building automation system (BAS) settings, but the program also investigates related capital measures, like controls, operations, processes, and HVAC. The implementation partner works collaboratively with Vectren South staff to recruit and screen customers for receiving facility energy assessments.

3.14.1.4 Strategic Energy Management Pilot

The Strategic Energy Management Pilot (SEM) is a guided operations and maintenance program with benchmarking and regular follow-up meetings to chart customer performance. The implementer will recruit customers to participate in the program and achieve energy savings for their facilities. The implementer will then measure their performance over time (usually a period of 6 months or a year) using energy billing data to determine the amount of energy savings the customer achieved and provide incentives to the customer accordingly. Depending on market research, the SEM pilot may also include cohorts of participants and inter-cohort and intra-cohort competition. Vectren may require the SEM pilot to fit Department of Energy (DOE) 50,001 Ready specifications. This DOE program model attempts to standardize programs across states and jurisdictions to give companies with facilities in more than one utility jurisdiction the opportunity to participate in SEM programs using similar qualification criteria and with similar program applications.

3.14.1.5 Midstream HVAC Pilot

The Midstream HVAC Pilot will provide incentives to actors at the distributor level (firms positioned between the manufacturer and the end user). The pilot will provide incentives for HVAC equipment such as gas furnaces and boilers.

Through midstream HVAC incentives, the program aims to influence the equipment that distributors stock, fine-tune incentives to fit desired program outcomes, and address the needs of the replace-on-burnout market. Because distributors have a large influence on the HVAC equipment that C&I customers eventually install, the pilot will be able to encourage distributors to supply more energy-efficient options. Midstream HVAC incentives can be more easily adjusted, as C&I customers receive the discount at the time of equipment purchase, not after a lengthy application process. Because C&I customers receive a discount at the time of purchase, the pilot may influence more quick-fire purchasing decisions such as replace-on-burnout purchases. C&I customers will not be encumbered by a lengthy application process to replace their defunct HVAC equipment.

3.14.2 Relation to Vectren's Market Potential Study

The Market Potential Study identified room in C&I markets, but due to the unique nature of each custom program project, it is difficult to compare Market Potential Study opportunity to Action Plan estimates.

3.14.3 Program Considerations

The team assumed that average participation rates from the C&I Custom Program would produce a rough estimate of participation for the program in the future. Due to the wide variations in program savings and number of participating projects over the years, this estimate has a very wide error bound.

3.14.4 Technology and Program Data

The following table provides summary of the C&I Custom Program energy impacts and budget.

TABLE 3-14 COMMERCIAL AND INDUSTRIAL CUSTOM – IMPACTS AND BUDGET

	2020	2021	2022	2023	2024	2025
Number of Participants	71	71	71	71	71	71
Energy Savings (Therms)	472,810	472,810	472,810	472,810	472,810	472,810
Total Program Budget	\$1,057,403	\$1,066,488	\$1,075,718	\$1,085,096	\$1,094,624	\$1,104,304
Per Participant Energy Savings (Therms)	6,659	6,659	6,659	6,659	6,659	6,659
Per Participant Average Incentive	\$6,896	\$6,896	\$6,896	\$6,896	\$6,896	\$6,896
Weighted Average Measure Life	16	16	16	16	16	16
Incremental Technology Cost	\$43,947	\$43,947	\$43,947	\$43,947	\$43,947	\$43,947
Net-to-Gross Ratio	100%	100%	100%	100%	100%	100%

Note: Number of participants, energy savings, and program costs estimated based on program estimates for the 2015-2017 energy efficiency scorecards. Weighted average measure life and net to gross ratio weighted by therms.

3.15 SMALL BUSINESS ENERGY SOLUTIONS

3.15.1 Background

The Small Business Energy Solutions Program (SBES) provides value by directly installing EE products such as smart thermostats, pre-rinse sprayers, faucet aerators, weather stripping, steam tram replacements and natural gas furnace tune-ups. The program helps small businesses and multi-family customers identify and install cost-effective energy-saving measures by providing an onsite energy assessment customized for their business.

Any participating Vectren South business customer with a maximum peak energy demand of less than 400 kW is eligible to participate in the program. Additionally, multi-family building owners with Vectren general electric service may qualify for the program, including apartment buildings, condominiums, cooperatives, duplexes, quadrplexes, townhomes, nursing homes, and retirement communities.

Trained trade ally energy advisors provide energy assessments to business customers with less than 400 kW peak demand and to multi-family buildings. The program implementer issues an annual Request for Qualification (RFQ) to select the trade allies with the best ability to provide high-quality and cost-effective service to small businesses and provide training to SBES trade allies on the program process, with an emphasis on improving energy efficiency sales. Trade allies walk through small businesses and record site characteristics and energy efficiency opportunities at no cost to the customer. They provide an energy assessment report that details customer-specific opportunities, costs, energy savings, incentives, and simple payback periods. The trade ally then reviews the report with the customer, presenting the program benefits and process, while addressing any questions.

The program has two types of measures provided. The first type of measures are installed at no cost to the customer. They include, but are not limited to, the following:

- Wifi-enabled thermostats
- Programmable thermostats
- High efficiency pre-rinse sprayers
- Faucet aerators

- Weather stripping (exterior door)

The second type of measures require the customer to pay a portion of the labor and materials. These measures include:

- Furnace tune-up
- Steam trap replacement
- Smart thermostats

In addition to the no-cost measures identified during the audit, the program also pays a cash incentive on every recommended and implemented improvement identified through the assessment. Incentive rates may change over time and vary with special initiatives.

Onsite verification is provided for the first three projects completed by each trade ally, in addition to the program standard of 5% of all completed projects and all projects receiving incentives greater than \$20,000. These verifications allow the program to validate energy savings, in addition to providing an opportunity to ensure trade allies provide high-quality customer services and the incentivized equipment satisfies program requirements.

3.15.2 Relation to Vectren's Market Potential Study

The Market Potential Study identified savings for the overall C&I sectors but provided less-specific estimates for the small business sector. As participation in the program is small, the team assumed that historic participation trends would continue through the timeline of the action plan.

3.15.3 Program Considerations

The team considered the inclusion of additional measures in the program and included those measures that passed cost-effectiveness testing or could be bundled within the program to produce an overall cost-effective program

3.15.4 Technology and Program Data

The following table provides summary of SBES energy impacts and budget.

TABLE 3-15 SMALL BUSINESS ENERGY SOLUTIONS – IMPACTS AND BUDGET

	2020	2021	2022	2023	2024	2025
Number of Participants	592	1,025	1,135	1,260	1,369	1,479
Energy Savings (Therms)	16,788	18,516	21,540	24,996	28,020	31,044
Total Program Budget	\$12,682	\$12,975	\$13,410	\$13,898	\$14,344	\$14,797
Per Participant Energy Savings (Therms)	28	18	19	20	20	21
Per Participant Average Incentive	\$10	\$6	\$5	\$5	\$5	\$5
Weighted Average Measure Life	11	11	12	12	12	13
Incremental Technology Cost	\$39	\$40	\$42	\$43	\$44	\$45
Net-to-Gross Ratio	91%	91%	91%	91%	91%	91%

Note: Number of participants and energy savings estimated based on the 2018 Operating Plan. Program costs estimated using the current program SOW and projected rising costs from 2018-20 filed Energy Efficiency Plan and Vectren Program Cost and Measure Data spreadsheet. Per participant average incentive and incremental technology cost estimated by summing the values for each piece of equipment and dividing by the number of participants. Weighted average measure life and net to gross ratio are weighted by therms.

VOLUME III

APPENDICES

*2020-2025 Integrated Natural Gas DSM Market
Potential Study & Action Plan*

prepared for



VECTREN
Live Smart

JANUARY 2019

APPENDICES *Natural Gas DSM Market Potential Study*

- A Sources
- B Residential Market Potential Study Measure Detail
- C Commercial Market Potential Study Measure Detail

APPENDICES *Natural Gas Action Plan*

- D Combined Gas & Electric Portfolio Summary
- E Combined Gas & Electric Costs Summary
- F Market Research
- G Measure Library

APPENDIX A DSM Market Potential Study Sources

This appendix catalogs many of the data sources used in this study, grouped by major activity. In general, GDS attempted to utilize Vectren-specific data, where available. When Vectren-specific data was not available or reliable, GDS leveraged secondary data from nearby or regional sources.

A.1 MARKET RESEARCH

Market research studies were used to understand home and business characteristics and equipment stock characteristics. Vectren supplied GDS with several residential market research studies, and GDS conducted primary research in the small commercial sector to gather additional equipment and efficiency characteristics.

- ***Vectren Residential Market Research Studies:*** The natural gas measure analysis was largely informed by a 2014 appliance saturation survey of Vectren gas customers (Vectren South and Vectren North), which helped inform the gas measure baseline and efficient saturation estimates. A 2017 electric baseline thermostat survey of Vectren customers was leveraged to better characterize the increased prominence of smart and Wi-Fi-enabled thermostats.
- ***Vectren Commercial Primary Market Research:*** GDS collected data in 38 commercial facilities to better understand electric and natural gas equipment saturation and efficiency characteristics.
- ***US American Community Survey:*** Public Use Microdata Survey data was used to estimate the percent of low-income households (using annual household income and number of people per household) in the Vectren South and North territories.
- ***Energy Star Shipment Data:*** Energy Star shipment data provides a detailed historical estimate of the percent of shipped equipment/appliances that meet ENERGY STAR standards. Over the long-term, this serves as a proxy for the percent of the market that could be considered energy efficient.

A.2 FORECAST CALIBRATION

The forecast calibration effort was used to create a detailed segmentation of Vectren's load forecast and ensure that estimated savings would not overstate future potential. Vectren supplied GDS with the most recent load forecast.

- ***Vectren Load Forecast:*** The 2016 Long-Term Electric Energy and Demand load forecast consists of the most recent ITRON load forecast completed for VEDI for 2016-2036. The natural gas forecast was provided directly from Vectren for the North and South territories from 2017 to 2027. Future years were escalated by a compound average annual growth rate.
- ***Vectren Commercial Customer Forecast:*** The 2017 historical commercial data utilized rate codes and existing NAICS code to segment historical sales by commercial building type.
- ***InfoUSA:*** GDS utilized a third-party dataset that provided additional commercial business information, including NAICS codes, to supplement the building types codes supplied by Vectren
- ***EIA Commercial Building Energy Consumption Survey:*** GDS updated the ITRON load forecast to utilize more recent information for the East South-Central region from the EIA 2012 CBECS survey.
- ***BEopt:*** GDS developed residential building prototypes from the market research effort to develop detailed consumption estimates by end-use and calibrated these models to Vectren's residential load forecasts.

A.3 ENERGY EFFICIENCY MEASURE DATA

The energy efficiency measure analysis developed per unit savings, cost, and useful life assumptions for each energy efficiency measure in the residential, and commercial sector. Preference was given to Vectren-specific evaluated savings and/or deemed savings/algorithms in the Indiana TRM.

- **2017 Vectren EM&V Report (Cadmus):** For the development of savings estimates of measures already offered by Vectren, GDS either used the estimates from the most recent evaluation reports or used the evaluation methodology to develop forward looking savings projections.
- **Indiana TRM v2.2:** In the absence of evaluation data, GDS attempted to leverage the Indiana TRM. Assumptions and algorithms were based off the IN TRM to the extent practical.
- **Vectren Operating Plan:** Historical incentive estimates and in some cases, incremental measure costs, were based on the Vectren Operating Plans.
- **Other TRMs:** In some cases, TRM's or deemed measure databases from other states were more applicable than the IN TRM due to more currently available estimates and the more appropriate use of updated federal standards. The Illinois TRM and the Michigan Energy Measures Database were the primary non-Indiana TRMs used.
- **Other Secondary Sources:** In some cases, following the source hierarchy listed above was not enough to develop savings estimates. In these cases, GDS leveraged other secondary research documents such as ACEEE emerging technology reports.

A.4 AVOIDED COST/ECONOMIC ANALYSIS

Avoided costs and related economic assumptions were used to assess cost-effectiveness. In addition, historical incentive levels were tied to willingness-to-participate (WTP) research to assess long-term market adoption in the achievable potential scenario.

- **Electric and Natural Gas Avoided Costs:** Avoided cost values for electric energy, electric capacity, and avoided transmission and distribution (T&D) were provided by Vectren as part of an initial data request. Electric energy is based on an annual system marginal cost. For years outside of the avoided cost forecast timeframe, future year avoided costs are escalated by the rate of inflation. Natural gas avoided costs are calculated using EIA Annual Outlook reference tables combined with demand rates and basis differentials provided by Vectren Gas Supply.
- **Other Economic Assumptions:** Includes the discount rate, inflation rate, line loss assumptions and reserve margin requirement. All economic assumptions were provided by Vectren and consistent with economic modeling assumptions used for other utility planning efforts.
- **Historical DSM Filings/Scorecards:** Historical DSM costs and savings data from 2011 to 2017 were used to determine non-incentive program delivery costs as well as cross-cutting portfolio costs.
- **Primary Market Research:** Vectren conducted over 300 surveys in the residential sector (online only) and 38 on-site surveys in the commercial sector regarding customer willingness-to-purchase energy efficient equipment at various incentive levels. This Vectren-specific customer data was used to determine long-term adoption rates by end-use for the MAP and RAP achievable potential scenarios.

APPENDIX B Natural Gas DSM Market Potential Study Residential Measure Detail

Vectren Gas South		Residential Measure Assumptions											
Measure #	End-Use	Measure Name	Home Type	Income Type	Replacement Type	Base Natural Gas Use (therms)	% Savings	Per unit Natural Gas Savings (therms)	Useful Life	Initial Measure Cost	Historical Incentive Amount	UCT Ratio	Measure Description
1007	Appliances	ENERGY STAR Clothes Washer (NG WH/E Dryer)	SF	N/A	MO	5.9	8%	0.5	14	84.0	\$40.00	1.82	ES Qualified ClothesWasher (IMEF=2.23 ; 1.75 Baseline)
1008	Appliances	ENERGY STAR Clothes Washer (NG WH/NG Dryer)	SF	N/A	MO	20.6	20%	4.0	14	84.0	\$40.00	0.82	ES Qualified ClothesWasher (IMEF=2.23 ; 1.75 Baseline)
1010	Appliances	Smart/CEE Tier3 Clothes Washer (NG WH/E Dryer)_ET	SF	N/A	MO	5.9	78%	4.7	14	141.0	\$70.00	1.33	CEE Tier 3 Qualified ClothesWasher (IMEF=2.92 ; 1.75 Baseline)
1011	Appliances	Smart/CEE Tier3 Clothes Washer (NG WH/NG Dryer)_ET	SF	N/A	MO	20.6	44%	9.0	14	141.0	\$70.00	0.62	CEE Tier 3 Qualified ClothesWasher (IMEF=2.92 ; 1.75 Baseline)
1013	Appliances	ENERGY STAR Dishwasher (NG WH)	SF	N/A	MO	7.4	12%	0.9	11	79.0	\$40.00	0.27	ES Qualified Dishwasher (v3.0)
1015	Appliances	Smart Dishwasher (NG WH)_ET	SF	N/A	MO	7.4	15%	1.1	11	395.0	\$200.00	0.07	Smart ES Qualified Dishwasher (v3.0)
1020	Appliances	ENERGY STAR Clothes Dryer (NG)	SF	NLI	MO	22.0	21%	4.6	16	152.0	\$75.00	0.57	ES Qualified Dryer (CEF=3.93)
1022	Appliances	Smart Clothes Dryer (NG)_ET	SF	NLI	MO	22.0	26%	5.8	16	236.0	\$120.00	0.45	Smart ES Qualified Dryer (5.5% additional energy savings)
1025	Appliances	Dryer Vent Cleaning (NG)	SF	LI	DI	22.0	6%	1.2	2	80.0	\$80.00	0.02	Dryer Vent Cleaning (5.5% Savings)
1031	Appliances	ENERGY STAR Clothes Washer (NG WH/E Dryer)	SF	N/A	NC	5.9	8%	0.5	14	84.0	\$40.00	1.82	ES Qualified ClothesWasher (IMEF=2.23 ; 1.75 Baseline)
1032	Appliances	ENERGY STAR Clothes Washer (NG WH/NG Dryer)	SF	N/A	NC	20.6	20%	4.0	14	84.0	\$40.00	0.82	ES Qualified ClothesWasher (IMEF=2.23 ; 1.75 Baseline)
1034	Appliances	Smart/CEE Tier3 Clothes Washer (NG WH/E Dryer)_ET	SF	N/A	NC	5.9	78%	4.7	14	141.0	\$70.00	1.33	CEE Tier 3 Qualified ClothesWasher (IMEF=2.92 ; 1.75 Baseline)
1035	Appliances	Smart/CEE Tier3 Clothes Washer (NG WH/NG Dryer)_ET	SF	N/A	NC	20.6	44%	9.0	14	141.0	\$70.00	0.62	CEE Tier 3 Qualified ClothesWasher (IMEF=2.92 ; 1.75 Baseline)
1037	Appliances	ENERGY STAR Dishwasher (NG WH)	SF	N/A	NC	7.4	12%	0.9	11	79.0	\$40.00	0.27	ES Qualified Dishwasher (v3.0)
1039	Appliances	Smart Dishwasher (NG WH)_ET	SF	N/A	NC	7.4	15%	1.1	11	395.0	\$200.00	0.07	Smart ES Qualified Dishwasher (v3.0)
1043	Appliances	ENERGY STAR Clothes Dryer (NG)	SF	N/A	NC	22.0	21%	4.6	16	152.0	\$75.00	0.57	ES Qualified Dryer (CEF=3.93)
1045	Appliances	Smart Clothes Dryer (NG)_ET	SF	N/A	NC	22.0	26%	5.8	16	236.0	\$120.00	0.45	Smart ES Qualified Dryer (5.5% additional energy savings)
1054	Appliances	ENERGY STAR Clothes Washer (NG WH/E Dryer)	MF	N/A	MO	5.9	8%	0.5	14	84.0	\$40.00	1.82	ES Qualified ClothesWasher (IMEF=2.23 ; 1.75 Baseline)
1055	Appliances	ENERGY STAR Clothes Washer (NG WH/NG Dryer)	MF	N/A	MO	20.6	20%	4.0	14	84.0	\$40.00	0.82	ES Qualified ClothesWasher (IMEF=2.23 ; 1.75 Baseline)
1057	Appliances	Smart/CEE Tier3 Clothes Washer (NG WH/E Dryer)_ET	MF	N/A	MO	5.9	78%	4.7	14	141.0	\$70.00	1.33	CEE Tier 3 Qualified ClothesWasher (IMEF=2.92 ; 1.75 Baseline)
1058	Appliances	Smart/CEE Tier3 Clothes Washer (NG WH/NG Dryer)_ET	MF	N/A	MO	20.6	44%	9.0	14	141.0	\$70.00	0.62	CEE Tier 3 Qualified ClothesWasher (IMEF=2.92 ; 1.75 Baseline)
1060	Appliances	ENERGY STAR Dishwasher (NG WH)	MF	N/A	MO	7.4	12%	0.9	11	79.0	\$40.00	0.27	ES Qualified Dishwasher (v3.0)
1062	Appliances	Smart Dishwasher (NG WH)_ET	MF	N/A	MO	7.4	15%	1.1	11	395.0	\$200.00	0.07	Smart ES Qualified Dishwasher (v3.0)
1067	Appliances	ENERGY STAR Clothes Dryer (NG)	MF	NLI	MO	22.0	21%	4.6	16	152.0	\$75.00	0.57	ES Qualified Dryer (CEF=3.93)
1069	Appliances	Smart Clothes Dryer (NG)_ET	MF	NLI	MO	22.0	26%	5.8	16	236.0	\$120.00	0.45	Smart ES Qualified Dryer (5.5% additional energy savings)

Vectren Gas South		Residential Measure Assumptions											
Measure #	End-Use	Measure Name	Home Type	Income Type	Replacement Type	Base Natural Gas Use (therms)	% Savings	Per unit Natural Gas Savings (therms)	Useful Life	Initial Measure Cost	Historical Incentive Amount	UCT Ratio	Measure Description
1072	Appliances	Dryer Vent Cleaning (NG)	MF	LI	DI	22.0	6%	1.2	2	80.0	\$80.00	0.02	Smart ES Qualified Dryer (5.5% additional energy savings)
1078	Appliances	ENERGY STAR Clothes Washer (NG WH/E Dryer)	MF	N/A	NC	5.9	8%	0.5	14	84.0	\$40.00	1.82	ES Qualified ClothesWasher (IMEF=2.23 ; 1.75 Baseline)
1079	Appliances	ENERGY STAR Clothes Washer (NG WH/NG Dryer)	MF	N/A	NC	20.6	20%	4.0	14	84.0	\$40.00	0.82	ES Qualified ClothesWasher (IMEF=2.23 ; 1.75 Baseline)
1081	Appliances	Smart/CEE Tier3 Clothes Washer (NG WH/E Dryer)_ET	MF	N/A	NC	5.9	78%	4.7	14	141.0	\$70.00	1.33	CEE Tier 3 Qualified ClothesWasher (IMEF=2.92 ; 1.75 Baseline)
1082	Appliances	Smart/CEE Tier3 Clothes Washer (NG WH/NG Dryer)_ET	MF	N/A	NC	20.6	44%	9.0	14	141.0	\$70.00	0.62	CEE Tier 3 Qualified ClothesWasher (IMEF=2.92 ; 1.75 Baseline)
1084	Appliances	ENERGY STAR Dishwasher (NG WH)	MF	N/A	NC	7.4	12%	0.9	11	79.0	\$40.00	0.27	ES Qualified Dishwasher (v3.0)
1086	Appliances	Smart Dishwasher (NG WH)_ET	MF	N/A	NC	7.4	15%	1.1	11	395.0	\$200.00	0.07	Smart ES Qualified Dishwasher (v3.0)
1090	Appliances	ENERGY STAR Clothes Dryer (NG)	MF	N/A	NC	22.0	21%	4.6	16	152.0	\$75.00	0.57	ES Qualified Dryer (CEF=3.93)
1092	Appliances	Smart Clothes Dryer (NG)_ET	MF	N/A	NC	22.0	26%	5.8	16	236.0	\$120.00	0.45	Smart ES Qualified Dryer (5.5% additional energy savings)
2007	Audit	Audit Recommendations (gas) - Single-family	SF	NLI	Retrofit	808.3	1%	9.5	1	80.0	\$80.00	0.07	Walk through audit and recommendations for behavioral and installation measures
2008	Audit	Audit Recommendations (gas) - Single-family	SF	LI	DI	808.3	1%	9.5	1	80.0	\$80.00	0.07	Walk through audit and recommendations for behavioral and installation measures
2009	Audit	Audit Recommendations (gas) - Multifamily	MF	NLI	Retrofit	379.1	3%	9.5	1	80.0	\$80.00	0.07	Walk through audit and recommendations for behavioral and installation measures
2010	Audit	Audit Recommendations (gas) - Multifamily	MF	LI	DI	379.1	3%	9.5	1	80.0	\$80.00	0.07	Walk through audit and recommendations for behavioral and installation measures
2011	Audit	Audit Recommendations (gas) - Mobile	Mobile	NLI	Retrofit	808.3	1%	9.5	1	80.0	\$80.00	0.07	Walk through audit and recommendations for behavioral and installation measures
2012	Audit	Audit Recommendations (gas) - Mobile	Mobile	LI	DI	808.3	1%	9.5	1	80.0	\$80.00	0.07	Walk through audit and recommendations for behavioral and installation measures
3019	Behavioral	Home Energy Reports (Gas furnace/CAC)	SF	N/A	Opt-Out	808.3	1%	10.0	1	7.9	\$7.90	1.48	Distribution of home energy reports encouraging adoption of energy-savings improvements
3020	Behavioral	Pre-pay (Gas furnace/CAC)	SF	N/A	Opt-In	808.3	11%	88.9	3	40.0	\$0.00	3.E+08	Pre-pay billing
3021	Behavioral	Home Energy Management System (Gas furnace/CAC)	SF	N/A	Retrofit	808.3	3%	25.9	5	90.0	\$45.00	2.98	HEMS are hardware and software systems that can control and monitor one or more energy uses in the home
3022	Behavioral	Home Energy Reports (Gas furnace/CAC)	SF	N/A	NC	411.2	1%	5.1	1	7.9	\$7.90	1.09	Distribution of home energy reports encouraging adoption of energy-savings improvements
3023	Behavioral	Pre-pay (Gas furnace/CAC)	SF	N/A	NC	411.2	11%	45.2	3	40.0	\$0.00	2.E+08	Pre-pay billing
3024	Behavioral	Home Energy Management System (Gas furnace/CAC)	SF	N/A	NC	411.2	3%	13.2	5	90.0	\$45.00	2.18	HEMS are hardware and software systems that can control and monitor one or more energy uses in the home

Vectren Gas South		Residential Measure Assumptions											
Measure #	End-Use	Measure Name	Home Type	Income Type	Replacement Type	Base Natural Gas Use (therms)	% Savings	Per unit Natural Gas Savings (therms)	Useful Life	Initial Measure Cost	Historical Incentive Amount	UCT Ratio	Measure Description
3025	Behavioral	Home Energy Reports (Gas furnace/CAC)	MF	N/A	Opt-Out	379.1	1%	4.7	1	7.9	\$7.90	0.91	Distribution of home energy reports encouraging adoption of energy-savings improvements
3026	Behavioral	Pre-pay (Gas furnace/CAC)	MF	N/A	Opt-In	379.1	11%	41.7	3	40.0	\$0.00	2.E+08	Pre-pay billing
3027	Behavioral	Home Energy Management System (Gas furnace/CAC)	MF	N/A	Retrofit	379.1	3%	12.2	5	90.0	\$45.00	1.82	HEMS are hardware and software systems that can control and monitor one or more energy uses in the home
3028	Behavioral	Home Energy Reports (Gas furnace/CAC)	MF	N/A	NC	183.4	1%	2.3	1	7.9	\$7.90	0.96	Distribution of home energy reports encouraging adoption of energy-savings improvements
3029	Behavioral	Pre-pay (Gas furnace/CAC)	MF	N/A	NC	183.4	11%	20.2	5	40.0	\$0.00	3.E+08	Pre-pay billing
3030	Behavioral	Home Energy Management System (Gas furnace/CAC)	MF	N/A	NC	183.4	3%	5.9	5	90.0	\$45.00	1.90	HEMS are hardware and software systems that can control and monitor one or more energy uses in the home
4130	HVAC Equipment	Smart Thermostat - Gas / CAC	SF	NLI	Retrofit	544.8	11%	59.1	15	154.0	\$60.00	7.41	Smart thermostat
4131	HVAC Equipment	WIFI Thermostat - Gas / CAC	SF	NLI	Retrofit	544.8	3%	18.4	15	103.2	\$50.00	4.36	Wifi (non-smart) thermostat
4132	HVAC Equipment	Filter Whistle	SF	NLI	Retrofit	544.8	2%	10.1	15	1.6	\$1.64	105.83	Whistle to remind owners to change air filter
4133	HVAC Equipment	Smart Thermostat - Gas / CAC	SF	LI	DI	544.8	11%	59.1	15	154.0	\$154.00	2.89	Smart thermostat
4134	HVAC Equipment	WIFI Thermostat - Gas / CAC	SF	LI	DI	544.8	3%	18.4	15	103.2	\$103.20	2.11	Wifi (non-smart) thermostat
4135	HVAC Equipment	Filter Whistle	SF	LI	DI	544.8	2%	10.1	15	1.6	\$1.64	105.83	Whistle to remind owners to change air filter
4136	HVAC Equipment	Programmable Thermostat - Gas / CAC	SF	N/A	Retrofit	544.8	2%	12.3	15	35.0	\$10.00	13.49	Programmable thermostat
4137	HVAC Equipment	Smart Vents/Sensors_ET	SF	N/A	Retrofit	544.8	10%	54.5	15	800.0	\$400.00	1.60	Smart vents relay temperature and occupancy information to a smart thermostat (or other control device) to reduce energy waste in unoccupied areas of the home
4138	HVAC Equipment	Programmable Thermostat - Gas / CAC	SF	N/A	NC	356.5	2%	8.0	18	35.0	\$10.00	11.87	Programmable thermostat
4139	HVAC Equipment	Smart Thermostat - Gas / CAC	SF	N/A	NC	356.5	11%	38.7	15	154.0	\$60.00	5.28	Smart thermostat
4140	HVAC Equipment	WIFI Thermostat - Gas / CAC	SF	N/A	NC	356.5	3%	12.0	15	103.2	\$50.00	3.38	Wifi (non-smart) thermostat
4141	HVAC Equipment	Filter Whistle	SF	N/A	NC	356.5	2%	6.6	15	1.6	\$1.64	83.65	Whistle to remind owners to change air filter
4142	HVAC Equipment	Smart Vents/Sensors_ET	SF	N/A	NC	356.5	10%	35.7	15	800.0	\$400.00	1.21	Smart vents relay temperature and occupancy information to a smart thermostat (or other control device) to reduce energy waste in unoccupied areas of the home
4143	HVAC Equipment	Smart Thermostat - Gas / CAC	MF	NLI	Retrofit	168.2	11%	18.2	15	154.0	\$60.00	3.27	Smart thermostat
4144	HVAC Equipment	WIFI Thermostat - Gas / CAC	MF	NLI	Retrofit	168.2	3%	5.7	15	103.2	\$50.00	2.53	Wifi (non-smart) thermostat
4145	HVAC Equipment	Filter Whistle	MF	NLI	Retrofit	168.2	2%	3.1	15	1.6	\$1.64	61.32	Whistle to remind owners to change air filter

Vectren Gas South		Residential Measure Assumptions											
Measure #	End-Use	Measure Name	Home Type	Income Type	Replacement Type	Base Natural Gas Use (therms)	% Savings	Per unit Natural Gas Savings (therms)	Useful Life	Initial Measure Cost	Historical Incentive Amount	UCT Ratio	Measure Description
4146	HVAC Equipment	Smart Thermostat - Gas / CAC	MF	LI	DI	168.2	11%	18.2	15	154.0	\$154.00	1.27	Smart thermostat
4147	HVAC Equipment	WIFI Thermostat - Gas / CAC	MF	LI	DI	168.2	3%	5.7	15	103.2	\$103.20	1.22	Wifi (non-smart) thermostat
4148	HVAC Equipment	Filter Whistle	MF	LI	DI	168.2	2%	3.1	15	1.6	\$1.64	61.32	Whistle to remind owners to change air filter
4149	HVAC Equipment	Programmable Thermostat - Gas / CAC	MF	N/A	Retrofit	168.2	2%	3.8	15	35.0	\$10.00	7.56	Programmable thermostat
4150	HVAC Equipment	Smart Vents/Sensors_ET	MF	N/A	Retrofit	168.2	10%	16.8	15	800.0	\$400.00	0.83	Smart vents relay temperature and occupancy information to a smart thermostat (or other control device) to reduce energy waste in unoccupied areas of the home
4151	HVAC Equipment	Programmable Thermostat - Gas / CAC	MF	N/A	NC	183.4	2%	4.1	15	35.0	\$10.00	7.20	Programmable thermostat
4152	HVAC Equipment	Smart Thermostat - Gas / CAC	MF	N/A	NC	183.4	11%	19.9	15	154.0	\$60.00	3.25	Smart thermostat
4153	HVAC Equipment	WIFI Thermostat - Gas / CAC	MF	N/A	NC	183.4	3%	6.2	15	103.2	\$50.00	2.40	Wifi (non-smart) thermostat
4154	HVAC Equipment	Filter Whistle	MF	N/A	NC	183.4	2%	3.4	15	1.6	\$1.64	57.41	Whistle to remind owners to change air filter
4155	HVAC Equipment	Smart Vents/Sensors_ET	MF	N/A	NC	183.4	10%	18.3	15	800.0	\$400.00	0.79	Smart vents relay temperature and occupancy information to a smart thermostat (or other control device) to reduce energy waste in unoccupied areas of the home
7005	New Construction	Gold Star: HERS Index Score \leq 63 - Gas Heated	SF	N/A	NC	411.2	37%	152.1	25	1573.3	\$175.00	23.67	Construction of home meeting Gold Star standard (HERS \leq 63)
7006	New Construction	Platinum Star: HERS Index Score \leq 60 - Gas Heated	SF	N/A	NC	411.2	40%	164.5	25	1778.3	\$200.00	22.40	Construction of home meeting Platinum Star standard (HERS \leq 60)
7007	New Construction	Gold Star: HERS Index Score \leq 63 - Gas Heated	MF	N/A	NC	183.4	37%	67.9	25	1573.3	\$775.00	4.72	Construction of home meeting Gold Star standard (HERS \leq 63)
7008	New Construction	Platinum Star: HERS Index Score \leq 60 - Gas Heated	MF	N/A	NC	183.4	40%	73.4	25	1778.3	\$900.00	4.40	Construction of home meeting Platinum Star standard (HERS \leq 60)
9115	HVAC Shell	Duct Sealing - Average Sealing - Gas Heating	SF	NLI	Retrofit	626.5	2%	14.0	20	200.0	\$175.00	1.61	15% to 10% leakage
9116	HVAC Shell	Duct Sealing - Inadequate Sealing - Gas Heating	SF	NLI	Retrofit	633.1	4%	24.3	20	350.0	\$300.00	1.25	20% to 15% leakage
9117	HVAC Shell	Duct Sealing/Insulation - Poor Sealing - Gas Heating	SF	NLI	Retrofit	640.1	9%	59.0	20	1442.5	\$1,000.00	0.91	25% to 15% leakage
9118	HVAC Shell	Wall Insulation - Gas Heating	SF	NLI	Retrofit	821.2	34%	276.4	25	2746.8	\$450.00	6.29	R0 to R11 wall insulation
9119	HVAC Shell	Air Sealing - Average Sealing - Gas Heating	SF	NLI	Retrofit	544.8	15%	80.5	15	624.7	\$100.00	7.18	10 ACH 50 to 7 ACH 50
9120	HVAC Shell	Air Sealing - Inadequate Sealing - Gas Heating	SF	NLI	Retrofit	651.7	16%	106.9	15	967.2	\$100.00	10.02	14 ACH 50 to 10 ACH 50
9121	HVAC Shell	Air Sealing - Poor Sealing - Gas Heating	SF	NLI	Retrofit	811.2	20%	159.5	15	967.2	\$100.00	15.38	20 ACH 50 to 14 ACH 50
9122	HVAC Shell	Attic Insulation - Average Insulation - Gas Heating	SF	NLI	Retrofit	544.8	3%	15.3	25	1259.7	\$450.00	0.48	R30 to R60
9123	HVAC Shell	Attic Insulation - Inadequate Insulation - Gas Heating	SF	NLI	Retrofit	564.1	6%	34.6	25	1744.2	\$450.00	1.00	R19 to R60

Vectren Gas South		Residential Measure Assumptions											
Measure #	End-Use	Measure Name	Home Type	Income Type	Replacement Type	Base Natural Gas Use (therms)	% Savings	Per unit Natural Gas Savings (therms)	Useful Life	Initial Measure Cost	Historical Incentive Amount	UCT Ratio	Measure Description
9124	HVAC Shell	Attic Insulation - Poor Insulation - Gas Heating	SF	NLI	Retrofit	596.7	11%	64.1	25	1550.4	\$450.00	1.81	R11 to R49
9125	HVAC Shell	Duct Sealing - Average Sealing - Gas Heating	SF	LI	DI	626.5	2%	14.0	20	200.0	\$200.00	1.41	15% to 10% leakage
9126	HVAC Shell	Duct Sealing - Inadequate Sealing - Gas Heating	SF	LI	DI	633.1	4%	24.3	20	350.0	\$350.00	1.08	20% to 15% leakage
9127	HVAC Shell	Duct Sealing/Insulation - Poor Sealing - Gas Heating	SF	LI	DI	640.1	9%	59.0	20	1442.5	\$1,442.50	0.63	25% to 15% leakage
9128	HVAC Shell	Wall Insulation - Gas Heating	SF	LI	DI	821.2	34%	276.4	25	2746.8	\$2,746.80	1.03	R0 to R11 wall insulation
9129	HVAC Shell	Air Sealing - Average Sealing - Gas Heating	SF	LI	DI	544.8	15%	80.5	15	624.7	\$624.65	1.15	10 ACH 50 to 7 ACH 50
9130	HVAC Shell	Air Sealing - Inadequate Sealing - Gas Heating	SF	LI	DI	651.7	16%	106.9	15	967.2	\$967.20	1.04	14 ACH 50 to 10 ACH 50
9131	HVAC Shell	Air Sealing - Poor Sealing - Gas Heating	SF	LI	DI	811.2	20%	159.5	15	967.2	\$967.20	1.59	20 ACH 50 to 14 ACH 50
9132	HVAC Shell	Attic Insulation - Average Insulation - Gas Heating	SF	LI	DI	544.8	3%	15.3	25	1259.7	\$1,259.70	0.17	R30 to R60
9133	HVAC Shell	Attic Insulation - Inadequate Insulation - Gas Heating	SF	LI	DI	564.1	6%	34.6	25	1744.2	\$1,744.20	0.26	R19 to R60
9134	HVAC Shell	Attic Insulation - Poor Insulation - Gas Heating	SF	LI	DI	596.7	11%	64.1	25	1550.4	\$1,550.40	0.52	R11 to R49
9135	HVAC Shell	Wall Sheathing - Gas Heating	SF	N/A	Retrofit	544.8	17%	93.9	25	2943.0	\$1,000.00	0.92	R12 polyiso
9136	HVAC Shell	ENERGY STAR Windows - Gas Heating	SF	N/A	Retrofit	544.8	5%	24.7	25	13601.3	\$1,000.00	0.76	U=0.30; SHGC=0.40
9137	HVAC Shell	Basement Sidewall Insulation - Gas Heating	SF	N/A	Retrofit	604.7	10%	59.9	25	2720.0	\$1,000.00	0.48	R0 to R13 sidewall insulation
9138	HVAC Shell	Floor Insulation Above Crawlspace - Gas Heating	SF	N/A	Retrofit	561.2	3%	16.4	25	316.2	\$90.00	0.73	R13 floor insulation
9139	HVAC Shell	ENERGY STAR Door - Gas Heating	SF	N/A	Retrofit	544.8	2%	11.5	25	388.0	\$120.00	1.25	Fiberglass
9140	HVAC Shell	Smart Window Coverings - Shade/Blind/Controller/Sensor - Gas Heating_ET	SF	N/A	Retrofit	544.8	16%	84.4	7	14875.0	\$1,000.00	0.53	Smart shades
9141	HVAC Shell	Smart Window Coverings - Film/Transformer - Gas Heating_ET	SF	N/A	Retrofit	544.8	16%	84.4	7	8160.8	\$1,000.00	0.53	Smart films
9142	HVAC Shell	Duct Sealing - Average Sealing - Gas Heating	MF	NLI	Retrofit	193.4	19%	36.6	20	200.0	\$175.00	6.06	15% to 10% leakage
9143	HVAC Shell	Duct Sealing - Inadequate Sealing - Gas Heating	MF	NLI	Retrofit	197.4	7%	14.6	20	350.0	\$300.00	2.41	20% to 15% leakage
9144	HVAC Shell	Duct Sealing/Insulation - Poor Sealing - Gas Heating	MF	NLI	Retrofit	202.1	19%	37.7	20	981.0	\$500.00	3.67	25% to 15% leakage
9145	HVAC Shell	Wall Insulation - Gas Heating	MF	NLI	Retrofit	245.2	31%	77.1	25	1159.2	\$450.00	2.12	R0 to R11 wall insulation
9146	HVAC Shell	Air Sealing - Average Sealing - Gas Heating	MF	NLI	Retrofit	168.2	22%	36.6	15	309.7	\$100.00	4.26	10 ACH 50 to 7 ACH 50
9147	HVAC Shell	Air Sealing - Inadequate Sealing - Gas Heating	MF	NLI	Retrofit	217.5	23%	49.3	15	479.5	\$100.00	5.01	14 ACH 50 to 10 ACH 50
9148	HVAC Shell	Air Sealing - Poor Sealing - Gas Heating	MF	NLI	Retrofit	295.2	26%	77.7	15	479.5	\$100.00	7.43	20 ACH 50 to 14 ACH 50
9149	HVAC Shell	Attic Insulation - Average Insulation - Gas Heating	MF	NLI	Retrofit	168.2	10%	16.3	25	1298.7	\$450.00	0.86	R30 to R60

Vectren Gas South		Residential Measure Assumptions											
Measure #	End-Use	Measure Name	Home Type	Income Type	Replacement Type	Base Natural Gas Use (therms)	% Savings	Per unit Natural Gas Savings (therms)	Useful Life	Initial Measure Cost	Historical Incentive Amount	UCT Ratio	Measure Description
9150	HVAC Shell	Attic Insulation - Inadequate Insulation - Gas Heating	MF	NLI	Retrofit	174.3	13%	22.3	25	1798.2	\$450.00	1.10	R19 to R60
9151	HVAC Shell	Attic Insulation - Poor Insulation - Gas Heating	MF	NLI	Retrofit	184.0	17%	30.7	25	1598.4	\$450.00	1.51	R11 to R49
9152	HVAC Shell	Duct Sealing - Average Sealing - Gas Heating	MF	LI	DI	193.4	19%	36.6	20	200.0	\$200.00	5.30	15% to 10% leakage
9153	HVAC Shell	Duct Sealing - Inadequate Sealing - Gas Heating	MF	LI	DI	197.4	7%	14.6	20	350.0	\$350.00	2.06	20% to 15% leakage
9154	HVAC Shell	Duct Sealing/Insulation - Poor Sealing - Gas Heating	MF	LI	DI	202.1	19%	37.7	20	981.0	\$981.00	1.87	25% to 15% leakage
9155	HVAC Shell	Wall Insulation - Gas Heating	MF	LI	DI	245.2	31%	77.1	25	1159.2	\$1,159.20	0.82	R0 to R11 wall insulation
9156	HVAC Shell	Air Sealing - Average Sealing - Gas Heating	MF	LI	DI	168.2	22%	36.6	15	309.7	\$309.69	1.38	10 ACH 50 to 7 ACH 50
9157	HVAC Shell	Air Sealing - Inadequate Sealing - Gas Heating	MF	LI	DI	217.5	23%	49.3	15	479.5	\$479.52	1.04	14 ACH 50 to 10 ACH 50
9158	HVAC Shell	Air Sealing - Poor Sealing - Gas Heating	MF	LI	DI	295.2	26%	77.7	15	479.5	\$479.52	1.55	20 ACH 50 to 14 ACH 50
9159	HVAC Shell	Attic Insulation - Average Insulation - Gas Heating	MF	LI	DI	168.2	10%	16.3	25	1298.7	\$1,298.70	0.30	R30 to R60
9160	HVAC Shell	Attic Insulation - Inadequate Insulation - Gas Heating	MF	LI	DI	174.3	13%	22.3	25	1798.2	\$1,798.20	0.28	R19 to R60
9161	HVAC Shell	Attic Insulation - Poor Insulation - Gas Heating	MF	LI	DI	184.0	17%	30.7	25	1598.4	\$1,598.40	0.43	R11 to R49
9162	HVAC Shell	Wall Sheathing - Gas Heating	MF	N/A	Retrofit	168.2	22%	36.7	25	1242.0	\$625.00	0.96	R12 polyiso
9163	HVAC Shell	ENERGY STAR Windows - Gas Heating	MF	N/A	Retrofit	168.2	13%	22.6	25	6743.3	\$1,000.00	0.64	U=0.30; SHGC=0.40
9164	HVAC Shell	Basement Sidewall Insulation - Gas Heating	MF	N/A	Retrofit	198.0	16%	31.8	25	2815.2	\$1,000.00	0.26	R0 to R13 sidewall insulation
9165	HVAC Shell	Floor Insulation Above Crawlspace - Gas Heating	MF	N/A	Retrofit	183.1	4%	7.0	25	849.2	\$425.00	0.02	R13 floor insulation
9166	HVAC Shell	Smart Window Coverings - Shade/Blind/Controller/Sensor - Gas Heating_ET	MF	N/A	Retrofit	168.2	16%	26.1	7	8500.0	\$1,000.00	0.28	Smart shades
9167	HVAC Shell	Smart Window Coverings - Film/Transformer - Gas Heating_ET	MF	N/A	Retrofit	168.2	16%	26.1	7	4046.0	\$1,000.00	0.28	Smart films
1095	Appliances	ENERGY STAR Clothes Dryer (NG)	SF	NLI	MO	22.0	21%	4.6	16	152.0	\$75.00	0.33	ES Qualified Dryer (CEF=3.93)
1096	Appliances	Smart Clothes Dryer (NG)_ET	SF	NLI	MO	22.0	26%	5.8	16	236.0	\$120.00	0.26	Smart ES Qualified Dryer (5.5% additional energy savings)
1097	Appliances	Dryer Vent Cleaning (NG)	SF	LI	DI	22.0	6%	1.2	2	80.0	\$80.00	0.01	Dryer Vent Cleaning (5.5% Savings)
1098	Appliances	ENERGY STAR Clothes Washer (NG WH/E Dryer)	SF	N/A	MO	5.9	8%	0.5	14	84.0	\$40.00	0.06	ES Qualified ClothesWasher (IMEF=2.23 ; 1.75 Baseline)
1099	Appliances	ENERGY STAR Clothes Washer (NG WH/NG Dryer)	SF	N/A	MO	20.6	20%	4.0	14	84.0	\$40.00	0.49	ES Qualified ClothesWasher (IMEF=2.23 ; 1.75 Baseline)
1100	Appliances	Smart/CEE Tier3 Clothes Washer (NG WH/E Dryer)_ET	SF	N/A	MO	5.9	78%	4.7	14	141.0	\$70.00	0.33	CEE Tier 3 Qualified ClothesWasher (IMEF=2.92 ; 1.75 Baseline)
1101	Appliances	Smart/CEE Tier3 Clothes Washer (NG WH/NG Dryer)_ET	SF	N/A	MO	20.6	44%	9.0	14	141.0	\$70.00	0.63	CEE Tier 3 Qualified ClothesWasher (IMEF=2.92 ; 1.75 Baseline)

Vectren Gas South		Residential Measure Assumptions											
Measure #	End-Use	Measure Name	Home Type	Income Type	Replacement Type	Base Natural Gas Use (therms)	% Savings	Per unit Natural Gas Savings (therms)	Useful Life	Initial Measure Cost	Historical Incentive Amount	UCT Ratio	Measure Description
1102	Appliances	ENERGY STAR Dishwasher (NG WH)	SF	N/A	MO	7.4	12%	0.9	11	79.0	\$40.00	0.09	ES Qualified Dishwasher (v3.0)
1103	Appliances	Smart Dishwasher (NG WH)_ET	SF	N/A	MO	7.4	15%	1.1	11	395.0	\$200.00	0.02	Smart ES Qualified Dishwasher (v3.0)
1104	Appliances	ENERGY STAR Clothes Dryer (NG)	SF	N/A	NC	22.0	21%	4.6	16	152.0	\$75.00	0.33	ES Qualified Dryer (CEF=3.93)
1105	Appliances	Smart Clothes Dryer (NG)_ET	SF	N/A	NC	22.0	26%	5.8	16	236.0	\$120.00	0.26	Smart ES Qualified Dryer (5.5% additional energy savings)
1106	Appliances	ENERGY STAR Clothes Washer (NG WH/E Dryer)	SF	N/A	NC	5.9	8%	0.5	14	84.0	\$40.00	0.06	ES Qualified ClothesWasher (IMEF=2.23 ; 1.75 Baseline)
1107	Appliances	ENERGY STAR Clothes Washer (NG WH/NG Dryer)	SF	N/A	NC	20.6	20%	4.0	14	84.0	\$40.00	0.49	ES Qualified ClothesWasher (IMEF=2.23 ; 1.75 Baseline)
1108	Appliances	Smart/CEE Tier3 Clothes Washer (NG WH/E Dryer)_ET	SF	N/A	NC	5.9	78%	4.7	14	141.0	\$70.00	0.33	CEE Tier 3 Qualified ClothesWasher (IMEF=2.92 ; 1.75 Baseline)
1109	Appliances	Smart/CEE Tier3 Clothes Washer (NG WH/NG Dryer)_ET	SF	N/A	NC	20.6	44%	9.0	14	141.0	\$70.00	0.63	CEE Tier 3 Qualified ClothesWasher (IMEF=2.92 ; 1.75 Baseline)
1110	Appliances	ENERGY STAR Dishwasher (NG WH)	SF	N/A	NC	7.4	12%	0.9	11	79.0	\$40.00	0.09	ES Qualified Dishwasher (v3.0)
1111	Appliances	Smart Dishwasher (NG WH)_ET	SF	N/A	NC	7.4	15%	1.1	11	395.0	\$200.00	0.02	Smart ES Qualified Dishwasher (v3.0)
1112	Appliances	ENERGY STAR Clothes Dryer (NG)	MF	NLI	MO	22.0	21%	4.6	16	152.0	\$75.00	0.33	ES Qualified Dryer (CEF=3.93)
1113	Appliances	Smart Clothes Dryer (NG)	MF	NLI	MO	22.0	26%	5.8	16	236.0	\$120.00	0.26	Smart ES Qualified Dryer (5.5% additional energy savings)
1114	Appliances	Dryer Vent Cleaning (NG)	MF	LI	DI	22.0	6%	1.2	2	80.0	\$80.00	0.01	Smart ES Qualified Dryer (5.5% additional energy savings)
1115	Appliances	ENERGY STAR Clothes Washer (NG WH/E Dryer)	MF	N/A	MO	5.9	8%	0.5	14	84.0	\$40.00	0.06	ES Qualified ClothesWasher (IMEF=2.23 ; 1.75 Baseline)
1116	Appliances	ENERGY STAR Clothes Washer (NG WH/NG Dryer)	MF	N/A	MO	20.6	20%	4.0	14	84.0	\$40.00	0.49	ES Qualified ClothesWasher (IMEF=2.23 ; 1.75 Baseline)
1117	Appliances	Smart/CEE Tier3 Clothes Washer (NG WH/E Dryer)_ET	MF	N/A	MO	5.9	78%	4.7	14	141.0	\$70.00	0.33	CEE Tier 3 Qualified ClothesWasher (IMEF=2.92 ; 1.75 Baseline)
1118	Appliances	Smart/CEE Tier3 Clothes Washer (NG WH/NG Dryer)_ET	MF	N/A	MO	20.6	44%	9.0	14	141.0	\$70.00	0.63	CEE Tier 3 Qualified ClothesWasher (IMEF=2.92 ; 1.75 Baseline)
1119	Appliances	ENERGY STAR Dishwasher (NG WH)	MF	N/A	MO	7.4	12%	0.9	11	79.0	\$40.00	0.09	ES Qualified Dishwasher (v3.0)
1120	Appliances	Smart Dishwasher (NG WH)_ET	MF	N/A	MO	7.4	15%	1.1	11	395.0	\$200.00	0.02	Smart ES Qualified Dishwasher (v3.0)
1121	Appliances	ENERGY STAR Clothes Dryer (NG)	MF	N/A	NC	22.0	21%	4.6	16	152.0	\$75.00	0.33	ES Qualified Dryer (CEF=3.93)
1122	Appliances	Smart Clothes Dryer (NG)_ET	MF	N/A	NC	22.0	26%	5.8	16	236.0	\$120.00	0.26	Smart ES Qualified Dryer (5.5% additional energy savings)
1123	Appliances	ENERGY STAR Clothes Washer (NG WH/E Dryer)	MF	N/A	NC	5.9	8%	0.5	14	84.0	\$40.00	0.06	ES Qualified ClothesWasher (IMEF=2.23 ; 1.75 Baseline)
1124	Appliances	ENERGY STAR Clothes Washer (NG WH/NG Dryer)	MF	N/A	NC	20.6	20%	4.0	14	84.0	\$40.00	0.49	ES Qualified ClothesWasher (IMEF=2.23 ; 1.75 Baseline)
1125	Appliances	Smart/CEE Tier3 Clothes Washer (NG WH/E Dryer)_ET	MF	N/A	NC	5.9	78%	4.7	14	141.0	\$70.00	0.33	CEE Tier 3 Qualified ClothesWasher (IMEF=2.92 ; 1.75 Baseline)

Vectren Gas South		Residential Measure Assumptions											
Measure #	End-Use	Measure Name	Home Type	Income Type	Replacement Type	Base Natural Gas Use (therms)	% Savings	Per unit Natural Gas Savings (therms)	Useful Life	Initial Measure Cost	Historical Incentive Amount	UCT Ratio	Measure Description
1126	Appliances	Smart/CEE Tier3 Clothes Washer (NG WH/NG Dryer)_ET	MF	N/A	NC	20.6	44%	9.0	14	141.0	\$70.00	0.63	CEE Tier 3 Qualified ClothesWasher (IMEF=2.92 ; 1.75 Baseline)
1127	Appliances	ENERGY STAR Dishwasher (NG WH)	MF	N/A	NC	7.4	12%	0.9	11	79.0	\$40.00	0.09	ES Qualified Dishwasher (v3.0)
1128	Appliances	Smart Dishwasher (NG WH)_ET	MF	N/A	NC	7.4	15%	1.1	11	395.0	\$200.00	0.02	Smart ES Qualified Dishwasher (v3.0)
2013	Audit	Audit Recommendations (gas) - Single-family	SF	NLI	Retrofit	808.3	1%	9.5	1	80.0	\$80.00	0.05	Walk through audit and recommendations for behavioral and installation measures
2014	Audit	Audit Recommendations (gas) - Single-family	SF	LI	DI	808.3	1%	9.5	1	80.0	\$80.00	0.05	Walk through audit and recommendations for behavioral and installation measures
2015	Audit	Audit Recommendations (gas) - Multifamily	MF	NLI	Retrofit	379.1	3%	9.5	1	80.0	\$80.00	0.05	Walk through audit and recommendations for behavioral and installation measures
2016	Audit	Audit Recommendations (gas) - Multifamily	MF	LI	DI	379.1	3%	9.5	1	80.0	\$80.00	0.05	Walk through audit and recommendations for behavioral and installation measures
2017	Audit	Audit Recommendations (gas) - Mobile	Mobile	NLI	Retrofit	808.3	1%	9.5	1	80.0	\$80.00	0.05	Walk through audit and recommendations for behavioral and installation measures
2018	Audit	Audit Recommendations (gas) - Mobile	Mobile	LI	DI	808.3	1%	9.5	1	80.0	\$80.00	0.05	Walk through audit and recommendations for behavioral and installation measures
3031	Behavioral	Home Energy Reports (Gas furnace/CAC)	SF	N/A	Opt-Out	808.3	1%	10.0	1	7.9	\$7.90	0.55	Distribution of home energy reports encouraging adoption of energy-savings improvements
3032	Behavioral	Pre-pay (Gas furnace/CAC)	SF	N/A	Opt-In	808.3	11%	88.9	3	40.0	\$0.00	1.E+08	Pre-pay billing
3033	Behavioral	Home Energy Management System (Gas furnace/CAC)	SF	N/A	Retrofit	808.3	3%	25.9	5	90.0	\$45.00	1.17	HEMS are hardware and software systems that can control and monitor one or more energy uses in the home
3034	Behavioral	Home Energy Reports (Gas furnace/CAC)	SF	N/A	NC	411.2	1%	5.1	1	7.9	\$7.90	0.28	Distribution of home energy reports encouraging adoption of energy-savings improvements
3035	Behavioral	Pre-pay (Gas furnace/CAC)	SF	N/A	NC	411.2	11%	45.2	3	40.0	\$0.00	6.E+07	Pre-pay billing
3036	Behavioral	Home Energy Management System (Gas furnace/CAC)	SF	N/A	NC	411.2	3%	13.2	5	90.0	\$45.00	0.59	HEMS are hardware and software systems that can control and monitor one or more energy uses in the home
3037	Behavioral	Home Energy Reports (Gas furnace/CAC)	MF	N/A	Opt-Out	379.1	1%	4.7	1	7.9	\$7.90	0.26	Distribution of home energy reports encouraging adoption of energy-savings improvements
3038	Behavioral	Pre-pay (Gas furnace/CAC)	MF	N/A	Opt-In	379.1	11%	41.7	3	40.0	\$0.00	5.E+07	Pre-pay billing
3039	Behavioral	Home Energy Management System (Gas furnace/CAC)	MF	N/A	Retrofit	379.1	3%	12.2	5	90.0	\$45.00	0.55	HEMS are hardware and software systems that can control and monitor one or more energy uses in the home
3040	Behavioral	Home Energy Reports (Gas furnace/CAC)	MF	N/A	NC	183.4	1%	2.3	1	7.9	\$7.90	0.13	Distribution of home energy reports encouraging adoption of energy-savings improvements
3041	Behavioral	Pre-pay (Gas furnace/CAC)	MF	N/A	NC	183.4	11%	20.2	3	40.0	\$0.00	3.E+07	Pre-pay billing

Vectren Gas South		Residential Measure Assumptions											
Measure #	End-Use	Measure Name	Home Type	Income Type	Replacement Type	Base Natural Gas Use (therms)	% Savings	Per unit Natural Gas Savings (therms)	Useful Life	Initial Measure Cost	Historical Incentive Amount	UCT Ratio	Measure Description
3042	Behavioral	Home Energy Management System (Gas furnace/CAC)	MF	N/A	NC	183.4	3%	5.9	5	90.0	\$45.00	0.26	HEMS are hardware and software systems that can control and monitor one or more energy uses in the home
4156	HVAC Equipment	Smart Thermostat - Gas / CAC	SF	NLI	Retrofit	544.8	11%	59.1	15	154.0	\$60.00	5.07	Smart thermostat
4157	HVAC Equipment	WIFI Thermostat - Gas / CAC	SF	NLI	Retrofit	544.8	3%	18.4	15	103.2	\$50.00	1.89	Wifi (non-smart) thermostat
4158	HVAC Equipment	Filter Whistle	SF	NLI	Retrofit	544.8	2%	10.1	15	1.6	\$1.64	31.64	Whistle to remind owners to change air filter
4159	HVAC Equipment	Smart Thermostat - Gas / CAC	SF	LI	DI	544.8	11%	59.1	15	154.0	\$154.00	1.98	Smart thermostat
4160	HVAC Equipment	WIFI Thermostat - Gas / CAC	SF	LI	DI	544.8	3%	18.4	15	103.2	\$103.20	0.92	Wifi (non-smart) thermostat
4161	HVAC Equipment	Filter Whistle	SF	LI	DI	544.8	2%	10.1	15	1.6	\$1.64	31.64	Whistle to remind owners to change air filter
4162	HVAC Equipment	Programmable Thermostat - Gas / CAC	SF	N/A	Retrofit	544.8	2%	12.3	15	35.0	\$10.00	6.31	Programmable thermostat
4163	HVAC Equipment	Smart Vents/Sensors_ET	SF	N/A	Retrofit	544.8	10%	54.5	15	800.0	\$400.00	0.70	Smart vents relay temperature and occupancy information to a smart thermostat (or other control device) to reduce energy waste in unoccupied areas of the home
4164	HVAC Equipment	Programmable Thermostat - Gas / CAC	SF	N/A	NC	356.5	2%	8.0	18	35.0	\$10.00	4.68	Programmable thermostat
4165	HVAC Equipment	Smart Thermostat - Gas / CAC	SF	N/A	NC	356.5	11%	38.7	15	154.0	\$60.00	3.32	Smart thermostat
4166	HVAC Equipment	WIFI Thermostat - Gas / CAC	SF	N/A	NC	356.5	3%	12.0	15	103.2	\$50.00	1.24	Wifi (non-smart) thermostat
4167	HVAC Equipment	Filter Whistle	SF	N/A	NC	356.5	2%	6.6	15	1.6	\$1.64	20.71	Whistle to remind owners to change air filter
4168	HVAC Equipment	Smart Vents/Sensors_ET	SF	N/A	NC	356.5	10%	35.7	15	800.0	\$400.00	0.46	Smart vents relay temperature and occupancy information to a smart thermostat (or other control device) to reduce energy waste in unoccupied areas of the home
4169	HVAC Equipment	Smart Thermostat - Gas / CAC	MF	NLI	Retrofit	168.2	11%	18.2	15	154.0	\$60.00	1.57	Smart thermostat
4170	HVAC Equipment	WIFI Thermostat - Gas / CAC	MF	NLI	Retrofit	168.2	3%	5.7	15	103.2	\$50.00	0.58	Wifi (non-smart) thermostat
4171	HVAC Equipment	Filter Whistle	MF	NLI	Retrofit	168.2	2%	3.1	15	1.6	\$1.64	9.77	Whistle to remind owners to change air filter
4172	HVAC Equipment	Smart Thermostat - Gas / CAC	MF	LI	DI	168.2	11%	18.2	15	154.0	\$154.00	0.61	Smart thermostat
4173	HVAC Equipment	WIFI Thermostat - Gas / CAC	MF	LI	DI	168.2	3%	5.7	15	103.2	\$103.20	0.28	Wifi (non-smart) thermostat
4174	HVAC Equipment	Filter Whistle	MF	LI	DI	168.2	2%	3.1	15	1.6	\$1.64	9.77	Whistle to remind owners to change air filter
4175	HVAC Equipment	Programmable Thermostat - Gas / CAC	MF	N/A	Retrofit	168.2	2%	3.8	15	35.0	\$10.00	1.95	Programmable thermostat

Vectren Gas South		Residential Measure Assumptions											
Measure #	End-Use	Measure Name	Home Type	Income Type	Replacement Type	Base Natural Gas Use (therms)	% Savings	Per unit Natural Gas Savings (therms)	Useful Life	Initial Measure Cost	Historical Incentive Amount	UCT Ratio	Measure Description
4176	HVAC Equipment	Smart Vents/Sensors_ET	MF	N/A	Retrofit	168.2	10%	16.8	15	800.0	\$400.00	0.22	Smart vents relay temperature and occupancy information to a smart thermostat (or other control device) to reduce energy waste in unoccupied areas of the home
4177	HVAC Equipment	Programmable Thermostat - Gas / CAC	MF	N/A	NC	183.4	2%	4.1	15	35.0	\$10.00	2.12	Programmable thermostat
4178	HVAC Equipment	Smart Thermostat - Gas / CAC	MF	N/A	NC	183.4	11%	19.9	15	154.0	\$60.00	1.71	Smart thermostat
4179	HVAC Equipment	WIFI Thermostat - Gas / CAC	MF	N/A	NC	183.4	3%	6.2	15	103.2	\$50.00	0.64	Wifi (non-smart) thermostat
4180	HVAC Equipment	Filter Whistle	MF	N/A	NC	183.4	2%	3.4	15	1.6	\$1.64	10.65	Whistle to remind owners to change air filter
4181	HVAC Equipment	Smart Vents/Sensors_ET	MF	N/A	NC	183.4	10%	18.3	15	800.0	\$400.00	0.24	Smart vents relay temperature and occupancy information to a smart thermostat (or other control device) to reduce energy waste in unoccupied areas of the home
4182	HVAC Equipment	Furnace Tune Up	SF	NLI	Retrofit	544.8	5%	27.2	2	50.0	\$50.00	0.46	Furnace tune-up
4183	HVAC Equipment	Natural Gas Furnaces (>95% AFUE)	SF	NLI	MO	636.3	22%	137.3	20	833.0	\$250.00	3.44	95 AFUE furnace
4184	HVAC Equipment	Furnace Tune Up	SF	LI	DI	544.8	5%	27.2	2	200.0	\$200.00	0.12	Furnace tune-up
4185	HVAC Equipment	Natural Gas Furnaces (>95% AFUE)	SF	LI	DI	636.3	22%	137.3	20	3700.0	\$3,700.00	0.23	95 AFUE furnace
4186	HVAC Equipment	Natural Gas Furnaces (>97% AFUE)	SF	NLI	MO	636.3	23%	147.6	20	1000.0	\$300.00	3.08	97 AFUE furnace
4187	HVAC Equipment	Boiler Tune Up	SF	N/A	Retrofit	658.8	5%	32.9	5	140.0	\$40.00	1.67	Boiler tune-up
4188	HVAC Equipment	Natural Gas Boilers (>90% AFUE)	SF	N/A	MO	658.8	15%	98.6	18	1000.0	\$300.00	1.92	90 AFUE boiler
4189	HVAC Equipment	Natural Gas Boilers (>92% AFUE)	SF	N/A	MO	658.8	17%	110.8	18	1200.0	\$360.00	1.80	92 AFUE boiler
4190	HVAC Equipment	Dual Fuel Air Source Heat Pump 16 SEER	SF	N/A	MO	544.8	38%	207.1	18	837.0	\$300.00	4.03	16 SEER Dual-fuel heat pump
4191	HVAC Equipment	Dual Fuel Air Source Heat Pump 18 SEER	SF	N/A	MO	544.8	38%	207.1	18	1123.0	\$500.00	2.42	18 SEER Dual-fuel heat pump
4192	HVAC Equipment	Natural Gas Furnaces (>95% AFUE)	SF	N/A	NC	401.1	16%	63.3	20	833.0	\$250.00	1.58	95 AFUE furnace
4193	HVAC Equipment	Natural Gas Furnaces (>97% AFUE)	SF	N/A	NC	401.1	18%	70.3	20	1000.0	\$300.00	1.47	97 AFUE furnace
4194	HVAC Equipment	Natural Gas Boilers (>90% AFUE)	SF	N/A	NC	428.4	11%	46.5	18	1000.0	\$300.00	0.90	90 AFUE boiler
4195	HVAC Equipment	Natural Gas Boilers (>92% AFUE)	SF	N/A	NC	428.4	13%	55.2	18	1200.0	\$360.00	0.90	92 AFUE boiler
4196	HVAC Equipment	Dual Fuel Air Source Heat Pump 16 SEER	SF	N/A	NC	356.5	41%	147.6	18	837.0	\$300.00	2.87	16 SEER Dual-fuel heat pump
4197	HVAC Equipment	Dual Fuel Air Source Heat Pump 18 SEER	SF	N/A	NC	356.5	41%	147.6	18	1123.0	\$500.00	1.72	18 SEER Dual-fuel heat pump
4198	HVAC Equipment	Furnace Tune Up	MF	NLI	Retrofit	168.2	5%	8.4	2	50.0	\$50.00	0.14	Furnace tune-up

Vectren Gas South		Residential Measure Assumptions											
Measure #	End-Use	Measure Name	Home Type	Income Type	Replacement Type	Base Natural Gas Use (therms)	% Savings	Per unit Natural Gas Savings (therms)	Useful Life	Initial Measure Cost	Historical Incentive Amount	UCT Ratio	Measure Description
4199	HVAC Equipment	Natural Gas Furnaces (>95% AFUE)	MF	NLI	MO	189.2	16%	29.9	20	833.0	\$250.00	0.75	95 AFUE furnace
4200	HVAC Equipment	Furnace Tune Up	MF	LI	DI	168.2	5%	8.4	2	200.0	\$200.00	0.04	Furnace tune-up
4201	HVAC Equipment	Natural Gas Furnaces (>95% AFUE)	MF	LI	DI	189.2	16%	29.9	20	3700.0	\$3,700.00	0.05	95 AFUE furnace
4202	HVAC Equipment	Natural Gas Furnaces (>97% AFUE)	MF	NLI	MO	189.2	18%	33.2	20	1000.0	\$300.00	0.69	97 AFUE furnace
4203	HVAC Equipment	Boiler Tune Up	MF	N/A	Retrofit	187.0	5%	9.3	5	140.0	\$40.00	0.47	Boiler tune-up
4204	HVAC Equipment	Natural Gas Boilers (>90% AFUE)	MF	N/A	MO	187.0	12%	23.0	18	1000.0	\$300.00	0.45	90 AFUE boiler
4205	HVAC Equipment	Natural Gas Boilers (>92% AFUE)	MF	N/A	MO	187.0	14%	26.5	18	1200.0	\$360.00	0.43	92 AFUE boiler
4206	HVAC Equipment	Dual Fuel Air Source Heat Pump 16 SEER	MF	N/A	MO	168.2	26%	43.5	18	837.0	\$300.00	0.85	16 SEER Dual-fuel heat pump
4207	HVAC Equipment	Dual Fuel Air Source Heat Pump 18 SEER	MF	N/A	MO	168.2	26%	43.5	18	1123.0	\$500.00	0.51	18 SEER Dual-fuel heat pump
4208	HVAC Equipment	Natural Gas Furnaces (>95% AFUE)	MF	N/A	NC	183.4	28%	52.0	20	833.0	\$250.00	1.30	95 AFUE furnace
4209	HVAC Equipment	Natural Gas Furnaces (>97% AFUE)	MF	N/A	NC	183.4	30%	54.7	20	1000.0	\$300.00	1.14	97 AFUE furnace
4210	HVAC Equipment	Natural Gas Boilers (>90% AFUE)	MF	N/A	NC	180.2	26%	47.5	18	1000.0	\$300.00	0.92	90 AFUE boiler
4211	HVAC Equipment	Natural Gas Boilers (>92% AFUE)	MF	N/A	NC	180.2	28%	50.4	18	1200.0	\$360.00	0.82	92 AFUE boiler
4212	HVAC Equipment	Dual Fuel Air Source Heat Pump 16 SEER	MF	N/A	NC	183.4	35%	63.5	18	837.0	\$300.00	1.24	16 SEER Dual-fuel heat pump
4213	HVAC Equipment	Dual Fuel Air Source Heat Pump 18 SEER	MF	N/A	NC	183.4	35%	63.5	18	1123.0	\$500.00	0.74	18 SEER Dual-fuel heat pump
7009	New Construction	Gold Star: HERS Index Score ≤ 63 - Gas Heated	SF	N/A	NC	411.2	37%	152.1	25	1573.3	\$175.00	6.23	Construction of home meeting Gold Star standard (HERS ≤63)
7010	New Construction	Platinum Star: HERS Index Score ≤ 60 - Gas Heated	SF	N/A	NC	411.2	40%	164.5	25	1778.3	\$200.00	5.89	Construction of home meeting Platinum Star standard (HERS ≤60)
7011	New Construction	Gold Star: HERS Index Score ≤ 63 - Gas Heated	MF	N/A	NC	183.4	37%	67.9	25	1573.3	\$775.00	0.63	Construction of home meeting Gold Star standard (HERS ≤63)
7012	New Construction	Platinum Star: HERS Index Score ≤ 60 - Gas Heated	MF	N/A	NC	183.4	40%	73.4	25	1778.3	\$900.00	0.58	Construction of home meeting Platinum Star standard (HERS ≤60)
9168	HVAC Shell	Duct Sealing - Average Sealing - Gas Heating	SF	NLI	Retrofit	626.5	2%	14.0	20	200.0	\$175.00	0.50	15% to 10% leakage
9169	HVAC Shell	Duct Sealing - Inadequate Sealing - Gas Heating	SF	NLI	Retrofit	633.1	4%	24.3	20	350.0	\$300.00	0.51	20% to 15% leakage
9170	HVAC Shell	Duct Sealing/Insulation - Poor Sealing - Gas Heating	SF	NLI	Retrofit	640.1	9%	59.0	20	1442.5	\$1,000.00	0.37	25% to 15% leakage
9171	HVAC Shell	Wall Insulation - Gas Heating	SF	NLI	Retrofit	821.2	34%	276.4	25	2746.8	\$450.00	4.40	R0 to R11 wall insulation
9172	HVAC Shell	Air Sealing - Average Sealing - Gas Heating	SF	NLI	Retrofit	544.8	15%	80.5	15	624.7	\$100.00	4.14	10 ACH 50 to 7 ACH 50
9173	HVAC Shell	Air Sealing - Inadequate Sealing - Gas Heating	SF	NLI	Retrofit	651.7	16%	106.9	15	967.2	\$100.00	5.50	14 ACH 50 to 10 ACH 50
9174	HVAC Shell	Air Sealing - Poor Sealing - Gas Heating	SF	NLI	Retrofit	811.2	20%	159.5	15	967.2	\$100.00	8.21	20 ACH 50 to 14 ACH 50

Vectren Gas South		Residential Measure Assumptions											
Measure #	End-Use	Measure Name	Home Type	Income Type	Replacement Type	Base Natural Gas Use (therms)	% Savings	Per unit Natural Gas Savings (therms)	Useful Life	Initial Measure Cost	Historical Incentive Amount	UCT Ratio	Measure Description
9175	HVAC Shell	Attic Insulation - Average Insulation - Gas Heating	SF	NLI	Retrofit	544.8	3%	15.3	25	1259.7	\$450.00	0.24	R30 to R60
9176	HVAC Shell	Attic Insulation - Inadequate Insulation - Gas Heating	SF	NLI	Retrofit	564.1	6%	34.6	25	1744.2	\$450.00	0.55	R19 to R60
9177	HVAC Shell	Attic Insulation - Poor Insulation - Gas Heating	SF	NLI	Retrofit	596.7	11%	64.1	25	1550.4	\$450.00	1.02	R11 to R49
9178	HVAC Shell	Duct Sealing - Average Sealing - Gas Heating	SF	LI	DI	626.5	2%	14.0	20	200.0	\$200.00	0.44	15% to 10% leakage
9179	HVAC Shell	Duct Sealing - Inadequate Sealing - Gas Heating	SF	LI	DI	633.1	4%	24.3	20	350.0	\$350.00	0.43	20% to 15% leakage
9180	HVAC Shell	Duct Sealing/Insulation - Poor Sealing - Gas Heating	SF	LI	DI	640.1	9%	59.0	20	1442.5	\$1,442.50	0.26	25% to 15% leakage
9181	HVAC Shell	Wall Insulation - Gas Heating	SF	LI	DI	821.2	34%	276.4	25	2746.8	\$2,746.80	0.72	R0 to R11 wall insulation
9182	HVAC Shell	Air Sealing - Average Sealing - Gas Heating	SF	LI	DI	544.8	15%	80.5	15	624.7	\$624.65	0.66	10 ACH 50 to 7 ACH 50
9183	HVAC Shell	Air Sealing - Inadequate Sealing - Gas Heating	SF	LI	DI	651.7	16%	106.9	15	967.2	\$967.20	0.57	14 ACH 50 to 10 ACH 50
9184	HVAC Shell	Air Sealing - Poor Sealing - Gas Heating	SF	LI	DI	811.2	20%	159.5	15	967.2	\$967.20	0.85	20 ACH 50 to 14 ACH 50
9185	HVAC Shell	Attic Insulation - Average Insulation - Gas Heating	SF	LI	DI	544.8	3%	15.3	25	1259.7	\$1,259.70	0.09	R30 to R60
9186	HVAC Shell	Attic Insulation - Inadequate Insulation - Gas Heating	SF	LI	DI	564.1	6%	34.6	25	1744.2	\$1,744.20	0.14	R19 to R60
9187	HVAC Shell	Attic Insulation - Poor Insulation - Gas Heating	SF	LI	DI	596.7	11%	64.1	25	1550.4	\$1,550.40	0.30	R11 to R49
9188	HVAC Shell	Wall Sheathing - Gas Heating	SF	N/A	Retrofit	544.8	17%	93.9	25	2943.0	\$1,000.00	0.67	R12 polyiso
9189	HVAC Shell	ENERGY STAR Windows - Gas Heating	SF	N/A	Retrofit	544.8	5%	24.7	25	13601.3	\$1,000.00	0.18	U=0.30; SHGC=0.40
9190	HVAC Shell	Basement Sidewall Insulation - Gas Heating	SF	N/A	Retrofit	604.7	10%	59.9	25	2720.0	\$1,000.00	0.43	R0 to R13 sidewall insulation
9191	HVAC Shell	Floor Insulation Above Crawlspace - Gas Heating	SF	N/A	Retrofit	561.2	3%	16.4	25	316.2	\$90.00	1.31	R13 floor insulation
9192	HVAC Shell	ENERGY STAR Door - Gas Heating	SF	N/A	Retrofit	544.8	2%	11.5	25	388.0	\$120.00	0.69	Fiberglass
9193	HVAC Shell	Smart Window Coverings - Shade/Blind/Controller/Sensor - Gas Heating_ET	SF	N/A	Retrofit	544.8	16%	84.4	7	14875.0	\$1,000.00	0.23	Smart shades
9194	HVAC Shell	Smart Window Coverings - Film/Transformer - Gas Heating_ET	SF	N/A	Retrofit	544.8	16%	84.4	7	8160.8	\$1,000.00	0.23	Smart films
9195	HVAC Shell	Duct Sealing - Average Sealing - Gas Heating	MF	NLI	Retrofit	193.4	19%	36.6	20	200.0	\$175.00	1.31	15% to 10% leakage
9196	HVAC Shell	Duct Sealing - Inadequate Sealing - Gas Heating	MF	NLI	Retrofit	197.4	7%	14.6	20	350.0	\$300.00	0.31	20% to 15% leakage
9197	HVAC Shell	Duct Sealing/Insulation - Poor Sealing - Gas Heating	MF	NLI	Retrofit	202.1	19%	37.7	20	981.0	\$500.00	0.47	25% to 15% leakage
9198	HVAC Shell	Wall Insulation - Gas Heating	MF	NLI	Retrofit	245.2	31%	77.1	25	1159.2	\$450.00	1.23	R0 to R11 wall insulation
9199	HVAC Shell	Air Sealing - Average Sealing - Gas Heating	MF	NLI	Retrofit	168.2	22%	36.6	15	309.7	\$100.00	1.89	10 ACH 50 to 7 ACH 50
9200	HVAC Shell	Air Sealing - Inadequate Sealing - Gas Heating	MF	NLI	Retrofit	217.5	23%	49.3	15	479.5	\$100.00	2.54	14 ACH 50 to 10 ACH 50

Vectren Gas South		Residential Measure Assumptions											
Measure #	End-Use	Measure Name	Home Type	Income Type	Replacement Type	Base Natural Gas Use (therms)	% Savings	Per unit Natural Gas Savings (therms)	Useful Life	Initial Measure Cost	Historical Incentive Amount	UCT Ratio	Measure Description
9201	HVAC Shell	Air Sealing - Poor Sealing - Gas Heating	MF	NLI	Retrofit	295.2	26%	77.7	15	479.5	\$100.00	4.00	20 ACH 50 to 14 ACH 50
9202	HVAC Shell	Attic Insulation - Average Insulation - Gas Heating	MF	NLI	Retrofit	168.2	10%	16.3	25	1298.7	\$450.00	0.26	R30 to R60
9203	HVAC Shell	Attic Insulation - Inadequate Insulation - Gas Heating	MF	NLI	Retrofit	174.3	13%	22.3	25	1798.2	\$450.00	0.36	R19 to R60
9204	HVAC Shell	Attic Insulation - Poor Insulation - Gas Heating	MF	NLI	Retrofit	184.0	17%	30.7	25	1598.4	\$450.00	0.49	R11 to R49
9205	HVAC Shell	Duct Sealing - Average Sealing - Gas Heating	MF	LI	DI	193.4	19%	36.6	20	200.0	\$200.00	1.14	15% to 10% leakage
9206	HVAC Shell	Duct Sealing - Inadequate Sealing - Gas Heating	MF	LI	DI	197.4	7%	14.6	20	350.0	\$350.00	0.26	20% to 15% leakage
9207	HVAC Shell	Duct Sealing/Insulation - Poor Sealing - Gas Heating	MF	LI	DI	202.1	19%	37.7	20	981.0	\$981.00	0.24	25% to 15% leakage
9208	HVAC Shell	Wall Insulation - Gas Heating	MF	LI	DI	245.2	31%	77.1	25	1159.2	\$1,159.20	0.48	R0 to R11 wall insulation
9209	HVAC Shell	Air Sealing - Average Sealing - Gas Heating	MF	LI	DI	168.2	22%	36.6	15	309.7	\$309.69	0.61	10 ACH 50 to 7 ACH 50
9210	HVAC Shell	Air Sealing - Inadequate Sealing - Gas Heating	MF	LI	DI	217.5	23%	49.3	15	479.5	\$479.52	0.53	14 ACH 50 to 10 ACH 50
9211	HVAC Shell	Air Sealing - Poor Sealing - Gas Heating	MF	LI	DI	295.2	26%	77.7	15	479.5	\$479.52	0.83	20 ACH 50 to 14 ACH 50
9212	HVAC Shell	Attic Insulation - Average Insulation - Gas Heating	MF	LI	DI	168.2	10%	16.3	25	1298.7	\$1,298.70	0.09	R30 to R60
9213	HVAC Shell	Attic Insulation - Inadequate Insulation - Gas Heating	MF	LI	DI	174.3	13%	22.3	25	1798.2	\$1,798.20	0.09	R19 to R60
9214	HVAC Shell	Attic Insulation - Poor Insulation - Gas Heating	MF	LI	DI	184.0	17%	30.7	25	1598.4	\$1,598.40	0.14	R11 to R49
9215	HVAC Shell	Wall Sheathing - Gas Heating	MF	N/A	Retrofit	168.2	22%	36.7	25	1242.0	\$625.00	0.42	R12 polyiso
9216	HVAC Shell	ENERGY STAR Windows - Gas Heating	MF	N/A	Retrofit	168.2	13%	22.6	25	6743.3	\$1,000.00	0.16	U=0.30; SHGC=0.40
9217	HVAC Shell	Basement Sidewall Insulation - Gas Heating	MF	N/A	Retrofit	198.0	16%	31.8	25	2815.2	\$1,000.00	0.23	R0 to R13 sidewall insulation
9218	HVAC Shell	Floor Insulation Above Crawlspace - Gas Heating	MF	N/A	Retrofit	183.1	4%	7.0	25	849.2	\$425.00	0.12	R13 floor insulation
9219	HVAC Shell	Smart Window Coverings - Shade/Blind/Controller/Sensor - Gas Heating_ET	MF	N/A	Retrofit	168.2	16%	26.1	7	8500.0	\$1,000.00	0.07	Smart shades
9220	HVAC Shell	Smart Window Coverings - Film/Transformer - Gas Heating_ET	MF	N/A	Retrofit	168.2	16%	26.1	7	4046.0	\$1,000.00	0.07	Smart films
10063	Water Heating	Water Heater Temperature Setback	SF	NLI	Retrofit	32.3	11%	3.6	15	6.5	\$6.50	2.84	WH Temp Setback from 135 to 120
10064	Water Heating	Pipe Wrap	SF	NLI	Retrofit	199.1	3%	6.0	15	1.7	\$1.72	17.87	Adding Pipe Wrap to Uninsulated Pipes
10065	Water Heating	Natural Gas Water Heater .67EF	SF	N/A	MO	199.1	11%	22.6	13	175.0	\$175.00	0.60	.67 EF Gas Water Heater (Replacing .594 EF)
10066	Water Heating	Natural Gas Water Heater .77EF	SF	N/A	MO	199.1	26%	51.3	13	685.0	\$200.00	1.19	.80 EF Gas Water Heater (Replacing .594 EF)
10067	Water Heating	Tankless Water Heater	SF	N/A	MO	199.1	21%	41.4	13	407.0	\$125.00	1.54	.75 EF Gas Water Heater (Replacing .594 EF)
10068	Water Heating	Smart Water Heater - Tank Controls and Sensors_ET	SF	N/A	Retrofit	199.1	15%	30.0	10	120.0	\$60.00	1.88	Smart WH Controls

Vectren Gas South		Residential Measure Assumptions											
Measure #	End-Use	Measure Name	Home Type	Income Type	Replacement Type	Base Natural Gas Use (therms)	% Savings	Per unit Natural Gas Savings (therms)	Useful Life	Initial Measure Cost	Historical Incentive Amount	UCT Ratio	Measure Description
10069	Water Heating	Bathroom Aerator 1.0 gpm	SF	NLI	Retrofit	2.2	47%	1.0	10	0.5	\$0.52	7.51	1.0 GPM Bathroom FA
10070	Water Heating	Kitchen Flip Aerator 1.5 gpm	SF	NLI	Retrofit	17.4	39%	6.7	10	1.3	\$1.34	18.87	1.5 GPM Kitchen FA
10071	Water Heating	Low Flow Showerhead 1.5 gpm	SF	NLI	Retrofit	26.9	43%	11.6	10	3.3	\$3.32	13.09	1.5 GPM Low Flow Showerhead
10072	Water Heating	Thermostatic Restrictor Shower Valve	SF	N/A	Retrofit	26.9	11%	3.1	10	30.0	\$15.00	0.77	Thermostatic Restrictor Shower Valve (on base flow device)
10073	Water Heating	Shower Timer	SF	N/A	Retrofit	26.9	9%	2.4	2	5.0	\$5.00	0.40	Shower Timer limit time to 5 mins (per shower)
10074	Water Heating	Drain water Heat Recovery	SF	N/A	Retrofit	199.1	25%	49.8	20	742.0	\$225.00	1.38	Drainpipe heat exchanger
10075	Water Heating	Bathroom Aerator 1.0 gpm	SF	LI	DI	2.2	47%	1.0	10	0.5	\$0.52	7.51	1.0 GPM Bathroom FA
10076	Water Heating	Kitchen Flip Aerator 1.5 gpm	SF	LI	DI	17.4	39%	6.7	10	1.3	\$1.34	18.87	1.5 GPM Kitchen FA
10077	Water Heating	Low Flow Showerhead 1.5 gpm	SF	LI	DI	26.9	43%	11.6	10	3.3	\$3.32	13.09	1.5 GPM Low Flow Showerhead
10078	Water Heating	Pipe Wrap	SF	LI	DI	199.1	3%	6.0	15	1.7	\$1.72	17.87	Adding Pipe Wrap to Uninsulated Pipes
10079	Water Heating	Water Heater Temperature Setback	SF	LI	DI	32.3	11%	3.6	15	6.5	\$6.50	2.84	WH Temp Setback from 135 to 120
10080	Water Heating	Water Heater Temperature Setback	SF	N/A	NC	32.3	11%	3.6	15	6.5	\$6.50	2.84	WH Temp Setback from 135 to 120
10081	Water Heating	Pipe Wrap	SF	N/A	NC	199.1	3%	6.0	15	1.7	\$1.72	17.87	Adding Pipe Wrap to Uninsulated Pipes
10082	Water Heating	Natural Gas Water Heater .67EF	SF	N/A	NC	199.1	11%	22.6	13	175.0	\$175.00	0.60	.67 EF Gas Water Heater (Replacing .594 EF)
10083	Water Heating	Natural Gas Water Heater .77EF	SF	N/A	NC	199.1	26%	51.3	13	685.0	\$200.00	1.19	.80 EF Gas Water Heater (Replacing .594 EF)
10084	Water Heating	Tankless Water Heater	SF	N/A	NC	199.1	21%	41.4	13	407.0	\$125.00	1.54	.75 EF Gas Water Heater (Replacing .594 EF)
10085	Water Heating	Smart Water Heater - Tank Controls and Sensors_ET	SF	N/A	NC	199.1	15%	30.0	10	120.0	\$60.00	1.88	Smart WH Controls
10086	Water Heating	Bathroom Aerator 1.0 gpm	SF	N/A	NC	2.2	47%	1.0	10	0.5	\$0.52	7.51	1.0 GPM Bathroom FA
10087	Water Heating	Kitchen Flip Aerator 1.5 gpm	SF	N/A	NC	17.4	39%	6.7	10	1.3	\$1.34	18.87	1.5 GPM Kitchen FA
10088	Water Heating	Low Flow Showerhead 1.5 gpm	SF	N/A	NC	26.9	43%	11.6	10	3.3	\$3.32	13.09	1.5 GPM Low Flow Showerhead
10089	Water Heating	Thermostatic Restrictor Shower Valve	SF	N/A	NC	26.9	11%	3.1	10	30.0	\$15.00	0.77	Thermostatic Restrictor Shower Valve (on base flow device)
10090	Water Heating	Shower Timer	SF	N/A	NC	26.9	9%	2.4	2	5.0	\$5.00	0.40	Shower Timer limit time to 5 mins (per shower)
10091	Water Heating	Drain water Heat Recovery	SF	N/A	NC	199.1	25%	49.8	20	742.0	\$225.00	1.38	Drainpipe heat exchanger
10092	Water Heating	Water Heater Temperature Setback	MF	NLI	Retrofit	32.3	11%	3.6	15	6.5	\$6.50	2.84	WH Temp Setback from 135 to 120
10093	Water Heating	Pipe Wrap	MF	NLI	Retrofit	149.9	3%	4.5	15	1.7	\$1.72	13.46	Adding Pipe Wrap to Uninsulated Pipes
10094	Water Heating	Natural Gas Water Heater .67EF	MF	N/A	MO	149.9	11%	17.0	13	175.0	\$175.00	0.45	.67 EF Gas Water Heater (Replacing .594 EF)
10095	Water Heating	Natural Gas Water Heater .77EF	MF	N/A	MO	149.9	26%	38.6	13	685.0	\$200.00	0.89	.80 EF Gas Water Heater (Replacing .594 EF)
10096	Water Heating	Tankless Water Heater	MF	N/A	MO	149.9	21%	31.2	13	407.0	\$125.00	1.16	.75 EF Gas Water Heater (Replacing .594 EF)
10097	Water Heating	Smart Water Heater - Tank Controls and Sensors_ET	MF	N/A	Retrofit	149.9	15%	22.5	10	120.0	\$60.00	1.41	Smart WH Controls
10098	Water Heating	Bathroom Aerator 1.0 gpm	MF	NLI	Retrofit	2.5	47%	1.2	10	0.5	\$0.52	8.63	1.0 GPM Bathroom FA
10099	Water Heating	Kitchen Flip Aerator 1.5 gpm	MF	NLI	Retrofit	12.1	39%	4.7	10	1.3	\$1.34	13.08	1.5 GPM Kitchen FA
10100	Water Heating	Low Flow Showerhead 1.5 gpm	MF	NLI	Retrofit	28.6	43%	12.3	10	1.3	\$1.34	34.48	1.5 GPM Low Flow Showerhead

Vectren Gas South		Residential Measure Assumptions											
Measure #	End-Use	Measure Name	Home Type	Income Type	Replacement Type	Base Natural Gas Use (therms)	% Savings	Per unit Natural Gas Savings (therms)	Useful Life	Initial Measure Cost	Historical Incentive Amount	UCT Ratio	Measure Description
10101	Water Heating	Thermostatic Restrictor Shower Valve	MF	N/A	Retrofit	28.6	11%	3.3	10	30.0	\$15.00	0.82	Thermostatic Restrictor Shower Valve (on base flow device)
10102	Water Heating	Shower Timer	MF	N/A	Retrofit	28.6	9%	2.5	2	5.0	\$5.00	0.43	Shower Timer limit time to 5 mins (per shower)
10103	Water Heating	Drain water Heat Recovery	MF	N/A	Retrofit	149.9	25%	37.5	20	742.0	\$225.00	1.04	Drainpipe heat exchanger
10104	Water Heating	Bathroom Aerator 1.0 gpm	MF	LI	DI	2.5	47%	1.2	10	0.5	\$0.52	8.63	1.0 GPM Bathroom FA
10105	Water Heating	Kitchen Flip Aerator 1.5 gpm	MF	LI	DI	12.1	39%	4.7	10	1.3	\$1.34	13.08	1.5 GPM Kitchen FA
10106	Water Heating	Low Flow Showerhead 1.5 gpm	MF	LI	DI	28.6	43%	12.3	10	1.3	\$1.34	34.48	1.5 GPM Low Flow Showerhead
10107	Water Heating	Pipe Wrap	MF	LI	DI	149.9	3%	4.5	15	1.7	\$1.72	13.46	Adding Pipe Wrap to Uninsulated Pipes
10108	Water Heating	Water Heater Temperature Setback	MF	LI	DI	32.3	11%	3.6	15	6.5	\$6.50	2.84	WH Temp Setback from 135 to 120
10109	Water Heating	Water Heater Temperature Setback	MF	N/A	NC	32.3	11%	3.6	15	6.5	\$6.50	2.84	WH Temp Setback from 135 to 120
10110	Water Heating	Pipe Wrap	MF	N/A	NC	149.9	3%	4.5	15	1.7	\$1.72	13.46	Adding Pipe Wrap to Uninsulated Pipes
10111	Water Heating	Natural Gas Water Heater .67EF	MF	N/A	NC	149.9	11%	17.0	13	175.0	\$175.00	0.45	.67 EF Gas Water Heater (Replacing .594 EF)
10112	Water Heating	Natural Gas Water Heater .77EF	MF	N/A	NC	149.9	26%	38.6	13	685.0	\$200.00	0.89	.80 EF Gas Water Heater (Replacing .594 EF)
10113	Water Heating	Tankless Water Heater	MF	N/A	NC	149.9	21%	31.2	13	407.0	\$125.00	1.16	.75 EF Gas Water Heater (Replacing .594 EF)
10114	Water Heating	Smart Water Heater - Tank Controls and Sensors_ET	MF	N/A	NC	149.9	15%	22.5	10	120.0	\$60.00	1.41	Smart WH Controls
10115	Water Heating	Bathroom Aerator 1.0 gpm	MF	N/A	NC	2.5	47%	1.2	10	0.5	\$0.52	8.63	1.0 GPM Bathroom FA
10116	Water Heating	Kitchen Flip Aerator 1.5 gpm	MF	N/A	NC	12.1	39%	4.7	10	1.3	\$1.34	13.08	1.5 GPM Kitchen FA
10117	Water Heating	Low Flow Showerhead 1.5 gpm	MF	N/A	NC	28.6	43%	12.3	10	1.3	\$1.34	34.48	1.5 GPM Low Flow Showerhead
10118	Water Heating	Thermostatic Restrictor Shower Valve	MF	N/A	NC	28.6	11%	3.3	10	30.0	\$15.00	0.82	Thermostatic Restrictor Shower Valve (on base flow device)
10119	Water Heating	Shower Timer	MF	N/A	NC	28.6	9%	2.5	2	5.0	\$5.00	0.43	Shower Timer limit time to 5 mins (per shower)
10120	Water Heating	Drain water Heat Recovery	MF	N/A	NC	149.9	25%	37.5	20	742.0	\$225.00	1.04	Drainpipe heat exchanger
Key Acronyms													
DI:	Direct-install												
LI:	Low-income												
MF:	Multifamily												
MO:	Market opportunity												
NC:	New Construction												
NLI:	Non-low-income												
SF:	Single-family												

Vectren Gas North		Residential Measure Assumptions											
Measure #	End-Use	Measure Name	Home Type	Income Type	Replacement Type	Base Natural Gas Use (therms)	% Savings	Per unit Natural Gas Savings (therms)	Useful Life	Initial Measure Cost	Historical Incentive Amount	UCT Ratio	Measure Description
1095	Appliances	ENERGY STAR Clothes Dryer (NG)	SF	NLI	MO	2.2	21%	0.5	16	152.0	\$75.00	0.33	ES Qualified Dryer (CEF=3.93)
1096	Appliances	Smart Clothes Dryer (NG)_ET	SF	NLI	MO	2.2	26%	0.6	16	236.0	\$120.00	0.26	Smart ES Qualified Dryer (5.5% additional energy savings)
1097	Appliances	Dryer Vent Cleaning (NG)	SF	LI	DI	2.2	6%	0.1	2	80.0	\$80.00	0.01	Dryer Vent Cleaning (5.5% Savings)
1098	Appliances	ENERGY STAR Clothes Washer (NG WH/E Dryer)	SF	N/A	MO	0.6	8%	0.0	14	84.0	\$40.00	0.06	ES Qualified ClothesWasher (IMEF=2.23 ; 1.75 Baseline)
1099	Appliances	ENERGY STAR Clothes Washer (NG WH/NG Dryer)	SF	N/A	MO	2.1	20%	0.4	14	84.0	\$40.00	0.50	ES Qualified ClothesWasher (IMEF=2.23 ; 1.75 Baseline)
1100	Appliances	Smart/CEE Tier3 Clothes Washer (NG WH/E Dryer)_ET	SF	N/A	MO	0.6	78%	0.5	14	141.0	\$70.00	0.33	CEE Tier 3 Qualified ClothesWasher (IMEF=2.92 ; 1.75 Baseline)
1101	Appliances	Smart/CEE Tier3 Clothes Washer (NG WH/NG Dryer)_ET	SF	N/A	MO	2.1	44%	0.9	14	141.0	\$70.00	0.64	CEE Tier 3 Qualified ClothesWasher (IMEF=2.92 ; 1.75 Baseline)
1102	Appliances	ENERGY STAR Dishwasher (NG WH)	SF	N/A	MO	0.7	12%	0.1	11	79.0	\$40.00	0.09	ES Qualified Dishwasher (v3.0)
1103	Appliances	Smart Dishwasher (NG WH)_ET	SF	N/A	MO	0.7	15%	0.1	11	395.0	\$200.00	0.02	Smart ES Qualified Dishwasher (v3.0)
1104	Appliances	ENERGY STAR Clothes Dryer (NG)	SF	N/A	NC	2.2	21%	0.5	16	152.0	\$75.00	0.33	ES Qualified Dryer (CEF=3.93)
1105	Appliances	Smart Clothes Dryer (NG)_ET	SF	N/A	NC	2.2	26%	0.6	16	236.0	\$120.00	0.26	Smart ES Qualified Dryer (5.5% additional energy savings)
1106	Appliances	ENERGY STAR Clothes Washer (NG WH/E Dryer)	SF	N/A	NC	0.6	8%	0.0	14	84.0	\$40.00	0.06	ES Qualified ClothesWasher (IMEF=2.23 ; 1.75 Baseline)
1107	Appliances	ENERGY STAR Clothes Washer (NG WH/NG Dryer)	SF	N/A	NC	2.1	20%	0.4	14	84.0	\$40.00	0.50	ES Qualified ClothesWasher (IMEF=2.23 ; 1.75 Baseline)
1108	Appliances	Smart/CEE Tier3 Clothes Washer (NG WH/E Dryer)_ET	SF	N/A	NC	0.6	78%	0.5	14	141.0	\$70.00	0.33	CEE Tier 3 Qualified ClothesWasher (IMEF=2.92 ; 1.75 Baseline)
1109	Appliances	Smart/CEE Tier3 Clothes Washer (NG WH/NG Dryer)_ET	SF	N/A	NC	2.1	44%	0.9	14	141.0	\$70.00	0.64	CEE Tier 3 Qualified ClothesWasher (IMEF=2.92 ; 1.75 Baseline)
1110	Appliances	ENERGY STAR Dishwasher (NG WH)	SF	N/A	NC	0.7	12%	0.1	11	79.0	\$40.00	0.09	ES Qualified Dishwasher (v3.0)
1111	Appliances	Smart Dishwasher (NG WH)_ET	SF	N/A	NC	0.7	15%	0.1	11	395.0	\$200.00	0.02	Smart ES Qualified Dishwasher (v3.0)
1112	Appliances	ENERGY STAR Clothes Dryer (NG)	MF	NLI	MO	2.2	21%	0.5	16	152.0	\$75.00	0.33	ES Qualified Dryer (CEF=3.93)
1113	Appliances	Smart Clothes Dryer (NG)	MF	NLI	MO	2.2	26%	0.6	16	236.0	\$120.00	0.26	Smart ES Qualified Dryer (5.5% additional energy savings)
1114	Appliances	Dryer Vent Cleaning (NG)	MF	LI	DI	2.2	6%	0.1	2	80.0	\$80.00	0.01	Dryer Vent Cleaning (5.5% Savings)
1115	Appliances	ENERGY STAR Clothes Washer (NG WH/E Dryer)	MF	N/A	MO	0.6	8%	0.0	14	84.0	\$40.00	0.06	ES Qualified ClothesWasher (IMEF=2.23 ; 1.75 Baseline)
1116	Appliances	ENERGY STAR Clothes Washer (NG WH/NG Dryer)	MF	N/A	MO	2.1	20%	0.4	14	84.0	\$40.00	0.50	ES Qualified ClothesWasher (IMEF=2.23 ; 1.75 Baseline)
1117	Appliances	Smart/CEE Tier3 Clothes Washer (NG WH/E Dryer)_ET	MF	N/A	MO	0.6	78%	0.5	14	141.0	\$70.00	0.33	CEE Tier 3 Qualified ClothesWasher (IMEF=2.92 ; 1.75 Baseline)
1118	Appliances	Smart/CEE Tier3 Clothes Washer (NG WH/NG Dryer)_ET	MF	N/A	MO	2.1	44%	0.9	14	141.0	\$70.00	0.64	CEE Tier 3 Qualified ClothesWasher (IMEF=2.92 ; 1.75 Baseline)
1119	Appliances	ENERGY STAR Dishwasher (NG WH)	MF	N/A	MO	0.7	12%	0.1	11	79.0	\$40.00	0.09	ES Qualified Dishwasher (v3.0)

Vectren Gas North		Residential Measure Assumptions											
Measure #	End-Use	Measure Name	Home Type	Income Type	Replacement Type	Base Natural Gas Use (therms)	% Savings	Per unit Natural Gas Savings (therms)	Useful Life	Initial Measure Cost	Historical Incentive Amount	UCT Ratio	Measure Description
1120	Appliances	Smart Dishwasher (NG WH)_ET	MF	N/A	MO	0.7	15%	0.1	11	395.0	\$200.00	0.02	Smart ES Qualified Dishwasher (v3.0)
1121	Appliances	ENERGY STAR Clothes Dryer (NG)	MF	N/A	NC	2.2	21%	0.5	16	152.0	\$75.00	0.33	ES Qualified Dryer (CEF=3.93)
1122	Appliances	Smart Clothes Dryer (NG)_ET	MF	N/A	NC	2.2	26%	0.6	16	236.0	\$120.00	0.26	Smart ES Qualified Dryer (5.5% additional energy savings)
1123	Appliances	ENERGY STAR Clothes Washer (NG WH/E Dryer)	MF	N/A	NC	0.6	8%	0.0	14	84.0	\$40.00	0.06	ES Qualified ClothesWasher (IMEF=2.23 ; 1.75 Baseline)
1124	Appliances	ENERGY STAR Clothes Washer (NG WH/NG Dryer)	MF	N/A	NC	2.1	20%	0.4	14	84.0	\$40.00	0.50	ES Qualified ClothesWasher (IMEF=2.23 ; 1.75 Baseline)
1125	Appliances	Smart/CEE Tier3 Clothes Washer (NG WH/E Dryer)_ET	MF	N/A	NC	0.6	78%	0.5	14	141.0	\$70.00	0.33	CEE Tier 3 Qualified ClothesWasher (IMEF=2.92 ; 1.75 Baseline)
1126	Appliances	Smart/CEE Tier3 Clothes Washer (NG WH/NG Dryer)_ET	MF	N/A	NC	2.1	44%	0.9	14	141.0	\$70.00	0.64	CEE Tier 3 Qualified ClothesWasher (IMEF=2.92 ; 1.75 Baseline)
1127	Appliances	ENERGY STAR Dishwasher (NG WH)	MF	N/A	NC	0.7	12%	0.1	11	79.0	\$40.00	0.09	ES Qualified Dishwasher (v3.0)
1128	Appliances	Smart Dishwasher (NG WH)_ET	MF	N/A	NC	0.7	15%	0.1	11	395.0	\$200.00	0.02	Smart ES Qualified Dishwasher (v3.0)
2013	Audit	Audit Recommendations (gas) - Single-family	SF	NLI	Retrofit	80.8	1%	1.0	1	80.0	\$80.00	0.05	Walk through audit and recommendations for behavioral and installation measures
2014	Audit	Audit Recommendations (gas) - Single-family	SF	LI	DI	80.8	1%	1.0	1	80.0	\$80.00	0.05	Walk through audit and recommendations for behavioral and installation measures
2015	Audit	Audit Recommendations (gas) - Multifamily	MF	NLI	Retrofit	37.9	3%	1.0	1	80.0	\$80.00	0.05	Walk through audit and recommendations for behavioral and installation measures
2016	Audit	Audit Recommendations (gas) - Multifamily	MF	LI	DI	37.9	3%	1.0	1	80.0	\$80.00	0.05	Walk through audit and recommendations for behavioral and installation measures
2017	Audit	Audit Recommendations (gas) - Mobile	Mobile	NLI	Retrofit	80.8	1%	1.0	1	80.0	\$80.00	0.05	Walk through audit and recommendations for behavioral and installation measures
2018	Audit	Audit Recommendations (gas) - Mobile	Mobile	LI	DI	80.8	1%	1.0	1	80.0	\$80.00	0.05	Walk through audit and recommendations for behavioral and installation measures
3031	Behavioral	Home Energy Reports (Gas furnace/CAC)	SF	N/A	Opt-Out	91.9	1%	1.1	1	7.9	\$3.15	1.65	Distribution of home energy reports encouraging adoption of energy-savings improvements
3032	Behavioral	Pre-pay (Gas furnace/CAC)	SF	N/A	Opt-In	91.9	11%	10.1	3	40.0	\$0.00	1.E+08	Pre-pay billing
3033	Behavioral	Home Energy Management System (Gas furnace/CAC)	SF	N/A	Retrofit	91.9	3%	3.0	5	90.0	\$45.00	1.37	HEMS are hardware and software systems that can control and monitor one or more energy uses in the home
3034	Behavioral	Home Energy Reports (Gas furnace/CAC)	SF	N/A	NC	41.1	1%	0.5	1	7.9	\$3.15	0.74	Distribution of home energy reports encouraging adoption of energy-savings improvements
3035	Behavioral	Pre-pay (Gas furnace/CAC)	SF	N/A	NC	41.1	11%	4.5	3	40.0	\$0.00	6.E+07	Pre-pay billing
3036	Behavioral	Home Energy Management System (Gas furnace/CAC)	SF	N/A	NC	41.1	3%	1.3	5	90.0	\$45.00	0.61	HEMS are hardware and software systems that can control and monitor one or more energy uses in the home

Vectren Gas North		Residential Measure Assumptions											
Measure #	End-Use	Measure Name	Home Type	Income Type	Replacement Type	Base Natural Gas Use (therms)	% Savings	Per unit Natural Gas Savings (therms)	Useful Life	Initial Measure Cost	Historical Incentive Amount	UCT Ratio	Measure Description
3037	Behavioral	Home Energy Reports (Gas furnace/CAC)	MF	N/A	Opt-Out	42.7	1%	0.5	1	7.9	\$3.15	0.77	Distribution of home energy reports encouraging adoption of energy-savings improvements
3038	Behavioral	Pre-pay (Gas furnace/CAC)	MF	N/A	Opt-In	42.7	11%	4.7	3	40.0	\$0.00	6.E+07	Pre-pay billing
3039	Behavioral	Home Energy Management System (Gas furnace/CAC)	MF	N/A	Retrofit	42.7	3%	1.4	5	90.0	\$45.00	0.64	HEMS are hardware and software systems that can control and monitor one or more energy uses in the home
3040	Behavioral	Home Energy Reports (Gas furnace/CAC)	MF	N/A	NC	22.9	1%	0.3	1	7.9	\$3.15	0.41	Distribution of home energy reports encouraging adoption of energy-savings improvements
3041	Behavioral	Pre-pay (Gas furnace/CAC)	MF	N/A	NC	22.9	11%	2.5	3	40.0	\$0.00	3.E+07	Pre-pay billing
3042	Behavioral	Home Energy Management System (Gas furnace/CAC)	MF	N/A	NC	22.9	3%	0.7	5	90.0	\$45.00	0.34	HEMS are hardware and software systems that can control and monitor one or more energy uses in the home
4156	HVAC Equipment	Smart Thermostat - Gas / CAC	SF	NLI	Retrofit	64.7	11%	7.0	15	154.0	\$60.00	6.05	Smart thermostat
4157	HVAC Equipment	WIFI Thermostat - Gas / CAC	SF	NLI	Retrofit	64.7	3%	2.2	15	103.2	\$50.00	2.25	Wifi (non-smart) thermostat
4158	HVAC Equipment	Filter Whistle	SF	NLI	Retrofit	64.7	2%	1.2	15	1.6	\$1.60	38.68	Whistle to remind owners to change air filter
4159	HVAC Equipment	Smart Thermostat - Gas / CAC	SF	LI	DI	64.7	11%	7.0	15	154.0	\$154.00	2.36	Smart thermostat
4160	HVAC Equipment	WIFI Thermostat - Gas / CAC	SF	LI	DI	64.7	3%	2.2	15	103.2	\$103.20	1.09	Wifi (non-smart) thermostat
4161	HVAC Equipment	Filter Whistle	SF	LI	DI	64.7	2%	1.2	15	1.6	\$1.60	38.68	Whistle to remind owners to change air filter
4162	HVAC Equipment	Programmable Thermostat - Gas / CAC	SF	N/A	Retrofit	64.7	2%	1.5	15	35.0	\$10.00	7.53	Programmable thermostat
4163	HVAC Equipment	Smart Vents/Sensors_ET	SF	N/A	Retrofit	64.7	10%	6.5	15	800.0	\$400.00	0.84	Smart vents relay temperature and occupancy information to a smart thermostat (or other control device) to reduce energy waste in unoccupied areas of the home
4164	HVAC Equipment	Programmable Thermostat - Gas / CAC	SF	N/A	NC	42.9	2%	1.0	18	35.0	\$10.00	5.62	Programmable thermostat
4165	HVAC Equipment	Smart Thermostat - Gas / CAC	SF	N/A	NC	42.9	11%	4.7	15	154.0	\$60.00	4.01	Smart thermostat
4166	HVAC Equipment	WIFI Thermostat - Gas / CAC	SF	N/A	NC	42.9	3%	1.4	15	103.2	\$50.00	1.50	Wifi (non-smart) thermostat
4167	HVAC Equipment	Filter Whistle	SF	N/A	NC	42.9	2%	0.8	15	1.6	\$1.64	25.02	Whistle to remind owners to change air filter
4168	HVAC Equipment	Smart Vents/Sensors_ET	SF	N/A	NC	42.9	10%	4.3	15	800.0	\$400.00	0.55	Smart vents relay temperature and occupancy information to a smart thermostat (or other control device) to reduce energy waste in unoccupied areas of the home
4169	HVAC Equipment	Smart Thermostat - Gas / CAC	MF	NLI	Retrofit	21.1	11%	2.3	15	154.0	\$60.00	1.97	Smart thermostat
4170	HVAC Equipment	WIFI Thermostat - Gas / CAC	MF	NLI	Retrofit	21.1	3%	0.7	15	103.2	\$50.00	0.73	Wifi (non-smart) thermostat
4171	HVAC Equipment	Filter Whistle	MF	NLI	Retrofit	21.1	2%	0.4	15	1.6	\$1.64	12.29	Whistle to remind owners to change air filter

Vectren Gas North		Residential Measure Assumptions											
Measure #	End-Use	Measure Name	Home Type	Income Type	Replacement Type	Base Natural Gas Use (therms)	% Savings	Per unit Natural Gas Savings (therms)	Useful Life	Initial Measure Cost	Historical Incentive Amount	UCT Ratio	Measure Description
4172	HVAC Equipment	Smart Thermostat - Gas / CAC	MF	LI	DI	21.1	11%	2.3	15	154.0	\$154.00	0.77	Smart thermostat
4173	HVAC Equipment	WIFI Thermostat - Gas / CAC	MF	LI	DI	21.1	3%	0.7	15	103.2	\$103.20	0.36	Wifi (non-smart) thermostat
4174	HVAC Equipment	Filter Whistle	MF	LI	DI	21.1	2%	0.4	15	1.6	\$1.64	12.29	Whistle to remind owners to change air filter
4175	HVAC Equipment	Programmable Thermostat - Gas / CAC	MF	N/A	Retrofit	21.1	2%	0.5	15	35.0	\$10.00	2.45	Programmable thermostat
4176	HVAC Equipment	Smart Vents/Sensors_ET	MF	N/A	Retrofit	21.1	10%	2.1	15	800.0	\$400.00	0.27	Smart vents relay temperature and occupancy information to a smart thermostat (or other control device) to reduce energy waste in unoccupied areas of the home
4177	HVAC Equipment	Programmable Thermostat - Gas / CAC	MF	N/A	NC	22.9	2%	0.5	15	35.0	\$10.00	2.67	Programmable thermostat
4178	HVAC Equipment	Smart Thermostat - Gas / CAC	MF	N/A	NC	22.9	11%	2.5	15	154.0	\$60.00	2.14	Smart thermostat
4179	HVAC Equipment	WIFI Thermostat - Gas / CAC	MF	N/A	NC	22.9	3%	0.8	15	103.2	\$50.00	0.80	Wifi (non-smart) thermostat
4180	HVAC Equipment	Filter Whistle	MF	N/A	NC	22.9	2%	0.4	15	1.6	\$1.64	13.36	Whistle to remind owners to change air filter
4181	HVAC Equipment	Smart Vents/Sensors_ET	MF	N/A	NC	22.9	10%	2.3	15	800.0	\$400.00	0.30	Smart vents relay temperature and occupancy information to a smart thermostat (or other control device) to reduce energy waste in unoccupied areas of the home
4182	HVAC Equipment	Furnace Tune Up	SF	NLI	Retrofit	64.7	5%	3.2	2	50.0	\$50.00	0.57	Furnace tune-up
4183	HVAC Equipment	Natural Gas Furnaces (>95% AFUE)	SF	NLI	MO	75.6	22%	16.3	20	833.0	\$250.00	4.06	95 AFUE furnace
4184	HVAC Equipment	Furnace Tune Up	SF	LI	DI	64.7	5%	3.2	2	200.0	\$200.00	0.14	Furnace tune-up
4185	HVAC Equipment	Natural Gas Furnaces (>95% AFUE)	SF	LI	DI	75.6	22%	16.3	20	3700.0	\$3,700.00	0.27	95 AFUE furnace
4186	HVAC Equipment	Natural Gas Furnaces (>97% AFUE)	SF	NLI	MO	75.6	23%	17.6	20	1000.0	\$300.00	3.64	97 AFUE furnace
4187	HVAC Equipment	Boiler Tune Up	SF	N/A	Retrofit	77.8	5%	3.9	5	140.0	\$40.00	2.03	Boiler tune-up
4188	HVAC Equipment	Natural Gas Boilers (>90% AFUE)	SF	N/A	MO	77.8	14%	11.0	18	1000.0	\$300.00	2.14	90 AFUE boiler
4189	HVAC Equipment	Natural Gas Boilers (>92% AFUE)	SF	N/A	MO	77.8	16%	12.5	18	1200.0	\$360.00	2.02	92 AFUE boiler
4190	HVAC Equipment	Dual Fuel Air Source Heat Pump 16 SEER	SF	N/A	MO	64.7	21%	13.5	18	837.0	\$300.00	2.62	16 SEER Dual-fuel heat pump
4191	HVAC Equipment	Dual Fuel Air Source Heat Pump 18 SEER	SF	N/A	MO	64.7	21%	13.5	15	1123.0	\$500.00	1.40	18 SEER Dual-fuel heat pump
4192	HVAC Equipment	Natural Gas Furnaces (>95% AFUE)	SF	N/A	NC	48.2	16%	7.6	20	833.0	\$250.00	1.89	95 AFUE furnace
4193	HVAC Equipment	Natural Gas Furnaces (>97% AFUE)	SF	N/A	NC	48.2	18%	8.5	20	1000.0	\$300.00	1.75	97 AFUE furnace
4194	HVAC Equipment	Natural Gas Boilers (>90% AFUE)	SF	N/A	NC	51.3	10%	5.3	18	1000.0	\$300.00	1.02	90 AFUE boiler

Vectren Gas North		Residential Measure Assumptions											
Measure #	End-Use	Measure Name	Home Type	Income Type	Replacement Type	Base Natural Gas Use (therms)	% Savings	Per unit Natural Gas Savings (therms)	Useful Life	Initial Measure Cost	Historical Incentive Amount	UCT Ratio	Measure Description
4195	HVAC Equipment	Natural Gas Boilers (>92% AFUE)	SF	N/A	NC	51.3	12%	6.2	18	1200.0	\$360.00	1.01	92 AFUE boiler
4196	HVAC Equipment	Dual Fuel Air Source Heat Pump 16 SEER	SF	N/A	NC	42.9	17%	7.1	15	837.0	\$300.00	1.23	16 SEER Dual-fuel heat pump
4197	HVAC Equipment	Dual Fuel Air Source Heat Pump 18 SEER	SF	N/A	NC	42.9	17%	7.1	15	1123.0	\$500.00	0.74	18 SEER Dual-fuel heat pump
4198	HVAC Equipment	Furnace Tune Up	MF	NLI	Retrofit	21.1	5%	1.1	2	50.0	\$50.00	0.19	Furnace tune-up
4199	HVAC Equipment	Natural Gas Furnaces (>95% AFUE)	MF	NLI	MO	23.7	16%	3.7	20	833.0	\$250.00	0.93	95 AFUE furnace
4200	HVAC Equipment	Furnace Tune Up	MF	LI	DI	21.1	5%	1.1	2	200.0	\$200.00	0.05	Furnace tune-up
4201	HVAC Equipment	Natural Gas Furnaces (>95% AFUE)	MF	LI	DI	23.7	16%	3.7	20	3700.0	\$3,700.00	0.06	95 AFUE furnace
4202	HVAC Equipment	Natural Gas Furnaces (>97% AFUE)	MF	NLI	MO	23.7	18%	4.2	20	1000.0	\$300.00	0.86	97 AFUE furnace
4203	HVAC Equipment	Boiler Tune Up	MF	N/A	Retrofit	23.7	5%	1.2	5	140.0	\$40.00	0.62	Boiler tune-up
4204	HVAC Equipment	Natural Gas Boilers (>90% AFUE)	MF	N/A	MO	23.7	13%	3.0	18	1000.0	\$300.00	0.58	90 AFUE boiler
4205	HVAC Equipment	Natural Gas Boilers (>92% AFUE)	MF	N/A	MO	23.7	14%	3.4	18	1200.0	\$360.00	0.55	92 AFUE boiler
4206	HVAC Equipment	Dual Fuel Air Source Heat Pump 16 SEER	MF	N/A	MO	21.1	11%	2.4	15	837.0	\$300.00	0.41	16 SEER Dual-fuel heat pump
4207	HVAC Equipment	Dual Fuel Air Source Heat Pump 18 SEER	MF	N/A	MO	21.1	11%	2.4	15	1123.0	\$500.00	0.24	18 SEER Dual-fuel heat pump
4208	HVAC Equipment	Natural Gas Furnaces (>95% AFUE)	MF	N/A	NC	22.9	28%	6.4	20	833.0	\$250.00	1.58	95 AFUE furnace
4209	HVAC Equipment	Natural Gas Furnaces (>97% AFUE)	MF	N/A	NC	22.9	29%	6.7	20	1000.0	\$300.00	1.39	97 AFUE furnace
4210	HVAC Equipment	Natural Gas Boilers (>90% AFUE)	MF	N/A	NC	22.8	26%	5.9	18	1000.0	\$300.00	1.15	90 AFUE boiler
4211	HVAC Equipment	Natural Gas Boilers (>92% AFUE)	MF	N/A	NC	22.8	28%	6.3	18	1200.0	\$360.00	1.02	92 AFUE boiler
4212	HVAC Equipment	Dual Fuel Air Source Heat Pump 16 SEER	MF	N/A	NC	22.9	22%	4.9	15	837.0	\$300.00	0.85	16 SEER Dual-fuel heat pump
4213	HVAC Equipment	Dual Fuel Air Source Heat Pump 18 SEER	MF	N/A	NC	22.9	22%	4.9	5	1123.0	\$500.00	0.21	18 SEER Dual-fuel heat pump
7009	New Construction	Gold Star: HERS Index Score ≤ 63 - Gas Heated	SF	N/A	NC	41.1	37%	15.2	25	1573.3	\$175.00	6.13	Construction of home meeting Gold Star standard (HERS ≤63)
7010	New Construction	Platinum Star: HERS Index Score ≤ 60 - Gas Heated	SF	N/A	NC	41.1	40%	16.4	25	1778.3	\$200.00	5.80	Construction of home meeting Platinum Star standard (HERS ≤60)
7011	New Construction	Gold Star: HERS Index Score ≤ 63 - Gas Heated	MF	N/A	NC	22.9	37%	8.5	25	1573.3	\$775.00	0.77	Construction of home meeting Gold Star standard (HERS ≤63)
7012	New Construction	Platinum Star: HERS Index Score ≤ 60 - Gas Heated	MF	N/A	NC	22.9	40%	9.2	25	1778.3	\$900.00	0.72	Construction of home meeting Platinum Star standard (HERS ≤60)
9168	HVAC Shell	Duct Sealing - Average Sealing - Gas Heating	SF	NLI	Retrofit	74.4	2%	1.8	20	200.0	\$175.00	0.64	15% to 10% leakage
9169	HVAC Shell	Duct Sealing - Inadequate Sealing - Gas Heating	SF	NLI	Retrofit	75.2	4%	3.2	20	350.0	\$300.00	0.66	20% to 15% leakage
9170	HVAC Shell	Duct Sealing - Poor Sealing - Gas Heating	SF	NLI	Retrofit	76.0	9%	7.1	20	1442.5	\$1,000.00	0.44	25% to 15% leakage
9171	HVAC Shell	Wall Insulation - Gas Heating	SF	NLI	Retrofit	96.5	33%	31.8	25	2746.8	\$450.00	4.99	R0 to R11 wall insulation

Vectren Gas North		Residential Measure Assumptions											
Measure #	End-Use	Measure Name	Home Type	Income Type	Replacement Type	Base Natural Gas Use (therms)	% Savings	Per unit Natural Gas Savings (therms)	Useful Life	Initial Measure Cost	Historical Incentive Amount	UCT Ratio	Measure Description
9172	HVAC Shell	Air Sealing - Average Sealing - Gas Heating	SF	NLI	Retrofit	64.7	15%	9.6	15	624.7	\$100.00	4.99	10 ACH 50 to 7 ACH 50
9173	HVAC Shell	Air Sealing - Inadequate Sealing - Gas Heating	SF	NLI	Retrofit	77.7	17%	13.0	15	967.2	\$100.00	6.72	14 ACH 50 to 10 ACH 50
9174	HVAC Shell	Air Sealing - Poor Sealing - Gas Heating	SF	NLI	Retrofit	97.2	20%	19.5	15	967.2	\$100.00	10.10	20 ACH 50 to 14 ACH 50
9175	HVAC Shell	Attic Insulation - Average Insulation - Gas Heating	SF	NLI	Retrofit	64.7	3%	1.7	25	1259.7	\$450.00	0.27	R30 to R60
9176	HVAC Shell	Attic Insulation - Inadequate Insulation - Gas Heating	SF	NLI	Retrofit	66.9	6%	3.9	25	1744.2	\$450.00	0.62	R19 to R60
9177	HVAC Shell	Attic Insulation - Poor Insulation - Gas Heating	SF	NLI	Retrofit	70.6	10%	7.2	25	1550.4	\$450.00	1.13	R11 to R49
9178	HVAC Shell	Duct Sealing - Average Sealing - Gas Heating	SF	LI	DI	74.4	2%	1.8	20	200.0	\$175.00	0.64	15% to 10% leakage
9179	HVAC Shell	Duct Sealing - Inadequate Sealing - Gas Heating	SF	LI	DI	75.2	4%	3.2	20	350.0	\$300.00	0.66	20% to 15% leakage
9180	HVAC Shell	Duct Sealing - Poor Sealing - Gas Heating	SF	LI	DI	76.0	9%	7.1	20	1442.5	\$1,442.50	0.31	25% to 15% leakage
9181	HVAC Shell	Wall Insulation - Gas Heating	SF	LI	DI	96.5	33%	31.8	25	2746.8	\$2,746.80	0.82	R0 to R11 wall insulation
9182	HVAC Shell	Air Sealing - Average Sealing - Gas Heating	SF	LI	DI	64.7	15%	9.6	15	624.7	\$624.70	0.80	10 ACH 50 to 7 ACH 50
9183	HVAC Shell	Air Sealing - Inadequate Sealing - Gas Heating	SF	LI	DI	77.7	17%	13.0	15	967.2	\$967.20	0.70	14 ACH 50 to 10 ACH 50
9184	HVAC Shell	Air Sealing - Poor Sealing - Gas Heating	SF	LI	DI	97.2	20%	19.5	15	967.2	\$967.20	1.04	20 ACH 50 to 14 ACH 50
9185	HVAC Shell	Attic Insulation - Average Insulation - Gas Heating	SF	LI	DI	64.7	3%	1.7	25	1259.7	\$1,259.70	0.10	R30 to R60
9186	HVAC Shell	Attic Insulation - Inadequate Insulation - Gas Heating	SF	LI	DI	66.9	6%	3.9	25	1744.2	\$1,744.20	0.16	R19 to R60
9187	HVAC Shell	Attic Insulation - Poor Insulation - Gas Heating	SF	LI	DI	70.6	10%	7.2	25	1550.4	\$1,550.40	0.33	R11 to R49
9188	HVAC Shell	Wall Sheathing - Gas Heating	SF	N/A	Retrofit	64.7	16%	10.7	20	2943.0	\$1,000.00	0.66	R12 polyiso
9189	HVAC Shell	ENERGY STAR Windows - Gas Heating	SF	N/A	Retrofit	64.7	3%	1.9	25	14205.8	\$1,000.00	0.14	U=0.30; SHGC=0.40
9190	HVAC Shell	Basement Sidewall Insulation - Gas Heating	SF	N/A	Retrofit	71.9	10%	7.2	25	2720.0	\$1,000.00	0.51	R0 to R13 sidewall insulation
9191	HVAC Shell	Floor Insulation Above Crawlspace - Gas Heating	SF	N/A	Retrofit	66.6	3%	2.0	25	316.2	\$90.00	1.54	R13 floor insulation
9192	HVAC Shell	ENERGY STAR Door - Gas Heating	SF	N/A	Retrofit	64.7	2%	1.3	25	388.0	\$120.00	0.78	Fiberglass
9193	HVAC Shell	Smart Window Coverings - Shade/Blind/Controller/Sensor - Gas Heating_ET	SF	N/A	Retrofit	64.7	16%	10.0	7	14875.0	\$1,000.00	0.28	Smart shades
9194	HVAC Shell	Smart Window Coverings - Film/Transformer - Gas Heating_ET	SF	N/A	Retrofit	64.7	16%	10.0	7	8160.8	\$1,000.00	0.28	Smart films
9195	HVAC Shell	Duct Sealing - Average Sealing - Gas Heating	MF	NLI	Retrofit	24.2	20%	5.0	20	200.0	\$175.00	1.76	15% to 10% leakage
9196	HVAC Shell	Duct Sealing - Inadequate Sealing - Gas Heating	MF	NLI	Retrofit	24.7	8%	1.9	20	350.0	\$300.00	0.39	20% to 15% leakage
9197	HVAC Shell	Duct Sealing - Poor Sealing - Gas Heating	MF	NLI	Retrofit	25.4	20%	5.0	20	981.0	\$500.00	0.62	25% to 15% leakage

Vectren Gas North		Residential Measure Assumptions											
Measure #	End-Use	Measure Name	Home Type	Income Type	Replacement Type	Base Natural Gas Use (therms)	% Savings	Per unit Natural Gas Savings (therms)	Useful Life	Initial Measure Cost	Historical Incentive Amount	UCT Ratio	Measure Description
9198	HVAC Shell	Wall Insulation - Gas Heating	MF	NLI	Retrofit	29.8	29%	8.8	25	1159.2	\$450.00	1.37	R0 to R11 wall insulation
9199	HVAC Shell	Air Sealing - Average Sealing - Gas Heating	MF	NLI	Retrofit	21.1	22%	4.6	15	309.7	\$100.00	2.39	10 ACH 50 to 7 ACH 50
9200	HVAC Shell	Air Sealing - Inadequate Sealing - Gas Heating	MF	NLI	Retrofit	27.0	22%	5.9	15	479.5	\$100.00	3.07	14 ACH 50 to 10 ACH 50
9201	HVAC Shell	Air Sealing - Poor Sealing - Gas Heating	MF	NLI	Retrofit	36.3	26%	9.3	15	479.5	\$100.00	4.80	20 ACH 50 to 14 ACH 50
9202	HVAC Shell	Attic Insulation - Average Insulation - Gas Heating	MF	NLI	Retrofit	21.1	10%	2.1	25	1298.7	\$450.00	0.32	R30 to R60
9203	HVAC Shell	Attic Insulation - Inadequate Insulation - Gas Heating	MF	NLI	Retrofit	21.7	13%	2.7	25	1798.2	\$450.00	0.43	R19 to R60
9204	HVAC Shell	Attic Insulation - Poor Insulation - Gas Heating	MF	NLI	Retrofit	22.8	16%	3.7	25	1598.4	\$450.00	0.58	R11 to R49
9205	HVAC Shell	Duct Sealing - Average Sealing - Gas Heating	MF	LI	DI	24.2	20%	5.0	20	200.0	\$175.00	1.76	15% to 10% leakage
9206	HVAC Shell	Duct Sealing - Inadequate Sealing - Gas Heating	MF	LI	DI	24.7	8%	1.9	20	350.0	\$300.00	0.39	20% to 15% leakage
9207	HVAC Shell	Duct Sealing - Poor Sealing - Gas Heating	MF	LI	DI	25.4	20%	5.0	20	981.0	\$981.00	0.32	25% to 15% leakage
9208	HVAC Shell	Wall Insulation - Gas Heating	MF	LI	DI	29.8	29%	8.8	25	1159.2	\$1,159.20	0.53	R0 to R11 wall insulation
9209	HVAC Shell	Air Sealing - Average Sealing - Gas Heating	MF	LI	DI	21.1	22%	4.6	15	309.7	\$309.70	0.77	10 ACH 50 to 7 ACH 50
9210	HVAC Shell	Air Sealing - Inadequate Sealing - Gas Heating	MF	LI	DI	27.0	22%	5.9	15	479.5	\$479.50	0.64	14 ACH 50 to 10 ACH 50
9211	HVAC Shell	Air Sealing - Poor Sealing - Gas Heating	MF	LI	DI	36.3	26%	9.3	15	479.5	\$479.50	1.00	20 ACH 50 to 14 ACH 50
9212	HVAC Shell	Attic Insulation - Average Insulation - Gas Heating	MF	LI	DI	21.1	10%	2.1	25	1298.7	\$1,298.70	0.11	R30 to R60
9213	HVAC Shell	Attic Insulation - Inadequate Insulation - Gas Heating	MF	LI	DI	21.7	13%	2.7	25	1798.2	\$1,798.20	0.11	R19 to R60
9214	HVAC Shell	Attic Insulation - Poor Insulation - Gas Heating	MF	LI	DI	22.8	16%	3.7	25	1598.4	\$1,598.40	0.16	R11 to R49
9215	HVAC Shell	Wall Sheathing - Gas Heating	MF	N/A	Retrofit	21.1	21%	4.5	20	1242.0	\$625.00	0.44	R12 polyiso
9216	HVAC Shell	ENERGY STAR Windows - Gas Heating	MF	N/A	Retrofit	21.1	13%	2.8	25	7043.0	\$1,000.00	0.20	U=0.30; SHGC=0.40
9217	HVAC Shell	Basement Sidewall Insulation - Gas Heating	MF	N/A	Retrofit	24.8	16%	4.0	25	2815.2	\$1,000.00	0.28	R0 to R13 sidewall insulation
9218	HVAC Shell	Floor Insulation Above Crawlspace - Gas Heating	MF	N/A	Retrofit	22.7	4%	0.8	25	849.2	\$425.00	0.14	R13 floor insulation
9219	HVAC Shell	Smart Window Coverings - Shade/Blind/Controller/Sensor - Gas Heating_ET	MF	N/A	Retrofit	21.1	16%	3.3	7	8500.0	\$1,000.00	0.09	Smart shades
9220	HVAC Shell	Smart Window Coverings - Film/Transformer - Gas Heating_ET	MF	N/A	Retrofit	21.1	16%	3.3	7	4046.0	\$1,000.00	0.09	Smart films
10063	Water Heating	Water Heater Temperature Setback	SF	NLI	Retrofit	3.2	11%	0.4	15	6.5	\$6.50	2.85	WH Temp Setback from 135 to 120
10064	Water Heating	Pipe Wrap	SF	NLI	Retrofit	19.9	3%	0.6	15	1.7	\$1.72	17.96	Adding Pipe Wrap to Uninsulated Pipes
10065	Water Heating	Natural Gas Water Heater .67EF	SF	N/A	MO	19.9	11%	2.3	13	175.0	\$175.00	0.60	.67 EF Gas Water Heater (Replacing .594 EF)
10066	Water Heating	Natural Gas Water Heater .77EF	SF	N/A	MO	19.9	26%	5.1	13	685.0	\$200.00	1.20	.80 EF Gas Water Heater (Replacing .594 EF)

Vectren Gas North		Residential Measure Assumptions											
Measure #	End-Use	Measure Name	Home Type	Income Type	Replacement Type	Base Natural Gas Use (therms)	% Savings	Per unit Natural Gas Savings (therms)	Useful Life	Initial Measure Cost	Historical Incentive Amount	UCT Ratio	Measure Description
10067	Water Heating	Tankless Water Heater	SF	N/A	MO	19.9	21%	4.1	13	407.0	\$125.00	1.55	.75 EF Gas Water Heater (Replacing .594 EF)
10068	Water Heating	Smart Water Heater - Tank Controls and Sensors_ET	SF	N/A	Retrofit	19.9	15%	3.0	10	120.0	\$60.00	1.91	Smart WH Controls
10069	Water Heating	Bathroom Aerator 1.0 gpm	SF	NLI	Retrofit	0.2	47%	0.1	10	0.5	\$0.52	7.64	1.0 GPM Bathroom FA
10070	Water Heating	Kitchen Flip Aerator 1.5 gpm	SF	NLI	Retrofit	1.7	39%	0.7	10	1.3	\$1.34	19.19	1.5 GPM Kitchen FA
10071	Water Heating	Low Flow Showerhead 1.5 gpm	SF	NLI	Retrofit	2.7	43%	1.2	10	3.3	\$3.32	13.31	1.5 GPM Low Flow Showerhead
10072	Water Heating	Thermostatic Restrictor Shower Valve	SF	N/A	Retrofit	2.7	11%	0.3	10	30.0	\$15.00	8.E-01	Thermostatic Restrictor Shower Valve (on base flow device)
10073	Water Heating	Shower Timer	SF	N/A	Retrofit	2.7	9%	0.2	2	5.0	\$5.00	0.42	Shower Timer limit time to 5 mins (per shower)
10074	Water Heating	Drain water Heat Recovery	SF	N/A	Retrofit	19.9	25%	5.0	20	742.0	\$225.00	1.38	Drainpipe heat exchanger
10075	Water Heating	Bathroom Aerator 1.0 gpm	SF	LI	DI	0.2	47%	0.1	10	0.5	\$0.52	8.E+00	1.0 GPM Bathroom FA
10076	Water Heating	Kitchen Flip Aerator 1.5 gpm	SF	LI	DI	1.7	39%	0.7	10	1.3	\$1.34	19.19	1.5 GPM Kitchen FA
10077	Water Heating	Low Flow Showerhead 1.5 gpm	SF	LI	DI	2.7	43%	1.2	10	3.3	\$3.32	13.31	1.5 GPM Low Flow Showerhead
10078	Water Heating	Pipe Wrap	SF	LI	DI	19.9	3%	0.6	15	1.7	\$1.72	2.E+01	Adding Pipe Wrap to Uninsulated Pipes
10079	Water Heating	Water Heater Temperature Setback	SF	LI	DI	3.2	11%	0.4	15	6.5	\$6.50	2.85	WH Temp Setback from 135 to 120
10080	Water Heating	Water Heater Temperature Setback	SF	N/A	NC	3.2	11%	0.4	15	6.5	\$6.50	2.85	WH Temp Setback from 135 to 120
10081	Water Heating	Pipe Wrap	SF	N/A	NC	19.9	3%	0.6	15	1.7	\$1.72	2.E+01	Adding Pipe Wrap to Uninsulated Pipes
10082	Water Heating	Natural Gas Water Heater .67EF	SF	N/A	NC	19.9	11%	2.3	13	175.0	\$175.00	0.60	.67 EF Gas Water Heater (Replacing .594 EF)
10083	Water Heating	Natural Gas Water Heater .77EF	SF	N/A	NC	19.9	26%	5.1	13	685.0	\$200.00	1.20	.80 EF Gas Water Heater (Replacing .594 EF)
10084	Water Heating	Tankless Water Heater	SF	N/A	NC	19.9	21%	4.1	13	407.0	\$125.00	1.55	.75 EF Gas Water Heater (Replacing .594 EF)
10085	Water Heating	Smart Water Heater - Tank Controls and Sensors_ET	SF	N/A	NC	19.9	15%	3.0	10	120.0	\$60.00	1.91	Smart WH Controls
10086	Water Heating	Bathroom Aerator 1.0 gpm	SF	N/A	NC	0.2	47%	0.1	10	0.5	\$0.52	7.64	1.0 GPM Bathroom FA
10087	Water Heating	Kitchen Flip Aerator 1.5 gpm	SF	N/A	NC	1.7	39%	0.7	10	1.3	\$1.34	19.19	1.5 GPM Kitchen FA
10088	Water Heating	Low Flow Showerhead 1.5 gpm	SF	N/A	NC	2.7	43%	1.2	10	3.3	\$3.32	13.31	1.5 GPM Low Flow Showerhead
10089	Water Heating	Thermostatic Restrictor Shower Valve	SF	N/A	NC	2.7	11%	0.3	10	30.0	\$15.00	0.78	Thermostatic Restrictor Shower Valve (on base flow device)
10090	Water Heating	Shower Timer	SF	N/A	NC	2.7	9%	0.2	2	5.0	\$5.00	0.42	Shower Timer limit time to 5 mins (per shower)
10091	Water Heating	Drain water Heat Recovery	SF	N/A	NC	19.9	25%	5.0	20	742.0	\$225.00	1.38	Drainpipe heat exchanger
10092	Water Heating	Water Heater Temperature Setback	MF	NLI	Retrofit	3.2	11%	0.4	15	6.5	\$6.50	2.85	WH Temp Setback from 135 to 120
10093	Water Heating	Pipe Wrap	MF	NLI	Retrofit	15.0	3%	0.4	15	1.7	\$1.72	13.52	Adding Pipe Wrap to Uninsulated Pipes
10094	Water Heating	Natural Gas Water Heater .67EF	MF	N/A	MO	15.0	11%	1.7	13	175.0	\$175.00	0.45	.67 EF Gas Water Heater (Replacing .594 EF)
10095	Water Heating	Natural Gas Water Heater .77EF	MF	N/A	MO	15.0	26%	3.9	13	685.0	\$200.00	0.90	.80 EF Gas Water Heater (Replacing .594 EF)
10096	Water Heating	Tankless Water Heater	MF	N/A	MO	15.0	21%	3.1	13	407.0	\$125.00	1.17	.75 EF Gas Water Heater (Replacing .594 EF)
10097	Water Heating	Smart Water Heater - Tank Controls and Sensors_ET	MF	N/A	Retrofit	15.0	15%	2.3	10	120.0	\$60.00	1.43	Smart WH Controls
10098	Water Heating	Bathroom Aerator 1.0 gpm	MF	NLI	Retrofit	0.3	47%	0.1	10	0.5	\$0.52	8.78	1.0 GPM Bathroom FA

Vectren Gas North		Residential Measure Assumptions												
Measure #	End-Use	Measure Name	Home Type	Income Type	Replacement Type	Base Natural Gas Use (therms)	% Savings	Per unit Natural Gas Savings (therms)	Useful Life	Initial Measure Cost	Historical Incentive Amount	UCT Ratio	Measure Description	
10099	Water Heating	Kitchen Flip Aerator 1.5 gpm	MF	NLI	Retrofit	1.2	39%	0.5	10	1.3	\$1.34	13.30	1.5 GPM Kitchen FA	
10100	Water Heating	Low Flow Showerhead 1.5 gpm	MF	NLI	Retrofit	2.9	43%	1.2	10	1.3	\$1.34	35.06	1.5 GPM Low Flow Showerhead	
10101	Water Heating	Thermostatic Restrictor Shower Valve	MF	N/A	Retrofit	2.9	11%	0.3	10	30.0	\$15.00	0.83	Thermostatic Restrictor Shower Valve (on base flow device)	
10102	Water Heating	Shower Timer	MF	N/A	Retrofit	2.9	9%	0.3	2	5.0	\$5.00	0.44	Shower Timer limit time to 5 mins (per shower)	
10103	Water Heating	Drain water Heat Recovery	MF	N/A	Retrofit	15.0	25%	3.8	20	742.0	\$225.00	1.04	Drainpipe heat exchanger	
10104	Water Heating	Bathroom Aerator 1.0 gpm	MF	LI	DI	0.3	47%	0.1	10	0.5	\$0.52	8.78	1.0 GPM Bathroom FA	
10105	Water Heating	Kitchen Flip Aerator 1.5 gpm	MF	LI	DI	1.2	39%	0.5	10	1.3	\$1.34	13.30	1.5 GPM Kitchen FA	
10106	Water Heating	Low Flow Showerhead 1.5 gpm	MF	LI	DI	2.9	43%	1.2	10	1.3	\$1.34	35.06	1.5 GPM Low Flow Showerhead	
10107	Water Heating	Pipe Wrap	MF	LI	DI	15.0	3%	0.4	15	1.7	\$1.72	13.52	Adding Pipe Wrap to Uninsulated Pipes	
10108	Water Heating	Water Heater Temperature Setback	MF	LI	DI	3.2	11%	0.4	15	6.5	\$6.50	2.85	WH Temp Setback from 135 to 120	
10109	Water Heating	Water Heater Temperature Setback	MF	N/A	NC	3.2	11%	0.4	15	6.5	\$6.50	2.85	WH Temp Setback from 135 to 120	
10110	Water Heating	Pipe Wrap	MF	N/A	NC	15.0	3%	0.4	15	1.7	\$1.72	13.52	Adding Pipe Wrap to Uninsulated Pipes	
10111	Water Heating	Natural Gas Water Heater .67EF	MF	N/A	NC	15.0	11%	1.7	13	175.0	\$175.00	0.45	.67 EF Gas Water Heater (Replacing .594 EF)	
10112	Water Heating	Natural Gas Water Heater .77EF	MF	N/A	NC	15.0	26%	3.9	13	685.0	\$200.00	0.90	.80 EF Gas Water Heater (Replacing .594 EF)	
10113	Water Heating	Tankless Water Heater	MF	N/A	NC	15.0	21%	3.1	13	407.0	\$125.00	1.17	.75 EF Gas Water Heater (Replacing .594 EF)	
10114	Water Heating	Smart Water Heater - Tank Controls and Sensors_ET	MF	N/A	NC	15.0	15%	2.3	10	120.0	\$60.00	1.43	Smart WH Controls	
10115	Water Heating	Bathroom Aerator 1.0 gpm	MF	N/A	NC	0.3	47%	0.1	10	0.5	\$0.52	8.78	1.0 GPM Bathroom FA	
10116	Water Heating	Kitchen Flip Aerator 1.5 gpm	MF	N/A	NC	1.2	39%	0.5	10	1.3	\$1.34	13.30	1.5 GPM Kitchen FA	
10117	Water Heating	Low Flow Showerhead 1.5 gpm	MF	N/A	NC	2.9	43%	1.2	10	1.3	\$1.34	35.06	1.5 GPM Low Flow Showerhead	
10118	Water Heating	Thermostatic Restrictor Shower Valve	MF	N/A	NC	2.9	11%	0.3	10	30.0	\$15.00	0.83	Thermostatic Restrictor Shower Valve (on base flow device)	
10119	Water Heating	Shower Timer	MF	N/A	NC	2.9	9%	0.3	2	5.0	\$5.00	0.44	Shower Timer limit time to 5 mins (per shower)	
10120	Water Heating	Drain water Heat Recovery	MF	N/A	NC	15.0	25%	3.8	20	742.0	\$225.00	1.04	Drainpipe heat exchanger	
Key Acronyms														
DI:	Direct-install													
LI:	Low-income													
MF:	Multifamily													
MO:	Market opportunity													
NC:	New Construction													
NLI:	Non-low-income													
SF:	Single-family													

APPENDIX C *Natural Gas DSM Market Potential Study* **Commercial Measure Detail**

Vectren Gas South		Commercial Measure Assumptions							
Measure #	End-Use	Measure Name	Replace Type	% MMBTU Savings	Per Unit MMBTU Savings	Useful Life	Initial Measure Cost	Cost / Unit Descriptor	UCT Ratio
1	Cooking	Energy Star Combination Oven	ROB	28%	27.80	12	\$2,125.00	each	1.63
2	Cooking	Convection Oven	ROB	16%	12.90	12	\$1,113.00	each	1.44
3	Cooking	Fryer	ROB	32%	50.80	12	\$500.00	each	12.66
4	Cooking	Griddle	ROB	11%	13.10	12	\$2,090.00	each	0.78
5	Cooking	Infrared Charbroiler	ROB	25%	70.70	12	\$2,173.00	each	4.05
6	Cooking	Infrared Upright Broiler	ROB	38%	94.30	12	\$4,400.00	each	2.67
7	Cooking	Steam Cooker	ROB	53%	105.40	12	\$3,500.00	each	3.75
8	Other	High Efficiency Pool Heater	ROB	7%	0.17	15	\$3.82	Mbtu	86.73
9	Other	Pool Covers	Retrofit	23%	0.06	10	\$2.20	per SF surface area	40.06
10	Other	Solar Pool Heater	ROB	8%	46.94	20	\$26,400.00	per unit	4.23
11	Space Heating	Boiler - O2 Trim Control	Retrofit	3%	1,150.75	10	\$23,250.00	each	7.15
12	Space Heating	Boiler Reset Control	Retrofit	8%	50.94	20	\$612.00	each	14.86
13	Space Heating	Boiler Tune-Up	Retrofit	2%	31.90	5	\$850.00	each	2.24
14	Space Heating	Boiler, 90% AFUE <300 MBH	ROB	9%	11.93	20	\$5,000.00	each	0.43
15	Space Heating	Boiler, 90% TE 1000 MBH	ROB	15%	136.65	20	\$5,000.00	each	4.88
16	Space Heating	Boiler, 90% TE 300-499 MBH	ROB	15%	36.21	20	\$5,000.00	each	1.29
17	Space Heating	Boiler, 90% TE 500-999 MBH	ROB	15%	102.49	20	\$5,000.00	each	3.66
18	Space Heating	Commercial Window Film	Retrofit	0%	-4.30	10	\$267.00	s.f.	-2.33
19	Space Heating	High Performance Glazing	Retrofit	0%	0.00	20	-\$0.01	\$0.00	9.69
20	Space Heating	Condensing Unit Heater	ROB	13%	26.60	12	\$676.00	each	4.90
21	Space Heating	Cool Roof	Retrofit	0%	-9.02	20	-\$16.77	per 1000 sf of roof area	0.48
22	Space Heating	EMS	Retrofit	10%	0.10	15	\$0.06	\$0.00	143.64
23	Space Heating	Furnace Tune-Up	ROB	2%	3.20	2	\$306.00	each	0.26
24	Space Heating	Furnace, 92% AFUE	ROB	13%	17.95	20	\$900.00	each	3.56
25	Space Heating	Furnace, 95% AFUE	ROB	16%	21.73	20	\$900.00	each	4.31
26	Space Heating	Furnace, 97% AFUE	ROB	18%	24.12	20	\$900.00	each	4.78
27	Space Heating	High Turndown Burner	Retrofit	1%	30.85	21	\$7,590.00	each	1.00
28	Space Heating	Guest Room Energy Management, Gas Heating Electric Cooling	ROB	25%	6.10	8	\$55.42	\$0.00	3.74
29	Space Heating	Integrated Building Design	ROB	30%	0.01	20	\$0.05	\$0.00	11.76
30	Space Heating	Linkageless Boiler Control	Retrofit	4%	0.40	16	\$2.50	Mbtu/h input	32.79
31	Space Heating	Natural Gas-Fired Infrared Heater	ROB	11%	23.20	15	\$920.00	each?	3.70
32	Space Heating	Programable Thermostats	Retrofit	10%	0.06	4	\$0.17	\$0.00	6.64
33	Space Heating	Retrocommissioning	Retrofit	16%	0.00	7	\$0.02	\$0.00	9.17
70	Space Heating	Commissioning	Retrofit	13%	0.00	7	\$0.06	\$0.00	1.93
56	Space Heating	Pipe Insulation - Steam	Retrofit	4%	0.65	15	\$9.40	per foot	10.15
35	Space Heating	Ceiling Insulation	Retrofit	8%	0.66	30	\$47.92	\$0.00	1.65
36	Space Heating	Wall Insulation	Retrofit	2%	5.23	30	\$12.33	\$0.00	51.34

Vectren Gas South		Commercial Measure Assumptions							
Measure #	End-Use	Measure Name	Replace Type	% MMBTU Savings	Per Unit MMBTU Savings	Useful Life	Initial Measure Cost	Cost / Unit Descriptor	UCT Ratio
37	Space Heating	Roof Insulation	Retrofit	8%	0.19	30	\$7.36		3.02
38	Space Heating	Shut Off Damper	Retrofit	5%	100.00	12	\$150.00	each	110.74
39	Space Heating	Stack Economizer	Retrofit	2%	0.40	15	\$4.50	kbtu/h input capacity	17.40
40	Space Heating	Steam Boiler	ROB	7%	62.70	20	\$5,000.00	each?	2.24
41	Space Heating	Steam Trap Replacement	Retrofit	2%	13.88	6	\$242.80	per trap	4.03
42	Space Heating	Smart Thermostats	Retrofit	8%	0.04	10	\$0.23	\$0.00	8.55
43	Space Heating	Duct sealing 15% leakage base	Retrofit	5%	0.15	18	\$7.68	\$0.00	1.72
44	Space Heating	Heat Recovery: Air to Air	Retrofit	14%	15.71	15	\$254.00	ton	12.11
45	Space Heating	Direct Fired Make-up Air System	Retrofit	29%	0.13	15	\$4.31	kBtu/hr input capacity	5.69
46	Space Heating	Smart Cloud-Based Energy Information System (EIS)	Retrofit	8%	0.01	10	\$1.85	\$0.00	0.45
47	Water Heating	DHW Boiler Tune-Up	Retrofit	3%	1.33	3	\$0.83	/Mbtuh input	79.40
48	Water Heating	Heat Recovery Grease Trap Filter	Retrofit	17%	151.36	15	\$14,000.00	per Unit	2.12
49	Water Heating	Drain Water Heat Recovery Water Heater	Retrofit	50%	968.29	20	\$150,000.00	per Unit	1.54
50	Water Heating	Indirect Gas Water Heater	ROB	22%	0.11	15	\$9.79	/MBH	2.13
51	Water Heating	Instant Gas Water Heater	ROB	41%	11.50	20	\$871.47	each	2.36
52	Water Heating	Low-Flow Faucet Aerator	Retrofit	39%	0.68	10	\$2.00	each	49.02
53	Water Heating	Low-Flow Showerhead	Retrofit	34%	0.31	10	\$18.50	each	2.40
54	Water Heating	Ozone Laundry	ROB	81%	3.07	10	\$79.84	per lb capacity	5.55
55	Water Heating	Pipe Insulation - Hot Water	Retrofit	4%	0.60	15	\$8.98	per foot	9.74
57	Water Heating	Pre-Rinse Sprayer, Low flow	Retrofit	44%	34.40	5	\$92.90	each	22.13
58	Water Heating	Refrigeration Waste Heat Recovery - DHW	Retrofit	27%	6.57	15	\$180.00	per ton	7.15
59	Water Heating	Water Heater TE 90% <=75.000 BTU	ROB	15%	21.38	13	\$1,135.00	per heater	2.49
62	Water Heating	Clothes Washer ENERGY STAR, Gas water heater, Gas dryer	ROB	38%	3.03	7	\$73.85	\$0.00	1.67
63	Water Heating	Clothes Washer ENERGY STAR, Gas water heater, Electric dryer	ROB	25%	1.47	7	\$21.20	\$0.00	2.24
64	Water Heating	Clothes Washer ENERGY STAR, Electric Water heater, Gas Dryer	ROB	33%	1.56	7	\$26.30	\$0.00	1.90
65	Water Heating	ES Dishwasher, High Temp, Gas Heat, Elec Booster	ROB	26%	25.62	15	\$154.02	\$0.00	9.75
66	Water Heating	ES Dishwasher, High Temp, Gas Heat, Gas Booster	ROB	15%	40.26	15	\$303.10	\$0.00	7.47
67	Water Heating	ES Dishwasher, Low Temp, Elec Heat	ROB	33%	0.00	16	\$0.00	\$0.00	78.01
68	Water Heating	ES Dishwasher, Low Temp, Gas Heat	ROB	5%	52.80	16	\$86.34	\$0.00	93.99
69	Water Heating	Water Heater TE 90% >75.000 BTU	ROB	14%	5.81	13	\$393.33	per heater	1.95

Vectren Gas North			Commercial Measure Assumptions						
Measure #	End-Use	Measure Name	Replace Type	% MMBTu Savings	Per Unit MMBTU Savings	Useful Life	Initial Measure Cost	Cost / Unit Descriptor	UCT Ratio
1	Cooking	Energy Star Combination Oven	ROB	28%	27.80	12	\$2,125.00	each	1.64
2	Cooking	Convection Oven	ROB	16%	12.90	12	\$1,113.00	each	1.46
3	Cooking	Fryer	ROB	32%	50.80	12	\$500.00	each	12.76
4	Cooking	Griddle	ROB	11%	13.10	12	\$2,090.00	each	0.79
5	Cooking	Infrared Charbroiler	ROB	25%	70.70	12	\$2,173.00	each	4.09
6	Cooking	Infrared Upright Broiler	ROB	38%	94.30	12	\$4,400.00	each	2.69
7	Cooking	Steam Cooker	ROB	53%	105.40	12	\$3,500.00	each	3.78
8	Other	High Efficiency Pool Heater	ROB	7%	0.17	15	\$3.82	Mbtu	86.77
9	Other	Pool Covers	Retrofit	23%	0.06	10	\$2.20	per SF surface area	112.55
10	Other	Solar Pool Heater	ROB	8%	46.94	20	\$26,400.00	per unit	0.02
11	Space Heating	Boiler - O2 Trim Control	Retrofit	3%	1,150.75	10	\$23,250.00	each	7.24
12	Space Heating	Boiler Reset Control	Retrofit	8%	50.94	20	\$612.00	each	14.69
13	Space Heating	Boiler Tune-Up	Retrofit	2%	31.90	5	\$850.00	each	2.31
14	Space Heating	Boiler, 90% AFUE <300 MBH	ROB	9%	11.93	20	\$5,000.00	each	0.42
15	Space Heating	Boiler, 90% TE 1000 MBH	ROB	15%	136.65	20	\$5,000.00	each	4.82
16	Space Heating	Boiler, 90% TE 300-499 MBH	ROB	15%	36.21	20	\$5,000.00	each	1.28
17	Space Heating	Boiler, 90% TE 500-999 MBH	ROB	15%	102.49	20	\$5,000.00	each	3.62
18	Space Heating	Commercial Window Film	Retrofit	0%	-4.30	10	\$267.00	s.f.	-2.36
19	Space Heating	High Performance Glazing	Retrofit	0%	0.00	20	-\$0.01	\$0.00	12.45
20	Space Heating	Condensing Unit Heater	ROB	13%	26.60	12	\$676.00	each	4.94
21	Space Heating	Cool Roof	Retrofit	0%	-9.02	20	-\$16.77	per 1000 sf of roof area	0.61
22	Space Heating	EMS	Retrofit	10%	0.10	15	\$0.06	\$0.00	185.87
23	Space Heating	Furnace Tune-Up	ROB	2%	3.20	2	\$306.00	each	0.27
24	Space Heating	Furnace, 92% AFUE	ROB	13%	17.95	20	\$900.00	each	3.52
25	Space Heating	Furnace, 95% AFUE	ROB	16%	21.73	20	\$900.00	each	4.26
26	Space Heating	Furnace, 97% AFUE	ROB	18%	24.12	20	\$900.00	each	4.73
27	Space Heating	High Turndown Burner	Retrofit	1%	30.85	21	\$7,590.00	each	0.98
28	Space Heating	Guest Room Energy Management, Gas Heating Electric Cooling	ROB	25%	6.10	8	\$55.42	\$0.00	5.01
29	Space Heating	Integrated Building Design	ROB	30%	0.01	20	\$0.05	\$0.00	15.15
30	Space Heating	Linkageless Boiler Control	Retrofit	4%	0.40	16	\$2.50	Mbtu/h input	32.72
31	Space Heating	Natural Gas-Fired Infrared Heater	ROB	11%	23.20	15	\$920.00	each?	3.70
32	Space Heating	Programable Thermostats	Retrofit	10%	0.06	4	\$0.17	\$0.00	6.59
33	Space Heating	Retrocommissioning	Retrofit	16%	0.00	7	\$0.02	\$0.00	12.12
70	Space Heating	Commissioning	Retrofit	13%	0.00	7	\$0.06	\$0.00	2.55
56	Space Heating	Pipe Insulation - Steam	Retrofit	4%	0.65	15	\$9.40	per foot	10.16
35	Space Heating	Ceiling Insulation	Retrofit	8%	0.66	30	\$47.92	\$0.00	2.10
36	Space Heating	Wall Insulation	Retrofit	2%	5.23	30	\$12.33	\$0.00	65.66
37	Space Heating	Roof Insulation	Retrofit	8%	0.19	30	\$7.36	\$0.00	3.85

Vectren Gas North		Commercial Measure Assumptions							
Measure #	End-Use	Measure Name	Replace Type	% MMBTu Savings	Per Unit MMBTU Savings	Useful Life	Initial Measure Cost	Cost / Unit Descriptor	UCT Ratio
38	Space Heating	Shut Off Damper	Retrofit	5%	100.00	12	\$150.00	each	111.64
39	Space Heating	Stack Economizer	Retrofit	2%	0.40	15	\$4.50	kbtu/h input capacity	17.41
40	Space Heating	Steam Boiler	ROB	7%	62.70	20	\$5,000.00	each?	2.21
41	Space Heating	Steam Trap Replacement	Retrofit	2%	13.88	6	\$242.80	per trap	4.13
42	Space Heating	Smart Thermostats	Retrofit	8%	0.04	10	\$0.23	\$0.00	8.38
43	Space Heating	Duct sealing 15% leakage base	Retrofit	5%	0.15	18	\$7.68	\$0.00	2.24
44	Space Heating	Heat Recovery: Air to Air	Retrofit	14%	15.71	15	\$254.00	ton	12.11
45	Space Heating	Direct Fired Make-up Air System	Retrofit	29%	0.13	15	\$4.31	kBtu/hr input capacity	5.70
46	Space Heating	Smart Cloud-Based Energy Information System (EIS)	Retrofit	8%	0.01	10	\$0.00	\$0.00	73.20
47	Water Heating	DHW Boiler Tune-Up	Retrofit	3%	1.33	3	\$0.83	/Mbtuh input	82.14
48	Water Heating	Heat Recovery Grease Trap Filter	Retrofit	17%	151.36	15	\$14,000.00	per Unit	2.12
49	Water Heating	Drain Water Heat Recovery Water Heater	Retrofit	50%	968.29	20	\$150,000.00	per Unit	1.52
50	Water Heating	Indirect Gas Water Heater	ROB	22%	0.11	15	\$9.79	/MBH	2.13
51	Water Heating	Instant Gas Water Heater	ROB	41%	11.50	20	\$871.47	each	2.33
52	Water Heating	Low-Flow Faucet Aerator	Retrofit	39%	0.68	10	\$2.00	each	49.67
53	Water Heating	Low-Flow Showerhead	Retrofit	34%	0.31	10	\$18.50	each	2.43
54	Water Heating	Ozone Laundry	ROB	81%	3.07	10	\$79.84	per lb capacity	5.63
55	Water Heating	Pipe Insulation - Hot Water	Retrofit	4%	0.60	15	\$8.98	per foot	9.75
57	Water Heating	Pre-Rinse Sprayer, Low flow	Retrofit	44%	34.40	5	\$92.90	each	22.75
58	Water Heating	Refrigeration Waste Heat Recovery - DHW	Retrofit	27%	6.57	15	\$180.00	per ton	7.15
59	Water Heating	Water Heater TE 90% <=75.000 BTU	ROB	15%	21.38	13	\$1,135.00	per heater	2.51
62	Water Heating	Clothes Washer ENERGY STAR, Gas water heater, Gas dryer	ROB	38%	3.03	7	\$73.85	\$0.00	1.70
63	Water Heating	Clothes Washer ENERGY STAR, Gas water heater, Electric dryer	ROB	25%	1.47	7	\$21.20	\$0.00	2.97
64	Water Heating	Clothes Washer ENERGY STAR, Electric Water heater, Gas Dryer	ROB	33%	1.56	7	\$26.30	\$0.00	2.53
65	Water Heating	ES Dishwasher, High Temp, Gas Heat, Elec Booster	ROB	26%	25.62	15	\$154.02	\$0.00	9.57
66	Water Heating	ES Dishwasher, High Temp, Gas Heat, Gas Booster	ROB	15%	40.26	15	\$303.10	\$0.00	7.43
67	Water Heating	ES Dishwasher, Low Temp, Elec Heat	ROB	0%	0.00	16	\$0.00	\$0.00	75.50
68	Water Heating	ES Dishwasher, Low Temp, Gas Heat	ROB	5%	52.80	16	\$86.34	\$0.00	35.21
69	Water Heating	Water Heater TE 90% >75.000 BTU	ROB	14%	5.81	13	\$393.33	per heater	1.96

APPENDIX D *Action Plan Combined Gas & Electric Portfolio Summary*

The following tables provide combined electric and gas portfolio targets for all programs for the years 2020-2025, with individual tables for each year.

TABLE D-1 2020 COMBINED PORTFOLIO TARGETS

	Electric							Gas					
	Number of Participants	Total kWh Savings	Total kW (Demand)	Admin.	Implementation	Incentives	Total Budget	Number of Participants	Total Therms Savings	Admin.	Implementation	Incentives	Total Budget
Residential	ELECTRIC							GAS					
Residential Lighting	239,866	8,088,914	905.24	\$101,000	\$186,419	\$463,014	\$750,433						
Residential Prescriptive	7,966	2,465,148	691.22	\$40,400	\$347,608	\$632,065	\$1,020,073	15,750	1,438,213	\$29,600	\$1,090,398	\$2,456,695	\$3,576,693
Residential New Construction	86	188,624	121.46	\$5,050	\$50,000	\$16,775	\$71,825	704	305,150	\$3,700	\$286,083	\$379,375	\$669,158
Home Energy Assessment	300	519,393	55.48	\$5,050	\$240,000	-	\$245,050	300	20,924	\$3,700	\$55,000	-	\$58,700
Income-Qualified Weatherization	539	778,285	443.32	\$20,200	\$1,275,176	-	\$1,295,376	513	56,971	\$14,800	\$872,202	-	\$887,002
Energy-Efficient Schools	2,600	1,149,200	136.50	\$20,200	\$113,589	-	\$133,789	2,600	38,480	\$22,200	\$28,397	-	\$50,597
Residential Behavioral Savings	49,000	7,049,208	1,574.28	\$40,400	\$323,803	-	\$364,203	34,778	375,933	\$37,000	\$108,182	-	\$145,182
Appliance Recycling	1,251	1,179,811	171.20	\$40,400	\$143,657	\$61,000	\$245,057						
CVR Residential	-	1,461,047	430	\$30,300	\$218,023	-	\$248,323						
Smart Cycle (DLC Change Out)	1,000	-	1,015.00	\$20,200	\$516,000	\$96,000	\$632,200						
BYOT (Bring Your Own Thermostat)	300	-	240.00	\$20,200	\$22,280	\$52,280	\$94,760						
Food Bank	-	-	-	-	-	-	-	-	-	-	-	-	-
Home Energy Management Systems	-	-	-	\$10,100	\$70,000	-	\$80,100	-	-	\$11,100	\$130,000	-	\$141,100
Multi-Family Direct Install								1,700	68,591	\$14,800	\$397,115	-	\$411,915
Targeted Income								46	15,022	\$29,600	\$74,470	-	\$104,070
Home Energy House Call-Integrated								1,122	49,144	\$29,600	\$179,527	-	\$209,127
Neighborhood Program-Integrated								1,000	134,440	\$29,600	\$185,910	-	\$215,510
Residential Subtotal	302,908	22,879,629	5,783.70	\$353,500	\$3,506,555	\$1,321,134	\$5,181,189	58,513	2,502,868	\$225,700	\$3,407,285	\$2,836,070	\$6,469,055
Commercial & Industrial	ELECTRIC							GAS					
Commercial Prescriptive	42,431	14,490,335	3,807.71	\$55,550	\$622,327	\$1,370,010	\$2,047,886	1,112	298,228	\$66,600	\$442,240	\$251,057	\$759,897
Commercial Custom	196	6,107,234	740.00	\$60,600	\$344,162	\$491,537	\$896,299	71	472,810	\$74,000	\$493,803	\$489,600	\$1,057,403
Small Business	381	2,940,932	213.00	\$5,050	\$215,618	\$548,167	\$768,835	592	16,788	\$3,700	\$3,096	\$5,886	\$12,682

	Electric							Gas					
	Number of Participants	Total kWh Savings	Total kW (Demand)	Admin.	Implementation	Incentives	Total Budget	Number of Participants	Total Therms Savings	Admin.	Implementation	Incentives	Total Budget
CVR Commercial	-	1,032,656	214	\$30,300	\$148,233	-	\$178,533						
Commercial & Industrial Subtotal	43,008	24,571,158	4,974.71	\$151,500	\$1,330,340	\$2,409,714	\$3,891,554	1,775	787,826	\$144,300	\$939,139	\$746,543	\$1,829,982
Indirect Costs	ELECTRIC							GAS					
Contact Center							\$63,000						\$132,080
Online Audit							\$42,911						\$200,564
Outreach							\$410,000						\$534,863
Portfolio Costs Subtotal							\$515,911						\$867,508
Subtotal (Before Evaluation)							\$9,588,653						\$9,166,544
Evaluation							\$490,728						\$482,414
DSM Portfolio Total							\$10,079,381						\$9,648,958
Other Costs	ELECTRIC							GAS					
Emerging Markets							\$ 200,000						\$ 200,000
Market Potential Study							-						-
Other Costs Subtotal							\$ 200,000						\$ 200,000
DSM Portfolio Total including Other Costs							\$10,279,381						\$9,848,958

TABLE D-2 2021 COMBINED PORTFOLIO TARGETS

	Electric							Gas					
	Number of Participants	Total kWh Savings	Total kW (Demand)	Admin.	Implementation	Incentives	Total Budget	Number of Participants	Total Therms Savings	Admin.	Implementation	Incentives	Total Budget
Residential	ELECTRIC							GAS					
Residential Lighting	262,832	8,704,288	875.28	\$102,616	\$189,402	\$455,001	\$747,018						
Residential Prescriptive	8,276	2,618,629	661.70	\$41,046	\$353,169	\$645,510	\$1,039,726	16,021	1,456,999	\$30,074	\$1,107,845	\$2,491,995	\$3,629,913
Residential New Construction	77	168,932	108.81	\$5,131	\$57,249	\$15,025	\$77,405	857	369,380	\$3,759	\$342,221	\$452,875	\$798,855
Home Energy Assessment	350	605,959	64.72	\$5,131	\$258,000	-	\$263,131	350	24,412	\$3,759	\$55,880	-	\$59,639

	Electric							Gas						
	Number of Participants	Total kWh Savings	Total kW (Demand)	Admin.	Implementation	Incentives	Total Budget	Number of Participants	Total Therms Savings	Admin.	Implementation	Incentives	Total Budget	
Income-Qualified Weatherization	566	823,215	467.28	\$20,523	\$1,293,527	-	\$1,314,050	538	60,190	\$15,037	\$885,268	-	\$900,304	
Energy-Efficient Schools	2,600	1,149,200	136.50	\$20,523	\$117,253	-	\$137,776	2,600	38,480	\$22,555	\$29,313	-	\$51,868	
Residential Behavioral Savings	49,000	7,049,208	1,574.28	\$20,523	\$328,984	-	\$349,507	34,778	375,933	\$22,555	\$109,913	-	\$132,468	
Appliance Recycling	1,344	1,285,473	172.83	\$41,046	\$159,415	\$66,625	\$267,086							
CVR Residential	-	-	-	\$30,785	\$197,378	-	\$228,163							
Smart Cycle (DLC Change Out)	1,000	198,000	1,015	\$20,523	\$536,000	\$116,000	\$672,523							
BYOT (Bring Your Own Thermostat)	300	-	240.00	\$20,523	\$30,280	\$60,280	\$111,083							
Food Bank	6,312	1,564,332	172.21	\$20,523	\$92,517	-	\$113,041	6,312	41,628	\$15,037	\$4,626	-	\$19,663	
Home Energy Management Systems	1,000	515,000	80.00	\$10,262	\$212,900	-	\$223,162	1,000	54,400	\$11,278	\$194,100	-	\$205,378	
Multi-Family Direct Install								1,700	68,591	\$15,037	\$403,469	-	\$418,506	
Targeted Income								46	15,022	\$30,074	\$75,662	-	\$105,735	
Home Energy House Call-Integrated								1,122	49,144	\$30,074	\$182,399	-	\$212,473	
Neighborhood Program-Integrated								1,000	134,440	\$30,074	\$188,885	-	\$218,959	
Residential Subtotal	333,657	24,682,235	5,568.60	\$359,156	\$3,826,074	\$1,358,441	\$5,543,671	66,324	2,688,619	\$229,311	\$3,579,580	\$2,944,870	\$6,753,761	
Commercial & Industrial	ELECTRIC							GAS						
Commercial Prescriptive	48,449	15,981,655	4,131.23	\$56,439	\$682,432	\$1,424,756	\$2,163,627	1,193	315,496	\$67,666	\$487,528	\$266,357	\$821,550	
Commercial Custom	196	6,107,234	740.00	\$61,570	\$349,669	\$491,537	\$902,775	71	472,810	\$75,184	\$501,704	\$489,600	\$1,066,488	
Small Business	382	2,944,615	213.00	\$5,131	\$219,172	\$539,573	\$763,876	1,025	18,516	\$3,759	\$3,209	\$6,006	\$12,975	
CVR Commercial	-	-	-	\$30,785	\$133,547	-	\$164,332							
Commercial & Industrial Subtotal	49,027	25,033,504	5,084.23	\$153,924	\$1,384,820	\$2,455,867	\$3,994,610	2,289	806,822	\$146,609	\$992,441	\$761,963	\$1,901,012	
Indirect Costs	ELECTRIC							GAS						
Contact Center							\$64,008						\$134,193	
Online Audit							\$43,598						\$203,774	

	Electric							Number of Participants	Total Therms Savings	Gas			
	Number of Participants	Total kWh Savings	Total kW (Demand)	Admin.	Implementation	Incentives	Total Budget			Admin.	Implementation	Incentives	Total Budget
Outreach							\$416,560						\$543,421
Portfolio Costs Subtotal							\$524,166						\$881,388
Subtotal (Before Evaluation)							\$10,062,446						\$9,536,161
Evaluation							\$522,653						\$507,425
DSM Portfolio Total							\$10,585,099						\$10,043,586
Other Costs	ELECTRIC									GAS			
Emerging Markets							200,000						200,000
Market Potential Study							300,000						300,000
Other Costs Subtotal							500,000						500,000
DSM Portfolio Total including Other Costs							\$11,085,099						\$10,543,586

TABLE D-3 2022 COMBINED PORTFOLIO TARGETS

	Electric							Number of Participants	Total Therms Savings	Gas			
	Number of Participants	Total kWh Savings	Total kW (Demand)	Admin.	Implementation	Incentives	Total Budget			Admin.	Implementation	Incentives	Total Budget
Residential	ELECTRIC									GAS			
Residential Lighting	91,708	3,259,915	255.83	\$104,258	\$144,380	\$346,846	\$595,484						
Residential Prescriptive	8,303	2,722,283	737.22	\$41,703	\$358,820	\$680,160	\$1,080,683	9,522	579,226	\$30,555	\$535,505	\$858,470	\$1,424,530
Residential New Construction	75	164,892	106.37	\$5,213	\$53,186	\$14,675	\$73,074	1,075	462,060	\$3,819	\$424,689	\$561,725	\$990,233
Home Energy Assessment	420	727,151	77.67	\$5,213	\$263,225	-	\$268,438	420	29,294	\$3,819	\$56,774	-	\$60,593
Income-Qualified Weatherization	594	869,076	492.09	\$20,852	\$1,312,171	-	\$1,333,023	564	63,502	\$15,277	\$980,165	-	\$995,443
Energy-Efficient Schools	2,600	670,800	93.60	\$20,852	\$92,229	-	\$113,080	2,600	38,480	\$22,916	\$30,743	-	\$53,659
Residential Behavioral Savings	49,000	7,049,208	1,574.28	\$20,852	\$334,248	-	\$355,099	34,778	375,933	\$22,916	\$111,671	-	\$134,587
Appliance Recycling	1,425	1,360,636	184.89	\$41,703	\$171,385	\$70,500	\$283,589						
CVR Residential	-	-	-	\$31,277	\$190,034	-	\$221,311						

	Electric							Gas					
	Number of Participants	Total kWh Savings	Total kW (Demand)	Admin.	Implementation	Incentives	Total Budget	Number of Participants	Total Therms Savings	Admin.	Implementation	Incentives	Total Budget
Smart Cycle (DLC Change Out)	1,000	198,000	1,015	\$20,852	\$556,000	\$136,000	\$712,852						
BYOT (Bring Your Own Thermostat)	300	-	240.00	\$20,852	\$38,280	\$68,280	\$127,412						
Food Bank	6,312	816,353	69.09	\$20,852	\$18,800	-	\$39,651	6,312	41,628	\$15,278	\$4,700	-	\$19,977
Home Energy Management Systems	1,000	515,000	80.00	\$10,426	\$219,900	-	\$230,326	1,000	54,400	\$11,458	\$187,100	-	\$198,558
Multi-Family Direct Install								1,700	68,591	\$15,277	\$409,925	-	\$425,202
Targeted Income								46	15,022	\$30,555	\$76,872	-	\$107,427
Home Energy House Call-Integrated								1,122	49,144	\$30,555	\$185,318	-	\$215,872
Neighborhood Program-Integrated								1,000	134,440	\$30,555	\$191,907	-	\$222,462
Residential Subtotal	162,737	18,353,314	4,926.04	\$364,902	\$3,752,658	\$1,316,461	\$5,434,021	60,139	1,911,720	\$232,980	\$3,195,369	\$1,420,195	\$4,848,544
Commercial & Industrial	ELECTRIC							GAS					
Commercial Prescriptive	52,971	17,154,963	4,383.05	\$57,342	\$733,558	\$1,448,274	\$2,239,173	1,312	338,606	\$68,748	\$541,210	\$286,137	\$896,095
Commercial Custom	196	6,107,234	740.00	\$62,555	\$355,263	\$491,537	\$909,355	71	472,810	\$76,387	\$509,731	\$489,600	\$1,075,718
Small Business	382	2,949,771	213.00	\$5,213	\$222,721	\$530,824	\$758,758	1,135	21,540	\$3,819	\$3,375	\$6,216	\$13,410
CVR Commercial	-	-	-	\$31,277	\$128,261	-	\$159,538						
Commercial & Industrial Subtotal	53,549	26,211,968	5,336.05	\$156,387	\$1,439,803	\$2,470,635	\$4,066,825	2,518	832,956	\$148,955	\$1,054,315	\$781,953	\$1,985,223
Indirect Costs	ELECTRIC							GAS					
Contact Center							\$65,032						\$136,340
Online Audit							\$44,295						\$207,034
Outreach							\$423,225						\$552,116
Portfolio Costs Subtotal							\$532,552						\$895,490
Subtotal (Before Evaluation)							\$10,033,398						\$7,729,257
Evaluation							\$518,856						\$415,538
DSM Portfolio Total							\$10,552,254						\$8,144,795
Other Costs	ELECTRIC							GAS					

	Electric							Gas						
	Number of Participants	Total kWh Savings	Total kW (Demand)	Admin.	Implementation	Incentives	Total Budget	Number of Participants	Total Therms Savings	Admin.	Implementation	Incentives	Total Budget	
Emerging Markets							200,000						200,000	
Market Potential Study							\$						\$	
Other Costs Subtotal							200,000						200,000	
DSM Portfolio Total including Other Costs							\$10,752,254						\$8,344,795	

TABLE D-4 2023 COMBINED PORTFOLIO TARGETS

	Electric							Gas						
	Number of Participants	Total kWh Savings	Total kW (Demand)	Admin.	Implementation	Incentives	Total Budget	Number of Participants	Total Therms Savings	Admin.	Implementation	Incentives	Total Budget	
Residential	ELECTRIC							GAS						
Residential Lighting	12,231	807,282	19.16	\$105,926	\$32,756	\$78,689	\$217,370							
Residential Prescriptive	8,140	2,793,920	812.09	\$42,370	\$364,561	\$707,135	\$1,114,066	9,565	580,541	\$31,044	\$544,073	\$863,520	\$1,438,637	
Residential New Construction	73	160,852	103.94	\$5,296	\$50,202	\$14,325	\$69,824	1,253	537,581	\$3,880	\$491,921	\$650,275	\$1,146,077	
Home Energy Assessment	504	872,581	93.20	\$5,296	\$267,437	-	\$272,733	504	35,153	\$3,880	\$57,682	-	\$61,563	
Income-Qualified Weatherization	623	917,290	518.75	\$21,185	\$1,331,114	-	\$1,352,299	591	66,991	\$15,522	\$1,060,825	-	\$1,076,347	
Energy-Efficient Schools	2,600	670,800	93.60	\$21,185	\$98,274	-	\$119,460	2,600	38,480	\$23,283	\$32,758	-	\$56,041	
Residential Behavioral Savings	49,000	7,049,208	1,574.28	\$21,185	\$339,596	-	\$360,781	34,778	375,933	\$23,283	\$113,458	-	\$136,741	
Appliance Recycling	1,435	1,366,149	188.46	\$42,370	\$174,745	\$70,750	\$287,865							
CVR Residential	-	1,461,047	430	\$31,778	\$270,252	-	\$302,029							
Smart Cycle (DLC Change Out)	1,000	198,000	1,015	\$21,185	\$576,000	\$156,000	\$753,185							
BYOT (Bring Your Own Thermostat)	300	-	240.00	\$21,185	\$46,280	\$76,280	\$143,745							
Food Bank	3,156	649,158	46.71	\$21,185	\$9,550	-	\$30,735	3,156	20,814	\$15,522	\$4,775	-	\$20,297	
Home Energy Management Systems	1,000	515,000	80.00	\$10,593	\$234,900	-	\$245,493	1,000	54,400	\$11,641	\$172,100	-	\$183,741	
Multi-Family Direct Install								1,700	68,591	\$15,522	\$416,484	-	\$432,005	
Targeted Income								46	15,022	\$31,044	\$78,102	-	\$109,146	

	Electric							Gas					
	Number of Participants	Total kWh Savings	Total kW (Demand)	Admin.	Implementation	Incentives	Total Budget	Number of Participants	Total Therms Savings	Admin.	Implementation	Incentives	Total Budget
Home Energy House Call-Integrated								1,122	49,144	\$31,044	\$188,283	-	\$219,326
Neighborhood Program-Integrated								1,000	134,440	\$31,044	\$194,978	-	\$226,021
Residential Subtotal	80,062	17,461,286	5,215.19	\$370,741	\$3,795,666	\$1,103,179	\$5,269,586	57,315	1,977,090	\$236,708	\$3,355,439	\$1,513,795	\$5,105,942
Commercial & Industrial	ELECTRIC							GAS					
Commercial Prescriptive	55,283	17,821,076	4,524.43	\$58,259	\$769,435	\$1,434,660	\$2,262,354	1,479	365,992	\$69,848	\$598,626	\$307,777	\$976,251
Commercial Custom	196	6,107,234	740.00	\$63,556	\$360,948	\$491,537	\$916,040	71	472,810	\$77,609	\$517,886	\$489,600	\$1,085,096
Small Business	382	2,952,715	213.00	\$5,296	\$226,003	\$521,287	\$752,586	1,260	24,996	\$3,880	\$3,561	\$6,456	\$13,898
CVR Commercial	-	1,032,656	214	\$31,778	\$184,861	-	\$216,639						
Commercial & Industrial Subtotal	55,861	27,913,681	5,691.43	\$158,889	\$1,541,248	\$2,447,483	\$4,147,620	2,810	863,798	\$151,338	\$1,120,073	\$803,833	\$2,075,244
Indirect Costs	ELECTRIC							GAS					
Contact Center							\$66,073						\$138,522
Online Audit							\$45,004						\$210,346
Outreach							\$429,997						\$560,949
Portfolio Costs Subtotal							\$541,073						\$909,818
Subtotal (Before Evaluation)							\$9,958,279						\$8,091,004
Evaluation							\$512,192						\$431,543
DSM Portfolio Total							\$10,470,471						\$8,522,547
Other Costs	ELECTRIC							GAS					
Emerging Markets							200,000						\$200,000
Market Potential Study							\$						-
Other Costs Subtotal							200,000						\$200,000
DSM Portfolio Total including Other Costs							\$10,670,471						\$8,722,547

TABLE D-5 2024 COMBINED PORTFOLIO TARGETS

	Electric							Gas					
	Number of Participants	Total kWh Savings	Total kW (Demand)	Admin.	Implementation	Incentives	Total Budget	Number of Participants	Total Therms Savings	Admin.	Implementation	Incentives	Total Budget
Residential	ELECTRIC							GAS					
Residential Lighting	14,089	977,297	19.66	\$107,621	\$38,416	\$92,287	\$238,324						
Residential Prescriptive	7,892	2,860,501	889.35	\$43,048	\$370,394	\$732,410	\$1,145,852	9,584	579,541	\$31,540	\$552,778	\$864,995	\$1,449,314
Residential New Construction	71	156,812	101.51	\$5,381	\$48,144	\$13,975	\$67,500	1,428	612,092	\$3,943	\$558,080	\$737,775	\$1,299,797
Home Energy Assessment	504	840,768	89.03	\$5,381	\$271,716	-	\$277,097	504	35,153	\$3,943	\$58,605	-	\$62,548
Income-Qualified Weatherization	653	967,302	546.35	\$21,524	\$1,350,360	-	\$1,371,884	619	70,571	\$15,770	\$1,120,207	-	\$1,135,977
Energy-Efficient Schools	2,600	670,800	93.60	\$21,524	\$106,392	-	\$127,916	2,600	38,480	\$23,655	\$35,464	-	\$59,119
Residential Behavioral Savings	49,000	7,049,208	1,574.28	\$21,524	\$345,029	-	\$366,554	34,778	375,933	\$23,655	\$115,273	-	\$138,929
Appliance Recycling	1,372	1,300,910	183.54	\$43,048	\$168,946	\$67,325	\$279,320						
CVR Residential	-	-	-	\$32,286	\$315,241	-	\$347,528						
Smart Cycle (DLC Change Out)	1,000	198,000	1,015	\$21,524	\$596,000	\$176,000	\$793,524						
BYOT (Bring Your Own Thermostat)	300	-	240.00	\$21,524	\$54,280	\$84,280	\$160,084						
Food Bank	3,156	649,158	46.71	\$21,524	\$9,703	-	\$31,227	3,156	20,814	\$15,770	\$4,851	-	\$20,622
Home Energy Management Systems	1,000	515,000	80.00	\$10,762	\$245,940	-	\$256,702	1,000	54,400	\$11,828	\$198,260	-	\$210,088
Multi-Family Direct Install								1,700	68,591	\$15,770	\$423,147	-	\$438,918
Targeted Income								46	15,022	\$31,540	\$79,352	-	\$110,892
Home Energy House Call-Integrated								1,122	49,144	\$31,540	\$191,295	-	\$222,835
Neighborhood Program-Integrated								1,000	134,440	\$31,540	\$198,097	-	\$229,638
Residential Subtotal	81,637	16,185,755	4,879.02	\$376,673	\$3,920,561	\$1,166,277	\$5,463,511	57,537	2,054,181	\$240,495	\$3,535,411	\$1,602,770	\$5,378,676
Commercial & Industrial	ELECTRIC							GAS					
Commercial Prescriptive	55,739	18,058,503	4,572.95	\$59,191	\$791,792	\$1,394,674	\$2,245,657	1,712	402,215	\$70,966	\$611,299	\$335,962	\$1,018,227
Commercial Custom	196	6,107,234	740.00	\$64,572	\$366,723	\$491,537	\$922,832	71	472,810	\$78,851	\$526,173	\$489,600	\$1,094,624
Small Business	383	2,957,870	213.00	\$5,381	\$229,663	\$512,537	\$747,582	1,369	28,020	\$3,943	\$3,736	\$6,666	\$14,344

	Electric							Number of Participants	Total Therms Savings	Gas			
	Number of Participants	Total kWh Savings	Total kW (Demand)	Admin.	Implementation	Incentives	Total Budget			Admin.	Implementation	Incentives	Total Budget
CVR Commercial	-	-	-	\$32,286	\$216,561	-	\$248,848						
Commercial & Industrial Subtotal	56,318	27,123,608	5,525.95	\$161,431	\$1,604,739	\$2,398,748	\$4,164,919	3,152	903,045	\$153,759	\$1,141,208	\$832,228	\$2,127,195
Indirect Costs	ELECTRIC							GAS					
Contact Center							\$67,130						\$140,738
Online Audit							\$45,724						\$213,712
Outreach							\$436,877						\$569,925
Portfolio Costs Subtotal							\$549,730						\$924,375
Subtotal (Before Evaluation)							\$10,178,160						\$8,430,246
Evaluation							\$520,077						\$446,225
DSM Portfolio Total							\$10,698,237						\$8,876,471
Other Costs	ELECTRIC							GAS					
Emerging Markets							200,000						200,000
Market Potential Study							300,000						300,000
Other Costs Subtotal							500,000						500,000
DSM Portfolio Total including Other Costs							\$11,198,237						\$9,376,471

TABLE D-6 2025 COMBINED PORTFOLIO TARGETS

	Electric							Number of Participants	Total Therms Savings	Gas			
	Number of Participants	Total kWh Savings	Total kW (Demand)	Admin.	Implementation	Incentives	Total Budget			Admin.	Implementation	Incentives	Total Budget
Residential	ELECTRIC							GAS					
Residential Lighting	15,913	1,146,410	274.12	\$109,343	\$44,005	\$105,714	\$259,061						
Residential Prescriptive	8,136	2,974,980	961.29	\$43,737	\$376,320	\$767,435	\$1,187,492	9,591	577,456	\$32,045	\$561,623	\$864,845	\$1,458,513
Residential New Construction	70	154,792	100.29	\$5,467	\$46,909	\$13,800	\$66,176	1,592	681,668	\$4,006	\$620,174	\$819,500	\$1,443,680
Home Energy Assessment	504	790,845	83.15	\$5,467	\$276,063	-	\$281,530	504	35,153	\$4,006	\$59,543	-	\$63,549

	Electric							Gas						
	Number of Participants	Total kWh Savings	Total kW (Demand)	Admin.	Implementation	Incentives	Total Budget	Number of Participants	Total Therms Savings	Admin.	Implementation	Incentives	Total Budget	
Income-Qualified Weatherization	685	1,018,544	575.34	\$21,869	\$1,369,913	-	\$1,391,782	649	74,337	\$16,022	\$1,156,992	-	\$1,173,014	
Energy-Efficient Schools	2,600	670,800	93.60	\$21,869	\$117,023	-	\$138,891	2,600	38,480	\$24,034	\$39,008	-	\$63,041	
Residential Behavioral Savings	49,000	7,049,208	1,574.28	\$21,869	\$350,550	-	\$372,418	34,778	375,933	\$24,034	\$117,118	-	\$141,151	
Appliance Recycling	1,253	1,180,913	171.99	\$43,737	\$155,651	\$61,050	\$260,438							
CVR Residential	-	-	-	\$32,803	\$282,073	-	\$314,876							
Smart Cycle (DLC Change Out)	1,000	198,000	1,015	\$21,869	\$616,000	\$196,000	\$833,869							
BYOT (Bring Your Own Thermostat)	300	-	240.00	\$21,869	\$62,280	\$92,280	\$176,429							
Food Bank	3,156	649,158	46.71	\$21,869	\$9,858	-	\$31,727	3,156	20,814	\$16,023	\$4,929	-	\$20,952	
Home Energy Management Systems	1,000	515,000	80.00	\$10,934	\$266,980	-	\$277,914	1,000	54,400	\$12,017	\$214,420	-	\$226,437	
Multi-Family Direct Install								1,700	68,591	\$16,022	\$429,918	-	\$445,940	
Targeted Income								46	15,022	\$32,045	\$80,621	-	\$112,666	
Home Energy House Call-Integrated								1,122	49,144	\$32,045	\$194,356	-	\$226,401	
Neighborhood Program-Integrated								1,000	134,440	\$32,045	\$201,267	-	\$233,312	
Residential Subtotal	83,617	16,348,650	5,215.76	\$382,700	\$3,973,626	\$1,236,279	\$5,592,604	57,738	2,125,438	\$244,343	\$3,679,968	\$1,684,345	\$5,608,656	
Commercial & Industrial	ELECTRIC							GAS						
Commercial Prescriptive	53,882	17,825,085	4,513.77	\$60,139	\$797,128	\$1,331,794	\$2,189,060	1,964	439,398	\$72,101	\$737,459	\$363,357	\$1,172,917	
Commercial Custom	196	6,107,234	740.00	\$65,606	\$372,590	\$491,537	\$929,733	71	472,810	\$80,112	\$534,591	\$489,600	\$1,104,304	
Small Business	383	2,963,026	213.00	\$5,467	\$233,383	\$503,787	\$742,637	1,479	31,044	\$4,006	\$3,915	\$6,876	\$14,797	
CVR Commercial	-	-	-	\$32,803	\$193,019	-	\$225,821							
Commercial & Industrial Subtotal	54,461	26,895,345	5,466.77	\$164,014	\$1,596,120	\$2,327,118	\$4,087,252	3,514	943,252	\$156,219	\$1,275,965	\$859,833	\$2,292,017	
Indirect Costs	ELECTRIC							GAS						
Contact Center							\$68,204						\$142,990	
Online Audit							\$46,456						\$217,131	

	Electric							Number of Participants	Total Therms Savings	Gas			
	Number of Participants	Total kWh Savings	Total kW (Demand)	Admin.	Implementation	Incentives	Total Budget			Admin.	Implementation	Incentives	Total Budget
Outreach							\$443,867						\$579,043
Portfolio Costs Subtotal							\$558,526						\$939,165
Subtotal (Before Evaluation)							\$10,238,382						\$8,839,838
Evaluation							\$520,203						\$464,552
DSM Portfolio Total							\$10,758,585						\$9,304,390
Other Costs				ELECTRIC						GAS			
Emerging Markets							200,000						200,000
Market Potential Study													
Other Costs Subtotal							200,000						200,000
DSM Portfolio Total including Other Costs							\$10,958,585						\$9,504,390

APPENDIX E Action Plan Combined Gas & Electric Costs Summary

The following tables present combined gas and electric costs for all residential programs for the years 2020-2025, with individual tables for each year. This is immediately followed by a table presenting the combined gas and electric costs for all commercial and industrial programs.

TABLE E-1 2020 COMBINED GAS AND ELECTRIC COSTS – RESIDENTIAL

	Admin.	Implementation	Incentives	Total Budget	Admin.	Implementation	Incentives	Total Budget
Residential	ELECTRIC				GAS			
Residential Lighting	\$101,000	\$186,419	\$463,014	\$750,433				
Residential Prescriptive	\$40,400	\$347,608	\$632,065	\$1,020,073	\$29,600	\$1,090,398	\$2,456,695	\$3,576,693
Residential New Construction	\$5,050	\$50,000	\$16,775	\$71,825	\$3,700	\$286,083	\$379,375	\$669,158
Home Energy Assessment	\$5,050	\$240,000	-	\$245,050	\$3,700	\$55,000	-	\$58,700
Income-Qualified Weatherization	\$20,200	\$1,275,176	-	\$1,295,376	\$14,800	\$872,202	-	\$887,002
Energy-Efficient Schools	\$20,200	\$113,589	-	\$133,789	\$22,200	\$28,397	-	\$50,597
Residential Behavioral Savings	\$40,400	\$323,803	-	\$364,203	\$37,000	\$108,182	-	\$145,182
Appliance Recycling	\$40,400	\$143,657	\$61,000	\$245,057				
CVR Residential	\$30,300	\$218,023	-	\$248,323				
Smart Cycle (DLC Change Out)	\$20,200	\$516,000	\$96,000	\$632,200				
BYOT (Bring Your Own Thermostat)	\$20,200	\$22,280	\$52,280	\$94,760				
Food Bank	-	-	-	-	-	-	-	-
Home Energy Management Systems	\$10,100	\$70,000	-	\$80,100	\$11,100	\$130,000	-	\$141,100
Multi-Family Direct Install					\$14,800	\$397,115	-	\$411,915
Targeted Income					\$29,600	\$74,470	-	\$104,070
Home Energy House Call- Integrated					\$29,600	\$179,527	-	\$209,127
Neighborhood Program- Integrated					\$29,600	\$185,910	-	\$215,510
Residential Subtotal	\$353,500	\$3,506,555	\$1,321,134	\$5,181,189	\$225,700	\$3,407,285	\$ 2,836,070	\$ 6,469,055

TABLE E-2 2020 COMBINED GAS AND ELECTRIC COSTS – COMMERCIAL & INDUSTRIAL

	Admin.	Implementation	Incentives	Total Budget	Admin.	Implementation	Incentives	Total Budget
Commercial & Industrial	ELECTRIC				GAS			
Commercial Prescriptive	\$55,550	\$622,327	\$1,370,010	\$2,047,886	\$66,600	\$442,240	\$251,057	\$759,897
Commercial Custom	\$60,600	\$344,162	\$491,537	\$896,299	\$74,000	\$493,803	\$489,600	\$1,057,403
Small Business	\$5,050	\$215,618	\$548,167	\$768,835	\$3,700	\$3,096	\$5,886	\$12,682
CVR Commercial	\$30,300	\$148,233	-	\$178,533				
Commercial & Industrial Subtotal	\$151,500	\$1,330,340	\$2,409,714	\$3,891,554	\$144,300	\$939,139	\$746,543	\$1,829,982

TABLE E-3 2021 COMBINED GAS AND ELECTRIC COSTS – RESIDENTIAL

	Admin.	Implementation	Incentives	Total Budget	Admin.	Implementation	Incentives	Total Budget
Residential	ELECTRIC				GAS			
Residential Lighting	\$102,616	\$189,402	\$455,001	\$747,018				
Residential Prescriptive	\$41,046	\$353,169	\$645,510	\$1,039,726	\$30,074	\$1,107,845	\$2,491,995	\$3,629,913
Residential New Construction	\$5,131	\$57,249	\$15,025	\$77,405	\$3,759	\$342,221	\$452,875	\$798,855
Home Energy Assessment	\$5,131	\$258,000	-	\$263,131	\$3,759	\$55,880	-	\$59,639
Income-Qualified Weatherization	\$20,523	\$1,293,527	-	\$1,314,050	\$15,037	\$885,268	-	\$900,304
Energy-Efficient Schools	\$20,523	\$117,253	-	\$137,776	\$22,555	\$29,313	-	\$51,868
Residential Behavioral Savings	\$20,523	\$328,984	-	\$349,507	\$22,555	\$109,913	-	\$132,468
Appliance Recycling	\$41,046	\$159,415	\$66,625	\$267,086				
CVR Residential	\$30,785	\$197,378	-	\$228,163				
Smart Cycle (DLC Change Out)	\$20,523	\$536,000	\$116,000	\$672,523				
BYOT (Bring Your Own Thermostat)	\$20,523	\$30,280	\$60,280	\$111,083				
Food Bank	\$20,523	\$92,517	-	\$113,041	\$15,037	\$4,626	-	\$19,663
Home Energy Management Systems	\$10,262	\$212,900	-	\$223,162	\$11,278	\$194,100	-	\$205,378

	Admin.	Implementation	Incentives	Total Budget	Admin.	Implementation	Incentives	Total Budget
Residential	ELECTRIC				GAS			
Multi-Family Direct Install					\$15,037	\$403,469	-	\$418,506
Targeted Income					\$30,074	\$75,662	-	\$105,735
Home Energy House Call- Integrated					\$30,074	\$182,399	-	\$212,473
Neighborhood Program- Integrated					\$30,074	\$188,885	-	\$218,959
Residential Subtotal	\$359,156	\$3,826,074	\$1,358,441	\$5,543,671	\$229,311	\$3,579,580	\$2,944,870	\$6,753,761

TABLE E-4 2021 COMBINED GAS AND ELECTRIC COSTS – COMMERCIAL & INDUSTRIAL

	Admin.	Implementation	Incentives	Total Budget	Admin.	Implementation	Incentives	Total Budget
Commercial & Industrial	ELECTRIC				GAS			
Commercial Prescriptive	\$56,439	\$682,432	\$1,424,756	\$2,163,627	\$67,666	\$487,528	\$266,357	\$821,550
Commercial Custom	\$61,570	\$349,669	\$491,537	\$902,775	\$75,184	\$501,704	\$489,600	\$1,066,488
Small Business	\$5,131	\$219,172	\$539,573	\$763,876	\$3,759	\$3,209	\$6,006	\$12,975
CVR Commercial	\$30,785	\$133,547	-	\$164,332				
Commercial & Industrial Subtotal	\$153,924	\$1,384,820	\$2,455,867	\$3,994,610	\$146,609	\$992,441	\$761,963	\$1,901,012

TABLE E-5 2022 COMBINED GAS AND ELECTRIC COSTS – RESIDENTIAL

	Admin.	Implementation	Incentives	Total Budget	Admin.	Implementation	Incentives	Total Budget
Residential	ELECTRIC				GAS			
Residential Lighting	\$104,258	\$144,380	\$346,846	\$595,484				
Residential Prescriptive	\$41,703	\$358,820	\$680,160	\$1,080,683	\$30,555	\$535,505	\$858,470	\$1,424,530
Residential New Construction	\$5,213	\$53,186	\$14,675	\$73,074	\$3,819	\$424,689	\$561,725	\$990,233
Home Energy Assessment	\$5,213	\$263,225	-	\$268,438	\$3,819	\$56,774	-	\$60,593
Income-Qualified Weatherization	\$20,852	\$1,312,171	-	\$1,333,023	\$15,277	\$980,165	-	\$995,443
Energy-Efficient Schools	\$20,852	\$92,229	-	\$113,080	\$22,916	\$30,743	-	\$53,659

	Admin.	Implementation	Incentives	Total Budget	Admin.	Implementation	Incentives	Total Budget
Residential	ELECTRIC				GAS			
Residential Behavioral Savings	\$20,852	\$334,248	-	\$355,099	\$22,916	\$111,671	-	\$134,587
Appliance Recycling	\$41,703	\$171,385	\$70,500	\$283,589				
CVR Residential	\$31,277	\$190,034	-	\$221,311				
Smart Cycle (DLC Change Out)	\$20,852	\$556,000	\$136,000	\$712,852				
BYOT (Bring Your Own Thermostat)	\$20,852	\$38,280	\$68,280	\$127,412				
Food Bank	\$20,852	\$18,800	-	\$39,651	\$15,278	\$4,700	-	\$19,977
Home Energy Management Systems	\$10,426	\$219,900	-	\$230,326	\$11,458	\$187,100	-	\$198,558
Multi-Family Direct Install					\$15,277	\$409,925	-	\$425,202
Targeted Income					\$30,555	\$76,872	-	\$107,427
Home Energy House Call- Integrated					\$30,555	\$185,318	-	\$215,872
Neighborhood Program- Integrated					\$30,555	\$191,907	-	\$222,462
Residential Subtotal	\$364,902	\$3,752,658	\$1,316,461	\$5,434,021	\$232,980	\$3,195,369	\$ 1,420,195	\$4,848,544

TABLE E-6 2022 COMBINED GAS AND ELECTRIC COSTS – COMMERCIAL & INDUSTRIAL

	Admin.	Implementation	Incentives	Total Budget	Admin.	Implementation	Incentives	Total Budget
Commercial & Industrial	ELECTRIC				GAS			
Commercial Prescriptive	\$57,342	\$733,558	\$1,448,274	\$2,239,173	\$68,748	\$541,210	\$286,137	\$896,095
Commercial Custom	\$62,555	\$355,263	\$491,537	\$909,355	\$76,387	\$509,731	\$489,600	\$1,075,718
Small Business	\$5,213	\$222,721	\$530,824	\$758,758	\$3,819	\$3,375	\$6,216	\$13,410
CVR Commercial	\$31,277	\$128,261	-	\$159,538				
Commercial & Industrial Subtotal	\$156,387	\$1,439,803	\$2,470,635	\$4,066,825	\$148,955	\$1,054,315	\$781,953	\$1,985,223

TABLE E-7 2023 COMBINED GAS AND ELECTRIC COSTS – RESIDENTIAL

	Admin.	Implementation	Incentives	Total Budget	Admin.	Implementation	Incentives	Total Budget
Residential	ELECTRIC				GAS			
Residential Lighting	\$105,926	\$32,756	\$78,689	\$217,370				
Residential Prescriptive	\$42,370	\$364,561	\$707,135	\$1,114,066	\$31,044	\$544,073	\$863,520	\$1,438,637
Residential New Construction	\$5,296	\$50,202	\$14,325	\$69,824	\$3,880	\$491,921	\$650,275	\$1,146,077
Home Energy Assessment	\$5,296	\$267,437	-	\$272,733	\$3,880	\$57,682	-	\$61,563
Income-Qualified Weatherization	\$21,185	\$1,331,114	-	\$1,352,299	\$15,522	\$1,060,825	-	\$1,076,347
Energy-Efficient Schools	\$21,185	\$98,274	-	\$119,460	\$23,283	\$32,758	-	\$56,041
Residential Behavioral Savings	\$21,185	\$339,596	-	\$360,781	\$23,283	\$113,458	-	\$136,741
Appliance Recycling	\$42,370	\$174,745	\$70,750	\$287,865				
CVR Residential	\$31,778	\$270,252	-	\$302,029				
Smart Cycle (DLC Change Out)	\$21,185	\$576,000	\$156,000	\$753,185				
BYOT (Bring Your Own Thermostat)	\$21,185	\$46,280	\$76,280	\$143,745				
Food Bank	\$21,185	\$9,550	-	\$30,735	\$15,522	\$4,775	-	\$20,297
Home Energy Management Systems	\$10,593	\$234,900	-	\$245,493	\$11,641	\$172,100	-	\$183,741
Multi-Family Direct Install					\$15,522	\$416,484	-	\$432,005
Targeted Income					\$31,044	\$78,102	-	\$109,146
Home Energy House Call- Integrated					\$31,044	\$188,283	-	\$219,326
Neighborhood Program- Integrated					\$31,044	\$194,978	-	\$226,021
Residential Subtotal	\$370,741	\$3,795,666	\$1,103,179	\$5,269,586	\$236,708	\$3,355,439	\$1,513,795	\$5,105,942

TABLE E-8 2023 COMBINED GAS AND ELECTRIC COSTS – COMMERCIAL & INDUSTRIAL

	Admin.	Implementation	Incentives	Total Budget	Admin.	Implementation	Incentives	Total Budget
Commercial & Industrial	ELECTRIC				GAS			
Commercial Prescriptive	\$58,259	\$769,435	\$1,434,660	\$2,262,354	\$69,848	\$598,626	\$307,777	\$976,251
Commercial Custom	\$63,556	\$360,948	\$491,537	\$916,040	\$77,609	\$517,886	\$489,600	\$1,085,096
Small Business	\$5,296	\$226,003	\$521,287	\$752,586	\$3,880	\$3,561	\$6,456	\$13,898
CVR Commercial	\$31,778	\$184,861	-	\$216,639				
Commercial & Industrial Subtotal	\$158,889	\$1,541,248	\$2,447,483	\$4,147,620	\$151,338	\$1,120,073	\$803,833	\$2,075,244

TABLE E-9 2024 COMBINED GAS AND ELECTRIC COSTS – RESIDENTIAL

	Admin.	Implementation	Incentives	Total Budget	Admin.	Implementation	Incentives	Total Budget
Residential	ELECTRIC				GAS			
Residential Lighting	\$107,621	\$38,416	\$92,287	\$238,324				
Residential Prescriptive	\$43,048	\$370,394	\$732,410	\$1,145,852	\$31,540	\$552,778	\$864,995	\$1,449,314
Residential New Construction	\$5,381	\$48,144	\$13,975	\$67,500	\$3,943	\$558,080	\$737,775	\$1,299,797
Home Energy Assessment	\$5,381	\$271,716	-	\$277,097	\$3,943	\$58,605	-	\$62,548
Income-Qualified Weatherization	\$21,524	\$1,350,360	-	\$1,371,884	\$15,770	\$1,120,207	-	\$1,135,977
Energy-Efficient Schools	\$21,524	\$106,392	-	\$127,916	\$23,655	\$35,464	-	\$59,119
Residential Behavioral Savings	\$21,524	\$345,029	-	\$366,554	\$23,655	\$115,273	-	\$138,929
Appliance Recycling	\$43,048	\$168,946	\$67,325	\$279,320				
CVR Residential	\$32,286	\$315,241	-	\$347,528				
Smart Cycle (DLC Change Out)	\$21,524	\$596,000	\$176,000	\$793,524				
BYOT (Bring Your Own Thermostat)	\$21,524	\$54,280	\$84,280	\$160,084				
Food Bank	\$21,524	\$9,703	-	\$31,227	\$15,770	\$4,851	-	\$20,622
Home Energy Management Systems	\$10,762	\$245,940	-	\$256,702	\$11,828	\$198,260	-	\$210,088
Multi-Family Direct Install					\$15,770	\$423,147	-	\$438,918

	Admin.	Implementation	Incentives	Total Budget	Admin.	Implementation	Incentives	Total Budget
Residential	ELECTRIC				GAS			
Targeted Income					\$31,540	\$79,352	-	\$110,892
Home Energy House Call- Integrated					\$31,540	\$191,295	-	\$222,835
Neighborhood Program- Integrated					\$31,540	\$198,097	-	\$229,638
Residential Subtotal	\$376,673	\$3,920,561	\$1,166,277	\$5,463,511	\$240,495	\$3,535,411	\$ 1,602,770	\$ 5,378,676

TABLE E-10 2024 COMBINED GAS AND ELECTRIC COSTS – COMMERCIAL & INDUSTRIAL

	Admin.	Implementation	Incentives	Total Budget	Admin.	Implementation	Incentives	Total Budget
Commercial & Industrial	ELECTRIC				GAS			
Commercial Prescriptive	\$59,191	\$791,792	\$1,394,674	\$2,245,657	\$70,966	\$611,299	\$335,962	\$1,018,227
Commercial Custom	\$64,572	\$366,723	\$491,537	\$922,832	\$78,851	\$526,173	\$489,600	\$1,094,624
Small Business	\$5,381	\$229,663	\$512,537	\$747,582	\$3,943	\$3,736	\$6,666	\$14,344
CVR Commercial	\$32,286	\$216,561	-	\$248,848				
Commercial & Industrial Subtotal	\$161,431	\$1,604,739	\$2,398,748	\$4,164,919	\$153,759	\$1,141,208	\$832,228	\$2,127,195

TABLE E-11 2025 COMBINED GAS AND ELECTRIC COSTS – RESIDENTIAL

	Admin.	Implementation	Incentives	Total Budget	Admin.	Implementation	Incentives	Total Budget
Residential	ELECTRIC				GAS			
Residential Lighting	\$109,343	\$44,005	\$105,714	\$259,061				
Residential Prescriptive	\$43,737	\$376,320	\$767,435	\$1,187,492	\$32,045	\$561,623	\$864,845	\$ 1,458,513
Residential New Construction	\$5,467	\$46,909	\$13,800	\$66,176	\$4,006	\$620,174	\$819,500	\$1,443,680
Home Energy Assessment	\$5,467	\$276,063	-	\$281,530	\$4,006	\$59,543	-	\$63,549
Income-Qualified Weatherization	\$21,869	\$1,369,913	-	\$1,391,782	\$16,022	\$1,156,992	-	\$1,173,014
Energy-Efficient Schools	\$21,869	\$117,023	-	\$138,891	\$24,034	\$39,008	-	\$63,041

	Admin.	Implementation	Incentives	Total Budget	Admin.	Implementation	Incentives	Total Budget
Residential	ELECTRIC				GAS			
Residential Behavioral Savings	\$21,869	\$350,550	-	\$372,418	\$24,034	\$117,118	-	\$141,151
Appliance Recycling	\$43,737	\$155,651	\$61,050	\$260,438				
CVR Residential	\$32,803	\$282,073	-	\$314,876				
Smart Cycle (DLC Change Out)	\$21,869	\$616,000	\$196,000	\$833,869				
BYOT (Bring Your Own Thermostat)	\$21,869	\$62,280	\$92,280	\$176,429				
Food Bank	\$21,869	\$9,858	-	\$31,727	\$16,023	\$4,929	-	\$20,952
Home Energy Management Systems	\$10,934	\$266,980	-	\$277,914	\$12,017	\$214,420	-	\$226,437
Multi-Family Direct Install					\$16,022	\$429,918	-	\$445,940
Targeted Income					\$32,045	\$80,621	-	\$112,666
Home Energy House Call- Integrated					\$32,045	\$194,356	-	\$226,401
Neighborhood Program- Integrated					\$32,045	\$201,267	-	\$233,312
Residential Subtotal	\$382,700	\$3,973,626	\$1,236,279	\$5,592,604	\$244,343	\$3,679,968	\$1,684,345	\$5,608,656

TABLE E-12 2025 COMBINED GAS AND ELECTRIC COSTS – COMMERCIAL & INDUSTRIAL

	Admin.	Implementation	Incentives	Total Budget	Admin.	Implementation	Incentives	Total Budget
Commercial & Industrial	ELECTRIC				GAS			
Commercial Prescriptive	\$60,139	\$797,128	\$1,331,794	\$2,189,060	\$72,101	\$737,459	\$363,357	\$1,172,917
Commercial Custom	\$65,606	\$372,590	\$491,537	\$929,733	\$80,112	\$534,591	\$489,600	\$1,104,304
Small Business	\$5,467	\$233,383	\$503,787	\$742,637	\$4,006	\$3,915	\$6,876	\$14,797
CVR Commercial	\$32,803	\$193,019	-	\$225,821				
Commercial & Industrial Subtotal	\$164,014	\$1,596,120	\$2,327,118	\$4,087,252	\$156,219	\$1,275,965	\$859,833	\$2,292,017

APPENDIX F Action Plan Market Research

RESIDENTIAL SURVEY RESULTS

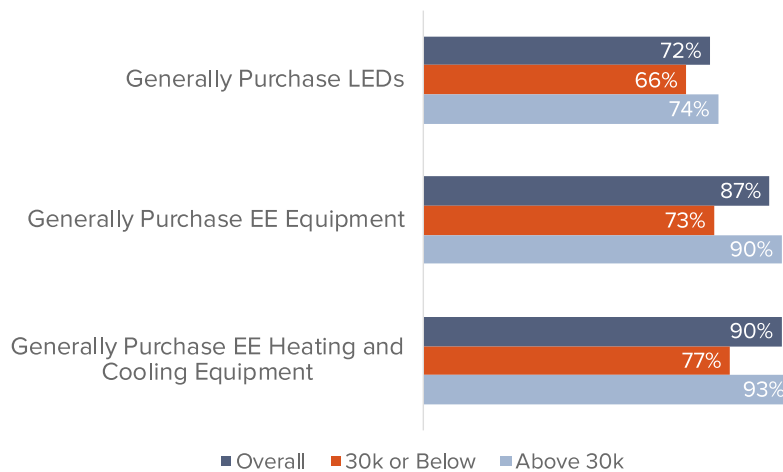
Background

The team completed an online survey of 466 residential customers in Vectren service territory. The survey was completed between June 25 and July 9, 2018. Vectren randomly sampled 4,000 residential customers and sent invitations to complete the survey by email. Customers were offered a \$25 incentive upon completion of the survey.

Results

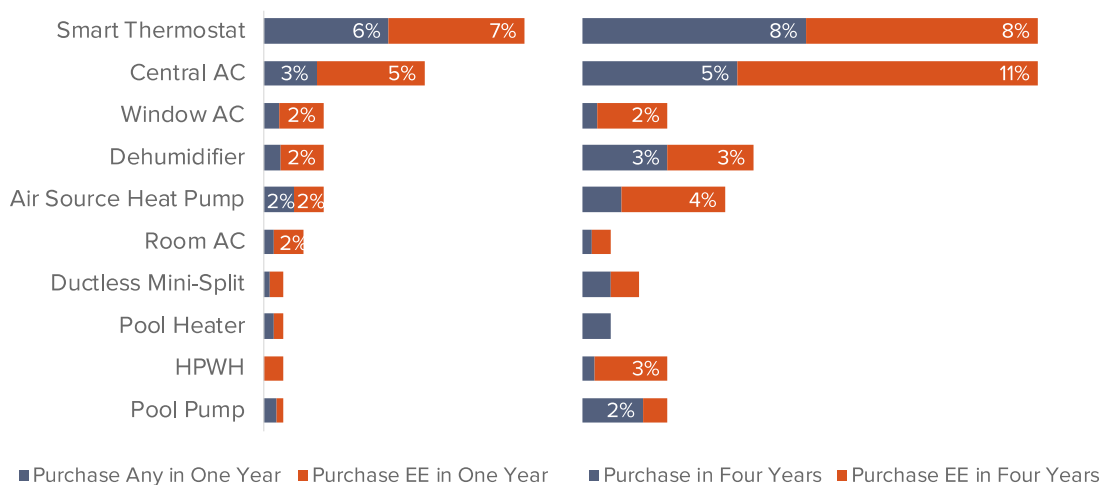
Customers generally reported purchasing energy-efficient equipment (72%, as seen below). As expected, fewer lower income customers (66%) reported purchasing energy-efficient equipment than those making higher incomes (74%).

FIGURE F-1 GENERAL PURCHASING BEHAVIOR



Most electric customers did not plan on purchasing any of the equipment discussed in the survey over the next year (76%) or in the next four years (63%). Electric customers most often report planning on purchasing smart thermostats (16%) or central air conditioners (16%) in the next four years.

FIGURE F-2 PLANNED IMPROVEMENTS



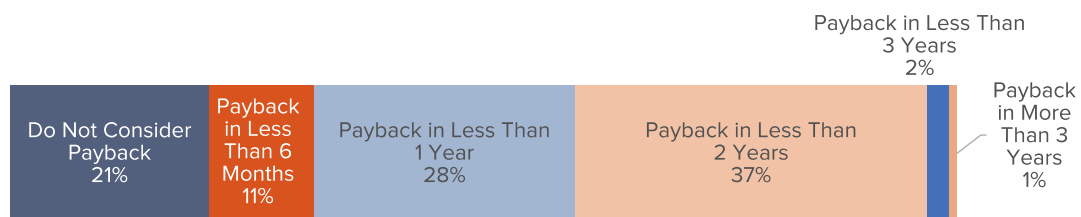
Generally, customers reported a lower willingness to pay for weatherization measures and a higher willingness to pay for energy-efficient appliances, as seen in the table below.

FIGURE F-3 WILLINGNESS TO PAY AT VARYING REBATE LEVELS (PERCENT OF INCREMENTAL COST)

Sector	End-Use / Technology	25%	50%	75%	100%
Average Likelihood					
Residential	Appliances	75%	86%	91%	96%
Residential	Space Heating	76%	84%	90%	96%
Residential	Weatherization	61%	72%	82%	93%
Extreme Likelihood (% the responded "10")					
Residential	Appliances	31%	50%	61%	85%
Residential	Space Heating	27%	39%	53%	83%
Residential	Weatherization	16%	20%	29%	76%

Less than one quarter of customers do not consider the payback timeframe of their energy efficiency equipment (21%, as seen below). About three quarters require a payback of two years or less.

FIGURE F-4 RESIDENTIAL REQUIRED PAYBACK PERIOD



COMMERCIAL & INDUSTRIAL ONSITE VISIT RESULTS

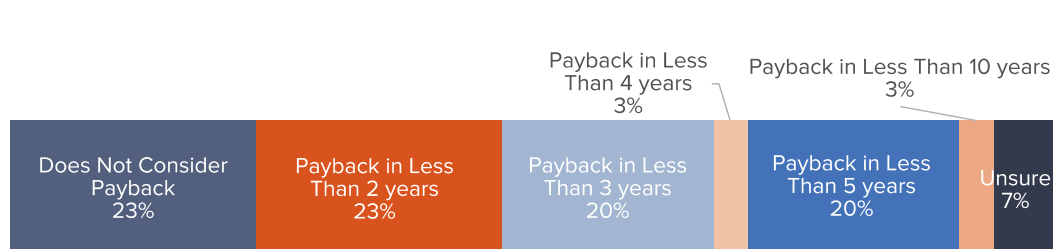
Background

The team completed an audit of 36 commercial and industrial sites in Vectren territory. During these audits, the team asked the company contact questions regarding their energy efficient product purchases and preferences.

Results

Similar to residential customers, about one-quarter of commercial and industrial customers do not consider the payback period of their energy efficiency equipment (23%, as seen below).

FIGURE F-5 COMMERCIAL & INDUSTRIAL REQUIRED PAYBACK PERIOD



Commercial and industrial customers most often reported receiving an incentive as a consideration when purchasing new energy efficient equipment (72%, as seen in the table below). Other regularly reported considerations included lowering monthly electric bills (67%) and increased employee comfort (58%).

TABLE F-6 IMPORTANT CONSIDERATIONS REGARDING ENERGY EFFICIENT EQUIPMENT

Response	Percent (n=36)
Receiving incentive	72%
Lower monthly electric bills	67%
Increased level of employee comfort	58%
Financing options	50%
Improving the image or value of business	36%
Recommendation of sales person, contractor, or consultant	28%
Helping to protect the environment	8%
Other	3%

Commercial and industrial customers most often reported that cost was a barrier to purchasing energy-efficient equipment (67%), followed by the performance of the equipment (44%).

TABLE F-7 BARRIERS TO PURCHASING ENERGY EFFICIENT EQUIPMENT

Response	Percent (n=36)
Cost	67%
Performance of the equipment	44%
Lack of product energy savings information	39%
Payback/ROI	31%
Lack of financing options	17%
Availability of equipment	11%
Other	6%

Commercial and industrial customers reported a higher willingness to purchase more expensive equipment at most levels of rebate incremental cost than residential customers, as seen in the table below.

TABLE F-8 WILLINGNESS TO PAY AT VARYING REBATE LEVELS (PERCENT OF INCREMENTAL COST)

Equipment Price	0%	25%	50%	75%
Equipment Priced Below \$200	6%	3%	11%	77%
Equipment Priced Above \$1,000	6%	11%	34%	97%

APPENDIX G *Action Plan Measure Library*

The following table provides a list of all the measures included in the Action Plan program concepts, broken up by year of the program.

Program	Measure	Description	2020	2021	2022	2023	2024	2025
Residential Prescriptive	Wall Insulation - Gas Heated - North (Gas Only)	Participation	16	16	16	16	16	16
Residential Prescriptive	Wall Insulation - Gas Heated - North (Gas Only)	Total Incentive Budget	\$7,200	\$7,200	\$7,200	\$7,200	\$7,200	\$7,200
Residential Prescriptive	Wall Insulation - Gas Heated - North (Gas Only)	Total Gross Incremental Savings (therms)	1,066	1,066	1,066	1,066	1,066	1,066
Residential Prescriptive	Wall Insulation - Gas Heated - North (Gas Only)	NTG	0.76	0.76	0.76	0.76	0.76	0.76
Residential Prescriptive	Wall Insulation - Gas Heated - North (Gas Only)	Incremental Cost	\$1,500.00	\$1,500.00	\$1,500.00	\$1,500.00	\$1,500.00	\$1,500.00
Residential Prescriptive	Wall Insulation - Gas Heated - South (Dual -- Gas & Electric)	Participation	110	110	110	110	110	110
Residential Prescriptive	Wall Insulation - Gas Heated - South (Dual -- Gas & Electric)	Total Incentive Budget	\$24,750	\$24,750	\$24,750	\$24,750	\$24,750	\$24,750
Residential Prescriptive	Wall Insulation - Gas Heated - South (Dual -- Gas & Electric)	Total Gross Incremental Savings (therms)	7,194	7,194	7,194	7,194	7,194	7,194
Residential Prescriptive	Wall Insulation - Gas Heated - South (Dual -- Gas & Electric)	NTG	0.76	0.76	0.76	0.76	0.76	0.76
Residential Prescriptive	Wall Insulation - Gas Heated - South (Dual -- Gas & Electric)	Incremental Cost	\$1,500.00	\$1,500.00	\$1,500.00	\$1,500.00	\$1,500.00	\$1,500.00
Residential Prescriptive	Tankless Water Heater	Participation	501	547	586	620	649	673
Residential Prescriptive	Tankless Water Heater	Total Incentive Budget	\$62,625	\$68,375	\$73,250	\$77,500	\$81,125	\$84,125
Residential Prescriptive	Tankless Water Heater	Total Gross Incremental Savings (therms)	20,743	22,648	24,263	25,671	26,871	27,865
Residential Prescriptive	Tankless Water Heater	NTG	0.63	0.63	0.63	0.63	0.63	0.63
Residential Prescriptive	Tankless Water Heater	Incremental Cost	\$400.00	\$400.00	\$400.00	\$400.00	\$400.00	\$400.00
Residential Prescriptive	Natural Gas Water Heater .77EF	Participation	532	577	614	645	668	686
Residential Prescriptive	Natural Gas Water Heater .77EF	Total Incentive Budget	\$26,600	\$28,850	\$30,700	\$32,250	\$33,400	\$34,300

Program	Measure	Description	2020	2021	2022	2023	2024	2025
Residential New Construction	Gold Star: HERS Index Score? 63 - Gas Heated South (Gas)	Incremental Cost	\$930.92	\$930.92	\$930.92	\$930.92	\$930.92	\$930.92
Residential New Construction	Platinum Star: HERS Index Score 60 - Gas Heated North	Participation	263	332	426	502	578	648
Residential New Construction	Platinum Star: HERS Index Score 60 - Gas Heated North	Total Incentive Budget	\$184,100	\$232,400	\$298,200	\$351,400	\$404,600	\$453,600
Residential New Construction	Platinum Star: HERS Index Score 60 - Gas Heated North	Total Gross Incremental Savings (therms)	142,583	179,990	230,952	272,154	313,357	351,307
Residential New Construction	Platinum Star: HERS Index Score 60 - Gas Heated North	NTG	0.50	0.50	0.50	0.50	0.50	0.50
Residential New Construction	Platinum Star: HERS Index Score 60 - Gas Heated North	Incremental Cost	\$3,610.00	\$3,610.00	\$3,610.00	\$3,610.00	\$3,610.00	\$3,610.00
Residential New Construction	Platinum Star: HERS Index Score 60 - Gas Heated South (Gas)	Participation	69	62	62	62	62	62
Residential New Construction	Platinum Star: HERS Index Score 60 - Gas Heated South (Gas)	Total Incentive Budget	\$62,100	\$55,800	\$55,800	\$55,800	\$55,800	\$55,800
Residential New Construction	Platinum Star: HERS Index Score 60 - Gas Heated South (Gas)	Total Gross Incremental Savings (therms)	37,408	33,613	33,613	33,613	33,613	33,613
Residential New Construction	Platinum Star: HERS Index Score 60 - Gas Heated South (Gas)	NTG	0.50	0.50	0.50	0.50	0.50	0.50
Residential New Construction	Platinum Star: HERS Index Score 60 - Gas Heated South (Gas)	Incremental Cost	\$1,832.00	\$1,832.00	\$1,832.00	\$1,832.00	\$1,832.00	\$1,832.00
Income Qualified Weatherization	Attic Insulation - Gas Heated (Gas)	Participation	25	27	29	31	33	35

Program	Measure	Description	2020	2021	2022	2023	2024	2025
Income Qualified Weatherization	Attic Insulation - Gas Heated (Gas)	Total Incentive Budget	-	-	-	-	-	-
Income Qualified Weatherization	Attic Insulation - Gas Heated (Gas)	Total Gross Incremental Savings (therms)	5,225	5,643	6,061	6,479	6,897	7,315
Income Qualified Weatherization	Attic Insulation - Gas Heated (Gas)	NTG	1.00	1.00	1.00	1.00	1.00	1.00
Income Qualified Weatherization	Attic Insulation - Gas Heated (Gas)	Incremental Cost	\$706.30	\$706.30	\$706.30	\$706.30	\$706.30	\$706.30
Income Qualified Weatherization	Audit Recommendations - dual (Gas)	Participation	340	357	374	392	411	431
Income Qualified Weatherization	Audit Recommendations - dual (Gas)	Total Incentive Budget	-	-	-	-	-	-
Income Qualified Weatherization	Audit Recommendations - dual (Gas)	Total Gross Incremental Savings (therms)	2,720	2,856	2,992	3,136	3,288	3,448
Income Qualified Weatherization	Audit Recommendations - dual (Gas)	NTG	1.00	1.00	1.00	1.00	1.00	1.00
Income Qualified Weatherization	Audit Recommendations - dual (Gas)	Incremental Cost	\$80.00	\$80.00	\$80.00	\$80.00	\$80.00	\$80.00
Income Qualified Weatherization	Bathroom Aerator 1.0 gpm - Gas DHW	Participation	183	193	203	214	225	237
Income Qualified Weatherization	Bathroom Aerator 1.0 gpm - Gas DHW	Total Incentive Budget	-	-	-	-	-	-
Income Qualified Weatherization	Bathroom Aerator 1.0 gpm - Gas DHW	Total Gross Incremental Savings (therms)	366	386	406	428	450	474

Program	Measure	Description	2020	2021	2022	2023	2024	2025
Income Qualified Weatherization	Bathroom Aerator 1.0 gpm - Gas DHW	NTG	1.00	1.00	1.00	1.00	1.00	1.00
Income Qualified Weatherization	Bathroom Aerator 1.0 gpm - Gas DHW	Incremental Cost	\$0.52	\$0.52	\$0.52	\$0.52	\$0.52	\$0.52
Income Qualified Weatherization	Kitchen Flip Aerator 1.5 gpm - Gas DHW	Participation	150	158	166	175	184	194
Income Qualified Weatherization	Kitchen Flip Aerator 1.5 gpm - Gas DHW	Total Incentive Budget	-	-	-	-	-	-
Income Qualified Weatherization	Kitchen Flip Aerator 1.5 gpm - Gas DHW	Total Gross Incremental Savings (therms)	1,050	1,106	1,162	1,225	1,288	1,358
Income Qualified Weatherization	Kitchen Flip Aerator 1.5 gpm - Gas DHW	NTG	1.00	1.00	1.00	1.00	1.00	1.00
Income Qualified Weatherization	Kitchen Flip Aerator 1.5 gpm - Gas DHW	Incremental Cost	\$1.34	\$1.34	\$1.34	\$1.34	\$1.34	\$1.34
Income Qualified Weatherization	Low Flow Showerhead 1.5 gpm - Gas DHW	Participation	201	212	223	235	247	260
Income Qualified Weatherization	Low Flow Showerhead 1.5 gpm - Gas DHW	Total Incentive Budget	-	-	-	-	-	-
Income Qualified Weatherization	Low Flow Showerhead 1.5 gpm - Gas DHW	Total Gross Incremental Savings (therms)	3,216	3,392	3,568	3,760	3,952	4,160
Income Qualified Weatherization	Low Flow Showerhead 1.5 gpm - Gas DHW	NTG	1.00	1.00	1.00	1.00	1.00	1.00
Income Qualified Weatherization	Low Flow Showerhead 1.5 gpm - Gas DHW	Incremental Cost	\$3.32	\$3.32	\$3.32	\$3.32	\$3.32	\$3.32
Income Qualified Weatherization	Pipe Wrap - Gas DHW (per home)	Participation	88	93	98	103	109	115
Income Qualified Weatherization	Pipe Wrap - Gas DHW (per home)	Total Incentive Budget	-	-	-	-	-	-

Program	Measure	Description	2020	2021	2022	2023	2024	2025
Income Qualified Weatherization	Pipe Wrap - Gas DHW (per home)	Total Gross Incremental Savings (therms)	440	465	490	515	545	575
Income Qualified Weatherization	Pipe Wrap - Gas DHW (per home)	NTG	1.00	1.00	1.00	1.00	1.00	1.00
Income Qualified Weatherization	Pipe Wrap - Gas DHW (per home)	Incremental Cost	\$1.72	\$1.72	\$1.72	\$1.72	\$1.72	\$1.72
Income Qualified Weatherization	Wifi Thermostat - South (Gas)	Participation	1	1	1	1	1	1
Income Qualified Weatherization	Wifi Thermostat - South (Gas)	Total Incentive Budget	-	-	-	-	-	-
Income Qualified Weatherization	Wifi Thermostat - South (Gas)	Total Gross Incremental Savings (therms)	69	69	69	69	69	69
Income Qualified Weatherization	Wifi Thermostat - South (Gas)	NTG	1.00	1.00	1.00	1.00	1.00	1.00
Income Qualified Weatherization	Wifi Thermostat - South (Gas)	Incremental Cost	\$82.56	\$82.56	\$82.56	\$82.56	\$82.56	\$82.56
Income Qualified Weatherization	Smart Thermostat (Gas)	Participation	27	29	31	33	35	37
Income Qualified Weatherization	Smart Thermostat (Gas)	Total Incentive Budget	-	-	-	-	-	-
Income Qualified Weatherization	Smart Thermostat (Gas)	Total Gross Incremental Savings (therms)	1,863	2,001	2,139	2,277	2,415	2,553
Income Qualified Weatherization	Smart Thermostat (Gas)	NTG	1.00	1.00	1.00	1.00	1.00	1.00
Income Qualified Weatherization	Smart Thermostat (Gas)	Incremental Cost	\$77.00	\$77.00	\$77.00	\$77.00	\$77.00	\$77.00
Income Qualified Weatherization	Filter Whistle	Participation	77	81	86	91	96	101
Income Qualified Weatherization	Filter Whistle	Total Incentive Budget	-	-	-	-	-	-
Income Qualified Weatherization	Filter Whistle	Total Gross Incremental Savings (therms)	1,155	1,215	1,290	1,365	1,440	1,515

Program	Measure	Description	2020	2021	2022	2023	2024	2025
Energy Efficient Schools	Aerators Pack (1 Kitchen and 2 Bathroom)	Total Incentive Budget	-	-	-	-	-	-
Energy Efficient Schools	Aerators Pack (1 Kitchen and 2 Bathroom)	Total Gross Incremental Savings (therms)	11,180	11,180	11,180	11,180	11,180	11,180
Energy Efficient Schools	Aerators Pack (1 Kitchen and 2 Bathroom)	NTG	1.00	1.00	1.00	1.00	1.00	1.00
Energy Efficient Schools	Aerators Pack (1 Kitchen and 2 Bathroom)	Incremental Cost	-	-	-	-	-	-
Energy Efficient Schools	Filter Whistle	Participation	2,600	2,600	2,600	2,600	2,600	2,600
Energy Efficient Schools	Filter Whistle	Total Incentive Budget	-	-	-	-	-	-
Energy Efficient Schools	Filter Whistle	Total Gross Incremental Savings (therms)	12,610	12,610	12,610	12,610	12,610	12,610
Energy Efficient Schools	Filter Whistle	NTG	1.00	1.00	1.00	1.00	1.00	1.00
Energy Efficient Schools	Filter Whistle	Incremental Cost	-	-	-	-	-	-
Residential Behavior Savings	Residential Behavior Letters	Participation	25,053	25,053	25,053	25,053	25,053	25,053
Residential Behavior Savings	Residential Behavior Letters	Total Incentive Budget	-	-	-	-	-	-
Residential Behavior Savings	Residential Behavior Letters	Total Gross Incremental Savings (therms)	298,648	298,648	298,648	298,648	298,648	298,648
Residential Behavior Savings	Residential Behavior Letters	NTG	1.00	1.00	1.00	1.00	1.00	1.00
Residential Behavior Savings	Residential Behavior Letters	Incremental Cost	-	-	-	-	-	-

Program	Measure	Description	2020	2021	2022	2023	2024	2025
Multi-Family Direct Install	Low Flow Showerhead 1.5 gpm - Gas DHW	NTG	1.00	1.00	1.00	1.00	1.00	1.00
Multi-Family Direct Install	Low Flow Showerhead 1.5 gpm - Gas DHW	Incremental Cost	-	-	-	-	-	-
Multi-Family Direct Install	Smart Thermostat - Gas Heated (Gas)	Participation	798	798	798	798	798	798
Multi-Family Direct Install	Smart Thermostat - Gas Heated (Gas)	Total Incentive Budget	-	-	-	-	-	-
Multi-Family Direct Install	Smart Thermostat - Gas Heated (Gas)	Total Gross Incremental Savings (therms)	25,871	25,871	25,871	25,871	25,871	25,871
Multi-Family Direct Install	Smart Thermostat - Gas Heated (Gas)	NTG	1.00	1.00	1.00	1.00	1.00	1.00
Multi-Family Direct Install	Smart Thermostat - Gas Heated (Gas)	Incremental Cost	-	-	-	-	-	-
Targeted Income	Air Sealing -28% Reduction	Participation	46	46	46	46	46	46
Targeted Income	Air Sealing -28% Reduction	Total Incentive Budget	-	-	-	-	-	-
Targeted Income	Air Sealing -28% Reduction	Total Gross Incremental Savings (therms)	6,505	6,505	6,505	6,505	6,505	6,505
Targeted Income	Air Sealing -28% Reduction	NTG	1.00	1.00	1.00	1.00	1.00	1.00
Targeted Income	Air Sealing -28% Reduction	Incremental Cost	-	-	-	-	-	-
Targeted Income	Bath Aerator - 1.0 GPM (1 unit)	Participation	32	32	32	32	32	32
Targeted Income	Bath Aerator - 1.0 GPM (1 unit)	Total Incentive Budget	-	-	-	-	-	-
Targeted Income	Bath Aerator - 1.0 GPM (1 unit)	Total Gross Incremental Savings (therms)	17	17	17	17	17	17
Targeted Income	Bath Aerator - 1.0 GPM (1 unit)	NTG	1.00	1.00	1.00	1.00	1.00	1.00
Targeted Income	Bath Aerator - 1.0 GPM (1 unit)	Incremental Cost	-	-	-	-	-	-

Program	Measure	Description	2020	2021	2022	2023	2024	2025
Targeted Income	Ceiling Insulation Pre R0 to Post R38	Participation	1	1	1	1	1	1
Targeted Income	Ceiling Insulation Pre R0 to Post R38	Total Incentive Budget	-	-	-	-	-	-
Targeted Income	Ceiling Insulation Pre R0 to Post R38	Total Gross Incremental Savings (therms)	73	73	73	73	73	73
Targeted Income	Ceiling Insulation Pre R0 to Post R38	NTG	1.00	1.00	1.00	1.00	1.00	1.00
Targeted Income	Ceiling Insulation Pre R0 to Post R38	Incremental Cost	-	-	-	-	-	-
Targeted Income	Ceiling Insulation Pre R8 to Post R38	Participation	2	2	2	2	2	2
Targeted Income	Ceiling Insulation Pre R8 to Post R38	Total Incentive Budget	-	-	-	-	-	-
Targeted Income	Ceiling Insulation Pre R8 to Post R38	Total Gross Incremental Savings (therms)	147	147	147	147	147	147
Targeted Income	Ceiling Insulation Pre R8 to Post R38	NTG	1.00	1.00	1.00	1.00	1.00	1.00
Targeted Income	Ceiling Insulation Pre R8 to Post R38	Incremental Cost	-	-	-	-	-	-
Targeted Income	Furnace 92% AFUE	Participation	44	44	44	44	44	44
Targeted Income	Furnace 92% AFUE	Total Incentive Budget	-	-	-	-	-	-
Targeted Income	Furnace 92% AFUE	Total Gross Incremental Savings (therms)	6,134	6,134	6,134	6,134	6,134	6,134
Targeted Income	Furnace 92% AFUE	NTG	1.00	1.00	1.00	1.00	1.00	1.00
Targeted Income	Furnace 92% AFUE	Incremental Cost	-	-	-	-	-	-
Targeted Income	Kitchen Aerator - 1.5 GPM (1 unit)	Participation	32	32	32	32	32	32
Targeted Income	Kitchen Aerator - 1.5 GPM (1 unit)	Total Incentive Budget	-	-	-	-	-	-

Program	Measure	Description	2020	2021	2022	2023	2024	2025
Home Energy House Call	Foam Weather Stripping	Incremental Cost	-	-	-	-	-	-
Neighborhood Program	Air Filtration Reduction Measures	Participation	1,000	1,000	1,000	1,000	1,000	1,000
Neighborhood Program	Air Filtration Reduction Measures	Total Incentive Budget	-	-	-	-	-	-
Neighborhood Program	Air Filtration Reduction Measures	Total Gross Incremental Savings (therms)	101,910	101,910	101,910	101,910	101,910	101,910
Neighborhood Program	Air Filtration Reduction Measures	NTG	1.00	1.00	1.00	1.00	1.00	1.00
Neighborhood Program	Air Filtration Reduction Measures	Incremental Cost	-	-	-	-	-	-
Neighborhood Program	Low Flow Showerhead/ Single Detached	Participation	1,000	1,000	1,000	1,000	1,000	1,000
Neighborhood Program	Low Flow Showerhead/ Single Detached	Total Incentive Budget	-	-	-	-	-	-
Neighborhood Program	Low Flow Showerhead/ Single Detached	Total Gross Incremental Savings (therms)	18,460	18,460	18,460	18,460	18,460	18,460
Neighborhood Program	Low Flow Showerhead/ Single Detached	NTG	1.00	1.00	1.00	1.00	1.00	1.00
Neighborhood Program	Low Flow Showerhead/ Single Detached	Incremental Cost	-	-	-	-	-	-
Neighborhood Program	Faucet Aerators/Single Detached	Participation	1,000	1,000	1,000	1,000	1,000	1,000
Neighborhood Program	Faucet Aerators/Single Detached	Total Incentive Budget	-	-	-	-	-	-
Neighborhood Program	Faucet Aerators/Single Detached	Total Gross Incremental Savings (therms)	10,070	10,070	10,070	10,070	10,070	10,070
Neighborhood Program	Faucet Aerators/Single Detached	NTG	1.00	1.00	1.00	1.00	1.00	1.00
Neighborhood Program	Faucet Aerators/Single Detached	Incremental Cost	-	-	-	-	-	-
Neighborhood Program	Pipe Wrap/Single Detached	Participation	1,000	1,000	1,000	1,000	1,000	1,000
Neighborhood Program	Pipe Wrap/Single Detached	Total Incentive Budget	-	-	-	-	-	-

Program	Measure	Description	2020	2021	2022	2023	2024	2025
Home Energy Assessment	Kitchen flip Aerator	Incremental Cost	-	-	-	-	-	-
Home Energy Assessment	Low Flow Showerhead	Participation	300	350	420	504	504	504
Home Energy Assessment	Low Flow Showerhead	Total Incentive Budget	-	-	-	-	-	-
Home Energy Assessment	Low Flow Showerhead	Total Gross Incremental Savings (therms)	2,715	3,168	3,801	4,561	4,561	4,561
Home Energy Assessment	Low Flow Showerhead	NTG	1.06	1.06	1.06	1.06	1.06	1.06
Home Energy Assessment	Low Flow Showerhead	Incremental Cost	-	-	-	-	-	-
Home Energy Assessment	Filter Whistle	Participation	300	350	420	504	504	504
Home Energy Assessment	Filter Whistle	Total Incentive Budget	-	-	-	-	-	-
Home Energy Assessment	Filter Whistle	Total Gross Incremental Savings (therms)	5,331	6,220	7,463	8,956	8,956	8,956
Home Energy Assessment	Filter Whistle	NTG	1.15	1.15	1.15	1.15	1.15	1.15
Home Energy Assessment	Filter Whistle	Incremental Cost	-	-	-	-	-	-
Home Energy Assessment	Pipe Wrap - Gas DHW (per home)	Participation	300	350	420	504	504	504
Home Energy Assessment	Pipe Wrap - Gas DHW (per home)	Total Incentive Budget	-	-	-	-	-	-
Home Energy Assessment	Pipe Wrap - Gas DHW (per home)	Total Gross Incremental Savings (therms)	74	87	104	125	125	125
Home Energy Assessment	Pipe Wrap - Gas DHW (per home)	NTG	1.09	1.09	1.09	1.09	1.09	1.09
Home Energy Assessment	Pipe Wrap - Gas DHW (per home)	Incremental Cost	-	-	-	-	-	-
Home Energy Assessment	Wi-Fi Thermostat - Combo	Participation	300	350	420	504	504	504
Home Energy Assessment	Wi-Fi Thermostat - Combo	Total Incentive Budget	-	-	-	-	-	-
Home Energy Assessment	Wi-Fi Thermostat - Combo	Total Gross Incremental Savings (therms)	7,500	8,750	10,500	12,600	12,600	12,600
Home Energy Assessment	Wi-Fi Thermostat - Combo	NTG	1.00	1.00	1.00	1.00	1.00	1.00
Home Energy Assessment	Wi-Fi Thermostat - Combo	Incremental Cost	-	-	-	-	-	-

Program	Measure	Description	2020	2021	2022	2023	2024	2025
Home Energy Assessment	Water Heater Setback (Gas)	Participation	300	350	420	504	504	504
Home Energy Assessment	Water Heater Setback (Gas)	Total Incentive Budget	-	-	-	-	-	-
Home Energy Assessment	Water Heater Setback (Gas)	Total Gross Incremental Savings (therms)	1,113	1,298	1,558	1,869	1,869	1,869
Home Energy Assessment	Water Heater Setback (Gas)	NTG	1.00	1.00	1.00	1.00	1.00	1.00
Home Energy Assessment	Water Heater Setback (Gas)	Incremental Cost	-	-	-	-	-	-
Home Energy Assessment	Showerstart Device (TSV Valve)	Participation	300	350	420	504	504	504
Home Energy Assessment	Showerstart Device (TSV Valve)	Total Incentive Budget	-	-	-	-	-	-
Home Energy Assessment	Showerstart Device (TSV Valve)	Total Gross Incremental Savings (therms)	921	1,074	1,289	1,546	1,546	1,546
Home Energy Assessment	Showerstart Device (TSV Valve)	NTG	1.00	1.00	1.00	1.00	1.00	1.00
Home Energy Assessment	Showerstart Device (TSV Valve)	Incremental Cost	-	-	-	-	-	-
Food Bank	Low Flow Showerhead 1.5 gpm - Gas DHW	Participation	-	6,312	6,312	1,578	1,578	1,578
Food Bank	Low Flow Showerhead 1.5 gpm - Gas DHW	Total Incentive Budget	-	-	-	-	-	-
Food Bank	Low Flow Showerhead 1.5 gpm - Gas DHW	Total Gross Incremental Savings (therms)	-	41,628	41,628	20,814	20,814	20,814
Food Bank	Low Flow Showerhead 1.5 gpm - Gas DHW	NTG	1.00	1.00	1.00	1.00	1.00	1.00
Food Bank	Low Flow Showerhead 1.5 gpm - Gas DHW	Incremental Cost	-	-	-	-	-	-
C&I Prescriptive	Boiler, > = 90% TE 500-999 MBH	Participation	7	9	12	15	18	22

Program	Measure	Description	2020	2021	2022	2023	2024	2025
C&I Prescriptive	Boiler Reset Control	Total Gross Incremental Savings (therms)	251	251	251	251	251	251
C&I Prescriptive	Boiler Reset Control	NTG	0.75	0.75	0.75	0.75	0.75	0.75
C&I Prescriptive	Boiler Reset Control	Incremental Cost	\$612.00	\$612.00	\$612.00	\$612.00	\$612.00	\$612.00
C&I Prescriptive	Boiler Tune-Up	Participation	250	250	250	250	250	250
C&I Prescriptive	Boiler Tune-Up	Total Incentive Budget	\$58,250	\$58,250	\$58,250	\$58,250	\$58,250	\$58,250
C&I Prescriptive	Boiler Tune-Up	Total Gross Incremental Savings (therms)	91,750	91,750	91,750	91,750	91,750	91,750
C&I Prescriptive	Boiler Tune-Up	NTG	0.75	0.75	0.75	0.75	0.75	0.75
C&I Prescriptive	Boiler Tune-Up	Incremental Cost	\$850.00	\$850.00	\$850.00	\$850.00	\$850.00	\$850.00
C&I Prescriptive	Combination Oven	Participation	1	1	1	1	1	1
C&I Prescriptive	Combination Oven	Total Incentive Budget	\$900	\$900	\$900	\$900	\$900	\$900
C&I Prescriptive	Combination Oven	Total Gross Incremental Savings (therms)	644	644	644	644	644	644
C&I Prescriptive	Combination Oven	NTG	0.75	0.75	0.75	0.75	0.75	0.75
C&I Prescriptive	Combination Oven	Incremental Cost	\$2,125.00	\$2,125.00	\$2,125.00	\$2,125.00	\$2,125.00	\$2,125.00
C&I Prescriptive	Commerical Dishwasher	Participation	8	8	8	8	8	8
C&I Prescriptive	Commerical Dishwasher	Total Incentive Budget	\$6,008	\$6,008	\$6,008	\$6,008	\$6,008	\$6,008
C&I Prescriptive	Commerical Dishwasher	Total Gross Incremental Savings (therms)	3,992	3,992	3,992	3,992	3,992	3,992
C&I Prescriptive	Commerical Dishwasher	NTG	0.75	0.75	0.75	0.75	0.75	0.75
C&I Prescriptive	Commerical Dishwasher	Incremental Cost	\$616.25	\$616.25	\$616.25	\$616.25	\$616.25	\$616.25
C&I Prescriptive	Fryer	Participation	1	1	1	1	1	1

Program	Measure	Description	2020	2021	2022	2023	2024	2025
C&I Prescriptive	Fryer	Total Incentive Budget	\$500	\$500	\$500	\$500	\$500	\$500
C&I Prescriptive	Fryer	Total Gross Incremental Savings (therms)	484	484	484	484	484	484
C&I Prescriptive	Fryer	NTG	0.75	0.75	0.75	0.75	0.75	0.75
C&I Prescriptive	Fryer	Incremental Cost	\$500.00	\$500.00	\$500.00	\$500.00	\$500.00	\$500.00
C&I Prescriptive	Furnace, 92% AFUE	Participation	13	13	13	13	13	13
C&I Prescriptive	Furnace, 92% AFUE	Total Incentive Budget	\$1,950	\$1,950	\$1,950	\$1,950	\$1,950	\$1,950
C&I Prescriptive	Furnace, 92% AFUE	Total Gross Incremental Savings (therms)	975	975	975	975	975	975
C&I Prescriptive	Furnace, 92% AFUE	NTG	0.75	0.75	0.75	0.75	0.75	0.75
C&I Prescriptive	Furnace, 92% AFUE	Incremental Cost	\$900.00	\$900.00	\$900.00	\$900.00	\$900.00	\$900.00
C&I Prescriptive	Furnace 95% AFUE	Participation	276	276	276	276	276	276
C&I Prescriptive	Furnace 95% AFUE	Total Incentive Budget	\$69,000	\$69,000	\$69,000	\$69,000	\$69,000	\$69,000
C&I Prescriptive	Furnace 95% AFUE	Total Gross Incremental Savings (therms)	36,708	36,708	36,708	36,708	36,708	36,708
C&I Prescriptive	Furnace 95% AFUE	NTG	0.75	0.75	0.75	0.75	0.75	0.75
C&I Prescriptive	Furnace 95% AFUE	Incremental Cost	\$900.00	\$900.00	\$900.00	\$900.00	\$900.00	\$900.00
C&I Prescriptive	Furnace, 97% AFUE	Participation	4	1	3	9	17	30
C&I Prescriptive	Furnace, 97% AFUE	Total Incentive Budget	\$1,200	\$300	\$900	\$2,700	\$5,100	\$9,000
C&I Prescriptive	Furnace, 97% AFUE	Total Gross Incremental Savings (therms)	800	200	600	1,800	3,400	6,000
C&I Prescriptive	Furnace, 97% AFUE	NTG	0.75	0.75	0.75	0.75	0.75	0.75
C&I Prescriptive	Furnace, 97% AFUE	Incremental Cost	\$900.00	\$900.00	\$900.00	\$900.00	\$900.00	\$900.00
C&I Prescriptive	Furnace Tune-Up	Participation	1	1	1	1	1	1
C&I Prescriptive	Furnace Tune-Up	Total Incentive Budget	\$20	\$20	\$20	\$20	\$20	\$20
C&I Prescriptive	Furnace Tune-Up	Total Gross Incremental Savings (therms)	21	21	21	21	21	21

Program	Measure	Description	2020	2021	2022	2023	2024	2025
C&I Prescriptive	Furnace Tune-Up	NTG	0.75	0.75	0.75	0.75	0.75	0.75
C&I Prescriptive	Furnace Tune-Up	Incremental Cost	\$306.00	\$306.00	\$306.00	\$306.00	\$306.00	\$306.00
C&I Prescriptive	Infrared Charbroiler	Participation	1	1	1	1	1	1
C&I Prescriptive	Infrared Charbroiler	Total Incentive Budget	\$500	\$500	\$500	\$500	\$500	\$500
C&I Prescriptive	Infrared Charbroiler	Total Gross Incremental Savings (therms)	661	661	661	661	661	661
C&I Prescriptive	Infrared Charbroiler	NTG	0.75	0.75	0.75	0.75	0.75	0.75
C&I Prescriptive	Infrared Charbroiler	Incremental Cost	\$2,200.00	\$2,200.00	\$2,200.00	\$2,200.00	\$2,200.00	\$2,200.00
C&I Prescriptive	Infrared Heater	Participation	1	1	1	1	1	1
C&I Prescriptive	Infrared Heater	Total Incentive Budget	\$350	\$350	\$350	\$350	\$350	\$350
C&I Prescriptive	Infrared Heater	Total Gross Incremental Savings (therms)	114	114	114	114	114	114
C&I Prescriptive	Infrared Heater	NTG	0.75	0.75	0.75	0.75	0.75	0.75
C&I Prescriptive	Infrared Heater	Incremental Cost	\$920.00	\$920.00	\$920.00	\$920.00	\$920.00	\$920.00
C&I Prescriptive	Infrared Upright Boiler	Participation	1	1	1	1	1	1
C&I Prescriptive	Infrared Upright Boiler	Total Incentive Budget	\$1,000	\$1,000	\$1,000	\$1,000	\$1,000	\$1,000
C&I Prescriptive	Infrared Upright Boiler	Total Gross Incremental Savings (therms)	1,089	1,089	1,089	1,089	1,089	1,089
C&I Prescriptive	Infrared Upright Boiler	NTG	0.75	0.75	0.75	0.75	0.75	0.75
C&I Prescriptive	Infrared Upright Boiler	Incremental Cost	\$5,900.00	\$5,900.00	\$5,900.00	\$5,900.00	\$5,900.00	\$5,900.00
C&I Prescriptive	Low Flow Pre-Rinse Sprayer	Participation	1	1	1	1	1	1
C&I Prescriptive	Low Flow Pre-Rinse Sprayer	Total Incentive Budget	\$73	\$73	\$73	\$73	\$73	\$73
C&I Prescriptive	Low Flow Pre-Rinse Sprayer	Total Gross Incremental Savings (therms)	408	408	408	408	408	408
C&I Prescriptive	Low Flow Pre-Rinse Sprayer	NTG	0.75	0.75	0.75	0.75	0.75	0.75
C&I Prescriptive	Low Flow Pre-Rinse Sprayer	Incremental Cost	\$92.90	\$92.90	\$92.90	\$92.90	\$92.90	\$92.90
C&I Prescriptive	Pipe Insulation - Hot Water	Participation	2	2	2	2	2	2

Program	Measure	Description	2020	2021	2022	2023	2024	2025
C&I Prescriptive	Steam Cooker	Incremental Cost	\$3,500.00	\$3,500.00	\$3,500.00	\$3,500.00	\$3,500.00	\$3,500.00
C&I Prescriptive	Steam Trap Replacement - Dry Cleaner	Participation	195	195	195	195	195	195
C&I Prescriptive	Steam Trap Replacement - Dry Cleaner	Total Incentive Budget	\$48,750	\$48,750	\$48,750	\$48,750	\$48,750	\$48,750
C&I Prescriptive	Steam Trap Replacement - Dry Cleaner	Total Gross Incremental Savings (therms)	99,255	99,255	99,255	99,255	99,255	99,255
C&I Prescriptive	Steam Trap Replacement - Dry Cleaner	NTG	0.75	0.75	0.75	0.75	0.75	0.75
C&I Prescriptive	Steam Trap Replacement - Dry Cleaner	Incremental Cost	\$77.00	\$77.00	\$77.00	\$77.00	\$77.00	\$77.00
C&I Prescriptive	Steam Trap Replacement - Low P < 15 psi	Participation	1	1	1	1	1	1
C&I Prescriptive	Steam Trap Replacement - Low P < 15 psi	Total Incentive Budget	\$50	\$50	\$50	\$50	\$50	\$50
C&I Prescriptive	Steam Trap Replacement - Low P < 15 psi	Total Gross Incremental Savings (therms)	673	673	673	673	673	673
C&I Prescriptive	Steam Trap Replacement - Low P < 15 psi	NTG	0.75	0.75	0.75	0.75	0.75	0.75
C&I Prescriptive	Steam Trap Replacement - Low P < 15 psi	Incremental Cost	\$77.00	\$77.00	\$77.00	\$77.00	\$77.00	\$77.00
C&I Prescriptive	Unit Heater	Participation	1	1	1	1	1	1
C&I Prescriptive	Unit Heater	Total Incentive Budget	\$200	\$200	\$200	\$200	\$200	\$200
C&I Prescriptive	Unit Heater	Total Gross Incremental Savings (therms)	266	266	266	266	266	266
C&I Prescriptive	Unit Heater	NTG	0.75	0.75	0.75	0.75	0.75	0.75
C&I Prescriptive	Unit Heater	Incremental Cost	\$676.00	\$676.00	\$676.00	\$676.00	\$676.00	\$676.00
C&I Prescriptive	Water Heater - 88% TE	Participation	12	12	12	12	12	12



prepared for

VECTREN ENERGY DELIVERY OF INDIANA

*2020-2025 Integrated **Natural Gas DSM Market Potential Study & Action Plan***

FINAL REPORT

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prepared by
**GDS ASSOCIATES INC
EMI CONSULTING**