Evergy Missouri West, Inc. Evaluation, Measurement, and Verification Report – Appendices

Program Year 2019

Prepared for:

Evergy Missouri West, Inc.

Submitted by:

Guidehouse, Inc.
1375 Walnut Street
Suite 100
Boulder, CO 80303

303.728.2500
Guidehouse.com

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REPORT DEFINITIONS

Note: Definitions provided in this section are limited to terms that are critical to understanding the values presented in this report.

Reporting Periods

Cycle 1
Refers to programs implemented in the timeframe of program years 2013-2015 (PY2013-PY2015).

Cycle 2
Refers to programs implemented in the timeframe of program years 2016-2019 (PY2016-PY2019), which corresponds to April 2016-December 2019.

Savings Types

Gross Reported Savings
Savings reported in the Evergy Missouri West annual reports prior to any EM&V ex-post gross adjustments and net-to-gross (NTG) adjustments. In previous Guidehouse EM&V reports, gross reported savings were referred to as ex-ante gross savings.

Gross Verified Savings
Savings verified through Guidehouse's impact evaluation methods prior to NTG adjustments. In previous EM&V reports, gross verified savings were referred to as ex post gross savings.

Gross Realization Rates
The ratio of gross verified savings to gross reported savings.

Missouri Energy Efficiency Investment Act (MEEIA) Target
Four-year savings target approved by the Missouri Public Service Commission for a given program.

Net Verified Savings
Savings verified through Guidehouse's impact evaluation methods and inclusive of NTG adjustments.

Percentage of MEEIA Target Achieved
The ratio of net verified savings to the MEEIA target; reflects Evergy Missouri West's overall achievement toward the MEEIA target.

Net-to-Gross Components

Free Ridership (FR)
The program savings attributable to free riders—i.e., program participants who would have implemented a program measure or practice in the absence of the program.

Participant Spillover (PSO)
The additional energy savings achieved when a program participant—as a result of the program's influence—installs energy efficiency measures or practices outside the efficiency program after having participated.

Nonparticipant Spillover (NPSO)
The additional energy savings achieved when a nonparticipant implements energy efficiency measures or practices because of the program's influence (e.g., through exposure to the program) but is not accounted for in program's gross verified savings.

Net Sales Analysis Approach to NTG
Approaches to estimating NTG that rely on the effect of program activity on total sales, yielding a market-level estimate of NTG that take FR, PSO, and NPSO into account. This involves establishing the sales with the program and estimating sales in the absence of the program, often based on expert opinions (e.g., the input of trade allies), stated participant and non-participant actions in the absence of the program (e.g., in-store intercept surveys), quasi-experimental designs (e.g., the use of comparison areas), or statistical modeling (e.g., modeling the impact of program activity on sales), thereby identifying the overall lift associated with program activity. Note that in some cases, such as the Home Lighting Rebate (HLR) program, sales data are limited to program bulbs only. Regression analysis of this subset of sales facilitates FR estimation, but not SO estimation. For lighting specifically, net savings are based on a combination of methods (shopper responses to in-store intercepts and regression analysis) to make certain the estimation reflects both FR and SO.

Billing Analysis Approach to NTG
Approaches to estimating NTG that rely on the use of control groups, either through randomized control trials (RCT) or quasi-experimental designs (e.g., the use of matching techniques to develop relevant non-participant comparison groups), and billing analysis to model participant net savings.

KEY REPORT SOURCES

Below is a list of the most commonly referenced documents that the evaluation team used for this year's analysis.

Illinois Technical Reference Manual Version 5.0. (IL TRM v5)
http://www.ilsag.info/il_trm_version_5.html

Illinois Technical Reference Manual Version 6.0. (IL TRM v6)
http://www.ilsag.info/il_trm_version_6.html

Illinois Technical Reference Manual Version 7.0. (IL TRM v7)
http://www.ilsag.info/il_trm_version_7.html

Missouri Energy Efficiency Investment Act (MEEIA) Rules and the Stipulation and Agreement approved April 6, 2016, by Great Plains Energy Services Incorporated (GPES)

Missouri Code of State Regulations 4 CSR 240-22.070 (8)

California Public Utilities Commission. *California Standard Practice Manual: Economic Analysis of Demand-Side Programs and Projects.* October 2001. http://www.cpuc.ca.gov/NR/rdonlyres/004ABF9D-027C-4BE1-9AE1-CE56ADF8DADC/0/CPUC_STANDARD_PRACTICE_MANUAL.pdf.

Daniel M. Violette and Pamela Rathbun. "Estimating Net Savings: Common Practices," Chapter 23 in *The Uniform Methods Project: Methods for Determining Energy Efficiency Savings for Specific Measures*. 2014. http://energy.gov/sites/prod/files/2015/02/f19/UMPChapter23-estimating-net-savings_0.pdf.

Jane Peters and Ryan Bliss. *Common Approach for Measuring Free Riders for Downstream Programs.* Research Into Action. October 4, 2013.

California Public Utilities Commission. "2007 SPM Clarification Memo." 2007.
http://www.cpuc.ca.gov/NR/rdonlyres/004ABF9D-027C-4BE1-9AE1-CE56ADF8DADC/0/CPUC_STANDARD_PRACTICE_MANUAL.pdf.

Evaluation, Measurement, and Verification Plan: KCP&L GMO Energy Efficiency and Demand Response Program 2013-2015 prepared by Navigant (now Guidehouse). October 2013.

Rachel Brailove, John Plunkett, and Jonathan Wallach. *Retrofit Economics 201: Correcting Commons Errors in Demand-Side Management Benefit-cost Analysis.* Resource Insight, Inc. Circa 1990.

ACRONYMS AND ABBREVIATIONS

ACUR	Air Conditioning Upgrade Rebate
AMI	Advanced Metering Infrastructure
AMR	Automated Meter Reading
BOEA	Business Online Energy Analyzer
Btu	British Thermal Unit
C&I	Commercial & Industrial
CAP	Community Action Program
CBL	Customer Baseline
CET	Customer Engagement Tracker
CF	Coincident Factor
CFL	Compact Fluorescent Lamp
DEM	Demand Elasticity Modeling
DID	Difference-in-Difference
DIY	Do It Yourself
DLC	Direct Load Control
DR	Demand Response
DRI	Demand Response Incentive
EER	Energy Efficiency Rebate
EM&V	Evaluation, Measurement, and Verification
ETO	Energy Trust of Oregon
FR	Free Rider(ship)
GPES	Great Plains Energy Services
HER	Home Energy Report
HLR	Home Lighting Rebate
HOEA	Home Online Energy Analyzer
HOU	Hours of Use
HSPF	Heating Seasonal Performance Factor
HVAC	Heating, Ventilation, and Air Conditioning
ICF	ICF is the residential program implementation contractor
IEMF	Income-Eligible Multifamily
IEW	Income-Eligible Weatherization
ISR	In-Service Rate
KCP&L	Kansas City Power and Light, now Evergy, Inc.
kW	Kilowatt
kWh	Kilowatt-Hour
LED	Light-Emitting Diode
LFER	Linear Fixed-Effects Regression
MEEIA	Missouri Energy Efficiency Investment Act
NPSO	Nonparticipant Spillover

NTG	Net-to-Gross
OLS	Ordinary Least Squares
ORNL	Oak Ridge National Lab
PA	Pennsylvania
PCT	Participant Cost Test
PITA	Program Influence on Trade Ally
POD	Post-Only Difference
PPR	Post-Period Regression
PT	Programmable Thermostat
RCT	Randomized Control Trial
RFP	Request for Proposal
RIM	Ratepayer Impact Measure
RUL	Remaining Useful Life
SBL	Small Business Lighting
SCT	Societal Cost Test
SEM	Strategic Energy Management
SEER	Seasonal Energy Efficiency Ratio
SO	Spillover
SPM	Standard Practice Manual
TRC	Total Resource Cost
TRM	Technical Reference Manual
UCT	Utility Cost Test
WACC	Weighted Average Cost of Capital
WHE	Whole House Efficiency
WHF	Waste Heat Factor
WUM	What Uses Most

APPENDIX A. SURVEY INSTRUMENTS

A.1 Business EER Custom Program Participant Online Survey Guide

Sample Variables

<MEASURE>: Rebated measure, using simplified measure name; pluralized if quantity is more than 1
<MEASURECAT>: "Lighting", "Building Optimization", "Compressed Air", "Variable Speed Drive for Pump or Fan", "Misc. Custom", "New Construction", "Air Optimization/Balancing", "Refrigeration", "Custom Packaged RTU", "Chiller Plant Optimization", "Energy Management System", "Economizers", "Constant Volume to Variable Volume Air Volume Conversion"
<REBATE>: The dollar value of the rebate the participant received for the measure
<MEASUREQTY>: The quantity of measures installed
<COMPANY>: The name of the customer's company
<SERVICE ADDRESS>: The address where the rebated measures were installed.
<SurveyType>: FR (full survey except spillover questions and $50 gift card) or SO (spillover and satisfaction questions only and $25 gift card)

Introduction

Thank you for participating in the Evergy Business Energy Savings Custom Program participant survey. All data collected is confidential and will only be used to inform our internal evaluation. The surveys will not affect your energy efficiency project, applications, rebates, or service.

If you accidentally close the survey or aren't able to finish today, your progress will be saved - just click the link in your email again.

At the end of the survey if you would like to receive the [$50/$25] Amazon e-gift card, we will ask for your email address in thanks for your time in completing the survey. The gift card will be emailed to you within 10 days of completing the survey.

Screening Questions

S1. Our records show that your organization <COMPANY> received <rebate amount> in Evergy Business Energy Savings Custom Program incentives to complete a <measure> project at <SERVICE ADDRESS>. Is this correct?

1. Yes [CONTINUE TO S2]
2. No [SKIP TO S6]
98. Don't know [SKIP S6]

[ASK IF S1=Yes]
S2. Were you directly involved in the decision to purchase and install and complete the <MEASURE> project at <SERVICE ADDRESS>? (Note that you may have completed other energy efficient projects but this survey will focus on <MEASURE>.)

1. Yes [CONTINUE TO S3]
2. No [SKIP TO S5]
98. Don't know [SKIP TO TERMINATE]

[ASK IF S2=2,98]

S3. Is there someone else at your organization who might be more familiar with the energy efficiency upgrade project? If so, would you please provide us with their email address?

1. Yes, please enter email address
2. No
98. Don't know

[ASK IF S2=Yes]
S4. Are you an employee of <COMPANY> or the OWNER/property manager at <SERVICE ADDRESS>, or were you involved in the project in some other capacity (e.g., as an installation contractor or energy services provider)?

1. Employed at <COMPANY> or owner/property manager at <SERVICE ADDRESS> [SKIP TO S6]
2. Employed by another organization [CONTINUE TO S5]
98. Don't know [SKIP TO TERMINATE]

[ASK IF S2=No or S4=Employed by another organization]
S5. We are looking to survey the decision-maker at <COMPANY> who made the purchase decision to install <MEASURE>. Could you provide us with the name and email address of the project decision-maker at <COMPANY> that you worked with?
[ENTER NAME/EMAIL]

98. Don't know [SKIP TO TERMINATE]

[ASK IF S4=Employed at <COMPANY> or owner]
S6. Could you please verify your name and email address? (Note: this information is requested for survey management purposes only; your responses will remain anonymous and will not be linked with any of your contact information.)
[ENTER NAME/EMAIL]
[SKIP TO S5]

[Display if S2=2 or 98 or S6=2 or 98]
Terminate Message: Those are all the questions we have for you. Thank you for your time.

[If <SurveyType>=SO, skip to Participant Spillover section]

Awareness and Participant Journey

A1. How did you first learn about the Business Energy Savings Custom Program?
[ROTATE 1-13]

1. Evergy newsletter
2. Evergy bill insert
3. Other mailing from Evergy
4. Evergy community event
5. Evergy website
6. Evergy field representative
7. Newspaper, magazine, or other print media advertisement
8. Radio advertisement
9. Family, friend, or word of mouth
10. Contractor, Vendor, or Equipment Installer
11. Evergy call center
12. Evergy information received after participating in another Evergy program
13. Social Media Ad
14. Other Evergy emails
15. Other, Please Describe
98. Don't know

A2. What made your company first decide to purchase the new <MEASURECAT> equipment? [SELECT ALL THAT APPLY; ROTATE 1-9]

1. Recommended by contractor
2. Old equipment stopped working
3. Old equipment needed too many repairs
4. Was paying high utility bills and wanted to save money
5. Wanted to improve our work environment
6. Wanted to make our company more “green”/reduce greenhouse gas emissions
7. Wanted to improve the property value
8. Wanted to reduce operation and maintenance costs
9. Learned about the availability of a rebate from Evergy
10. Received a rebate from Evergy or other utility in the past
97. Other, Please Describe
98. Don’t know

A3. What was the status of your old equipment when you decided to buy the new <MEASURECAT> equipment? [SELECT ONE]

1. It was working and did not need any repairs beyond regular maintenance
2. It was working but needed minor repairs
3. It was working but needed major repairs
4. It was not working but was repairable
5. It was not working and could not be repaired
6. Not applicable, rebated <MEASURE> was new equipment
7. Other, please describe
98. Don’t know

Multiple Projects

[Ask if ProjectQty> 1]

MP1. Our records show that you've completed multiple projects through this program. Would you say that your experience with the program and decision-making process has been similar for all projects?

1. Yes
2. No
98. Don’t know

[Ask if MP1= 2 or 98]

MP2. Can you describe how your experience was different at other locations?
[Open-ended text box]

Participant Free Ridership

[Ask if A4 <>9]

FR1. Had you already decided to purchase the new <MEASURECAT> equipment before you learned about the program?

1. Yes
2. No
98. Don’t know

[Ask if FR1=1 or A4=9, else skip to FR3]
FR2a. Prior to learning about the Business Energy Savings Custom Program, had you received a cost estimate for the full cost of the <MEASURE> project at the same scope and efficiency level as completed through the program?
1. Yes
2. No
98. Don't know

[Ask if FR2a=1, else skip to FR3]
FR2b. Did you have a budget to cover that full cost without any discounts or incentives prior to learning about the Business Energy Savings Custom Program?
1. Yes
2. No
98. Don't know

FR3. Which of the following statements best describe what you would have done if the program incentive had not been available? [ROTATE; ALLOW ONE RESPONSE]
1. Would not have purchased any equipment or done any upgrades
2. Would have postponed the purchase for more than one year
3. Would have purchased exactly the same <MEASURE> project within a year
4. Would have purchased less efficient project
5. [IF MEASUREQTY>1] Would have implemented fewer energy-efficient <MEASURES> of the same efficiency level
98. Don't know

[Ask if FR3 = 4]
FR3a. You stated that without the program incentive, you likely would have implemented a less efficient project. How much less efficient would the project have been?
1. Almost as efficient
2. Somewhat less efficient
3. Much less efficient (minimal efficiency level available)
4. Lowest cost available regardless of efficiency
98. Don't know

[Ask if FR3 = 5]
FR3b. How many fewer <MEASURE> would you have purchased?
1. Most of them (approximately two-thirds of the <MEASURES> or more)
2. Some of them
3. Few of them (approximately one-third of the <MEASURES> or fewer)
98. Don't know

[Ask if FR3 = 5]
FR3c. You stated that without the program incentive, you would have completed exactly the same project. Does that mean your business would have paid an additional ${e://Field/Rebate} to cover the entire cost of the ${e://Field/Measure} project?
1. Yes
2. No
98. Don't know

FR4. On a scale of 1 to 5, where 5 is "very influential" and 1 is "not at all influential," how influential were the following elements on your decision to complete the <MEASURE> project?
[For FR4 responses 1, 2 and 3 record responses 1 through 5, DK]

1. Program incentive
2. Information from an Evergy program
3. Installation Contractor/Trade Ally

[Skip to Awareness and Participant Journey Part 2 section]

Participant Spillover

SO1. Since learning about the program, did you install any *additional* energy efficient equipment or make any additional energy efficiency upgrades at the same facility or at any other facility within Evergy's service territory?

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

[Ask if SO1 = 1, else skip to PS1]
SO2. Did you apply for an incentive from Evergy for the additional energy-efficient equipment or upgrade?

1. Yes, and I received an incentive from Evergy
2. Yes, but I did not receive an incentive from Evergy
3. No
98. Don't know

[Ask if SO2=2]
SO3. Do you know why you did not receive an incentive from Evergy for the additional energy-efficient equipment or upgrade?

[OPEN ENDED]
98. Don't know

[Ask if SO2=3]
SO4. Why didn't you apply for an incentive from Evergy for the additional energy-efficient equipment or upgrade?

[OPEN ENDED]
98. Don't know

[Ask if SO2 = 2 or 3, else skip to PS1]
SO5. How influential was Evergy's Business Energy Savings Custom Program on your decision to install the *additional* energy efficient equipment which did not receive incentives**? Please rate on a 5-point scale in which 5 means "very influential" and 1 means "not at all influential."**

[1-5, DK]

[Ask if SO5=3, 4, or 5, else skip to PS1]
SO6. Please describe the energy efficient equipment that was installed without incentives:

a. Enter description:
b. Enter quantity: [NUMERIC]
c. Enter approximate installation date [DATE]

SO7. To the best of your knowledge, did this new equipment save more energy, about the same amount of energy, or less energy than the equipment that was rebated by Business Energy Savings Custom Program?

1. More energy savings
2. Same energy savings
3. Less energy savings
98. Don't know

[Skip to Participant Satisfaction section]

Awareness and Participant Journey Part 2

A_6A. On a scale of 1 to 5 where 1 means "strongly disagree" and 5 means "strongly agree," please rate your agreement with the following statements:

1. The program is easy to work with and understand.
2. When I had questions, I knew who to contact.
3. I had enough information about measure eligibility and rebates to make decisions about which equipment to install.
98. Don't know

[Ask if A_6A 1-3 is less than 4]
A_6B_1. Please describe what aspects of the program were not easy to work with or understand.
A_6B_2. Please describe any confusion there may have been regarding who to contact.
A_6B_3. **Please describe the lack of clarity there may have been regarding the measure eligibility or rebates.**

A6. How easy was it to find an Evergy Authorized Trade Ally (i.e., Evergy-approved contractor) for your Business Energy Savings Custom Program rebate project? Please use a scale of 1 to 5, where 1 is "not at all easy" and 5 is "extremely easy".
[Record 1-5, 98. DK,]
98. N/A: Self-directed project and did not use a Trade Ally [Skip to A8]

[Ask if A6 != 98]
A7. How did you find the Evergy Authorized Trade Ally you used for your Business Energy Savings Custom Program rebate project? Please select all that apply.
[ROTATE; Multiple Response]
1. Evergy website
2. Knew the Trade Ally from a previous project
3. Someone referred the Trade Ally
4. Other, please specify [Open end; record verbatim]
98. Don't know

A8. Who submitted the pre-approval application for your project?
[ROTATE; Single Response]
1. [If A6 !=98] An Evergy authorized Trade Ally
2. Myself
3. Another company employee
4. Other, please specify [Open end; record verbatim]
98. Don't know

[Ask if A8 = 2; else skip to A10]
A9. How easy was it to complete your Business Energy Savings Custom Program project pre-approval application? Please use a scale of 1 to 5, where 1 is "not at all easy" and 5 is "extremely easy".
[Record 1-5, DK, Refused]

[Ask if A5 != 99]
A10. How would you rate your satisfaction with the following aspects of the trade ally's project recommendations? Please rate these on a 5-point scale where 5 means "extremely satisfied" and 1 means "not at all satisfied" [Record 1-5, DK, Refused for each].

a. The number of measure options the Trade Ally recommended
b. The attractiveness of the measure options the Trade Ally recommended
c. The Trade Ally's explanation of the measure options recommended

A10a. [Ask for each aspect from A9a where the response was < 3] **Why did you provide this rating for the number of measure options the trade ally recommended?**
[OPEN ENDED; Record verbatim]

A10b. [Ask for each aspect from A9b where the response was < 3] **Why did you provide this rating for the attractiveness of the measure options the trade ally recommended?**
[OPEN ENDED; Record verbatim]

A10c. [Ask for each aspect from A9c where the response was < 3] **Why did you provide this rating for the trade ally's explanation of the measure options recommended?**
[OPEN ENDED; Record verbatim]

Participant Satisfaction

[Ask if Survey Type = FR]
PS1. How would you rate your satisfaction with the following aspects of the Evergy Business Energy Savings Custom Program? Please rate on a 5-point scale in which 5 means "very satisfied" and 1 means "not at all satisfied."
[ROTATE a-f, RECORD 1-5, DK]

a. Amount of rebate
b. Time it took to receive the rebate
c. Requirements to participate in program
d. Program Communications
e. [ASK IF A8 != 2] Application process
f. [ASK IF A8 = 2] Pre-approval application process
g. [ASK IF A8 = 2] Final approval process
h. [ASK IF ProjectIncentive>$10,000] Inspection process (if applicable)
i. The Program representative
j. Your installation contractor
k. Overall satisfaction with the program

[Ask PS2a if PS1a was < 3]
PS2a. Why did you provide this rating for the amount of the rebate?
[OPEN ENDED]

[Ask PS2b if PS1b was < 3]
PS2b. Why did you provide this rating for the time it took to receive the rebate?
[OPEN ENDED]

[Ask PS2c if PS1c was < 3]
PS2c. Why did you provide this rating for the program communications?
[OPEN ENDED]

[Ask PS2d if PS1d was < 3]
PS2d. Why did you provide this rating for the requirements to participate in the program?
[OPEN ENDED]

[Ask PS2e if PS1e was < 3]
PS2e. Why did you provide this rating for the application process?
[OPEN ENDED]

[Ask PS2f if PS1f was < 3]
PS2f. Why did you provide this rating for the pre-approval application process?
[OPEN ENDED]

[Ask PS2g if PS1g was < 3]
PS2g. Why did you provide this rating for the final approval application process?
[OPEN ENDED]

[Ask PS2h if PS1h was < 3]
PS2h. Why did you provide this rating for the inspection process?
[OPEN ENDED]

[Ask PS2i if PS1i was < 3]
PS2i. Why did you provide this rating for the Program Representative?
[OPEN ENDED]

Ask PS2jif PS1j was < 3]
PS2j. Why did you provide this rating for your installation contractor?
[OPEN ENDED]

[Ask PS2k if PS1k was < 3]
PS2k. Why did you provide this rating for your overall satisfaction with the program?
[OPEN ENDED]

[ASK ALL]
PS3. How likely you would be to participate in Evergy rebate programs again? Please rate on a 5-point scale in which 5 is "very likely" and 1 is "not at all likely."
[For PS9a-PS9c, Record responses 1 through 5, DK]

PS4. Have you recommended the Evergy Business Energy Savings Custom Program to colleagues or friends?

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

[Ask if Survey Type = FR]
PS5. Were there any other types of energy saving equipment or upgrades that you wanted to install but that Evergy did not approve?
[OPEN ENDED, None]

PS6. Please share any suggestions you may have for improving the Evergy Business Energy Savings Custom Program.
[OPEN ENDED, None]

PS7. Based on your overall experience as a customer of Evergy, how would you rate your satisfaction with the company on a scale of 1 to 5, where 5 is very satisfied and 1 is not at all satisfied?
[1-5, DK]

[Ask if PS7<3, else skip to PI1]
PS8. What were the reasons that you give it that rating?
[OPEN-ENDED]

Firmographics

Just a few questions left.

F1. What type of organization is <COMPANY>?
[ROTATE]

1. Office
2. Retail
3. Convenience Store
4. Grocery
5. Restaurant
6. Industrial
7. Light Manufacturing
8. Warehouse
9. Church
10. K-12 School
11. College/University
12. Government Building
13. Other (PLEASE SPECIFY)
14. Don't know

F2. Which of the following descriptions best fits the facility at <SERVICE ADDRESS>?

1. Your organization's only location
2. One of several locations within Evergy service territory
3. One of several locations both within and outside of Evergy service territory
4. Your organization's headquarters, with several locations within Evergy service territory
5. Your organization's headquarters, with several locations both within and outside of Evergy service territory
6. Other, please describe (SPECIFY)
98. Don't know

F3. Would you like a follow-up call from program staff regarding any of your experiences in the program, to share additional comments or ask questions?

1. Yes
2. No

[ASK IF F3 = 1]
F4. Please provide your phone number (this will only be used for the follow-up call).
[NUMERIC PHONE NUMBER ENTRY]

Close

We would like to offer you a [$50/$25] Amazon e-gift card in thanks for completing our survey. If you would like to receive this gift card, please enter your preferred email address below. If you would not like the gift card, please check "No thanks."

Your email address will only be used to send the e-gift card. You will receive the gift card within a week of completing the survey. Be sure to click the forward arrow below to record your response.

a. Please enter your email address:
b. No thanks, I do not wish to receive an Amazon gift card

Survey completion message

Thank you for your time in completing this survey. Your responses will help Evergy improve their programs to better serve customers like you!

A.2 Business EER Custom Program Trade Ally Online Survey Guide

Sample Variables

<MeasureCat>: "Lighting", "Building Optimization", "Compressed Air", "Variable Speed Drive for Pump or Fan", "Misc. Custom", "New Construction", "Air Optimization/Balancing", "Refrigeration", "Custom Packaged RTU", "Chiller Plant Optimization", "Energy Management System", "Economizers", "Constant Volume to Variable Volume Air Volume Conversion"
<Measure1>: Trade ally's highest saving measure
<Measure2>: Trade ally's second highest saving measure (if applicable)
<Measure3>: Trade ally's third highest saving measure (if applicable)
<Measure1qty>: Number of program-incented <Measure1> units in 2019
<Measure2qty>: Number of program-incented <Measure2> units in 2019 (if applicable)
<Measure3qty>: Number of program-incented <Measure3> units in 2019 (if applicable)

Screening Questions

Thank you for participating in the EVERGY Business Energy Efficiency Rebates Custom Program Trade Ally Survey. This survey effort will provide EVERGY with valuable feedback to improve program offerings and ultimately help you better serve your customers. This survey is being administered by EVERGY's independent third-party evaluator, Guidehouse, and your responses will remain confidential and will be presented to EVERGY only in aggregate form.

In thanks for your time, EVERGY would like to offer you a $50 Amazon gift card for participation in the survey. You must complete the entire survey to receive the gift card. At the end of the survey, you will be asked to provide the email address at which you wish to receive the gift card.

S1. What type of role(s) do you play on efficiency projects that participate in EVERGY's Business Energy Efficiency Rebates Custom program? Please check all that apply.

1. Making sales calls via phone
2. Making sales calls in person
3. Preparing project specifications/proposals for customers
4. Processing incentive applications
5. Installing equipment at customer sites
6. Other [Please describe _____]

98. Don't know

Program Influence on Trade Allies

PITA1. Have you participated in any program webinars, meetings, or training sessions, or received any educational materials from the program?

1 Yes
2 No
98. Don't Know

PITA2. Have you ever brought an EVERGY program staff member on sales calls to customer sites with you?

1 Yes
2 No
98. Don't Know

[IF PITA2=1, ASK PITA2a, ELSE SKIP TO PITA3]
PITA2a. About how many times have you brought a EVERGY program staff member on sales calls with you?
[NUMERIC OPEN ENDED]
98 Don't know

PITA2b. How helpful are those joint sales calls with EVERGY staff in selling high efficiency <MEASURECAT>?
[1-5 scale, endpoints labeled 1 "Not at all helpful" and 5 "Very helpful"]
98. Don't Know

PITA3. Have you received any marketing materials from the Business Energy Efficiency Rebates Custom program for you to pass along to your customers?
1 Yes
2 No
98. Don't know

[IF PITA3=1, ASK PITA3a, ELSE SKIP TO PITA4]
PITA3a. How much influence have those marketing materials had on your ability to market energy efficiency to your customers?
[1-5 scale, endpoints labeled 1 "Not at all influential" and 5 "Very influential"]
98 Don't know

PITA4. Since you started participating in the EVERGY commercial and industrial efficiency programs, have you changed the type of <MEASURECAT> project that you offer to your customers, especially regarding level of efficiency? Please select all that apply.
[ROTATE 1-3, MULTIPLE RESPONSES]
1. Started offering higher efficiency equipment as the "default" recommendation
2. Added new higher efficiency equipment to your offerings
3. Stopped carrying lower efficiency equipment
4. Other [SPECIFY]
5. None of the above
98. Don't know

[IF PITA4=1, 2, or 3, ASK PITA4a, ELSE SKIP TO PITA5]
PITA4a. If the programs had never been available, what is the likelihood that you would have made those same changes in your offerings for high efficiency <MeasureCat>?
[1-5 scale, endpoints labeled 1 "Not at all likely" and 5 "Very likely"]
98. Don't know

PITA5. Have you observed an increase in your overall high efficiency <MeasureCat> sales since participating in the EVERGY commercial and industrial efficiency programs?
1. Yes
2. No
98. Don't know

[IF PITA5=1, ASK PITA4a, ELSE SKIP TO PITA6]
PITA5a. Would you say that your overall <MeasureCat> sales have increased, a higher percentage of customers are choosing high efficiency <MeasureCat>, or both?
1. Overall sales have increased (including standard and high efficiency)
2. A higher percentage of customers are choosing high efficiency
3. Both
98. Don't know

[ASK IF PITA5a=2 or 3, ELSE SKIP TO PITA5d]
PITA5b. Making your best estimate, what was the percentage of customers who choose high efficiency options before you started participating in the programs?
RECORD NUMBER BETWEEN 0% and 100%
98. Don't Know

PITA5c. And, making your best estimate, what was the percentage of customers who chose high efficiency options this past year?
RECORD NUMBER BETWEEN 0% and 100%
98. Don't Know

[ASK IF PITA5a=1,2,3]
PITA5d. How influential do you think the C&I Custom program was on the increase in high efficiency sales?
[1-5 scale, endpoints labeled 1 "Not at all influential" and 5 "Very influential"]
98. Don't Know

[IF PITA5=1]
PITA5e. Has the program's influence on your business enabled you to hire additional employees to meet the additional demand for high efficiency?
1. Yes; please describe: [OPEN ENDED]
2. No
98. Don't know

PITA6. Which of the following non-utility benefits do you typically discuss with customers when selling high efficiency <MeasureCat>? Please select all that apply.
[ROTATE 1-6]

1. Lower utility bills
2. Improved work environment
3. Chance to make the company more "green"
4. Increased property value
5. Lower operating and maintenance cost
6. Quick payback period
7. Other; please describe [OPEN ENDED]
8. I do not discuss any of these benefits with customers

PITA7. If the C&I Custom program did not exist, how would your business be different (if at all)?
[OPEN ENDED]
98. Don't Know

Measure Level Sales

Our next set of questions focuses on your past and current sales of the two highest-saving energy efficiency measures that you installed through Evergy's programs this past year. The following table summarizes those two measures based on your projects recorded in the program database.

Measure Name	Number of Projects Rebated by EVERGY this past year
<Measure1>	<Measure1qty>
<Measure2>	<Measure2qty>

ML1. Did you sell any more of these measures *without* EVERGY program rebates this past year? Please consider only measures sold in EVERGY's Missouri territory to the extent possible (see map).

1. <Measure 1> [CONTINUE]
2. <Measure 2> [CONTINUE]
3. None of the above [SKIP TO ML5]
98. Don't know [SKIP TO ML5]

[IF ML1=1, ELSE SKIP TO ML5]

ML2. Approximately how many additional projects did you complete this past year without rebates, in EVERGY's Missouri territory? An estimate is fine. (The number in parentheses indicates the number of units you sold **with** rebates, according to EVERGY's program records.)

Measure Name	Number of Projects Rebated by EVERGY this past year	Number of Additional Projects Completed Without Rebates this past year
<Measure1>	<Measure1qty>	ML2a. [NUMERIC OPEN END]
<Measure2>	<Measure2qty>	ML2b. [NUMERIC OPEN END]

ML3. How influential do you think the EVERGY commercial and industrial programs were on these additional projects completed without rebates?
[1-5 scale, endpoints labeled 1 "Not at all influential" and 5 "Very influential"]
98. Don't know

ML4. Why didn't you seek EVERGY rebates for these additional units sold?
[OPEN ENDED]
98. Don't know

ML5. Are there any *other* program-qualifying measures that you frequently install without any Evergy program rebates in EVERGY's Missouri territory?
1. Yes [CONTINUE]
2. No [SKIP TO ML8]
98. Don't know [SKIP TO ML8]

[IF ML5=1, CONTINUE, ELSE SKIP TO ML8]
ML6. What are these other program-qualifying measures that you frequently install without any EVERGY program rebates? Please select all that apply. [ROTATE 1-14]
1. Lighting
2. Building Optimization
3. Compressed Air
4. Variable Speed Drive for Pump or Fan
5. Misc. Custom
6. New Construction
7. Air Optimization/Balancing
8. Refrigeration
9. Custom Packaged RTU
10. Chiller Plant Optimization
11. Energy Management System
12. Economizers
13. Constant Volume to Variable Air Volume Conversion
14. Other [Please Specify]
98. Don't know

ML7. Why didn't you seek EVERGY rebates for these additional measures?
[OPEN ENDED]
98. Don't know

ML8. The following table summarizes the number of rebated projects (from the program records) and non-rebated projects that you indicated in a previous question.

Measure Name	Total Number of Projects Sold this past year	Best Estimate of Number Sold without Program
<Measure1>	<Measure1qty>+<ML2a>	ML11a. [NUMERIC OPEN END]
<Measure2>	<Measure2qty>+<ML2b>	ML11b. [NUMERIC OPEN END]

Given your experience in the market, how many projects of these types do you think you would have completed this past year even if EVERGY had not offered any commercial and industrial rebate programs? Please provide your lower bound estimate, best estimate, and upper bound

estimate of the number of projects that you would have completed without the EVERGY programs.

Measure Name	Total Number of Projects Sold this past year	Lower Bound	Upper Bound
<Measure1>	<Measure1qty>+<ML2a>	ML12a. [NUMERIC OPEN END]	ML12d. [NUMERIC OPEN END]
<Measure2>	<Measure2qty>+<ML2b>	ML12b. [NUMERIC OPEN END]	ML12e. [NUMERIC OPEN END]

ML10. EVERGY is interested in increasing the number of participants in the following measures: custom packaged RTUs, split-systems, and chiller replacements. Do you have any insights into why there aren't more participants in those measures? Please select all that apply.
[Randomize 1-7]

1. Incentives are too low
2. We don't have the expertise to implement these measures
3. The measures take a long time to implement
4. Equipment is used by few customers
5. Customers are not interested in these measures
6. Customers are not aware of the incentives
7. Customers are not aware of the measures
8. Other; please describe: [OPEN ENDED]
98. Don't know

Program Experiences

PE1A. On a scale of 1 to 5 where 1 means "strongly disagree" and 5 means "strongly agree," please rate your agreement with the following statements:

1. The program is easy to work with and understand.
2. When I had questions, I knew who to contact.
3. I had enough information about measure eligibility and rebates to make decisions about which equipment to install.
98. Don't know

[Ask if PE1A 1-4 is less than 4]
PE1B _1. Please describe what aspects of the program were not easy to work with or understand.
PE1B _2. Please describe any confusion regarding who to contact.
PE1B _3. **Please describe any lack of information regarding the measure eligibility or rebates.**

PE1. How would you rate your satisfaction with the following aspects of the C&I Custom program?
[MATRIX – COLUMNS: Not at all satisfied (1), 2, 3, 4, "Very satisfied" (5), Don't know]
[ROTATE a-i]

PE1a. The Program Representative
PE1b. Marketing materials provided by the program
PE1c. Amount and type of communication received from the program
PE1d. Amount and type of training provided by the program
PE1e. Project application process
PE1f. Time to complete a project through the program
PE1g. The amount of the program incentives

[Ask if PE1a<3]
PE2a. Why did you rate your satisfaction with **the marketing materials provided by the program** as a [insert response value from PE1a]?
[OPEN ENDED]

[Ask if PE1b<3]
PE2b. Why did you rate your satisfaction with **the amount and type of communication received from the program** as a [insert response value from PE1b]?
[OPEN ENDED]

[Ask if PE1c<3]
PE2c. Why did you rate your satisfaction with **the amount and type of training provided from the program** as a [insert response value from PE1c]?
[OPEN ENDED]

[Ask if PE1d<3]
PE2d. Why did you rate your satisfaction with the **project application process** as a [insert response value from PE1d]?
[OPEN ENDED]

[Ask if PE1e<3]
PE2e. Why did you rate your satisfaction with **the time to complete a project through the program** as a [insert response value from PE1e]?
[OPEN ENDED]

[Ask if PE1f<3]
PE2f. Why did you rate your satisfaction with **the amount of the program incentive** as a [insert response value from PE1f]?
[OPEN ENDED]

PE3. Would you say that your satisfaction with the following elements increased, stayed the same, or decreased this past year relative to previous program years?
[MATRIX – COLUMNS: Increased, Stayed the Same, Decreased, Don't know, Not Applicable]
[ROTATE a-i]

PE3a. Marketing materials provided by the program
PE3b. Amount and type of communication received from the program
PE3c. Amount and type of training provided by the program
PE3d. Project application process
PE3e. Time to complete a project through the program
PE3f. The amount of the program incentives

[ASK IF ANY RESPONSE TO PE3a-i is Increased or Decreased]
PE3j. What is driving that change in satisfaction from previous program years?
[OPEN ENDED]

98. Don't know

PE4. How often do you want to receive information about the Program? [SELECT ONE]

1. Weekly
2. Every other week
3. Monthly
4. Every other month
5. Quarterly
6. Other; describe: -- [OPEN ENDED]
98. Don't know

PE5. What is your preferred way to receive information about the program? Please select all that apply. [MULTIPLE SELECT]
[ROTATE 1-5]

1. EMAIL
2. PHONE
3. US MAIL
4. WEBINARS
5. MEETINGS
6. OTHER -- [OPEN ENDED]
98. Don't know

PE6. Are there any other measures that you think should be eligible for the program that currently are not?

1. Yes, please describe: [OPEN ENDED]
2. None
98. Don't know

PE7. How would you rate your overall satisfaction with the Custom program?
[SCALE OF 1 to 5, ENDS LABELED "Not at all satisfied" (1) and "Very satisfied" (5)]

98. Don't know

[If PE7 not equal to DK]
PE8. Why did you provide that rating?
[OPEN ENDED]

Participant Insights

PA1. What types of customers do you typically market high efficiency <MeasureCat> to? Please select all that apply. [ALLOW MULTIPLE SELECTIONS]
[ROTATE 1-15]

1. Large/Medium Commercial: Offices
2. Large/Medium Commercial: Other (Non-Offices)
3. Large/Medium Industrial
4. Small Commercial: Churches
5. Small Commercial: Convenience Stores
6. Small Commercial: Independent Grocery Stores
7. Small Commercial: Light Manufacturing (<50,000 square feet)
8. Small Commercial: Offices (<50,000 square feet)
9. Small Commercial: Restaurants
10. Small Commercial: Retail
11. Small Commercial: Warehouse (<50,000 square feet)
12. Institutional: Colleges/Universities
13. Institutional: Government Buildings
14. Institutional: K-12 Schools
15. Warehouses
16. Other [SPECIFY]
98. Don't know

[SKIP IF PA41=98]
PA2. Of those customer types, which most frequently choose high efficiency over standard efficiency equipment?
[LIST RESPONSES TO PA1; ALLOW MULTIPLE SELECTIONS]

1. None
98. Don't know

[Carry forward unselected choices from PA1]
PA3a. Are there any types of customers that you specifically do not market high efficiency <MeasureCat> to?
[OPEN ENDED]

1. None
98. Don't know

[If PA3b **not** equal to None or DK]
PA3b. **Why don't you market high efficiency to those types of customers?**
[OPEN ENDED]

PA4. Are there any types of customers that you think would particularly benefit from participating in EVERGY energy efficiency programs who aren't currently participating? Can you describe these customers (in terms of size, industry, building type, geography, etc.)?
[OPEN ENDED]

1. None
98. Don't know

[IF PA4=Open Ended response]
PA5. What would it take to engage these types of customers in EVERGY energy efficiency programs?
[OPEN ENDED]
98. Don't know

PA6. Which of the following non-energy benefits do you feel might influence a customer's decision to choose high efficiency over standard efficiency equipment?
[ALLOW MULTIPLE SELECTIONS, ROTATE 1-6]
1. Lower utility bills
2. Improved work environment
3. Chance to make the company more "green"/reduce carbon emissions
4. Increased property value
5. Lower operating and maintenance cost
6. Quick payback period
7. None of these benefits influence a customer's decision
98. Don't know

Program Improvements

PIM1. How can EVERGY help you complete more energy efficiency projects?
[OPEN ENDED]
98. Don't Know

PIM2. How can the EVERGY Business Energy Efficiency Rebates Custom program be improved?
[ROTATE RESPONSES, ALLOW MULTIPLE RESPONSES]
1. Offer incentives for additional types of equipment [DESCRIBE]
2. More marketing directly to customers [DESCRIBE]
3. More marketing support for contractors and other trade allies [DESCRIBE]
4. More training/technical support for contractors and other trade allies [DESCRIBE]
5. More administrative support for contractors and other trade allies [DESCRIBE]
6. Target marketing to specific customer groups; note which groups: [DESCRIBE]
7. Other, please describe: [DESCRIBE]
8. No improvements necessary [Exclusive response]
98. Don't Know [Exclusive response]

Firmographics

F1. In what year did your company start selling <MeasureCat> in the EVERGY area?
RECORD YEAR
98. Don't know

F2. How many branches or offices does your company have in the U.S.?
RECORD NUMBER
98. Don't know

[ASK IF F2>1, ELSE SKIP TO F4]
F3. How many branches or offices does your company have in the EVERGY area?
RECORD NUMBER
98. Don't know

F4. How many employees in the EVERGY area work on energy efficiency related projects?
RECORD NUMBER
98. Don't know

Closing Text

CT1. Those are all of our questions. We would like to offer you a $50 gift card in thanks for completing this survey. If you would like to receive this gift card, please enter your e-mail address below, or check "No thanks." The gift card will be emailed to you within the next two weeks.
[EMAIL ADDRESS for gift card]

1. No thanks – I do not wish to receive a $50 gift card.

Thank you for your time. Your input will help EVERGY improve the C&I Custom program.

APPENDIX B. STANDARD METHODOLOGIES

This appendix covers Guidehouse's overall approach toward cross-cutting methodologies, namely determining cost-effectiveness and net-to-gross (NTG) savings. Appendix E through Appendix P detail program-specific methodologies, including any differences between these standard methodologies and those the evaluation team used for each program. Appendix Q details the findings and recommendations that resulted from the evaluation of each program.

B.1 Cost-Effectiveness Approach

Guidehouse calculated benefit cost ratios and total net benefits at the program and portfolio level for the five standard benefit cost tests. These tests include the Total Resource Cost (TRC) test, Societal Cost Test (SCT), Utility Cost Test (UCT), Participant Cost Test (PCT), and Ratepayer Impact Measure (RIM) test. Benefit-cost ratios are informative as they show the value of monetary benefits relative to the value of monetary costs as seen from various stakeholder perspectives. Cost-effectiveness values were calculated using Evergy's DSMore model in conjunction with Guidehouse-verified EM&V findings including energy and demand impacts, incremental costs, NTG ratios, participation numbers, and measure lifetimes. All program and avoided cost data, and discount rates, are consistent with those used by Evergy in calculating cost-effectiveness as part of their annual filing. Evergy's DSMore formulation of the cost-benefit tests followed the 2001 California Standard Practice Manual (SPM)[1] and does not account for the subsequent 2007 SPM Clarification Memo.[2]

Table B-1 summarizes how program costs and benefits are assigned to each of the cost tests, consistent with the California SPM. In this analysis, the TRC test and the SCT test only differ in the discount rate assumed (i.e., externalities are not included in this SCT analysis). Refer to Table B-2 for sources of assumptions regarding discount rates. For comparison with Evergy Missouri West reported cost-benefit ratios, this report provides TRC and SCT results without including incentives paid to free riders as required by the 2007 Clarification Memo.

[1] California Public Utilities Commission. October 2001. "California Standard Practice Manual: Economic Analysis of Demand-Side Programs and Projects." http://www.cpuc.ca.gov/NR/rdonlyres/004ABF9D-027C-4BE1-9AE1-CE56ADF8DADC/0/CPUC_STANDARD_PRACTICE_MANUAL.pdf.

[2] California Public Utilities Commission. 2007. "2007 SPM Clarification Memo." http://www.cpuc.ca.gov/NR/rdonlyres/004ABF9D-027C-4BE1-9AE1-CE56ADF8DADC/0/CPUC_STANDARD_PRACTICE_MANUAL.pdf.

Table B-1. Cost and Benefit Assignments by Cost Test

Item	TRC Test	SCT	UCT	PCT	RIM Test
Avoided Costs	Benefit	Benefit	Benefit	N/A	Benefit
Incentives	Transfer	Transfer	Cost	Benefit	Cost
Lost Revenues	Transfer	Transfer	N/A	Benefit	Cost
Administrative Costs	Cost	Cost	Cost	N/A	Cost
Participant Equip. Costs	Cost	Cost	N/A	Cost	N/A

Source: Guidehouse

B.1.1 Sources of Benefit and Cost Assumptions

The sources of data used in the cost-benefit analysis are summarized in Table B-2. Many of the input assumptions used in Guidehouse's analysis came directly from Evergy Missouri West. Critical assumptions that differed in Guidehouse's analysis were energy and peak demand savings (derived from verified data rather than reported estimates), NTG ratios, effective useful life (EUL) and remaining useful life (RUL) values, and participant equipment costs. Please refer to Appendix R for inputs to Guidehouse's cost-benefit model.

Table B-2. Sources of Benefit and Cost Data

Data[3]	Source
Avoided energy costs	Provided by Evergy Missouri West
Avoided capacity costs	Provided by Evergy Missouri West
Retail rates	Provided by Evergy Missouri West
Load shapes	Provided by Evergy Missouri West
Discount rates	Provided by Evergy Missouri West and classified by Evergy Missouri West as highly confidential
Participant equip. costs	Illinois Technical Reference Manual (TRM), Evergy Missouri West assumptions
Energy and peak demand savings	Guidehouse engineering analyses
EUL	Illinois TRM
RUL	Guidehouse analysis based on lifetime of replaced equipment and related mortality analysis techniques.
NTG	Guidehouse NTG analysis
Line loss factors	Provided by Evergy Missouri West
Incentives	Program tracking database
Participation	Program tracking database
Administrative costs	Provided by Evergy Missouri West

Source: Guidehouse

[3] Guidehouse did not provide the avoided energy and capacity costs in this report as they are confidential to Evergy Missouri West.

B.2 Net-to-Gross

This section outlines the methods Guidehouse used to estimate free ridership (FR) and spillover (SO) as part of its evaluation of the Evergy Missouri West portfolio of energy efficiency and demand response (DR) programs.

The objective of Guidehouse's approach is to accurately estimate NTG components using multiple methods to approximate not only FR but also SO over the course of the 3-year program cycle. Guidehouse used the following definitions, provided by the Uniform Methods Project,[4] to calculate net savings:

- **FR:** The program savings attributable to free riders—i.e., program participants who would have implemented a program measure or practice in the absence of the program.
- **Participant SO (PSO):** Additional energy savings achieved when a program participant—because of the program's influence—installs energy efficient measures or practices outside the efficiency program after having participated.
- **Nonparticipant SO (NPSO):** Additional energy savings achieved when a nonparticipant implements energy efficiency measures or practices because of the program's influence (e.g., through exposure to the program) that are not accounted for in program savings.

Using these definitions, the NTG ratio is calculated using Equation B-1:

Equation B-1. NTG Ratio

$$\text{NTG Ratio} = 1 - \text{FR rate} + \text{PSO rate} + \text{NPSO rate}$$

The Guidehouse team used several types of NTG estimates depending on the program type, data availability, and the level of effort planned for the evaluation. Some programs' savings estimates are inherently net, therefore no NTG estimation is necessary. Some programs receive a deemed value of 1.0 based on assumptions about potential free ridership (e.g., evaluators expect income-eligible programs to have zero free ridership) or data availability. Some programs use the prior year's estimated NTG value in the absence of new NTG research. Finally, some of the evaluated programs have no claimed savings and therefore do not require NTG estimation. Table B-3 summarizes the NTG method used for each program.

[4] Daniel M. Violette and Pamela Rathbun. *Estimating Net Savings: Common Practices*, Chapter 23 in The Uniform Methods Project: Methods for Determining Energy Efficiency Savings for Specific Measures. 2014. http://energy.gov/sites/prod/files/2015/02/f19/UMPChapter23-estimating-net-savings_0.pdf.

Table B-3. NTG Methods by Program

Program Name*	Estimated in 2017	Savings are Inherently Net	Deemed Value of 1.0	Used Prior Year's Value	Not Applicable (No Claimed Savings)
Business EER Custom	X				
Business EER Standard				X	
Strategic Energy Management					X
Block Bidding			X		
Online Business Energy Audit					X
Small Business Lighting				X	
Business Programmable Thermostat		X			
Demand Response Incentive		X			
Home Energy Report		X			
Online Home Energy Audit					X
Whole House Efficiency				X	
Income-Eligible Multi Family			X		
Home Lighting Rebate	X				
Residential Programmable Thermostat		X			

The remainder of this section describes the self-report method used for Small Business Lighting.

B.2.1 Participant FR

This section presents the general FR methodology. FR was assessed using a customer self-report approach following the Research Into Action and Energy Trust of Oregon (ETO) framework.[5] This approach used surveys designed to assess the likelihood that participants would have installed some or all of the energy efficiency measures incented by the program even if the program had not existed. The participant surveys followed the same basic structure as the ETO framework.

[5] Jane Peters and Ryan Bliss. *Common Approach for Measuring Free Riders for Downstream Programs.* Research Into Action. October 4, 2013.

Based on the ETO methodology, the FR analysis included the following two elements: 1) intention to carry out the energy efficient project without program funds, and 2) influence of the program in the decision to carry out the energy efficient project.

The total FR score was the sum of the intention and program influence scores, resulting in a score ranging from 0 to 100. This score was divided by 100 to convert it into a proportion for application to gross savings values (see Equation B-2).

Equation B-2. Total FR

$$\text{Free Ridership (FR)} = \frac{\text{Intention Score + Program Influence Score}}{100}$$

B.2.1.1 Participant FR Intention Score

The evaluation team assessed intention through several brief questions used to determine how the upgrade or equipment replacement likely would have differed if the respondent had not received the program assistance. The initial question asked the respondent to identify, out of a limited set of options, the option that best described what most likely would have occurred without program assistance. Specific wording of the questions varied based on the types of measures installed through the program, but the offered response options captured the following four general outcomes:

1. Would have canceled the project, upgrade, purchase, etc.
2. Would have postponed the project by at least 1 year
3. Would have done something that would have produced savings but not as much as those achieved through the project as implemented
4. Would have done the project exactly as implemented through the program
5. Don't know

Respondents who said they would have canceled or postponed the project were not considered free riders in terms of intention (a score of 0 for the intention score). The respondents that indicated they would have undertaken the project as implemented or purchased/installed the same energy efficient equipment without the program were considered total free riders in terms of intention (a score of 50 for the intention component). Respondents who indicated they would have done something that would have resulted in less savings were considered partial free riders with an intention score of 25.

The level of FR depended on the level of savings that the respondent would have achieved without the program's assistance. "Don't know" responses were assigned the midpoint score of 25 for the intention component.

B.2.1.2 Participant FR Influence Score

The evaluation team assessed the program influence on the participant's decision to implement energy efficiency improvements by asking the respondent how much influence—on a scale of 1 (no influence) to 5 (great influence)—various program elements such as incentives and program information had on the decision to implement the measure.

A participant's program influence score was then set to the participant's maximum influence rating for any program element. The rationale was that if any given program element had a great influence on the respondent's decision then the program itself had that level of influence, even if other elements had less influence.

The following table shows the questions asked to calculate the influence score and the possible answers.

Table B-4. FR Program Influence Responses

Rate the influence of the following program elements in your decision to implement the measure:	Not at all influential Very influential					
Program incentive	1	2	3	4	5	Don't know
Program information from Evergy	1	2	3	4	5	Don't know
Recommendations and information from your contractor or installer	1	2	3	4	5	Don't know
The information provided through the home energy assessment you received*	1	2	3	4	5	Don't know

** If applicable*

Source: Guidehouse analysis

Table B-5 shows the influence score for each possible influence rating response. An influence rating response of "5 – Very influential" resulted in an influence score of 0, contributing no value to the total FR score. Program influence and FR have an inverse relationship: the greater the program influence, the lower the FR, and vice versa.

Table B-5. FR Program Influence Scores

Maximum Program Influence Rating Response	Influence Score
1 – Not at all influential	50
2	37.5
3	25
4	12.5
5 – Very influential	0
Don't know	25

Source: Research Into Action and ETO Standard FR Protocol

FR is estimated individually for each participant survey respondent according to the algorithm described above and then savings are weighted by the individual participant's share of program savings to estimate measure category-level FR (e.g., lighting, envelope, HVAC). Measure-level FR is then weighted by each measure category's share of total program savings to estimate program-level FR.

B.2.2 Participant SO

Guidehouse also assesses SO through the customer surveys. SO is the energy savings influenced by the program but that did not receive program incentives and are not included in the program records. Survey questions aimed to identify whether participants purchased or installed additional energy efficient products without an incentive. Below are examples of these SO questions:

1. Since your participation in the program, did you install or purchased any ADDITIONAL energy efficient products in your home that did NOT receive incentives through Evergy?
2. Could you describe the energy efficient product installed or purchased?
3. How did you know the product was energy efficient?
4. How many energy efficient products did you purchase without an incentive?

Additionally, the evaluation team included a question about the level of influence the program had on the respondent's decision to install the additional measures. An example of the question is below.

1. On a 1-5 scale where 1 is not at all influential and 5 is very influential, how influential was your experience in the Evergy program in your choice to install or purchase the energy efficient product?

The 1-5 influence ratings form a SO influence score as follows:

- 1 (low program influence) = 0%
- 2 = 25%
- 3 = 50%
- 4 = 75%
- 5 (high program influence) = 100% (full attribution)

For each participant, Guidehouse calculated SO for measures reported as the product of the measure savings, number of units, and influence score, as illustrated in Equation B-3.

Equation B-3. SO Savings from Installed Measures

$$\text{Measure SO} = \text{Measure Savings} * \text{Quantity} * \text{SO Influence Score}$$

For each participant, the evaluators then totaled the measure-level SO savings to give the participant-level SO savings reflected in Equation B-4.

Equation B-4. Overall Participant SO

$$\text{Participant SO} = \Sigma\text{Measure SO}$$

The team then multiplied the mean participant SO savings (including zeroes) for the participant sample by the total number of participants to yield an estimated total participant SO savings at the stratum level. SO is first summed at the stratum level to correct any bias in the survey due to oversampling of specific populations. Equation B-5 shows the algorithm used to calculate SO for each stratum.

Equation B-5. SO Savings for the Stratum

$$\Sigma \text{Participant SO (population)} = \frac{\sum \text{Participant SO (sample)}}{\text{Sample n}} * \text{Population N}$$

Finally, the team summed the SO across strata and divided the program total SO savings by the program total savings to yield a participant SO percentage, as shown in Equation B-6.

Equation B-6. Participant SO Percentage

$$\% \text{ Participant SO} = \frac{\sum \text{Participant SO (population)}}{\text{Program Savings}}$$

B.2.3 Trade Ally FR and NPSO

The following sections present details on the trade ally NTG methods used. Guidehouse's trade ally (TA) net-to-gross (NTG) analysis employs an incremental scoring approach (i.e., 0=0%, 1=25%, 2=50%, 3=75%, 4=100%) for all scoring.

B.2.3.1 Program Influence on Trade Ally and FR Methodology

The analysis used the responses to the program influence on trade ally (PITA) questions in three ways:

- To qualitatively provide insight and context for the NTG analysis
- To ensure that trade allies' responses to direct measure-level FR questions are consistent with their account of the program's influence
- To form part of an attribution factor to determine what share of non-incented high efficiency project savings should be attributed to the program as SO

Guidehouse's analysis resulted in a marketing influence score based on questions that focus on how trade allies are marketing energy efficient products due to program influence. Table B-6 presents the question and resulting program volume influence scores.

Table B-6. Calculation of Marketing Influence Score

Response to Question: "How much influence has that marketing assistance had on your ability to successfully market energy efficiency to your customers?" (Scale of 1-5)	Marketing Influence Score
1 (Not at all influential)	0%
2	25%
3	50%
4	75%
5 (Very influential)	100%

Source: Guidehouse analysis

Guidehouse also asked trade allies about the likelihood that they would have recommended the same high efficiency measures in the absence of the program. That response was converted into a

recommendation program influence score as shown in Table B-7. Note that a high likelihood score converts into a low program influence score and vice versa.

Table B-7. Calculation of Recommendations Influence Score

Response to Question: "Since participating in the Evergy program, have you changed your energy efficiency offerings to customers? For instance, have you added more high efficiency products to your offerings, stopped offering lower efficiency models, or started recommending higher efficiency models as the "default" option? If the program had never been available, what is the likelihood that you would have made those same changes? (Scale of 1-5)	Recommendations Influence Score
1 (Not at all likely)	100%
2	75%
3	50%
4	25%
5 (Very likely)	0%

Source: Guidehouse analysis

Table B-8. Calculation of High Efficiency Sales Influence Score

Response to Question: "How influential do you think the program was the increase in high efficiency sales?" (Scale of 1-5)	Marketing Influence Score
1 (Not at all influential)	0%
2	25%
3	50%
4	75%
5 (Very influential)	100%

Source: Guidehouse analysis

Table B-9. Calculation of Early Replacement Influence Score (WHE Program Only)

Response to Question: "How influential do you think the program was the increase in customer willingness to replace still-functioning equipment?" (Scale of 1-5)	Marketing Influence Score
1 (Not at all influential)	0%
2	25%
3	50%
4	75%
5 (Very influential)	100%

Source: Guidehouse analysis

Finally, the team calculated an overall PITA score. The score is the maximum of the previously calculated influence scores. The maximum of the scores is used rather than an average because using an average would unduly underestimate the program's impact in instances where the program has had a strong

influence on the high efficiency sales of a trade ally who has always recommended high efficiency measures, for example.

Trade Ally Direct Estimate of FR. The surveys ask a series of program influence questions prior to direct queries regarding the trade ally's views on FR to assist the trade ally in recalling the diversity of ways in which the program may have influenced their high efficiency projects, including the program's influence on trade allies that participants can't see on their marketing and stocking practices. The program influence questions were asked generally about all high efficiency measures. The direct FR questions focused specifically on the trade ally's top three measures based on program savings. The trade allies were asked to directly assess FR by estimating the number of units they would have sold in the absence of the program after being reminded of how many units they sold through the program. The trade ally estimates of free ridership are used as a cap on the participant estimates of free ridership on a measure-by-measure basis whenever the estimates are lower than participant free ridership, based on the rationale that participants have the best sense of their ability to afford high efficiency measures without rebates, but participants may not be aware of the ways in which the program has influenced trade allies beyond the provision of rebates. Averaging participant and trade ally free ridership would penalize the program in situations where participants indicate the influence rebates have on them because trade allies don't always know the financial realities their customers are facing. The evaluation team therefore doesn't want to increase the free ridership that participants report on the basis of trade allies' incomplete information. However, if participants are unaware of the fact that trade allies might not have even offered high efficiency without the program, though, they can't accurately report that they would have done high efficiency in the absence of the program. The trade ally questions focus specifically on these changes that participants would be unaware of. Guidehouse did not used trade ally free ridership as a cap in the PY2019 analysis because it was not lower than participant free ridership.

These trade ally estimates of free ridership are estimated at the measure level as described in the following equation.

Equation B-7. Trade Ally Free Ridership Estimated at Measure Level

$$Trade\ Ally\ FR_{\ Measure} = \frac{\sum Trade\ Allies'\ Direct\ Estimate\ of\ Units\ Sold\ without\ Program}{\sum Program\ Incented\ Units}$$

B.2.3.2 NPSO Methodology

Trade allies answered a series of questions to establish the possible existence of SO for their top three highest saving measures.

Estimating the Number of Non-Incented High Efficiency Projects. For each measure, the survey asked the trade ally to estimate how many (if any) additional projects it completed without rebates. Trade allies often reported that spillover occurred because customers did not want to take the time to complete the program-related paperwork, whereas the participants have demonstrated that they are willing to take the time to complete program paperwork to receive rebates when working with a participating trade ally who is aware of the program rebates. This suggests that the participating trade allies' reported spillover is occurring with non-participating customers who don't value rebates enough to take the time to apply for them.

Attributing Non-Incented Projects to the Program. For each SO measure, Guidehouse calculated the number of SO projects by multiplying each trade ally's total number of non-incented projects by an attribution factor based on the trade ally's responses to program influence questions. If the trade ally said that the program did not have any influence on the non-incented measures, the attribution factor was automatically 0% (meaning that no SO was assigned to the program for those measures for that trade ally). Otherwise, the attribution factor was based on the PITA score (discussed above) and the trade ally's response to the following question on program influence:

"How influential do you think the program was on these additional units sold without rebates?" (Scale of 1-5)

The 1-5 influence ratings form a SO influence score as follows:

- 1 (low program influence) = 0%
- 2 = 0%
- 3 = 50%
- 4 = 100%
- 5 (high program influence) = 100%

Equation B-8. Attribution Factor

$$\text{Attribution} = \text{PITA Score} * \text{SO Influence Score}$$

Next, Guidehouse calculated the number of SO projects per trade ally for each measure by multiplying the total number of non-incented projects by the attribution factor.

Equation B-9. Number of SO Projects by Trade Ally and Measure

$$\#\text{ of SO Projects}_{Measure} = \#\text{ of Non-Incented Projects}_{Measure} * \text{Attribution}$$

Estimating SO Project Savings. SO was calculated for each trade ally/measure combination separately. Guidehouse then calculated the total number of SO projects per measure category and multiplied the total number of SO projects across all trade allies by the measure's savings adjustment factor.

Equation B-10. Savings-Adjusted SO at the Measure Level

$$SO_{Measure} = \frac{\sum \#\text{ of SO Projects}_{Measure}}{\#\text{ of Program Projects}_{Measure}}$$

Finally, Guidehouse calculated a program-level SO estimate by weighting each measure's SO estimate by the measure's share of total program energy savings, as shown in Equation B-11.

Equation B-11. SO at the Program Level

$$SO = \sum SO_{Measure} * \frac{\text{Program Savings}_{Measure}}{\text{Program Savings}_{Total}}$$

APPENDIX C. MISSOURI REQUIREMENTS FOR IMPACT EVALUATION

In accordance with Missouri regulations,[6] Evergy Missouri West is required to complete an impact evaluation for each program using one or both of the methods and one or both of the protocols detailed below.

1. **Impact evaluation methods.** At a minimum, comparisons of one or both of the following types shall be used to measure program and rate impacts in a manner that is based on sound statistical principles:
    a. Comparisons of pre-adoption and post-adoption loads of program or demand-side rate participants, corrected for the effects of weather and other intertemporal differences
    b. Comparisons between program and demand-side rate participants' loads and those of an appropriate control group over the same period
2. **Load impact measurement protocols.** The evaluator shall develop load impact measurement protocols designed to make the most cost-effective use of the following types of measurements, either individually or in combination:
    a. Monthly billing data, hourly load data, load research data, end-use load metered data, building and equipment simulation models, and survey responses
    b. Audit and survey data on appliance and equipment type, size and efficiency levels, household or business characteristics, or energy-related building characteristics

The evaluator will also be required to develop protocols to gather information and to provide estimates of program FR, SO, and program NTG ratios.

The Guidehouse team's methods and protocols, as they align with Missouri requirements, for the impact evaluation are summarized in Table C-1.

[6] Missouri Code of State Regulations 20 CSR 4240-22.070 (8)

Table C-1. Missouri Regulations Impact Evaluation Methods and Protocols

Program		Impact Evaluation Method	Impact Evaluation Protocol
C&I Energy Efficiency Programs	Business EER Standard Program	1a	2a and 2b
	Business EER Custom Program	1a	2b
	Block Bidding	1a	2b
	Strategic Energy Management (SEM)	1a	2a
	Small Business Lighting (SBL)	1a	2a and 2b
	Whole House Efficiency (WHE)	1a	2b
	Income-Eligible Multifamily (IEMF)	1a	2b
	Home Lighting Rebate (HLR)	1a**	2b
Educational/Behavioral Programs	Home Energy Report (HER)	1b	2a
	Online Business Energy Audit*	1b	2a
	Online Home Energy Audit*	1b	2a
DR Programs	Business Programmable Thermostat	1b	2b
	Residential Programmable Thermostat	1b	2b
	Demand Response Incentive (DRI)	1a	2a

** Guidehouse does not recommend conducting an impact evaluation for these programs because Evergy does not report savings. However, these programs would likely be evaluated using 1b and 2a.*

***The upstream nature of the HLR does not allow for identification of participants and nonparticipants for assessments for comparisons of load shapes; for budgetary reasons the evaluation did not include an hours of use study, which could have provided lighting load shapes for all households.*

Source: Guidehouse analysis

APPENDIX D. C&I BUSINESS EER STANDARD PROGRAM-SPECIFIC METHODOLOGIES

Evergy designed the Business Energy Efficiency Rebate (Business EER) Standard program to help commercial and industrial (C&I) customers save energy through a broad range of energy efficiency options that address all major end uses and processes. The program offers standard rebates as well as mid-stream incentives. The measures incentivized—including lighting, HVAC equipment, and motors—are proven technologies that are readily available with known performance characteristics.

Based on Missouri regulations (see Appendix C), the evaluation team used method 1a and protocol 2a and 2b to evaluate the C&I Business EER Standard program. This evaluation of the Standard program consisted of the following activities:

- Gross impact evaluation (detailed in Section D.1)
- Process evaluation (detailed in Section 0)
- NTG analysis based on work conducted in PY2016 (detailed in Section B.2)

D.1 Impact Evaluation

The evaluation team conducted the bulk of the Standard program gross impact evaluation activities in PY2016, with smaller efforts in PY2017 through PY2019 to update results in a cost-effective manner. The impact evaluation assessed gross energy and demand savings by conducting the following activities:

- Tracking database review
- Deemed measure savings review

D.1.1 Tracking Database Review

The evaluation team conducted a thorough review of the program tracking database in February 2020 that included 9 months of data (April 2019-December 2019) for the program year. Guidehouse reviewed the program tracking database to assess the availability of data fields that help the impact evaluation, including the following:

- Participant contact details and installation address
- Building type
- Installed measure information (quantity, measure type, size, capacity, efficiency levels)
- Reported energy and demand savings at the measure and project[7] levels
- Project costs (implementation cost and incremental equipment cost)
- Trade ally contact information

[7] A project is a unique application that includes single or multiple Standard measures.

D.1.2 Deemed Measure Savings Review

The Evergy Missouri Energy Efficiency Investment Act (MEEIA) TRM documents assumptions for deemed measure savings for the Business EER Standard program. The evaluation team reviewed the deemed measure savings used to calculate the reported savings for the Business EER Standard program. This review identified and verified the accuracy and completeness of the engineering algorithms and assumptions used in the deemed savings calculations to ensure they reflect equipment performance in Evergy's service territory. Guidehouse reviewed the baseline and efficient case wattages, hours of use (HOU), waste heat factors (WHFs), and coincident factors (CFs) used for lighting measures. For non-lighting measures, Guidehouse reviewed the baseline and efficient case ratings and calculation variables such as HOU, CF, etc. used to calculate the deemed savings. The deemed measures do not differentiate by building type whereas many of the values used for calculating savings such as HOU, WHFs, and CFs do vary by building type.

The table below summarizes the assumed baseline wattages for all the lighting measures included in the Standard Program savings. The majority of these are from the IL TRM v7 but some updates were made to more closely match the baseline wattage range or baseline wattage lamp type listed in the measure name.

Table D-1. Baseline Wattage Assumptions

Measure Code	Measure Name	Baseline Wattage Assumption (W)
96.1	Directional LED Lamp replacing 50-70W Lamp	60
96.2	Interior Directional LED Lamp replacing 50-70W Lamp	60
96.3	Interior Directional LED Lamp replacing 50-70W Lamp	60
97.1	Directional LED Lamp replacing 71-110W Lamp	90
97.2	Interior Directional LED Lamp replacing 71-110W Lamp	90
97.3	Interior Directional LED Lamp replacing 71-110W Lamp	90
102	LED Exit Sign	10.5
109.1	Remove 4ft Lamp from T8 or T12 system	30.8
110.1	Remove 8ft Lamp from T8 or T12 System	56
112.1	Omnidirectional LED Lamp replacing 40-60W Lamp	50
112.2	Interior Omnidirectional LED Lamp replacing 40-60W Lamp	50
112.3	Interior Omnidirectional LED Lamp replacing 40-60W Lamp	50
113.1	Omnidirectional LED Lamp replacing 61-100W Lamp	80
113.2	Interior Omnidirectional LED Lamp replacing 61-100W Lamp	80
113.3	Interior Omnidirectional LED Lamp replacing 61-100W Lamp	80
149.1	Exterior LED replacing > 400W Fixture or Mogul Screw-Base Lamp	1031
150.1	Exterior LED replacing 251W-400W Fixture or Mogul Screw-Base Lamp	325

151.1	Exterior LED replacing 175W-250W Fixture or Mogul Screw-Base Lamp	213
152.1	Exterior LED replacing < 175W Fixture or Mogul Screw-Base Lamp	151
153.1	Parking Garage LED replacing > 175W Fixture or Mogul Screw-Base Lamp	258
153.2	Parking Garage LED replacing > 175W Fixture or Mogul Screw-Base Lamp	258
154.1	Parking Garage LED replacing 101W-175W Fixture or Mogul Screw-Base Lamp	137
154.2	Parking Garage LED replacing 101W-175W Fixture or Mogul Screw-Base Lamp	137
155.1	Parking Garage LED replacing ≤ 100W Fixture or Mogul Screw-Base Lamp	124
166	LED linear replacement lamp replacing a 4' T8, T12, or T5 lamp (Eligible for lighting optimization if applicable to project)	29
166.1	LED Linear Lamp Replacing 4ft T8, T12, or T5 Lamp	29
166.2	Interior LED Linear Lamp Replacing 4ft T8, T12, or T5 Lamp	29
167.1	LED Linear Lamp Replacing 2ft T8, T12, or T5 Lamp	17
168.1	LED 1X4 Retrofit Kit replacing T8, T12 or T5/T5HO fixture	77
168.2	Interior LED 1X4 Retrofit Kit replacing T8, T12 or T5/T5HO fixture	77
169.1	LED 2X4 Retrofit Kit replacing T8, T12 or T5/T5HO fixture	98
169.2	Interior LED 2X4 Retrofit Kit replacing T8, T12 or T5/T5HO fixture	98
170.1	LED 2X2 Retrofit Kit replacing T8, T12 or T5/T5HO fixture	77
170.2	Interior LED 2X2 Retrofit Kit replacing T8, T12 or T5/T5HO fixture	77
171.1	LED 1X4 Troffer or Linear Ambient replacing T8, T12 or T5/T5HO fixture	77
171.2	Interior LED 1X4 Troffer or Linear Ambient replacing T8, T12 or T5/T5HO fixture	77
172.1	LED 2X4 Troffer or Linear Ambient replacing T8, T12 or T5/T5HO fixture	98
173.1	LED 2X2 Troffer or Linear Ambient replacing T8, T12 or T5/T5HO fixture	77
173.2	Interior LED 2X2 Troffer or Linear Ambient replacing T8, T12 or T5/T5HO fixture	77
174.1	LED Refrigerated Case Lights w/Doors 4ft, 5ft, or 6ft replacing Fluorescent Refrigerated Case Lights w/Doors 4ft, 5ft, or 6ft	84.75
174.2	LED Refrig Case Lights w/Doors 4ft 5ft or 6ft repl Fluor Refrig Case Lights w/Doors 4ft 5ft or 6ft	84.75
175.1	LED Freezer Case Lights w/Doors 4ft, 5ft, or 6ft replacing Fluorescent Freezer Case Lights w/Doors 4ft, 5ft, or 6ft	84.75
175.2	LED Freezer Case Lights w/Doors 4ft 5ft or 6ft repl Fluor Freezer Case Lights w/Doors 4ft 5ft or 6ft	84.75
176.1	LED Downlight or Retrofit Kit replacing 45-60W Fixture	52
176.2	Interior LED Downlight or Retrofit Kit replacing 45-60W Fixture	52
177.1	LED Downlight or Retrofit Kit replacing 61-100W Fixture	80
177.2	Interior LED Downlight or Retrofit Kit replacing 61-100W Fixture	128
178.1	LED Downlight or Retrofit Kit replacing 101-155W Fixture	128

220.1	LED Low Bay Fixture replacing 150W-300W fixture	225
220.2	LED Low Bay Fixture replacing 150W-300W fixture	225
221.1	LED Low/High Bay Fixture replacing 301W-450W fixture	375
221.2	LED Low/High Bay Fixture replacing 301W-450W fixture	375
221.3	LED Low/High Bay Fixture replacing 301W-450W fixture	375
222.1	LED High Bay Fixture replacing 451W - 750W fixture	600
222.2	LED High Bay Fixture replacing 451W - 750W fixture	600
223.1	LED High Bay fixture replacing > 750W fixture	1078
223.2	LED High Bay fixture replacing > 750W fixture	1078
226	LED low bay mogul screw-base lamp/retrofit kit replacing 150W - 300W fixture	225
226.1	LED low bay mogul screw-base lamp/retrofit kit replacing 150W - 300W fixture	225
227	LED low/high bay mogul screw-base lamp/retrofit kit replacing 301W - 450W fixture	375
227.1	LED low/high bay mogul screw-base lamp/retrofit kit replacing 301W - 450W fixture	375
228	LED high bay mogul screw-base lamp/retrofit kit replacing 451W - 750W fixture	600
229	LED high bay mogul screw-base lamp/retrofit kit replacing > 750W fixture	1078
313	Interior 8' LED Linear Lamp Replacing 8ft T8 or T12 Lamp	59.5

Source: Guidehouse analysis.

D.1.3 Verified Savings Analysis

This section describes Guidehouse's methodology for the completion of the onsite metering and associated analysis of the sites selected for metering from the PY2016 Business EER Standard project sample. Guidehouse used results of the sampling of the PY2016 project population for PY2017 through PY2019 based on review of the mix of building types showed that the project populations are similar.

D.1.3.1 Sampling

For PY2016, Guidehouse selected a sample of projects completed through November 2016 for onsite EM&V during the January-February 2017 timeframe. This assumes that the population of projects through the end of November 2016 are representative of the entire PY2016, PY2017, PY2018 and PY2019 populations of the Business EER Standard program within a stratum. Guidehouse evaluated both service territories in a combined sample based on discussions with implementer and Evergy product managers. Guidehouse feels that this is a reasonable approach due to similarities in program execution. Additional detail on the sampling is available in the PY2016 Report and Appendix. Guidehouse completed both short-term and long-term metering at the sampled sites. Table D-2 lists the meter count by building type for the short-term metering.

Table D-2: Business EER Standard Program Meter Count by Building Type

Strata	PY2016 + PY2017 Standard		PY2016 + PY2017 SBL		Cycle 1 Loggers		Total
	Evergy Missouri West	Evergy Metro	Evergy Missouri West	Evergy Metro	Evergy Missouri West	Evergy Metro	
Industrial	14	6			13		33
Office	3	20	0	6			29
Other	7	7	7	4	36		61
Retail	17	17	8	3	51	7	103
School	15	29			1		45
Warehouse	12	17	5		26		60
Exterior	7	7	2	2			18
Total	**75**	**103**	**22**	**15**	**127**	**7**	**349**

Source: Guidehouse Analysis

Table D-3 lists the meter count by building type for the long-term metering. A total of 18 sites were included in the long-term metering and a total of 97 lighting loggers were installed.

Table D-3: Business EER Standard Program Meter Count by Building Type for Long-term Metering

Strata	Long-term Sampling Standard		Total
	Evergy Missouri West	Evergy Metro	
Office	3	20	23
School	15	29	44
Warehouse	12	18	30
Total	**30**	**67**	**97**

Source: Guidehouse Analysis

Table D-4 presents a comparison of the program participation by strata between PY2016, PY2017, PY2018, and PY2019 for the Standard program. The percent of total reported savings by strata is similar among all program years. However, some strata such as 'Warehouse' have seen a decrease in the percentage of reported energy and demand savings because high bay measures with overestimated savings accounted for a large fraction of the "Warehouse" strata savings. With the correction made to this measure for PY2017, the percent of the total savings in the "Warehouse" strata decreased in PY2017, PY2018 and PY2019.

Table D-4. Comparison of PY2016, PY2017, PY2018 and PY2019 Reported Savings by Strata

Strata	% of Total Reported kWh				% of Total Reported kW			
	PY2016	PY2017	PY2018	PY2019	PY2016	PY2017	PY2018	PY2019
Industrial	27%	28%	12%	6%	28%	28%	10%	7%
Office	2%	3%	6%	24%	2%	4%	7%	24%
Other	21%	13%	24%	27%	20%	10%	24%	26%
Retail	9%	24%	36%	12%	7%	25%	36%	12%
School	9%	15%	13%	19%	9%	17%	14%	19%
Warehouse	32%	16%	9%	11%	33%	16%	9%	11%
Total	**100%**	**100%**	**100%**	**100%**	**100%**	**100%**	**100%**	**100%**

Source: Guidehouse Analysis

The following table provides the number of buildings metered and the number of meters for each stratum for the PY2016-PY2017 lighting study, as well as relative precision values for energy and demand impacts for each building type. Guidehouse used a confidence and relative precision target analysis to confirm that enough individual buildings were metered to provide reasonable values for HOU and CF. For the combined Evergy Missouri West and Evergy Metro sample, the relative precision and confidence for each building type fell within the target range of 90/20 confidence and precision at the program level.

Table D-5. Business EER Standard Program Metering by Strata

Program	Stratum	Buildings		Meters	Energy	Demand
		Year-End Building Population	Building Sample Size	Meters Sample Size	Relative Precision at 90% Confidence (one-tailed)	Relative Precision at 90% Confidence (one-tailed)
Standard & SBL	Industrial	163	7	33	7.3%	5.9%
	Office	144	5	29	34.6%	29.9%
	Other	262	9	61	27.8%	22.2%
	Retail	251	12	103	34.6%	17.4%
	School	94	8	45	9.5%	14.5%
	Warehouse	206	9	60	13.9%	10.9%
	Total	**1,120**	**50**	**331**	**13.5%**	**10.4%**

Source: Guidehouse Analysis

Guidehouse also calculated the relative precision for the CF and HOU for each stratum at end of the long-term metering. The following table presents these results at the 90% confidence interval. The overall relative precision for the mix of building types falls within the 90/20 target range.

Table D-6. Business EER Standard Program Relative Precision by Strata

Strata	CF Relative Precision at 90% Confidence	HOU Relative Precision at 90% Confidence
Industrial	29%	44%
Office	15%	19%
Other	9%	20%
Retail	6%	7%
School	9%	19%
Warehouse	14%	24%
Exterior	NA	7%
Total Program	**9%**	**14%**

Source: Guidehouse Analysis

D.1.3.2 Onsite Verification and Metering

In PY2017, Guidehouse completed the onsite verification and metering of sampled projects for the Business EER Standard program that was started in PY2016. For the sample selected in PY2016, Guidehouse stratified the Standard program population by building type, including “Industrial”, “Office”, “Retail”, “School”, “Warehouse”, and “Other”. Guidehouse developed the sample by building type to capture the hours of operation (HOU) and coincident demand factors (CF) by building type for the lighting measures installed in the Standard program.

Guidehouse metered most of the sampled projects for the short-term duration (8 weeks, February 2017-April 2017) and completed long term metering of a smaller sample for three strata. The three strata were selected based on feedback from the Evergy team on which building types were of most interest to them. Guidehouse selected three strata—school, warehouse, and office—for the long-term (12 months) metering. “Warehouse” building type represented highest energy savings (32%) of the program level savings for PY2016. “School” building type has considerable seasonality through a typical year which Guidehouse aimed to capture through the long-term metering. “Office” building type represented less than 5% of program level energy savings for PY2016. However, Evergy anticipates future growth in this building type, thus Guidehouse included “Office” in long-term metering as well. Other space types included in the study, “Industrial” and “Retail”, have consistent hours. Whereas, the “Other” space type includes wide range of different building types which does not warrant a long-term metering strategy.

The evaluation team retrieved short-term data for the three long-term metering strata in April 2017, along with the other short-term sites, and used that data for the PY2016 verification. The evaluation team also collected metering data in October 2017 and for a final time in March 2018. Guidehouse used onsite verification to verify project implementation information and to collect the operating parameters for installed lighting projects. Guidehouse used the metered data (lighting loggers, current data loggers, etc.) to develop building type level inputs for HOUs and CFs used in the verified savings calculations for PY2017, PY2018 and PY2019.

D.1.3.3 Hours of Use and Coincident Factor Analysis Methodology

The following discussion is for reference, as PY2019's analysis used the results from the PY2016 and PY2017 lighting logger activities. In PY2017 the evaluation team stratified each of the building type strata (i.e. Industrial, Office, Retail, etc.) further into "large" and "small" building types, because the HOU for large and small customers is measurably different. The evaluation team stratified the sites by size based on whether the reported energy savings for a site were greater than 100,000 kWh or the reported demand savings by site were greater than 10 kW. Guidehouse did not use building size (e.g. square footage) as a method to stratify the population because these data were not available for all sites. However, for the sites with square footage data, Guidehouse compared the stratification using the kWh and kW savings criteria to the building size and found good correlation. Guidehouse used the substrata to determine the weighted strata HOU and CF as outlined in the figure below.

Figure D-1. Methodology for Determining HOU and CF from Logger Data

Step 1: Stratify PY2016 population by size	• Use information on reported kWh and kW savings by site to stratify into large and small sites
Step 2: Determine a substrata weight	• Determine what % each strata's kWh savings is represented by small or large sites in the PY2016 population
Step 3: Assign a substrata to each HOU and CF determined from the logger data by space type	• Roll up the lighting logger data to be by space type withing the site • Link the results of step 1 to the logger data so that each logger data point by space type is assigned to a substrata
Step 4: Assign a substrata for Cycle 1 and SBL logger sites	• Use reported kWh or KW to assign a substrata for Cycle 1 sites • All small business lighting sites from the short terms sampling are assigned to the small strata
Step 5: Determine a substrata HOU and CF	• Equally weight all logger calculated HOUs and CFs within a substrata • Result will be 13 HOUs and CFs
Step 6: Determine a weighted strata HOU and CF	• Weight substrata results by substrata population weight determined in Step 2 • End result will be a 7 strata HOU and CF

The results of this analysis using the long-term metering data compared to the HOU and CF calculated for PY2016 from just the short-term logger data are presented in Table D-7. Overall, the HOU decreased between 7-19% for all interior space types. This decrease is due to two reasons. First, for the strata with the long-term metering, HOU in the summer months declined leading to an overall lower HOU than just the HOU based on the short-term metering in the winter months. Second, the previous weighting method gave more weight to some sites with higher than average HOU, independent of whether these sites represented the overall population. The HOU increased for exterior space types 15% due to some of the long-term metering sites having exterior loggers that recorded higher HOU. The CF increased for the industrial, other, and school strata, and decreased for the office, retail, and warehouse strata. The change for the three strata with long-term metering, school, office, and warehouse, is based on seasonal variations in operating hours captured in the long-term metering. The change for the three strata not included in the long-term metering is based on the updated weighting. If the CF increased such as for industrial and other building types, the previous weighting was weighing sites with lower CF more heavily. If it decreased, such as for retail, the previous weighting was weighing sites with higher CF more heavily.

Table D-7. Comparison Between PY2016 and PY2017 for CF and HOU

Strata	Results of Short-Term Logger Analysis		Results of Long-Term Logger Analysis and Updated Weighting		% Change	
	CF	HOU	CF	HOU	CF	HOU
Industrial	0.62	5,144	0.64	4,584	3%	-11%
Office	0.75	4,484	0.69	3,636	-8%	-19%
Other	0.67	5,280	0.73	4,925	9%	-7%
Retail	0.83	5,662	0.74	4,921	-10%	-13%
School	0.59	4,074	0.63	3,642	6%	-11%
Warehouse	0.64	4,110	0.55	3,611	-15%	-12%
Exterior	0.0	4,702	0.0	5,392	0%	15%

Source: Guidehouse Analysis

The WHF_e and WHF_d at the strata level for offices and schools varied slightly between PY2016 and PY2017 due to the updated weighting. Each PY2016 sampled site was assigned a WHF_e and WHF_d based on the building type and size. These were then weighted based on the substrata weights determined for the HOUs and CF. The updated WHF_e and WHF_d at the strata level are presented in Table D-8.

Table D-8. Comparison Between PY2016 and PY2017 for WHF_e and WHF_d

Strata	Results of Short-Term Logger Analysis		Results of Long-Term Logger Analysis and Updated Weighting		% Change	
	WHF_e	WHF_d	WHF_e	WHF_d	WHF_e	WHF_d
Industrial	1.02	1.04	1.02	1.04	0%	0%
Office	1.21	1.44	1.25	1.39	3%	-3%
Other	1.09	1.36	1.09	1.36	0%	0%
Retail	1.12	1.29	1.12	1.29	0%	0%
School	1.18	1.35	1.17	1.33	0%	-2%
Warehouse	1.00	1.22	1.00	1.22	0%	0%
Exterior	1.00	1.00	1.00	1.00	0%	0%

Source: Guidehouse Analysis

D.1.3.4 Analysis

The following section describes the evaluation team's analysis methodology to calculate the verified energy savings and coincident peak demand savings for the Business EER Standard program measures. Guidehouse applied the following calculation algorithms using guidance from the Evergy MEEIA TRM and the IL TRM v7 which includes industry standard algorithms for engineering review of the following measures implemented:

1. Lighting
2. Compressed Air – Engineered Nozzle 1/8"
3. ECM Motors Walk-in Coolers & Freezers
4. High Efficiency Reach-in Freezers
5. Strip Curtains
6. Variable Speed Drive Compressor
7. Low Flow Faucet Aerator
8. Package Terminal Air Conditioner
9. Air Source Air Conditioner

Lighting Measures
The team referenced the Evergy MEEIA TRM to obtain the calculation inputs.

Energy Savings

Equation D-1. Energy Savings for C&I Lighting Measures

$$\Delta kWh = \frac{(Watts_{base}\text{-}Watts_{ee}) * ISR * Hours * WHF_e}{1{,}000}$$

Where:

$Watts_{base}$ Wattage of actual baseline lighting fixture/lamp. The evaluation team used the following data sources (listed by priority)

1. Wattages from the onsite verification for the LED High Bay (176-350W) measure
2. The midpoint of the replacement wattage listed in the measure name
3. Wattages from secondary sources on baseline fixture wattage, including the IL TRM v7 and manufacturer specification sheets for the efficient lighting product which listed equivalent baseline products

$Watts_{ee}$ Actual wattage of installed efficient lighting. The evaluation team used the following data sources (listed by priority):

1. Actual wattage from the tracking database
2. Wattage listed by the manufacturer for the efficient technology reported in the tracking database

ISR In-service rate (99% assumed for interior lighting, 97% assumed for exterior lighting based on the onsite findings)

Hours[8] Average HOU per year. The evaluation team used the following data sources to get the HOU (listed by priority):

1. HOU according to space type based on results of the long-term metering
2. HOU from Section 4.5 of the IL TRM v7 for parking garage measures

WHF_e[9] Waste heat factor for energy to account for cooling energy savings from efficient lighting. The waste heat factor varies according to space type and is based on Section 4.5 from the ILTRM v7.

Coincident Peak Demand Savings

Equation D-2. Coincident Peak Demand Savings for C&I Lighting Measures

$$\Delta kW = \frac{(Watts_{base} - Watts_{ee}) * ISR * CF * WHF_d}{1{,}000}$$

Where:

$Watts_{base}$ Same as above

$Watts_{ee}$ Same as above

ISR Same as above

CF Summer peak coincidence demand factor. The evaluation team used the following data sources to get the CF (listed by priority):

1. CF according to space type based on results of the long-term metering
2. CF according to space type from Section 4.5 of the IL TRM v7 for parking garages

[8] The referenced version of the Evergy MEEIA TRM uses annual HOU from the IL TRM v4 for the Office-Midrise space type for most interior lighting measures.

[9] Ibid.

WHF_d	Waste heat factor for demand to account for cooling energy savings from efficient lighting. The waste heat factor varies according to space type and is based on Section 4.5 from the IL TRM v7.

Compressed Air – Engineered Nozzle 1/8”

Energy Savings

Equation D-3. Energy Savings for Compressed Air – Engineered Nozzle 1/8”

$$\Delta kWh = (SCFM \times \%SCFM_{reduced}) \times \Delta kW/CFM_{CFM} \times \%Use \times Hours$$

Where:

SCFM	Air flow through standard nozzle = 21 CFM
%SCFMreduced	Percent in reduction of air loss per nozzle = 50%
ΔkW/CFM	System power reduction per air demand: Reciprocating-On/off Control = 0.18 kW/CFM Reciprocating-Load/Unload = 0.14 kW/CFM Screw–Load/Unload = 0.15 kW/CFM Screw–Inlet Modulation = 0.06 kW/CFM Screw–Inlet Modulation w/ Unloading = 0.06 kW/CFM Screw–Variable Displacement = 0.15 kW/CFM Screw–VFD = 0.18 kW/CFM
%Use	Percent of the compressor total operating hours that the nozzle is in use If unknown assume 5%
Hours	Compressed air system pressurized hours Single shift = 1,976 hours Two shifts = 3,952 hours Three shifts = 5,928 hours Four shift or continual operation = 8,320 hours Unknown = 5,702 hours

Coincident Peak Demand Savings

Equation D-4. Coincident Peak Demand Savings Compressed Air – Engineered Nozzle 1/8”

$$\Delta kW = \Delta kWh / Hours * CF$$

Where:

Hours	Same as above
CF	Summer peak coincident factor: Single shift = 0.59 Two shifts = 0.95 Three shifts = 0.95 Four shifts or continual operation = 0.95 Unknown = 0.89

ECM Motors Walk-in Coolers & Freezers

Energy Savings

Equation D-5. Energy Savings for ECM Motors Walk-in Coolers & Freezers

ΔkWh= Savings per motor * # of Motors

Where:

Savings per motor	Based on motor rating of the ECM motor = 16W = 408 kWh savings/motor 1/15 - 1/20 HP = 1,064 kWh savings/motor 1/5 HP = 1,409 kWh savings/motor 1/3 HP = 1,994 kWh savings/motor ½ HP = 2,558 kWh savings/motor ¾ HP = 2,782 kWh savings/motor
# of Motors	Number of fan motors replaced

Coincident Peak Demand Savings

Equation D-6. Coincident Peak Demand Savings for ECM Motors Walk-in Coolers & Freezers

ΔkW = ΔkWh / 8760 * CF * # of Motors

Where:

CF	Coincidence factor = 1.0

High Efficiency Reach-in Freezers

Energy Savings

Equation D-7. Energy Savings for High Efficiency Reach-In Freezers

ΔkWh= (kWhbase – kWhee) * 365.25

Where:

Algorithm assumes 15 ft^3 of actual chilled or frozen compartment volume and uses an average baseline and efficient saving value from solid and glass door freezers.

KWhbase	Baseline maximum daily energy consumption = 5.99 kWh
kWhee	Efficient maximum daily energy consumption = 4.94

Coincident Peak Demand Savings

Equation D-8. Coincident Peak Demand Savings for High Efficiency Reach-in Freezers

ΔkW = ΔkWh / 8766 * CF

Where:

CF	Coincidence factor = 0.937

Strip Curtains

Energy Savings

Equation D-9. Energy Savings for Strip Curtains

$$\Delta kWh = \Delta kWh/sq\ ft * A$$

Where:

A	Doorway area
ΔkWh/sq. ft	Average annual kWh savings per square foot of infiltration barrier per table below

Table D-9. Average Annual Energy Savings Per Square Foot of Infiltration Barrier

Type	Pre-Existing Curtains	Energy Savings ΔkWh/sq. ft
Supermarket - Cooler	Yes	37
Supermarket - Cooler	No	108
Supermarket - Freezer	Yes	119
Supermarket - Freezer	No	349
Convenience Store - Cooler	Yes	5
Convenience Store - Cooler	No	20
Convenience Store - Freezer	Yes	8
Convenience Store - Freezer	No	27
Restaurant - Cooler	Yes	8
Restaurant - Cooler	No	30
Restaurant - Freezer	Yes	34
Restaurant - Freezer	No	119
Refrigerated Warehouse	Yes	254
Refrigerated Warehouse	No	729

Source: IL TRM v7

Coincident Peak Demand Savings

Equation D-10. Coincident Peak Demand Savings for Strip Curtains

$$\Delta kW = \Delta kWh / 8766 * CF$$

Where:

Hours per year	8,766
CF	1.0

Variable Speed Drive Compressor

Energy Savings

Equation D-11. Energy Savings for Variable Speed Drive Compressor

$$\Delta kWh = 0.9 \times hp_{compressor} \times HOURS \times (CF_b - CF_e)$$

Where:

ΔkWh	Gross customer annual kWh savings for the measure
$hp_{compressor}$	Compressor motor nominal hp
0.9	Compressor motor nominal hp to full load kW conversion factor
HOURS	Compressor total hours of operation below depending on shift 1,976 for single shift Weekdays 3,952 for 2 shift Weekdays 5,928 for 3 shift Weekdays 8,320 for 3 shift weekdays plus weekends
CF_b	Baseline compressor factor = 0.890
CF_e	Efficient compressor = 0.705

Coincident Peak Demand Savings

Equation D-12. Coincident Peak Demand Savings for Variable Speed Drive Compressor

$$\Delta kW = \Delta kWh / HOURS * CF$$

Where:

CF	Coincidence Factor = 0.59 for single shift 0.95 for 2-shift 0.95 for 3-shift 0.95 for 4-shift

Low Flow Faucet Aerator

Energy Savings

Equation D-13. Energy Savings for Low Flow Faucet Aerator

$$\Delta kWh = \%ElectricDHW * ((GPM\_base - GPM\_low)/GPM\_base) * Usage * EPG\_electric * ISR$$

Where:

%ElectricDHW	Proportion of water heating supplied by electric resistance heating = 100%
GPM_base	Average flow rate, in gallons per minute, of the baseline faucet “as-used” = 1.39 gallons
GPM_low	Average flow rate, in gallons per minute, of the low-flow faucet aerator “as-used” = 0.94 gallons for bathroom
Usage	Estimated usage of mixed water (mixture of hot water from water heater line and cold water line) per faucet (gallons per year) = 5,000 gallons
EPG_electric	Energy per gallon of mixed water used by faucet (electric water heater) = 0.0795 kWh/gal for bathroom
ISR	In service rate of faucet aerators = 0.95

Coincident Peak Demand Savings

Equation D-14. Coincident Peak Demand Savings for Low Flow Faucet Aerator

$$\Delta kW = \Delta kWh / Hours * CF$$

Where:

Hours	Annual Recovery Hours - Annual electric DHW recovery hours for faucet use = 49 hours
CF	0.0128

Package Terminal Air Conditioner (PTAC)

Guidehouse applied the International Energy Conservation Code (IECC) 2012 as the baseline for baseline SEER, EER, and other baseline energy efficiency ratings. For the installed energy efficiency equipment, Guidehouse confirmed energy efficiency ratings by checking the model numbers and manufacturers of products provided from the tracking database.

Energy Savings

Equation D-15. Energy Savings for PTAC

$$\Delta kWh = (kBtu/hrcool) * [(1/EERbase) – (1/EERee)] * EFLHcool$$

Where:

$kBtu/_{hrcool}$	Capacity of cooling equipment (1 ton = 12 kBtu/hr)
EER_{base}	Energy efficiency ratio of the baseline equipment based on the IECC 2012 For units < 65 kBtu/hr, assume the following conversion from SEER to EER for calculation of peak savings: EER = (-0.02 * $SEER^2$) + (1.12 * SEER)
EER_{ee}	Energy efficiency ratio of efficient equipment. The evaluation team used the following data sources (listed by priority): 1. Checking the model numbers and manufacturers of installed energy efficiency equipment, or, 2. Tracking data
$EFLH_{cool}$	Equivalent full load hours for cooling are provided in Section 4.4 HVAC End Use of the Illinois TRM Version 7 and vary by space type.

Coincident Peak Demand Savings

Equation D-16. Coincident Peak Demand Savings for PTAC

$$\Delta kW = (kBtu/hrcool) * [(1/EERbase) – (1/EERee)] *CF$$

Where:

CF	Summer peak coincident demand savings factor from the Evergy MEEIA TRM = 91.3% (based on the value in the Illinois TRM Version 7)

Air Sourced Air Conditioner

Guidehouse applied the International Energy Conservation Code (IECC) 2012 as the baseline for baseline SEER, EER, and other baseline energy efficiency ratings. For the installed energy efficiency

equipment, Guidehouse confirmed energy efficiency ratings by checking the model numbers and manufacturers of products provided from the tracking database.

E***nergy Savings***

Equation D-17. Energy Savings for Air Sourced Air Conditioners

For units with cooling capacities less than 65 kBtu/hr:
$$\Delta kWh = (kBtu/hr) * [(1/SEERbase) - (1/SEERee)] * EFLH$$

For units with cooling capacities equal to or greater than 65 kBtu/hr:
$$\Delta kWh = (kBtu/hr) * [(1/IEERbase) - (1/IEERee)] * EFLH$$

Where:

kBtu/hr — Capacity of the cooling equipment installed in kBtu per hour (1 ton of cooling capacity equals 12 kBtu/hr)

$SEER_{base}$ — Baseline EER from IECC 2012

$SEER_{ee}$ — Efficient case SEER value. The evaluation team used the following data sources (listed by priority):

1. Checking the model numbers and manufacturers of installed energy efficiency equipment, or,
2. Tracking data

$IEER_{base}$ — Baseline IEER from IECC 2012

$IEER_{ee}$ — Efficient case IEER value. The evaluation team used the following data sources (listed by priority):

1. Checking the model numbers and manufacturers of installed energy efficiency equipment, or,
2. Tracking data

EFLH — Equivalent Full Load Hours for Cooling are provided in Section 4.4 HVAC End Use of the Illinois TRM Version 7 and vary by space type.

Coincident Peak Demand Savings

Equation D-18. Coincident Peak Demand Savings for Air Sourced Air Conditioners

$$\Delta kW = (kBtu/hr) * [(1/EERbase) - (1/EERee)] * CF$$

Where:

kBtu/hr — Same as above.

EER_{base} — Baseline EER from IECC 2012

EER_{ee} — Efficient case EER value. The evaluation team used the following data sources (listed by priority):

1. Checking the model numbers and manufacturers of installed energy efficiency equipment, or,
2. Tracking data

CF Summer peak coincident demand savings factor from the Evergy MEEIA TRM = 91.3% (based on the value in the Illinois TRM Version 7)

D.2 Process Evaluation

In PY2019, Guidehouse addressed the five Missouri-required questions for process evaluation through interviews with program staff.

Table D-10 displays the evaluation team's key process research questions and the evaluation activities conducted to address these questions.

Table D-10. Process Evaluation Research Questions and Approaches

Process Evaluation Research Question	Evaluation Activities
Missouri-Required Questions for Process Evaluation	
1. What are the primary market imperfections that are common to the target market segment?	• Program staff interviews
2. Is the target market segment appropriately defined, or should it be further subdivided or merged with other market segments?	• Program staff interviews
3. Does the mix of end-use measures included in the program appropriately reflect the diversity of end-use energy service needs and existing end-use technologies within the target market segment?	• Program staff interviews
4. Are the communication channels and delivery mechanisms appropriate for the target market segment?	• Program staff interviews
5. What can be done to more effectively overcome the identified market imperfections and to increase the rate of customer acceptance and implementation of each end-use measure included in the program?	• Program staff interviews

Source: Guidehouse

D.2.1 Program Staff Interviews

Guidehouse conducted a program manager interview and an implementation contractor interview. Specific process evaluation topics addressed included the following:

- Program operation, challenges, successes, and goals
- Qualification process for trade allies to apply for rebates through the program
- Qualifications for customers to participate in the program

APPENDIX E. C&I BUSINESS EER CUSTOM PROGRAM-SPECIFIC METHODOLOGIES

The Business Energy Efficiency Rebate (Business EER) Custom program is designed to help C&I customers save energy and peak demand through a broad range of energy efficiency options that align with customers' needs.

Based on Missouri regulations (see Appendix C), the evaluation team used method 1a and protocol 2b to evaluate the Business EER Custom program. The evaluation of the Custom program consisted of the following activities:

- Gross impact evaluation (detailed in Section E.1)
- Process evaluation (detailed in Section E.2)

E.1 Impact Evaluation

Guidehouse performed the following impact evaluation activities:

- Tracking database review
- Engineering review consisting of:
    - Engineering desk review
    - Measure and project verification via phone interviews
    - On-site verification
    - Parallel path review

E.1.1 Tracking Database Review

The evaluation team conducted a thorough review of the program tracking database as described in Section 0.

E.1.2 Engineering Desk Review

Based on the program tracking database review, Guidehouse drew a sample of the program population for an engineering review. Assessing savings for a sample of the program population is a uniform method for the evaluation of large energy efficiency programs[10]. This section describes Guidehouse's methodology for the sampling and engineering review of the Business EER Custom program in PY2019.

[10] Chapter 11: Sample Design Cross-Cutting Protocol. National Renewable Energy Laboratory (NREL). https://www.nrel.gov/docs/fy17osti/68567.pdf

E.1.2.1 Sampling

Guidehouse used a stratified ratio estimation sampling design to develop a sample achieving 90/10 confidence/precision on the program-level realization rate. The team took the following steps:

- Review the program tracking database and define the confidence and precision at the overall program level
- Define the statistical stratum based on program characteristics
- Estimate an appropriate variance for each stratum
- Select a random sample within each stratum

The evaluation team then divided the projects by reported energy and coincidence peak demand savings into the following strata:

- Certainty
- Large Lighting
- Small Lighting
- Large Non-Lighting
- Small Non-Lighting

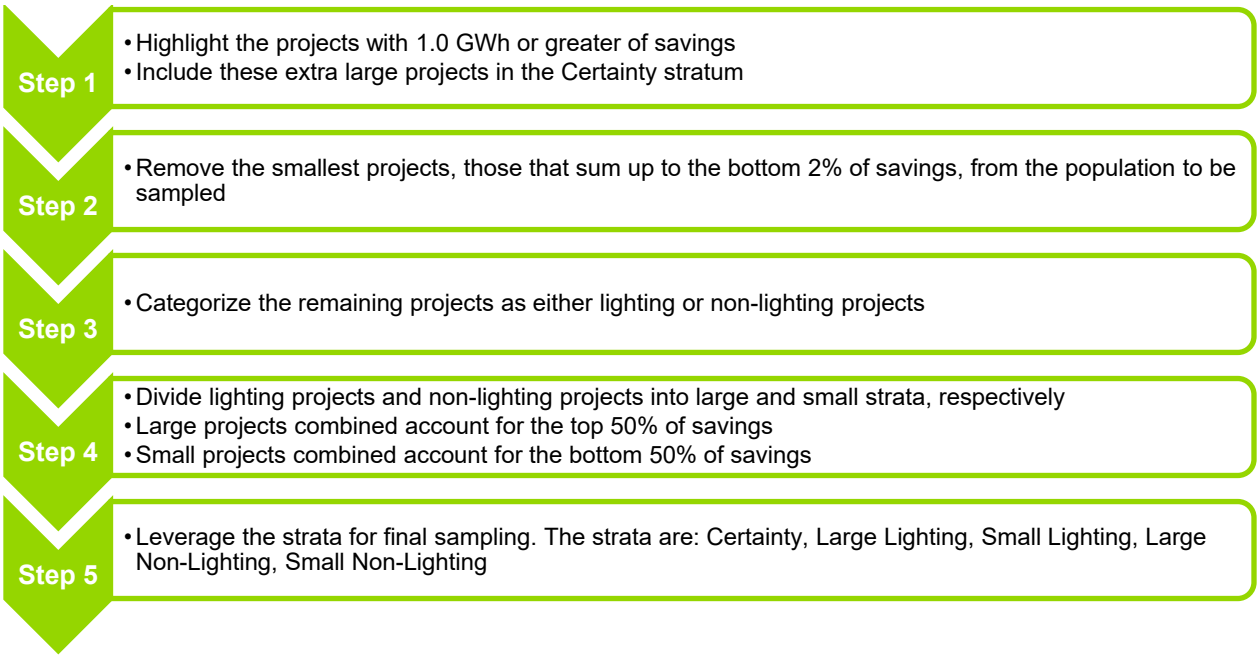
Stratification aligns with the project size variability and allows the sample to have a good representation of the population. The Guidehouse team randomly selected projects proportionately within each stratum to ensure both of the following:

- The evaluation of the largest projects and contributors to the program performance
- The fair representation of smaller projects in the evaluation

The Certainty stratum included the largest projects implemented in the program year, each of which reported 1.0 GWh or greater of energy savings. The evaluation team removed very small projects for sampling. The total savings of those very small projects made up no more than 2% of the total program savings. Guidehouse then divided the remaining projects into lighting and non-lighting projects. Lighting projects constituted over half of the program savings, thus this sampling approach avoids over representation of lighting projects. The evaluation team divided lighting projects into Large Lighting and Small Lighting strata, with large projects constituting the top 50% of lighting project savings and small projects the bottom 50%. The same approach was applied for non-lighting projects. The evaluation team

then randomly selected projects within each stratum to determine the final sample. The sampling procedures are summarized in the following figure.

Figure E-1. Custom Program Sampling Procedures in PY2019



E.1.2.2 Engineering Review Methodology

The evaluation team requested project files for the sampled projects from Evergy and the implementation team. Guidehouse reviewed the project files and all the assumptions made by the implementer in developing reported savings. The team also conducted telephone interviews and on-site verification to ensure full understanding of the project. Guidehouse then verified the energy and coincident peak demand savings for each sampled project using industry standard evaluation methodologies based on the Uniform Methods Protocols (UMP)[11], all of which are detailed further below in this section. Finally, Guidehouse calculated realization rates (RR) for the program using the following process.

Equation E-1. Realization Rates Per Stratum

$$RR_{stratum} = \frac{\sum_{sampled} E_{ex-post}}{\sum_{sampled} E_{ex-ante}}$$

Where:

E Electric energy savings or peak demand reduction for each project in the stratum

[11] https://www.energy.gov/eere/about-us/ump-protocols

Realization rates in each stratum were applied to the project population of that stratum using Equation E-2:

Equation E-2. Realization Rates Per Stratum and Project Population

$$E_{i,ex-post} = RR_{stratum} * E_{i,ex-ante}$$

The program level realization rate for the program was calculated using Equation E-3:

Equation E-3. Realization Rates for the Entire Program

$$RR_{program} = \frac{\sum_{i=1}^{5} E_{i,ex-post}}{\sum_{i=1}^{5} E_{i,ex-ante}}$$

The evaluation team's engineering review methodology to calculate the verified energy savings and coincident peak demand savings for the Business EER Custom program measures is described below. Guidehouse applied industry standard methodologies for engineering review of the following measures or similar measures implemented in PY2019.

- Lighting Measures
- Building Management System (BMS) Upgrades
- Variable Speed Drive for Pump or Fan
- HVAC
- Refrigeration Upgrade
- New Construction

Lighting Measures

Energy Savings

Equation E-4. Energy Savings for C&I Lighting Measures

$$\Delta kWh = (kW_{base} - kW_{ee}) * ISR * Hours * WHF_e$$

Where:

kW_{base}	kW of the baseline lighting, based on kW of existing lighting fixtures for retrofit projects or based on the building-area method or space-by-space method defined in the energy code
kW_{ee}	kW of the post-retrofit or energy efficient lighting system, based on lighting plans and specifications and verified by phone interview
HOURS	Average hours of use per year, based on project information and verified by phone interview
WHF_e	Waste heat factor for energy, based on the IL TRM v7 for each building type
ISR	In-service rate, based on project information and verified by phone interview

Equation E-5. Energy Savings for C&I Lighting Controls

$$\Delta kWh = kW_{controlled} * ISR * Hours * ESF * WHF_e$$

Where:

$kW_{controlled}$	Total lighting load connected to the installed lighting controls, based on lighting plans and specifications and verified by phone interview
ESF	energy savings factor for installed lighting controls, based on the IL TRM v7 for each building type

Coincident Peak Demand Savings

Equation E-6. Coincident Peak Demand Savings for C&I Lighting Measures

$$\Delta kW = (kW_{base} - kW_{ee}) * ISR * CF * WHF_d$$

Where:

CF	Summer peak demand coincidence factor, based on Guidehouse's long-term metering study results and verified by phone interview to confirm lighting operation schedule
WHF_d	Waste heat factor for demand, based on the IL TRM v7

Equation E-7. Coincident Peak Demand Savings for C&I Lighting Controls

$$\Delta kW = kW_{controlled} * ISR * (CF_{baseline} - 0.15) * WHF_d$$

Where:

$CF_{baseline}$	Summer peak demand coincidence factor, based on the Guidehouse's long-term metering study results for each building type

Building Management System (BMS) Upgrades

Guidehouse applied consumption data analysis, also called billing data analysis, for the BMS upgrade measures. Billing data analysis is a reasonable approach for the estimation of whole building energy savings. It is simpler and more cost effective to conduct compared to the end use regression model method.

The billing data analysis approach includes the following steps:

1. Review the billing data and corresponding historical weather data for the site location
    a. The billing data analysis depends on the types of data available. If hourly billing data are collected, an hourly billing data analysis is conducted. An hourly billing data analysis is more accurate than a monthly billing data analysis and easy to align with the peak demand period for the calculation of peak demand savings.
2. Define the pre- and post-retrofit period
3. Create a regression relationship between the billing data and historical weather data for both pre- and post-retrofit periods
4. Predict the pre- and post-retrofit hourly power demand using the created regression models and the Typical Meteorological Year 3 (TMY3) weather data
5. Calculate the project savings by subtracting the post-retrofit consumption from the pre-retrofit consumption

Variable Speed Drive for Pump or Fan

Guidehouse applied the end use regression model approach for the estimation of energy and peak demand savings for variable speed drive projects. Guidehouse performed an end use regression analysis using the following steps.

1. Review the metering data and other variables (such as outdoor air temperature, production data—this depends on the project type)
2. Create a regression relationship between the metering data and other variables for both pre- and post-retrofit periods
3. Predict the pre- and post-retrofit hourly power using the created regression models and other variables
    a. Other variables depend on the project type. For example, if the regression analysis is run for metering data and weather data, the TMY3 data is used for the prediction
4. Calculate the project savings by subtracting the post-retrofit consumption from the pre-retrofit consumption

HVAC

Guidehouse applied an 8,760 hourly data analysis approach for the determination of energy and peak demand savings for the weather-dependent HVAC measures. The steps for Guidehouse's 8,760 hourly data analysis approach are as follows:

1. Create a regression model comparing the demand against dry bulb temperatures or other relevant variables
    a. For example, the regression model could be performed for a performance curve for a cooling system, pump, or fan
2. Calculate the hourly power for each hour using the regression model
3. Calculate the pre- and post-retrofit energy consumptions by summing up the 8,760 hours of power
4. Calculate the pre- and post-retrofit peak demand by extracting savings that fall within the peak period

Refrigeration Upgrade

Guidehouse applied the end use regression model approach for the estimate of energy and peak demand savings for the refrigeration upgrade project. The detailed methodology is summarized in the section 'Variable Speed Drive for Pump or Fan'.

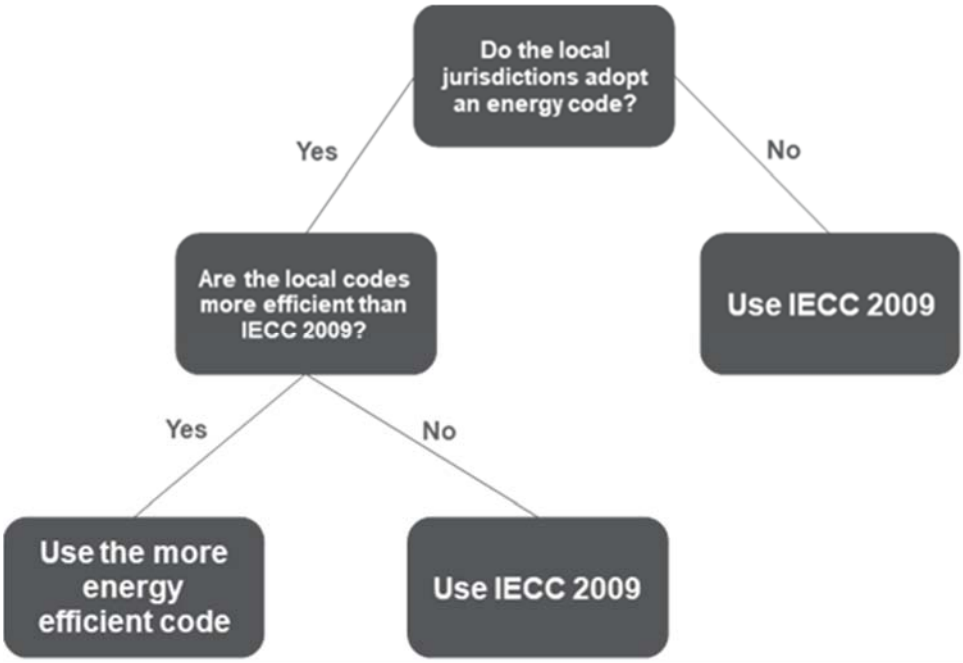
New Construction

Guidehouse used the 8,760 hourly data analysis approach summarized in the preceding HVAC section for the estimate of energy and peak demand savings for non-lighting new construction projects, specifically weather-dependent HVAC measures.

Guidehouse applied the relevant codes and standards for evaluation of all new construction projects as described below.

- **Baseline standard or code for Custom new construction projects**
  Guidehouse established the following rule of thumb for energy code, as shown in Figure E-2.

Figure E-2. Evergy Custom Program Baseline Code



- **Calculation approach for Custom new construction lighting projects**
  The evaluation team used the building-area or space-by-space method defined by the energy code to calculate savings for the Custom program's new construction lighting projects.

E.1.2.3 On-site Verification

Guidehouse conducted on-site verification of 14 non-lighting projects to support the PY2019 impact evaluation. The objectives of the on-site verification included the following.

- Support the impact evaluation of non-lighting projects:
  - Guidehouse verified that the measures listed in the project tracking data were successfully installed and implemented. Guidehouse reviewed the HVAC system, control strategies and building energy management system (EMS) to verify that the assumptions used for calculating savings are accurate reflections of the site conditions. Finally, Guidehouse requested trend data for all non-lighting measures[12].
  - On-site verification helped Guidehouse to understand how Custom measures were being implemented, the customers' experiences, and their expectations.
  - Whenever possible, Guidehouse determined verified savings using the actual performance data collected during the site visit.
  - The on-site verification improved the accuracy of the verified savings analysis.

[12] Guidehouse has had limited success with collecting trend data as part of customer phone interviews. Guidehouse has generally had more success overall collecting trend data as part of on-site verification efforts.

- Support the participant NTG research in PY2019:
    - The objective of the NTG research was to understand customer's experience with the Custom program, quantify the free ridership and spillover, and identify areas for improvement. While on-site, Guidehouse asked customers if they would be willing to participate in the NTG survey distributed in early February 2020. During this time, Guidehouse made sure that the customers had access to the survey.
- Update demand factors for non-lighting end uses:
    - The verified savings calculated by leveraging the actual performance data was used to update the demand factors for non-lighting end uses, including unitary AC, HVAC control, motors and drive, and refrigeration. These updated demand factors will be intended for use in Cycle 3 PY2.

Guidehouse verified and confirmed the following during the on-site visits:

- Installation of energy efficiency measures
- Existing or baseline conditions
- The efficiency levels and operating conditions of the installed energy efficiency measures
- The building's verified specification as built for whole-building design projects.

Guidehouse also collected nameplate data of installed equipment, spot readings, and trend data when available. While many project parameters can use assumptions based on industry standard practices or codes and standards, many parameters are unique to a project and Guidehouse collected trend data whenever possible to back up the temperature dependent relationships used in calculation of project savings. When feasible, Guidehouse collected hourly or even smaller interval trend data to show the relationship between the dependent and independent variables, allowing extrapolation across an entire year of equipment operation. Trend data is helpful (or, in some cases necessary) for the following reasons:

- It shows that the baseline and post-project conditions are accurately described and modeled
- It establishes a relationship between the dependent variable and (typically) outdoor temperature that allow for utility demand calculations

Guidehouse recognizes that it is often not economical to install metering devices to trend all possible variables, particularly for projects with small savings. In addition, the timeline of on-site verification did not align with the summer period when the system demand peaks and when peak demand savings are evaluated. However, during the site visits, Guidehouse found that trend data could often be gathered at a minimal cost of time and effort from a building's existing EMS. Therefore, Guidehouse included collecting trend data while on-site as one of the key objectives of the on-site verification effort in PY2019.

E.1.2.4 Parallel Path Review

Guidehouse performed parallel path reviews for the implementation contractor. The goal of this parallel path approach was to minimize risk and uncertainty in application of kW factors, engineering approach, data collection, and measurement and verification. The evaluation team applied industry standard

approaches based on the International Performance Measurement and Verification Protocol (IPMVP) Options[13] and the Uniform Methods Protocol (UMP).

E.2 Process Evaluation

Guidehouse addressed two process evaluation research questions and the five Missouri-required questions for process evaluation through program staff interviews, a program materials review, two rounds of participant free-ridership surveys, one round of trade ally surveys, and one round of participant spillover surveys, for the Business EER Custom program.

Table E-1 displays the evaluation team's key process research questions and the evaluation activities conducted to address these questions.

Table E-1. Process Evaluation Research Questions and Approaches

Process Evaluation Research Question	Evaluation Activity
General Process Evaluation Questions	
1. What is the status of the program's progress toward implementing the key process recommendations provided in the program's most recent EM&V report?	• Program staff interviews • Materials review
2. What changes have been made to the program in this program year, and what changes are planned for the next program year?	• Program staff interviews • Materials review
Missouri-Required Questions for Process Evaluation	
1. What are the primary market imperfections that are common to the target market segment?	• Program staff interviews • Materials review • Trade ally surveys
2. Is the target market segment appropriately defined, or should it be further subdivided or merged with other market segments?	• Program staff interviews • Materials review • Trade ally surveys
3. Does the mix of end-use measures included in the program appropriately reflect the diversity of end-use energy service needs and existing end-use technologies within the target market segment?	• Program staff interviews • Materials review • Trade ally surveys
4. Are the communication channels and delivery mechanisms appropriate for the target market segment?	• Program staff interviews • Materials review • Trade ally surveys • Participant surveys
5. What can be done to more effectively overcome the identified market imperfections and to increase the rate of customer acceptance and implementation of each end-use measure included in the program?	• Program staff interviews • Materials review • Trade ally surveys • Participant surveys

Source: Guidehouse

[13] https://evo-world.org/en/products-services-mainmenu-en/protocols/ipmvp

E.2.1 Program Staff Interviews

Guidehouse conducted a program manager interview and two implementation contractor interviews as described in Section D.2.1.

E.2.2 Materials Review

Guidehouse conducted a review of the program description and documents available from Evergy to understand the Custom program application process and program requirements. Guidehouse reviewed the following program documents:

- Program tracking database
- Bill inserts, brochures, point of sales materials, and other marketing collateral
- Contractor/trade ally training materials
- Program implementation manual
- Internal process checklists or flowcharts
- Any regulatory filings regarding the program
- Program logic model

E.2.3 Market Actor Surveys

The evaluation team conducted trade ally surveys in December 2019 to support the non-participant spillover research and understand the trade allies' experience with the Custom program.

E.2.4 Participant Surveys

The evaluation team conducted two rounds of participant free ridership surveys to support the Custom program free ridership research in PY2019. One survey was conducted on September 2019 and the other one in February 2020. Additionally, Guidehouse also conducted spillover surveys of all unique PY2019 participants in February 2020.

APPENDIX F. C&I BLOCK BIDDING PROGRAM-SPECIFIC METHODOLOGIES

The Block Bidding program did not have any program activity in PY2019.

APPENDIX G. C&I STRATEGIC ENERGY MANAGEMENT PROGRAM-SPECIFIC METHODOLOGIES

The Strategic Energy Management (SEM) program did not have any program activity in PY2019.

APPENDIX H. SMALL BUSINESS LIGHTING PROGRAM-SPECIFIC METHODOLOGIES

The Small Business Lighting program (SBL) did not have any program activity in PY2019.

APPENDIX I. WHOLE HOUSE EFFICIENCY PROGRAM-SPECIFIC METHODOLOGIES

The Whole House Efficiency (WHE) Program encourages improvements to homes by promoting home energy audits and comprehensive retrofits. This program is eligible to customers that own or rent a residence. The program has the five key goals listed below:

- Demonstrate persistent energy savings
- Encourage energy-saving behavior and whole house improvements
- Help residential customers reduce their electricity bills
- Educate customers about the benefits of installing high efficiency HVAC equipment
- Develop partnerships with HVAC contractors to bring efficient systems to market

In PY2019, customers could participate in the program through three different options, or tiers. Tier 1 offered a home energy assessment and direct install measures such as faucet aerators, low-flow showerheads, advanced power strips, hot water pipe insulation, energy efficient lighting, and furnace whistles. Tier 2 consisted of weatherization measures including air sealing, ceiling insulation and wall insulation. Tier 3 consisted of HVAC measures such as ECM furnace fans, indoor and outdoor coil cleaning, HVAC maintenance and tune-ups, efficient air conditioners, and efficient heat pumps.

Based on Missouri regulations (see Appendix C), Guidehouse used impact evaluation method 1a and protocol 2b to evaluate the WHE program. The evaluation consisted of the following activities for PY2019:

- Gross impact evaluation (detailed in Section I.1)
- Process evaluation (detailed in Section I.2)
- Cost-effectiveness (detailed in Section B.1)

I.1 Impact Evaluation

To estimate gross savings for the WHE program, the evaluation team conducted the following activities:

- Tracking database review
- Deemed savings review

I.1.1 Tracking Database Review

The evaluation team obtained program tracking data from the WHE program management team covering the period from April 2019 through the end of December 2019. The team reviewed the program data to assess the following:

- Ability to verify gross savings by the inclusion of data about the baseline units removed and efficient units installed

- Level of detail on the characteristics of products sold, including rebate amounts, number of units installed, and measure-specific data such as unit efficiencies, wattage values, operating schedules, nameplate data, and similar specifications
- Possible errors in the data by verifying that the values for each variable fell within reasonable bounds
- Data aligned with expectations based on the program design

Guidehouse held several meetings with the Evergy WHE program staff and the program implementation team (ICF) to discuss the results of the review. WHE and ICF program staff provided additional data to Guidehouse when needed.

I.1.2 Deemed Savings Review

The evaluation team conducted a thorough engineering desk review of the approaches used to estimate reported gross savings for the WHE program.

The team used site-level data and industry standard algorithms to calculate the verified savings for the program measures. The team referenced the IL TRM v7 to obtain these values for most measures, except where otherwise noted. The team then compared these calculations against the energy and coincident demand savings reported by the WHE program. As a result of the review, the evaluation team highlighted any cases where discrepancies between the savings goals, reported values, and evaluated values arose or where insufficient data gathering occurred.

The algorithms for each measure evaluated in this analysis are detailed below.

I.1.2.1 Tier 1: Home Energy Audit and Direct Install Measures

The evaluation team used industry standard algorithms to calculate the verified savings for the direct install measures. The team referenced IL TRM v7 to calculate the verified savings values, except where otherwise noted.

Low-Flow Faucet Aerator Energy Savings

Equation I-1. Low-Flow Faucet Aerator Energy Savings

$$\Delta kWh = \%ElectricDHW * \left(\left((GPM_{base} \times L_{base} - GPM_{low} \times L_{low}) \right) \times Household * 365.25 * \frac{DF}{FPH} \right) * EPG_{electric} * ISR$$

Where:

%ElectricDHW	Proportion of water heating supplied by electric water heaters = 1 electric, 0 gas
GPM_{base}	Baseline Gallons per minute = 1.63 kitchen, 1.53 bathroom
GPM_{low}	Efficient Gallons per minute = 1.5 kitchen, 1.0 bathroom
$L_{base} = L_{low}$	Minutes per day = 4.5 kitchen, 1.6 bathroom

Household	Persons per household = 2.56
FPH	Faucets per household = 1 kitchen, 2.83 bathroom
DF	Drain factor = 75% kitchen, 90% bathroom
$EPG_{electric}$	Energy per gallon of hot water supplied by electricity = 0.0969 kWh/gal kitchen, 0.0795 kWh/gal bathroom
ISR	In-service rate = 95%

Low-Flow Faucet Aerator Coincident Demand Savings

Equation I-2. Low-Flow Faucet Aerator Coincident Demand Savings

$$\Delta kW = \frac{\left[\%ElectricDHW * \left(\left((GPM_{base} \times L_{base} - GPM_{low} \times L_{low})\right) \times Household * 365.25 * \frac{DF}{FPH}\right) * EPG_{electric} * ISR\right]}{Hours * CF}$$

Where:

%ElectricDHW	Same as above
GPM_{base}, GPM_{low}	Same as above
$L_{base} = L_{low}$	Same as above
Household	Same as above
FPH	Same as above
DF	Same as above
$EPG_{electric}$	Same as above
ISR	Same as above
Hours	Annual electric hot water recovery hours = 102 kitchen, 14 bathroom
CF	Coincidence factor = 0.022

Low-Flow Showerhead Energy Savings

Equation I-3. Low-Flow Showerhead Energy Savings

$$\Delta kWh = \%ElectricDHW * \left(\left((GPM_{base} \times L_{base} - GPM_{low} \times L_{low})\right) \times Household * SCPD * 365.25/SPH\right) * EPG_{electric} * ISR$$

Where:

%ElectricDHW	Proportion of water heating supplied by electric water heaters = 1 electric, 0 gas
GPM_{base}	Gallons per minute = 2.24 base
GPM_{low}	Gallons per minute = actual for low-flow = 1.5
$L_{base} = L_{low}$	Minutes per day = 7.8
Household	Persons per household = 2.56
SCPD	Showers per capita per day = 0.6
SPH	Showers per household = 1.79
$EPG_{electric}$	Energy per gallon of hot water supplied by electricity = 0.117 kWh/gal
ISR	In-service rate = 98%

Low-Flow Showerhead Coincident Demand Savings

Equation I-4. Low-Flow Showerhead Coincident Demand Savings

$$\Delta kW = \frac{\left[\left(\%ElectricDHW * \left(\left((GPM_{base} \times L_{base} - GPM_{low} \times L_{low})\right) \times Household * SCPD * \frac{365.25}{SPH}\right) * EPG_{electric} * ISR\right)\right]}{Hours * CF}$$

Where:

%ElectricDHW	Same as above
GPM_{base},GPM_{low}	Same as above
L_{base} = L_{low}	Same as above
Household	Same as above
SCPD	Same as above
SPH	Same as above
$EPG_{electric}$	Same as above
ISR	Same as above
Hours	Annual electric hot water recovery hours = 255
CF	Coincidence factor = 0.0278

Advanced Power Strip Energy Savings

Equation I-5. Advanced Power Strip Energy Savings

$$\Delta kWh_{7\text{-}plug} = 103$$

Where:

ΔkWh	Deemed energy savings = 103 kWh for 7-plug strip

Advanced Power Strip Coincident Demand Savings

Equation I-6. Advanced Power Strip Coincident Demand Savings

$$\Delta kW_{7\text{-}plug} = 0.0116$$

Where:

ΔkW	Deemed coincident demand savings = 0.0116 kW for 7-plug strip

Hot Water Pipe Insulation Energy Savings

Equation I-7. Hot Water Pipe Insulation Energy Savings

$$\Delta kWh = \frac{\left(L * \left(\left(\frac{C_{exist}}{R_{exist}}\right) - \left(\frac{C_{new}}{R_{new}}\right)\right)\right) * \Delta T * Hours}{(EffDHW / 3{,}412)}$$

Where:

C_{exist}	Hot Water Pipe Circumference (0.75 inch) = 0.196 ft
C_{new}	Insulation + Hot Water Pipe Diameter = 0.393 ft
L	Length of pipe from water heating source covered by pipe wrap (ft) = 6 ft
R_{exist}	Pipe heat loss coefficient of uninsulated pipe (existing) [(hr-°F-ft)/Btu] = 1
R_{new}	Pipe heat loss coefficient of insulated pipe (new) [(hr-°F-ft)/Btu] = 1 + 5 = 6
ΔT	Average temperature difference between supplied water and outside air temperature = 60°F
Hours	Hours in a year = 8,766
EffDHW	Recovery efficiency of electric water heater = 98%
3,412	Conversion factor from Btu to kWh

Hot Water Pipe Insulation Coincident Demand Savings

Equation I-8. Hot Water Pipe Insulation Coincident Demand Savings

$$\Delta kW = \frac{\Delta kWh}{8{,}766}$$

LED Energy Savings

LED energy savings algorithms are from v7 of the IL TRM. Where applicable, variable values were calculated based on weighted averages of actual Evergy-specific measure installation data.

Equation I-9. LED Energy Savings

$$\Delta kWh = \frac{(W_{base}\text{-}W_{ee})}{1{,}000} * ISR * Hours * WHF_e$$

Where:

W_{base}	Wattage of baseline bulb = 29W Candle, 29W Globe, 50W BR30, 43W A19
W_{ee}	Wattage of efficient bulb from program tracking data = 6.7W Candle, 6.7W Globe, 8.5W BR30, 11.4W A19
ISR	In-service rate = 94.2%
Hours	Average hours of use per year = 1,089 A19, 763 globe, candle, BR30
WHF_e	Waste heat factor to account for cooling savings from efficient lighting = 1.06

LED Coincident Demand Savings

Equation I-10. LED Coincident Demand Savings

$$\Delta kW = \left[\frac{(W_{base} - W_{ee})}{1{,}000} * ISR * WHF_d\right] * CF$$

Where:

W_{base}	Same as above
W_{ee}	Same as above
ISR	Same as above
WHF_d	Waste heat factor to account for cooling savings from efficient lighting = 1.11
CF	Coincidence factor = 12.80% A19, 10.9% globe, candle, BR30

Furnace Filter Alarm Energy Savings

Equation I-11. Furnace Filter Alarm Energy Savings

$$\Delta kWh = \Delta \mathbf{kWh/yr_{heat}} + \Delta \mathbf{kWh/yr_{cool}}$$

$$\Delta \mathbf{kWh/yr_{heat}} = \mathbf{kW_{motor}} \times \mathbf{EFLH_{heat}} \times \mathbf{EI} \times \mathbf{ISR}$$

$$\Delta \mathbf{kWh/yr_{cool}} = \mathbf{kW_{motor}} \times \mathbf{EFLH_{cool}} \times \mathbf{EI} \times \mathbf{ISR}$$

Where:

kW_{motor}	Average motor full load electric demand = 0.5
$EFLH_{heat}$	Estimated full load hours for heating = 1376 (Guidehouse Analysis)
$EFLH_{cool}$	Estimated full load hours for cooling = 738 (MO TRM)
EI	Efficiency improvement = 15%
ISR	In-service rate = 47.4%

Note that Furnace Filter Alarm algorithms come from the 2016 PA TRM.

Furnace Filter Alarm Coincident Demand Savings

Equation I-12. Furnace Filter Alarm Coincident Demand Savings

$$\Delta kW = \frac{\Delta\, kWh/yr_{cool}}{EFLH_{cool}} \times CF$$

Where:

$\Delta kWh/yr_{cool}$	Same as above
$EFLH_{cool}$	Same as above
CF	Coincidence factor = 65%

I.1.2.2 Tier 2: Building Shell Measures

The evaluation team used industry standard algorithms to calculate the verified savings from the building shell measures. Consistent with the evaluation team's approach for other measures, the team referenced IL TRM v7 to obtain these values, except where otherwise noted.

Air Sealing Energy Savings

Equation I-13. Air Sealing Energy Savings

$$\Delta kWh = \Delta kWh_{cooling} + \Delta kWh_{heating}$$

Equation I-14. Air Sealing Energy Savings - Cooling

$$\Delta kWh_{cooling} = \frac{(CFM_{base} - CFM_{ee})}{N_{cool}} * 60 * 24 * CDD * DUA * 0.018 / (1{,}000 * EffCool) * LM * ADJ_{AirSealingCool}$$

Where:

CFM	Infiltration at 50Pa (pre and post-retrofit) from program tracking data
N_{cool}	Infiltration conversion factor = 35.8 (St. Louis – assumes 1.5 stories)
60*24	Conversion factor from cubic feet per minute to cubic feet per day
CDD	Cooling degree days = 1,445 per ORNL for Kansas City[14]
DUA	Discretionary Use Adjustment = 0.75
0.018	Specific heat capacity of air
1,000	Converts BTU to kBTU
EffCool	Seasonal energy efficiency ratio (SEER) of cooling equipment = 10 assume AC units before installed 2006, in the absence of AC age information
LM	Latent cooling multiplier = 3.6
$ADJ_{AirSealingCool}$	Adjustment for cooling savings to account for inaccuracies in engineering algorithms = 121% for air sealing and attic insulation installed at the same time; 100% for air sealing without attic insulation installed at the same time

Equation I-15. Air Sealing Energy Savings – Heating (electric heat [resistance or heat pump])

$$\Delta kWh_{heating} = \frac{(CFM_{base} - CFM_{ee})}{N_{heat}} * 60 * 24 * HDD * 0.018 / (1{,}000 * EffHeat) * 3{,}412$$

Where:

CFM	Same as above
N_{heat}	Infiltration conversion factor = 22.5 (St. Louis – assumes 1.5 stories)
60*24	Same as above
HDD	Heating degree days = 5,155 per Oak Ridge National Laboratory for Kansas City[15]
0.018	Same as above
1,000	Converts BTU to kBTU

[14] http://web.ornl.gov/sci/buildings/tools/heating-data/

[15] http://web.ornl.gov/sci/buildings/tools/heating-data/

EffHeat	COP of heating equipment = 1.7 – assume heat pump installed before 2006 in the absence of heating equipment age information
3,412	Conversion factor from Btu to kWh

Equation I-16. Air Sealing Energy Savings – Heating (gas furnace heat)

$$\Delta kWh_{heating} = \Delta therms \times F_e \times 29.3 \times ADJ_{AirSealingHeatFan}$$

$$\Delta therms = (\left(\frac{CFM50_{existing} - CFM50_{new}}{N_{heat}}\right) * 60 * 24 * HDD * 0.018)/(\eta_{heat} * 100{,}000) * ADJ_{AirSealingGasHeat}$$

Where:

F_e	Furnace fan energy consumption as a percentage of annual fuel consumption = 3.14%
29.3	kWh per therm
$ADJ_{AirSealingHeatFan}$	Adjustment for fan savings during heating season to account for inaccuracies in engineering algorithms = 107% for air sealing installations including attic insulation at the same time; = 100% for air sealing without installing attic insulation at the same time
N_{heat}	Same as above
60*24	Same as above
HDD	Same as above
0.018	Same as above
ηHeat	Same as above
$ADJ_{AirSealingGasHeat}$	Adjustment for gas heating savings to account for inaccuracies in engineering algorithms = 72% for air sealing and attic insulation; 100% for air sealing without attic insulation

Air Sealing Coincident Demand Savings

Equation I-17. Air Sealing Coincident Demand Savings

$$\Delta kW = \left(\frac{\Delta kWh_{cooling}}{EFLH_{cool}}\right) \times CF$$

Where:

$EFLH_{cool}$	Effective full load cooling hours = 738 based on MO TRM
CF	Coincidence factor = 72% for heat pumps, 68% for air conditioners

Insulation Energy Savings

Equation I-18. Insulation Energy Savings

$$\Delta kWh = \Delta kWh_{cooling} + \Delta kWh_{heating}$$

$$\Delta kWh_{cooling} = \left(\frac{\left(\left(\left(\frac{1}{R_{old}} - \frac{1}{R_{new}} \right) \times Area \times (1-Ff) \right) \times 24 \times CDD \times DUA \right)}{(1{,}000 \times \eta Cool)} \right) \times ADJ_{Cool}$$

$$\Delta kWh_{heating} = \left(\frac{\left(\left(\left(\frac{1}{R_{old}} - \frac{1}{R_{new}} \right) \times Area \times (1-Ff) \right) \times 24 \times HDD \right)}{(3{,}412 \times \eta Heat)} \right) \times ADJ_{Heat}$$

Where:

R_{old}	Existing R-value from program tracking data
R_{new}	New R-value from program tracking data
Area	Area of insulation installed from program tracking data
Ff	Framing factor = 7% for ceiling, 25% for wall
CDD	Cooling degree days = 1,445 per Oak Ridge National Laboratory for Kansas City[16]
DUA	Discretionary use adjustment factor = 0.75
ηCool	Cooling efficiency SEER, from program tracking data when available or SEER 10 for units installed before 2006, SEER 13 for AC units installed after 2006, or SEER 14 for heat pump units installed after 1/1/2015
Adj_{Cool}	Adjustment for cooling savings from basement wall insulation = 80% or adjustment for attic cooling savings to account for inaccuracies in engineering algorithms = 121%
HDD	Heating degree days = 5,155 per Oak Ridge National Laboratory for Kansas City[17]
ηHeat	Heating efficiency, from program tracking data when available or COP 1.7 for heat pumps installed before 2006, COP 1.92 for heat pumps installed 2006-2014, COP 2.04 for heat pumps installed 2015+, or 1.0 for electric resistance heating
Adj_{Heat}	Adjustment for wall and attic insulation = 60% or adjustment for fan savings to account for inaccuracies in attic engineering algorithms = 107%

If heating is via gas furnace, $\Delta kWh_{heating} = \Delta therms * F_e * 29.3 * ADJ_{AtticHeatFan}$

$$\Delta therms = \left(\left(\frac{1}{R_{old}} - \frac{1}{R_{new}} \right) * Area * (1 - Ff) * 24 * HDD \right) / (\eta_{heat} * 100{,}000) * ADJ_{AtticGasHeat}$$

[16] http://web.ornl.gov/sci/buildings/tools/heating-data/

[17] http://web.ornl.gov/sci/buildings/tools/heating-data/

Where:

F_e	Furnace fan energy consumption as a percentage of annual fuel consumption = 3.14%
29.3	kWh per therm
100,000	BTUs per therm
$ADJ_{AtticHeatFan}$	Adjustment for electric heating savings to account for inaccuracies in engineering algorithms = 60%
$ADJ_{AtticGasHeat}$	Gas heating efficiency = 72%

Insulation Coincident Demand Savings

Equation I-19. Insulation Coincident Demand Savings

$$\Delta kW = \left(\frac{\Delta kWh_{cooling}}{EFLH_{cool}}\right) \times CF$$

Where:

$EFLH_{cool}$	Effective full load cooling hours = 738 based on MO TRM
CF	Coincidence factor = 72% for heat pumps, 68% for air conditioners

I.1.2.3 Tier 3: HVAC Measures

The evaluation team used industry standard algorithms to calculate the verified savings from the HVAC measures. To be consistent with the PY2018 evaluation, the team referenced IL TRM v7 for the methodology and input values except where otherwise noted.

The measures were evaluated as early retirement (ER) or replace on burnout (ROB). The program's implementation team has a two-step approach to determine whether a unit is ER or ROB. First, they ask the customer, in the mandatory T&C (Terms & Conditions) document, to describe the operational state of the existing air conditioner or heat pump that is being replaced. Second, the trade ally records the pre-existing status of the equipment - specifically whether the equipment is operating or has failed. In addition, Evergy offers a single rebate amount for both ER and ROB in an effort to de-incentivize a reason to report the operating condition of the equipment incorrectly. The evaluation team analyzed the savings according to the type of replacement listed in the implementer's database which is primary program data and preferred to the assumptions in IL TRM v7.

Air Conditioner and Air Conditioner, Early Retirement

Air conditioners are split into six specific measures:

- Air Conditioner SEER 15
- Air Conditioner SEER 16
- Air Conditioner SEER 17
- Air Conditioner SEER 15, Early Retirement
- Air Conditioner SEER 16, Early Retirement

- Air Conditioner SEER 17, Early Retirement

The savings algorithms and inputs are detailed below.

Air Conditioner and Air Conditioner, Early Retirement Energy Savings

Equation I-20. Air Conditioner and Air Conditioner, Early Retirement Energy Savings

$$\Delta kWh = \frac{\left(EFLH_{cool} \times CAP_{cool} \times \left(\frac{1}{(SEER_{base} \times (1 - DeratingCool_{base})} - \frac{1}{SEER_{ee} \times SEERadj \times (1 - DeratingCool_{eff})}\right)\right)}{1{,}000}$$

Where:

$EFLH_{cool}$	Effective full load cooling hours = 738 based on MO TRM
CAP_{cool}	Cooling capacity from program tracking data
$SEER_{base}$	Baseline SEER from the IL TRM v7. The Early Retirement baseline SEER is specified to be 9.3 for the first six years of an early retirement measure and 13 otherwise
$SEER_{ee}$	Installed SEER from program tracking data when available, or the average SEER of the installed units when not available for a specific project
$DeratingCool_{base}$	Baseline Central Air Conditioner Cooling derating = 10%
$DeratingCool_{eff}$	Efficient Central Air Conditioner Cooling derating = 10% (no quality installation)
SEERadj	Adjustment percentage to account for in-situ performance of the unit = 0.805 X (EER_{ee} / $SEER_{ee}$) + 0.367

Air Conditioner and Air Conditioner, Early Retirement Coincident Demand Savings

Equation I-21. Air Conditioner and Air Conditioner, Early Retirement Coincident Demand Savings

$$\Delta kW = \left(\frac{CAP_{cool} \times \left(\frac{1}{EER_{base} \times (1 - DeratingCool_{base})} - \frac{1}{EER_{ee} \times (1 - DeratingCool_{eff})}\right)}{1{,}000}\right) \times CF$$

Where:

CAP_{cool}	Same as above
EER_{base}	The Early Retirement baseline EER is specified in the IL TRM v7 as 7.5 for early retirement measures and is an average of Evergy tracking data for time-of-sale measures.
EER_{ee}	Installed EER from program tracking data when available, the average EER of the installed units when not available for a specific project within a given SEER level, or the IL TRM v7's deemed value if neither is available.
$DeratingCool_{base}$	Same as above
$DeratingCool_{eff}$	Same as above
CF	Summer peak coincidence factor = 68%

$EFLH_{Heating}$ Approach Summary

Guidehouse leveraged the IL TRM v7 to develop a more precise estimate (when compared to a weighted average based on housing units) of Full Load Hours Heating (FLH_h). The values for heating degree-days are identical between IL TRM v7 and IL TRM v5. Using Heating Degree Day (HDD) data for each of the four regions presented in the IL TRM, Guidehouse developed a linear equation, shown below in Equation I-22, to estimate a normalized FLH_h for Kansas City, MO, using an HDD of 5154.5.

Equation I-22. Normalized Full Load hours - Heating

$$y = mx + b$$

Where:

Y	Normalized Full Load Hours – Heating
m	0.3605 FLH_h
b	482.9 FLH_h
x	HDD for city or region of interest.

Table I-1 below shows a comparison of the FLH_h presented in the IL TRM, Normalized FLH_h based on Equation I-22, and Energy Star estimates for heating hours. Also shown in Table I-1, the evaluation team reviewed Energy Star estimates for the cities presented in the IL TRM in addition to Kansas City and found that the normalized values used in the PY2017 evaluation and in subsequent program years were conservative when compared to the values used by Energy Star.

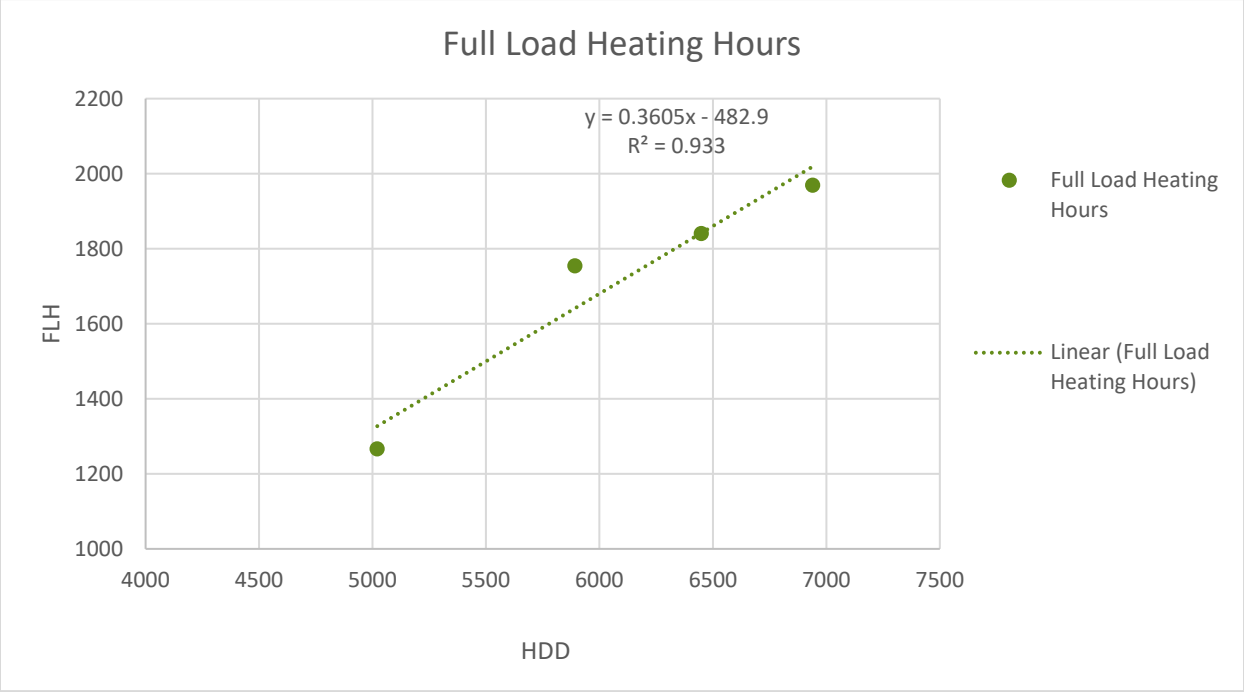
Table I-1. Full Load Hour Comparison - Heating

City	Full Load Heating Hours (IL TRM)	Normalized EFLH Heating Hours, per HDD 65	Energy Star Heating Hours	HDD 65
Rockford, IL	1,969	2,019.69	2,418	6,939.5
Chicago, IL	1,840	1,843.04	2,459	6,449.5
Springfield, IL	1,754	1,642.07	2,154	5,892
Belleville, IL / St. Louis, MO	1,266	1,328.07	2,009	5,021
Kansas City, MO		**1,376.20**	**2,149**	**5,154.5**

Source: Guidehouse Analysis

Inputting an HDD value for Kansas City, MO of 5,154.5 yields a normalized FLH_h of 1,376.20. Figure I-1 shows the FLH_h for each of the four cities presented in the IL TRM plotted against their corresponding HDD. Additionally, the linear equation for heating hours is presented with its corresponding R-Squared value.

Figure I-1. FLH Versus HDD



Source: Guidehouse Analysis

In conclusion, in the absence of primary field collected data, the PY2017 FLH_h is tailored to the local Evergy markets while also providing a more conservative estimate when compared to the Energy Star estimates.

Heat Pumps - Air Source, Ductless Mini-Split, and Ground Source

The heat pumps are split into 7 specific measures:

- Heat Pump, Air Source, Time of Sale
- Heat Pump, Air Source, Early Replacement
- Heat Pump, Air Source, Replace Electric Resistance Heat
- Heat Pump, Ductless Mini-Split
- Heat Pump, Ground Source, Time of Sale
- Heat Pump, Ground Source, Early Replacement
- Heat Pump, Ground Source, Replace Electric Resistance Heat

The savings algorithms and inputs are detailed below.

Heat Pumps, Air Source and Ductless Mini-Split Energy Savings

Equation I-23. Heat Pumps, Air Source and Ductless Mini-Split Energy Savings

$$\Delta kWh = \left(\frac{EFLH_{cool} \times CAP_{cool} \times \left(\frac{1}{(SEER_{base} \times (1 - DeratingCool_{base})} - \frac{1}{SEER_{ee} \times SEERadj \times (1 - DeratingCool_{eff})} \right)}{1{,}000} \right) + \left(\frac{EFLH_{heat} \times CAP_{heat} \times \left(\frac{1}{HSPF_{base} \times (1 - DeratingHeat_{base})} - \frac{1}{HSPF_{ee} \times HSPFadj \times (1 - DeratingHeat_{eff})} \right)}{1{,}000} \right)$$

Where:

$EFLH_{cool}$	Effective full load cooling hours = 738 based on MO TRM
CAP_{cool}	Cooling capacity from program tracking data
$SEER_{base}$	Baseline SEER from the IL TRM v7. The Early Retirement baseline SEER is 9.3, and the time-of-sale seer is 13. For measures that replace failed electric resistance heat, the cooling baseline efficiencies will use the early retirement values, since cooling was not the impetus for replacement. Ductless mini split units are confirmed by the implementer to be almost exclusively time-of-sale, and will be evaluated as such.
$SEER_{ee}$	Installed SEER from program tracking data when available, or the average SEER of the installed units when not available for a specific project.
$EFLH_{heat}$	Effective full load heating hours = 1,376. Based on normalizing Kansas City's ENERGY STAR heating hours to correlate with the IL TRM v7 effective full load heating hours using heating degree days.
CAP_{heat}	Heating capacity from program tracking data
$HSPF_{base}$	Baseline heating system performance factor (HSPF) from the IL TRM v7. The Early Retirement baseline HSPF is 5.54, and the time-of-sale value is 8.2.
$HSPF_{ee}$	Installed HSPF from program tracking data when available, or the average HSPF of the installed units.
$DeratingCool_{base}$	Baseline Heat Pump Cooling derating = 10%
$DeratingCool_{eff}$	Efficient Heat Pump Cooling derating = 10% (no quality installation)
SEERadj	Adjustment percentage to account for in-situ performance of the unit = 0.805 X (EER_{ee} / $SEER_{ee}$) + 0.367
$DeratingHeat_{base}$	Baseline Heat Pump Cooling derating = 10%
$DeratingHeat_{eff}$	Efficient Heat Pump Cooling derating = 10% (no quality installation)
HSPFadj	Adjustment percentage to account for in-situ performance of the unit, dictated based on a ratio of effective heating capacity at 17F versus effective heating capacity at 47F. In lieu of measured data, HSPFadj is assumed to = 1.001 as in the TRM example.

Heat Pumps, Air Source and Ductless Mini Split Coincident Demand Savings

Equation I-24. Heat Pumps, Air Source and Ductless Mini Split Coincident Demand Savings

$$\Delta kW = \left(\frac{CAP_{cool} \times \left(\frac{1}{EER_{base} \times (1 - DeratingCool_{base})} - \frac{1}{EER_{ee} \times (1 - DeratingCool_{eff})} \right)}{1{,}000} \right) \times CF$$

Where:

$EFLH_{cool}$	Effective full load cooling hours = 738 based on MO TRM
CAP_{cool}	Same as above
EER_{base}	Baseline EER from the IL TRM v7. The Early Retirement baseline EER is 7.5, and the time-of-sale value is an average of the 2019 program tracking data. For measures that replace failed electric resistance heat, the cooling baseline efficiencies will use the early retirement values, since cooling was not the impetus for replacement. Ductless mini split units are confirmed by the implementer to be almost exclusively time-of-sale, and will be evaluated as such.
EER_{ee}	Installed EER from program tracking data when available, or the average EER of the installed units.
$DeratingCool_{base}$	Same as above
$DeratingCool_{eff}$	Same as above
CF	Summer peak coincidence factor = 72%

Heat Pumps, Ground Source Energy Savings

Equation I-25. Heat Pumps, Ground Source, Time of Sale Energy Savings

$$\Delta kWh = [(EFLHcool * CAP_{cool} * (1/SEER_{base} – (1/EER_{PL})/1000] + [Elec_{heat} * EFLH_{heat} * CAP_{heat} * (1/HSPF_{base} – (1/COP_{PL} * 3.412)))/1000] + [Elec_{DHW} * DHW_{Displaced} * (((1/EF_{ELEC}) * GPD * Household * 365.25 * \gamma_{Water} * (T_{OUT} – T_{IN}) * 1.0) / 3412)]$$

Equation I-26. Heat Pumps, Ground Source, Early Replacement Energy Savings

$$\Delta kWh = [(EFLHcool * CAP_{cool} * (1/SEER_{exist} – (1/EER_{PL})/1000] + [Elec_{heat} * EFLH_{heat} * CAP_{heat} * (1/HSPF_{exist}) – (1/COP_{PL} * 3.412)))/1000] + [Elec_{DHW} \ \%DHWDisplaced * (((1/ EF_{ELEC}) * GPD * Household * 365.25 * \gamma_{Water} * (T_{OUT} – T_{IN}) * 1.0) / 3412)]$$

Where:

$EFLH_{cool}$	Effective full load cooling hours = 738 based on MO TRM
CAP_{cool}	Cooling capacity from program tracking data
$SEER_{base}$ / $SEER_{exist}$	10 for early retirement GSHP, 14 for time-of-sale GSHP, otherwise 9.3 for early retirement AC/ASHP units and 143 for time-of-sale AC/ASHP units, as per the IL TRM v7
$SEER_{exist}$	SEER for removed units = 9.3
$SEER_{ee}$	Installed SEER from program tracking data when available, or the average SEER of the installed units when not available for a specific project
$Elec_{heat}$	Heating factor = 1 if existing building is electrically heated, = 0 if existing building is not electrically heated
EER_{PL}	Part Load EER Efficiency of efficient GSHP unit

$EFLH_{heat}$	Effective full load heating hours = 1,376. Based on normalizing Kansas City's ENERGY STAR heating hours to correlate with the IL TRM v7 effective full load heating hours using heating degree days.
CAP_{heat}	Heating capacity from program tracking data
$HSPF_{base}$ / $HSPF_{exist}$	Federal baseline HSPF = 3.41 for early retirement of electric resistance heating systems, 5.54 for other early retirement, and 8.2 for time-of-sale
$HSPF_{exist}$	Baseline heating system performance factor (HSPF) from the IL TRM v7. The Early Retirement baseline HSPF = 3.41 for early retirement of electric resistance heating systems, 5.54 for other early retirement.
$HSPF_{ee}$	Installed HSPF from program tracking data when available, or the average HSPF of the installed units.
COP_{PL}	Part Load Coefficient of Performance of efficient unit = 4.5
$Elec_{DHW}$	Water heating factor = 1 if existing DHW is electrically heated, = 0 if existing DHW is not electrically heated
$DHW_{displaced}$	Percentage of total DHW load that the GSHP will provide = 44%
EF_{Elec}	Efficiency factor of electric water heater, Federal Standard 430.32, assumes 100gal storage = 2.0071
GPD	Gallons of hot water use per day = 17.6
Household	Average number of people per household = 2.56
γ_{Water}	Specific weight of water = 8.33
T_{out}	Tank temperature = 125
T_{in}	Incoming water temperature = 54

Heat Pumps, Ground Source Coincident Demand Savings

Equation I-27. Heat Pumps, Ground Source, Time of Sale Coincident Demand Savings

$$\Delta kW = (CAP_{cool} * (1/EER_{base} - 1/EER_{FL}))/1000) * CF$$

Equation I-28. Heat Pumps, Ground Source, Early Replacement Coincident Demand Savings

$$\Delta kW = (CAP_{cool} * (1/EER_{exist} - 1/EER_{FL}))/1000) * CF$$

Where:

Cap_{cool}	Same as above
EER_{exist}	Energy efficiency ratio of existing unit = 7.5 as per v7 IL TRM
EER_{base}	Energy efficiency ratio of the equivalent federal standard unit = 11.8 for time-of-sale or 11 for time-of-sale replacing electric resistance. EERbase / EER_{exist} 11 for early retirement GSHP, 11.8 for time-of-sale GSHP, otherwise 7.5 for early retirement AC/ASHP units and 11 for time-of-sale AC/ASHP units, as per the IL TRM v7
EER_{fl}	In the absence of program tracking data, assume COP * 3.412 = 4.5 * 3.412 = 15.35
CF	Coincidence factor = 72%

Efficient ECM Fan Energy Savings

These algorithms were sourced from IL TRM v5 since v7 algorithms require equipment size, which is not tracked by the program. Note that this measure will not be offered in MEEIA 3 since ECM fans will be required by code at that time.

Equation I-29. Efficient ECM Fan Energy Savings

ΔkWh = Heating Savings + Cooling Savings + Shoulder Season Savings

Where:

Heating Savings	Blower motor savings during the heating season = 418
Cooling Savings	Blower motor savings during the cooling season = 263 for central AC, 175 if no central AC, 241 if cooling system unknown
Shoulder Season Savings	ECM furnace fan savings during shoulder seasons = 51

Efficient ECM Fan Coincident Demand Savings

Equation I-30. Efficient ECM Fan Coincident Demand Savings

$$\Delta kW = \frac{\text{Cooling Savings}}{EFLH_{cool}} \times CF$$

Where:

Cooling Savings	Same as above
$EFLH_{cool}$	Effective full load cooling hours = 738 based on MO TRM
CF	Summer peak coincidence factor = 68%

Central Air Conditioner and Air-Source Heat Pump Tune-up Energy Savings

For Central Air Conditioners:

Equation I-31. Central Air Conditioner Tune-up Energy Savings

$$\Delta kWh = FLH_{cool} \times Capacity_{cool} \left(\frac{1}{SEER_{AC}}\right) / 1000 \times MFe$$

For Air-Source Heat Pumps:

Equation I-32. Air-Source Heat Pump Tune-up Energy Savings

$$\Delta kWh = FLH_{cool} \times Capacity_{cool} \left(\frac{1}{SEER_{ASHP}}\right) / 1000 \times MFe + FLH_{heat} \times Capacity_{heat} \left(\frac{1}{HSPF_{ASHP}}\right) / 1000 \times MFe$$

Where:

FLH_{cool}	Full Load Cooling Hours = 738, per MO TRM
FLH_{heat}	Full Load Heating Hours = 1376, per Guidehouse analysis
$Capacity_{cool,heat}$	Cooling or heating capacity of the air conditioner or heat pump unit, per program tracking data
$SEER_{ASHP,AC}$	Assumed cooling SEER of the heat pump or air conditioner = 10
MF_e	Maintenance energy savings factor = 0.05

Central Air Conditioner and Air-Source Heat Pump Tune-up Coincident Demand Savings

For Central Air Conditioners and Air-Source Heat Pumps:

Equation I-33. Central Air Conditioner and Air-Source Heat Pump Tune-up Coincident Demand Savings

$$\Delta kWh = Capacity_{cool}\left(\frac{1}{EER}\right)/1000 \times MFd \times CF$$

Where:

$Capacity_{cool}$	Same as above
EER	Assumed cooling EER of the heat pump or air conditioner = -0.02*SEER^2 + 1.12*SEER
MF_d	Maintenance energy savings factor = 0.02
CF	Coincidence Factor = 68% for air conditioners or 72% for heat pumps

Central Air Conditioner and Air-Source Heat Pump Coil Cleaning or Refrigerant Charge Correction Energy Savings

This algorithm was sourced from the 2017 WI TRM since the measure is not included in IL TRM v7.

Equation I-34. Central Air Conditioner and Air-Source Heat Pump Coil Cleaning or Refrigerant Charge Correction Energy Savings

$$\Delta kWh = (EFLH_{cool} \times Capacity_{cool}/1000) \times \left(\frac{1}{(SEER \times CCFRCF)} - \frac{1}{SEER}\right)$$

Where:

$EFLH_{cool}$	Equivalent full-load cooling hours = 738 per MO TRM
$Capacity_{cool}$	Cooling capacity of air conditioner or heat pump = average tracking data from AC and HP measures in PY2019
SEER	Assumed air conditioner or heat pump efficiency = 10, in lieu of available tracking data
CCFRCF	Coil Cleaning Factor or Refrigerant Charge Factor = 93.2% for coil cleaning and 98.3% for refrigerant charge correction, per 2017 WI TRM

Central Air Conditioner and Air-Source Heat Pump Coil Cleaning or Refrigerant Charge Correction Coincident Demand Savings

This algorithm was sourced from the 2017 WI TRM since the measure is not included in IL TRM v7.

Equation I-35. Central Air Conditioner and Air-Source Heat Pump Coil Cleaning or Refrigerant Charge Correction Coincident Demand Savings

$$\Delta kW = CF \times Capacity_{cool}/1000) \times \left(\frac{1}{(EER \times CCFRCF)} - \frac{1}{EER}\right)$$

Where:

CF	Coincidence factor = 90% per 2017 WI TRM
$Capacity_{cool}$	Cooling capacity of air conditioner or heat pump = average tracking data from AC and HP measures in PY2019

EER	Assumed air conditioner or heat pump efficiency = 9.2, in lieu of available tracking data
CCFRCF	Coil Cleaning Factor or Refrigerant Charge Factor = 93.2% for coil cleaning and 98.3% for refrigerant charge correction, per 2017 WI TRM

I.1.3 Net-to-Gross

See Section B.2 for a detailed discussion of the evaluation team's NTG methodology.

I.2 Process Evaluation

Guidehouse carried out interviews with the WHE product manager and the implementation team to address the five Missouri-required questions for process evaluation listed in Table I-2.

Table I-2. MO Process Research Questions

Research Questions	Evaluation Activity
Missouri-Required Questions for Process Evaluation	
1. What are the primary market imperfections that are common to the target market segment?	• Interviews with product manager and implementation staff
2. Is the target market segment appropriately defined, or should it be further subdivided or merged with other market segments?	• Interviews with product manager and implementation staff
3. Does the mix of end-use measures included in the program appropriately reflect the diversity of end-use energy service needs and existing end-use technologies within the target market segment?	• Interviews with product manager and implementation staff
4. Are the communication channels and delivery mechanisms appropriate for the target market segment?	• Interviews with product manager and implementation staff
5. What can be done to more effectively overcome the identified market imperfections and to increase the rate of customer acceptance and implementation of each end-use measure included in the program?	• Interviews with product manager and implementation staff

Source: Guidehouse

I.2.1 Program Staff Interviews

Guidehouse conducted in-depth interviews with the program management team over the course of several phone conversations to better understand the program design, goals and targets, recent and upcoming changes to program design, and challenges faced by the implementation team. These interviews informed the process evaluation.

APPENDIX J. INCOME-ELIGIBLE MULTIFAMILY PROGRAM-SPECIFIC METHODOLOGIES

The Income-Eligible Multifamily (IEMF) program delivers long-term energy savings and bill reductions to residents in multifamily housing that meets the income requirements as well as multifamily housing buildings with income-eligible residents. The program was separated into two tracks in PY2019: one consisting of direct install efficiency kit measures and the other consisting of custom measures. This section outlines Guidehouse's methodology for evaluating the savings and processes associated with this program.

This evaluation of the IEMF program consisted of the following activities:

- Gross impact evaluation (detailed in Section J.1)
- Process evaluation (detailed in Section J.2)
- Cost-effectiveness (detailed in Section B.1)

J.1 Impact Evaluation

To estimate gross savings for the IEMF program, the evaluation team conducted the following activities during PY2019 to answer the impact evaluation questions:

- Tracking database review
- Measure-level review

J.1.1 Tracking Database Review

The evaluation team completed a thorough tracking database review to determine if it included the key items needed for measure-level evaluation. Such items included the following:

- Measure descriptions
- Reported measure savings (kW and kWh)

J.1.2 Measure-Level Review

The evaluation team used site-level data and industry standard algorithms to calculate the verified savings for the program measures. The team referenced the IL TRM v7 to obtain these values. The team then compared these calculations against the kilowatt (kW) and kilowatt-hour (kWh) savings reported by the IEMF program. As a result of the review, the evaluation team offered mitigation options for any cases where discrepancies between the savings goals, reported values, and evaluated values arose or where insufficient data gathering occurred.

The algorithms for each measure evaluated in this analysis are detailed in the following sections.

J.1.2.1 Tier 1: Apartment Measures

Low-Flow Faucet Aerator Energy Savings

Equation J-1. Low-Flow Faucet Aerator Energy Savings

$$\Delta kWh = \%ElectricDHW * \left((GPM_{base} * L_{base} - GPM_{low} * L_{low}) \times Household * 365.25 * \frac{DF}{FPH} \right) * EPG_{electric} * ISR$$

Where:

%ElectricDHW	Proportion of water heating supplied by electric resistance heating
GPM_{base}	Baseline Gallons per minute = 1.53 bathroom, 1.63 kitchen
GPM_{ee}	Efficient Gallons per minute = 1.5 kitchen, 1.0 bathroom
L	Minutes per day = 4.5 kitchen, 1.6 bathroom
Household	Persons per household = 2.1
FPH	Faucets per household = 1 per kitchen, 1.5 for bathrooms
DF	Drain factor = 75% kitchen, 90% bathroom
$EPG_{electric}$	Energy per gallon of hot water supplied by electricity = 0.0969 kWh/gal kitchen, 0.0795 kWh/gal bathroom
ISR	In-service rate = 95% bathroom, 91% kitchen

Low-Flow Faucet Aerator Coincident Demand Savings

Equation J-2. Low-Flow Faucet Aerator Coincident Demand Savings

$$\Delta kW = \frac{\left[\%ElectricDHW * \left((GPM_{base} * L_{base} - GPM_{low} * L_{low}) \times Household * 365.25 * \frac{DF}{FPH} \right) * EPG_{electric} * ISR \right]}{Hours} * CF$$

Where:

%ElectricDHW	Same as above
GPM	Same as above
L	Same as above
Household	Same as above
FPH	Same as above
DF	Same as above
$EPG_{electric}$	Same as above
ISR	Same as above
Hours	Annual electric DHW recovery hours for faucet use per faucet = 84 for kitchen; 22 for bath
CF	Coincidence factor = 0.022

Low-Flow Showerhead Energy Savings

Equation J-3. Low-Flow Showerhead Energy Savings

$$\Delta kWh = \%ElectricDHW * \left((GPM_{base} * L_{base} - GPM_{low} * L_{low}) \times Household * SPCD * 365.25/SPH\right) * EPG_{electric} * ISR$$

Where:

%ElectricDHW	Proportion of water heating supplied by electric resistance heating
GPM	Gallons per minute = actual for energy efficient, 2.24 base, 1.5 for efficient
L	Minutes per day = 7.8 energy efficient, 7.8 base
Household	Same as above
SCPD	Showers per capita per day = 0.6
SPH	Showers per household = 1.3
$EPG_{electric}$	Energy per gallon of hot water supplied by electricity = 0.117 kWh/gal
ISR	In-service rate = 95%

Low-Flow Showerhead Coincident Demand Savings

Equation J-4. Low-Flow Showerhead Coincident Demand Savings

$$\Delta kW = \frac{\left[\left(\%ElectricDHW * \left((GPM_{base} * L_{base} - GPM_{ee} * L_{ee}) \times Household * SPCD * \frac{365.25}{SPH}\right) * EPG_{electric} * ISR\right)\right]}{Hours} * CF$$

Where:

%ElectricDHW	Same as above
GPM	Same as above
L	Same as above
Household	Same as above
SCPD	Same as above
SPH	Same as above
$EPG_{electric}$	Same as above
ISR	Same as above
Hours	Annual electric DHW recovery hours for showerhead use, 208 for MF Direct Install
CF	Coincidence factor = 0.0278

Advanced Power Strip Energy Savings

Equation J-5. Advanced Power Strip Energy Savings

$$\Delta kWh_{7\text{-}plug} = 103$$

Where:

ΔkWh	Deemed energy savings: 103 kWh for 7-plug strip

Advanced Power Strip Coincident Demand Savings

Equation J-6. Advanced Power Strip Coincident Demand Savings

$$\Delta kW_{7\text{-}plug} = 0.0116$$

Where:

ΔkW	Deemed coincident demand savings: 0.0116 kW for 7-plug strip

LEDs Energy Savings

Equation J-7. LEDs Energy Savings

$$\Delta kWh = \frac{(W_{base} - W_{ee})}{1{,}000} * ISR * Hours * WHF_e$$

Where:

W_{base}	Wattage of baseline bulb (43W for 9W LED, 50 W for 5W Candelabra, 40W for 6W Globe, 50W for 8W BR30)
W_{ee}	Wattage of efficient bulb (9W, 5W Candelabra, 6W Globe, and 8W BR30)
ISR	In-service rate = 96.9%
Hours	1,089 for 9W and 763 for Candelabra, Globe, and BR30
WHF_e	Waste heat factor to account for cooling savings from efficient lighting = 1.04

LEDs Coincident Demand Savings

Equation J-8. LEDs Coincident Demand Savings

$$\Delta kW = \frac{(W_{base} - W_{ee})}{1{,}000} * ISR * WHF_d * \mathbf{CF}$$

Where:

W_{base}	Same as above
W_{ee}	Same as above
ISR	Same as above
Hours	Same as above
WHF_d	Waste heat factor to account for cooling savings from efficient lighting = 1.07
CF	Coincidence factor = 0.128 for 9W bulbs, 0.109 for Candelabra, Globe, and BR 30 (assumed “Interior”)

J.1.2.2 Common Area Measures

Lighting Energy Savings

Equation J-9. LEDs Energy Savings

$$\Delta kWh = \frac{(W_{base}\text{-}W_{ee})}{1{,}000} * ISR * Hours * WHF_e$$

Where:

W_{base}	Same as above
W_{ee}	Same as above
ISR	In-service rate = 96.9%
Hours	1,159 Unknown
WHF_e	Waste heat factor to account for cooling savings from efficient lighting = 1.051 Multifamily Unknown Area

Lighting Coincident Demand Savings

Equation J-10. LEDs Coincident Demand Savings

$$\Delta kW = \frac{(W_{base}\text{-}W_{ee})}{1{,}000} * ISR * WHF_d * \mathbf{CF}$$

Where:

W_{base}	Same as above
W_{ee}	Same as above
ISR	Same as above
Hours	Same as above
WHF_e	Waste heat factor to account for cooling savings from efficient lighting = 1.093 Multifamily Unknown Area
CF	Coincidence factor = 0.128 interior

HVAC Tune-Up (Central Air Conditioning)

Equation J-11. HVAC Tune-up Energy Savings

$$\Delta kWh = FLHcool * Capacity\text{-}cooling * \frac{(1/SEER_{CAC})}{1{,}000} * MF_e$$

Where:

FLHcool	Full load cooling hours = 738, per MO TRM
Capacity-cooling	Cooling capacity of equipment in Btu/hr, per tracking data
$SEER_{CAC}$	SEER efficiency of existing central air conditioner = Actual, or 10
MF_e	Maintenance energy savings factor = 0.05

HVAC Tune-Up (Central Air Conditioning)

Equation J-12. HVAC Tune-Up Coincident Demand Savings

$$\Delta kW = \text{Capacity-cooling} * \frac{(1/EER)}{1{,}000} * MF_d * CF$$

Where:

Capacity-cooling	Same as above
EER_{CAC}	EER Efficiency of existing unit = -0.02 * $SEER^2$ + 1.12 * SEER
MF_d	Maintenance demand savings factor = 0.02
CF	Coincidence factor = 0.68

J.1.2.3 Custom Measures

Variable values for the custom measures are unique to each project and are provided in the program tracking data and the IL TRM v7.

Refrigerator Energy Savings

Equation J-13. Refrigerator Energy Savings

$$\Delta kWh = kWh_{base} - kWh_{ESTAR}$$

Where:

kWh_{base}	Baseline kWh consumption per year, per tracking data
kWh_{ESTAR}	ENERGY STAR kWh consumption per year, per tracking data

Refrigerator Coincident Demand Savings

Equation J-14. Refrigerator Coincident Demand Savings

$$\Delta kW = \Delta kWh / 8766 * TAF * LSAF$$

Where:

ΔkWh	Calculated above
TAF	Temperature Adjustment Factor = 1.25
LSAF	Load Shape Adjustment Factor 1.057

Ductless Heat Pump Mini-Split Energy Savings

Equation J-15. Ductless Heat Pump Mini-Split Energy Savings

$$\Delta kWh = ((Elecheat * Capheat + EFLHheat * (1/HSPFexist - 1/HSPFee)) / 1000) + ((Capcool * EFLHcool * (1/SEERexist - 1/SEERee))/1000)$$

Where:

Elecheat	If building is electrically heated = 1, otherwise = 0
Capheat	Heating capacity of the ductless heat pump in Btu/hr
EFLHheat	Equivalent full load heating hours
HSPFexist	Heating system performance factor of existing heating system
HSPFee	Heating system performance factor of efficient heating system
Capcool	Cooling capacity of ductless heat pump in Btu/hr
SEERexist	SEER efficiency of existing unit
SEERee	SEER rating of efficient equipment

Ductless Heat Pump Mini-Split Coincident Demand Savings

Equation J-16. Ductless Heat Pump Mini-Split Coincident Demand Savings

$$\Delta kW = (Capcool * (1/EERexist - 1/EERee))/1000) * CF$$

Where:

Capcool	Same as above
EERexist	Energy efficiency ratio of existing cooling system = 11
EERee	Energy efficiency ratio of new ductless heat pump mini-split
CF	Coincidence Factor = 0.72

Air Source Heat Pump Energy Savings

Equation J-17. Heat Pumps, Air Source and Ductless Mini-Split Energy Savings

$$\Delta kWh = \left(\frac{EFLH_{cool} \times CAP_{cool} \times \left(\frac{1}{(SEER_{exist} \times (1 - DeratingCool_{base})} - \frac{1}{SEER_{ee} \times SEERadj \times (1 - DeratingCool_{eff})}\right)}{1{,}000}\right) + \left(\frac{EFLH_{heat} \times CAP_{heat} \times \left(\frac{1}{HSPF_{exist} \times (1 - DeratingHeat_{base})} - \frac{1}{HSPF_{ee} \times HSPFadj \times (1 - DeratingHeat_{eff})}\right)}{1{,}000}\right)$$

Where:

$EFLH_{cool}$	Effective full load cooling hours = 738, Kansas City
CAP_{cool}	Cooling capacity from program tracking data
$SEER_{exist}$	SEER of existing unit, per tracking data

$SEER_{ee}$	SEER of efficient unit, per tracking data
$EFLH_{heat}$	Effective full load heating hours = 1,376, Kansas City
CAP_{heat}	Heating capacity, per tracking data
$HSPF_{exist}$	Heating system performance factor of existing unit, per tracking data
$HSPF_{ee}$	Heating system performance factor or efficient unit, per tracking data
$DeratingCool_{base}$	Baseline Heat Pump Cooling derating = 0%
$DeratingCool_{eff}$	Efficient Heat Pump Cooling derating = 0%
SEERadj	Adjustment percentage to account for in-situ performance of the unit = 0.805 X (EER_{ee} / $SEER_{ee}$) + 0.367
$DeratingHeat_{base}$	Baseline Heat Pump Cooling derating = 0%
$DeratingHeat_{eff}$	Efficient Heat Pump Cooling derating = 0%
HSPFadj	Heating System Performance Factor Adjustment = 1

Air Source Heat Pump Coincident Demand Savings

Equation J-18. Heat Pumps, Air Source and Ductless Mini Split Coincident Demand Savings

$$\Delta kW = \left(\frac{CAP_{cool} \times \left(\frac{1}{EER_{exist} \times (1 - DeratingCool_{base})} - \frac{1}{EER_{ee} \times (1 - DeratingCool_{eff})} \right)}{1{,}000} \right) \times CF$$

Where:

$EFLH_{cool}$	Effective full load cooling hours = 738, Kansas City
CAP_{cool}	Same as above
EER_{exist}	EER of existing unit = 7.5
EER_{ee}	EER or the efficient unit = 12.5
$DeratingCool_{base}$	Same as above
$DeratingCool_{eff}$	Same as above
CF	Summer peak coincidence factor = 67%, multifamily

Lighting Energy Savings

Equation J-19. LEDs Energy Savings

$$\Delta kWh = \frac{(W_{base} - W_{ee})}{1{,}000} * ISR * Hours * WHF_e$$

Where:

W_{base}	Wattage of existing system, per tracking data
W_{ee}	Wattage of efficient system, per tracking data
ISR	In-service rate = 0.98
Hours	Annual operating hours, per tracking data
WHF_e	Waste heat factor to account for cooling savings from efficient lighting = 1.24

Lighting Coincident Demand Savings

Equation J-20. LEDs Coincident Demand Savings

$$\Delta kW = \frac{(W_{base} - W_{ee})}{1{,}000} * ISR * WHF_d * \mathbf{CF}$$

Where:

W_{base}	Same as above
W_{ee}	Same as above
ISR	Same as above
Hours	Same as above
WHF_e	Waste heat factor to account for cooling savings from efficient lighting = 1.55
CF	Coincidence factor = 0.82

J.2 Process Evaluation

Guidehouse addressed the five Missouri-required questions for process evaluation through staff interviews and a program materials review.

Table J-1. Process Evaluation Research Questions and Approaches

Process Evaluation Research Question	Evaluation Activity
Missouri-Required Questions for Process Evaluation	
1. What are the primary market imperfections that are common to the target market segment?	• Program staff interviews • Materials review
2. Is the target market segment appropriately defined, or should it be further subdivided or merged with other market segments?	• Program staff interviews • Materials review
3. Does the mix of end-use measures included in the program appropriately reflect the diversity of end-use energy service needs and existing end-use technologies within the target market segment?	• Program staff interviews • Materials review
4. Are the communication channels and delivery mechanisms appropriate for the target market segment?	• Program staff interviews • Materials review
5. What can be done to more effectively overcome the identified market imperfections and to increase the rate of customer acceptance and implementation of each end-use measure included in the program?	• Program staff interviews • Materials review

Source: Guidehouse

displays the evaluation team's activities conducted to address these questions.

Table J-1. Process Evaluation Research Questions and Approaches

Process Evaluation Research Question	Evaluation Activity
Missouri-Required Questions for Process Evaluation	
6. What are the primary market imperfections that are common to the target market segment?	• Program staff interviews • Materials review
7. Is the target market segment appropriately defined, or should it be further subdivided or merged with other market segments?	• Program staff interviews • Materials review
8. Does the mix of end-use measures included in the program appropriately reflect the diversity of end-use energy service needs and existing end-use technologies within the target market segment?	• Program staff interviews • Materials review
9. Are the communication channels and delivery mechanisms appropriate for the target market segment?	• Program staff interviews • Materials review
10. What can be done to more effectively overcome the identified market imperfections and to increase the rate of customer acceptance and implementation of each end-use measure included in the program?	• Program staff interviews • Materials review

Source: Guidehouse

J.2.1 Program Staff Interviews

The team performed an in-depth interview with Evergy program staff and a separate interview with ICF International, the program implementer. These interviews addressed the following topics:

- Roles and responsibilities of program and implementation staffs
- Program goals and objectives, including progress on recommendations made in previous evaluations
- Program budget, including non-program incentives and any budget changes
- Program implementation, including marketing, products supported, installation mechanisms (Direct Install versus Custom), and issues encountered in the program year

J.2.2 Materials Review

Guidehouse reviewed materials provided by Evergy, including brochures linked to the program, and the materials available for review on the Evergy website. Since the primary marketing for this program is direct contact with property owners and managers, this was the most relevant information.

APPENDIX K. HOME LIGHTING REBATE PROGRAM-SPECIFIC METHODOLOGIES

The Evergy Home Lighting Rebate (HLR) program provides upstream incentives to partnering manufacturers and retailers in the Evergy Missouri West and Evergy Metro service territories. The program started in April 2016 and continued to operate into until December 2019, the period covered in this annual report. In PY2019, the HLR program supported standard (A-line) LEDs and specialty LEDs (reflectors, floods, candelabras, and globe lamps, among others) in all retail channels for the entire program year. The program also sold standard and specialty LEDs through an on-line pop-up store in November and December 2019.

Based on Missouri regulations (see Appendix C), the Guidehouse team used impact evaluation method 2b to evaluate the HLR program in PY2019 and incorporated results produced in PY2016, PY2017, and PY2018 using impact evaluation method 1a (modified for the upstream nature of the program). This program evaluation consisted of the following activities:

- Gross impact evaluation (detailed in Section K.1.1)
- Process evaluation (detailed in Section K.2)

K.1 Impact Evaluation

The Guidehouse team used the impact evaluation activities to determine if the reported energy and demand savings accurately characterized program impacts and what the gross savings were for the program.

K.1.1 Gross Impact Evaluation

To estimate the gross savings for the HLR program, the evaluation team conducted the following activities:

- Tracking database review
- Engineering desk review

K.1.1.1 Tracking Database Review

The evaluation team requested and obtained the program tracking data from the HLR program implementer ICF (the IC). The IC data also included summaries of sales, incentives, and reported savings for MEEIA Cycle II through PY2019.

The Guidehouse team reviewed the program tracking data to assess the following (some of which also informed the process evaluation):

- Ability to verify gross first year and lifetime savings by the inclusion of measure wattage and number of products sold
- Tracking of significant program changes, including a large sales push both in retail stores and a newly launched on-line store in November and December 2019
- Level of detail on the characteristics of products sold, especially the shape and features of bulbs, number of bulbs per package, pre-rebate price of package, rebate amount per package, and post-rebate price per package
- Dates of bulb sales and invoices

K.1.1.2 Engineering Desk Review

The evaluation team performed an engineering desk review of savings algorithms and deemed inputs to verify that the reported energy and demand savings accurately characterized program impacts. Next, the Guidehouse team calculated verified energy and demand savings based on the number and characteristics of LEDs sold through the program in the 2019 program year as described above in Section K.1.1.1.

For the engineering desk review, the Guidehouse team drew on primary evaluated results from research conducted in PY2016 through PY2018 within the Evergy service territories as well as information from the program tracking database. As in PY2018, when primary information was not available for Evergy, the Guidehouse team supplemented with inputs from the IL TRM V7.

The Guidehouse team reviewed the equations used by Evergy to estimate reported savings to make certain that they aligned with those the evaluation team used to estimate gross energy and demand savings for each LED sold through the program. The evaluation team used Equation K-1 and Equation K-2 to calculate gross energy and demand savings, respectively.

Equation K-1. Annual Residential Lighting Energy Savings

$$\Delta kWh = \frac{(Watts_{base} - Watts_{ee})}{1{,}000} \times Annual\ HOU \times ISR \times WHF_e$$

Equation K-2. Annual Residential Lighting Demand Savings

$$\Delta kW = \frac{(Watts_{base} - Watts_{ee})}{1{,}000} \times ISR \times WHF_d \times CF$$

Where,

$Watts_{base}$	Wattage of baseline bulb = 43 watts for standard LEDs and 54 watts for specialty LEDs (Source: IL TRM v7 guidance for assumed baseline wattages of equivalent lumen bulbs and Program Tracking Database)
$Watts_{LED}$	Wattage of program-supported LED = 9.7 watts for standard LEDs and 8.5 watts for specialty LEDs (Source: Program Tracking Database)
HOU	Annual hours of use = 1,089 for standard and 879 for specialty (Source: Source: IL TRM v7)

ISR	In-service rate = 94.2% (Source: Guidehouse research PY2016)
WHF	Waste heat factor = 1.06 for energy and 1.1 for demand (Source: IL TRM v7)
CF	Peak coincidence factor = 0.13 for standard and 0.12 for specialty (Source: IL TRM v7)

The Guidehouse team adjusted the residential savings downwards by 14% to account for leakage outside of the Evergy Missouri West and Evergy Metro service territories, as estimated in PY2017.

The evaluation team applied alternative values to the percentage of cross-sector sales – HLR bulbs installed in C&I settings. Guidehouse research conducted in PY2017 confirmed a 4% cross-sector sales rate. The Guidehouse team then recalculated Equation K-1 and Equation K-2 using the listed assumptions for the 4% of program sales likely installed in C&I settings. The alternative C&I values result from Guidehouse research on omnidirectional LEDs installed only in the retail, small business, and "other" C&I locations, so they differ from the assumptions for C&I lighting more generally. The greater hours of use and peak coincidence factors mean that HLR bulbs installed in C&I setting yield greater per bulb savings than in residential settings.

$Watts_{base}$	Wattage of baseline bulb = 43 watts for standard LEDs and 54 watts for specialty LEDs (Source: IL TRM v7 guidance for assumed baseline wattages of equivalent lumen bulbs and Program Tracking Database)
$Watts_{LED}$	Wattage of program-supported LED = 9.7 watts for standard LEDs and 8.5 watts for specialty LEDs (Source: Program Tracking Database)
HOU	Annual hours of use = 3306 (Source: Guidehouse research PY2016)
ISR	In-service rate = 94.2% (Source: Guidehouse research PY2016)
WHF	Waste heat factor = 1.23 for energy and 1.31 for demand (Source: Guidehouse research PY2016)
CF	Peak coincidence factor = 0.6 (Source: Guidehouse research PY2016)

The Guidehouse team then multiplied the per bulb savings for each bulb type (standard and specialty) and sector (residential and C&I) and summed the results to yield program-level energy and demand savings.

After computing energy and demand savings using these updated inputs, the evaluation team compared the reported savings and assumptions based on actual program sales and input values, calculating realization rates as verified savings divided by reported savings.

K.2 Process Evaluation

The evaluation team addressed two process research questions and the five Missouri-required questions for process evaluation in PY2019. Prior evaluations had addressed all the questions. Table K-1 displays the evaluation team's key process research questions and the evaluation activities conducted to address these questions in PY2016 through PY2019.

Table K-1. Process Evaluation Research Questions and Approaches

Process Evaluation Research Question	Evaluation Activity
General Process Evaluation Questions	
1. What is the status of the program's progress toward implementing the key process recommendations provided in the program's most recent EM&V report?	• Program staff interviews
2. What changes have been made to the program in PY2019 and what changes are planned for MEEIA Cycle 3?	• Program staff interviews
Missouri-Required Questions for Process Evaluation	
1. What are the primary market imperfections that are common to the target market segment?	• Program staff interviews • Materials review • Consumer surveys
2. Is the target market segment appropriately defined, or should it be further subdivided or merged with other market segments?	• Program staff interviews • Materials review • Consumer surveys • Onsite saturation visits
3. Does the mix of end-use measures included in the program appropriately reflect the diversity of end-use energy service needs and existing end-use technologies within the target market segment?	• Program staff interviews • Materials review • Supplier interviews • In-store intercept surveys
4. Are the communication channels and delivery mechanisms appropriate for the target market segment?	• Program staff interviews • Materials review
5. What can be done to more effectively overcome the identified market imperfections and to increase the rate of customer acceptance and implementation of each end-use measure included in the program?	• Program staff interviews • Materials review • Consumer surveys • Onsite saturation visits • In-store intercept surveys

Source: Guidehouse

K.2.1 Program Staff Interviews

The Guidehouse team performed an in-depth interview with Evergy program staff and a separate interview with ICF International, the program implementer. These interviews addressed the following topics:

- Program changes in PY2019
- Plans for MEEIA Cycle 3

APPENDIX L. HOME ENERGY REPORTS PROGRAM-SPECIFIC METHODOLOGIES

Through the Home Energy Reports (HER) program, Evergy distributes single-page print reports by mail to educate residential customers about their home energy usage and to provide them with information designed to encourage behavior change. Each report contains comparisons of the recipient's energy usage to that of similar homes in their area, historical trends in the recipient's energy usage, and energy-saving action steps. Customers with an email address on file also receive similar information via email. Evergy Missouri West sends reports to five waves of customers in the HER program. The HER waves started receiving reports in 2013, 2015, 2016, 2017, and 2019.

The evaluation plan included a full billing analysis in PY2016 and PY2018. The PY2017 and PY2019 impact evaluations consisted of a desk review of implementer-reported savings. Methodologies are explained in:

- Impact evaluation (detailed in Section L.1)
- Process evaluation (detailed in Section L.2)

L.1 Impact Evaluation

The HER program is a randomized control trial (RCT), wherein the treatment and control groups for each wave are randomly drawn from a single group of eligible customers, ensuring that the control group is equivalent to the treatment group. In this case, the treatment group receives home energy reports while the control group does not. For PY2019, the evaluation team collected the implementer's data for monthly energy usage and savings for each wave. With this data, the evaluation team examined trends in the data, checked for anomalies, compared data to prior years, and summed savings across months and waves to compare to the reported savings.

During the billing analysis in PY2018, the evaluation team measured energy use using monthly billing data from participants and controls. The PY2018 evaluation consisted of the following activities, which are detailed in the PY2018 evaluation report appendix and are summarized in this PY2019 evaluation report appendix for reference.

- **Data cleaning:** Identified customer data to be excluded from the analysis. Reasons for exclusion included an insufficient number of pre-period and program period months, insufficient billing days within a given month to determine a monthly average, or a treatment customer not having received a report.
- **Equivalency check:** Verified that the distribution of average monthly energy usage before receiving the HERs was sufficiently similar between the treatment and control groups, ensuring that estimates of energy savings were unbiased.
- **Pre-period program participation equivalency check:** Verified that the treatment and control groups had similar rates of participation in energy efficiency programs in the year prior to the start of the treatment.

- **Regression analysis:** Verified program impacts using two alternative statistical models: a post-period regression (PPR) analysis with lagged customer controls and a linear fixed-effects regression (LFER) analysis. Both were applied to monthly energy usage data obtained from customer bill records. For PY2019, the evaluation team collected the implementer's data for monthly energy usage and savings for each wave. With this data, the evaluation team examined trends in the data, checked for anomalies, compared data to prior years, and summed savings across months and waves to compare to the reported savings. Guidehouse also applied adjustments to the implementer-reported savings to account for double-counted savings by applying past double-counted savings to PY2019, adjusting for attrition.
- **Channeling analysis:** Estimated the uplift in other energy efficiency programs due to suggested actions on HERs through a post-only difference (POD) approach applied to program tracking data from other programs.
- **Demand reductions**: Monthly billing data did not have sufficient granularity to estimate demand impacts. Modeling demand impacts requires hourly or shorter-interval meter data. The implementer calculated coincident demand savings by taking energy savings from August and dividing it by the number of hours in August times a factor of 1.5. The evaluation team verified that the implementer applied this calculation correctly. The evaluation team also applied the same calculation to the evaluated savings from August.

L.2 Process Evaluation

Guidehouse addressed the five Missouri-required questions for process evaluation through staff interviews and a program materials review. Table L-1 displays the activities conducted to address these questions.

Table L-1. Process Evaluation Research Questions and Approaches

Process Evaluation Research Question	Evaluation Activity
Missouri-Required Questions for Process Evaluation	
1. What are the primary market imperfections that are common to the target market segment?	• Program staff interviews • Materials review
2. Is the target market segment appropriately defined, or should it be further subdivided or merged with other market segments?	• Program staff interviews • Materials review
3. Does the mix of end-use measures included in the program appropriately reflect the diversity of end-use energy service needs and existing end-use technologies within the target market segment?	• Program staff interviews • Materials review
4. Are the communication channels and delivery mechanisms appropriate for the target market segment?	• Program staff interviews • Materials review
5. What can be done to more effectively overcome the identified market imperfections and to increase the rate of customer acceptance and implementation of each end-use measure included in the program?	• Program staff interviews • Materials review

Source: Guidehouse

L.2.1 Program Staff Interviews

Guidehouse conducted in-depth interviews with the Evergy product lead to better understand the HER/IHER programs and the key considerations of the five Missouri questions, namely:

- Program's performance to date
- Any issues or challenges faced
- Potential opportunities for improvement
- Effectiveness of program communication

L.2.2 Materials Review

Guidehouse reviewed the following program planning and marketing materials to research the key considerations of the five Missouri questions:

- HER Report examples
- Samples of marketing modules included on the HERs in 2019
- Implementer's program design and report schedule documents
- Evergy Missouri West program description documents
- Implementation Contractor's Customer Engagement Tracker

APPENDIX M. HOME ONLINE ENERGY ANALYZER AND BUSINESS ONLINE ENERGY ANALYZER PROGRAM-SPECIFIC METHODOLOGIES

The Home Online Energy Analyzer (HOEA) and the Business Online Energy Analyzer (BOEA) are opt-in online tools that provide energy-saving tips and help customers track their energy usage. The tools encourage customers to take energy-saving actions in their homes and businesses through actions they can take on their own and by participating in other Evergy energy efficiency programs.

Evergy does not report energy savings for the Energy Analyzer tools. This evaluation program consisted of the following activities for PY2019:

- Process evaluation (detailed in Section M.1)

M.1 Process Evaluation

Guidehouse addressed the five Missouri-required questions for process evaluation through staff interviews and a program materials review.

Table M-1 displays the evaluation team's key process research questions and the evaluation activities conducted to address these questions.

Table M-1. Process Evaluation Research Questions and Approaches

Process Evaluation Research Question	Evaluation Activity
Missouri-Required Questions for Process Evaluation	
1. What are the primary market imperfections that are common to the target market segment?	• Program staff interviews • Materials review
2. Is the target market segment appropriately defined, or should it be further subdivided or merged with other market segments?	• Program staff interviews • Materials review
3. Does the mix of end-use measures included in the program appropriately reflect the diversity of end-use energy service needs and existing end-use technologies within the target market segment?	• Program staff interviews • Materials review
4. Are the communication channels and delivery mechanisms appropriate for the target market segment?	• Program staff interviews • Materials review
5. What can be done to more effectively overcome the identified market imperfections and to increase the rate of customer acceptance and implementation of each end-use measure included in the program?	• Program staff interviews • Materials review

Source: Guidehouse

M.1.1 Program Staff Interviews

Guidehouse conducted in-depth interviews with Evergy's product lead to better understand the HOEA/BOEA program and the key considerations of the five Missouri questions, namely:

- Program's performance to date
- Any issues or challenges faced
- Potential opportunities for improvement
- Effectiveness of program communication

M.1.2 Materials Review

Guidehouse reviewed the following program planning and marketing materials to research the key considerations of the five Missouri questions, namely:

- Screen shots of the online tools available to customers through HOEA and BOEA
- Data on customer logins and tips usage
- Modules used on HERs to promote HOEA
- Lists of tips used in HOEA and BOEA
- Evergy Missouri West program description documents
- Implementation Contractor's Customer Engagement Tracker

APPENDIX N. RESIDENTIAL AND BUSINESS THERMOSTAT PROGRAM-SPECIFIC METHODOLOGIES

The Residential and Business Programmable Thermostat (PT) programs employ the Nest 3rd generation thermostat as well as the Nest Thermostat E to achieve annual energy savings as well as demand curtailment during summer months. Evergy calls demand response (DR) events during peak demand periods by sending a signal to participating thermostats that causes them to run HVAC systems in reduced load mode for up to 4 hours. A subset of thermostat customers also participates in the Seasonal Savings (SS) program which offers customers an opportunity to make their cooling schedules more efficient. Guidehouse reviewed Nest's impact findings for SS customers and used these findings to identify potential SS impact.

Based on Missouri regulations (see Appendix C), Guidehouse used method 1b and protocol 2b to evaluate the Residential and Business PT programs. This program evaluation consisted of the following activities:

- Impact evaluation (detailed in Section N.1)
- Process evaluation (detailed in Section N.2)

In PY2019, Guidehouse used the impact findings from PY2017 to determine impacts for the population of thermostat participants in PY2019. In PY2017, the evaluation team also estimated program demand impacts for the Rush Hour Rewards Program and annual energy savings for the Nest thermostat through two separate billing analyses. The methodologies are described in full in the following section. In addition, the team calibrated the Nest energy savings analysis for SS to align with cooling system load assumptions in the Rush Hour Rewards impact analysis.

N.1 Impact Evaluation

The following section details the methodologies used to calculate Rush Hour Rewards DR impacts and annual thermostat savings for the thermostat programs in PY2017, and the methodologies for extrapolating those impacts to PY2019 thermostat participants.

N.1.1 Rush Hour Rewards

The Rush Hour Rewards (RHR) Program is a DR program designed to reduce demand during system peak hours. Participating customers were provided with a free programmable, two-way communicating Nest Thermostat which automatically reduces electric cooling load upon request during the curtailment events. Evergy called five events in the summer of 2019.

In PY2017, the evaluation team relied on thermostat run time data, supplied by Nest, to estimate the impacts of the RHR program. The thermostat run time data was converted to energy demand using an average cooling system maximum demand of 3.1 kW. After converting the thermostat runtime data to average kW demand during 15-minute intervals, a within-subject Linear Fixed Effects Regression (LFER) model was run to estimate the impacts during RHR events. The LFER model uses participating

customers' thermostat run times on similar non-event days to estimate the impact on energy demand. The LFER model specified energy demand as a function of temperature and other variables that influence usage in the regression equation.

Guidehouse conducted the following steps to calculate the per-device demand impacts of the Rush Hour Rewards program:

1. Collected and reviewed thermostat run time data, program tracking data, and event signal data.
    a. Ensured that tracking data were complete and consistently formatted.
    b. Verified completeness of thermostat run time data and removed devices that fall under the following conditions:
        i. Indoor air temperature was below cooling target by more than 3 degrees while cooling time was non-zero; i.e. system should not have been cooling but was.
        ii. Indoor air temperature is above cooling target by more than 2 degrees while cooling time is zero; i.e. system is not cooling but should be.
        iii. Device is associated with more than one structure.
        iv. Device where zip code is missing. Thermostat zip code is necessary for the analysis because it allows associated weather data to be linked to the device run time data.
        v. Device with a zip code not in the Evergy Metro or Evergy Missouri West service territory.
2. Created and calculated the following variables in the dataset:
    a. Created dummy variables for event periods and calendar-related effects (i.e., days of the week, month, etc.)
    b. Calculated variables for weather data (i.e., cooling degree hours, snapback counters, etc.).
    c. Converted the thermostat run time values to an estimate of kW demand based on utility specific assumed average AC unit capacity of 37,200 Btu/Hr and Energy Efficiency Ratio of 10.1[18].

    Equation N-1 presents the modeled relationship between AC runtime and electric demand

Equation N-1. RHR Program Run Time Conversion

$$kW = 0.07 + 0.84 * \frac{Runtime * \frac{Btu}{h}}{EER * 1000} - 0.001 * CDH70 + 0.0056 * CDH * \frac{Runtime * \frac{Btu}{h}}{EER * 1000}$$

[18] Guidehouse calculated AC unit capacity, for the runtime to power conversion, using program tracking data. The team took an average of all customers' system sizes. The customers with AC unit system sizes listed in the tracking data were a subset of direct install customers. Presumably this is because the direct install technicians were responsible for recording AC unit size information. The team used the age associated with these AC units to estimate EER of each unit. The assumption used was units manufactured 2007 and later used an EER 11.1 and units manufactured 2006 and before used an EER of 9. Ultimately, the team averaged the EER of all AC units to get the EER value for the runtime to power conversion calculation.

Where:

Runtime	Length of time that the AC unit is running
Btu/h	Assumed average of AC unit capacity in the utility territory
EER	Assumed Energy Efficiency Ratio
CDH70	Cooling degree hours

Equation N-2 presents the AC runtime and electric demand conversion equation.

Equation N-2. RHR Program Run Time Conversion[19]

$$kW = 0.07 + 0.84 * \frac{Runtime * 38,528}{6 * 1000} - 0.001 * CDH + 0.0056 * CDH * \frac{Runtime * 38,528}{6 * 1000}$$

3. Identified 4 non-event days during the same month of the events, July 2017, whose weather pattern most closely matched the weather pattern of the event days. These non-event days served as the counterfactual baseline.
4. Implemented two-way Linear Fixed Effects (FE) regression models to estimate impacts for each event while controlling for time and individual invariants. The general form of the equation for the regression model is shown below, Equation N-3.

Equation N-3. RHR Program Regression Model

$$kW\_estimate_{it} = \beta_1 * CDH_{it} + \beta_2 * MA4CDH_{it} + \beta_3 * MA24CDH_{it} + \beta_4 * PreCooling_{it} + \beta_5 * NHBU_{it} + \beta_6 * Event_{it} + \beta_7 * Snapback_{it} * + \varepsilon_{it}$$

Where:

β_{1-7}	Coefficients to be estimated by the model
β_6	Coefficient of interest
t	Index for time intervals
i	Index for individual devices
kW	Average kW during interval
CDH	Cooling degree hours with a set point of 72 degrees
MA4CDH	Moving average of the last 4 hours CHD with a base of 72 degrees
MA24CDH	Moving average of the last 24 hours CDH with a set point of 72 degrees
PreCooling	Counter for precooling hours, the 3 hours preceding an event

[19] Source: WHE program tracking database and Guidehouse analysis

NHBU	Normalized Heat Build Up defined as the cumulative heat buildup based on the weighted average of past hourly values. The weighting uses a compounded discount factor of 0.958333 for the number of hours prior - up to 72 hours prior
Event	Binary for event hours
Snapback	Counter for snapback hours, the 3 hours following an event
ε	Error term

To calculate gross impacts for the RHR program in PY2019, Guidehouse multiplied the average DR impact per thermostat obtained in the steps listed above by the number of thermostats activated by the end of the program year. Guidehouse used the "completion date" column to identify customers in the tracking data who activated their thermostat within the program year.

The sources for the data used in this analysis are as follows:

1. Evergy provided Guidehouse with PY2019 program tracking data.
2. Nest provided Guidehouse with PY2017 thermostat run time data and event signal data.
3. The Guidehouse team retrieved weather data from NOAA for the summer of 2017.

N.1.2 Annual Thermostat Energy Savings

Nest is a learning thermostat that once installed, identifies patterns in customer behavior that aims to maximize comfort while optimizing electricity use. Guidehouse calculated gross annual energy savings for PT customers by employing a Lagged Dependent Variable (LDV) regression model. The model used monthly billing data and tracking data provided by Evergy as inputs.

In PY2017, Guidehouse conducted the steps below to calculate per-device annual energy savings for the PT program. To obtain the total estimated energy savings on a program level in PY2019, the team multiplied the average savings per thermostat of 197 kWh per thermostat by the number of thermostats considered part of the thermostat program in PY2019[20].

[20] The count of thermostats consisted of: Direct Install (DI) thermostats with a completion date in PY2019, Do It Yourself (DIY) thermostats with a work order date within PY2019, or between January 1, 2020 and March 31, 2020. The kWh savings calculation does not include Bring Your Own Device (BYOD) thermostats because it is assumed these customers would have kWh savings through their thermostat without being enrolled in Evergy's thermostat program.

Guidehouse assumed that thermostats also participating in the Seasonal Savings[21] (SS) program achieved 121 kWh of incremental energy savings per device[22]. The team multiplied the number of devices in SS by 121 kWh and added this number to the step identified directly above to ultimately get the verified total program annual energy savings.

Analysis Steps

1. Collected billing and tracking data.
    a. Ensured that the tracking data were complete.
    b. Reviewed monthly billing data for outliers and ensured that there was enough pre-participation data to identify a matched control for each participant.
2. Created a matched control group.
    a. Used twelve months of consumption data prior to the month in which the thermostat was installed to identify a control customer for each program participant using a matching algorithm.
    b. The matching algorithm accounted for the magnitude and monthly pattern of consumption in determining the best match. Another customer (non-participant) with the lowest sum of squared monthly differences was selected as the matched control for each participant.
    c. Checked the quality of the matches for each participant and excluded participants for whom a relatively good[23] match was not found so as to prevent unintended bias from being introduced into the model due to inappropriate matches.
3. Extracted and Prepared Weather Data
    a. The Kansas City International Airport weather station was used for all customers.
    b. Average daily weather from NOAA[24] was used to calculate cooling (CDD) and heating (HDD) degree days for each month of the year. Thresholds of 60^0F and 72^0F were used as thresholds for HDD and CDD respectively.
4. Prepared Data for Regression

[21] Seasonal Savings is an opt-in aspect of the PT program that provides customers with the opportunity to make their thermostats' cooling schedules even more efficient than default. These thermostats undergo a three-week algorithm that optimizes energy efficiency and results in a more efficient cooling schedule for the rest of the cooling season.

[22] In PY2017, the evaluation team did not have sufficient data to evaluate a SS specific kWh savings through a billing analysis due to the lack of experimental design (i.e. no control group for SS customers) for the SS program, so the team used a modified version of what Nest found for the annual energy saved by SS thermostats participants. Nest found that each SS thermostat achieved 144 kWh savings per year assuming average population system capacity was 3.8 kW. Guidehouse assumed average population system capacity was 3.1 kW based on an assessment of program tracking data used in "Step Two" or the RHR methodology. The evaluation team scaled Nest's 144 kWh down to assume a 3.1 kW system capacity, instead of 3.8 kW, bringing the team to 121 kWh additional annual energy savings for SS customers.

[23] For some participants, the closest match had a notably high sum of square error compared to other matched controls meaning that quality of the match was not reliable. It was not unusual for some customers to have a notably higher monthly consumption or a unique monthly consumption pattern that was uncommon when compared to rest of the population and hence a reliable matched control could not be found.

[24] Local Climatological Data

a. A dummy variable corresponding to each month was created.

b. A new variable containing the same month's consumption in the previous year was created for each customer[25].

c. For each participant, the post period was identified as the month after the thermostat installation was completed. The installation month was excluded from analysis.

d. For each participant and their matched control, data within the participant's post period timeframe was kept. This resulted in each participant and their matched control having the same number of observations in the post period.

5. LDV Regression Analysis

a. A LDV model was run using only the post period data for all the participants and their matched controls. The regression model presented in

b. Equation N-4.

Equation N-4. Programmable Thermostat Energy Savings Regression Model

$$kWh_{i.t} = \sum_{m=1}^{12} \alpha_m * Month_{m.t} + \beta * kWh\_Lag12_{i.t} + \sum_{m=1}^{12} \gamma_m * No\_Thermostats_{i.t} \cdot HDD60_{i.t} \cdot Month_{m,t} + \sum_{m=1}^{12} \delta_m * No\_Thermostats_{i.t} \cdot CDD72_{i.t} \cdot Month_{m,t} + \eta * HDD60_{i.t} + \phi * CDD72_{i.t} + \varepsilon_{i.t}$$

Where:

i	Index to denote an individual customer
t	Index to denote the month
$kWh_{i.t}$	Kilowatt hours consumed for month t
$Month_{i.t}$	Dummy variable for the month of the year
$kWh\_Lag12_{i.t}$	Kilowatt hours consumed in the same month one year ago
$No\_Thermostats_{i.t}$	Number of thermostats installed in month t
$HDD60_{i.t}$	Heating degree days in month t
$CDD72_{i.t}$	Cooling degree days in month t
$\varepsilon_{i.t}$	Error term in month t
$\alpha, \beta, \gamma, \delta, \eta, \phi$	Parameters to be estimated by the model

6. Weather Normalization

[25] This was the lagged dependent (consumption) variable.

a. Thirty-year weather normal values for CDD72 and HDD60 were extracted from NOAA for Kansas City International Airport.

7. Average Savings per Thermostat under Normal Weather
   a. The monthly weather normal HDD and CDD values were interacted with the coefficients from the regression model, namely the gamma's (γ) and delta's (δ), to calculate the average savings associated with heating and cooling loads respectively for a single thermostat.

N.2 Process Evaluation

Guidehouse addressed the five Missouri-required questions for process evaluation. To answer these questions and gain information for this process evaluation, the evaluation team interviewed the product manager at Evergy and the implementation contractor.

Table N-1 displays the evaluation team's key process research questions and the evaluation activities conducted to address these questions.

Table N-1. Process Evaluation Research Questions and Approaches

Process Evaluation Research Question	Evaluation Activity
Missouri-Required Questions for Process Evaluation	
1. What are the primary market imperfections that are common to the target market segment?	• Program staff interviews • Materials review
2. Is the target market segment appropriately defined, or should it be further subdivided or merged with other market segments?	• Program staff interviews • Materials review
3. Does the mix of end-use measures included in the program appropriately reflect the diversity of end-use energy service needs and existing end-use technologies within the target market segment?	• Program staff interviews • Materials review
4. Are the communication channels and delivery mechanisms appropriate for the target market segment?	• Program staff interviews • Materials review
5. What can be done to more effectively overcome the identified market imperfections and to increase the rate of customer acceptance and implementation of each end-use measure included in the program?	• Program staff interviews • Materials review

N.2.1 Program Staff Interviews

Guidehouse conducted in-depth interviews with Evergy's product lead and the implementation contractor to better understand the Residential and Business PT programs and the key considerations of the five Missouri questions, namely:

- Issues or challenges faced
- Opportunities for improvement and efficiencies
- Participant recruitment and communication

- Internal program partnerships
- Upcoming program changes

N.2.2 Materials Review

Guidehouse reviewed the following materials to gain insight on the process evaluation research questions:

- Business Thermostat Program customer website: https://www.evergy.com/ways-to-save/programs/energy-efficiency/smart-thermostat
- Residential Thermostat Program customer website: https://www.evergy.com/ways-to-save/programs/energy-efficiency/smart-thermostat

APPENDIX O. DEMAND RESPONSE INCENTIVE PROGRAM-SPECIFIC METHODOLOGIES

The Demand Response Incentive (DRI) Program is a C&I DR program that is designed to reduce demand during system peak load periods. Participating customers provide the utility with demand reduction capacity by committing to reduce electric load upon request during the curtailment season (June to September). In return, the utility provides customers with an economic incentive to meet contracted curtailment loads. The utility counts the DR savings capacity represented by the summed differences between participants' estimated peak demands and firm power level as an offset to generation.

Based on Missouri regulations (see Appendix C), Guidehouse used method 1a and protocol 2a to evaluate the DRI program. The program evaluation consisted of the following activities:

- Impact evaluation (detailed in Section P.1)
- Process evaluation (detailed in Section O.2)

The evaluation team also estimated program load impacts through hourly load data supplied by automated meter reading (AMR) and advanced metering infrastructure (AMI). Both are described in more detail below.

O.1 Impact Evaluation

The Demand Response Incentive program incentivizes commercial and industrial customers to curtail load during peak demand events that Evergy identifies. The following section discusses the methodology for evaluating this program.

To estimate the impacts of the DRI program, the evaluation team relied on hourly load data supplied by AMR and AMI—described in more detail below.

Guidehouse answered the research questions in Table O-1 during the DRI program impact evaluation. These questions represent those addressed through evaluation best practices and provide input on the critical impact information needed for this program.

Table O-1. Impact Evaluation Research Questions

	Research Questions
1	Does the reported demand impact accurately characterize program impacts? And if not, what is the gross impact associated with the program?
2	What is the verified demand impact associated with the program?

Source: Guidehouse Analysis

O.1.1 Gross Analysis

Guidehouse utilized the following approaches to estimate the gross impact of the DRI program:

1. **Within-subject regression:** Uses loads of participating customers on non-event days to estimate the reference load. Demand is specified as a function of temperature and other variables that influence usage in the regression equation.
2. **Day averaging (CBL):** Reference load calculation, which is the simple arithmetic mean of loads from the same hour on preceding non-event days.

Guidehouse primarily aimed to employ within-subject regression approach to evaluate demand savings from the DRI participants. Guidehouse specified a separate regression equation for each customer and estimated the gross impacts for customers that had sufficient continuous interval data to support the regression analysis. As a secondary option, Guidehouse calculated savings using a day averaging (CBL) approach in cases where within-subject regression is not possible to employ, or Guidehouse believes a customer's load is not weather-dependent. A noted difference between within-subject regression approach and CBL approach is that the within-subjects approach controls for the weather impacts while the CBL approach does not account for weather impacts on customer demand.

Guidehouse conducted the following steps to calculate gross impacts and savings for the DRI program:

1. Collected billing and tracking data
    a. Ensured that tracking data were complete and consistently formatted.
    b. Ensured that billing data is complete and identified any outliers (high usage, no usage, etc.).
    c. Pulled Kansas City weather data from NOAA.
2. Created dummy variables and calculated variables in dataset
    a. Dummy variables for event periods and calendar-related effects (i.e., days of the week, month, etc.).
    b. Calculated variables for weather data (i.e., cooling degree hours, etc.).
3. Examined the load profiles of each customer to identify patterns in usage due to business operations. This information was used to help specify the regression model for each customer and to inform the estimation of impacts.
4. For each customer, a customer-specific ordinary least squares (OLS) regression model was fit using the event eligible hours (12 PM – 8PM, Monday through Friday) to estimate impacts. The general form of the equation for the regression model is shown below in Equation O-1. After running the regression model for each customer, the following diagnostic steps were taken:
    a. Tested for statistical significance of coefficients to determine whether their estimated impact is significantly different from zero.
    b. Identified the coefficient estimates for each customer and event.
    c. Summarized the coefficients for each event and customer to provide a cumulative impact for each event across all customers.

Equation O-1. DRI Program Regression Model

$$kW_t = \beta_0 + \beta_1 * CDH_t + \beta_2 * Week + \beta_3 * DOW + \beta_4 * Hour_t + \beta_5 * PreEvent + \beta_6 * Event + \beta_7 * Snapback + \beta_8 * PreUsage + \varepsilon$$

Where:

β_{1-7}	Parameters to be estimated by the model
t	Index for hourly time intervals
kW	Average hourly kW
CDH	Cooling degree hours
PreEvent	Binary variable for pre-event hours, the 2 hours prior to an event
Event	Binary variable for event hours
Snapback	Binary variable for snapback hours, the 3 hours following an event
PreUsage	Daily average usage from 8am to 10am
ε	Error term

5. For each customer, a day-matching approach was also estimated to provide an alternative baseline calculation for customers without sufficient data for regression analysis.
    a. Identified the baseline (non-event) days preceding each event.
        i. Baselines were calculated using data from the month prior to the event day for each customer. Weekends, holidays, and the week of July 4th were excluded from the calculation.
    b. Determined if an event-day adjustment is needed for each customer.
        i. After selecting the days in the baseline, we assessed whether an adjustment to the baseline was needed to account for differences in the baseline load and the loads during the event day preceding the event.
        ii. Based on this analysis, we decided to not use an event-day adjustment. This was due to decreases in load that were evident for some customers altering their operations earlier in the event day due to notifications that were sent the preceding day.
    c. Calculated the average usage for each hour of the day during the day-matching baseline for each customer.
    d. Calculated impact estimates from the difference between event-day usage and the baseline average.
6. Compiled impact estimates from Step 4 and Step 5 for all participants and events. The impact estimates were then compared between the regression and day-matching approaches to determine the consistency of impact estimates across approaches. With the context of the weather sensitivity identified in Step 3, a determination was made regarding the approach that provided the most appropriate estimation for each customer. This determination was based on

the weather sensitivity of the customer's loads, predictability of usage patterns, and the magnitude of fluctuations in a customer's loads. For most customers, the regression and day-matching approaches provided similar impact estimates for each event. In those cases, the regression analysis estimates were selected due to the ability to identify the statistical significance of those estimates. In the cases where the regression model produced negative coefficients on the CDH variable, the customer was determined not to be weather sensitive. For those customers, the day-matching impact estimate was selected since it reflected the average usage leading up to an event and that was determined to be the best available estimate of their usage in absence of the event.

7. Summed impact by event for reporting purposes.

O.2 Process Evaluation

Guidehouse addressed the five Missouri-required questions for process evaluations. To answer these questions and gain information for this process evaluation, Guidehouse interviewed the product manager at Evergy and reviewed program materials.

Table O-2 displays the evaluation team's key process research questions and the evaluation activities conducted to address these questions.

Table O-2. Process Evaluation Research Questions and Approaches

Process Evaluation Research Question	Evaluation Activity
Missouri-Required Questions for Process Evaluation	
1. What are the primary market imperfections that are common to the target market segment?	• Program Staff Interviews
2. Is the target market segment appropriately defined, or should it be further subdivided or merged with other market segments?	• Program Staff Interviews • Materials Review
3. Does the mix of end-use measures included in the program appropriately reflect the diversity of end-use energy service needs and existing end-use technologies within the target market segment?	• Program Staff Interviews
4. Are the communication channels and delivery mechanisms appropriate for the target market segment?	• Program Staff Interviews • Materials Review
5. What can be done to more effectively overcome the identified market imperfections and to increase the rate of customer acceptance and implementation of each end-use measure included in the program?	• Program Staff Interviews • Materials Review

Source: Guidehouse

O.2.1 Program Staff Interviews

Guidehouse conducted in-depth interviews with Evergy's product lead to better understand the DRI program and the key considerations of the five Missouri questions, namely:

- Program's performance to date
- Issues or challenges faced

- Opportunities for improvement and efficiencies
- Participant recruitment and communication
- Internal program partnerships
- Upcoming program changes

O.2.2 Materials Review

Guidehouse reviewed the following materials to gain insight on the process evaluation research questions:

- Evergy Demand Response Incentive Program Operating Plan-Public Facing document provided to Guidehouse by the Evergy product manager.
- DRI customer website: https://www.evergy.com/ways-to-save/incentives/demand-response

APPENDIX P. SUMMARY OF PROGRAM FINDINGS AND RECOMMENDATIONS

The following section provides a high-level summary of Guidehouse impact and process evaluation recommendations.

P.1 Business EER – Standard Program

The Business Energy Efficiency Rebate (EER) – Standard program offers a diverse set of measures that have standardized measure savings and an incentive process that improves accessibility to the customer. This helps increase the number of participants in the program for a broad segment of Evergy Missouri West's (Evergy MO West) customers, with more complex projects using the Business EER – Custom program to tailor the upgrades to a customer's needs. Any Evergy MO West commercial and industrial (C&I) customer is eligible to participate in the program. Program measures include EE projects such as lighting, motors, and HVAC. The program implementation transitioned to TRC Companies, Inc. (formerly the Distributed Energy Solutions Group of Lockheed Martin) for PY2019.

P.1.1 Impact Evaluation Findings & Recommendations

P.1.1.1 Findings

This section provides Guidehouse's findings from the PY2019 Standard program impact evaluation.

The Standard program achieved a 108% realization rate for gross energy savings and a 124% realization rate for gross demand savings, as shown in Table P-1.

Table P-1. Business EER – Standard PY2019 Energy and Demand Savings Summary*

	Gross			Net		
	Reported Savings	Verified Savings	Realization Rate	MEEIA Cycle 2 4-Year Target	Verified Savings	Percentage of MEEIA 4-Year Target Achieved
Energy at Customer Meter (kWh)	18,115,902	19,569,054	108%	43,388,453	18,786,292	39%
Coinc Demand at Customer Meter (kW)	3,549	4,414	124%	7,981	4,237	53%

*Based on PY2016 research, a NTG ratio of 0.96 to the Standard program.
Source: Guidehouse analysis

Table P-2 presents the Standard program-to date-realization rate, energy, and demand savings. The program achieved almost 2.5 times the MEEIA 4-year target for both energy and demand.

Table P-2. Business EER – Standard Program to Date Energy and Demand Savings Summary*

	Gross			Net		
	Reported Savings	Verified Savings	Realization Rate	MEEIA 4-Year Cycle 2 Target	Verified 4-Year Savings	Percentage of MEEIA 4-Year Target Achieved
Energy at Customer Meter (kWh)	138,921,385	115,710,357	83%	43,388,453	111,081,942	230%
Coinc Demand at Customer Meter (kW)	25,341	20,500	81%	7,981	19,680	247%

* Based on PY2016 research, a NTG ratio of 0.96 to the Standard program.

Source: Guidehouse analysis

Guidehouse calculated savings using data from the tracking database, onsite metering, and secondary sources (i.e. the IL TRM). Like previous years of this program, lighting measures accounted for more than 98% of the overall program savings. For this reason, the factors with the greatest impact on the overall program realization rate correspond with the lighting measure savings calculations. Guidehouse identified that some key factors influenced the verified savings the most. These key factors include assumptions around the baseline wattage, the recorded efficient wattage, hours of use, in-service rate, and coincidence factor. The team also notes that these same key factors highly influenced the PY2018 impact evaluation. The team addressed these key factors with the following steps:

1. First, Guidehouse aligned the baseline wattage for the verified savings using one of 3 approaches, including;
    a. Alignment with the midpoint of the baseline wattage range listed in the measure name.
    b. Leveraging the onsite lighting research conducted in PY2016 and PY2017.
    c. Used secondary sources on baseline fixture wattage, including the IL TRM v7 and manufacturer specification sheets for the efficient lighting product which listed equivalent baseline products.
2. Second, Guidehouse leveraged the recorded efficient wattage for the lamp or fixture in the verified lighting savings calculation for each measure incentivized.
3. Finally, Guidehouse included the results of the long-term onsite verification lighting study concluded in PY2017 in the verified lighting savings calculation. The results of the long-term lighting study led to adjustments to the in-service rate (ISR), hours of use (HOU), and coincidence factors (CF) for lighting measures.

To determine the net savings, Guidehouse used the net-to-gross (NTG) analysis conducted in PY2016 which indicated limited instances of free ridership (FR) at 5% and spillover (SO) at 0.5%. Based on these findings, Guidehouse applied an NTG ratio of 0.96.

P.1.1.2 Recommendations

Table P-3 provides a summary of our recommendations based on our impact evaluation findings.

Table P-3. Business EER – Standard Program Impact Recommendations

Summary of Recommendations	
1. Guidehouse recommends that the IC perform additional quality checks of the customer or TA reported efficient lamp/fixture wattage to ensure that they match the value in the product specification sheets.	The evaluation team found that less than 1% of the reported efficient measures did not match the specification sheets, such as in the case of a 15 W 4' linear lamp that had a reported efficient wattage of 30 W or a 9 W 2' linear lamp that had a reported wattage of 18 W. Guidehouse reviewed such instances and suggests providing more training to trade allies to understand that each measure in the Standard program is required to be a one-to-one replacement. This way the efficient wattage will always match the specification sheets and the quantity will reflect the number of each lamp/fixture installed and replaced.
2. Guidehouse recommends that the IC align with Evergy on the methodology for tracking the tonnage for non-lighting measures.	Guidehouse noted that the tonnage in the Nexant database and the tonnage in the IC's database did not always match. The tonnage should match the information in the specification sheets.
3. Guidehouse recommends providing further guidelines, such as a lumen equivalency range, around what qualifies for the LED High/Low Bay measures.	Currently, this measure category tends to be used as a catch-all with a wide range of efficient measures categorized together. For example, in PY2019 efficient equipment wattages ranged from 27 W to 162 W for the measure LED High/Low Bay Fixture replacing 150 W-300 W fixture. The LED Low/High Bay market is under transformation and the number of products available is increasing rapidly, which has also increased the mis-categorization of new efficient products.
4. Guidehouse recommends updating deemed savings for non-lighting measures to align with the IL TRM v7 algorithms.	The non-lighting measures in this program currently have deemed savings values that would benefit from an update. For example, the deemed savings algorithm to calculate energy for air cooled-single package/split systems > 65 kBtuh uses the EER rather than the IEER as specified in the IL TRM v7. The EER is the efficiency of a system at peak load capacity, while the IEER accounts for both partial and full load efficiencies which provides a better representation of a system's efficiency.
5. Guidehouse recommends that there is an additional field for the efficiency of the unit installed for non-lighting measures.	For example, in PY2019's tracking data the EER and SEER for air cooled-single package/split systems was in the efficient measure make and model field which forced the evaluation team to manually extract the values from the measure name or research the make and model to find the equipment's efficiency.

Source: Guidehouse analysis

P.1.2 Process Evaluation Findings & Recommendations

P.1.2.1 Findings

The Business EER – Standard program is an important component of Evergy MO West portfolio of C&I programs, as it represents approximately 41% of verified gross energy savings in PY2019. The process evaluation revealed these findings. Table P-4 provides a summary of the Missouri required process questions and associated answers to those questions.

Table P-4. Business EER – Standard Program Missouri Requirement-Based Findings

Missouri Question	Guidehouse Findings
1. What are the primary market imperfections that are common to the target market segment?	The target market faces a high barrier to make an energy efficiency upgrade due to the first cost and a lack of understanding of lifetime value for energy efficient products. Evergy MO West addresses the barrier by providing incentives which reduce the incremental cost. In addition, there are many smaller C&I customers that have limited resources for researching energy conservation, leading to imperfect or incomplete information about the market. Evergy MO West has developed targeted marketing materials and hosted interactive events to increase participation of smaller C&I customers in implementing energy conservation measures.
2. Is the target market segment appropriately defined, or should it be further subdivided or merged with other market segments?	Evergy MO West has a well-defined target market (C&I) for the Standard program. No further subdivisions appear necessary given current program participation.
3. Does the mix of end-use measures included in the program appropriately reflect the diversity of end-use energy service needs and existing end-use technologies within the target market segment?	While the Standard program includes many measures that address a participant's water heating, refrigeration, and HVAC energy end-uses, 98% of the projects in PY2019 were for lighting measures. The other Evergy MO West Business EER programs primarily address the other end-uses.
4. Are the communication channels and delivery mechanisms appropriate for the target market segment?	The IC for the Standard program works one on one with the larger customers. The trade-ally network addresses medium and smaller customers. In addition, there is also targeted marketing for sectors with historically lower participation such as datacenters and property managers on the website. Evergy MO West's marketing activities meet the programs needs as evidenced by them exceeding their savings and participation goals.
5. What can be done to more effectively overcome the identified market imperfections and to increase the rate of customer acceptance and implementation of each end-use measure included in the program?	In PY2019, Evergy MO West continued to have strong success with the efficient lighting measures in the Standard program. The effect from other end uses was less than 1%, but other programs such as the Custom program covers many of those non-lighting measures.

Source: Guidehouse analysis

P.1.2.2 Recommendations

The Standard program has surpassed its 4-year MEEIA target, primarily through significant participation in efficient lighting measures. Overall, Guidehouse found that Evergy MO West has addressed the process recommendations noted in the PY2018 Evaluation report and no further recommendations are recommended based on the process research conducted during PY2019.

P.2 Business EER – Custom Program

Evergy product managers and the IC made substantial efforts in PY2019 to move the Evergy MO West Custom program forward to align the program performance with the Cycle 2 target. As a result, the Evergy MO West Custom program implemented 107 projects in 9 months. To date, the Evergy MO West Custom program has achieved 64% and 49% of the 4-year MEEIA Cycle 2 target energy and coincidence peak demand savings, respectively.

The Business Energy Efficiency Rebate (EER) – Custom program provides incentives for energy efficient upgrades for business customers. This program is available to all commercial and industrial (C&I) Evergy MO West customers and is designed to cover a broad range of projects that do not fit within the Business EER –Standard program. The Evergy MO West Custom program:

- Delivers rebates—available for both existing and new facilities—only to those projects that achieve a Societal Cost Test (SCT) score of 1.0 or higher and that have a simple payback period (before applying the rebate) of 1.5 years or greater.
- Calculates rebates in program year (PY) 2019 based on following:
  - The incentive is calculated at the $550/coincidence peak kW saved.
  - Custom participants get paid a maximum of $0.40 per first-year kWh saved and a minimum of $0.04 per first-year kWh-hour saved.
  - Custom incentives are capped at 75% of the incremental project costs.
  - Up to $100,000 of maximum annual cap per customer per service territory for Custom rebates.
  - Custom participants get paid a rate of $0.04 per first-year kWh saved for projects that exceed the incentive cap.
- Requires preapproval from the implementation contractor (IC) before participants purchase and install equipment

P.2.1 Impact Evaluation Findings & Recommendations

P.2.1.1 Findings

Table P-5 summarizes the energy and peak demand savings and the corresponding realization rates for the Evergy MO West Custom program in PY2019. Table P-6 shows the program's savings to date for the Evergy MO West Custom program in Cycle 2. For PY2019, Guidehouse verified 10,792,667 kWh of energy savings and 1,899 kW of coincidence peak demand savings, and realization rates of 98% and 88%, respectively. PY2019 achieved 20% of the 4-year MEEIA Cycle 2 target for energy savings and 14% for coincidence peak demand savings.

Table P-5. Business EER – Custom Program PY2019 Energy and Demand Savings Summary

	Gross			Net[26]		
	Reported Savings[27]	Verified Savings[28]	Realization Rate	MEEIA Cycle 2 4-Year Target	Verified Savings	Percentage of MEEIA 4-Year Target Achieved
Energy at Customer Meter (kWh)	11,064,346	10,792,667	98%	37,599,915	7,446,940	20%
Coinc Demand at Customer Meter (kW)	2,163	1,899	88%	9,698	1,311	14%

Source: Guidehouse analysis

Table P-6. Business EER – Custom Program to Date Energy and Demand Savings Summary

	Gross			Net[29]		
	Reported Savings	Verified Savings	Realization Rate	MEEIA 4-Year Cycle 2 Target	Verified 4-Year Savings	Percentage of MEEIA 4-Year Target Achieved
Energy at Customer Meter (kWh)	34,330,320	34,215,568	100%	37,599,915	24,193,938	64%
Coinc Demand at Customer Meter (kW)	6,375	6,802	107%	9,698	4,783	49%

Source: Guidehouse analysis

Guidehouse made the following adjustments to the engineering calculations and were the primary drivers of energy and coincidence peak demand realization rates in PY2019:

1. **For lighting measures:**

    a. Guidehouse applied a waste heat factor for energy (WHFe) based on the IL TRM v7 in the calculation of energy savings.

[26] Guidehouse calculated net verified savings by multiplying gross verified savings by the NTG ratio.

[27] The evaluation team characterized savings as reported and verified. Reported savings represent project savings estimated at the time of measure installation and reported in the program tracking database.

[28] Verified savings represent energy savings verified at the time of the evaluation.

[29] The to-date net program savings are calculated using the NTG ratio for each respective program year and are summed up.

b. Guidehouse used the engineering algorithm outlined in the IL TRM v7 for estimating the peak demand savings while the implementation contractor used a kW factor approach[30].

c. The evaluation team applied a waste heat factor for demand (WHFd) and coincidence factor (CF) for calculation of peak demand savings to align with lighting spaces and operating schedules verified through phone interviews and desk reviews.

d. The evaluation team adjusted lighting hours of use to account for schedules verified through phone interviews and desk reviews.

e. The verified results adjusted occupancy sensor control savings based on collected baseline and efficient data during the on-site verification.

2. For non-lighting projects:

a. The evaluation team consistently applied a savings calculation methodology that differs from the approach implemented by the IC for all non-lighting end-use categories[31]. The Guidehouse approach builds on the IC methodology by applying 8,760 hourly weather data to capture impacts based on time of day and seasonality.

b. Guidehouse adjusted calculation inputs based on on-site verification, phone interviews, and desk reviews.

c. Guidehouse aligned the calculation of peak demand savings with the utility peak period[32] while the IC used the demand factor approach.

P.2.1.2 Recommendations

Table P-7 provides a summary of our recommendations based on our impact evaluation findings.

[30] In PY2019, at the request of Evergy, Guidehouse developed a list of kW factors by end use for calculation of peak demand savings based on the historically implemented Custom projects in the Evergy MO West service territory. The kW factor is ratio of the first-year peak demand savings to the first-year energy savings. It was established that the implementation contractor would use a kW factor for calculation of peak demand savings which is called the "kW factor approach" and Guidehouse would continue using an engineering approach for estimate of peak demand savings. The engineering approach varies depending on the energy efficiency measures, summarized in the Custom program appendix.

[31] Both Guidehouse and the implementation contractor used the Typical Meteorological Year 3 (TMY3) weather data to estimate the pre- and post-retrofit power in calculation of project savings. The TMY3 weather data includes 8,760 outdoor air dry-bulb temperatures and other weather parameters. For the HVAC Controls and Motors and Drives measures, the implementation contractor divided the 8,760 hourly temperatures to temperature bins in 2-degree, 5-degree, or other intervals and calculated the count of hours in each temperature bin. Then the implementation contractor predicted the pre- and post-retrofit power for each temperature bin. However, this approach does not estimate load corresponding to time and day of year. Alternatively, Guidehouse predicted pre- and post-retrofit power for each hour of each day (8,760 hours in total) based on the established regression models and the TMY3 weather data. Using this approach, Guidehouse was able to calculate the peak demand savings following the system peak period.

[32] The system peak period is the period during which demand savings are evaluated. The current Evergy peak period is 4:00 p.m.–6:00 p.m. on Weekdays when daily maximum dry-bulb outdoor air temperature is >=95°F from June to August, excluding holidays.

Table P-7. Business EER – Custom Program Impact Recommendations

Summary of Recommendations
• Guidehouse recommends that all calculations, independent of measure type, are initially performed in worksheets where the equations are transparent and easily reviewed to facilitate verification and evaluation. Currently, a subset of measure types uses locked worksheets which make verification of the engineering analysis more time intensive.
• Use the 8,760 hourly data analysis approach instead of 2-degree or other interval bin data analysis approach for weather-dependent measures like HVAC controls and motors & drive. Guidehouse has provided the IC an analysis template with the 8,760 hourly data analysis approach for estimating savings of HAVC unit replacement projects and would recommend applying this approach to other weather-dependent measures when appropriate.
• Collect calculation inputs by verifying with the customer and contractor and gathering data from customer's building management system (BMS), including, but not limited to, temperature setpoints, setbacks during unoccupied times, operating schedules, balance point, baseline conditions, and efficient conditions.
• For measures that could have both a peak demand or non-peak demand impact, such as HVAC controls, verify that the kW factor accurately reflects the control strategy applied for each project. Guidehouse found that in a few instances when a kW factor with a peak demand impact was used, the measure only had an influence on the unoccupied operating schedules which happened to be after Evergy's peak period.

Source: Guidehouse analysis

P.2.1.3 Net-to-Gross

To capture the customer experience, the net-to-gross analysis used primary research methods which included fielding free ridership and spillover surveys. Guidehouse sent the participant free ridership to two populations: 1) the PY2018 participants from the end of PY2018 that were not included in the last round of PY2018 surveys and 2) the PY2019 participants. Also, Guidehouse sent the survey with questions focused on spillover to all PY2018 participants. Guidehouse sent the Trade Ally survey to 57 trade allies across both Evergy Metro and Missouri West territories in the Fall of 2019, receiving 18 completed responses.

Survey responses indicated a weighted FR of 32%, a weighted participant SO (PSO) of 1%, and non-participant SO (NPSO) of 0% for a resulting program NTG ratio of 69%. The PY2019 NTG ratio is lower than in PY2018 which is attributed to the NPSO of zero percent, compared to 4.6% in PY2018. Guidehouse acknowledges that Evergy may have influenced NPSO in PY2019 that wasn't reflected in the 18 TA responses. Appendix C describes methodologies for calculation of free ridership (FR), spillover (SO) and NTG. Table P-8 shows the components of the NTG ratio for the Custom program.

Guidehouse's approach to incorporating trade ally NTG values into the overall program NTG value is consistent with prior year's evaluations. It uses trade ally FR as a cap on participant FR (meaning, if the trade ally FR estimate is lower than the participant FR estimate, Guidehouse uses the trade ally value), and Guidehouse adds the trade ally NPSO value to any PSO. In equation form, this is represented by the following:

$$NTG = 1 - MINIMUM(Part\ FR, Trade\ Ally\ FR) + PSO + NPSO$$

In the PY2019 calculation of NTG, the participant FR score was used in the formula and the trade ally FR was not per the formula above.

Table P-8. Business EER – Custom Program NTG Components and Ratio: PY2019

Program Year	Weighted FR	Weighted PSO	NPSO	NTG Ratio
2019	0.32	0.01	0.00	69%

FR = free ridership, PSO = participant spillover, NPSO = nonparticipant spillover, NTG = net-to-gross
Source: Guidehouse's NTG ratio research in PY2019 for the Business EER – Custom program

P.2.2 Process Evaluation Findings & Recommendations

P.2.2.1 Findings

The evaluation team addressed the five Missouri-required questions for process evaluation through program manager and implementation staff interviews and participant and trade ally surveys. Participant and trade ally survey response rates (Table P-9.) were consistent with prior evaluation years.

Table P-9. Evergy Metro and Missouri West Custom Program Survey Sample Size and Responses

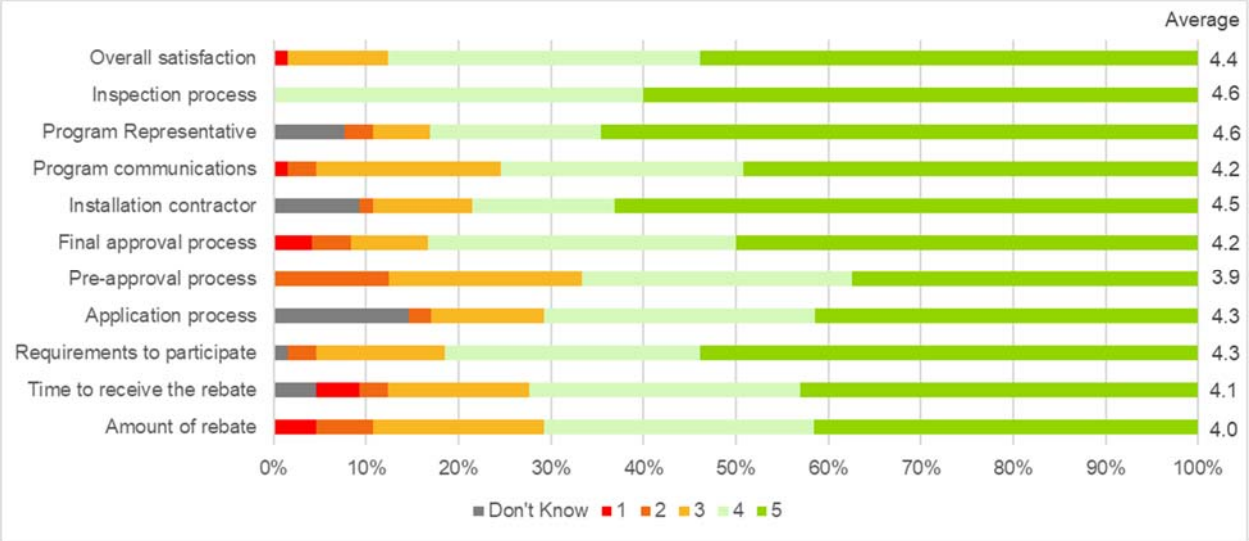
Year	Survey Type	Population Size	Completed Surveys	Response Rate
2019	Participant FR[1]	262	65	25%
	Participant SO[2]	207	37	18%
	Trade Ally	57	18	32%
2018	Participant	270	63	23%
	Trade Ally	152	48	32%
2017	Participant	80	18	23%
	Trade Ally	56	11	20%

Source: Guidehouse Survey Analysis
1 Survey sent to PY2018 participants (not surveyed in PY2018) and PY2019 participants.
2 Survey sent to all PY2018 participants.

Survey respondents[33] ranked their satisfaction with the various aspects of the program high, with all categories receiving an average ranking of 3.9 to 4.6 (on a 1-5 scale, where 1 is low and 5 is high) (Figure P-1).

[33] PY2019 Participant FR survey

Figure P-1 Participant Satisfaction with Program Aspects

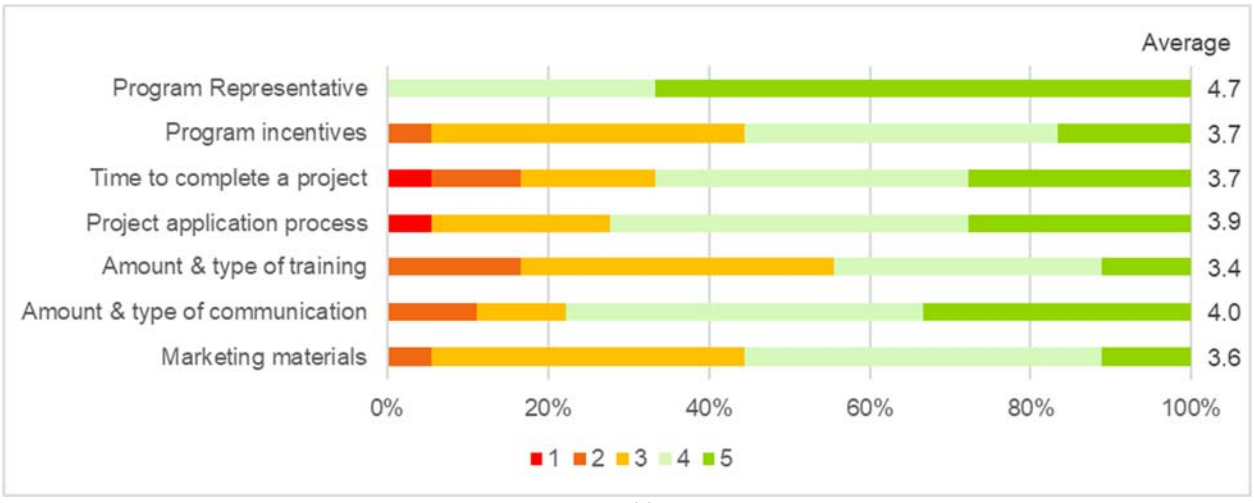


N=65

Source: Guidehouse Survey Analysis

Trade allies ranked their satisfaction with the various aspects of the program high, with all categories receiving an average ranking of 3.4 to 4.7 (on a 1-5 scale, where 1 is low and 5 is high) (Figure P-2). Training ranked lowest (3.4) because some trade allies were unaware of training while others thought training could be more in-depth.

Figure P-2. Trade Ally Satisfaction with Program Aspects



n=18

Source: Guidehouse Survey Analysis

Table P-10 provides a summary of the Missouri required process questions and associated answers to those questions.

Table P-10. Business EER - Custom Program Missouri Requirement-Based Findings

Missouri Question	Guidehouse Findings
1. What are the primary market imperfections that are common to the target market segment?	Custom measures are complex and can have uncertainty in energy savings requiring utility education and incentives.
2. Is the target market segment appropriately defined, or should it be further subdivided or merged with other market segments?	Yes, the target market is appropriately defined. All business customers are eligible to participate in the Custom program. Tier one customers provide the most energy savings to the program. The program could target small and medium sized customers.
3. Does the mix of end-use measures included in the program appropriately reflect the diversity of end-use energy service needs and existing end-use technologies within the target market segment?	Due to the shortened program year, the program focused on lighting measures to meet the PY2019 goals. Lighting measures made up 54% of the energy savings in PY2019. The Product Manager for the Custom program continued to increase focus on non-lighting measures in PY2019. This is apparent in the year-over-year increase in participation in non-lighting measures, including HVAC and motor end-uses.
4. Are the communication channels and delivery mechanisms appropriate for the target market segment?	Due to the shortened program year in PY2019, the marketing and promotion of the program was primarily through emails to customers and trade allies.
5. What can be done to more effectively overcome the identified market imperfections and to increase the rate of customer acceptance and implementation of each end-use measure included in the program?	Customers need support in the identification and implementation of energy efficient projects. Support would encourage more customers to complete high efficiency projects, particularly when equipment needs to be specified and installed quickly.

Source: Guidehouse analysis

P.2.2.2 Recommendations

The recommendations that correspond to Guidehouse's findings on the process evaluation are provided in Table P-11. These recommendations are based on the findings outlined above and are informed by the customer and trade ally surveys conducted in PY2019.

Table P-11. Business – EER Custom Program Missouri Requirement-Based Recommendations

Missouri Question	Guidehouse Recommendations
1. What are the primary market imperfections that are common to the target market segment?	Some customers do not have the in-house engineering expertise to pursue complex custom projects. The program should continue efforts to offer additional technical support to: a) help identify energy efficiency projects, b) help customers with the application process including the preapproval and post phase, and c) develop industry-specific outreach campaigns, which help customers understand how custom projects benefit customers like them.

Missouri Question	Guidehouse Recommendations
2. Is the target market segment appropriately defined, or should it be further subdivided or merged with other market segments?	Ensure Evergy's Customer Solution Managers (CSMs) have the training and expertise to help customers identify energy savings in their facilities through an in-depth audit and face-to-face interactions. The CSMs could also work more closely with the implementer to help identify potential projects and utilize the implementation staff to support the customer through the application process.
3. Does the mix of end-use measures included in the program appropriately reflect the diversity of end-use energy service needs and existing end-use technologies within the target market segment?	Trade Allies and customers should be encouraged to install non-lighting measures. These efforts could include case studies, marketing campaigns, trade shows, and additional training on the various non-lighting measures.
4. Are the communication channels and delivery mechanisms appropriate for the target market segment?	In addition to customer and trade ally email communications, the utility and implementer should engage trade allies and customers through other channels. The website could be utilized as a central repository. There are opportunities to streamline the Custom application. For example, the fields that are common on the various steps of the electronic application such as contact name and number on the application could be auto-filled for subsequent pages after the cover page.
5. What can be done to more effectively overcome the identified market imperfections and to increase the rate of customer acceptance and implementation of each end-use measure included in the program?	Evergy and TRC could offer additional technical support such as outside subject matter experts to help customers with complex processes (such as food or electronic manufacturing), or energy-dense end uses (such as data centers) to help customers find opportunities to reduce their consumption. Guidehouse recommends incentive levels are reviewed annually to ensure they are significant enough to not only increase participation in the program without increasing free ridership but to also consider the time and effort needed to complete the Custom application.

Source: Guidehouse analysis

P.3 Whole House Efficiency

The Whole House Efficiency (WHE) program encourages whole house improvements to existing homes by promoting home energy audits and comprehensive retrofits. Customers are eligible for this program if they own or rent a residence. The program has five key goals:

- Demonstrate persistent energy and demand savings
- Encourage energy-saving behavior and whole house improvements
- Help residential customers reduce their electricity bills
- Educate customers about the benefits of energy efficient homes
- Develop partnerships with HVAC contractors and energy auditors to bring efficient systems to market

In program year (PY) 2019, customers could participate in the program through three different options, known as tiers. The three tiers are described below.

- **Tier 1 – Home Energy Assessment and Energy Savings Kit:** This tier offers a home energy assessment and a suite of direct install (DI) measures such as faucet aerators, low flow showerheads, advanced power strips, hot water pipe insulation, furnace filter alarms, and light-emitting diode (LED) lighting.
- **Tier 2 – Weatherization Measures:** This tier offers building shell and weatherization measures including air sealing, ceiling insulation and wall insulation after customers complete an energy audit by an authorized energy auditor trade ally.
- **Tier 3 – HVAC Equipment:** Tier 3 offers HVAC measures such as efficient central air conditioning, air- and ground-source heat pumps, ductless mini-split heat pumps, furnace fans with electronically commutated motors, and HVAC tune-ups, refrigerant charge and coil cleaning.

P.3.1 Impact Evaluation Findings & Recommendations

P.3.1.1 Findings

Table P-12 presents the energy and demand savings summary for the WHE program in PY2019. The cumulative energy and demand savings achieved by the program from PY2016 to PY2019 are presented in Table P-13. The program has achieved 93% of its 4-year MEEIA energy savings target between PY2016 and PY2019. The 4-year target for net coincident demand has been exceeded with the program achieving 200% of the target.

Table P-12. WHE Program PY2019 Energy and Demand Savings Summary

	Gross			Net		
	Reported Savings[34]	Verified Savings	Realization Rate	MEEIA Cycle 2 4-Year Target	Verified Savings	Percentage of MEEIA 4-Year Target Achieved
Energy at Customer Meter (kWh)	6,297,355	6,636,825	105%	24,647,183	5,309,460	22%
Coincident Demand at Customer Meter (kW)	2,221	3,611	163%	6,340	2,889	46%

Source: WHE program tracking database and Guidehouse analysis

Table P-13. WHE Program to Date Energy and Demand Savings Summary

	Gross			Net		
	Reported Savings	Verified Savings	Realization Rate	MEEIA 4-Year Cycle 2 Target	Verified 4-Year Savings	Percentage of MEEIA 4-Year Target Achieved
Energy at Customer Meter (kWh)	31,749,935	28,619,677	90%	24,647,183	22,895,742	93%
Coincident Demand at Customer Meter (kW)	13,251	15,854	120%	6,340	12,683	200%

Source: WHE program tracking database and Guidehouse analysis

Guidehouse verified savings for WHE program measures using the industry-standard energy and demand savings algorithms from the Illinois Technical Reference Manual (IL TRM) v7. When a measure was not included in the IL TRM v7, Guidehouse used other industry-accepted evaluation methods as described in Appendix J. The evaluation team used values sourced directly from the program tracking data whenever possible and used deemed inputs from the IL TRM v7 when the required input values were not present in the program tracking data. The analysis methodologies, including algorithms and variable input values, are detailed in Appendix J.

Overall WHE program realization rates were higher in PY2019 than in PY2018 and exceeded 100% for both energy and demand savings. The increase in program realization was largely due to an increase in the Tier 3 realization rates. Tier 3 measures were the dominant driver of program performance, providing 95% of PY2019 verified gross energy savings and 98% of verified gross coincident demand savings.

[34] Reported savings in the IC tracking database totaled 6,296,999 kWh, differing by 355 kWh compared to Evergy Missouri West's Nexant database. The differences in savings are attributed to the differences in precision each of the tracking systems use. The reported savings above align with Evergy Missouri West's Nexant extract. Demand savings aligned for both the IC tracking data and Nexant database.

Several important realization rate drivers are common among Tier 3 measures; the largest drivers are outlined here.

- **Parameters used in the reporting algorithms have been updated to more closely align with parameters used in the verification algorithms.** For most measures, these changes result in realization rates closer to 100% than in previous years and are indicative of more accurate reporting. Notable updates include:
    - The reported baseline efficiency values for early retirement HVAC measures have been updated for PY2019. In particular, the $SEER_{exist}$ values used to calculate reported savings for early retirement air conditioners and air-source heat pumps are close to the IL TRM v7 values used for verification.[35]
    - The reported equivalent full-load hours (EFLH) for cooling now aligns with the IL TRM v7.[36] This parameter is used in most Tier 2 and Tier 3 measures, and the updated value results in improved realization rates.
- **There is still a substantial gap between the EER_{exist} values in the reporting and verification algorithms for early retirement measures.**[37] Because this difference affects the two largest measures—early retirement central air conditioners and early retirement air-source heat pumps—it is the primary factor in the high overall WHE realization rate for demand.
- **Some structural differences still exist between the reporting and verification algorithms.** The reporting algorithms largely cited the IL TRM v5, while the verified values cited the IL TRM v7. For measures in which the savings algorithms changed between the two TRM versions, such changes factor into non-100% realization rates.[38]
    - Many algorithms in the IL TRM v7 include parameters that were not present in the IL TRM v5 algorithms. For example, new equipment degradation factors and efficiency adjustment factors are now present in all central air conditioning and air-source heat pump savings algorithms in IL TRM v7. These factors did not exist in IL TRM v5, and were therefore not used in the reporting algorithms.

Tier 2 measures, including air sealing and ceiling insulation, were the second largest program savings contributors and shared common realization rate drivers:

- **Reported savings included electrical heating savings for all projects while verified savings only included them when applicable.** Electrically-heated projects made up 4% of the air sealing

[35] Previous $SEER_{exist}$ values of 6.87 for both CAC units and air-source heat pumps were updated to 9.12 and 10, respectively. Previous EER_{exist} values of 6.00 for CAC units and 6.70 for air-source heat pumps were updated to 9.2 and 8.15, respectively.

[36] PY2018 reported savings used an EFLH value of 982 hours for cooling, while the PY2019 reported savings used an EFLH value of 738 hours.

[37] Verification algorithms used an EER_{exist} of 7.5 for both air conditioners and heat pumps, while reporting algorithms used 9.2 for air conditioners and 8.15 for heat pumps. The difference in EER_{exist} results in high demand realization rates for these measures. Because early retirement air conditioners and heat pumps represent more than half of the savings for the WHE portfolio, their high realization rates have a significant effect on the realization of the entire program.

[38] As a result of differences in reporting and verification algorithms, the realization rates for some measures increased, while others decreased.

population and 3% of the ceiling insulation population, based on program tracking data. For this reason, the verified savings values for most projects were lower than reported.

- **IL TRM v7 algorithms include a correction factor that was not present in IL TRM v5.** Verification algorithms were sourced from the IL TRM v7 and include a correction factor to correctly allocate savings for projects with *both* insulation and air sealing. The reported savings algorithms used IL TRM v5 did not include the correction factor. This change resulted in higher verified energy and demand savings.

Tier 1 measures are more varied and Guidehouse identified the most important drivers by measure category:

- **Lighting measures - The verified savings considered project-specific bulb types while reported savings assumed all bulbs were standard A19 LEDs.** Reported LED energy savings for standard and specialty bulbs were calculated as if they were all standard A19 bulbs. The IL TRM v7 includes distinct algorithms for each bulb type, as well as distinct values for the variables used to determine savings such as hours of use, pre- and post-retrofit wattages, waste heat factors, and coincidence factors. The verified savings leveraged those distinct methodologies to determine savings for the standard and specialty bulbs. The modifications to individual parameters were small, and resulted in a small reduction in overall LED lighting savings.

- **Water measures – IL TRM v7 algorithms include updated baseline flowrates for faucet aerators and low-flow showerheads.** The verification algorithms sourced baseline flowrates for these measures from the IL TRM v7, and they are lower flowrates than those used in the reporting algorithms. This change resulted in a reduction in realization rates for these measures.

P.3.1.2 Recommendations

Table P-14 provides a summary of our recommendations based on our impact evaluation findings.

Table P-14. Whole House Efficiency Program Impact Recommendations

Summary of Recommendations	
1. The tracking database should contain all data needed to track installed program measures and calculate program savings.	For PY2019, this includes a more detailed description of the specific HVAC system types, fuel types, and the presence of supplemental electric heating for insulation and air sealing projects, as well as the collection of full-load EER for ground-source heat pump installations.
2. The program implementer should continue working toward updating the methodology used to calculate the program's reported savings to align with the IL TRM v7.	For PY2019, this includes calculating insulation and air-sealing project savings in a manner that is more representative of the actual HVAC equipment installed through each project. Insulation and air-sealing projects should include savings for electric heating only if implemented in homes with electric heat. In addition, savings for ductless mini-split heat pumps should be calculated either as time-of-sale units or as early retirement units and that determination should be made on a project-level basis. The method of calculating reported savings in PY2019 assumed all early retirement units.

Source: Guidehouse analysis

P.3.2 Process Evaluation Findings & Recommendations

P.3.2.1 Findings

Guidehouse conducted interviews with the implementer and product managers in PY2019 and maintained close contact regarding program activities and issues throughout the year. Table P-15 provides a summary of the Missouri required process questions and associated answers to those questions.

Table P-15. Whole House Efficiency Program Missouri Requirement-Based Findings

Missouri Question	Guidehouse Findings
1. What are the primary market imperfections that are common to the target market segment?	Participants in each tier often experience different barriers to participation. Tier 1 participants may face difficulties in finding time to engage with the program and sometimes are hesitant to engage with the program, questioning the credibility of free upgrades with no-strings-attached. For Tier 2 and Tier 3 participants, up-front costs can be a significant barrier to entry, given the expenses associated with building envelope or HVAC upgrades. It remains crucial to help these customers understand the value of replacing and upgrading equipment before the failure of an air conditioner or heat pump, for example.
2. Is the target market segment appropriately defined, or should it be further subdivided or merged with other market segments?	The Whole House Efficiency program combines three programs into one, with participants in each tier experiencing their own motivations and barriers. In that regard, the program is sufficiently subdivided. The implementer continues to conduct research to better segment the market and understand the needs of each customer segment. In addition, Evergy is implementing a recommendation from PY2018 to provide measures to multifamily market-rate customers through a MEEIA 3 incubator program.
3. Does the mix of end-use measures included in the program appropriately reflect the diversity of end-use energy service needs and existing end-use technologies within the target market segment?	The program offers measures that cover most of the common energy end uses for residential customers. However, most energy savings and participation come from air conditioning units and heat pumps. Evergy engaged new trade allies in PY2019 to encourage greater participation in building envelope measures. Ceiling insulation in particular saw close to a 30% increase in participation for PY2019.
4. Are the communication channels and delivery mechanisms appropriate for the target market segment?	The current means of communication include customer support and education provided by energy efficiency professionals and trade allies, leave-behind materials for customers, and targeted marketing campaigns. These channels and mechanisms are appropriate for the program, which achieves high levels of customer satisfaction according to internal surveys.
5. What can be done to more effectively overcome the identified market imperfections and to increase the rate of customer acceptance and implementation of each end-use measure included in the program?	Up-front costs continue to be an important barrier to many participants – especially prospective low-income participants. Evergy is looking at alternative financing mechanisms, including a Pay As You Save (PAYS) program, to help offset the cost of large building envelope or HVAC measures. Continuing to explore the feasibility and effectiveness of this approach is highly encouraged.

Source: Guidehouse analysis

P.3.2.2 Recommendations

Guidehouse addressed the five required process evaluation questions through the research activities described above. Table P-16 describes Guidehouse's recommendations based on each question.

Table P-16. WHE Missouri Requirement-Based Recommendations

Missouri Question	Guidehouse Recommendation
1. What are the primary market imperfections that are common to the target market?	Customer education and access to financing are two important factors in the market. Encouraging customers to be proactive about replacing old equipment will help guide them through the decision-making process regarding equipment failure. In addition, Evergy should continue to explore the effectiveness and feasibility of—and offer support for—alternative financing programs such as PAYS to help offset the burden of up-front cost, particularly for expensive insulation and HVAC measures.
2. Is the target market segment appropriately defined, or should it be further subdivided or merged with other market segments?	The three program tiers offered by the WHE program adequately spans customer needs within the target market. Because program tiers are distinct from one another, and because savings tends to increase by tier, Evergy should continue emphasizing customer participation in multiple program tiers to encourage greater synergy and more energy savings.
3. Does the mix of end-use measures included in the program appropriately reflect the diversity of end-use energy service needs and existing end-use technologies within the target market segment?	Tier 2 and Tier 3 measures offer the most potential energy savings for homeowners. Even though these measures are cost effective, participation may be difficult due to the high up-front costs. This is particularly true for lower-income customers. Alternative financing mechanisms (such as PAYS) may encourage the adoption of Tier 2 and Tier 3 measures, allowing customers to save more energy while remaining within their individual home improvement budgets.
4. Are the communication channels and delivery mechanisms appropriate for the target market segment?	Guidehouse does not have any recommendations related to this research question since the communication channels and delivery mechanisms are appropriate, including the customer support and education provided by the EEPs and trade allies, the leave-behind materials for customers, and the targeted marketing campaigns.
5. What can be done to more effectively overcome the identified market imperfections and to increase the rate of customer acceptance and implementation of each end-use measure included in the program?	Evergy is doing a commendable job in exploring new opportunities for program offerings and delivery mechanisms. In addition to the implementation of new financing mechanisms, it may be worthwhile to explore additional direct install measure offerings and combinations

Source: Guidehouse analysis

P.4 Income-Eligible Multifamily

The Income-Eligible Multifamily (IEMF) program delivers long-term energy savings and bill reductions to residents in multifamily housing that meet the income requirements and to multifamily housing owners and property managers whose buildings have income-eligible residents. Prior to program year (PY) 2019, the program consisted of three different options, known as tracks. This year, the Food Bank track was not implemented. PY2019 tracks included:

- **Track 1 – Direct Install:** Efficiency kits that are installed directly into tenant residences and energy efficient measures that are installed in multifamily common areas.
- **Track 2 – Custom:** Custom program option for measures that fall outside of those offered as part of the efficiency kits or measures for common areas.

P.4.1 Impact Evaluation Findings & Recommendations

P.4.1.1 Findings

The results of the PY2019 impact evaluation are presented below in Table P-17. Guidehouse's verification methods indicate that the IEMF program achieved 1,423,120 kWh and 172 kW in gross energy and demand savings, resulting in realization rates of 93% for gross energy and 81% for gross demand. During PY2019, the program achieved 11% of its 4-year MEEIA Cycle 2 net energy target and 10% of its net demand target.

Table P-17. IEMF Program PY2019 Energy and Demand Savings Summary

	Gross			Net		
	Reported Savings	Verified Savings	Realization Rate	MEEIA Cycle 2 4-Year Target	Verified Savings	Percentage of MEEIA 4-Year Target Achieved
Energy at Customer Meter (kWh)	1,533,561	1,423,120	93%	12,517,848	1,423,120	11%
Coinc Demand at Customer Meter (kW)	212.34	172	81%	1,696	172	10%

Source: Program tracking database and Guidehouse analysis

As seen in Table P-18, cumulatively (PY2016 – PY2019), the IEMF program achieved 95% of its net energy savings goals to-date and 87% of its net demand savings goals to-date.

Table P-18. IEMF Program to Date Energy and Demand Savings Summary

	Gross			Net		
	Reported Savings	Verified Savings	Realization Rate	MEEIA Cycle 2 4-Year MEEIA Target	Verified 4-Year Savings	Percentage of MEEIA 4-Year Target Achieved
Energy at Customer Meter (kWh)	12,815,744	11,894,677	93%	12,517,848	11,894,677	95%
Coinc Demand at Customer Meter (kW)	1,462	1,481	101%	1,696	1,481	87%

Source: Program tracking database and Guidehouse analysis

Additional key findings for PY2019 include:

- **Food bank LED distribution**: This program track was not included in PY2019. This resulted in lower program energy and demand savings when compared to previous program years that included it.
- **Aerators and showerheads**: According to the program implementer, the Evergy Missouri West territory has a higher percentage of electric water heaters than Evergy Metro. As a result, Evergy West has a greater number of low-flow electric faucet aerator and showerhead installations that contribute to approximately 13% of the program energy savings and 26% of the demand savings.
- **HVAC tune-up central air conditioning:** There were 490 central air conditioning tune-up measures in PY2019 that contributed 4% of the program energy savings and 15% of the demand savings.
- **Custom measures:** PY2019 included 1,953 custom measures. These included ductless mini-split heat pumps, air source heat pumps, refrigerators, and lighting projects. In PY2019, custom measures contributed 62% of the program energy savings and 36% of the demand savings, and the majority of those savings were from the 1,908 custom lighting measures.

Guidehouse calculated verified savings using industry-standard engineering algorithms. The evaluation team leveraged actual characteristics (i.e., capacity, efficiency) of the program-incented equipment, when available, as inputs to these algorithms. When project-specific data was not available, the team used relevant performance variables (i.e., operation hours) sourced from the Illinois Technical Reference Manual (IL TRM) v7. Guidehouse chose this TRM given its geographic proximity to the service territory. Where applicable, climate conditions used in the analyses were reflective of Kansas City.

Verified savings differed from reported savings primarily because the verified savings are based on IL TRM v7 and the reported savings are based on IL TRM v5. The most significant differences were seen with the following measures, where the realization rates differ from 1.0.

- **Lighting:** For the in-unit measures, the Guidehouse team applied 1,089 hours of use for the 9W LEDs and 763 hours for the candelabra, globe, and BR30 bulbs. For the common area measures, Guidehouse applied 1,159 hours of use. The energy waste heat factors applied were 1.04 for in-unit measures and 1.051 for common area measures. The demand waste heat factors applied were 1.07 for in-unit measures and 1.093 for common area measures. Finally, Guidehouse

applied a coincidence factor of 0.128 for the 9W bulbs and 0.109 for candelabra, globe, and BR 30 bulbs. The reported savings applied 759 hours of use for in-unit measures and 847 hours of use for common area measures, single family waste heat factors of 1.06 (energy) and 1.11 (demand), and a coincidence factor of 0.028 for in-unit measures and 0.071 for common area measures.

- **Aerators:** The Guidehouse team applied IL TRM v7 hours of use for multifamily dwellings (84 hours for kitchen and 22 hours for bath). The evaluation team also applied the IL TRM v7 gallons per minute (GPM) baseline value of 1.63 GPM for kitchens and 1.53 GPM for bathrooms. The reported savings applied IL TRM v5 hours of use (77 hours for kitchen and 22 hours for bathrooms) and 2.2 GPM for both the kitchen and bathroom aerators.

- **Low-flow showerheads:** The Guidehouse team applied IL TRM v7 hours of use for multifamily dwellings (208 hours) and updated the baseline GPM to 2.24 GPM. The reported savings included the IL TRM v5 baseline GPM of 2.67 GPM and 248 hours of use.

P.4.1.2 Recommendations

The tracking data and savings calculations provided by Evergy Metro and the implementation team included type, quantity, and location of measures, which were appropriate for the evaluation of the direct install measures. The tracking data for the custom measures would benefit from additional detail, and Guidehouse provides a summary of recommendations in Table P-19.

Table P-19. IEM Program Impact Recommendations

Summary of Recommendations	
1. The tracking database did not include all data needed to evaluate the custom measures. The evaluation team made a separate request for detailed information for custom measures including the following: • Lighting: Baseline wattage, bulb location, and hours of use • Air Sealing: Blower door test results • Refrigerators: Equipment models and configurations for both the existing and the efficient equipment • Multiple Measure Types: Equipment specifications and descriptions	Guidehouse recommends that the program implementer includes this information in the tracker since these are input values for the custom measure savings calculations. This recommendation was also made in PY2018.

Source: Guidehouse analysis

P.4.2 Process Evaluation Findings & Recommendations

P.4.2.1 Findings

Guidehouse conducted staff interviews and a program material review to address the five Missouri-required questions for process evaluation. The evaluation team interviewed and exchanged emails with the Evergy program manager and implementation team, and reviewed materials on the program website to inform the process evaluation. Table P-20 provides a summary of the Missouri required process questions and the evaluation team's findings.

Table P-20. IEMF Program Missouri Requirement-Based Findings

Missouri Question	Guidehouse Findings
1. What are the primary market imperfections that are common to the target market segment?	The target market for this program are income-eligible multifamily residents and property owners and managers, targeting tenant units for direct install measures and property owners and managers for building improvements. This market generally has limited capital availability and property management staff experience high turnover. However, the program is overcoming these challenges with direct outreach strategies, developing relationships with property managers, and a new concierge approach that was rolled out for HVAC projects in PY2019. This concierge approach involved providing a consultation for the customer, identifying possible contractors, developing an RFP for the work that contractors can respond to, and completing savings calculations for the projects. Program staff report that the HVAC offerings were very successful in PY2019.
2. Is the target market segment appropriately defined, or should it be further subdivided or merged with other market segments?	The target market includes income-eligible multifamily properties. Implementation staff noted that there was limited participation of smaller MF properties during PY2019 (for example, a six-unit building as opposed to a larger 40-unit building). A goal for MEEIA Cycle 3 is to increase participation of this market segment in order to bring more diversity to the program and continue achieving program goals. Program staff reported that barriers to reaching this market segment include that there may not be a property manager on site, contact information for offsite property managers may be difficult to obtain, property budgets tend to be very limited, and more support is typically required to engage this market segment in the program because these smaller buildings tend to need more updates.
3. Does the mix of end-use measures included in the program appropriately reflect the diversity of end-use energy service needs and existing end-use technologies within the target market segment?	Guidehouse found that the program includes appropriate measures for its current targets. Custom projects continued to perform well, as they did in PY2018.
4. Are the communication channels and delivery mechanisms appropriate for the target market segment?	As in prior program years, communication channels focused largely on direct outreach, in-person contacts, and forming relationships with MF property managers. During PY2019, the program placed advertisements in apartment association magazines to generate broad awareness of the program, did video advertising on a local television channel (channel 41), and conducted approximately 10 community outreach events, often by partnering with neighborhood association meetings. This neighborhood outreach approach was a new strategy in PY2019. Program staff reported that their aim was to increase awareness of the program among neighborhoods and tenants, developing a vehicle through which they could reach property owners and managers. Program staff reported that they intend to select specific geographic areas in which to conduct neighborhood-level outreach for MEEIA Cycle 3.

Missouri Question	Guidehouse Findings
5. What can be done to more effectively overcome the identified market imperfections and to increase the rate of customer acceptance and implementation of each end-use measure included in the program?	The program is leveraging several strategies to overcome market imperfections and increase measure implementation such as a concierge-type service for selecting measures to support property managers and owners, and neighborhood-level outreach.

Source: Guidehouse analysis

P.4.2.2 Recommendations

Guidehouse addressed the five required process evaluation questions set forth in Missouri regulations[39] for the IEMF program.

Table P-21 presents Guidehouse's recommendations for the program.

Table P-21. IEMF Missouri Requirement-Based Recommendations

Missouri Question	Guidehouse Recommendation
1. What are the primary market imperfections that are common to the target market?	The program is attempting to address the market imperfections by prioritizing direct outreach and relationship-building with property managers and owners and a concierge-type serve for HVAC measures. Future evaluation research could investigate the effectiveness of the concierge service from the property manager and owner perspective, in addition to the overall property manager and owner program experience.
2. Is the target market segment appropriately defined, or should it be further subdivided or merged with other market segments?	The program plans to increase participation of smaller multi-family properties in MEEIA Cycle 3. The program should identify best practices for engaging these types of properties, determine the effectiveness of the programs' outreach in increasing participation of this market segment, and conduct research to identify motivations, barriers to participation, and participant satisfaction within this market segment.
3. Does the mix of end-use measures included in the program appropriately reflect the diversity of end-use energy service needs and existing end-use technologies within the target market segment?	The measures for the direct install track of the program are appropriate. Similar to PY2018, there was a high volume of custom measures, particularly for lighting measures. Guidehouse continues to recommend that Evergy identify commonly implemented measures that may be suited for a prescriptive track.
4. Are the communication channels and delivery mechanisms appropriate for the target market segment?	Working with property managers and owners via direct outreach and relationship-building has proven to be an effective means of communication. Future research could evaluate the effectiveness of the neighborhood-level outreach deployed during PY2019 in increasing program awareness and participation for these groups.

[39] 4 CFR- 240-22.070(8)

Missouri Question	Guidehouse Recommendation
5. What can be done to more effectively overcome the identified market imperfections and to increase the rate of customer acceptance and implementation of each end-use measure included in the program?	The program plans to continue offering custom measures, the new concierge-type service for HVAC measures, and conducting outreach to increase participation and measure installation at smaller MF properties. Future evaluation research should determine the effectiveness of these program and outreach solutions, including identifying ways to optimize outreach at smaller MF properties, and the customer experience with new program offerings.

Source: Guidehouse analysis

P.5 Home Lighting Rebate Program

The Home Lighting Rebate (HLR) program provides upstream incentives to partnering manufacturers and retailers in the Kansas City Power and Light Missouri Operations Company (Evergy MO West) and Greater Missouri Operations (Evergy MO West) service territories. In turn, the manufacturers and retailers discount the shelf price of ENERGY STAR-qualified light-emitting diode (LED) bulbs, passing the incentive on to their customers. The program also provides marketing and educational materials at the point of purchase. In program year (PY) 2019, the program supported standard (A-line) LEDs and specialty LEDs (reflectors, floods, candelabras, and globe lamps, among others) in all retail channels for the entire year. The program also sold standard and specialty LEDs through an on-line pop-up store in November and December 2019.

In PY2019, the Evergy MO West HLR program paid an average markdown discount of about $1.62 per standard LED bulb and $2.37 per specialty LED bulb. In PY2019, 10 manufacturers and 11 retailers sold 575,522 standard LEDs and 135,115 specialty LEDs through the Evergy MO West program. Notably 62% of bulb sales occurred in October to December 2019, when Evergy MO West hosted a holiday online popup store and an in-store off-shelf promotion with a specific retailer.

P.5.1 Impact Evaluation Findings & Recommendations

P.5.1.1 Findings

To verify program impacts, the Guidehouse team reviewed tracking databases to assess the thoroughness, clarity, and accuracy of the information provided on program sales, bulb characteristics, and savings assumptions. The evaluation team also performed an engineering desk review, comparing Evergy MO West's energy and demand savings assumptions to evaluated results for Evergy MO West from PY2016 through PY2018. The Guidehouse team estimated HLR energy and demand savings using assumptions drawn from the Illinois Technical Reference Manual (IL TRM) v7, as described in Appendix L.1.

As shown in Table P-22, the HLR program performed strongly in PY2019. The Evergy MO West verified energy savings exceeded reported values, yielding a realization rate of 122%. The program made substantial progress toward the 4-year net energy savings target (65%). Cumulatively, the HLR program has achieved a realization rate of 108% for gross energy savings and secured 147% of the 4-year MEEIA net energy savings target. The Guidehouse team verified a gross demand realization rate of 174% for PY2019, and the program secured 88% of its net demand savings target. The 4-year demand savings realization rate stands at 141%, and the program has achieved 186% of its net demand savings targets.

Table P-22. HLR Program PY2019 Energy and Demand Savings Summary

	Gross			Net		
	Reported Savings	Verified Savings	Realization Rate	MEEIA Cycle 2 4-Year Target	Verified Savings	Percentage of MEEIA 4-Year Target Achieved
Energy at Customer Meter (kWh)	20,876,641	25,384,698	122%	31,610,181	20,556,620	65%
Coinc Demand at Customer Meter (kW)	2,003	3,479	174%	3,197	2,803	88%

Source: Program tracking database and Guidehouse analysis

Table P-23. HLR Program to Date Energy and Demand Savings Summary

	Gross			Net		
	Reported Savings	Verified Savings	Realization Rate	MEEIA Cycle 2 4-Year Target	Verified 3 - Year Savings	Percentage of MEEIA 4-Year Target Achieved
Energy at Customer Meter (kWh)	52,701,893	57,112,164	108%	31,610,181	46,501,447	147%
Coinc Demand at Customer Meter (kW)	5,186	7,333	141%	3,197	5,941	186%

Source: Program tracking database and Guidehouse analysis

Three factors drove the realization rates. Some of these factors increased savings, while others decreased them. This resulted in the observed annual realization rates described above.

1. The first factor, leakage, served to reduce savings. Leakage occurs when customers who live outside of the Evergy MO West and Metro service territories buy HLR program-supported bulbs. In PY2017, the evaluation team calculated leakage to be 14% for the combined Evergy MO service territories (sample sizes were too small to provide unique estimates for each territory).

2. The second factor, cross-sector sales to commercial and industrial (C&I) customers, increased savings, particularly demand savings. Cross-sector sales occur when customers buy HLR program-incentivized bulbs for use in C&I applications. In PY2017, the evaluation team estimated cross-sector sales to be 4%. Savings are higher for cross-sector sales because C&I customer exhibit higher hours of use (HOU) (3,306 hours vs. 1,089 hours for standard and 879 hours for specialty bulbs) and CFs[40] (0.6 vs. 0.13 for standard and 0.12 for specialty).

3. The third factor stems from the decision to update non-evaluated savings assumptions from the IL TRM v5 to v7. IL TRM v7 raised HOU assumptions for standard bulbs, baseline wattage

[40] These coincident factors indicate that C&I customers use their lighting during peak periods more often than residential customers.

assumptions for specialty bulbs (weighted to the mix of bulbs sold in the HLR), and CFs for both standard and specialty bulbs (see PY2018 Appendix L.1 for more details). The IL TRM v7 revisions served to increase savings. The revised Illinois TRM also led to reductions in specialty bulb HOU and waste heat factors (weighted to the mix of bulbs sold in the HLR), which depressed savings.

P.5.1.2 Recommendations

Overall, the HLR program performed strongly in PY2019, as it did throughout MEEIA Cycle 2. The evaluation team encourages the program to continue supporting ENERGY STAR LEDs, but also to monitor the market closely for signs that LED market share could stand on its own without program incentives.

Table P-24 provides a summary of our recommendations. Note that in the in-depth interviews conducted as part of the process evaluation, the IC indicated that the reported sales adhere to Evergy's internal planning TRM for the full MEEIA Cycle 2, making adjustments only when developing the TRM for the next program cycle. However, they do maintain a separate spreadsheet based on the prior year's evaluation recommendations to provide the Evergy program staff with an indication of what verified savings will likely be.

Table P-24. Home Lighting Rebate Program Impact Recommendations

Summary of Recommendations	
1. The implementation contractor should account for leakage when estimating reported savings.	Leakage is assumed to be 14% of HLR LED bulb sales (Evergy MO West currently makes no adjustment for leakage)
2. Align the standard and specialty LED savings assumptions listed below with the IL TRM V7 as outlined in the residential savings assumptions in Appendix L.1	These inputs include: • Annual HOU (weighted by program sales and interior and exterior installation) • Baseline wattages (weighted by program sales in each lumen bin) • Coincident factors • Waste heat factors
3. Account for the C&I cross-sector sales	The C&I cross-sector sales contribution of HLR LED bulb sales by applying HOU and CF values of 3,306 and 0.6, respectively, to 4% of the bulbs sold through the program
4. Adjust NTG to align with evaluated findings	Assume a NTG ratio of 85% for standard LEDs and 66% for specialty LEDs

Source: Guidehouse analysis

P.5.2 Process Evaluation Findings & Recommendations

P.5.2.1 Findings

The HLR program represented approximately 33% of verified gross energy savings in PY2019. The HLR program's process evaluation activities in PY2019 was limited to in-depth interviews with program and IC staff members, but the findings presented here draw on the results of all process evaluation activities for PY2016 to PY2019. This includes gathering input from participating manufacturers and retailers, Evergy MO West residential customers, and light bulb shoppers in retail settings. The Guidehouse team had also

reviewed program marketing and outreach materials. The process evaluation revealed the following findings.

Table P-25. HLR Program Missouri Requirement-Based Findings

Missouri Question	Guidehouse Finding
1. What are the primary market imperfections that are common to the target market?	The program seeks to address imperfections of price, availability, and consumer knowledge of efficient lighting choices. The program has made strong progress on each, offering incentives that reduce the shelf price of LEDs, diversifying the retail channels and venues through which consumers can buy supported LEDs, and engaging in marketing and educational campaigns that explain the benefits of energy efficient lighting. In PY2019, the program expanded offerings to an online popup store through which consumers could purchase multipacks of both standard and specialty bulbs during the holiday season.
2. Is the target market segment appropriately defined, or should it be further subdivided or merged with other market segments?	The program appropriately defines the target market as all residential customers, which is an appropriate definition for the HLR.
3. Does the mix of end-use measures included in the program appropriately reflect the diversity of end-use energy service needs and existing end-use technologies within the target market segment?	The program offered incentives on a wide variety of standard and specialty bulbs, expanding to include bulbs with features such as WiFi (smart) or solar sensors (i.e., dusk to dawn). The IC indicated that they have considered offering downlight retrofit kits and LED fixtures, but the program budget is not sufficient to support incentives for those products at this time.
4. Are the communication channels and delivery mechanisms appropriate for the target market segment?	Evergy MO West and the IC updated program marketing to reflect the new branding. Otherwise, program marketing and outreach mirrored efforts, as these were sufficient given the strong program performance.
5. What can be done to more effectively overcome the identified market imperfections and to increase the rate of customer acceptance and implementation of each end-use measure included in the program?	Guidehouse verified that the Evergy MO West HLR program has achieved 108% of reported savings and 147% of its MEEIA Cycle 2 net savings targets cumulatively between PY2016 and PY2019. Given strong realization rates and progress toward net savings goals, the HLR program has shown great success in increasing consumer acceptance and implementation of ENERGY STAR qualified LED bulbs.

Source: Guidehouse analysis

P.5.2.2 Recommendations

Evergy MO West implemented the recommendations from PY2018, and Guidehouse has no further recommendations for PY2019.

P.6 Home Energy Report Program

Through the Home Energy Reports (HER) program, Evergy MO West distributes single-page print reports by mail to educate residential customers about their home energy usage and provide them with information designed to encourage behavior change in energy usage. The reports contain the following information:

- A comparison of the customer's energy usage to that of similar homes in their area
- A comparison of the customer's energy usage to that of average homes and efficient homes over the last 12 months to show trends and progress over time
- Energy-saving action steps, including no cost or low cost tips
- A month-by-month comparison of the customer's energy usage in the current year to the previous year to show trends and progress over time
- A marketing module that changes each month and highlights different Evergy MO West programs and savings opportunities
- Options to (a) opt out of receiving the reports, (b) go online to find more energy-saving solutions, and (c) view home information used in the similar homes comparison

Customers with an email address on file also receive email monthly reports that contain similar information.

To measure savings impacts for this program, customers are screened for eligibility and then are randomly assigned to either a treatment group (recipients of reports) or a control group (non-recipients) using a randomized control trial (RCT) approach. The control group provides a comparative baseline for measuring the influence and energy savings effect of the program on the treatment group. Customers are grouped into waves based on start date in the program. Program year (PY) 2019 included five waves:

- Evergy MO West 2013
- Evergy MO West 2015
- Evergy MO West 2016
- Evergy MO West 2017
- Evergy MO West 2019

Waves are identified by the year they started throughout this report. Results refer to PY2019 unless otherwise noted.

Customers in all waves received reports in April, July, and October 2019. Customers with email addresses on file (about 50% of customers) also received email reports.

P.6.1 Impact Evaluation Findings & Recommendations

To verify program impacts, the evaluation team referenced IC billing analysis results from February 2020, covering PY2019. These results included the most up-to-date values for each month in PY2019.

P.6.1.1 Findings

The HER program achieved 11,787,812 kWh of verified gross and net incremental energy savings at the customer meter in PY2019. This represents the combined savings from the five waves of customers. The program achieved 56% of the PY2019 Missouri Energy Efficiency Investment Act (MEEIA) target.

The program achieved 3,291 kW of verified gross and net coincident demand savings at the customer meter in PY2019. This represents the combined coincident saving from all five waves of customers. The program achieved 78% of the PY2019 MEEIA target. Demand reductions are based on August energy savings as August is the assumed peak month.

Note that the PY2019 targets are identical to the PY2018 targets although the program was active for only three-quarters of the year.

Table P-26. HER Program PY2019 / Program-to-Date Energy and Demand Savings Summary

	Gross			Net		
	Reported Savings	Verified Savings	Realization Rate	MEEIA Cycle 2 4-Year Target	Verified Savings	Percentage of MEEIA 4-Year Target Achieved
Energy at Customer Meter (kWh)	12,813,477	11,787,812	92%	21,070,772	11,787,812	56%
Coinc Demand at Customer Meter (kW)	3,410	3,291	97%	4,215	3,291	78%

Source: Guidehouse analysis

Verified saving are slightly lower than Reported savings for two reasons: (1) Verified savings include an adjustment for estimated savings due to participation in other energy efficiency programs (“double-counted” savings). This represents cumulative savings from other programs across all program years. (2) Reported savings are based on monthly reports from the implementer to Evergy MO West. Each month Evergy records savings for the month prior. However, implementer reported savings are based on analysis of billing data and billing data can change for about three months after each program month as billing cycles close out and data are verified. As noted, the evaluation team referenced billing analysis results from February 2020 that included the most up-to-date values for each month in PY2019 which will vary slightly from the values recorded throughout PY2019.

P.6.1.2 Recommendations

The tracking data and savings calculations provided by the IC are appropriate for billing analysis of a RCT.

The evaluation team provides recommendations related to the impact evaluation in Table P-27.

Table P-27. HER Program Impact Recommendations

Summary of Recommendations	
1. Continue to use IC-reported savings for tracking purposes.	Historically the evaluated savings for this program align with the implementer-reported savings for this program (not including double-counted savings), affirming that the implementer-reported savings are an estimate of what we expect from evaluation.
2. Evaluate the reported savings with a billing analysis every 2 years to monitor continued consistency between evaluated savings and implementer-reported savings.	As noted, evaluated savings tend to align with implementer-reported savings, however, as the program adds new waves and the composition of waves changes, we recommend verifying results with a billing analysis every 2 years.
3. Evaluate the performance of the 2016 and 2019 waves after a full year of implementation of the new report design with additional features.	The 2016 wave has achieved low percent of household usage savings over time. The new report design might help boost savings. The 2019 wave had low savings for PY2019, but that is often expected in the first year of a wave. Savings often have a ramp-up effect over the first year.
4. After the program integrates AMI data, consider evaluating demand impacts using AMI data from a sample of treatment and control customers. Guidehouse suggests using a post-only difference approach as most customers will not have AMI data available for the pre-period.	The current method for estimating demand impacts is based on energy savings during the peak month. Using AMI hourly data would provide a more direct measurement of demand impacts.

Source: Guidehouse analysis

P.6.2 Process Evaluation Findings & Recommendations

P.6.2.1 Findings

The evaluation team addressed the five Missouri-required questions for process evaluation through staff interviews, a program materials review, and a review of the program implementation contractor's (IC's) PY2018 Customer Engagement Tracker (CET) survey results. The IC did not survey customers in PY2019 so results from the survey refer to PY2018.

Table P-28. HER Program Missouri Requirement-Based Findings

Missouri Question	Guidehouse Findings
1. What are the primary market imperfections that are common to the target market segment?	Some residential customers do not understand how their behaviors, appliances, and electronic devices can affect their energy use and contribute to their monthly bills. Customers are also unaware of cost-effective strategies to reduce energy in their home.
2. Is the target market segment appropriately defined, or should it be further subdivided or merged with other market segments?	The target market segment is appropriately defined as residential customers in single-family homes.
3. Does the mix of end-use measures included in the program appropriately reflect the diversity of end-use energy service needs and existing end-use technologies within the target market segment?	HERs provide a diverse set of suggestions that target all residential end uses. The focus of the report is to modify behaviors; therefore, the program does not offer rebates for specific measures, but does promote rebates provided through other EE programs.

Missouri Question	Guidehouse Findings
4. Are the communication channels and delivery mechanisms appropriate for the target market segment?	The HER program uses two primary communication channels: paper mailed reports and emails.
5. What can be done to more effectively overcome the identified market imperfections and to increase the rate of customer acceptance and implementation of each end-use measure included in the program?	Paper report readership rates are consistent with IC-reported utility averages and email open rates are about 46%. However, there may be opportunities to encourage additional readership.

Source: Guidehouse analysis

P.6.2.2 Recommendations

Guidehouse addressed the five required process evaluation questions set forth in the Missouri regulations[41] for the HER program. Overall, the evaluation team found that the program meets the requirements. The Guidehouse team summarizes its conclusions in Table P-29 and recommends a full process and impact evaluation after the revised reports have been live for a full program year.

Table P-29. HER Missouri Requirement-Based Recommendations

Missouri Question	Guidehouse Recommendation
1. What are the primary market imperfections that are common to the target market?	Evergy MO West should continue providing reports in multiple formats and encouraging customers to log into the Online Energy Audit to help customers understand how to manage their energy use.
2. Is the target market segment appropriately defined, or should it be further subdivided or merged with other market segments?	The target market segment is appropriately defined as residential single-family homes. As the program modifies the reports and add features, Evergy MO West should consider assessing the effectiveness of the program with customers in multifamily homes in order to expand the target market.
3. Does the mix of end-use measures included in the program appropriately reflect the diversity of end-use energy service needs and existing end-use technologies within the target market segment?	The program greatly expanded and revised its library of tips for PY2019. The expanded tips included tips on working from home, new technologies like EV charging and solar subscriptions, as well as more tips on HVAC and appliance use. Guidehouse has no new recommendations.
4. Are the communication channels and delivery mechanisms appropriate for the target market segment?	With launch of the new process that will enable more customers to receive email reports, high bill alerts, and other communications, Evergy MO West may want to consider additional future research on the effectiveness and customer experience with these touchpoints.
5. What can be done to more effectively overcome the identified market imperfections and to increase the rate of customer acceptance and implementation of each end-use measure included in the program?	With increased distribution of email reports and revisions to the look and feel of reports, Evergy MO West may want to consider additional research on effectiveness after the new program elements have been in place for a full year.

Source: Guidehouse analysis

[41] 4 CFR- 240-22.070(8)

P.7 Home Online Energy Audit and Business Online Energy Audit

The Home Online Energy Audit (HOEA) and Business Online Energy Audit (BOEA) for small business are online tools that enable residential and business customers to track and analyze their energy use. The tools also provide educational materials on energy savings for heating, cooling, lighting, and other electrical equipment.

Residential customers in the Evergy MO West territories can access the full functionality of the tools through Evergy's My Account webpage. Residential customers can compare their bills to analyze changes on a monthly or annual basis, retrieve their billing information, compare their home to similar homes using the dashboard comparison, and find out more about where they are using energy in their homes via the Energy Analyzer.

Business customers that are billed based on energy use (kWh) and not demand (kW) can access the tool through My Account. These customers can track their energy and access tips for saving energy. However, they cannot access a neighbor comparison or energy analyzer.

P.7.1 Impact Evaluation Findings & Recommendations

P.7.1.1 Findings

Because the HOEA and BOEA do not claim savings for program activities, a savings impact analysis was not part of the scope of the evaluation.

P.7.1.2 Recommendations

There are no savings associated with the Energy Audit programs. The programs track overall page views and customer-level activity on key program pages such as the Analyzer and Tip Actions. This detailed information is valuable for tracking use of the tools and should be continued.

P.7.2 Process Evaluation Findings & Recommendations

P.7.2.1 Findings

Guidehouse addressed the five Missouri-required questions for process evaluation through the following activities staff interviews, program material review, and review of the PY2018 Home Energy Report (HER) Customer Engagement Tracker (CET) questions that apply to HOEA. The IC did not deploy a CET in PY2019, so results refer to PY2018

Table P-30 provides a summary of the Missouri required process questions and associated answers to those questions.

Table P-30. HOEA and BOEA Programs Missouri Requirement-Based Findings

Missouri Question	Guidehouse Findings
1. What are the primary market imperfections that are common to the target market segment?	Some customers do not understand how their actions and appliances or equipment in their home or business can affect their energy use. The HOEA and BOEA tools educate customers on their energy use and provide tips to help them lower their use.
2. Is the target market segment appropriately defined, or should it be further subdivided or merged with other market segments?	In PY2019, the program targeted residential and small business customers interested in making their homes/businesses more energy efficient and/or reducing their electricity bill. The applicability of energy-saving tips is different for residential and small business customers, so it is appropriate to have separate tools for these groups.
3. Does the mix of end-use measures included in the program appropriately reflect the diversity of end-use energy service needs and existing end-use technologies within the target market segment?	The tools appropriately reflect the diversity of end-use energy service needs of the target market. • The residential tool has five components: o Trends: Customers can view their energy usage over time. They can also view trends of "efficient" and "all neighbors" over time. The page also includes energy saving tips. o Compare: Customers can view their current usage compared to similar homes. The page also includes energy saving tips. o Analyze: This is an online survey that helps customers understand the sources of their energy use. The page also includes energy saving tips. o Save: This tip library provides practical suggestions for customers to reduce their energy use. The guides use customer attributes to generate personalized guides and include common residential end uses such as lighting, HVAC, pools, and plug loads. o Reports: Home Energy Report recipients can opt-out and designate their preferred communication channel. • The small business tool has three components: o My Energy Usage: Customers can view their own usage on a monthly or annual basis. o Ways to Save: This tip library provides business-specific suggestions in the areas of lighting, HVAC, and refrigeration for customers to reduce their energy use. The library contains over 30 tips.
4. Are the communication channels and delivery mechanisms appropriate for the target market segment?	Both communication channels and delivery mechanisms are appropriate for the target market segments. In PY2019 Evergy Metro cross-promoted HOEA through multiple channels including a series of emails related to the utility re-branding and the HERs. • Across all Evergy MO territory, 3,342 customers completed the Analyzer survey and in total completed or plan to complete 8,536 energy-saving tips. • BOEA did not do any targeted communications in PY2019 pending changes to the program expected in 2020/2021.

Missouri Question	Guidehouse Findings
5. What can be done to more effectively overcome the identified market imperfections and to increase the rate of customer acceptance and implementation of each end-use measure included in the program?	The main barrier to entry for residential customers is awareness of and understanding how to use the tools. Evergy has continually address these through extensive cross promotion through web, social media, email campaigns, and cross-promoting through other programs. Evergy has also made the tools easier use through embedded widgets. With a single sign on and no load time, customers have a more seamless experience. Every widget or page of the tool includes energy-saving tips, ensuring that even if customers use only a portion of the available tools, they still receive tips. The main barrier to entry for small business customers is likely time and perceived value of the tools. Evergy is planning to address these barriers with change to the program expected in 2020/2021.

Source: Guidehouse analysis

P.7.2.2 Recommendations

Guidehouse addressed the five required process evaluation questions set forth in the Missouri regulations[42] for HOEA and BOEA. Overall, the evaluation team found that the program meets the requirements. Table P-31 summarizes the team's conclusions, and the team recommends more in-depth evaluation after the revised tools have been live for a full program year.

Table P-31. HOEA and BOEA Missouri Requirement-Based Recommendations

Missouri Question	Guidehouse Recommendation
1. What are the primary market imperfections that are common to the target market?	After the revised tools have been active for several months, Evergy MO West may want to consider gathering additional feedback from customers to understand, from the customer perspective, how effectively the tools engage and educate customers on their energy use and how to reduce their energy use.
2. Is the target market segment appropriately defined, or should it be further subdivided or merged with other market segments?	Evergy MO West should continue to monitor the effectiveness of outreach to ensure residential and small business customers learn about the tools. Evergy Metro may want to consider segmentation or propensity modeling to understand who is using the tools and who is not to better target both groups.
3. **Does the mix of end-use measures included in the program appropriately reflect the diversity of end-use energy service needs and existing end-use technologies within the target market segment?**	Evergy MO West could consider a quick analysis to assess savings associated with the program by assigning rough estimates to the tips and applying those estimates to customers who indicated they have taken the tip action.
4. **Are the communication channels and delivery mechanisms appropriate for the target market segment?**	Evergy MO West has used a variety of communication channels in the past. With the launch of the updated tools, using and assessing the efficacy of a variety of channels will continue to be important.

[42] 4 CFR- 240-22.070(8)

Missouri Question	Guidehouse Recommendation
5. **What can be done to more effectively overcome the identified market imperfections and to increase the rate of customer acceptance and implementation of each end-use measure included in the program?**	After the new tools have been active for several months Evergy may want to assess the most effective approaches to drive different types of customers to the tools through A/B testing, propensity modeling, or other approaches.

Source: Guidehouse analysis

P.8 Residential and Business Programmable Thermostat Programs

The Residential and Business Programmable Thermostat (PT) programs incentivize customers to sign up to receive a Nest thermostat at no cost or for an incentive on their previously owned Nest thermostat. By participating in this Rush Hour Rewards (RHR) program, customers allow Evergy to remotely operate their HVAC system during peak demand periods by sending a signal to participating thermostats. The thermostats help participants save energy throughout the year through optimization algorithms that learn participants' HVAC use. Finally, thermostat customers can elect to enroll in the Seasonal Savings (SS) program, which further optimizes energy efficiency through more aggressive cooling schedules.

In Cycle 2, customers participated through three delivery channels:

1. **Do It Yourself (DIY):** These participants are customers who sign up for the program through the online web portal and receive their free thermostat in the mail. DIY participants install the thermostat themselves and receive a $50 incentive upon installation. These customers receive a $25 incentive each year they remain in the program. DIY participants are the most common type of thermostat participant in PY2016, PY2017 and PY2019. The DIY delivery channel was shut down in PY2018 because the implementation contractor would have had to prematurely stop the program until the next Cycle due to high enrollment numbers via the portal.

2. **Direct Install (DI):** These participants sign up for the program, and CLEAResult sends technicians to install the free thermostat. They also receive a $25 incentive each year they remain in the program.

3. **Bring Your Own Device (BYOT):** These participants already own a Nest thermostat when they sign up for the program. Upon program enrollment, they receive a $100 incentive. These customers also receive a $25 incentive each year they remain in the program.

Evergy met its enrollment targets. With new target for the Cycle 2 extension year, Evergy reopened the DIY portal. In addition, the utility increased marketing of the BYOT channel.

P.8.1 Impact Evaluation Findings & Recommendations

P.8.1.1 Findings

As shown in Table P-32 and Table P-33, the Residential PT program achieved 732,352 kWh of energy savings at the customer meter in PY2019 for a realization rate of 110%, meeting 10% of the 4-year MEEIA target in PY2019. The program achieved 4,841 kW of demand impact in PY2019 for a realization rate of 97%, meeting 23% of the 4-year MEEIA target. Over the 4-year cycle, the program achieved 83% of its target for energy savings and exceeded its target for demand savings by achieving 143%.

As shown in Table P-34 and Table P-35, the Business PT program achieved 20,164 kWh of energy savings at the customer meter in PY2019 for a realization rate of 128%, meeting 20% of the 4-year MEEIA target. The program achieved 120 kW of demand impact in PY2019 for a realization rate of 107%, meeting 45% of the 4-year MEEIA target. Over the 4-year cycle, the program strongly exceeded its 4-year MEEIA targets by achieving 151% of its target for energy savings and 322% of its target for demand savings.

Table P-32. Residential PT PY2019 Energy and Demand Savings Summary

	Gross			Net		
	Reported Savings	Verified Savings	Realization Rate	MEEIA Cycle 2 4-Year Target	Verified Savings	Percentage of MEEIA 4-Year Target Achieved
Energy at Customer Meter (kWh)	665,269	732,352	110%	7,680,173	732,352	10%
Coinc Demand at Customer Meter (kW)	5,012	4,841	97%	20,946	4,841	23%

Source: Guidehouse analysis

Table P-33. Residential PT Program to Date Energy and Demand Savings Summary

	Gross			Net		
	Reported Savings	Verified Savings	Realization Rate	MEEIA Cycle 2 4-Year Target	Verified 3 - Year Savings	Percentage of MEEIA 4-Year Target Achieved
Energy at Customer Meter (kWh)	9,653,941	6,363,521	66%	7,680,173	6,363,521	83%
Coinc Demand at Customer Meter (kW)	29,561	29,897	101%	20,946	29,897	143%

Source: Guidehouse analysis

Table P-34. Business PT PY2019 Energy and Demand Savings Summary*

	Gross			Net		
	Reported Savings	Verified Savings	Realization Rate	MEEIA Cycle 2 4-Year Target	Verified Savings	Percentage of MEEIA 4-Year Target Achieved
Energy at Customer Meter (kWh)	15,760	20,164	128%	98,753	20,164	20%
Coinc Demand at Customer Meter (kW)	113	120	107%	269	120	45%

Source: Guidehouse analysis

Table P-35. Business PT Program to Date Energy and Demand Savings Summary*

	Gross			Net		
	Reported Savings	Verified Savings	Realization Rate	MEEIA Cycle 2 4-Year Target	Verified 3 - Year Savings	Percentage of MEEIA 4-Year Target Achieved
Energy at Customer Meter (kWh)	255,076	149,032	58%	98,753	149,032	151%
Coinc Demand at Customer Meter (kW)	768	868	113%	269	868	322%

Source: Guidehouse analysis

Key drivers of the realization rate are summarized as follows:

- Verified savings are calculated using per-device deemed savings as well as the number of thermostats in the program and enrolled in RHR by the end of the program year.
- Energy deemed savings value of 197 kWh per device is based on billing data utilized in the PY2017 analysis.
- Demand deemed savings of 1.40 kW per device is based on telemetry data utilized in the PY2017 analysis.
- Reported savings also rely on the same per device deemed savings values but calculate the number of enrolled thermostats differently[43]. Thus, the realization rate can be different from 100%.

P.8.1.2 Recommendations

Guidehouse's impact recommendations in PY2017 centered around further areas for analytical investigation and customer education, some of which are still valid recommendations in PY2019. Table P-36Table P-3 provides a summary of our recommendations.

[43] For energy savings, Guidehouse includes DIY thermostats with a Work Order Date in PY2019 and DI thermostats with a Completion Date within PY2019. For demand savings, Guidehouse includes BYOT, DIY, and DI thermostats with a Completion Date within PY2019.

Table P-36. Residential and Business Programmable Thermostat Programs Impact Recommendations

Summary of Recommendations	
1. Refresh Deemed Savings Value with Regression Analysis	Guidehouse recommends conducting a refreshed regression analysis to reevaluate the per-device deemed savings value. In conjunction with the regression analysis, Evergy could test the impacts of RHR events under a variety of conditions or conduct an analysis to identify non-participating thermostats as recommended in the PY2018 report.
2. Achieve More Savings	The PY2018 process evaluation identified that some customers took additional energy saving actions during events. Evergy should consider using AMI data to identify non-thermostat related impacts during event hours.

Source: Guidehouse analysis

P.8.2 Process Evaluation Findings & Recommendations

P.8.2.1 Findings

Guidehouse addressed two process evaluation research questions and the five Missouri-required questions for process evaluation through the staff interviews, IC interviews, and program materials review. The process evaluation revealed the following findings.

Table P-37 provides a summary of the Missouri required process questions and associated answers to those questions.

Table P-37. Residential and Business Programmable Thermostat Programs Missouri Requirement-Based Findings

Missouri Question	Guidehouse Findings
1. What are the primary market imperfections that are common to the target market segment?	As noted in the PY2018 evaluation, the program addresses market imperfections by providing customers with an ability to reduce electricity usage during hours of peak demand.
2. Is the target market segment appropriately defined, or should it be further subdivided or merged with other market segments?	Evergy resumed recruitment efforts of customers in PY2019 to meet their enrollment targets. In MEEIA Cycle 3, Guidehouse recommends focusing on BYOT and waitlist customers. In MEEIA Cycle 3, Evergy may consider targeting a more staggered program enrollment over the cycle's duration.
3. Does the mix of end-use measures included in the program appropriately reflect the diversity of end-use energy service needs and existing end-use technologies within the target market segment?	The mix of end-use measures included in the program (i.e., PTs) meets the needs of the existing market. Evergy is expanding the program to include customers that have already purchased other brands of smart or connected thermostats. In addition, Evergy could continue expanding the BYOT customer segment through targeted marketing in MEEIA Cycle 3. BYOT programs are comparatively inexpensive to operate and a way that many utilities run thermostat programs successfully.
4. Are the communication channels and delivery mechanisms appropriate for the target market segment?	In PY2019, Evergy successfully released an online customer portal to better communicate with and educate customers.

Missouri Question	Guidehouse Findings
5. What can be done to more effectively overcome the identified market imperfections and to increase the rate of customer acceptance and implementation of each end-use measure included in the program?	As noted in PY2019, Evergy should monitor program savings targets in addition to enrollment goals to ensure that program cost-effectiveness remains high. Guidehouse acknowledges Evergy addressed this issue in PY2019, identifying the need to expand the low-cost BYOT channel.

Source: Guidehouse analysis

P.8.2.2 Recommendations

Guidehouse addressed the five required process evaluation questions set forth in the Missouri regulations[44] for the Residential and Business PT programs. Table P-38 details recommendations surrounding these questions.

Table P-38. PT Programs Missouri Requirement-Based Recommendations

Missouri Question	Guidehouse Recommendation
1. What are the primary market imperfections that are common to the target market?	Continuing to monitor the market for how the Nest solution compares to competition, especially as Evergy rolls out the Ecobee option, can help ensure the program is matching the market.
2. Is the target market segment appropriately defined, or should it be further subdivided or merged with other market segments?	Evergy met enrollment targets in PY2019. Guidehouse recommends a continued focus on BYOD customers, whose acquisition costs are lower.
3. Does the mix of end-use measures included in the program appropriately reflect the diversity of end-use energy service needs and existing end-use technologies within the target market segment?	Evergy should continue to explore opportunities to include other brands of WiFi thermostats. This will widen the pool of potential participants, especially BYOD customers who have low cost of acquisition.
4. Are the communication channels and delivery mechanisms appropriate for the target market segment?	Evergy should consider further educating customers on event notification options and the purpose of DR events to reduce customer confusion and increase program satisfaction. The program should continue to focus communication channels around activating DIY thermostats that have yet to be activated.
5. What can be done to more effectively overcome the identified market imperfections and to increase the rate of customer acceptance and implementation of each end-use measure included in the program?	In PY2018, Guidehouse recommended expanding the program to reach more multifamily participants. If the barriers to participation for this segment can be overcome, the program could access a new pool of participants to increase energy and DR impacts.

Source: Guidehouse analysis

[44] 4 CFR- 240-22.070(8)

P.9 Demand Response Incentive Program

The Demand Response Incentive (DRI) program provides rebates to commercial and industrial (C&I) customers for curtailing energy usage during system peak demand periods. Participating customers provide Evergy with demand reduction capacity by committing to reduce electric load upon request during the demand response (DR) curtailment season (June-September). During enrollment, participants sign a contract that obligates them to reduce electric load to a predefined firm power level (FPL) during curtailment events.

Evergy agrees to limit curtailment events to a maximum of 10 events during the season. Events are restricted to weekdays from 12:00 p.m. to 8:00 p.m. Participating customers receive an event notification at least 4 hours before the event starts and are often notified a full day before the event's start.

CLEAResult, the implementation contractor (IC), recruits C&I customers for participation. The Evergy meter data management (MDM) system maintains the interval data used for billing and this analysis. In PY2019, Evergy engaged with OATI to create a distributed resource management system (DERMS) to send event notifications.

Participants receive two different incentives for participating in the program:

1. **Participation payment:** A monthly participation payment of $32.50 per participating kW for being on call to curtail load. These payments are provided as either bill credits (settled on the following bill monthly during the DR season) or by paper check at the end of the DR season.

    a. The annual payment of $32.50 per kW is paid in equal payments to each participant over the 4-month DR season.

2. **Event payment:** An additional payment per curtailment event of $0.075/kW per hour curtailed up to the first 30 hours of dispatch and $0.25/kW for the remaining 50 hours of dispatch. These variable payments are paid at the end of the DR season. This payment is a net true up of what the customer did or did not perform over each of the event periods. Customers are accountable to pay a penalty[45] if they do not meet their contracted FPL.

P.9.1 Impact Evaluation Findings & Recommendations

P.9.1.1 Findings

Guidehouse verified impacts for nine Evergy Metro customers. All of the customers had sufficient data for regression or CBL analysis. The evaluation team verified impacts for 104 customers using a customer-specific regression analysis using participant interval data from May 2019 through September 2019. The team employed a CBL approach for twelve customers who had inconsistent usage patterns relative to observable variables (i.e., temperature, day of week, hour of day) and whose interval usage data was not well explained by a regression model. Customer-specific impact estimates were averaged across all hours of the event to get the full program impact.

[45] As defined in the DRI customer contract: Penalty Per Hour = 150%*(1-%Performance)*HRP, %Performance = Curtailable Load Actual/ Curtailable Load Contractual, Hourly Payment (HRP) = ($32.50 * Curtailable Load Contractual)/ 80 hours.

Table P-39. DRI PY2019 Demand Impact Summary[46]

	Gross			Net		
	Reported Savings	Verified Savings	Realization Rate	MEEIA Cycle 2 4-Year Target	Verified Savings	Percentage of MEEIA 4-Year Target Achieved
MEEIA Participant Demand Savings (kW)	36,428	30,983	85%	-	-	-
Opt-Out Demand Savings (kW)	3,058	957	31%			
Total Demand Savings (kW)	**39,486**	**31,940**	**81%**	**55,000**	**31,940**	**58%**

Source: Guidehouse analysis

The DRI program achieved 39,486 kW of gross and net demand impacts in PY2019 for a realization rate of 81%. In PY2019, the program achieved 58% of the 4-year Missouri Energy Efficiency Investment Act (MEEIA) target. Reported and verified demand impacts are based on the amount of electricity curtailed, not whether customers met their FPL. Evergy does not claim energy savings for DRI; thus, the evaluation team did not calculate energy savings. Guidehouse assumes energy loads to be mostly shifted to times outside of the event period.

The realization rate increased from 62% in PY2018 to 81% in PY2019, with roughly half of customers meeting their contracted curtailable load. Guidehouse found that:

- Sixty-three of the 116 customers performed at less than 80% of their contracted curtailable load during event hours.
- Sixteen of the 116 customers performed at more than 120% of their contracted curtailable load during event hours.
- Thirty-seven of the 116 customers performed within 20% of their contracted curtailable load during event hours.

Some customers that performed at less than 80% of their contracted curtailable load did not respond to the event at all, while others responded but did not reach what they had contracted. This emphasizes the need for both behavior management among customers and a need to recalculate EPD and CL— both of which the Evergy product manager prioritized for the Cycle 2 extension participants. Many customers who did not respond at all will not be invited back into the program for Cycle 3. To further motivate participation, the Evergy product manager is moving to a "pay-for-performance" settlement process beginning in Cycle 3.

P.9.1.2 Recommendations

Overall, Guidehouse found that the DRI program is limited by the fundamental program design, making it difficult to reach the 3-year program target. The Evergy product manager implemented many process improvements during PY2018 and PY2019, but there are still many customers who continue to miss their

[46] DR impacts persist for 1 year and, therefore, do not accumulate year over year. As a result, the program-to-date achievements for DRI are equal to those in the most recent year.

contracted CL yet still receive participation incentive payments. The following impact and process recommendations are based on the evaluation team's analysis of program interval and tracking data, interviews with the Evergy product manager and IC, and a program materials review. Table P-40 provides a summary of our recommendations.

Table P-40. DRI Program Impact Recommendations

Summary of Recommendations	
1. Guidehouse provides the following recommendations regarding program design	Guidehouse acknowledges the program will move toward a "pay-for-performance" incentive structure that calculates customer performance and corresponding payment following each event in Cycle 3. Guidehouse recommends that Evergy identify customer-specific baselines in advance of the next DR season to best align performance payment calculations and end-of-season EM&V impacts.
2. Guidehouse provides the following recommendations regarding tracking and interval data	Guidehouse, Evergy, and the implementation contractor successfully collaborated on data transfer protocols, including establishing a daily data transfer process, and recommends continuing the process in Cycle 3. With AMI data available within a few days, Guidehouse recommends making use of that data to calculate impacts immediately following each event.

Source: Guidehouse analysis

P.9.2 Process Evaluation Findings & Recommendations

P.9.2.1 Findings

Table P-41 provides a summary of the Missouri required process questions and associated answers to those questions.

Table P-41. DRI Program Missouri Requirement-Based Findings

Missouri Question	Guidehouse Findings
1. What are the primary market imperfections that are common to the target market segment?	CLEAResult continued using propensity modeling in PY2019 to select customers to recruit.
2. Is the target market segment appropriately defined, or should it be further subdivided or merged with other market segments?	The target market is appropriately defined.
3. Does the mix of end-use measures included in the program appropriately reflect the diversity of end-use energy service needs and existing end-use technologies within the target market segment?	The mix of end-use measures appropriately reflects the diversity of end-use energy needs. Evergy should consider the impacts of weather when determining a participant's curtailable load in cool summers.

Missouri Question	Guidehouse Findings
4. Are the communication channels and delivery mechanisms appropriate for the target market segment?	Per PY2017 recommendation, as AMI becomes more prevalent, Evergy has worked hard to provide more consistent updates to participants regarding their program performance. Guidehouse recommends continuing this effort in preparation for a "pay-for-performance" incentive structure in which immediate event feedback in required from DERMS. Such capabilities would also allow for more periodic updates of participants' event target values (FPLs), as recommended in PY2017.
5. What can be done to more effectively overcome the identified market imperfections and to increase the rate of customer acceptance and implementation of each end-use measure included in the program?	In PY2019, the DRI product manager made progress to better manage participants' event behavior. The results of the PY2019 impact evaluation reveal limitations in what performance improvements are achievable through behavior management due to the fundamental program design.

Source: Guidehouse analysis

P.9.2.2 Recommendations

Guidehouse addressed the five required process evaluation questions set forth in the Missouri regulations[47] for the DRI program.

[47] 4 CFR- 240-22.070(8)

Table P-42. DRI Missouri Requirement-Based Recommendations

Missouri Question	Guidehouse Recommendation
1. What are the primary market imperfections that are common to the target market?	Evergy should continue to refine propensity modeling to select customers for the program. Additionally, Evergy should begin to identify and target customers with automated curtailment capabilities.
2. Is the target market segment appropriately defined, or should it be further subdivided or merged with other market segments?	Guidehouse has not recommendations regarding the target market.
3. Does the mix of end-use measures included in the program appropriately reflect the diversity of end-use energy service needs and existing end-use technologies within the target market segment?	Customers with highly volatile loads have underperformed because their load is not a “firm” resource that can be relied upon (e.g. a highly volatile customer may already be below their FPL on the event day with no load to shed). Guidehouse recommends avoiding recruiting these customers into the program.
4. Are the communication channels and delivery mechanisms appropriate for the target market segment?	Access to real-time data will allow the program manager to have preliminary results much sooner than the end of the season.
5. What can be done to more effectively overcome the identified market imperfections and to increase the rate of customer acceptance and implementation of each end-use measure included in the program?	Guidehouse recommends moving to a “pay-for-performance” incentive structure to increase event participation in Cycle 3. As noted earlier, the DRI Product Manager is planning to adopt this recommendation in MEEIA Cycle 3.

Source: Guidehouse analysis