

## MidAmerican Energy Company

# Residential Behavioral Program Impact and Process Evaluation



TETRA TECH

ILLUME

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## 1.0 EXECUTIVE SUMMARY

MidAmerican Energy Company (MidAmerican) offers energy efficiency programs to its customers throughout their Iowa and Illinois service territories. These programs cover electric and natural gas energy efficiency measures, as well as other service and education offerings such as those offered through the Residential Behavioral program. This report details the activities, results, and recommendations from the evaluation of program year 2020 (PY2020) for the Residential Behavioral program in MidAmerican's Iowa and Illinois service territories.

### 1.1 BACKGROUND

The Residential Behavioral program is designed to encourage energy savings through behavioral modification. The program mails Home Energy Reports (HERs) to targeted customers on an opt-out basis. HERs contained personalized information about their energy use, including a comparison of their energy usage to similar homes in their area, a historical analysis of monthly usage (over the past year), and energy savings tips. Energy-saving tips varied by season and cohort and may have included no-cost or low-cost tips as well as suggestions for other MidAmerican energy efficiency programs or rebates. In PY2020, due to COVID-19, MidAmerican customized the report design to display relevant tips and, in some months, suppressed the similar homes comparison.

For PY2014-PY2018, most customers received about six paper reports per calendar year. Starting in PY2019, MidAmerican reduced the frequency for mailing paper HERs. In PY2019, earlier cohorts (groups) in Iowa received two paper reports while the newest cohort (Iowa Reduction Backfill) received four reports. In PY2020, all recipients in Iowa received two paper reports per year. In Illinois for PY2020, customers in their first year of the program received six reports per year, while customers who have been in the program for two or more years received four reports per year. All participating customers were provided an option to enroll in email reports.

In PY2020, the program included eight distinct cohorts—six cohorts were comprised of Iowa customers (including two low-income cohorts) and two cohorts were comprised of Illinois customers. With the exception of the low-income cohorts, the program has targeted high-usage customers, as these customers have a greater potential for energy savings.

Like other HER programs, the program is designed as a Randomized Control Trial (RCT), where the HER recipients (the treatment group) were randomly selected from a larger group of eligible customers, and the remaining randomly-selected group of eligible customers was the control group (did not receive HERs). The RCT design allows for direct estimation of net savings by comparing changes in consumption of the treatment group to the control group.

The table below details the various cohorts, including treatment and control group sizes and fuel type.



**Table 1. Cohort Characteristics and Sizes by State**

Cohort	Start Month	Treatment Group Size (January 2020)	Control Group Size (January 2020)	Fuel Type
Iowa				
Iowa Pilot*	November 2011	28,195	14,052	Dual Fuel
Iowa Expansion*	March 2014	80,959	12,477	Dual Fuel
Iowa Refill	February 2016	24,695	7,402	Dual Fuel
Iowa Reduction Backfill	January 2017	12,017	7,939	Dual Fuel
		33,254	9,462	Electric Only
Iowa Low-Income	June 2014	6,639	-	Dual Fuel
		2,900	-	Electric Only
Iowa Low-Income Refill	November 2017	12,315	-	Dual Fuel
		3,694	-	Electric Only
Illinois				
Illinois Expansion	June 2014	29,963	5,823	Dual Fuel
Illinois Rolling Enrollment	November 2017	16,599	5,255	Dual Fuel
		4,842	1,499	Electric Only

\* Indicates cohort was involved in the reduced treatment frequency test (see Section 3.4 for details).

## 1.2 EVALUATION METHODOLOGY

This evaluation included both impact and process components. For the impact evaluation, the Tetra Tech team leveraged the experimental design (RCT) of the program to calculate electricity and natural gas program net savings by analyzing monthly billing data for each standard income cohort for PY2020<sup>1</sup>. Because some of the savings identified by the billing analysis may have been achieved through cross-participation in other MidAmerican energy efficiency programs, the impact analysis also included a program “channeling analysis” to estimate the program savings that could have been double-counted through participation in these other programs (e.g., HomeCheck Online®, Residential Equipment).

To assess program processes, the Tetra Tech team sampled treatment and control customers from each of the distinct treatment and control cohorts and sent a postcard invitation to participate in an online survey. The objective was to understand differences between treatment and control groups in MidAmerican program awareness, satisfaction, and actions taken toward energy efficiency. For treatment groups, the survey gathered feedback on customers’ recall, readership, and opinions of the HER. The Tetra Tech team also explored whether there were differences in treatment customer experiences between standard income treatment groups and low-income treatment groups.

<sup>1</sup> Savings were not calculated for the low-income cohorts, as the program does not claim these savings.

### 1.3 SUMMARY OF KEY FINDINGS AND RECOMMENDATIONS

Overall, it is the opinion of the Tetra Tech team that the Residential Behavioral program was run well and efficiently for PY2020. In particular, PY2020 energy efficiency programs were impacted by COVID-19 across the country and MidAmerican's Residential Behavioral program achieved expected average household savings, even with more customers using more electricity while working and schooling from home. In our professional experience, behavioral programs of this type prior to COVID-19 typically generated average household electric savings of 1.0 to 2.0 percent of baseline energy and average household natural gas savings of 0.5 to 1.5 percent. Overall, the Iowa cohorts achieved average household electricity savings of 1.51 percent and the Illinois cohorts achieved average household electricity savings of 1.60 percent. The Illinois cohorts achieved average household gas savings of 0.83 percent. MidAmerican does not claim natural gas savings from this program in Iowa, however, because the program still generates natural gas savings as a result of dual fuel customers receiving treatment, gas savings and realization rates are still presented and discussed to some extent.

On a per-household basis, average daily energy savings<sup>2</sup> were highest for both fuels for the Iowa Pilot cohort, though the Iowa Reduction Refill - Electric Only and the Illinois Expansion cohorts also generated substantial average daily electric savings. These three cohorts had the highest pre-period baseline consumption which, like other HER studies across the country, correlates to higher savings. Additionally, the Iowa Pilot is the longest-standing group and savings tend to increase over time in these types of longer-term cohorts for other HER programs.

**Table 2. Unadjusted Evaluated Net Electric Savings and 90% Confidence Intervals**

Electric Cohorts	Start Month	Average Daily Household Electric Savings	Unadjusted Net Evaluated (MWh)	90% Confidence Interval (MWh)
Iowa Pilot	November 2011	2.15%	7,046	±688
Iowa Reduction Backfill - Electric Only	January 2017	1.89%	12,042	±1,226
Iowa Expansion	March 2014	1.22%	10,889	±1,716
Iowa Reduction Backfill - Dual Fuel	January 2017	0.90%	725	±256
Iowa Refill	February 2016	0.86%	1,882	±653
<b>Iowa Total</b>		<b>1.51%</b>	<b>32,584</b>	
Illinois Expansion	June 2014	1.80%	4,954	±886
Illinois Rolling Enrollment	November 2017	1.33%	2,313	±1,939
<b>Illinois Total</b>		<b>1.62%</b>	<b>7,267</b>	

<sup>2</sup> When comparing savings between cohorts or fuels, the Tetra Tech team used industry standard practices, and assessed average daily savings because some households move/drop out of program, so not all households have a full year of billing data. As a result, data is normalized on the number of days in the program. At the model level, the Tetra Tech team used average daily consumption for each billing month for a similar reason; billing months/calendar months do not have the same number of days. When reporting savings, it is then based on the actual number of days each household was in the program for that program year.

**Table 3. Unadjusted Evaluated Net Natural Gas Savings and 90% Confidence Intervals**

Natural Gas Cohorts	Start Month	Average Daily Household Natural Gas Savings	Unadjusted Net Evaluated (therms)	90% Confidence Interval (therms)
Iowa Pilot	November 2011	1.34%	359,481	±42,888
Iowa Expansion	March 2014	0.87%	556,029	±93,310
<b>Iowa Total</b>		<b>1.01%</b>	<b>915,510</b>	
Illinois Rolling Enrollment	November 2017	0.91%	109,916	±172,648
Illinois Expansion	June 2014	0.78%	170,561	±51,177
<b>Illinois Total</b>		<b>0.83%</b>	<b>280,477</b>	

Evaluated savings also generally aligned well with implementer reported values. The overall unadjusted realization rate for net electric savings in Iowa was 105 percent, while the overall unadjusted realization rate for net electric savings in Illinois was 96 percent<sup>3</sup>. The overall realization rate for unadjusted natural gas savings in Illinois was 115 percent. Adjustments to the evaluated savings to account for cross-channeled savings were negligible, accounting for only 1.60 percent of evaluated electric savings in Iowa (521 MWh), and 0.73 percent of evaluated electric savings in Illinois (56 MWh); there were no channeled gas savings in Illinois.

**Table 4. PY2020 Electric Impacts**

Electric Cohorts	Implementer-Reported Net (MWh)	Unadjusted Net Savings		Adjusted Net Savings	
		Unadjusted Evaluated Net (MWh)	Unadjusted Realization Rate	Adjusted Evaluated Net (MWh)	Adjusted Realization Rate
Iowa Pilot	6,976	7,046	101%	6,984	100%
Iowa Expansion	8,870	10,889	123%	10,755	121%
Iowa Refill	1,957	1882	96%	1,861	95%
Iowa Reduction Refill	13,158	12767	97%	12,464	95%
<b>Iowa Total</b>	<b>30,961</b>	<b>32,584</b>	<b>105%</b>	<b>32,063</b>	<b>104%</b>
Illinois Expansion	5,352	4,954	93%	4,898	92%
Illinois Rolling Enrollment	2,187	2,313	106%	2,313	106%
<b>Illinois Total</b>	<b>7,539</b>	<b>7,267</b>	<b>96%</b>	<b>7,211</b>	<b>96%</b>

<sup>3</sup> The *unadjusted* realization rate is calculated as evaluated net savings unadjusted for program channeling (cross-participation) divided by implementer-reported net savings, while the *adjusted* realization rate accounts for channeled savings (cross-participation) from other MidAmerican residential energy efficiency programs. The implementer-reported net savings were not adjusted for double-counting due to program channeling, and while the Tetra Tech team did evaluate the impacts of cross program participation, we do not recommend adjusting the savings values due to the low and variable channeled savings values. The methodology for estimating double-counted savings due to program channeling is provided in Appendix C.

Table 5. PY2020 Natural Gas Impacts

Natural Gas Cohorts	Implementer-Reported Net (therms)	Unadjusted Net Savings		Adjusted Net Savings	
		Unadjusted Evaluated Net (therms)	Unadjusted Realization Rate	Adjusted Evaluated Net (therms)	Adjusted Realization Rate
Iowa Pilot	360,144	359,481	100%	359,481	100%
Iowa Expansion	504,412	556,029	110%	553,463	110%
Iowa Refill	N/A	N/A	N/A	N/A	N/A
Iowa Reduction Refill	N/A	N/A	N/A	N/A	N/A
<b>Iowa Total</b>	<b>864,555</b>	<b>915,510</b>	<b>106%</b>	<b>912,944</b>	<b>106%</b>
Illinois Expansion	123,098	170,561	139%	170,561	139%
Illinois Rolling Enrollment	121,634	109,916	90%	109,916	90%
<b>Illinois Total</b>	<b>244,733</b>	<b>280,477</b>	<b>115%</b>	<b>280,477</b>	<b>115%</b>

The Tetra Tech team confirmed that treatment and control group customers were equivalent with each other. The results of the statistical equivalency check of pre-period energy consumption showed that energy usage between the two groups was statistically equivalent prior to report delivery, for all cohorts and fuel types, while survey results showed that customers in these groups were characteristically similar across various demographics. Surveyed customers in both the treatment and control groups had statistically similar characteristics in all regards, including income, household size, and age. The exception was home ownership, where slightly more treatment customers were homeowners (99 percent) than control customers (95 percent).<sup>4</sup>

Surveyed HER recipients said they were engaged with the reports, found them useful, and were satisfied with them. Most HER recipients (71 percent) completing the online survey also said that HERs were a motivator for them to complete energy savings actions like cleaning or replacing air filters or setting their thermostats to 68 degrees or lower in the winter<sup>5</sup>. Treatment group customers reported a higher awareness of the heating and cooling equipment rebates than other groups, as expected. Customers across all groups, including the control group, were satisfied with the services they received from MidAmerican.

Next the Tetra Tech team presents key findings from the evaluation and associated recommendations.

**Finding #1: Residential Behavior participant survey responses indicate that the program is well-received.** HER recipients gave high ratings of program satisfaction, HER module usefulness, and satisfaction with MidAmerican's services in general.

**Finding #1a: HER recipients were highly satisfied with the program and engaged with reports.** The survey asked HER recipients to rate their satisfaction with the reports they

<sup>4</sup> While these numbers are not statistically significant, they are still quite close, and both rates are very high. The differences between rate of homeownership between treatment and control customers is significant with 90% confidence (p-value≤0.10).

<sup>5</sup> Because these types of measures are not rebated through any of MidAmerican's residential energy efficiency programs, the Tetra Tech team could not verify completion of these types of energy saving actions. However, it is clear from the average daily household savings analysis that customers are taking action.

received. Most customers said they were “very” or “extremely” satisfied (74 percent), with about another quarter saying they were “somewhat” satisfied. Customers were highly engaged with HERs and found the information useful. Most HER recipients said they recalled receiving a HER (93 percent). Of these, most customers said they either read or glanced through the most recent report they received (96 percent). Most customers said the sections of the HER were “somewhat” or “very useful” (83 to 97 percent), with the highest ratings given for the Track Your Progress section (97 percent). These findings were consistent across standard income treatment and low-income treatment groups.

**Finding #1b: HER recipients found the similar homes comparison useful, and their satisfaction with this element generally corresponded with the evaluation report findings, which is consistent with prior evaluations.** Most surveyed customers who recalled receiving a HER and seeing the comparison of their monthly use with similar homes in the area said the similar homes comparison was “useful” (83 percent). Additionally, overall satisfaction with the HERs was higher among those who were shown that they use about as much or less energy than others. This is consistent with other similar evaluation findings from around the country.

**Finding #1c: Customers were highly satisfied with the services they receive from MidAmerican.** The survey asked all customers to rate their satisfaction with the services they received from MidAmerican. Overall, 93 percent of customers reported being “very” or “extremely” satisfied with MidAmerican. This finding was similar across standard income treatment and control groups (89 percent standard income treatment, 96 percent low-income treatment, 95 percent control). Further, the Tetra Tech team found these high satisfaction ratings to be consistent across customers in different income groups, where 89 to 95 percent of customers who provided income and household size information reported being “very” to “extremely” satisfied with MidAmerican’s services (89 percent lower income, 95 percent moderate income, 94 percent higher income). Refer to Appendix E for detailed definitions of these income groups.

*Recommendation #1: Continue monitoring customers’ satisfaction levels for the program, with HER modules, and with MidAmerican’s services to understand if customer experiences continue to be consistent or if a shift occurs that may require an enhancement or adaption to the current program design.*

**Finding #2: HER recipients reported higher general awareness of other MidAmerican programs and said they were motivated by the report to take energy savings actions.** HER recipients in the standard income treatment and low-income treatment groups indicated higher levels of awareness with certain MidAmerican residential program offerings, including MidAmerican’s smart thermostat rebates (52 percent low-income treatment, 30 percent standard income treatment, 34 percent control), and the heating and cooling equipment rebates (86 percent standard income treatment, 63 percent low-income treatment, 60 percent control). In part, this may have been a result of HERs effectiveness in referring customers to MidAmerican’s energy efficiency website for product and rebate information.

The Tetra Tech team found that while surveyed treatment customers commonly said that the HER had “some” to “a great deal” of influence on their decision to take energy savings actions (71 percent), overall, surveyed customers in low-income treatment, standard treatment, and control groups reported doing most energy savings actions listed in the survey at similar rates. Evaluated differences, and not similarities, in energy savings actions taken between surveyed treatment and control groups typically serves as supporting evidence to impact analyses that the savings generated by HER recipients are attributable to the program. There are a variety of reasons why this evaluation found similarities between the groups. For example, it could be that the actions listed as possible response choices did not reflect all the actions that customers took, or it could be that the timing between when treatment



customers received the report and when they completed the survey was long enough to cause recollection issues. The billing analysis clearly shows that the program is driving savings despite low detection of significant differences between surveyed treatment and control customers about energy savings actions taken.

Across standard treatment, low-income treatment, and control groups, the most common energy savings actions were cleaning or replacing air filters, setting thermostats to 68 degrees in the winter, and unplugging electronics or appliances when not in use. Low-income treatment customers (90 percent) were less likely than treatment customers (96 percent) to say that they cleaned or replaced their air filters.

*Recommendation #2: Continue to promote behavior change strategies while also encouraging customers to engage with MidAmerican through the website, customer portal, or emails directing customers to where they can access all tips and promotions for other programs and measures.*

**Finding #3: Higher energy saving cohorts may experience more substantial and consistent decreases in energy savings after a reduction in the frequency of report delivery than cohorts that produce lower energy savings. However, while there is some evidence of lower savings among customers who received less frequent program treatment in 2017 and 2018 persisting into 2019 and 2020, the lack of statistically significant differences in these values prevents the Tetra Tech team from making any conclusions regarding the long-term impacts of the reduced frequency study.** The relative electric and gas savings of customers who received reports at a reduced frequency in 2017 and 2018 (two compared to six reports per year) were variable and inconsistent. While electric and gas savings of the reduced frequency treatment group have been consistently lower than those of the standard treatment group for the Iowa Pilot cohort, the reduced frequency treatment group in the Iowa Expansion cohort achieved higher electric savings in two of four years (including 2020) and higher gas savings in one year (2017). Given the short time period with which the experiment has been in place, and the high amounts of variability among the relative savings of standard and reduced frequency groups, the Tetra Tech team is unable to say if there is a timeframe at which the frequency of reports can be reduced with minimal impact on savings.

The savings generated by the Iowa Pilot cohort have been substantially higher than the Iowa Expansion cohort for both electric and gas since the inception of the reduced treatment frequency experiment, even though the Iowa Pilot and Iowa Expansion cohorts had similar levels of pre-period baseline energy consumption for both electric (32.69 and 31.09 kWh/day respectively) and gas (2.67 and 2.22 therms/day respectively). The savings discrepancy between the two waves is so great that the reduced frequency treatment group of the Iowa Pilot group has continued to generate higher savings than the standard frequency treatment group of the Iowa Expansion cohort for both fuels on an annual basis. The higher savings generated by the Iowa Pilot cohort could be indicative of higher levels of interaction with the HERs, and a reduction in the frequency of those reports is evident through the lower relative savings. Conversely among the Iowa Expansion cohort, a reduction in the frequency of report delivery is less evident through evaluated savings, as total savings are consistently lower and thus potentially indicative of lower report engagement overall. It is thus the opinion of the Tetra Tech team that both the initial response to a reduction in the frequency of HER delivery, as well as the persistence of those savings in the ensuing years after the reduction, are correlated with the level of savings attained prior to the reduction in treatment, and in turn with the unobservable characteristics of a treatment group that contribute to their overall savings.

*Recommendation #3: Should MidAmerican choose to reduce the frequency of or completely pause report delivery for future cohorts, consider targeting lower performing (less relative energy savings) cohorts first.*

## 2.0 INTRODUCTION

This report presents the detailed results for the PY2020 impact and process evaluation of the Residential Behavioral program offering in MidAmerican's Iowa and Illinois service territories.

### 2.1 PROGRAM DESCRIPTION

The Residential Behavioral program is designed to encourage energy savings through behavioral modification. A key component of the HER has been a comparison of the customer's usage from the past month with similar homes in the customer's area using simple graphs and labels. The HER's graphs and charts reflected whether the customer was using more or less energy than average or efficient homes in their area. This section of the HER was designed to activate the idea of "social norms" by showing how the customer compared to similar homes, as social norms can motivate people to change behavior. Other sections of the HER provided tips for how a household could save energy, including no-cost and low-cost actions and behaviors, as well as provided information on other MidAmerican energy efficiency offerings they could participate in. Most HERs also provided detailed analysis of a home's usage in the current month compared with the same month the previous year. The HERs contained a dedicated 1-800 number so that customers could speak to MidAmerican Customer Service Representatives (CSRs) who were specifically trained to address questions about the HERs, if needed.

In response to COVID-19, the program implementer made the following adjustments to program delivery in PY2020:

- Suppressed the similar homes comparison on print and electronic HERs from approximately March 15<sup>th</sup> through October 1<sup>st</sup>
- Suppressed tips that were deemed inappropriate for shelter in place and pandemic related reasons in March through July
- Included a specific COVID-19 customized module for all Illinois print reports in mid-March through June
- Included a specific COVID-19 customized module for all electronic HER recipients (Illinois and Iowa) in March and April
- Ran a module promoting easy ways to save while at home for all Illinois print reports in mid-March through June
- Ran a module promoting easy ways to save while at home for all electronic HER recipients in March and April.

For PY2014-PY2018, most customers received about six paper reports per calendar year. Starting in PY2019, MidAmerican reduced the frequency for mailing paper HERs. In PY2019, earlier cohorts in Iowa received two paper reports while the newest cohort (Iowa Reduction Backfill) received four reports. In PY2020, all recipients in Iowa received two paper reports per year. In Illinois for PY2020, customers in their first year of the program received six reports per year, while customers who have been in the program for one or more years received four reports per year. Treatment customers also had the option to: receive the HERs by email (in addition to or in lieu of paper reports); and/or log into an online portal that contained similar personalized information and energy-savings tips as the reports. Treatment customers may "opt out" of the program if they do not wish to receive HERs.



The Residential Behavioral program, like most other HERs programs run by the same implementer across the country, was designed as a RCT, which is an “experiment” whereby net savings can be measured by comparing the energy usage of report recipients (the treatment group) with the usage of an equivalent group of customers who do not receive program treatment (the control group). The program targeted two types of eligible customers: (1) non-low-income customers that the implementer identified as high energy users; and (2) low-income customers. The program implementer screened customers for usage<sup>6</sup>, income eligibility, and for sufficient billing history.

All treatment and control customers in the program belong to a distinct cohort, defined by the program start date, usage level, and income. The table below describes the existing program cohorts, including current sizes and fuel type. The Iowa Expansion and Illinois Expansion cohorts, which launched in March and June 2014 respectively, significantly increased the number of treatment group customers from the pilot period. In February 2016, the program launched a new cohort of Iowa customers to backfill for customers removed from the populations, predominantly for closing their electric and gas accounts with lesser extents of customer opt-outs (Iowa Backfill cohort). In 2017 the program launched three additional cohorts: the Iowa Reduction Refill cohort, the Illinois Rolling Enrollment cohort, and the Iowa Low-Income Refill Cohort. The Illinois Rolling Enrollment cohort began by enrolling approximately 6,000 customers in November of 2017 and has continuously added additional treatment customers on a rolling basis through mid-2019.

**Table 6. Cohort Characteristics and Sizes**

Cohort	Start Date	Treatment Group Size (January 2020)	Control Group Size (January 2020)	Fuel Type
Iowa				
Iowa Pilot*	November 2011	28,195	14,052	Dual Fuel
Iowa Expansion*	March 2014	80,959	12,477	Dual Fuel
Iowa Refill	February 2016	24,695	7,402	Dual Fuel
Iowa Reduction Backfill	January 2017	12,017	7,939	Dual Fuel
		33,254	9,462	Electric Only
Iowa Low-Income	June 2014	6,639	-	Dual Fuel
		2,900	-	Electric Only
Iowa Low-Income Refill	November 2017	12,315	-	Dual Fuel
		3,694	-	Electric Only
Illinois				
Illinois Expansion	June 2014	29,963	5,823	Dual Fuel
Illinois Rolling Enrollment	November 2017	16,599	5,255	Dual Fuel
		4,842	1,499	Electric Only

\* Indicates cohort was involved in the reduced frequency treatment test (see Section 3.4 for details).

<sup>6</sup> The Tetra Tech team attempted to learn from the implementer how they were defining “high energy users,” but the information was not obtainable. This is not uncommon among similar programs run by the same implementer around the country. In many ways, however, the point is moot so long as the treatment and control group are comparable, and the Tetra Tech team did complete an analysis to ensure that was the case.

In 2016 the Tetra Tech team worked with MidAmerican to design and sample for a Reduced Treatment Frequency Test (RTF). This involved identifying cohorts that were large enough to support splitting treatment customers into reduced versus standard treatment, and which cohorts might provide information on whether the reduced treatment effect varied by program maturity. The Tetra Tech team and MidAmerican worked together to identify the Iowa Pilot and Iowa Expansion cohorts as candidates for the RTF. The Tetra Tech team conducted stratified random sampling by baseline energy use within each cohort to identify participants to receive reduced treatment or continue receiving standard program treatment. The program implementer delivered reports to the reduced treatment customers in January and July of 2017. Standard treatment customers received reports in these two months as well as April, June, September, and November of 2017. In 2019, standard frequency treatment customers were also reduced to two reports per year.

### 2.1.1 Summary of Researchable Questions and Evaluation Activities

This section describes the analytic methods and data collection activities implemented as part of the PY2020 impact and process evaluation of the Residential Behavioral program. The Tetra Tech team designed a methodology to evaluate the program and address the researchable questions outlined in the program's Detailed Evaluation Plan<sup>7</sup>, as well as to address other issues that became relevant during the evaluation process.

Based on discussions with MidAmerican staff and a documentation review, The Tetra Tech team developed and prioritized key researchable questions for the evaluation of the Residential Behavioral program. These questions provided context to the motivation behind the research impact and process evaluation research activities. The table below outlines the researchable questions that this evaluation examined.

**Table 7. Researchable Questions**

Researchable Questions	Activity to Support the Question
Program Design	
Was the experimental design implemented successfully in 2020?	<ul style="list-style-type: none"> <li>Equivalency check using customer lists and billing data</li> </ul>
Do savings change when the paper report frequency changes from six reports per year to two reports per year?	<ul style="list-style-type: none"> <li>Billing analysis of reduced treatment frequency test (update from 2018)</li> </ul>
Customer Engagement	
What is customer readership and engagement with HERs?	<ul style="list-style-type: none"> <li>Customer survey</li> </ul>
What energy-saving actions do HERs motivate customers to take?	<ul style="list-style-type: none"> <li>Customer survey</li> </ul>
How useful are different sections or types of information of HERs?	<ul style="list-style-type: none"> <li>Customer survey</li> </ul>
How do participants perceive the Similar Homes Comparison?	<ul style="list-style-type: none"> <li>Customer survey</li> </ul>

<sup>7</sup> A select group of Iowa and Illinois stakeholders were provided an opportunity to review and comment on the draft Residential Behavioral Detailed Evaluation Plan in January of 2021.

Researchable Questions	Activity to Support the Question
Program Satisfaction	
What is customer satisfaction with HERs?	<ul style="list-style-type: none"> <li>Customer survey</li> </ul>
Do HERs affect customer satisfaction with MidAmerican?	<ul style="list-style-type: none"> <li>Customer survey</li> </ul>
Are there differences in satisfaction or perceptions of HERs between lower-income, moderate-income, and higher-income households?	<ul style="list-style-type: none"> <li>Customer survey</li> </ul>
Program Optimization	
Do savings decay when the HERs cease?	<ul style="list-style-type: none"> <li>Secondary research</li> </ul>
Do savings decay when the frequency of paper HERs is reduced?	<ul style="list-style-type: none"> <li>Reduced treatment frequency experiment</li> </ul>
Is there a time at which the frequency of reports can be reduced with minimal impact on savings?	<ul style="list-style-type: none"> <li>Reduced treatment frequency experiment</li> </ul>
Program Impacts	
What are overall net savings for each state and cohort in PY2020?	<ul style="list-style-type: none"> <li>Customer billing analysis</li> </ul>
What portion of net HER savings are achieved jointly through other MidAmerican energy efficiency savings, that may be double-counted by those programs?	<ul style="list-style-type: none"> <li>Channeling analysis</li> </ul>
How do evaluated savings compare with implementer-reported savings?	<ul style="list-style-type: none"> <li>Customer billing analysis</li> <li>Review of implementer-reported savings</li> </ul>

## 2.2 EVALUATION METHODS

The table below documents the activities that were completed as part of this evaluation. The evaluation focused on estimating and verifying program impacts and providing key feedback on the functionality of program processes. A summary description of each activity follows.

**Table 8. Evaluation Activities**

Evaluation Type	Evaluation Activities
Overarching Evaluation Activities	<p><b>Program staff interviews.</b> Conducted an initial in-depth interview with the product manager and energy efficiency director to understand program design and evaluation objectives and held a number of ad hoc follow-up calls.</p> <p><b>Tracking system review.</b> Analyzed tracking databases, reported savings, and documentation for consistency.</p> <p><b>Program documentation review.</b> Reviewed program implementer documentation and savings methodology.</p>

Evaluation Type	Evaluation Activities
Impact Evaluation Approach	<p><b>Billing analysis.</b> Received monthly billing data for all cohorts. Prepared billing data and tested the equivalency of treatment and control groups. Conducted a statistically based billing analysis of energy savings for all non-low-income cohorts. Used Iowa billing data to estimate electric savings, and Illinois billing data to estimate electric and natural gas savings. Billing analysis also estimated net savings through panel regression models. Compared evaluated savings to implementer-reported savings and calculated realization rates.</p> <p><b>Channeling analysis.</b> Estimated potential participation lift and incremental savings in other MidAmerican residential energy efficiency programs.</p> <p><b>Reduced treatment frequency test update.</b> Estimated difference in PY2019 and PY2020 savings between participants who experienced a reduction in report frequency from six to two reports per year in PY2017-PY2018, compared with customers who continued to receive six reports per year in PY2017-PY2018.</p>
Process Evaluation Approach	<p><b>Customer surveys.</b> Implemented an online customer survey; received 340 completed surveys—116 treatment group, 100 low-income treatment group, and 124 control group customers.</p>

Below is more information related to the methodologies used for the different evaluation activities associated with MidAmerican's Residential Behavioral program evaluation. Where relevant, the reader is directed to specific report sub-sections and/or appendix for detailed information.

- **Program staff interviews.** On September 18, 2020, Tetra Tech team members interviewed the MidAmerican product manager and energy efficiency director. This interview was completed to gain a better understanding of the program design and delivery, discuss program successes and challenges, and identify and prioritize researchable issues for the evaluation. The Tetra Tech team requested follow-up items and continued conversations with MidAmerican to further clarify program design and customer engagement questions on an ad hoc basis.
- **Program documentation review.** The Tetra Tech team worked with MidAmerican and the implementer to collect program documentation, including marketing materials such as those used for spring and fall campaigns. Other documents provided included the welcome letter, various reporting information, and program modifications made in response to COVID-19.
- **Billing analysis of electric and gas savings.** The Tetra Tech team requested electric and gas billing data histories for all customers in the treatment and control groups going back at least one year prior to each customer's first report data (or as far as possible for the Illinois Rolling Enrollment cohort). The Tetra Tech team cleaned and prepared this data for analysis, which included performing checks for data sufficiency (i.e., sufficient number of observations per person). This billing data was used to:
  - **Complete equivalency checks.** This equivalency check assessed the equivalency of pre-program (baseline) electricity and gas consumption patterns of each treatment group compared to their control group to validate the experimental design (i.e., are treatment and control groups similar?). This check found that the treatment and control groups were statistically equivalent and validated the experimental design. See Section 3.2 and Appendix A for more detail related to the equivalency check.
  - **Estimate program savings.** To estimate electric and gas savings for each state, day, year, and cohort, the Tetra Tech team completed a billing analysis using the monthly electric and gas bills of treatment and control customers and standard industry models. The experimental design of the program means that savings estimated through billing analysis are net savings—i.e., savings need no additional adjustments to move from

gross to net savings. To estimate program savings, and similar to past evaluations, the Tetra Tech team used a post-period regression model (PPR) to estimate the net consumption change between treatment and control in the program period. The PPR model combines both cross-sectional and time series data in a panel dataset. The underlying logic is that systematic differences between treatment and control groups will be reflected in differences in their past energy use, which is highly correlated with their current energy use. The Tetra Tech team utilized a different modeling approach to analyze the Illinois Rolling Enrollment tracks, as the customers in those cohorts did not have sufficient pre-period data (by design) to be accurately modeled using the PPR model. For these cohorts (and as a robustness check for all program cohorts) the Tetra Tech team utilized a Linear Fixed-Effects Regression model (LFER).

Both models provided a difference-in-differences estimate of program savings by considering each customer's change in consumption from the pre-to-post period as well as the difference in consumption between the treatment and control groups in the post period<sup>8</sup>. See Sections 3.1, 3.2, and 3.3 for additional information. Additionally, Appendix B provides more detail on the data cleaning and bill analysis methodology, including model specifications.

- **Channeling Analysis.** The HERs included some messaging that encouraged households to enroll in other MidAmerican residential energy efficiency programs. Channeling occurs when the HERs result in more households enrolling in energy efficiency programs than they otherwise would have (incremental participation and savings). The purpose of channeling analysis is two-fold. First, the analysis estimated potential participation lift (incremental participation) in other MidAmerican residential energy efficiency programs, which could occur because of the HERs. Second, the analysis estimated potential incremental savings that were captured in the net Residential Behavioral program savings observed in billing analysis but could be double-counted by other programs that claimed those savings through program and rebate databases. Due to the negligible estimated savings amounts resulting from the channeling analysis, savings adjustments were not made based on this activity. Thus, information related to the channeling analysis results can be found in Appendix D.
- **Reduced Treatment Frequency (RTF) Test Persistence.** In 2016, MidAmerican reduced the frequency of treatment for a sample of customers in the Iowa Pilot and Iowa Expansion cohorts, from six reports to two reports per year. In 2019, MidAmerican reduced the frequency of treatment for all Iowa customers who have received treatment for longer than one year (including the two RTF cohorts) to two reports per year. For this evaluation, the Tetra Tech team performed electric and natural gas billing analyses of the originally defined standard treatment group compared with the reduced treatment group to identify whether any difference in savings identified in previous evaluations persisted into 2019 and 2020. This billing analysis followed the billing analysis process described above (using post-period regression models) but included an additional term to interact the RTF and standard frequency groups with the HER treatment and control groups. The model coefficient on the reduced frequency by treatment term corresponds with the average change in kWh per household per day for RTF customers as compared to standard frequency customers. See Section 3.4 and Appendix C for additional information.

<sup>8</sup> Both the PPR and LFER models are standard methods of evaluating HER programs using panel data (monthly billing data). PPR models have become increasingly common in recent years and is the implementer's current approach, though the Tetra Tech team still recommends estimating impacts using both methods as a sensitivity analysis.

- 
- **Customer surveys.** With a representative sample of both standard income treatment, low-income treatment, and control customers, the Tetra Tech team emailed postcards with links to an online survey. HER recipient (both standard income treatment and low-income treatment) customer surveys captured: customer engagement with, and perceptions of, the HERs, specific sections of the reports, and other program components (e.g., electronic HERs); customer satisfaction with the program and with MidAmerican; and whether the reports influenced customers to take additional actions or participate in energy efficiency programs (including awareness). Control group customer surveys allowed for comparisons between the treatment groups and the control group responses related to awareness in energy saving behaviors and purchases and satisfaction with MidAmerican's services. Survey results can be found in Section 4. See Appendix E for the customer survey response rate, Appendix F for the moderate income methodology used for analysis, and Appendix G for the survey instrument.



### 3.0 PROGRAM SAVINGS AND IMPACT EVALUATION FINDINGS

This section presents the results for the PY2020 Residential Behavioral impact evaluation in Iowa and Illinois. The impact evaluation was designed around the key researchable questions identified in the methodology section. First, the Tetra Tech team presents the program savings and then discuss the equivalency check and cohort comparisons, followed by billing analysis. Detailed information related to persistence analysis follows in Sections 3.4 and detailed information related to the channeling analysis is in Appendix C.

#### 3.1 PROGRAM SAVINGS

In this subsection the Tetra Tech team presents the electric and natural gas energy savings results. Net program savings are estimated through billing analysis of monthly electricity and gas usage data. This approach is standard for similar types of programs and leverages the experimental design of the program; namely, random selection of a treatment and control group that allows for calculation of net savings through regression models. For this evaluation, we focused on the net *unadjusted* savings values attained through the billing analysis. The net unadjusted savings values capture impacts resulting from both the Residential Behavioral program treatment as well as treatment and control group participation in other MidAmerican residential energy efficiency programs. The program implementer has not accounted for channeled or incremental savings when providing savings progress to MidAmerican; therefore, the net unadjusted results provide the most direct comparison of evaluated and implementer-reported values.

The two tables below summarize the program savings findings of the Residential Behavioral program for PY2020. The evaluated savings align closely with those reported by MidAmerican for all cohorts evaluated. The unadjusted realization rates for electric savings ranged from 96 percent to 123 percent, depending on the cohort reviewed. Electric savings aligned more closely at the cumulative service territory level within each state—realization rates in MidAmerican’s Iowa service territory were 105 percent and were 96 percent in its Illinois service territory. The unadjusted realization rates for natural gas savings ranged from 90 percent to 139 percent. Similar to electric savings, gas savings aligned more closely at the overall service territory level in each state, with realization rates of 115 percent of reported savings in Illinois (gas savings are not claimed in Iowa).

**Table 9. PY2020 Electric Savings Impacts**

Electric Cohorts	Implementer-Reported Net (MWh)	Unadjusted Evaluated Net (MWh)	Unadjusted Realization Rate
Iowa Pilot	6,976	7,046	101%
Iowa Expansion	8,870	10,889	123%
Iowa Backfill	1,957	1,882	96%
Iowa Reduction Refill	13,158	12,767	97%
<b>Iowa Total</b>	<b>30,961</b>	<b>32,584</b>	<b>105%</b>
Illinois Expansion	5,352	4,954	93%
Illinois Rolling Enrollment	2,187	2,313	106%
<b>Illinois Total</b>	<b>7,539</b>	<b>7,267</b>	<b>96%</b>



**Table 10. PY2020 Natural Gas Savings Impacts**

<b>Natural Gas Cohorts</b>	<b>Implementer-Reported Net (therms)</b>	<b>Unadjusted Evaluated Net (therms)</b>	<b>Unadjusted Realization Rate</b>
Iowa Pilot	360,144	359,481	100%
Iowa Expansion	504,412	556,029	110%
<b>Iowa Total</b>	<b>864,555</b>	<b>915,510</b>	<b>106%</b>
Illinois Expansion	123,098	170,561	139%
Illinois Rolling Enrollment	121,634	109,916	90%
<b>Illinois Total</b>	<b>244,733</b>	<b>280,477</b>	<b>115%</b>

The remainder of this section provides more details related to the billing analysis, including equivalency check and cohort comparisons, and detailed billing analysis results.

## 3.2 EQUIVALENCY CHECK AND COHORT COMPARISONS

The Residential Behavioral program was designed as a RCT to allow for a straightforward calculation of program savings and is the same methodology as other similar HER programs around the country. The validity of any energy savings in a RCT is estimated by comparing the treatment and control groups and depends on the statistical equivalency, or similarity, of those two groups. To assess the equivalency of cohorts treatment and control groups, the Tetra Tech team performed month-by-month equivalency checks of each cohort's pre-period (prior to program intervention) energy consumption. The equivalency check showed no significant differences (at the 90% confidence interval) between any treatment group and its associated control group. Appendix A provides the full results and methodology of the equivalency checks.

## 3.3 BILLING ANALYSIS DETAILED FINDINGS

The following sections discuss the billing analysis and resulting program savings in greater detail.

### 3.3.1 Unadjusted Evaluated Savings

The Residential Behavioral program provided HERs to 230,273 customers in PY2020 (179,031 in Iowa, 51,242 in Illinois) and achieved evaluated unadjusted total net savings totaling 32,584 MWh in Iowa, 7,267 MWh in Illinois, and 280,577 therms in Illinois. Based on a 90% confidence interval around the savings estimates, savings were statistically significant for all cohorts except for the gas savings of the Illinois Rolling Enrollment dual fuel cohort<sup>9</sup> (highlighted in blue in Table 13, below). The wide confidence interval for this cohort is likely due to the relatively small size of the cohort's treatment group (16,243 customers, which was the smallest of all gas cohorts) and control group (5,240 customers, which was the second smallest of all gas cohorts) populations<sup>10</sup>. It is the opinion of the Tetra Tech team

<sup>9</sup> The standard error of the treatment term (coefficient  $\beta_2$ ) was used to calculate a 90% confidence interval for each savings estimate representing sampling error, and these confidence intervals were used to determine statistical significance of the savings estimate.

<sup>10</sup> For reference, the implementer recommends control groups of at least 12,000 customers to detect savings through billing analysis, and the Tetra Tech team recommends starting with at least 15,000 customers per group (treatment or control) to allow for attrition.

that because the program utilizes a RCT experimental design, the results of the billing analysis are the unbiased, best estimates of savings values. Although for the Illinois Rolling Enrollment dual fuel cohort we cannot rule out that savings are unequal to zero, for each cohort we cannot rule out that the savings are unequal to a different value within the confidence interval. The Tetra Tech team reports confidence intervals for all cohorts, and for all cohorts uses the point estimate as the best estimate of savings; situations where the confidence interval crosses zero should not be treated any differently. The two tables below document evaluated unadjusted net savings and confidence intervals around savings impacts.

**Table 11. Unadjusted Evaluated Net Electric Savings and 90% Confidence Intervals**

Electric Cohorts	Start Month	Average Daily Household Electric Savings	Unadjusted Net Evaluated (MWh)	90% Confidence Interval (MWh)
Iowa Pilot	November 2011	2.15%	7,046	±688
Iowa Reduction Backfill - electric only	January 2017	1.89%	12,042	±1,226
Iowa Expansion	March 2014	1.22%	10,889	±1,716
Iowa Reduction Backfill - dual fuel	January 2017	0.90%	725	±256
Iowa Refill	February 2016	0.86%	1,882	±653
<b>Iowa Total</b>		<b>1.51%</b>	<b>32,584</b>	
Illinois Expansion	June 2014	1.80%	4,954	±886
Illinois Rolling Enrollment	November 2017	1.33%	2,313	±1,939
<b>Illinois Total</b>		<b>1.62%</b>	<b>7,267</b>	

**Table 12. Unadjusted Evaluated Natural Gas Savings and 90% Confidence Intervals**

Natural Gas Cohorts	Start Month	Average Daily Household Natural Gas Savings	Unadjusted Net Evaluated (therms)	90% Confidence Interval (therms)
Iowa Pilot	November 2011	1.34%	359,481	±42,888
Iowa Expansion	March 2014	0.87%	556,029	±93,310
<b>Iowa Total</b>		<b>1.01%</b>	<b>915,510</b>	
Illinois Rolling Enrollment <sup>a</sup>	November 2017	0.91%	109,916	±172,648
Illinois Expansion	June 2014	0.78%	170,561	±51,177
<b>Illinois Total</b>		<b>0.83%</b>	<b>280,477</b>	

<sup>a</sup> Results are not statistically significant for this cohort.

### 3.3.2 Comparison to Implementer-Reported Values

As noted earlier, the program implementer provided MidAmerican with savings estimates monthly, based on monthly regression-based analysis. The implementer provided the Tetra Tech team with a sum of these monthly values for each cohort and year to represent annual savings totals. The Tetra Tech team compared these annual totals with evaluated unadjusted values (i.e., evaluated values not adjusted for channeled savings).

In general, implementer estimates of annual program savings agreed with the evaluated results, as shown in the two tables, below. The numbers provided by the implementer were all within the 90% confidence intervals<sup>11</sup> of the net evaluated electric savings estimates calculated based on the PPR model (LFER for Illinois Rolling Enrollment tracks) except for the Iowa Expansion cohort, which exceeded implementer estimated savings by a significant margin.

**Table 13. Implementer-Reported Electric Savings Compared with Confidence Intervals of Evaluated Savings**

Electric Cohorts	Implementer -Reported Savings <sup>a</sup>	Net Evaluated Savings	Realization Rate	Evaluated Lower Bound (90% CI)	Evaluated Upper Bound (90% CI)
Iowa Pilot	6,976	7,046	101%	6,358	7,733
Iowa Expansion	8,870	10,889	123%	9,173	12,605
Iowa Refill	1,957	1,882	96%	1,229	2,535
Iowa Reduction Backfill - dual fuel	862	725	84%	469	981
Iowa Reduction Backfill - electric only	12,295	12,042	98%	10,816	13,269
<b>Iowa Total</b>	<b>31,980</b>	<b>32,584</b>	<b>105%</b>		
Illinois Expansion	5,352	4,954	93%	4,067	5,840
Illinois Rolling Enrollment	2,187	2,313	106%	373	4,252
<b>Illinois Total</b>	<b>7,539</b>	<b>7,267</b>	<b>96%</b>		

<sup>a</sup> The program implementer did not provide confidence intervals for reported savings, therefore it is unknown whether any of their reported savings lack statistical significance.

While the evaluated natural gas savings for the Illinois Rolling Enrollment cohort were not statistically significant, the numbers provided by the implementer were all within the 90% confidence intervals of the unadjusted evaluated gas savings estimates calculated based on the PPR model (LFER for Illinois Rolling Enrollment tracks).

<sup>11</sup> The 90% confidence can be interpreted as the probability that the savings value is somewhere between the evaluated lower and upper bounds. While the point estimate provided through the net evaluated savings is the Tetra Tech team's best unbiased estimate of the savings generated by the Residential Behavioral program, we can only say with certainty that there is a 90% likelihood that the savings estimate is somewhere within the range of those two values.

**Table 14. Implementer-Reported Gas Savings Compared with Confidence Intervals of Evaluated Savings**

Gas Cohorts	Implementer-Reported Savings <sup>a</sup>	Net Evaluated Savings	Realization Rate	Evaluated Lower Bound (90% CI)	Evaluated Upper Bound (90% CI)
Iowa Pilot	360,144	359,481	100%	316,593	402,370
Iowa Expansion	504,412	556,029	110%	462,719	649,339
<b>Iowa Total</b>	<b>864,555</b>	<b>915,510</b>	<b>106%</b>		
Illinois Expansion	123,098	170,561	139%	119,383	221,738
Illinois Rolling Enrollment <sup>b</sup>	121,634	109,916	90%	-62,732	282,564
<b>Illinois Total</b>	<b>244,733</b>	<b>280,477</b>	<b>115%</b>		

<sup>a</sup> The program implementer did not provide confidence intervals for reported savings, therefore it is unknown whether any of their reported savings lack statistical significance.

<sup>b</sup> Results are not statistically significant for this cohort.

Some variation in results from implementer-reported savings is expected. From the Tetra Tech team's perspective, the reasons for differences between implementer-reported and evaluated values is related to multiple small differences in impact analysis methodology. One explanation may be the data used to conduct the analysis. The implementer calculated savings monthly using monthly models compared with the Tetra Tech team's use of annual data to calculate savings. There are adjustments to monthly usage and bills which would be accounted for in the annual data but not represented and captured in the monthly analysis. Additionally, based on the counts of households included in analysis, it appears that the implementer may have had slightly different data preparation and filtering rules from the Tetra Tech team. The evaluated savings analysis generally included more households, and in applying results, the Tetra Tech team applied per household evaluated savings to all program treatment days, including customers who were excluded from billing analysis for data cleaning reasons. More detail on data cleaning steps is detailed in Appendix B.

### 3.4 PERSISTENCE ANALYSIS

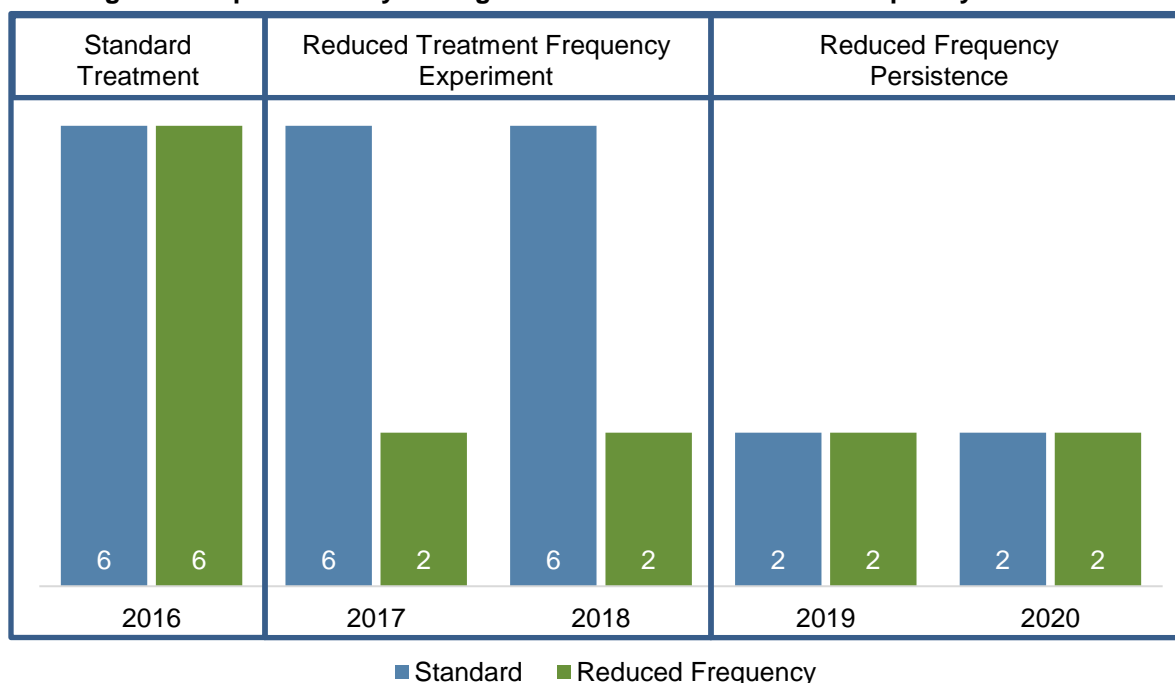
In 2017, the Residential Behavioral program implemented a Reduced Treatment Frequency (RTF) experiment for the Iowa Pilot and Iowa Expansion cohorts. The Residential Behavioral program had been delivering about six reports per year to customers since each cohort's inception. The RTF was designed to determine if there would be savings decay when reports are reduced to two reports per year among program treatment customers who had been receiving reports at MidAmerican's standard frequency (about six per year) for three or more years (see Appendix D for details on the RTF test design and historical analysis). Initial findings from the experiment using 2017 billing data were inconclusive: the Tetra Tech team found suggestive evidence of lower savings in the Iowa Pilot reduced treatment group (electric and gas), however, the opposite was observed in the Iowa Expansion cohort, which included suggestive evidence of higher savings among the reduced frequency group. Furthermore, no results were statistically significant so the Tetra Tech team was unable to assert whether reduced treatment savings were different than the continued treatment.

In early 2019, the Tetra Tech team again performed electric and natural gas billing analyses of the standard treatment group compared with the reduced treatment group using 2018 billing data. This analysis found that point estimates of savings for each of the reduced frequency groups (electric and gas) were lower compared with the standard frequency groups for both cohorts. While the Tetra Tech team again found no statistical difference in annual savings between the reduced and standard

frequency groups, these results provided suggestive evidence that the impact of a reduced frequency of HER treatment is proportionally lower energy savings.

In PY2019, MidAmerican reduced the frequency of all treatment customers in these two cohorts to two reports per year. As a result, any further analysis of this experiment will no longer be able to detect the impacts of the RTF as designed; rather, any further analysis would be assessing the *persistence* of the impacts of the RTF experiment and whether there are any observable lingering impacts of the RTF that was employed in 2017 and 2018. The figure below depicts the timing of report delivery for both groups.

**Figure 1. Report Delivery Timing for Reduced and Standard Frequency Customers**



### 3.4.1 Detailed Findings

To varying extents, the lower relative savings achieved by the RTF groups compared to the standard frequency treatment groups persisted into PY2019 and PY2020. Differences in relative savings (both gas and electric) have been more consistent among the Iowa Pilot cohort compared to the Iowa Expansion cohort, with the RTF group generating lower savings than the standard frequency group in the Iowa Pilot cohort in each year since the experiment began. Conversely for the Iowa Expansion cohort, the RTF group has generated higher savings than the standard frequency group in at least one year for each fuel. A discussion of specific persistence findings by cohort and fuel is presented next and are shown in Table 15 (electric) and Table 16 (gas).

**Iowa Pilot cohort electric savings.** The electric savings from the Iowa Pilot cohort have consistently shown the largest relative difference between the reduced and standard frequency groups. For PY2019 the savings generated by the RTF group fell to their lowest value relative to the standard frequency group (69 percent) and this difference was statistically significant for the first time since the experiment began. However, for PY2020 the RTF group achieved the highest relative percentage of standard frequency treatment group electric savings to date (75 percent), but the difference between standard and reduced frequency customers savings were not significant.

**Iowa Expansion cohort electric savings.** Relative electric savings between the reduced and standard frequency groups have been less consistent for the Iowa Expansion cohort compared to the Iowa Pilot cohort. The relative savings observed in the second year of the RTF experiment (2018) persisted for PY2019, with the relative difference remaining statistically equivalent in each year. However, this trend reversed for PY2020, when the RTF group produced savings at a substantially (though not significantly) higher rate than did the standard treatment group.

The Tetra Tech team notes that while the average daily baseline energy consumption of the Iowa Expansion cohort (31.08 kWh/day) is similar to that of the Iowa Pilot cohort (32.69 kWh/day), the savings generated from the Iowa Expansion cohort have historically been lower overall. As such, a smaller absolute difference in savings between the reduced and standard frequency groups for this cohort appears to be a larger relative difference than for the Iowa Pilot cohort.

**Table 15: Electric Persistence Savings Differences**

Electric Cohort	Program Year	Annual MWh Savings per Household		Relative Difference (Reduced/ Standard)
		Reduced Frequency	Standard Frequency	
Iowa Pilot	2017	263.2	356.7	74%
Iowa Pilot	2018	254.4	348.2	73%
Iowa Pilot	2019	211.1	304.1	69% <sup>a</sup>
Iowa Pilot	2020	215.7	288.7	75%
Iowa Expansion	2017	166.1	150.6	110%
Iowa Expansion	2018	178.5	205.5	87%
Iowa Expansion	2019	147.8	166.4	89%
Iowa Expansion	2020	160.5	135.2	119%

<sup>a</sup> Indicates that the difference between reduced frequency group savings and standard frequency group savings are significant at the 90% confidence interval.

**Iowa Pilot cohort gas savings:** In the two years of the RTF experiment, the RTF group achieved approximately 80 percent of the relative savings achieved by the standard treatment group. Because all treatment customers were reduced to two reports per year in PY2019, the relative savings of the RTF group have increased year over year, and for PY2020 achieved the highest relative percentage of standard frequency treatment group gas savings to date (95 percent). None of these differences to date have been statistically significant.

**Iowa Expansion cohort gas savings:** In contrast to the Iowa Pilot cohort, the gas savings of the reduced frequency group of the Iowa Expansion cohort have decreased steadily every year. For PY2020, this cohort achieved the lowest relative percentage of standard frequency treatment group gas savings to date (77 percent), though none of these differences were statistically significant.

**Table 16: Gas Persistence Savings Differences**

Gas Cohort	Program Year	Annual Therm Savings per Household		Relative Difference (Reduced/ Standard)
		Reduced Frequency	Standard Frequency	
Iowa Pilot	2017	10.4	13.0	80%
Iowa Pilot	2018	12.5	15.9	79%
Iowa Pilot	2019	11.9	13.8	86%
Iowa Pilot	2020	12.6	13.3	95%
Iowa Expansion	2017	8.6	6.6	130%
Iowa Expansion	2018	6.2	6.9	90%
Iowa Expansion	2019	7.2	9.1	79%
Iowa Expansion	2020	5.7	7.4	77%

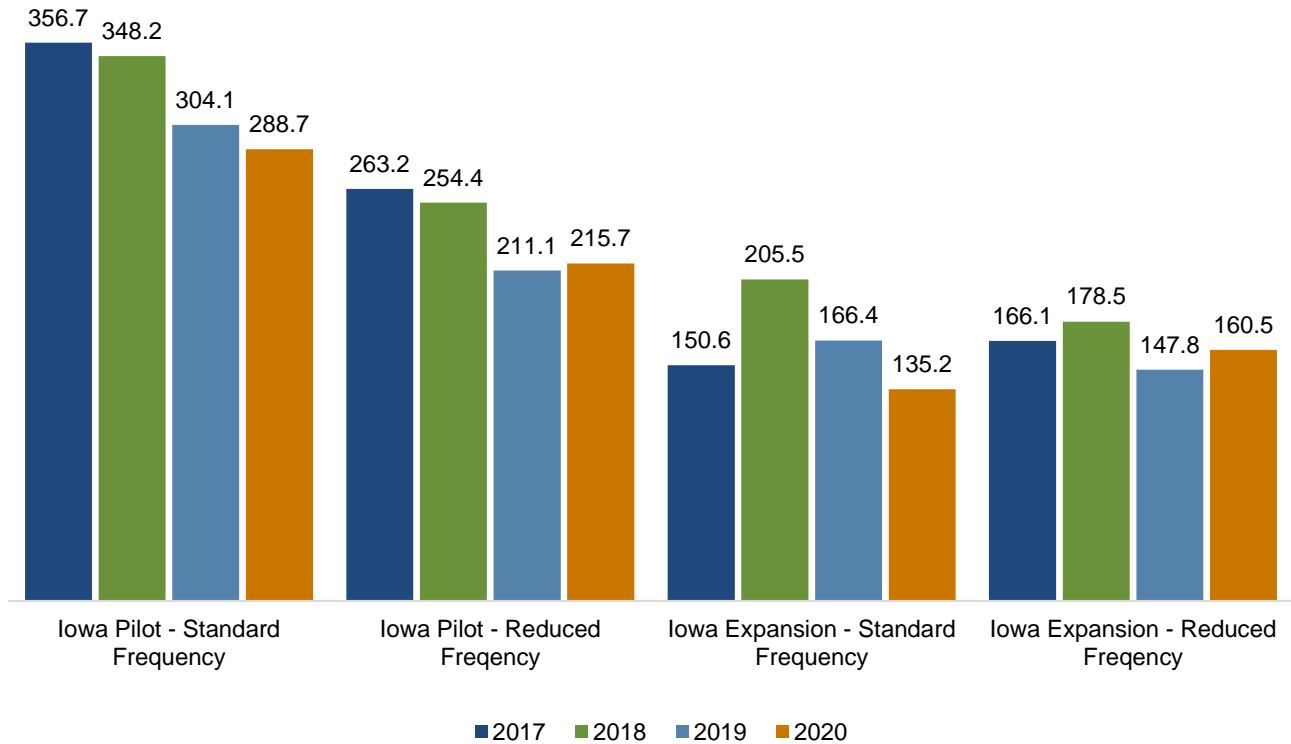
Higher energy saving cohorts may experience more substantial and consistent decreases in energy savings after a reduction in the frequency of report delivery than cohorts that produce relatively lower energy savings. The savings generated by the Iowa Pilot cohort have been substantially higher than the Iowa Expansion cohort for both electric (Figure 2) and gas (Figure 3) since the inception of the experiment, even though the Iowa Pilot and Iowa Expansion cohorts had similar levels of pre-period baseline energy consumption for both electric (32.69 and 31.09 kWh/day respectively) and gas (2.67 and 2.22 therms/day respectively). The savings discrepancy between the two cohorts is so great that the Iowa Pilot RTF group has continued to generate higher savings than the standard frequency treatment group of the Iowa Expansion cohort for both fuels on an annual basis.

The higher savings generated by the Iowa Pilot cohort could be indicative of higher levels of interaction with the HERs, and a reduction in the frequency of those reports is evident through the lower relative savings. Conversely among the Iowa Expansion cohort, a reduction in the frequency of report delivery is less evident through evaluated savings, as total savings are consistently lower and thus potentially indicative of lower report engagement overall<sup>12</sup>. It is thus the opinion of the Tetra Tech team that both the initial response to a reduction in the frequency of HER delivery and the persistence of those savings in the ensuing years after the reduction are correlated with the level of savings attained prior to the reduction in treatment, and in turn with the unobservable characteristics of a treatment group that contribute to their overall savings.

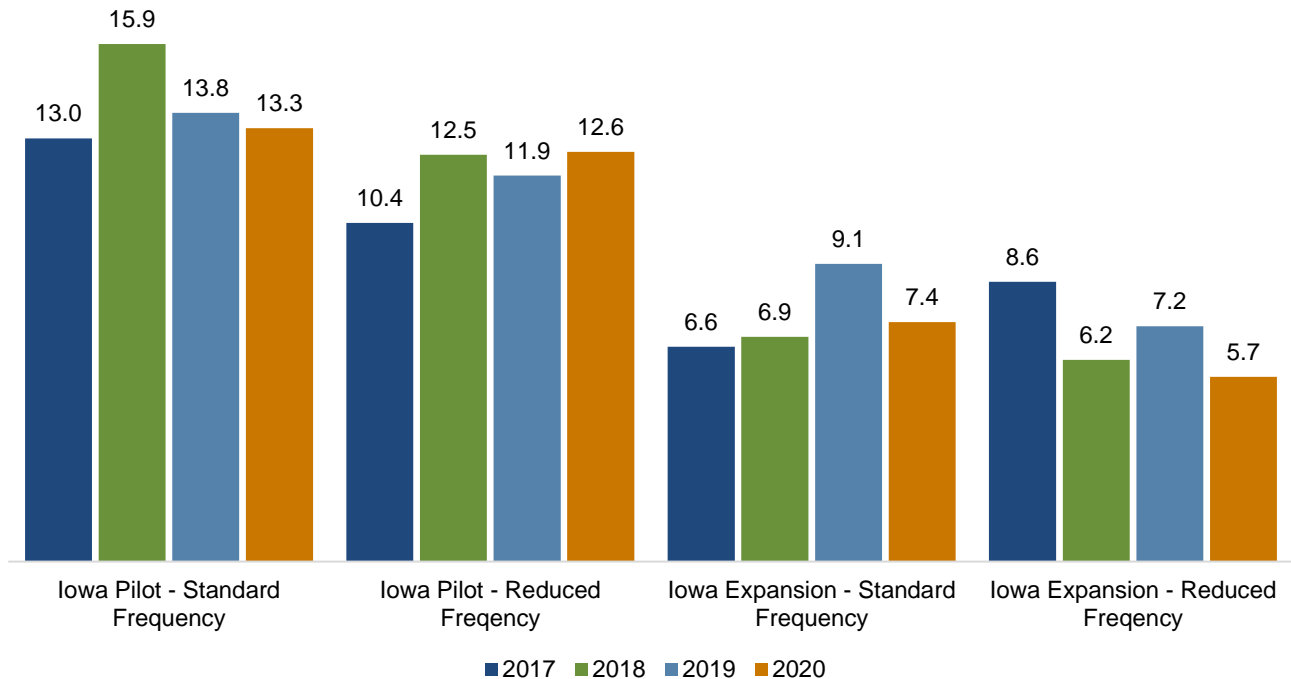
<sup>12</sup> There were not enough survey responses from treatment customers in these two cohorts to garner any statistical inference into connections between survey readership and relative energy savings.



**Figure 2. Annual Electric Savings of RTF Cohorts**



**Figure 3. Annual Natural Gas Savings of RTF Cohorts**



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### 3.4.2 Persistence Savings - Secondary Literature Review

While the persistence analysis conducted for this evaluation provides insight into the persistence of any differences in relative savings between subsamples of treatment customers after a reduction in the frequency of HER delivery, it does not provide insight into the persistence of energy savings after HER delivery is discontinued entirely. Currently, the Illinois TRM is the best source for peer-reviewed synthesis of persistence research. The Illinois Technical Advisory Committee regularly reviews and updates HER persistence and decay rates based on studies where HERs are discontinued. The Illinois TRM for PY2021 (version 9.0) aggregated results from 15 distinct electric HER programs that conducted persistence studies (complete termination of HER delivery for some period of time). As a result, the Illinois TRM assumed a 22 percent annual decay rate for electric savings in the first year after reports cease, with additional decay of 13 percent and 14 percent in the subsequent two years<sup>13</sup>. For gas savings, the Illinois TRM aggregated the results of five distinct gas HER programs that conducted persistence studies. As a result, the Illinois TRM reflects a 30 percent annual decay rate for gas savings in the first year after reports cease, with additional decay of 21 percent and 15 percent in the subsequent two years.

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<sup>13</sup> 2021 Illinois Statewide Technical Reference Manual for Energy Efficiency Version 9.0 Volume 4: Cross-Cutting Measures and Attachments.

## 4.0 PROCESS EVALUATION FINDINGS

This section presents the findings from the process evaluation activities for MidAmerican’s Iowa and Illinois service territories. The process evaluation was designed around the key researchable questions identified in Section 2.1.1. Process evaluation activities consisted of an online survey with treatment and control group customers in Iowa and Illinois. The key process-related findings are detailed in the subsections below.

The Tetra Tech team surveyed MidAmerican customers across all Residential Behavioral cohorts (for comparison and easy identification, they are referenced in this section as “standard income treatment,” “low-income treatment,” and “control group”) to understand differences in MidAmerican program awareness, satisfaction, and actions taken toward energy efficiency between treatment groups and the control group. For all HER treatment groups, the survey also gathered feedback on customers’ recall, readership, and opinions of the HER itself.

The Tetra Tech team used Residential Behavioral program customer lists provided by MidAmerican on December 2, 2020<sup>14</sup> to develop the sample frame. The Iowa tracking data file contained a list of customers from each Iowa deployment cohort and consisted of 426,261 records. The Illinois tracking data file contained a list of customers from each Illinois deployment cohort and consisted of 101,223 records. The Tetra Tech team removed records ineligible for the study, including customers assigned to more than one cohort, and customers with no bills after January 2020 (presumably closed accounts). The Tetra Tech team then randomly sampled from each cohort with the goal of achieving 100 completes from each of the three groups—standard income treatment, low-income treatment, and control groups.

The Tetra Tech team mailed a postcard to invite customers to take the online survey. Surveys were completed by 340 customers—116 standard income treatment customers, 100 low-income treatment customers, and 124 control group customers, achieving an 11 percent response rate. A detailed survey response rate table can be found in Appendix E.

**Table 17. Survey Sample Stratification and Survey Completes by Cohort**

Survey Stratum	Fuel	Percent of Stratum (Treatment)	Sample Frame Count (Treatment)	Sample Frame Count (Control)	Completes (Treatment)	Completes (Control)
<b>Iowa Cohorts</b>						
Iowa Pilot	Dual	12%	126	126	21	18
Iowa Expansion	Dual	35%	357	357	41	48
Iowa Refill	Dual	11%	111	111	8	15
Iowa Reduction Backfill	Dual	5%	54	54	5	5
	Electric Only	14%	147	147	25	15
<b>Total Iowa Standard Income</b>		<b>77%</b>	<b>795</b>	<b>795</b>	<b>100</b>	<b>101</b>

<sup>14</sup> Filenames: opwr\_mec\_customer\_extract\_20201130.tsv (Iowa; 426,261 records) and opwr\_mil\_customer\_extract\_20201130.tsv (IL; 101,223 records).

Survey Stratum	Fuel	Percent of Stratum (Treatment)	Sample Frame Count (Treatment)	Sample Frame Count (Control)	Completes (Treatment)	Completes (Control)
Iowa Low-Income	Dual	27%	270	n/a	28	n/a
	Electric Only	12%	117	n/a	11	n/a
Low-Income Refill #1	Dual	48%	483	n/a	50	n/a
	Electric Only	13%	135	n/a	11	n/a
<b>Total Iowa Low-Income</b>		<b>100%</b>	<b>1,005</b>	<b>0</b>	<b>100</b>	<b>0</b>
<b>Total Iowa</b>			<b>1,800</b>	<b>795</b>	<b>200</b>	<b>101</b>
<b>Illinois Cohorts</b>						
Illinois Pilot	Dual	13%	132	132	14	17
Illinois Rolling Enrollment	Dual	7%	69	69	2	4
	Electric Only	2%	21	21	0	2
<b>Total Illinois Standard Income<sup>15</sup></b>		<b>22%</b>	<b>222</b>	<b>222</b>	<b>16</b>	<b>23</b>
<b>Total All Cohorts</b>			<b>2,022</b>	<b>1,017</b>	<b>216</b>	<b>124</b>

## 4.1 SURVEYED CUSTOMER CHARACTERISTICS

Before discussing the results of the Residential Behavioral customer survey, it is important to understand who responded and the characteristics of those respondents. These characteristics might affect customers' responses to questions, as well as potentially inform differences highlighted within the process evaluation findings. This section characterizes the survey respondents by standard income treatment, low-income treatment, and control groups, highlighting statistical differences.

Surveyed respondents primarily live in single-family detached homes, and surveyed customers in both the standard income treatment and control groups were statistically similar in all regards except home ownership where slightly more standard income treatment customers were homeowners (99 percent) than control customers (95 percent). While these 'majority' trends were consistent for surveyed low-income customers, those in the low-income treatment group had significantly different rates for characteristics like homeownership, home type, household size, and income levels, which is not unexpected.

Across all three groups, most surveyed customers reported owning their home (76 percent low-income treatment, 95 percent standard income treatment, 99 percent control) and living in single-family detached houses (82 percent low-income treatment, 92 percent standard income treatment, 90 percent control). Most customers lived in homes built between the 1940s and 1970s (43 percent low-income treatment, 43 percent standard income treatment, 42 percent control).

The Tetra Tech team found that significantly more low-income treatment customers rented (24 percent) than other groups (one percent standard income treatment, five percent control), and significantly fewer lived in single-family detached houses (82 percent low-income treatment, 92 percent standard income treatment, 90 percent control). More low-income customers than any other groups reported living in

<sup>15</sup> Due to the low number of completed surveys in Illinois and similarities in how the program is implemented in Iowa and Illinois, survey responses for Iowa and Illinois have been combined.

smaller homes, like homes less than 1,000 square feet (35 percent low-income treatment, nine percent standard income treatment, eight percent control). Significantly more low-income customers lived in older homes built in 1930 or earlier (39 percent) compared to other groups (21 percent standard income treatment, 16 percent control), and significantly fewer lived in newer homes built in 1980 or later (18 percent) compared to standard income treatment (31 percent) and control customers (42 percent).

**Table 18. Home Characteristics by Group**

Category	Low-Income Treatment (n=100)	Treatment (n=116)	Control (n=124)
Own or rent home	n=100	n=116	n=124
Own	76% <sup>A,B</sup>	99% <sup>A,c</sup>	95% <sup>B,c</sup>
Rent	24% <sup>A,B</sup>	1% <sup>A,c</sup>	5% <sup>B,c</sup>
Square Footage of Home	n=80	n=105	n=118
Less than 1,000 sq ft	35% <sup>A,B</sup>	9% <sup>A</sup>	8% <sup>B</sup>
1,001 to 1,500 sq ft	46% <sup>a,B</sup>	33% <sup>a</sup>	30% <sup>B</sup>
1,501 to 2,000 sq ft	14% <sup>a,B</sup>	25% <sup>a</sup>	32% <sup>B</sup>
2,001 to 3,000 sq ft	5% <sup>A,B</sup>	26% <sup>A</sup>	20% <sup>B</sup>
More than 3,000 sq ft	-	8%	11%
Home Type	n=100	n=116	n=124
Single-family detached	82% <sup>A,b</sup>	92% <sup>A</sup>	90% <sup>b</sup>
Single-family attached house (townhouse, row house, or duplex)	7%	3%	4%
Apartment building with 2-4 units	2%	1%	-
Apartment building with 5 or more units	8% <sup>a</sup>	-	3% <sup>a</sup>
Mobile home or house trailer	1%	3%	3%
Other	-	1%	-
Year Home Built	n=97	n=116	n=122
1930s or earlier	39% <sup>A,B</sup>	21% <sup>A</sup>	16% <sup>B</sup>
1940s to 1970s	43%	43%	42%
1980s or later	18% <sup>A,B</sup>	36% <sup>A</sup>	42% <sup>B</sup>
Number of Years Lived in Home*	n=99	n=116	n=123
0 to 8 years	41% <sup>A,B</sup>	21% <sup>A</sup>	23% <sup>B</sup>
9 to 15 years	21%	25%	29%
16 to 24 years	16%	24%	21%
25 or more years	22%	30%	27%

\* Due to the small number of completes in each age category by group, the Tetra Tech team combined some question responses into categories. This was done based on quartiles to get close to even group sizes for age categories.

<sup>a,b,c</sup> Differences between groups is significant with 90% confidence.

<sup>A,B,C</sup> Difference between groups is significant with 95% confidence.

Note: Comparisons between specific groups are designated as 'a' to 'a' or 'A' to 'A' between low-income treatment and standard income treatment groups, as 'b' to 'b' or 'B' to 'B' between low-income treatment and control groups, and as 'c' to 'c' or 'C' to 'C' between standard income treatment and control groups.

Most customers cooled their homes with central air conditioning (72 percent low-income treatment, 80 percent standard income treatment, 82 percent control), and most used natural gas as their main heating fuel (71 percent low-income treatment, 66 percent standard income treatment, 72 percent control). There were significantly fewer low-income treatment customers that cooled their home with central air conditioning (72 percent) compared the control customers (82 percent). There were no significant differences in cooling systems when comparing either low-income or control customers to the standard income treatment customers.

**Table 19. Energy Use Characteristics by Group**

	Low-Income Treatment (n=100)	Standard Income Treatment (n=116)	Control (n=124)
Cooling System	n=99	n=115	n=121
Central A/C only	72% <sup>b</sup>	80%	82% <sup>b</sup>
Central A/C plus window unit(s)	17%	17%	12%
Window unit(s) only	11% <sup>A</sup>	3% <sup>A</sup>	6%
Main Heating Fuel Type	n=95	n=116	n=120
Electric	24%	25%	24%
Natural gas	71%	66%	72%
Other	5%	9%	4%

<sup>a,b,c</sup> Differences between groups is significant with 90% confidence.

<sup>A,B,C</sup> Difference between groups is significant with 95% confidence.

Note: Comparisons between specific groups are designated as 'a' to 'a' or 'A' to 'A' between low-income treatment and standard income treatment groups, as 'b' to 'b' or 'B' to 'B' between low-income treatment and control groups, and as 'c' to 'c' or 'C' to 'C' between standard income treatment and control groups.

Unsurprisingly, there is a difference in reported income between the treatment groups. Significantly more low-income treatment customers reported living in a household that makes less than \$24,000 per year (40 percent) compared to standard income treatment (11 percent) and control customers (six percent). Significantly fewer low-income treatment customers reported living in a household that earns \$75,000 or more per year (16 percent) compared to standard income treatment (48 percent) and control customers (60 percent).

The Tetra Tech team found some customers in the low-income cohorts earned household incomes at or above \$75,000 per year (n=13). To qualify for MidAmerican's low-income status, households with that level of income would have to have at least seven people; however, customers reported in their survey responses that these were 1- to 5-person households. The Tetra Tech team also found that some standard income treatment customers (n=11) and some control customers (n=6) had household incomes of less than \$24,000 per year and would thus qualify for low-income status. These were 1- to 6- person households. This information points to the challenges of identifying low-income customers, including that income levels can vary from year to year. Such shifts are generally due to the fluctuations in the economy or job changes, as well as other factors. In PY2020, these other factors may have been related to COVID-19.

**Table 20. Demographics by Group**

	Low-Income Treatment (n=100)	Standard Income Treatment (n=116)	Control (n=124)
<b>Customer Age</b>	<b>n=96</b>	<b>n=112</b>	<b>n=120</b>
18 to 24	2%	1%	-
25 to 34	11%	4%	3%
35 to 44	14%	21%	17%
45 to 54	20%	19%	21%
55 to 64	30%	22%	25%
65 or older	23% <sup>a</sup>	33%	34% <sup>a</sup>
<b>Household Income</b>	<b>n=82</b>	<b>n=96</b>	<b>n=96</b>
Less than \$24,000	40% <sup>A,B</sup>	11% <sup>A</sup>	6% <sup>B</sup>
\$24,000 to less than \$50,000	24%	19%	19%
\$50,000 to less than \$75,000	20%	22%	16%
\$75,000 to less than \$100,000	10% <sup>B</sup>	17%	22% <sup>B</sup>
\$100,000 or greater	6% <sup>A,B</sup>	31% <sup>A</sup>	38% <sup>B</sup>
<b>Number of People in Household</b>	<b>n=96</b>	<b>n=113</b>	<b>n=121</b>
One person	48% <sup>A,B</sup>	13% <sup>A</sup>	16% <sup>B</sup>
Two people	26% <sup>A,B</sup>	51% <sup>A</sup>	47% <sup>B</sup>
Three or more people	26% <sup>b</sup>	36%	37% <sup>b</sup>

<sup>a,b,c</sup> Differences between groups is significant with 90% confidence.

<sup>A,B,C</sup> Difference between groups is significant with 95% confidence.

Note: Comparisons between specific groups are designated as 'a' to 'a' or 'A' to 'A' between low-income treatment and standard income treatment groups, as 'b' to 'b' or 'B' to 'B' between low-income treatment and control groups, and as 'c' to 'c' or 'C' to 'C' between standard income treatment and control groups.

#### 4.1.1 Moderate Income<sup>16</sup> Survey Respondent Characteristics

The Tetra Tech team analyzed survey data to identify moderate income customers and assess differences among low-income, moderate income, and higher incomes households.<sup>17</sup> The Tetra Tech team found that overall characteristic trends among customers living moderate income households

<sup>16</sup> The Tetra Tech team defined customers' household incomes and household sizes as self-reported through the online survey. Given the number of survey completes achieved for each income group among customers who recalled HERs and answered relevant survey questions, it was not possible to reliably test differences in HER experiences among income groups. A much larger number of completed surveys would have been needed, which would have substantially impacted the evaluation budget.

<sup>17</sup> The Tetra Tech team assessed household size and income levels to identify households living just above the low-income threshold up to about 80 percent of the state median income and designated these households as 'moderate income households' (see detailed methodology in Appendix F).



were like other income groups (most owned their homes and lived in single-detached homes, for example). In some instances, *moderate income* households had significantly higher or lower rates of demographic characteristics compared to other income groups:

- Homeownership
  - Significantly **more own their homes** (91 percent moderate income) compared to lower income households (75 percent), and the rate is about the same as higher income households (95 percent).
- Home Type
  - Significantly **fewer live in single-family detached homes** (83 percent moderate income) than higher income households (94 percent), and the rate is about the same as lower income households (80 percent).
  - Significantly **more live in mobile homes or house trailers** (six percent moderate income) compared to higher income households (one percent), and the rate is about the same as lower income households (three percent).
- Year Home Built
  - Significantly **more live in homes built in the 1930s or earlier** rates (32 percent moderate income) compared to higher income households (18 percent), and the rate is about the same as lower income households (27 percent).
  - Significantly **fewer live in homes built in the 1980s or later** (27 percent moderate income) than higher income households (40 percent), and the rate is about the same as lower income households (19 percent).
- Cooling System
  - Significantly **more cool with window air condition units only** (eight percent moderate income) than higher income households (two percent), and the rate is about the same as lower income households (14 percent).
- Customer Age
  - Significantly **more said they were 65 years or older** (41 percent moderate income) compared to higher income households (20 percent), and the rate is about the same as lower income households (34 percent).
  - Significantly **fewer said they were 45 to 64 years of age** (33 percent moderate income) than higher income households (52 percent), and the rate is about the same as lower income households (44 percent).
- Household Size
  - Significantly **more live in 1-person households** (35 percent moderate income) compared to higher income households (nine percent), and the rate is about the same as lower income households (45 percent).
  - Significantly **fewer live in 2-person households** (32 percent moderate income) compared to higher income households (55 percent), and significantly lower rates compared to lower income households (14 percent).

#### 4.1.2 Socket Saturation

The Tetra Tech team asked surveyed customers about the types of lightbulbs they installed in their homes to help understand saturation rates of CFLs and LEDs. Customers were asked to consider all the sockets inside and outside of their home and report how many of these sockets had CFLs or LEDs installed in them, respectively.

**Table 21. CFL and LED Socket Saturation Rates Among Survey Respondents**

Category	Low-Income Treatment (n=100)	Standard Income Treatment (n=116)	Control (n=124)
CFLs installed across all sockets	n=78	n=96	n=99
0% - 20%	62%	56%	67%
21% - 40%	12%	9%	12%
41% - 60%	6% <sup>A</sup>	22% <sup>A,B</sup>	11% <sup>B</sup>
61% - 80%	10%	6%	5%
81% - 100%	10%	6%	5%
LEDs installed across all sockets	n=76	n=99	n=110
0% - 20%	43% <sup>A</sup>	38% <sup>B</sup>	25% <sup>A,B</sup>
21% - 40%	13%	8%	15%
41% - 60%	9% <sup>A,B</sup>	21% <sup>A</sup>	20% <sup>A</sup>
61% - 80%	9%	9%	11%
81% - 100%	25%	21%	25%

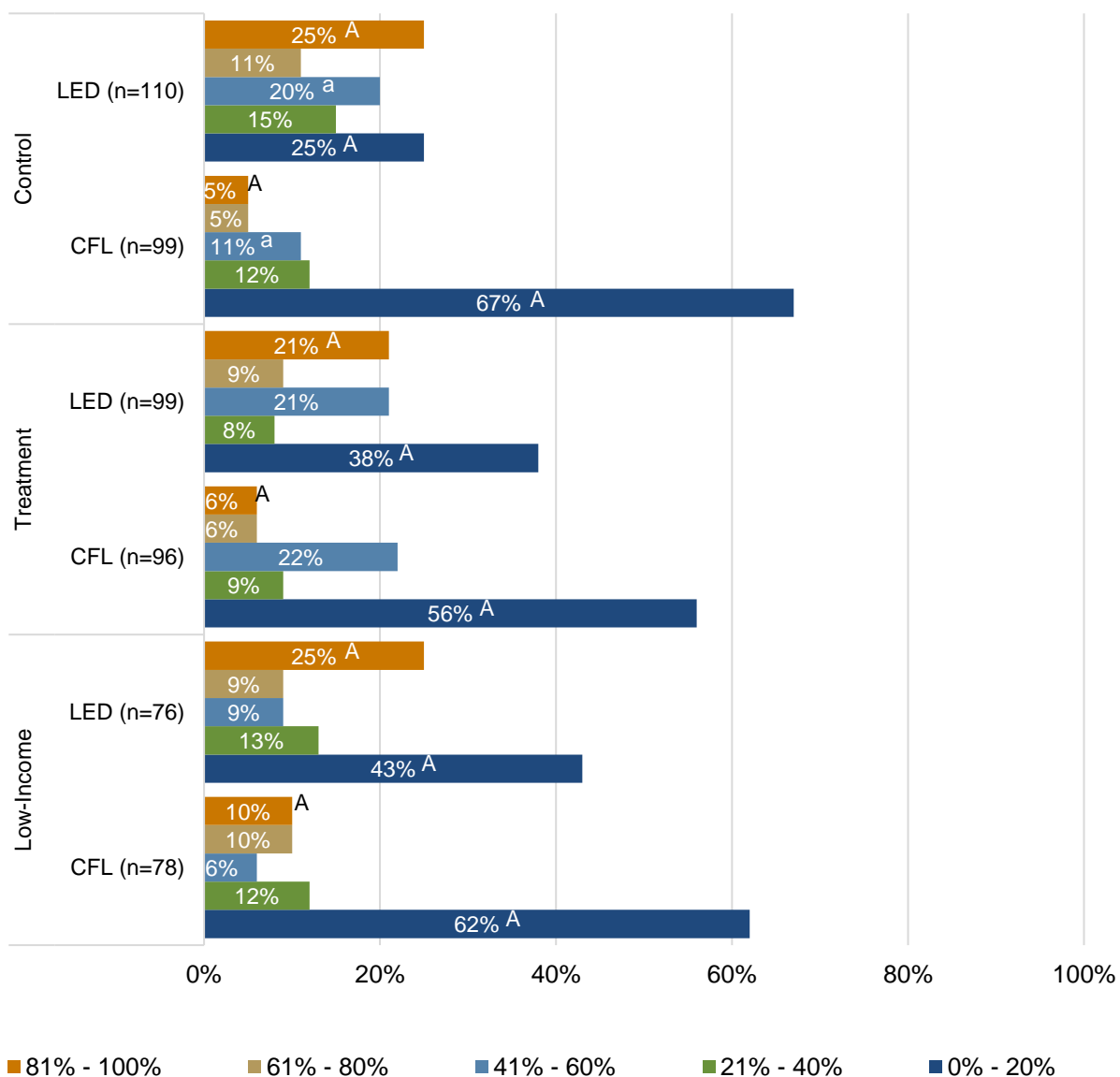
Source: PY2020 Customer Survey, LT3 and LT5

Note: Percentages may not add up to 100 percent due to rounding.

While there were some significant differences across groups at the different saturation ranges, no strong overarching trends were apparent between treatment groups and the control group. Control group customers were less likely to have 0 to 20 percent LEDs installed than either treatment group, and low-income treatment customers were less likely to have 41 to 60 percent LED saturation compared to the other groups. However, similar amounts of each group have LEDs installed at the higher ranges of 61 to 80 percent and 81 to 100 percent.

Overall, and across groups, customers tended to report lower saturation rates of CFLs than LEDs. Significantly more customers in all groups reported having higher rates (81 to 100 percent) of LEDs in their homes than CFLs (Figure 4). This trend towards LEDs is expected, given advances in LED technology and a lowering of bulb prices over the last several years.

**Figure 4. PY2020 CFL versus LED Saturation Rates**



Source: 2020 Customer Survey, LT3 and LT5

A Difference between CFL and LED rate is statistically significant with 95% confidence.

a Difference between CFL and LED is statistically significant with 90% confidence.

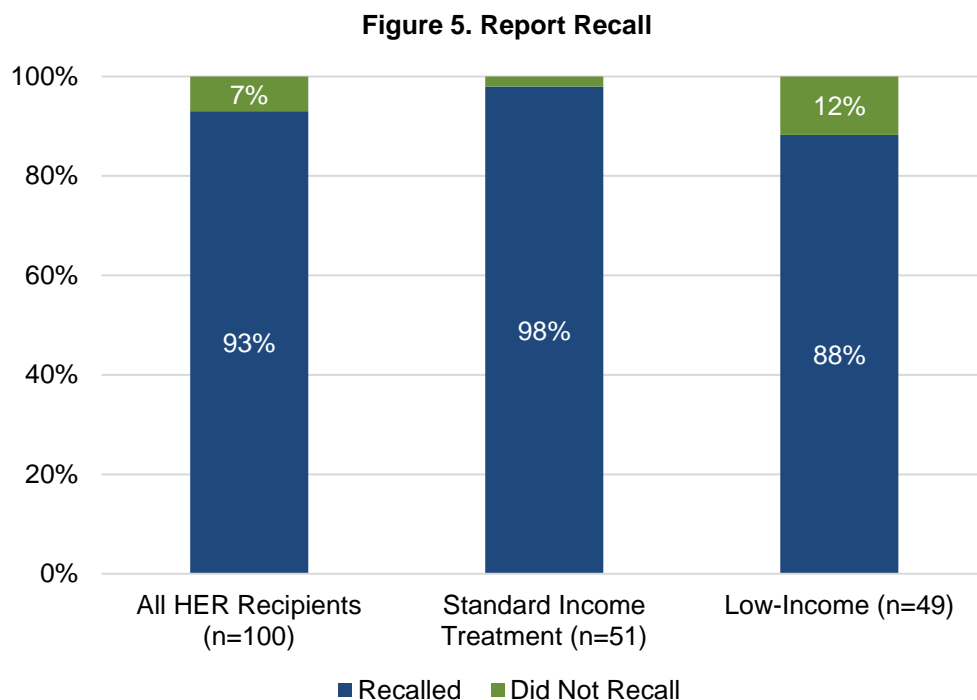
## 4.2 PROGRAM PROCESSES

### 4.2.1 Engagement with the Report

HER effectiveness and savings are maximized with higher levels of customer engagement. Next the Tetra Tech team discusses report readership and usefulness of report sections based on surveyed HER recipients (standard income treatment and low-income treatment customer groups).<sup>18</sup>

#### 4.2.1.1 Readership

Treatment customers generally received and opened the reports. The figure below shows that 93 percent of standard income treatment customers recalled receiving the HER. Few said they did not recall the HER (seven percent)

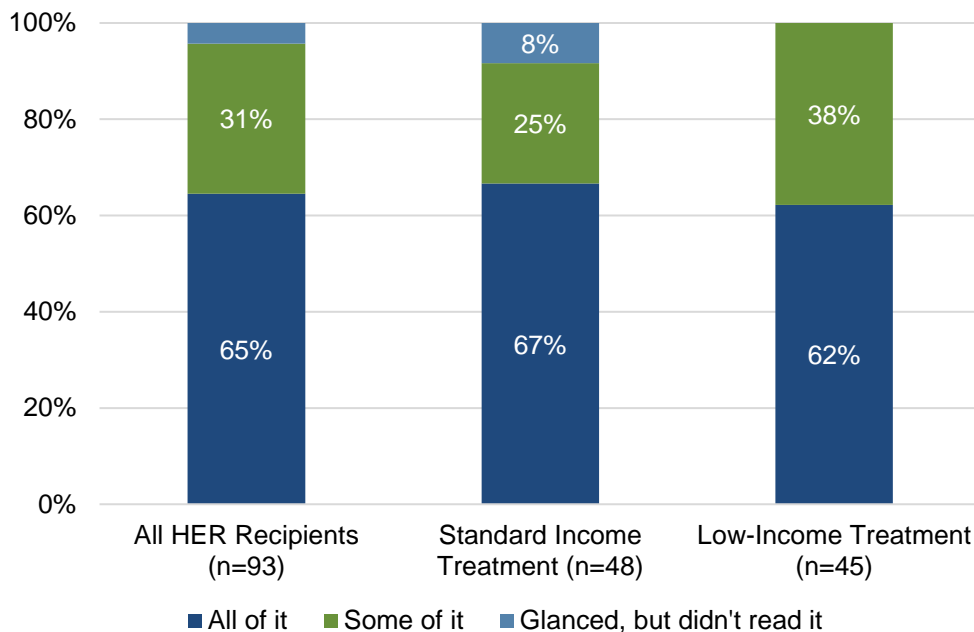


Source: 2020 Customer Survey, S2

Of these, readership was high, with most surveyed customers reporting that they read some or all of the most recent report they received (96 percent). No survey respondents reported that they read none of their most recent HER. The figure below shows this finding was consistent across both the standard income treatment (92 percent) and low-income treatment (100 percent) groups.

<sup>18</sup> The Tetra Tech team used quotas in the design of the customer survey to limit the number of customers that were shown and asked to respond to questions about their HER experiences. This approach reduced overall survey burden for customers while still allowing the evaluation to gather enough data to assess the customer experience overall. As such, findings in figures are shown as the overall “All HERs Recipients,” which represents the combined survey responses from both standard income treatment and low-income treatment customers, and by the separate standard income treatment and low-income treatment groups. Results from these separate groups should be interpreted as trends, or marginally statistically significant comparisons as the counts of responses in each group is small.

**Figure 6. Readership**



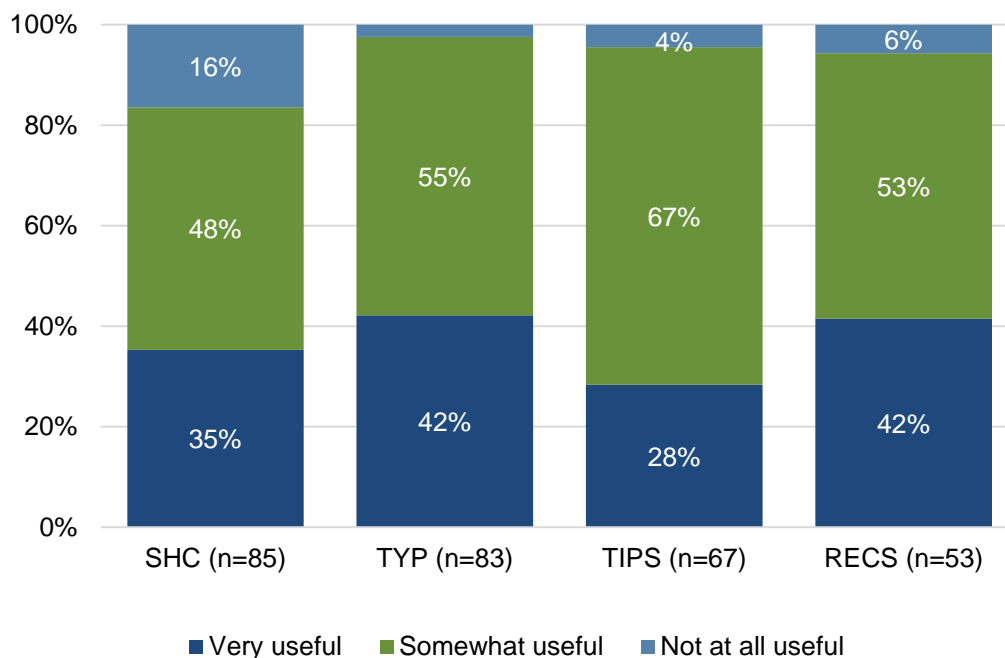
Source: 2020 Customer Survey, R1

Most customers said they saved the report for future reference (49 percent) and/or discussed it with someone else (34 percent). Of the 11 customers who said they took some other action, eight said they first read it and then discarded it.

#### 4.2.1.2 Usefulness of Report Features

Of customers who recalled receiving a HER, most found the different report sections to be “somewhat useful” or “very useful” (83 to 97 percent), with the highest percentage of usefulness given for the Track Your Progress (TYP) section (97 percent useful). The Similar Homes Comparison (SHC) section was least useful to HER recipients, with 16 percent reporting it was “not at all useful.” These findings reflect combined responses from both the standard income treatment and low-income treatment groups.<sup>19</sup>

<sup>19</sup> The Tetra Tech team could not reasonably assess whether the difference in findings between the standard income treatment and low-income treatment groups were statistically significant because the counts of customers in each group (25 to 46 customers) that responded to this question was not high enough to reasonably compare the two groups with confidence.

**Figure 7. Usefulness of Report Sections**

Source: 2020 Customer Survey, SHC3, TYP2, TIPS2, PR2

SHC=Similar Home Comparison; TYP=Track Your Progress; TIPS=Tips for Efficient Homes; RECS=Program or Equipment Information

#### 4.2.1.3 Perceptions of the Similar Homes Comparison

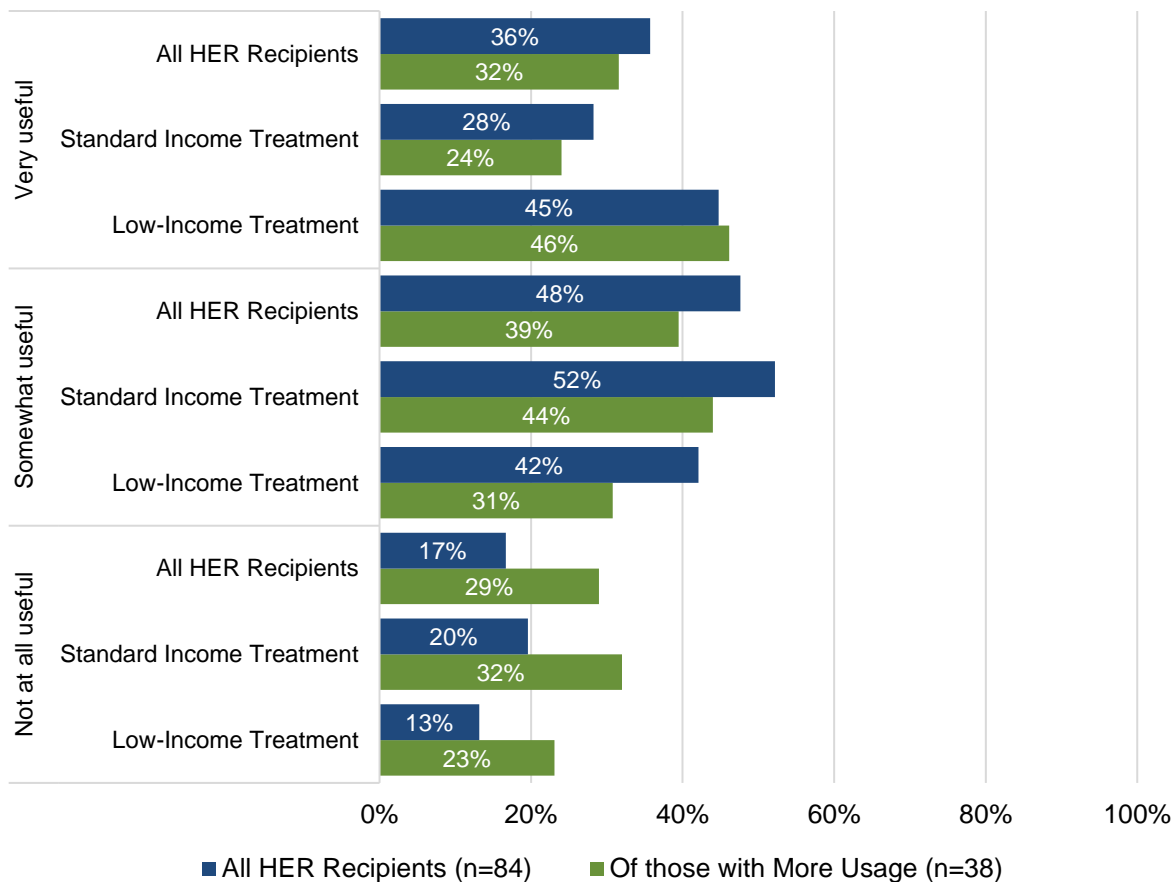
A key element of the behavior report design is encouraging energy savings through normative behavior change—i.e., using social norms to encourage change. If customers see they are not doing as well as similar homes, they are theoretically encouraged to make changes to improve. For those who are shown they are doing better than similar homes, the report is designed to reinforce their “good” performance. Therefore, the SHC report module that compares the recipient with comparison homes is a foundational component of the report.

Customers’ SHC usefulness ratings may be driven by how their homes ranked against similar homes in the HER. Of all treatment customers who recalled receiving a report and recalled seeing the comparison of their monthly use with similar homes in the area, about half (44 percent) reported that their use was more than similar homes. About a quarter (27 percent) reported that they used less, and another quarter (27 percent) reported that they used about the same amount of energy.

The figure below shows that customers who reported their SHC showed more usage than others were more likely to say the comparison was not at all useful, where these customers found the comparison about 10 percent less useful. This trend was consistent in both the standard income treatment and low-income treatment groups.



**Figure 8. Usefulness of Similar Homes Comparison Perceptions by Usage Feedback**



Source: 2020 Customer Survey, SCH2, SHC3

Some customers who rated the usefulness of the SHC as “somewhat” or “not at all useful” provided feedback for making the SHC more useful. Most commonly, customers suggested factors to include when calculating the comparison (n=13) like square footage, household size, fuel type (for example, electric/dual/gas for appliances, geothermal heating). Customers also asked for help to save energy or money (n=7) suggesting higher rebates, new energy savings tips or a tips checklist, or a simulator to figure out where repairs or upgrades might be needed. Several customers mentioned that they thought their SHC was unfair for their home (n=6), others simply said they did not understand how the comparison was done (n=6).<sup>20</sup>

<sup>20</sup> The 2018 Residential Behavioral program evaluation included a literature review and found that customers who do not understand or believe in the SHC tend to think it’s inaccurate or unfair and “write off” that section of the report completely. They do not invest time into trying to understand it. This reaction often comes from their assumption that (a) the similar homes are from their immediate neighborhood, rather than a larger area (and with this assumption, they come up with stories for why they are not comparable), or (b) misinterpretation of what “efficient” means, thinking it relates wholly to the equipment and physical characteristics of the home rather than behaviors. These customers are also more likely to think that efficient homes are new homes with “fancy” equipment, which then seems unattainable. Further, the study found that these types of reactions, which are an intended outcome of the SHC module founded in social norm theory, do drive savings by motivating customers to take action they might not have otherwise taken. (Tetra Tech. “MidAmerican Energy Company Residential Behavior 2016-2017 Impact and Process Evaluation.” November 7, 2018.)

Select respondent comments included:

*"We have more finished square feet than any of the other houses in the neighborhood...if you did the comparisons on a square footage basis...it would compare not just ones you think are about the same size."*

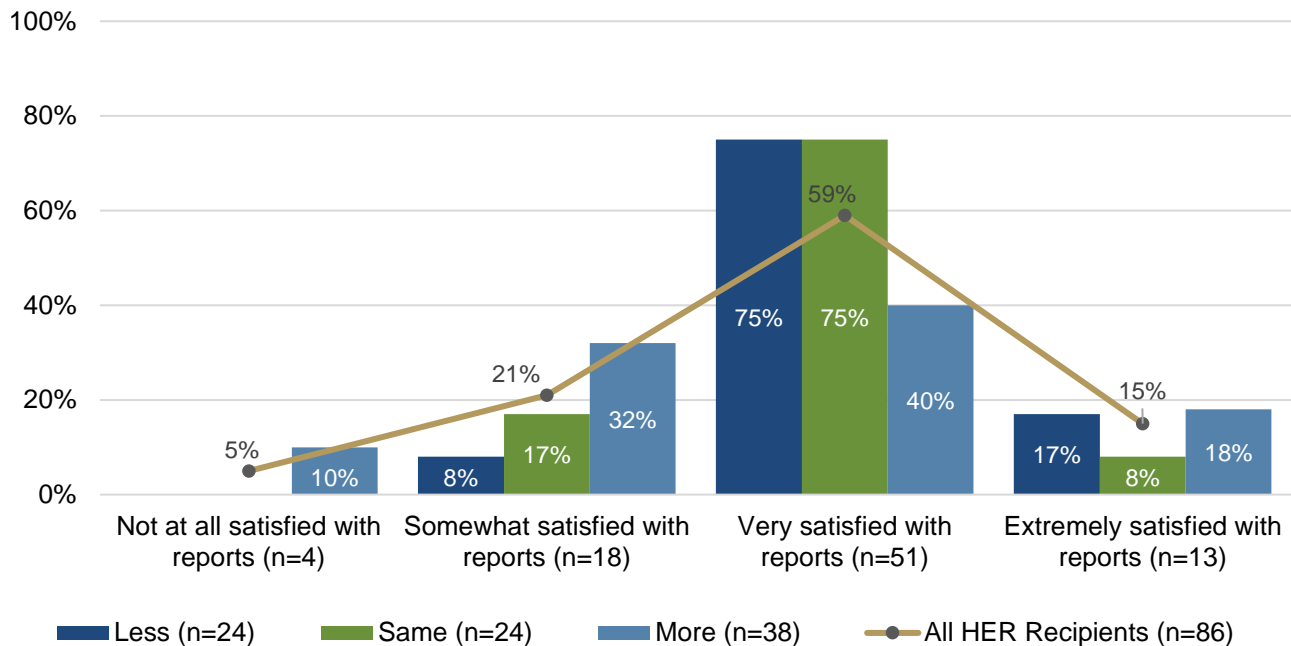
*"It would be helpful to know what caused the differences or to see a comprehensive checklist of things to evaluate."*

*"We have more appliances and tubs than neighbors so info not relevant to us."*

*"...Sometimes it says I use more energy than other households and sometimes it uses less, so I'm confused by why it changes so often."*

The Tetra Tech team also found that overall satisfaction with the reports trended higher among HER recipients who were shown that they used about as much or less energy than similar homes. However, just over half of customers who said that they used more energy (58 percent) also said they were "very" to "extremely" satisfied with reports, with another 32 percent who said they were "somewhat" satisfied. The figure below displays this trend by comparing overall HER satisfaction ratings to satisfaction ratings by the energy usage feedback customers reported they saw in their HERs.

**Figure 9. Trends in Report Satisfaction Ratings by SHC Energy Usage Feedback**



Source: 2020 Customer Survey, SCH2, HS1

#### 4.2.2 Impact of HER on Customer Awareness and Actions

Readership and usefulness alone will not drive longer-term energy savings. Increased awareness, participation in efficiency programs, and behavioral changes are necessary for a program like Residential Behavioral to achieve its goals. The Tetra Tech team recognizes that participation in other MidAmerican programs, because of information provided in the reports, counts against the program

savings to avoid double-counting<sup>21</sup>. However, this channeling should be considered an element of program effectiveness, even if not directly recognized in claimed savings. The Tetra Tech team therefore presents in this section the impacts of how the report may have influenced behavior change through energy savings actions taken, and how the report may have influenced customer awareness of other MidAmerican programs and/or behavior modifications.

#### 4.2.2.1 Impact of HER on Customer Actions

One of the key objectives of the customer survey was to assess the degree to which HERs influence customers to take energy-saving actions in their home. As a behavior-based program, this is a useful metric to determine how effective the reports are in driving change, as well as to give further context to the impact evaluation findings.

##### i. Actions Taken

The survey presented a list of actions to respondents and asked them whether they had taken each action in the last year. Some of these actions were purely behavioral (e.g., turning down thermostat temperature) while others were low-cost improvements (e.g., weather-stripping). The Tetra Tech team compared actions taken among control group customers to those taken by standard income treatment or low-income treatment customers. The Tetra Tech team found that the most common actions taken across groups were:

1. Cleaning or replacing air filters (90 percent low-income treatment, 96 percent standard income treatment, 95 percent control);
2. Setting the thermostat to 68 degrees in the winter (68 percent low-income treatment, 66 percent standard income treatment, 60 percent control); and
3. Unplugging electronics or appliances when not in use (55 percent low-income treatment, 48 percent standard income treatment, 49 percent control).

Significantly fewer low-income customers cleaned or replaced their filters than standard income treatment customers. All other rates of taking these three common actions are similar across groups.

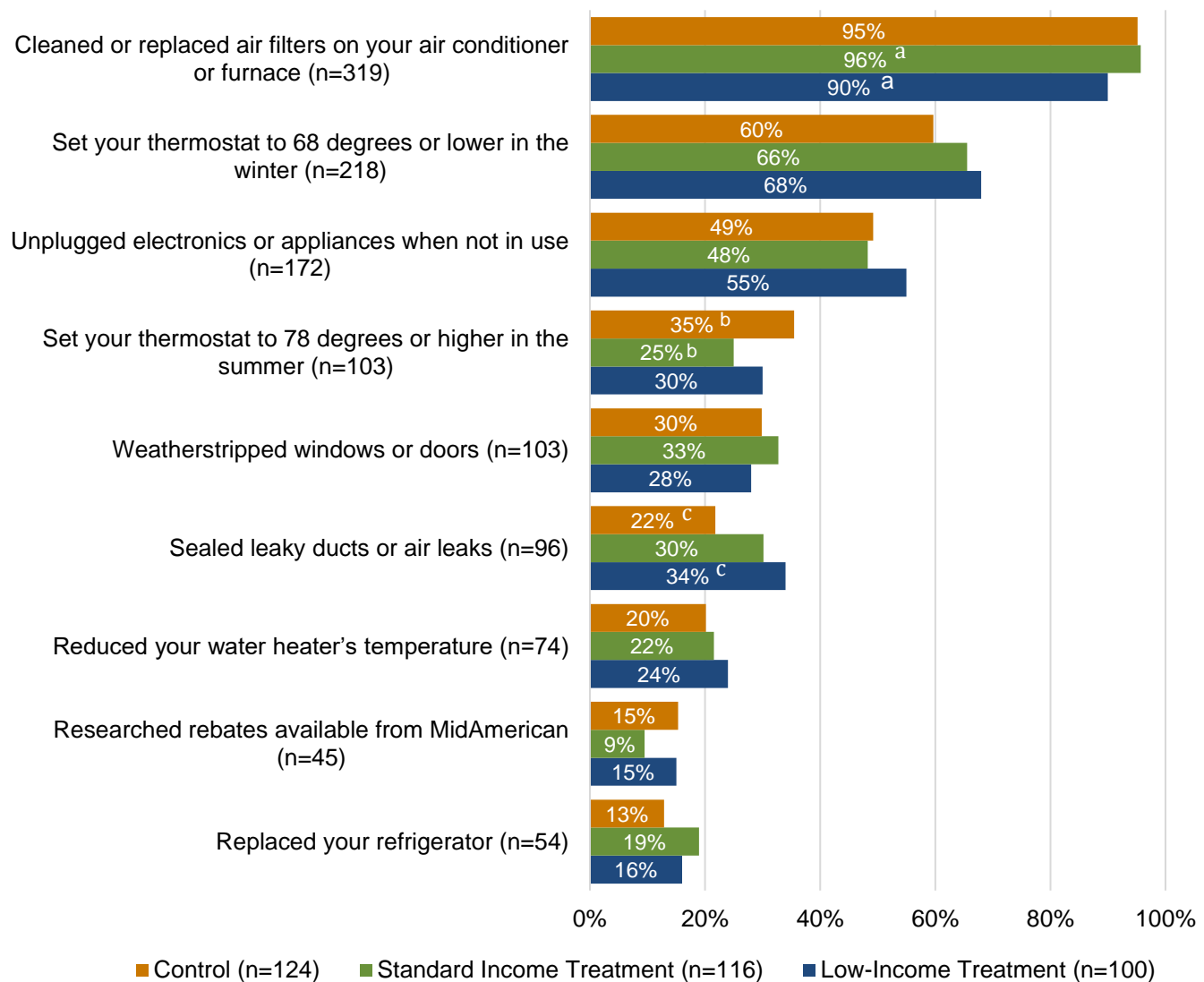
While knowing how these populations might act is valuable from a market perspective, it is understanding the differences in how the treatment groups and control group responds that is of most value. Statistically significant differences would indicate report effectiveness at encouraging these changes and provide additional evidence outside of the impact results that the savings are attributable to the HERs. However, customer recollection of actions taken may at times differ from what happened. Impact results presented in previous sections of the report illustrate that the program is influencing household energy consumption at higher rates among treatment groups than the control group. The following survey results paint a slightly different picture, with fewer differences in reported actions taken between the treatment groups and the control group. This apparent conflict between the impact and survey results could be for a variety of reasons. For example, it could be that the actions highlighted in the survey did not reflect all the actions that responding treatment group customers took because of the HERs. The survey administration also lagged the program year being tested, which could cause recollection issues.

The survey results showed only one significant difference between standard income treatment and control groups. Standard income treatment customers reported setting their thermostats to 78 degrees

<sup>21</sup> See Appendix D for more information related to this.

or higher in the summer significantly less often (25 percent) than control customers (35 percent). Low-income treatment customers took this action at similar rates to both standard income treatment and control customers. This indicates that the HER was likely not a factor in customers' decisions to set their thermostats at or above 78 degrees in the summer.

**Figure 10. Energy Efficiency Actions Taken Within the Last Year**



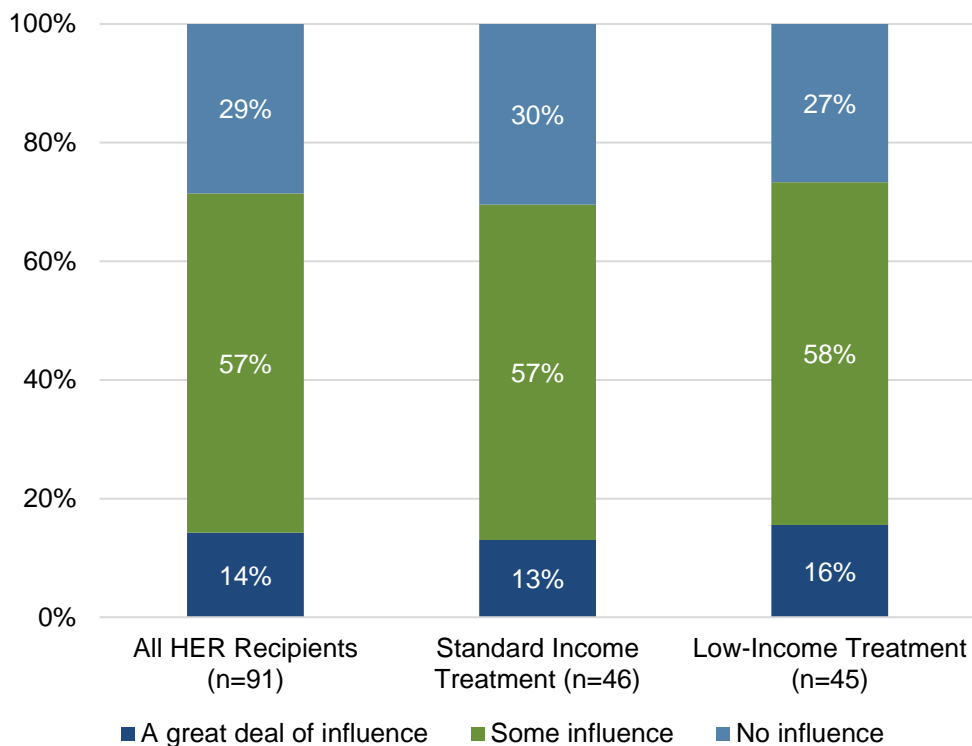
Source: 2020 Customer Survey, B1 (multiple choice)

a Differences between treatment and low-income treatment groups are marginally significant with 90% confidence.

b Differences between low-income treatment and control groups are significant with 90% confidence.

Of respondents who reported taking at least one energy savings action in their home, a high proportion of HER recipients said that the HER had “some” to a “great deal” of influence on their decision to take energy savings actions (71 percent). The figure below shows that this trend is consistent across standard treatment and low-income treatment groups.

**Figure 11. Influence of HERs on Customer Actions**

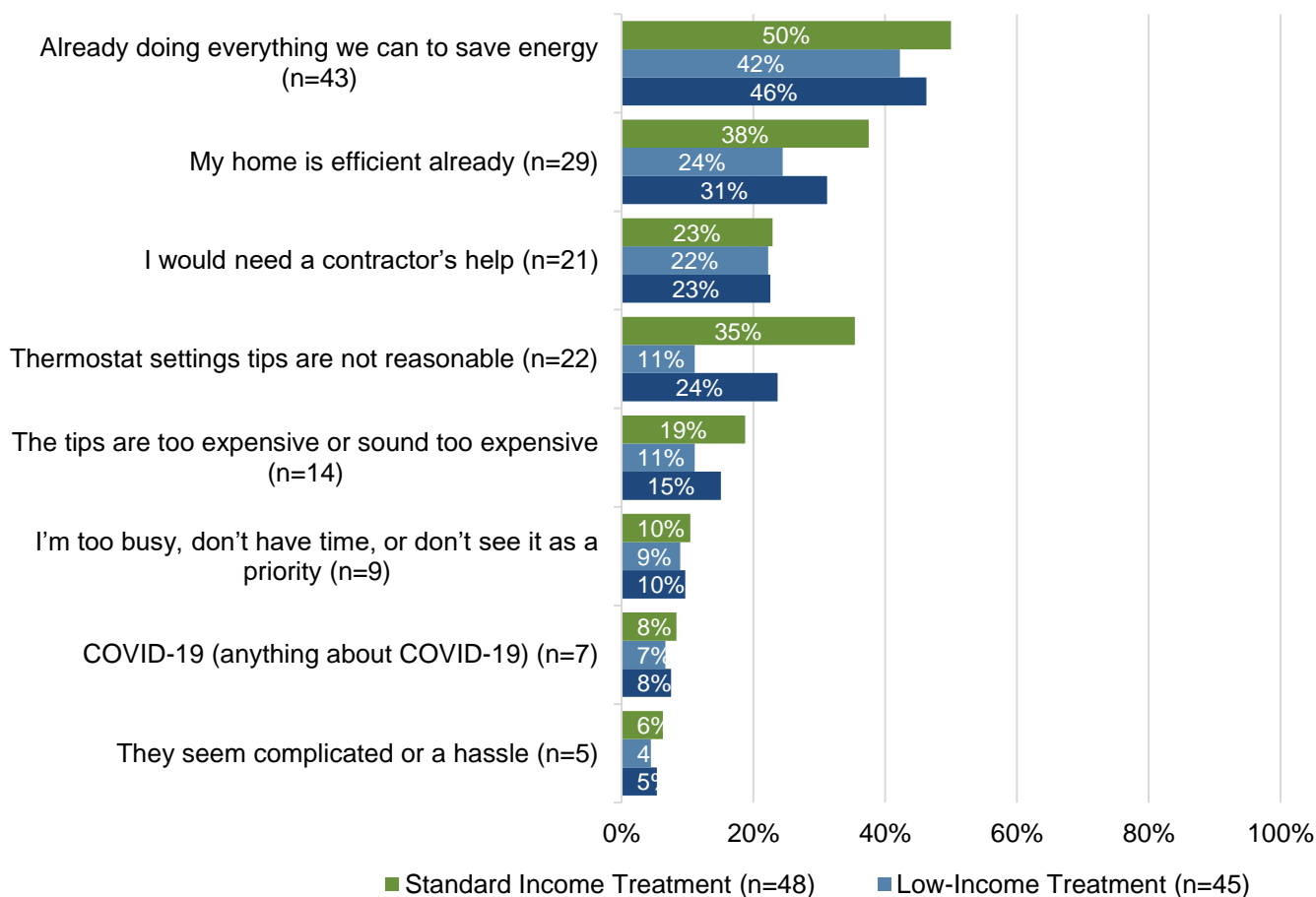


Source: 2020 Customer Survey, I1

## ii. Barriers to Taking Action

In the survey, the Tetra Tech team asked HER recipients who recalled receiving a report about the barriers that may exist that prevented them from following tips or taking energy-savings actions. The Tetra Tech team found that most customers across groups said they were already doing everything they can to save energy (46 percent) or thought their home was already energy efficient (31 percent). Significantly more standard income treatment customers said that the thermostat tips are not reasonable (35 percent) compared to the low-income treatment group (11 percent), although the difference is marginal given small sample sizes.

**Figure 12. Barriers to Taking Energy Saving Actions**



Source: 2020 Customer Survey, T1 (multiple choice)

A Differences between treatment and low-income treatment groups are marginally statistically significant with 95% confidence.

Customers that reported COVID-19 was a barrier (n=7) said that taking actions was difficult because of limited exposure to others (n=5) and that their income had been negatively affected (n=2). For example:

*"Isolating because of health risks."*

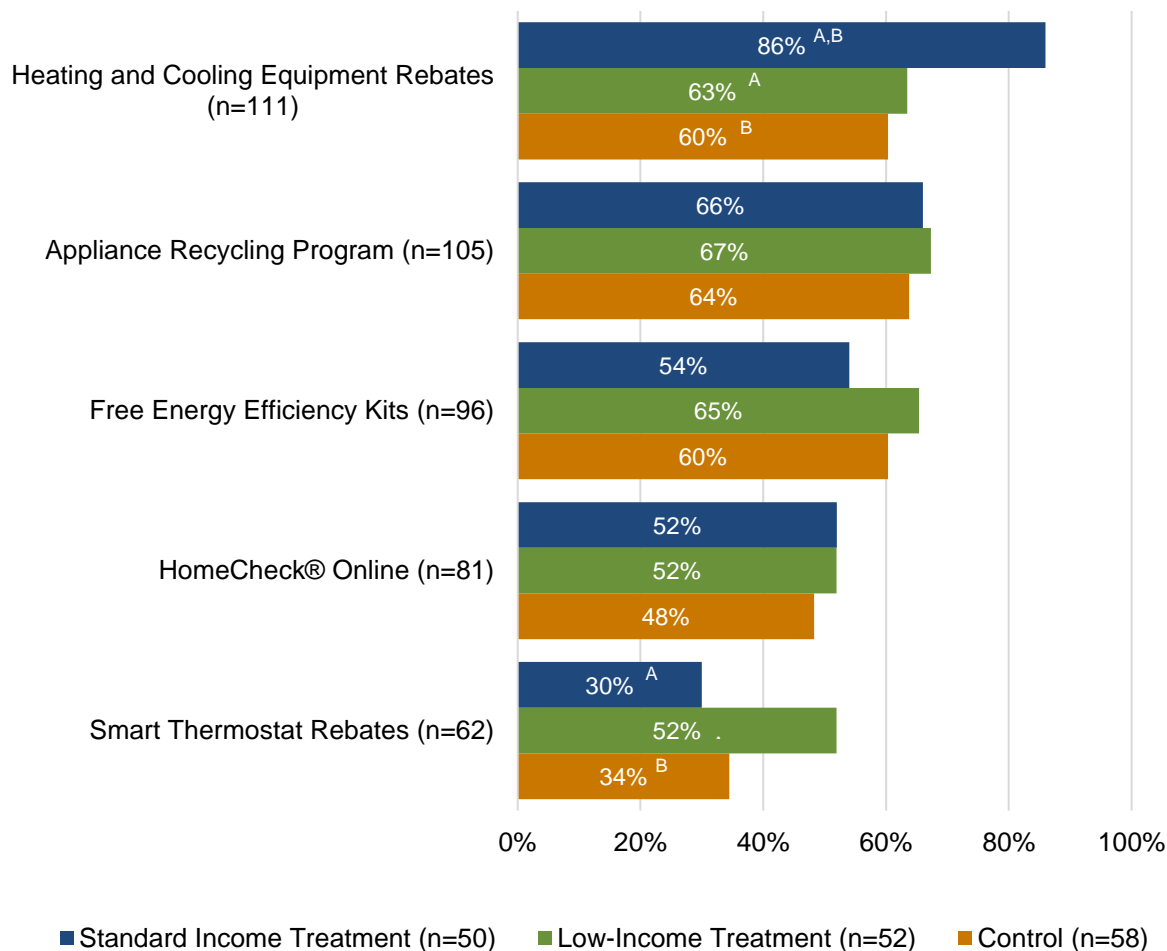
*"Our income has plummeted due to COVID."*

#### 4.2.2.2 Impact of HER on Customer Awareness of MidAmerican Programs

Customers across groups were generally aware that MidAmerican offers other programs. About half of surveyed customers said they were aware that MidAmerican offers other programs, rebates, or incentives to help them save money and energy in their homes (51 percent). Of these, significantly more low-income treatment customers (59 percent) were aware of MidAmerican's other programs compared to the standard income treatment group (45 percent). There was no statistical difference between either the low-income treatment group or the standard income treatment group and the control group (51 percent). This general question assessed their recall only and did not prompt for their awareness of specific programs.

The Tetra Tech team found that standard income treatment customers (86 percent) were significantly more likely to say they were aware of heating and cooling equipment rebates than any other group (63 percent low-income treatment, 60 percent control), indicating that the higher awareness of these rebates may be attributable to the Residential Equipment program. Significantly more low-income treatment customers (52 percent) were likely to say they were aware of smart thermostat equipment rebates than any other group (30 percent standard income treatment, 34 percent control). These statistical differences are marginal given small sample sizes among respondents. The figure below shows survey respondents' awareness of specific programs.

**Figure 13. Awareness of MidAmerican Programs by HER Group**



Source: 2020 Customer Survey, A2 (multiple choice)

A,B Differences between treatment and low-income treatment groups are statistically significant with 95% confidence.

Higher awareness of other programs among low-income customers may be tied to how these customers tend to learn about energy savings programs and resources. For example, a low-income customer who qualifies for LIHEAP also qualifies for the statewide weatherization programs funded by the federal Weatherization Assistance program and MidAmerican's Residential Low-Income program. They likely access these services through organizations like community action agencies that tend to bundle energy efficiency offerings and resources.



The Tetra Tech team also assessed differences in program awareness by household income (lower income, moderate income, higher income) and found no statistical differences among income groups (see Appendix F for detailed definitions of income groups).

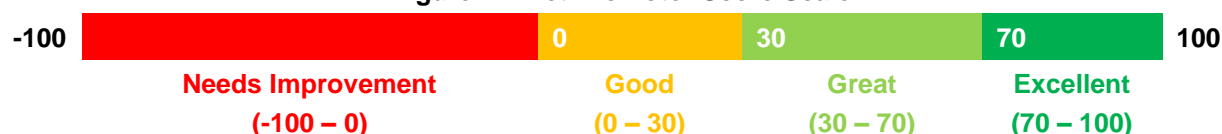
### 4.2.3 Program Satisfaction

Below the Tetra Tech team discuss customers' satisfaction with the HER program and with MidAmerican.

#### 4.2.3.1 Net Promoter Score

A new metric being presented for MidAmerican programs in this evaluation cycle is the Net Promoter or Net Promoter Score (NPS)<sup>22</sup>. The NPS is calculated based on responses to a single question: How likely is it that you would recommend our company/product/service to a friend or colleague? The NPS is then the percentage of customers rating their likelihood to recommend a company, a product, or a service to a friend or colleague as 9 or 10 ("promoters") minus the percentage rating this at 6 or below ("detractors") on a scale from 0 to 10. Respondents who provide a score of 7 or 8 are referred to as "passives." The result of the calculation is expressed without the percentage sign. Promoters are considered likely to exhibit value-creating behaviors, such as buying more, remaining customers for longer, and making more positive referrals to other potential customers. Detractors are believed to be less likely to exhibit the value-creating behaviors.

**Figure 14. Net Promoter Score Scale**



Overall, HER recipients rated the likelihood that they would recommend HERs to others on scale of 0 to 10 where 0 was "extremely unlikely" and 10 was "extremely likely." Based on survey responses, the Residential Behavioral program has an NPS of six (33 percent – 27 percent = 6). This NPS score falls into the Good category (0-30), which is a reasonable score for a behavioral program with an opt-out model.<sup>23</sup>

<sup>22</sup> NPS is a management tool used as a measure of customer satisfaction and has been shown to correlate with revenue growth relative to competitors. NPS has been widely adopted by Fortune 500 companies and other organizations. Scores vary substantially among industries, so a good score is simply one whose trend is better than that of competitors in the same industry, as measured by double-blind benchmark research. The metric was developed by (and is a registered trademark of) Fred Reichheld, Bain & Company and Satmetrix. It was introduced by Reichheld in his 2003 Harvard Business Review article, "The One Number You Need to Grow". Its popularity and broad use have been attributed to its simplicity and its openly available methodology.

<sup>23</sup> NPS scores are commonly used as a metric for programs or products where customers opt-in to participate, inherently have more buy-in to the program, and thus are more likely to say they would recommend the program to others. As the Residential Behavioral program uses an opt-out model to reach a broader group of customers, a lower NPS score for Likelihood to Recommend is expected.

**Table 22. NPS for all HER Recipients**

NPS Score and Category	All HER Recipients
<b>NPS Score</b>	<b>6</b>
Promoters (rating 9 or 10)	33%
Passives (rating 7 or 8)	27%
Detractors (rating 0 – 6)	40%
<b>Respondents</b>	<b>93</b>

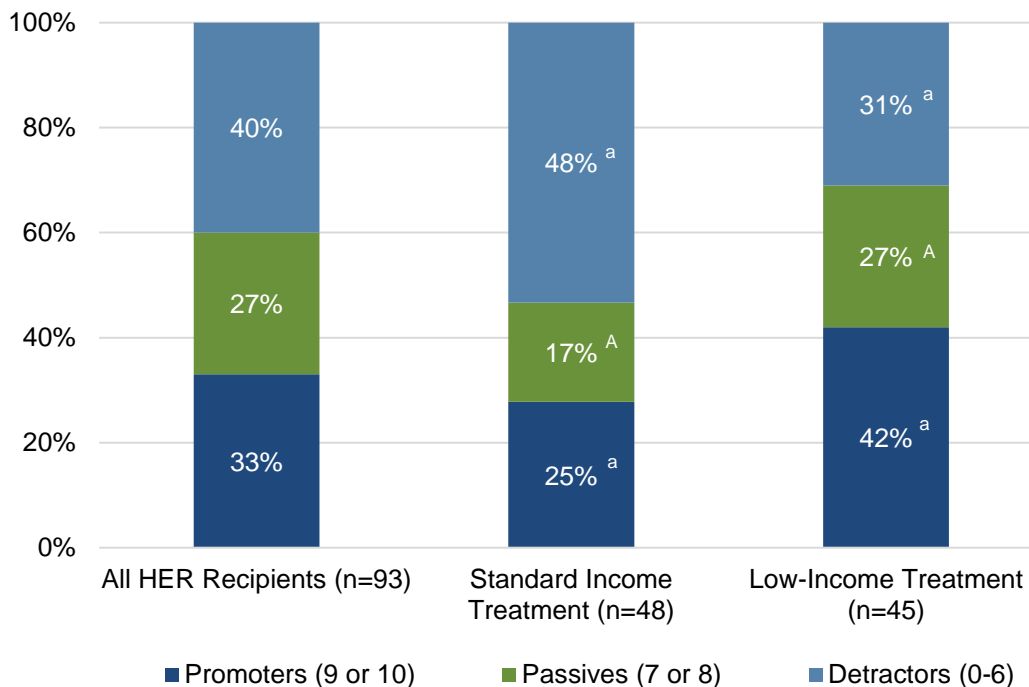
Source: PY2020 Customer Survey, HS3

Don't know and refused responses are excluded

Rated on a scale of 0 to 10, where 0 was "extremely unlikely" and 10 was "extremely likely"

The figure below shows that, overall, most customers that received a HER gave a rating of 7 or above. Low-income treatment customers gave higher ratings of 9 or 10 (42 percent) or 7 or 8 (27 percent) than standard income treatment customers (25 percent and 17 percent, respectively), although these differences are marginal given small sample sizes among respondents.

**Figure 15. Likelihood to Recommend the HER by Customer Group**



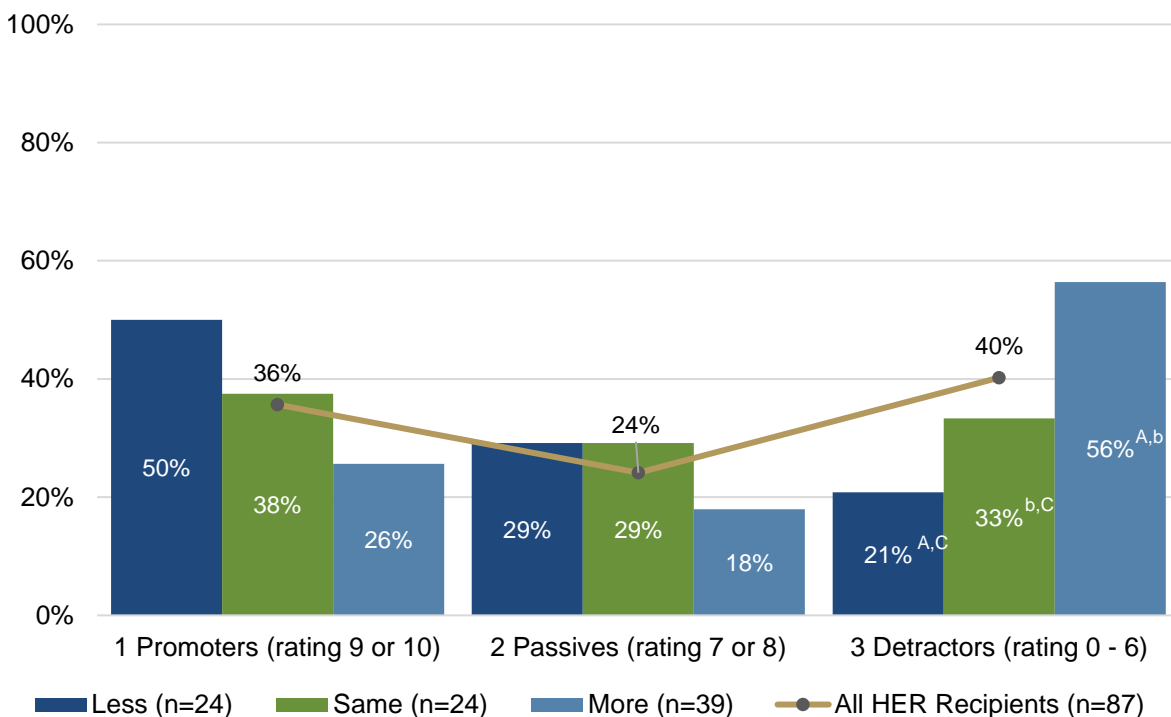
Source: 2020 Customer Survey, HS3

<sup>A</sup> Differences between treatment and low-income treatment groups are marginally statistically significant with 95% confidence.

<sup>a</sup> Differences between treatment and low-income treatment groups are marginally statistically significant with 90% confidence.

The Tetra Tech team compared ratings of likelihood to recommend the program with energy usage feedback. As we would expect to see, customers who said they saw more usage compared to similar homes were significantly more likely to say that they would not recommend the program to others. This aligns with the Tetra Tech team's finding that these customers were more likely to say they were not satisfied with HERs, as it follows that customers who are not satisfied with HERs would not recommend the program to others.

**Figure 16. Likelihood to Recommend the HER by Usage Feedback**



Source: 2020 Customer Survey, SHC2, HS3

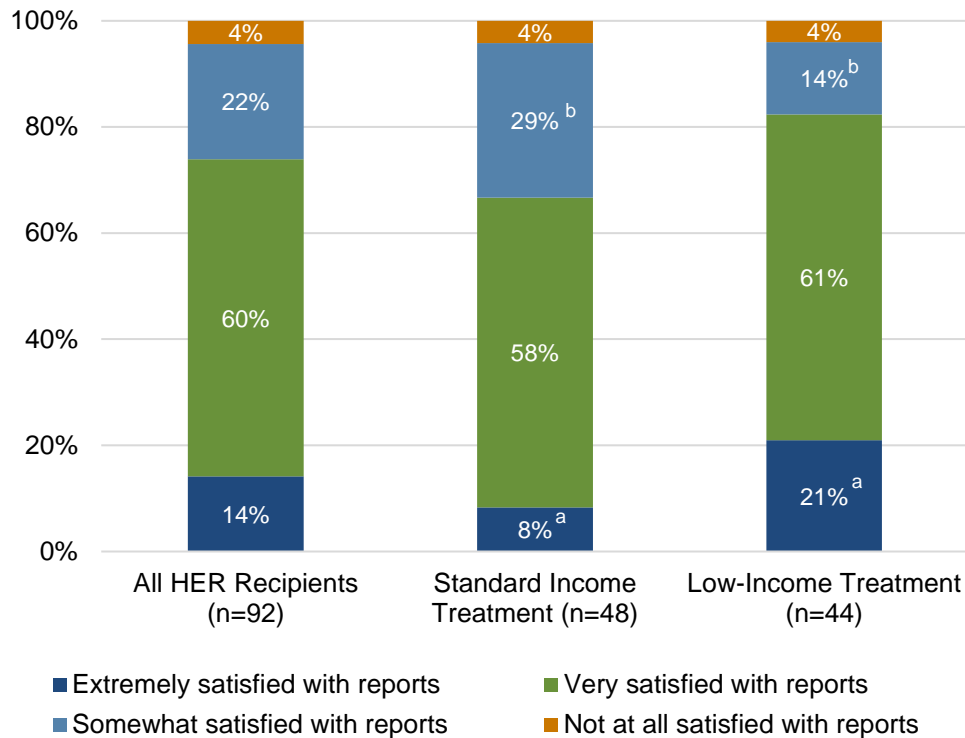
A,C Differences are statistically significant with 95% confidence.

b Differences statistically significant with 90% confidence.

#### 4.2.3.2 Customer Satisfaction

The Tetra Tech team asked HER recipients to rate their overall satisfaction with HERs they received. Overall, about three quarters were “very” to “extremely” satisfied (74 percent) and about another quarter were “somewhat satisfied” (22 percent). The Tetra Tech team found that low-income treatment customers were more likely to say they were satisfied with reports than standard income treatment customers. This is shown in the figure below where more low-income treatment customers reported being “extremely satisfied” with reports (21 percent) compared to standard income treatment customers (eight percent), and more standard income treatment customers reported being “somewhat satisfied” (29 percent) compared to low-income treatment customers (14 percent). These differences are marginally significant given small sample sizes among respondents, although it is also consistent with similar evaluations. There are many reasons why we see this difference. For example, low-income households may have a higher need for saving money and are therefore more likely to be satisfied when they receive tips on ways to save.

**Figure 17. Customer Satisfaction with HER**



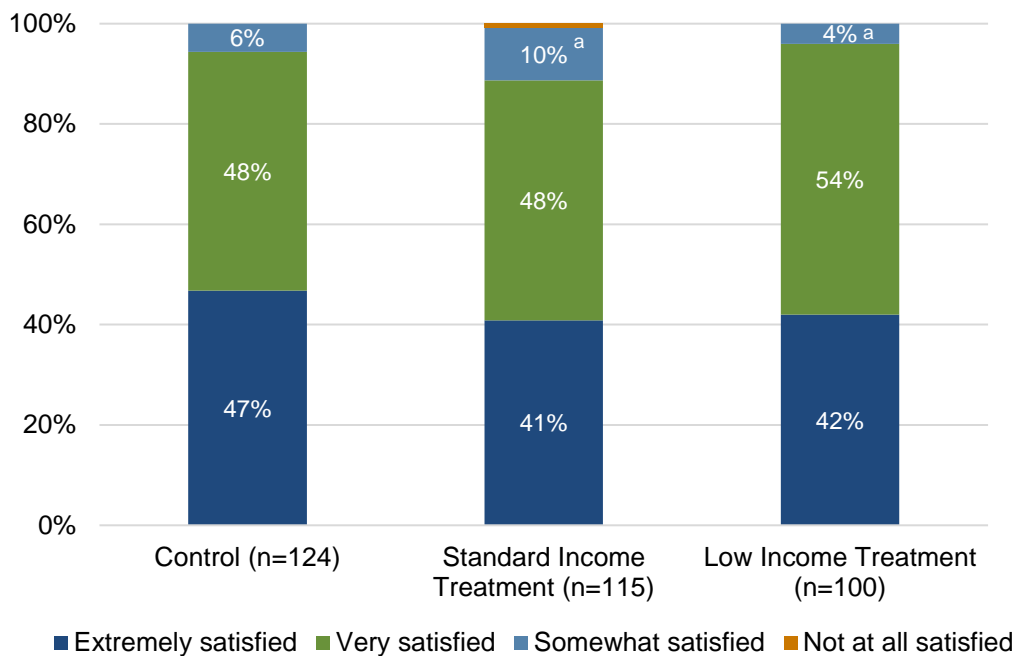
Source: 2020 Customer Survey, HS1

a,b Differences between treatment and low-income treatment groups are marginally statistically significant with 90% confidence.

#### 4.2.3.3 Customer Satisfaction with MidAmerican

The survey asked customers to rate their satisfaction with the services provided by MidAmerican. Across groups, survey respondents commonly said they were “very” or “extremely satisfied” with MidAmerican (96 percent low-income treatment, 89 percent standard income treatment, 95 percent control). Low-income treatment customers were less likely to report lower rates of being “somewhat satisfied” (four percent) than standard income treatment customers (10 percent); neither treatment group had significantly different rates of satisfaction compared to the control group (six percent). The Tetra Tech team also assessed differences in satisfaction with MidAmerican based on income group among customers who reported their household income and size in the survey. Most customers in all income groups were similarly “very” to “extremely satisfied” with the services they had received from MidAmerican (89 percent lower income, 95 percent moderate income, 94 percent higher income). There were no statistical differences between income group responses.

**Figure 18. Customer Satisfaction with MidAmerican**

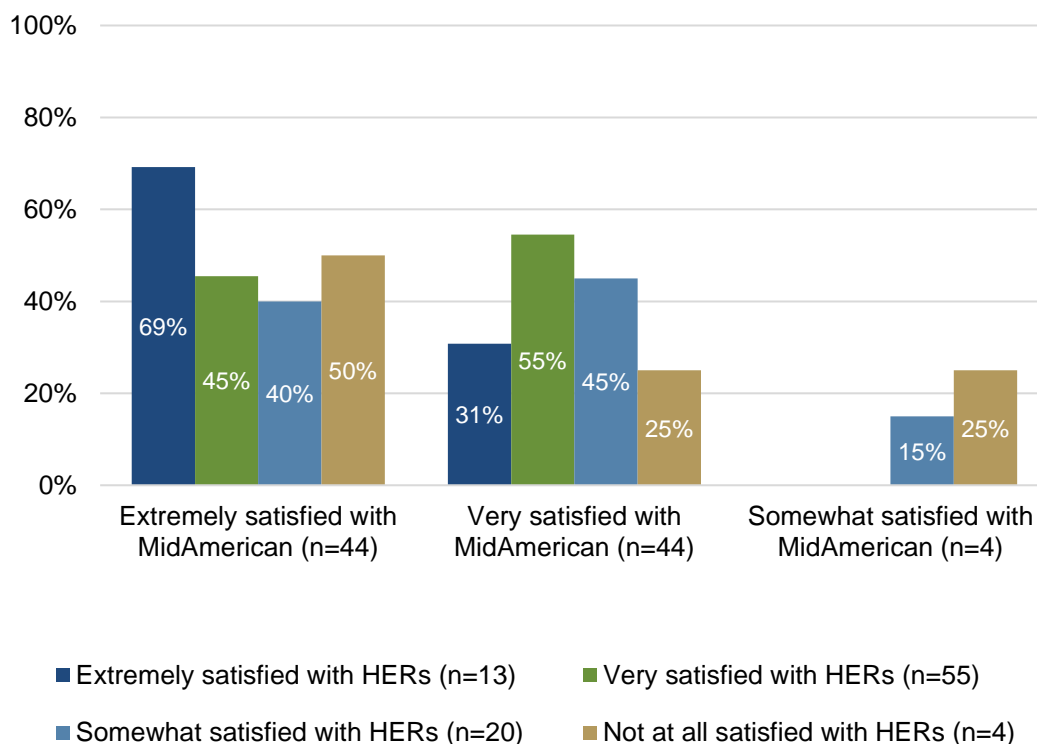


Source: 2020 Customer Survey, SAT1

<sup>a</sup> Differences between treatment and low-income treatment groups are marginally statistically significant with 90% confidence.

The Tetra Tech team assessed whether HER recipients' satisfaction with the reports had an impact on how satisfied they were with MidAmerican. While the response counts were too small to test for statistical significance, and therefore the results may not reflect the larger population, the Tetra Tech team observed that customers who said they were "not at all satisfied" with the HERs still reported being "somewhat satisfied," "very satisfied," or "extremely satisfied" with MidAmerican, indicating that satisfaction with HERs did not directly affect their satisfaction with MidAmerican.

**Figure 19. Ratings of Satisfaction with HERs and with MidAmerican**



Source: 2020 Customer Survey, SAT1 and HS1

Note: The survey was programmed to show questions about HER satisfaction to a subset of HER recipients who said they recalled receiving a HER. This figure does not include customers who were not shown questions about satisfaction with HERs. Additionally, only one HER recipient reported that they were “not at all satisfied” with MidAmerican. This customer did not provide a HERs satisfaction rating and therefore is not represented in this figure.

## APPENDIX A: EQUIVALENCY CHECK METHODOLOGY AND RESULTS

To validate comparability of each of the treatment and control group cohorts (and validity of the experimental design and selection), the Tetra Tech team completed an equivalency check and cohort comparisons. The method and results for each are described below.

### A.1 EQUIVALENCY CHECK

The Residential Behavioral program was designed as a RCT to allow for direct calculations of program net savings. In an RCT, the validity of any estimated energy savings depends on the equivalency of those two groups. Month-by-month equivalency checks between control and treatment groups were performed for each cohort. The next two tables display the P-values from the equivalency checks performed on the electric and gas cohorts, respectively. The equivalency checks were comprised of a simple independent 2-sample t-test of the pre-period energy consumption for each respective cohort in the 12 months prior to distribution of each cohort's first report. As evidenced by the tables, pre-period energy consumption was statistically equivalent for each cohort and fuel type in each pre-period month for all evaluated cohorts.

**Table 23. P-values of Electric Cohort Equivalency Checks\***

Months Prior to Treatment Start	Iowa Pilot	Iowa Expansion	Illinois Expansion	Iowa Refill	Iowa Reduction Backfill - Dual Fuel	Iowa Reduction Backfill - Electric Only	Illinois Rolling Enrollment
12	0.189	0.599	0.695	0.944	0.816	0.898	0.946
11	0.398	0.702	0.661	0.865	0.918	0.872	0.790
10	0.599	0.155	0.865	0.408	0.752	0.961	0.474
9	0.430	0.107	0.806	0.226	0.707	0.868	0.271
8	0.339	0.147	0.659	0.472	0.846	0.521	0.409
7	0.279	0.066	0.907	0.840	0.928	0.645	0.634
6	0.465	0.070	0.939	0.745	0.963	0.969	0.885
5	0.785	0.389	0.916	0.532	0.722	0.961	0.816
4	0.471	0.573	0.895	0.855	0.738	0.738	0.537
3	0.363	0.405	0.813	0.882	0.835	0.952	0.775
2	0.472	0.476	0.609	0.706	0.841	0.481	0.140
1	0.229	0.576	0.664	0.819	0.808	0.638	0.233

\* P-values greater than 0.05 indicate that the two groups are statistically equivalent at the 95% confidence interval.



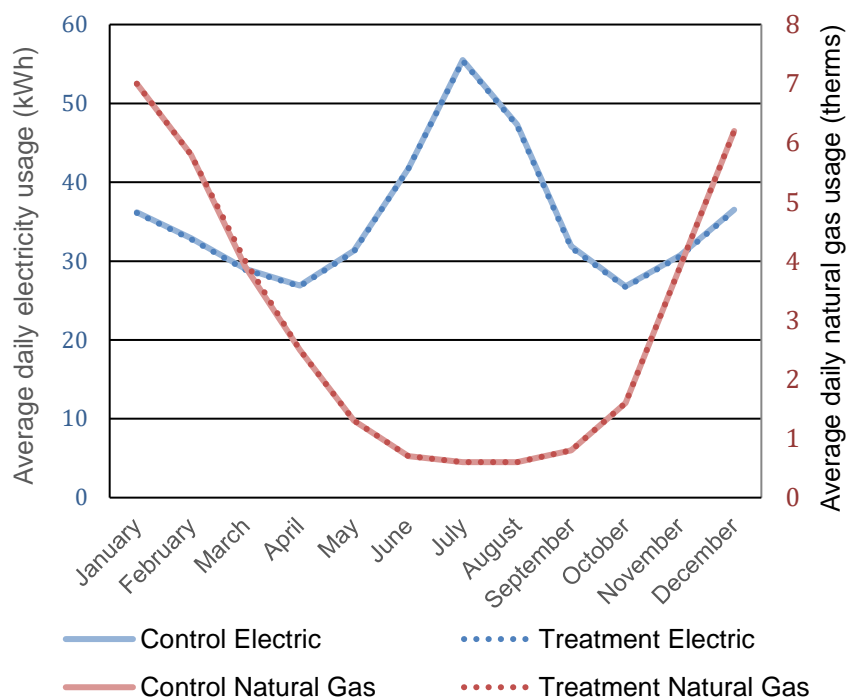
**Table 24: P-values of Gas Cohort Equivalency Checks\***

Months Prior to Treatment Start	Iowa Pilot	Iowa Expansion	Illinois Expansion	Illinois Rolling Enrollment
12	0.910	0.327	0.942	0.946
11	0.702	0.052	0.997	0.618
10	0.739	0.125	0.937	0.329
9	0.906	0.308	0.905	0.337
8	0.652	0.252	0.790	0.346
7	0.745	0.515	0.763	0.433
6	0.851	0.760	0.662	0.424
5	0.310	0.802	0.586	0.315
4	0.163	0.715	0.819	0.421
3	0.334	0.686	0.724	0.505
2	0.514	0.797	0.756	0.669
1	0.779	0.931	0.403	0.576

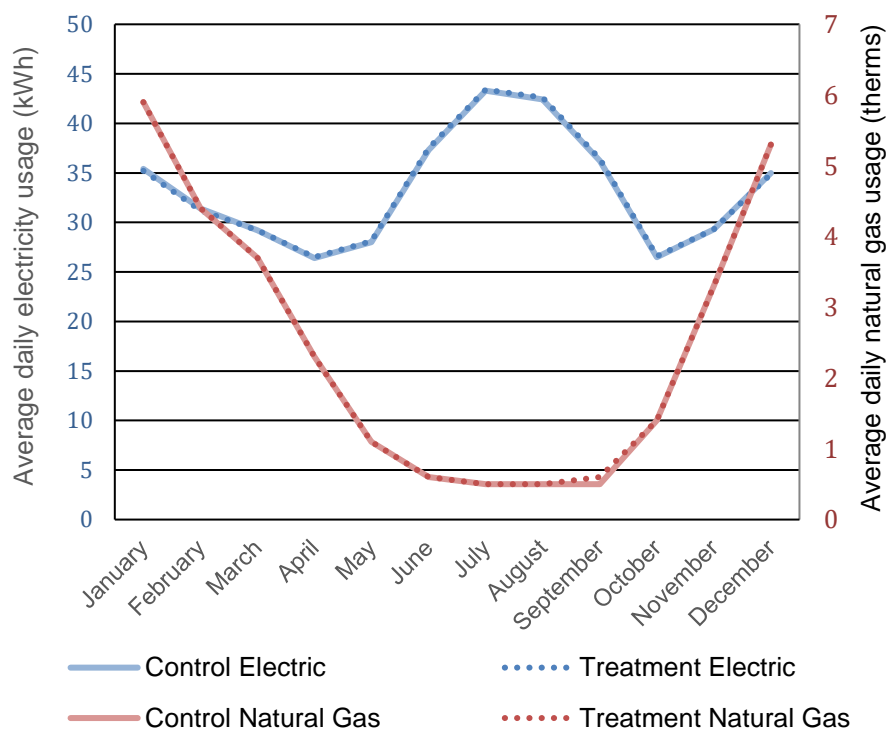
\* P-values greater than 0.05 indicate that the two groups are statistically equivalent at the 95% confidence interval.

The following four figures compare average monthly energy usage for the treatment and control groups in each cohort's pre-treatment year (baseline year) and provide a visualization of pre-period treatment and control group energy use for select cohorts.

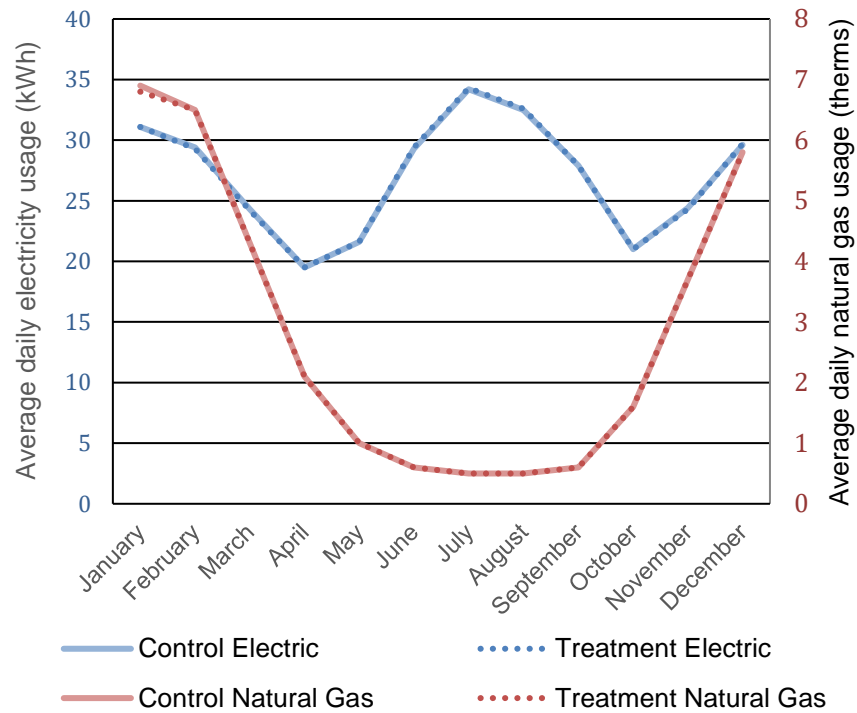
**Figure 20. Comparison of Treatment and Control Pre-Period Energy Usage for the Iowa Pilot Cohort**



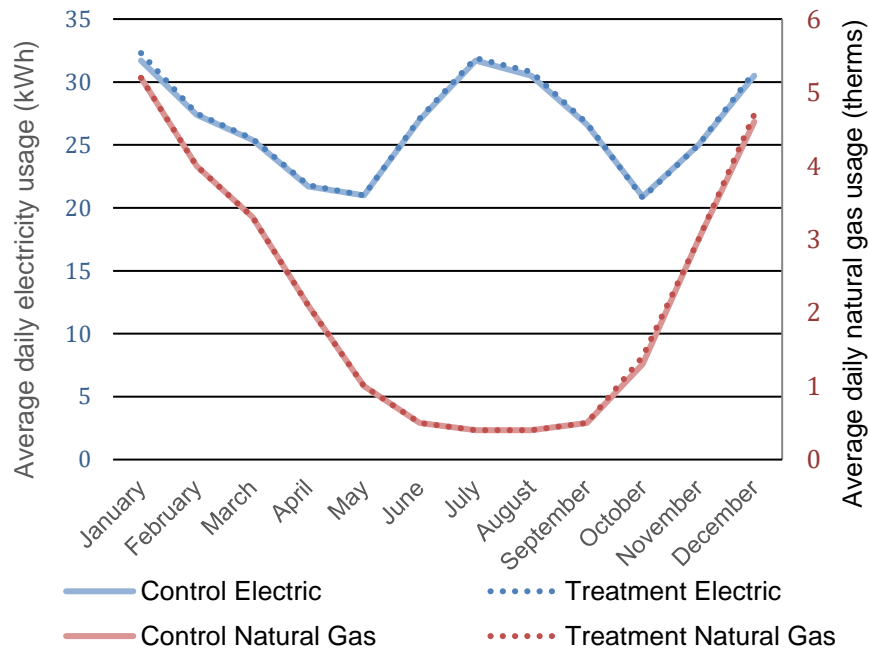
**Figure 21. Comparison of Treatment and Control Pre-Period Energy Usage for the Iowa Expansion Cohort**



**Figure 22. Comparison of Treatment and Control Pre-Period Energy Usage for the Illinois Expansion Cohort**



**Figure 23. Comparison of Treatment and Control Pre-Period Energy Usage for the Iowa Low-Income Cohort**



## A.2 COHORT COMPARISON

For each cohort, the control and treatment groups successfully passed an equivalency check. However, because the pre-periods of each cohort do not occur in the same date range, there is inherent dissimilarity among the various cohorts. To address this, the Tetra Tech team compared each control group's 2020 consumption to understand whether there are any systematic differences between groups in terms of consumption patterns.<sup>24</sup>

**Table A-1. Control Group Average Annual Consumption During Evaluation Period**

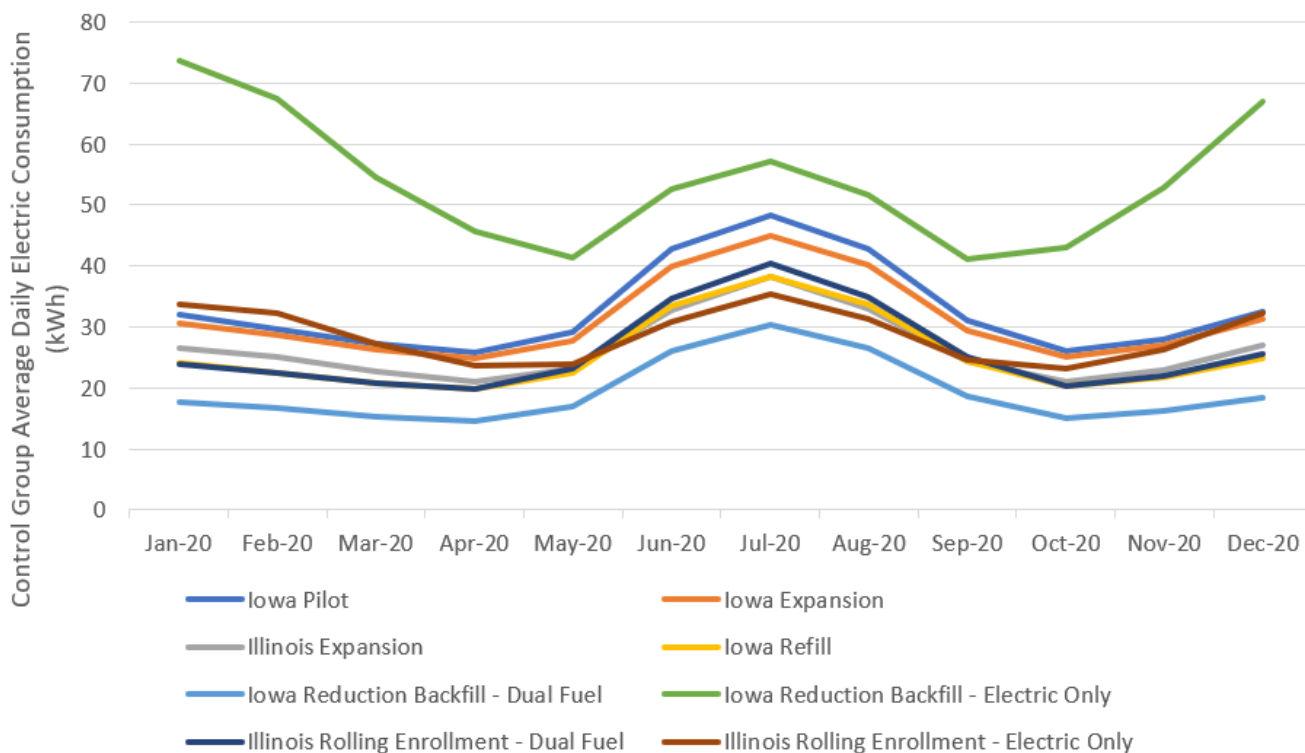
Cohort	Average Annual Electric Consumption of Control Group (kWh per Customer)	Average Annual Gas Consumption of Control Group (Therms per Customer)
<b>Iowa</b>		
Iowa Pilot	12,034	969
Iowa Expansion	11,448	807
Iowa Backfill	9,311	-
Iowa Reduction Refill – Dual Fuel	7,076	-
Iowa Reduction Refill – Electric Only	19,721	-
<b>Illinois</b>		
Illinois Expansion	9,676	875
Illinois Rolling Enrollment – Dual Fuel	9,525	896
Illinois Rolling Enrollment – Electric Only	10,487	-

Typically, usage correlates to energy savings, with higher use generally resulting in energy savings (i.e., the more energy used, the more opportunity there is to save energy). To understand each cohort's energy usage patterns in more detail, the Tetra Tech team looked at monthly usage patterns of each control group for PY2020. The control group comparisons for PY2020 show the average energy use of a given cohort experiencing the same seasonal conditions, which cannot be done by comparing pre-periods because they are desynchronized across cohorts.

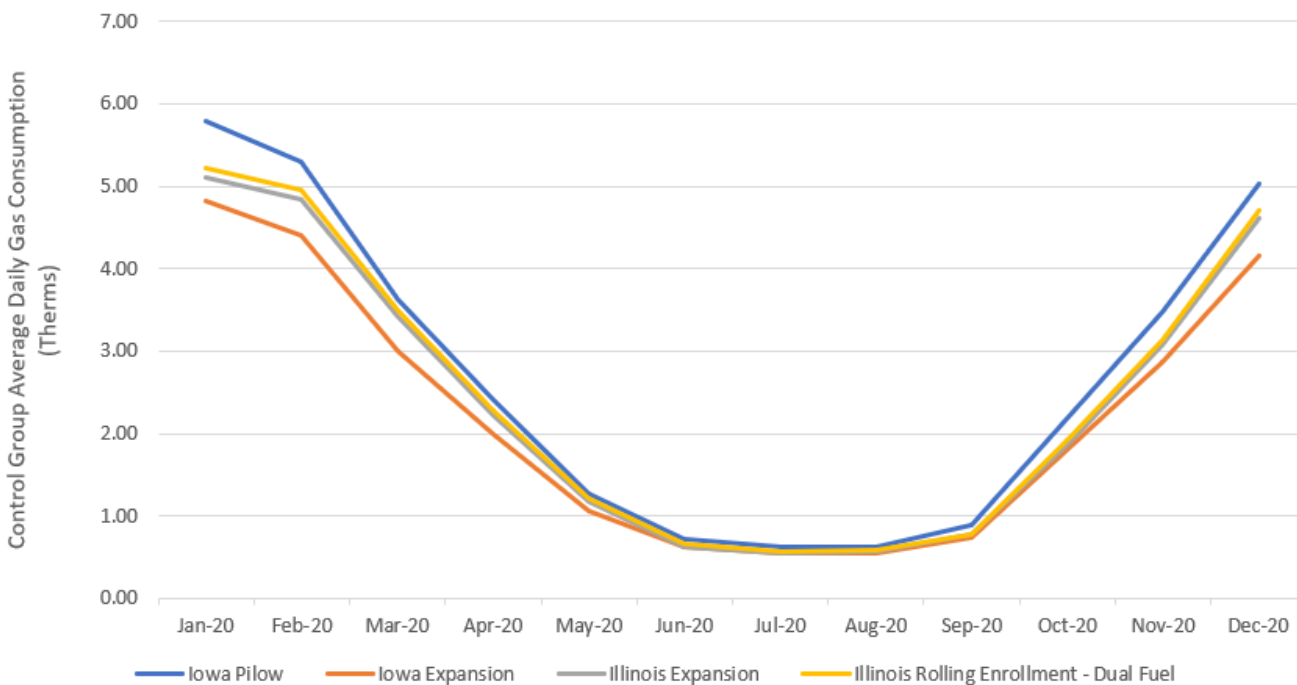
The following two figures show average monthly electric and gas consumption of each control group for PY2020. Each control group exhibits the seasonal energy use pattern to be expected given their respective fuels—the dual fuel cohorts exhibit their highest usage in the summer months, peaking in July, with less extreme peaks in winter months, while the electric only cohorts also exhibit a more extreme winter peak in addition to a summer peak. The Iowa Reduction Backfill - Electric Only cohort uses considerably more energy in the winter months than in the summer months, indicative of a substantial amount of winter electric heating capacity. The strong discrepancy between usage patterns of the Iowa Reduction Refill cohorts (electric only and dual fuel) prevented them from being analyzed concurrently with one another, while the relative alignment between the Illinois Rolling Enrollment cohorts allowed them to be analyzed concurrently.

<sup>24</sup> As demonstrated above through equivalence testing, for each cohort, the treatment and control groups were similar in their respective baseline periods. Therefore, we can compare control groups in any given time period (i.e., any given cohort) to understand general differences among groups.

**Figure 24. Comparison of 2020 Electricity Usage of Control Groups for Each Cohort**



**Figure 25. Comparison of 2020 Natural Gas Usage of Control Groups for Each Cohort**



## APPENDIX B: BILLING ANALYSIS METHODOLOGY

In this appendix the Tetra Tech team detail the data cleaning process, the billing analysis methodology, and provide select detailed results.

### B.1 DATA CLEANING

The customer lists were prepared by the implementer and delivered to the Tetra Tech team via MidAmerican on December 2, 2020 to the project SharePoint site. The billing data files for the billing analysis were prepared by MidAmerican and loaded to the SharePoint site as a package of 13 encrypted .csv files containing 26,172,903 billing records across all files. Electric and gas records were sent in separate files. The files each contain four ID fields (utility\_id, ba\_ky, prem\_no\_ky, svc\_pt\_ky), start date and end date of each billing period, total usage during each billing period, bill days in billing period, and a service code.

For billing analysis, the Tetra Tech team restricted the billing data set to accounts with clear and sufficient billing history in each program year under evaluation. As noted above in the methodology section, these exclusions for analysis reasons do not mean that program savings are not counted for these accounts – rather, the findings from billing analysis were applied to all treatment customers depending on the number of days they received treatment in each program year. The Tetra Tech team excluded billing records for the following reasons:

- **Duplicative or anomalous billing records.** Data cleaning was performed (depending on the state of the electric and gas billing data) to identify and remove duplicative or anomalous billing records. Anomalous billing records were defined as those with an average daily consumption (ADC) in any month that was greater/less than a factor of 10 of the ADC for that wave in that month.
- **Customer assigned to more than one cohort.** For the customers who were assigned to multiple cohorts, (for example, assigned to the treatment group of one cohort and the control group of another cohort), the Tetra Tech team developed cleaning rules to exclude billing data that would “contaminate” the experimental design of a cohort (e.g., if a customer was assigned to the treatment group of the Pilot and Control group of the Expansion Group, the Tetra Tech team would exclude their data from the Expansion Group’s analysis).
- **Insufficient pre-program records.** The Tetra Tech team performed “data sufficiency” checks on all bill data to ensure each record (customer) had an adequate number of pre-program billing data to be included in the analysis. This amounted to 12 months of pre-period data for standard tracks, and one month of pre-period data for the rolling-enrollment tracks.

The table below shows the number records excluded from billing analysis for each cohort.

**Table 25. Billing Data Disposition by Cohort**

Cohort	Initial Active Customer Count	Number of Customers Excluded from Billing Analysis	Final Count for Billing Analysis	Percentage of Initial Customer List Retained
<b>Iowa</b>				
Iowa Pilot	42,874	1,430	41,444	97%
Iowa Expansion	94,094	7,417	86,677	92%
Iowa Backfill	32,144	4,775	27,369	85%
Iowa Reduction Refill – Dual Fuel	19,974	980	18,994	95%
Iowa Reduction Refill – Electric Only	42,840	2,012	40,828	95%
<b>Illinois</b>				
Illinois Expansion	36,073	2,819	33,254	92%
Illinois Rolling Enrollment	21,726	4,363	17,363	80%

## B.2 BILLING ANALYSIS METHODOLOGY

The Tetra Tech team used a PPR model to estimate the net consumption change between treatment and control in the program period. The PPR model combines both cross-sectional and time series data in a panel dataset. This model uses post-program data to estimate savings, with lagged energy use for the same calendar month of the pre-program period acting as a control for any small systematic differences between the treatment and control customers. The underlying logic is that systematic differences between treatment and controls will be reflected in differences in their past energy use, which is highly correlated with their current energy use. The base version the Tetra Tech team estimate includes monthly fixed effects and interacts these monthly fixed effects with the pre-program energy use variable. These interaction terms allow pre-program usage to have a different effect on post-program usage in each calendar month. The basic model specification is:

### Model 1. Post-Program Regression (PPR) Model

$$ADC_{kt} = \beta_0 + \beta_1 ADClag_{kt} + \beta_2 Treatment_k + \sum_j \beta_{3j} Month_{jt} + \sum_j \beta_{4j} Month_{jt} ADClag_{kt} + \varepsilon_{kt}$$

$ADC_{kt}$  = The average daily usage in kWh for customer  $k$  during month  $t$ . This is the dependent variable in the model<sup>25</sup>

$Month_{jt}$  = A binary variable taking a value of 1 when  $j=t$  and 0 otherwise<sup>26</sup>

<sup>25</sup> Billing data were calendarized for consistency. Billing data were adjusted to reflect calendar months since the actual time periods of billing cycles can vary across customers. ADC reflects average daily consumption across the calendar month.

<sup>26</sup> In other words, if there are  $T$  post-program months, there are  $T$  monthly dummy variables in the model, with the dummy variable  $Month$  the only one to take a value of 1 at time  $t$ . For example if there is a month of June in the



$ADClag_{kt}$	= Customer $k$ 's average daily energy use in the same calendar month of the pre-program year as the calendar month of month $t$
$Treatment_k$	= A binary variable indicating whether customer $k$ is in the treatment group (taking a value of 1) or in the control group (taking a value of 0)
$\varepsilon_{kt}$	= The cluster-robust error term for customer $k$ during billing cycle $t$ . Cluster-robust errors account for heteroscedasticity and autocorrelation at the customer level <sup>27</sup>
$\beta_2$	= Estimate of the treatment effects: the average daily energy savings per household due to behavioral program treatment. $\beta_2$ is the coefficient used to calculate program savings (described below)
$\beta_1$	= The effect of pre-period energy use on post-period energy use of the same month
$\beta_{3j}$	= Accounts for the effect of different months on energy use
$\beta_{4j}$	= Accounts for the interaction of past energy use and month; that is, the way past energy use predicts post-period energy use may differ, for example, in April compared to August

As a robustness check the Tetra Tech team also estimated a Linear Fixed-Effects Regression model (LFER) as part of sensitivity analysis. Both models theoretically provide unbiased estimates of program savings and should provide the same results, though standard errors (with implications for precision) may vary across models. Like the PPR model, the LFER model combines both cross-sectional and time series data in a panel dataset. The model compares pre- and post-program billing data for treatment and control customers to identify the effect of the program. A customer-specific constant term ("fixed effect") captures all customer-specific effects on energy usage that do not change over time, including those that are unobservable. The fixed effect represents an attempt to control for any small systematic differences between the treatment and control customers that might occur due to chance. The basic model specification is:

#### Model 2. Linear Fixed Effects Regression Model

$$ADC_{kt} = \beta_{0k} + \beta_1 Post_t + \beta_2 Treatment_k Post_t + \varepsilon_{kt}$$

$ADC_{kt}$	= The average daily usage in kWh for customer $k$ during billing cycle $t$ . This is the dependent variable in the model;
$Post_t$	= A binary variable indicating whether bill cycle $t$ is in the post-program period (taking a value of 1) or in the pre-program period (taking a value of 0);

post-period, then the June monthly dummy variable will have a value of 1 for any records for the June and 0 for any records related to other months. These are, in other words, monthly fixed effects.

<sup>27</sup> Ordinary Least Squares (OLS) regression models assume that the data are homoskedastic and not autocorrelated. If either of these assumptions is violated, the resulting standard errors of the parameter estimates are incorrect (usually underestimated). A random variable is heteroscedastic when the variance is not constant. A random variable is autocorrelated when the error term in one period is correlated with the error terms in at least some of the previous periods.

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$Treatment_k$	= A binary variable indicating whether customer k is in the treatment group (taking a value of 1) or in the control group (taking a value of 0);
$\varepsilon_{kt}$	= The cluster-robust error term for customer k during billing cycle t. Cluster-robust errors account for heteroscedasticity and autocorrelation at the customer level.
$\beta_2$	= Estimate of the treatment effects: the average daily energy savings per household due to behavioral program treatment
$\beta_{0k}$	= The customer-specific fixed effect
$\beta_1$	= The effect of being in the post-period on energy use to account for non-program effects that impact both the treatment and control groups

In both models,  $\beta_2$  is the estimate of average daily energy savings per household due to behavioral program treatment.<sup>28</sup> Annual program savings are the product of the average daily savings estimate ( $\beta_2$ ) and the total number of days that all treatment group customers were exposed to the program. The total number of days that all treatment group customers were exposed to the program is referred to as participant-days. Participant-days are the cumulative number of days starting with the first report date and counting to the end of the program year or customer move-out date. The sum of all treatment days includes treatment days for households who were not included in the billing analysis (e.g., due to insufficient pre-period billing history) so that program savings reflect the full effect of program treatment. The net savings estimate from the model can be considered “unadjusted” net savings, because it reflects overall program savings without removing savings that could have been achieved through incremental participation in other MidAmerican programs (discussed in the Channeling Analysis section).

The Tetra Tech team used the coefficient on the program treatment term ( $\beta_2$ ) from each model to estimate average daily fuel savings per household (specific to each fuel and cohort). The standard error of the treatment term (coefficient  $\beta_2$ ) was used to calculate a 90% confidence interval for each savings estimate representing sampling error, and these confidence intervals were used to determine statistical significance of the savings estimate for each cohort, year and fuel.

The LFER and PPR results were consistent.

### B.3 ROLLING ENROLLMENT ANALYSIS

The Tetra Tech team utilized a different modeling approach to analyze the Illinois Rolling Enrollment tracks, as the customers in those cohorts do not have sufficient pre-period data (by design) to be accurately modeled using the PPR model. To begin, the Tetra Tech team relaxed the data cleaning requirements for these tracks and allowed any treatment customer with a minimum of five months of pre-period data to be included in the model. For these cohorts Tetra Tech team utilized the LFER model with a slightly different specification than that used for the standard program tracks. Like the PPR model, the LFER model combines both cross-sectional and time series data in a panel dataset. The model compares pre- and post-program billing data for treatment and control customers to identify the effect of the program. A time-specific constant term (“fixed effect”) captures all time-specific effects on energy usage, including those that are unobservable. The fixed effect represents an attempt to

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<sup>28</sup> Coefficients from other model terms are not needed to calculate the average daily energy savings.  $\beta_0$

control for any small systematic differences between the treatment and control customers that might occur due to chance. The basic model specification is:

### Model 2. Linear Fixed Effects Regression Model

$$ADC_{kt} = \beta_{0t} + \beta_1 Post_t + \beta_2 Treatment_k + \beta_3 Treatment_k Post_t + \beta_4 ReportStartMonth_k + \varepsilon_{kt}$$

$ADC_{kt}$	= The average daily usage in kWh for customer k during billing cycle t. This is the dependent variable in the model;
$Post_t$	= A binary variable indicating whether bill cycle t is in the post-program period (taking a value of 1) or in the pre-program period (taking a value of 0);
$Treatment_k$	= A binary variable indicating whether customer k is in the treatment group (taking a value of 1) or in the control group (taking a value of 0);
$ReportStartMonth_k$	= A factor variable indicating the specific year/month that a customer began receiving treatment;
$\varepsilon_{kt}$	= The cluster-robust error term for customer k during billing cycle t. Cluster-robust errors account for heteroscedasticity and autocorrelation at the customer level.
$\beta_2$	= Estimate of the treatment effects: the average daily energy savings per household due to behavioral program treatment
$\beta_{0t}$	= The time-specific fixed effect
$\beta_1$	= The effect of being in the post-period on energy use to account for non-program effects that impact both the treatment and control groups.
$\beta_3$	= The estimate of average daily energy savings per household due to behavioral program treatment <sup>29</sup>

Annual program savings are the product of the average daily savings estimate ( $\beta_3$ ) and the total number of days that all treatment group customers were exposed to the program. The total number of days that all treatment group customers were exposed to the program is referred to as participant-days. Participant-days are the cumulative number of days starting with the first report date and counting up to the end of the program year or customer move-out date. The sum of all treatment days includes treatment days for households who were not included in the billing analysis (e.g., due to insufficient pre-period billing history) so that program savings reflect the full effect of program treatment. The net savings estimate from the model can be considered “unadjusted” net savings, because it reflects overall program savings without removing savings that could have been achieved through incremental participation in other MidAmerican programs (discussed in the Channeling Analysis section).

The Tetra Tech team used the coefficient on the program treatment term ( $\beta_3$ ) from each model to estimate average daily fuel savings per household (specific to each fuel and cohort). The standard error of the treatment term (coefficient  $\beta_3$ ) was used to calculate a 90% confidence interval for each savings

<sup>29</sup> Coefficients from other model terms are not needed to calculate the average daily energy savings.  $\beta_0$

estimate representing sampling error, and these confidence intervals were used to determine statistical significance of the savings estimate for each cohort, year and fuel.

#### B.4 BILLING ANALYSIS RESULTS

Below the Tetra Tech team include detailed tables related to the impact results. Specifically, the Tetra Tech team include the total number of treatment households used for savings calculations, and the net unadjusted and adjusted (for channeling) savings impacts.

**Table 26. Net Unadjusted and Adjusted Electric Savings for All Cohorts**

Cohort	Total Number of Treatment Households	Unadjusted Net Savings (MWh)	Unadjusted Percent Savings	Adjusted Net Savings (MWh)	Adjusted Percent Savings
<b>Iowa</b>					
Iowa Pilot	28,186	7,046	2.15%	6,984	2.13%
Iowa Expansion	80,940	10,889	1.22%	10,755	1.20%
Iowa Refill	24,683	1,882	0.86%	1,861	0.85%
Iowa Reduction Backfill – Dual Fuel	12,009	725	0.90%	694	0.87%
Iowa Reduction Backfill – Electric Only	33,213	12,042	1.89%	11,770	1.85%
<b>Illinois</b>					
Illinois Expansion	29,944	4,954	1.80%	4,898	1.78%
Illinois Rolling Enrollment	21,298	2,313	1.33%	2,313	1.33%

**Table 27. Net Unadjusted and Adjusted Gas Savings for All Cohorts**

Cohort	Total Number of Treatment Households	Unadjusted Net Savings (therms)	Unadjusted Percent Savings	Adjusted Net Savings (therms)	Adjusted Percent Savings
<b>Iowa</b>					
Iowa Pilot	28,186	359,481	1.34%	359,481	1.34%
Iowa Expansion	80,940	556,029	0.87%	553,463	0.87%
<b>Illinois</b>					
Illinois Expansion	29,944	170,561	0.78%	170,561	0.78%
Illinois Rolling Enrollment	16,243	109,916	0.91%	109,916	0.91%

## APPENDIX C: REDUCED TREATMENT FREQUENCY TEST HISTORICAL FINDINGS

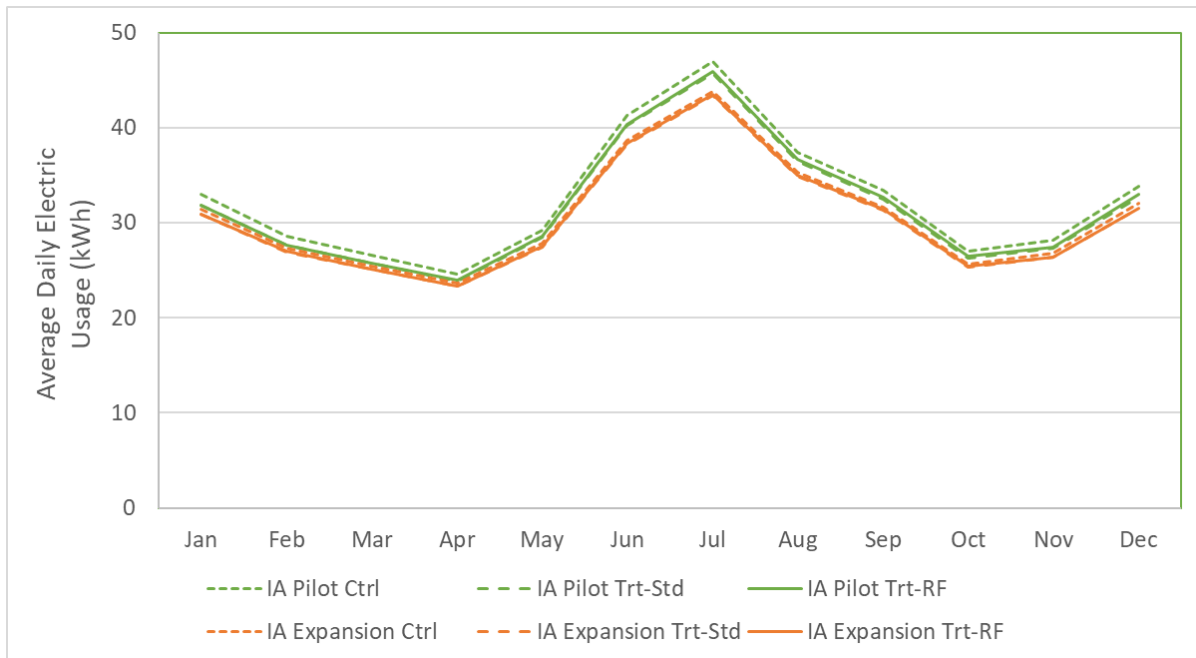
The Tetra Tech team worked with MidAmerican to reduce the frequency of reports to two reports per year starting in January 2017 for stratified random samples of the Iowa Pilot and Iowa Expansion cohorts, shown in the table below. The Iowa Pilot and Iowa Expansion cohorts were specifically chosen in part for their size and for the fact that they had been receiving reports for 62 and 33 months, respectively.

**Table 28. Reduced Treatment Frequency Test Design**

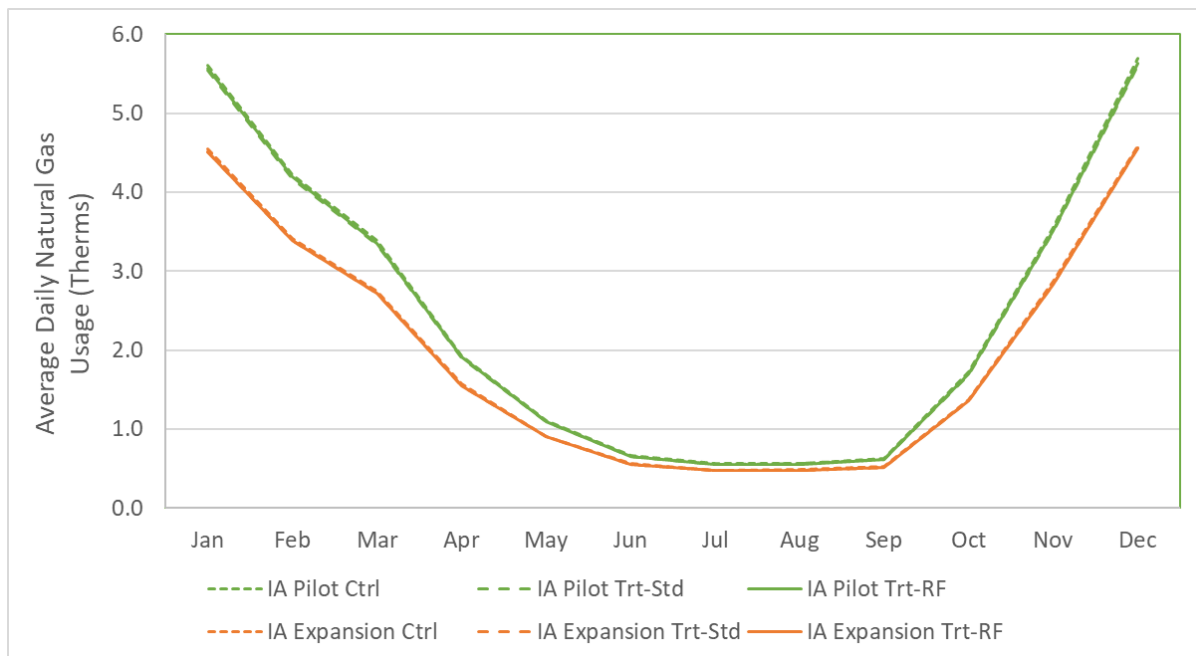
Cohort	Sample Group	Electric		Gas	
		Standard Frequency	Reduced Frequency	Standard Frequency	Reduced Frequency
Iowa Pilot	Treatment	16,840	16,841	16,839	16,841
	Control	16,901		16,897	
Iowa Expansion	Treatment	72,549	24,144	72,547	24,143
	Control	14,927		14,927	

The randomized samples comprise the “reduced treatment” groups of each cohort, and their billing patterns were compared with the “standard treatment” group of each cohort—those customers who continued receiving six reports per year—to investigate whether savings decay with reduced treatment. The principle of randomizing participants in order to create equivalent groups remains valid when sub-setting a treatment population, as in the reduced treatment frequency test. After randomly selecting customers to receive reports at reduced frequency, the Tetra Tech team tested equivalency among the three groups created within each cohort: the standard treatment customers, the reduced frequency treatment customers, and the control (untreated) customers. While there were differences between the two original cohorts, both the Pilot and the Iowa Expansion cohorts were successfully subdivided into new equivalent groups, as shown in the next two figures.

**Figure 26. Comparison of 2015 Electricity Usage of Control Groups for the Reduced Frequency Cohorts**



**Figure 27. Comparison of 2015 Natural Gas Usage of Control Groups for the Reduced Frequency Cohorts**



## C.1 ROUND 1 ANNUAL SAVINGS ANALYSIS

In 2018, the Tetra Tech team performed electric and natural gas billing analysis of each cohort's standard frequency treatment group compared with the RTF group. We followed the billing analysis procedures used in the PY2016 evaluation (i.e., PPR models) to determine if savings declined in PY2017 among the RTF group, and if so, by what magnitude. Results were reported separately for each cohort (Iowa Pilot and Iowa Expansion) and each fuel.

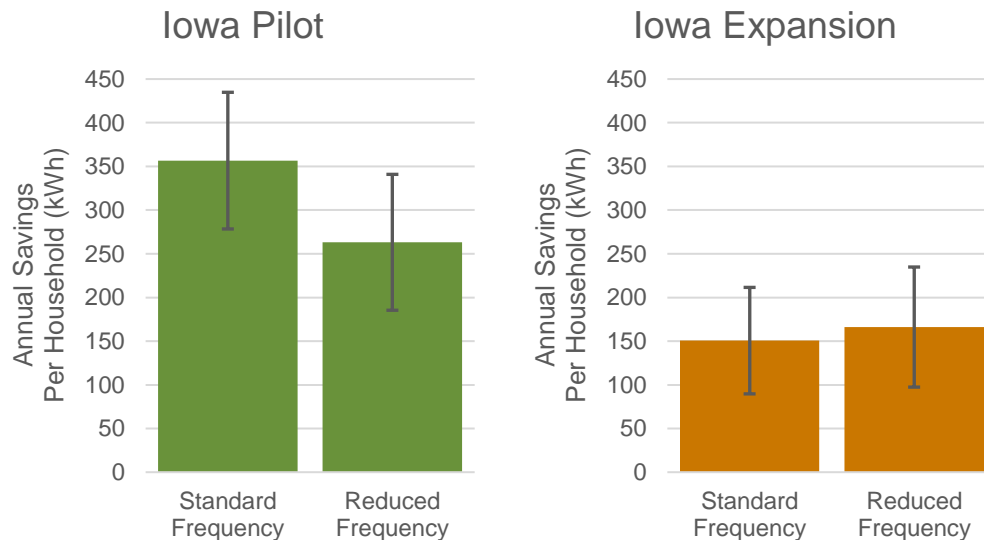
The Tetra Tech team found no statistical difference in annual savings between the reduced and standard frequency groups. Therefore, we could not assert that reduced treatment savings were different than the standard treatment. Point estimates for the Iowa Pilot RTF group (electric and gas) compared with the standard frequency group suggest lower savings, though this observation was reversed in the Iowa Expansion cohort (suggestive evidence of higher savings among the RTF group).

**Table 29. Difference Between Reduced and Standard Frequency Electric Savings**

Electric	Annual MWh Savings per Household (Reduced)	Annual MWh Savings per Household (Standard)	Difference (Reduced—Standard (MWh) <sup>a</sup>	Lower Bound of Difference (90% CI)	Upper Bound of Difference (90% CI)
Iowa Pilot	263.2	356.7	-93.5	-203.8	16.8
Iowa Expansion	166.1	150.6	15.5	-76.3	107.4

<sup>a</sup> Negative values suggest lower savings among the reduced frequency group (an expected result), while positive values suggest higher savings in the Reduced Frequency Test group (an unexpected result). Given that both confidence intervals cross zero, the point estimates should be interpreted with caution.

**Figure 28. Difference in Electric Savings for Reduced and Standard Frequency Groups**

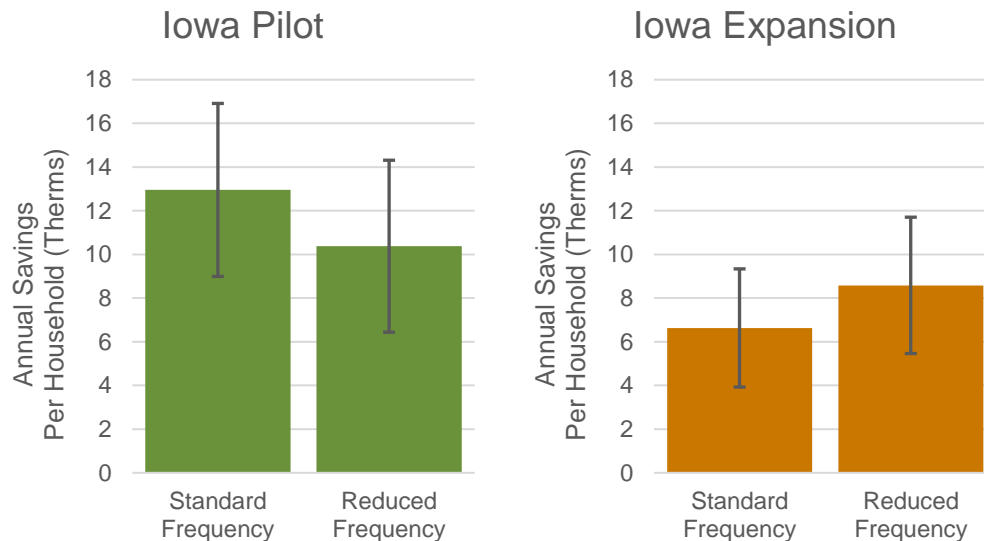




**Table 30. Difference Between Reduced and Standard Frequency Natural Gas Savings**

Gas	Annual Therm Savings per Household (Reduced)	Annual Therm Savings per Household (Standard)	Difference (Reduced—Standard (Therms) <sup>a</sup>	Lower Bound of Difference (90% CI)	Upper Bound of Difference (90% CI)
Iowa Pilot	10.4	13.0	-2.6	-8.2	3.0
Iowa Expansion	8.6	6.6	2.0	-2.2	6.1

<sup>a</sup> Negative values suggest lower savings among the reduced frequency group (an expected result), while positive values suggest higher savings in the Reduced Frequency Test group (an unexpected result). Given that both confidence intervals cross zero, the point estimates should be interpreted with caution.

**Figure 29. Difference in Natural Gas Savings for Reduced and Standard Frequency Groups**

These early results suggested that biannual reports may be sufficient to maintain savings among cohorts that have been receiving reports for multiple years. However, it may take longer than a single year to detect whether there is a difference in savings between the reduced and standard frequency groups.

## C.2 ROUND 2 ANNUAL SAVINGS ANALYSIS

In early 2019, the Tetra Tech team again performed electric and natural gas billing analyses of the standard treatment group compared with the RTF group. This billing analysis used separate PPR models to estimate savings for the continued and RTF groups. As noted earlier, the PPR model combines both cross-sectional and time series data in a panel dataset. This model uses post-program data to estimate savings, with lagged energy use for the same calendar month of the pre-program period acting as a control for any small systematic differences between the treatment and control customers. The underlying logic is that systematic differences between treatment and control groups will be reflected in differences in their past energy use, which is highly correlated with their current energy use. The base version estimated by the Tetra Tech team included monthly fixed effects and interacts these monthly fixed effects with the pre-program energy use variable. These interaction terms allow pre-program usage to have a different effect on post-program usage in each calendar month. The

Tetra Tech team compared estimates from the RTF model results to the continued frequency model results to detect changes in savings due to the reduction in HER frequency.

The Tetra Tech team found no statistical difference in annual savings between the reduced and standard frequency groups. Therefore, we could not assert that reduced treatment savings were different than the standard treatment. However, point estimates of savings for each of the RTF groups (electric and gas) were lower compared with the continued frequency groups for both cohorts. Given the error bounds on these results, the Tetra Tech team could not determine whether this finding would remain stable over time.

**Table 31. Difference Between Reduced and Standard Frequency Electric Savings**

<b>Electric</b>	<b>Annual MWh Savings per Household (Reduced)</b>	<b>Annual MWh Savings per Household (Standard)</b>	<b>Difference (MWh)</b>	<b>Lower Bound of Difference (90% CI)</b>	<b>Upper Bound of Difference (90% CI)</b>	<b>Difference (%)</b>
Iowa Pilot	254.4	348.2	-93.7	-197.2	9.7	-26.9%
Iowa Expansion	178.5	205.5	-27.0	-97.5	43.5	-13.1%

**Table 32. Difference Between Reduced and Standard Frequency Natural Gas Savings**

<b>Gas</b>	<b>Annual MWh Savings per Household (Reduced)</b>	<b>Annual MWh Savings per Household (Standard)</b>	<b>Difference (MWh)</b>	<b>Lower Bound of Difference (90% CI)</b>	<b>Upper Bound of Difference (90% CI)</b>	<b>Difference (%)</b>
Iowa Pilot	12.5	15.9	-3.4	-8.9	2.1	-21.3%
Iowa Expansion	6.2	6.9	-0.7	-4.5	3.1	-10.7%

## APPENDIX D: DETAILED CHANNELING ANALYSIS METHODOLOGY

The HERs included messaging about other MidAmerican energy efficiency programs with the goal of encouraging participation in (or “channeling” HER recipients to) other energy efficiency programs. In PY2020, the Residential Behavioral program provided recipients with information for the Appliance Recycling program and kits. The Tetra Tech team analyzed the effect of this channeling for two purposes: (1) measure program participation lift due to receiving HERs; and (2) identify potential savings from participation that should be removed from the Residential Behavioral program savings to avoid double-counting. Both analyses take advantage of the RCT design to measure program effects by comparing the treatment and control groups. An intended effect of this uplift is that savings will be accrued, and thus counted, in programs outside of the Residential Behavioral program. Because the RCT billing analysis generally detects the same effects that are being counted elsewhere, channeling analysis of savings is performed to determine how much energy reduction may be being double counted. As with participation lift, a difference-in-differences approach yields a program-level estimate for the double-counted savings but tabulates deemed energy savings instead of participation counts<sup>30</sup>. The Tetra Tech team describe each component of the channeling analysis below.

- **Participation Lift.** The participation lift metric shows the portion of households that participated in other residential energy efficiency programs and that can be attributed to the Residential Behavioral program.
- **Double-counting.** When the HERs result in more treatment group customers enrolling in energy efficiency programs than they otherwise would have, then the savings detected in the HER billing analysis includes savings also counted by those energy efficiency programs. Because other residential programs claim savings (and count all participants and measures), there is a risk of double-counting savings from channeling if they are captured in the Residential Behavioral savings and are claimed by other programs<sup>31</sup>. If participation rates in other residential energy efficiency programs are the same for treatment and control group households, then there is no channeling. In other words, the results indicate that the Residential Behavioral program had no effect on participation in any other programs and no portion of the savings estimates from the billing analysis would not be attributable to other programs.

To calculate the potential double-counted savings for each cohort and fuel, the Tetra Tech team:

1. Merged MidAmerican’s program tracking data with Residential Behavioral customer data to identify treatment and control group customers that participated in those programs in PY2020.
2. Calculated annual savings resulting from participation in other MidAmerican residential energy efficiency programs for each customer in the treatment and control groups based on implementer-reported savings values in MidAmerican’s program tracking data. The Tetra Tech team adjusted annual implementer-reported savings on a proportional basis based on measure installation date.

<sup>30</sup> The Tetra Tech team decided to only report on first-year channeled savings and not subtract out savings over the lifetime of the measures because it is our understanding that Iowa does not require double-counted savings to be calculated in this way. With respect to Illinois, we understand that for MidAmerican’s programs, Illinois has agreed to accept what is accepted Iowa.

<sup>31</sup> In some jurisdictions these savings are removed from behavior program impacts to eliminate double-counting. However, the savings could still be considered Residential Behavior program savings, at least in part, because the program had a role in achieving those savings.

3. Calculated average annual savings for each cohort, and fuel<sup>32</sup>, and compared average annual channeled savings between treatment and control groups for each cohort, and fuel.

The difference in average annual adjusted savings per household achieved through other residential energy efficiency programs is the channeled savings double-counted by these other programs. In other words, the average program savings from other programs for households in the treatment group, less the average program savings for the control group, is the channeled or double-counted savings.

The Tetra Tech team received PY2020 participant tracking data in Excel format from MidAmerican for the programs listed in the table below.

**Table 33. Residential Program/Program Components Used in Channeling Analysis**

Program/ Program Component	Years Included in Analysis
Appliance Recycling	2020
HomeCheck Online	2020
Residential Equipment	2020
Multifamily Follow Up	2020
Low-income Weatherization (Iowa customers only)	2020
Residential Kits	2020
Residential HVAC	2020

## D.1 PARTICIPATION UPLIFT

Across cohorts, treatment customers exhibited higher rates of residential program participation than control groups about half the time (n=22~~Error! Reference source not found.~~). Control group c customers exhibited higher rates of participation in 13 instances, while there was no evidence of participation among HER participants (no records linking HER customers to that program in PY2020, indicated by 0 percent) in five instances. Notable findings of the participation uplift include:

- **Uplift by treatment cohort.** The Iowa Expansion cohort experienced participation had uplift more frequently than any other cohort (six of seven programs), while every other cohort experienced participation uplift in five or fewer programs, and negative participation uplift in at least two programs.
- **Uplift by program.** The Appliance Recycling and kits were the two programs/program components promoted through the Residential Behavioral program in PY2020. Analysis shows that the Appliance Recycling program experienced participation uplift across all treatment cohorts and the kits program component received uplift for two of six cohorts. The HomeCheck Online program also experienced uplift across all treatment cohorts, while the Multifamily and Residential Equipment programs experienced participation uplift in three cohorts. The Low-Income Weatherization program experienced negative uplift in three of four potential cohorts (potentially indicating that control customers are more likely to be classified as low-income for this cohort). Negative participation uplift was most common among the kits program component (four of six treatment cohorts) and the residential HVAC equipment rebates (five of six treatment cohorts).

<sup>32</sup> In this calculation, the majority of treatment and control customers have a zero savings value because they did not participate.

**Table 34. Participation Lift by Cohort and Program/Program Component\***

Cohort	Appliance Recycling	HomeCheck Online	Multifamily Follow Up	Residential Equipment	Low-Income Weatherization (Iowa Only)	Residential Kits	Residential HVAC
<b>Iowa</b>							
Iowa Pilot	1.25%	0.01%	0.00%	-0.04%	0.33%	-0.37%	-0.04%
Iowa Expansion	0.75%	0.11%	0.01%	0.12%	-0.60%	0.69%	0.06%
Iowa Refill	0.74%	0.16%	0.00%	1.40%	-3.97%	-1.02%	-0.26%
Iowa Reduction Backfill	0.43%	0.10%	0.27%	0.37%	-0.03%	0.05%	-0.02%
<b>Illinois</b>							
Illinois Expansion	1.04%	0.74%	0.00%	0.00%	N/A	-0.01%	-1.18%
Illinois Rolling Enrollment	0.93%	0.50%	0.00%	0.00%	N/A	-0.93%	-1.41%

\* Positive values indicate higher participation among the treatment group, negative values indicate higher participation among the control group, 0.00 percent values indicate no evidence of either treatment or control group participation, and N/A values indicate the program was not available to residents of that state.

## D.2 ELECTRIC SAVINGS UPLIFT

Overall, each of the Iowa electric cohorts appeared to have received some amount of savings uplift from the other MidAmerican residential energy efficiency programs, ranging from 0.9 percent to 4.2 percent of total cohort savings. **Error! Reference source not found..** The channeled electric savings for the Illinois Expansion cohort amounted to 1.1 percent of the cohorts total evaluated savings, while the Illinois Rolling Enrollment cohort experienced negative savings uplift, indicating that control customers saved more energy on average than treatment customers.

The channeled electric savings represent 1.6 percent of the total evaluated savings in Iowa, and 0.7 percent of the total evaluated savings in Illinois. Similar evaluations conducted by the Tetra Tech team have found that channeled electric savings typically amount to between one and five percent of a programs evaluated savings. Given that consideration, the channeled electric savings found through this evaluation are on the low-end of similar evaluations, but within reason.

**Table 35: Channeled Electric Savings Relative to Evaluated Savings**

<b>Cohort</b>	<b>Evaluated Savings (MWh)</b>	<b>Total Uplift (MWh)</b>	<b>Uplift as Percent of Evaluated Savings</b>	<b>Adjusted Net Evaluated (MWh)</b>
Iowa Pilot	7,045.5	61.8	0.9%	6,983.7
Iowa Expansion	10,889.4	134.4	1.2%	10,755.0
Iowa Refill	1,881.8	21.1	1.1%	1,860.7
Iowa Reduction Backfill – Dual Fuel	725.0	30.7	4.2%	694.3
Iowa Reduction Backfill – Electric Only	12,042.4	273.5	2.3%	11,768.9
<b>Iowa Total</b>	<b>32,584.0</b>	<b>521.4</b>	<b>1.6%</b>	<b>32,062.6</b>
Illinois Expansion	4,953.8	55.9	1.1%	4,897.9
Illinois Rolling Enrollment	2,312.8	(2.7)	-0.1%	2,315.5
<b>Illinois Total</b>	<b>7,266.6</b>	<b>53.3</b>	<b>0.7%</b>	<b>7,213.3</b>

Among the Iowa electric cohorts (dual fuel and electric only), the Appliance Recycling and Residential Equipment programs provided 95 percent of all channeled savings for MidAmerican's Iowa service territory. **Error! Reference source not found..** Each respective cohort in Iowa received positive savings uplift from the Appliance Recycling program, while the channeled savings derived from the Residential Equipment program were almost exclusively from the Iowa Reduction Backfill – Electric Only cohort.

Among the Illinois electric cohorts, channeled savings were nearly exclusively from the Appliance Recycling program (163 percent) and the Homecheck Online program (18 percent). However, a considerable portion of the channeled electric savings were negated by negative savings uplift by the Illinois Expansion cohort through the Residential Equipment program (-73 percent).

**Table 36. Electric Savings Lift by Cohort and MidAmerican Efficiency Program (MWh)\***

Cohort	Appliance Recycling	HomeCheck Online	Multifamily Follow Up	Residential Equipment	Low-Income Weatherization (Iowa Only)	Residential Kits	Residential HVAC	Total
Iowa Pilot	71.0	0.1	-	(11.1)	3.2	(1.9)	0.3	61.8
Iowa Expansion	131.6	2.5	0.9	(10.3)	(18.8)	21.7	6.8	134.4
Iowa Refill	27.9	0.2	-	12.4	(11.5)	(3.8)	(4.2)	21.1
Iowa Reduction Backfill – Dual Fuel	3.7	(0.2)	0.7	10.1	22.6	(3.9)	(2.4)	30.7
Iowa Reduction Backfill – Electric Only	50.6	1.1	-	213.3	4.8	4.4	(0.8)	273.5
<b>Iowa Total</b>	<b>284.9</b>	<b>3.7</b>	<b>1.6</b>	<b>214.4</b>	<b>0.3</b>	<b>16.6</b>	<b>(0.2)</b>	<b>521.4</b>
Illinois Expansion	86.7	9.4	-	(38.9)	-	(1.3)	-	55.9
Illinois Rolling Enrollment	(1.5)	(0.5)	-	1.53	-	(2.3)	-	(2.7)
<b>Illinois Total</b>	<b>85.3</b>	<b>8.9</b>	<b>-</b>	<b>(37.4)</b>	<b>-</b>	<b>(3.5)</b>	<b>-</b>	<b>53.3</b>

### D.3 GAS SAVINGS UPLIFT

Each of the Illinois gas cohorts appeared to have experienced net negative channeled savings from other MidAmerican residential energy efficiency programs. Only the Iowa Expansion cohort experienced any channeled gas savings uplift. As such, no savings adjustments were made based on evaluated gas savings.

**Table 37: Channeled Gas Savings Relative to Evaluated Savings**

Cohort	Evaluated Savings (Therms)	Total Uplift (Therms)	Uplift as Percent of Evaluated Savings	Adjusted Net Evaluated (Therms)
Iowa Pilot	359,481.3	(3,305.0)	-0.0%	362,786.3
Iowa Expansion	556,029.0	2,566.1	0.5%	553,462.9
<b>Iowa Total</b>	<b>915,510.3</b>	<b>(738.8)</b>	<b>-0.1%</b>	<b>916,249.2</b>
Illinois Expansion	170,560.5	(2,719.6)	-0.0%	173,280.1
Illinois Rolling Enrollment	109,916.0	(1,275.6)	-0.0%	111,191.6
<b>Illinois Total</b>	<b>280,476.5</b>	<b>(3,995.2)</b>	<b>-1.4%</b>	<b>284,471.7</b>



Negative savings uplift from either the Residential Equipment program and the Low-Income Weatherization program completely negated all channeled gas savings for all gas cohorts. Interestingly, as with electric savings uplift, the largest source of negative uplift savings among Iowa HER recipient customers was the Iowa Expansion group's participation in the Low-Income Weatherization program, potentially indicating that the control group is comprised of significantly more income-qualified eligible customers than the treatment group (or what was intended in the programs design). Illinois gas cohorts experienced relatively few instances of channeled gas savings, with the negative savings uplift from the Residential Equipment program negating all channeled gas savings from the Illinois treatment groups.

**Table 38. Gas Savings Lift by Cohort and MidAmerican Efficiency Program (Therms)**

Cohort	HomeCheck Online	Multifamily Follow Up	Residential Equipment	Low-Income Weatherization (Iowa Only)	Residential Kits	Residential HVAC	Total
Iowa Pilot	69.8	-	(3,347.7)	1,142.0	(305.5)	(863.6)	(3,305.0)
Iowa Expansion	73.1	96.8	4,308.9	(5,114.5)	811.6	2,390.2	2,566.1
<b>Iowa Total</b>	<b>142.2</b>	<b>97.3</b>	<b>1,035.8</b>	<b>(4,017.4)</b>	<b>515.2</b>	<b>1,552.7</b>	<b>(674.2)</b>
Illinois Expansion	(88.0)	70.2	(2,801.3)	-	99.5	-	(2,719.6)
Illinois Rolling Enrollment	199.0	-	(1,520.5)	-	45.9	-	(1,275.6)
<b>Illinois Total</b>	<b>96.0</b>	<b>72.6</b>	<b>(4,324.5)</b>	<b>-</b>	<b>146.0</b>	<b>-</b>	<b>(4,009.8)</b>

## APPENDIX E: CUSTOMER SURVEY RESPONSE RATES

Table 39. Customer Survey Response Rates by Group and Overall

Metric	Treatment	Control	Low-Income Treatment	Overall
<b>Sample</b>	<b>1,017</b>	<b>1,017</b>	<b>1,005</b>	<b>3,039</b>
Not a utility customer	0	0	0	0
Affiliated with utility	0	0	0	0
<b>Eligible sample</b>	<b>1,017</b>	<b>1,017</b>	<b>1,005</b>	<b>3,039</b>
Screened out	5	9	1	15
Does not recall participating	0	0	0	0
Quota filled	3	0	1	4
Incompletes (partial surveys)	2	2	1	5
Not completed	891	882	902	2,675
Completed	116	124	100	340
<b>Response Rate</b>				
<b>Response Rate (Completed / Eligible Sample)</b>	<b>11%</b>	<b>12%</b>	<b>10%</b>	<b>11%</b>
<b>Average Survey Length (min)</b>				<b>8.6</b>

Notes: Survey launched March 10, 2021 and closed March 29, 2021.

## APPENDIX F: MODERATE INCOME HOUSEHOLD METHODOLOGY

The Tetra Tech team set moderate income thresholds to assess differences in customers' survey responses among income levels. We defined three levels—lower income households, moderate income households, and higher income households. For the purposes of this analysis, lower income households were identified based on the income and household size information they reported in the survey. As such, some customers in the lower income household group may not be part of a low-income HER cohort and, likewise, customers in other HER cohorts may have ended up in the lower income household group.

The Tetra Tech team set moderate income household thresholds by calculating lower and an upper bounds, each marking the threshold between the other income categories. Both the lower and upper bounds were set as percentage points above the Federal Poverty Line (FPL) and based on household size and household income levels. The table below provides a summary of these thresholds. A detailed description of how thresholds were set follows.

**Table 40. Income Categories**

Income Category	Criteria	
	Iowa	Illinois
Lower income	LIHEAP eligibility (175% FPL) <sup>33</sup>	LIHEAP eligibility (200% FPL) <sup>34</sup>
Moderate income	176-245% FPL	201-265% FPL
Higher income	245% FPL +	265% FPL +

**Lower income threshold.** MidAmerican currently defines customer eligibility for the low-income program as being eligible for the LIHEAP program. Households that meet LIHEAP eligibility criteria live at or below 175 percent FPL in Iowa and 200 percent FPL in Illinois.

**Moderate income threshold.** The moderate income lower threshold begins at one percentage point above the lower income threshold, or 176 percent in Iowa and 201 percent in Illinois.

To define the upper moderate income threshold, the Tetra Tech team first gathered information about rules used in other states, then selected the definition of moderate income used in the Massachusetts Moderate Income Market Characterization Study (2018)<sup>35</sup>. In the market characterization study, households living between 61 and 80 percent of the State Median Income (SMI) were flagged as moderate income households. The Tetra Tech team used the 80 percent SMI as the basis for setting the upper moderate income threshold. The Tetra Tech team then converted the 80 percent SMI rate to percentage points amount above the FPL in each state by following these steps:

1. Gathered census data on the SMI (\$60,523 in Iowa<sup>36</sup>, \$65,886 in Illinois<sup>37</sup>) and average household size in each state (about 2.5 in both states).

<sup>33</sup> <https://humanrights.iowa.gov/dcaa/liheap/eligibility>

<sup>34</sup> <https://www2.illinois.gov/dceo/CommunityServices/UtilityBillAssistance/pages/howtoapply.aspx>

<sup>35</sup> Navigant Consulting, Inc. "Moderate Income Market Characterization Survey Findings (RES 40)," March 16, 2018. <https://ma-eeac.org/wp-content/uploads/Moderate-Income-Market-Characterization-Report-Final-16Mar2018.pdf>

<sup>36</sup> <https://www.census.gov/quickfacts/IA>

<sup>37</sup> <https://www.census.gov/quickfacts/fact/table/IL,IA/PST045219>

2. Multiplied each state's SMI by 80 percent in accordance with the market characterization study definition and assumed this household income amount (\$48,418 in Iowa, \$52,709 in Illinois) correlated to each state's average household size (2.5).
3. Divided the new household income amount (\$48,418 in Iowa, \$52,709 in Illinois) by the FPL for 2.5 person households (halfway between 2- and 3-person households) (\$19,690).
4. Set the resulting rates (245 percent of the FPL in Iowa, 265 percent of the FPL in Illinois) as upper thresholds for the moderate income group in each state.

#### Moderate Income Threshold Calculations by State:

- Iowa median household income = \$60,523, average household size is 2.5 persons (rounded up from 2.4)
  - $80\% \times \$60,523 = \$48,418$ , 80% SMI assuming 2.5 person household
  - $\$48,418 / \$19,690$  (middle of 2 and 3 person FPL household income levels) = 245% FPL
  - Upper threshold set to 245%
- Illinois median household income = \$65,886, average household size is 2.5 persons per household (rounded down from 2.6)
  - $80\% \times \$65,886 = \$52,709$ , 80% SMI assuming 2.5 person household
  - $\$52,709 / \$19,690$  (middle of 2 and 3 person FPL household income levels) = 265% FPL (rounded down from 267%)
  - Upper threshold set to 265%

**Higher income threshold.** The higher income threshold is set at one percentage point above the moderate income upper threshold (246 percent in Iowa, 266 percent in Illinois) and above.

The table below shows the full comparison of income thresholds from 100 percent FPL to the low-income threshold, the lower and upper moderate income thresholds, and the higher income threshold.

**Table 41. Calculated Household Income Category Thresholds by Household Income and Size**

Number of People in Home	Federal Poverty Guideline	Iowa				Illinois			
		Low-income Threshold	Moderate Income Lower Threshold	Moderate Income Upper Threshold	Higher Income Threshold	Low-Income Threshold	Moderate Income Lower Threshold	Moderate Income Upper Threshold	Higher Income Threshold
	100%	175%	176%	245%	246%	200%	201%	265%	266%
1	\$12,880	\$22,540	\$22,669	\$31,556	\$31,685	\$25,760	\$25,889	\$34,132	\$34,261
2	\$17,420	\$30,485	\$30,659	\$42,679	\$42,853	\$34,840	\$35,014	\$46,163	\$46,337
3	\$21,960	\$38,430	\$38,650	\$53,802	\$54,022	\$43,920	\$44,140	\$58,194	\$58,414
4	\$26,500	\$46,375	\$46,640	\$64,925	\$65,190	\$53,000	\$53,265	\$70,225	\$70,490
5	\$31,040	\$54,320	\$54,630	\$76,048	\$76,358	\$62,080	\$62,390	\$82,256	\$82,566
6	\$35,580	\$62,265	\$62,621	\$87,171	\$87,527	\$71,160	\$71,516	\$94,287	\$94,643
7	\$40,120	\$70,210	\$70,611	\$98,294	\$98,695	\$80,240	\$80,641	\$106,318	\$106,719
8	\$44,660	\$78,155	\$78,602	\$109,417	\$109,864	\$89,320	\$89,767	\$118,349	\$118,796

## APPENDIX G: CUSTOMER SURVEY INSTRUMENT

### MidAmerican Energy Residential Behavioral Home Energy Report Participant and Control Survey Instrument

#### INTRODUCTION

**INTRO** Thank you for being a valued MidAmerican Energy customer! We are conducting a study about your home energy use and experience with MidAmerican Energy. Your responses are very important and will help MidAmerican Energy to improve offerings in the future.

Customers who complete this survey will receive a \$15 Tango gift card that you can redeem for an online debit card (Visa® or MasterCard®), or your choice of a retailer or restaurant (including Amazon.com, Lowe's, Apple Store and iTunes, Google Play, Applebee's, Xbox, and more).

Your responses will be kept confidential. If you would like to talk with someone from MidAmerican Energy about this study, feel free to call MidAmerican Energy's call center at (888) 427-5632.

01 [CONTINUE]

#### SCREENING QUESTIONS

##### [ASK OF ALL]

**S1** Are you, or is anyone in your household, a current or former employee of MidAmerican? (Check one)

- 01 Yes [THANK AND TERMINATE]
- 02 No
- 88 Don't know [THANK AND TERMINATE]
- 99 Refused [THANK AND TERMINATE]

#### TERMINATIONS

[IF S1=1,88,99 EXIT SURVEY AND SHOW: "Based on your responses you are not eligible to complete this study at this time. We may reach out to you again in the future. We appreciate your time and willingness to participate."]]

#### SATISFACTION WITH MIDAMERICAN

##### [ASK OF ALL]

**SAT1** The next questions ask about your experience with MidAmerican as your energy provider. How would you rate your satisfaction with the service provided by MidAmerican? (Check one)

- 01 Not at all satisfied
- 02 Somewhat satisfied
- 03 Very satisfied
- 04 Extremely satisfied
- 88 Don't know

**SAT2** [SHOW IF SAT1=01,02] Why did you rate your satisfaction with MidAmerican that way?  
[OPEN VERBATIM RESPONSE]

**PROGRAM AWARENESS**

**[ASK QUESTION A1 OF ALL]**

**A1** Are you aware of any programs, rebates, or incentives offered by MidAmerican to help you save money and energy in your home? *(Check one)*

- 01 Yes
- 02 No [SKIP TO B1]
- 88 Don't know [SKIP TO B1]

**A2** [SHOW IF A1 = 1] Which of the following MidAmerican programs or rebates have you heard of?  
*(Select all that apply)*

[PROGRAMMER NOTE: RANDOMIZE choices 1-6]

For A2C01 through A2C88

- 0 Not mentioned
- 1 Mentioned

**A2C01 Smart Thermostat Rebates** (MidAmerican offers a rebate the installation of a new ENERGY STAR® certified smart thermostat)

**A2C02 Appliance Recycling Program** (MidAmerican will pick up and recycle your old, working refrigerator or freezer for free)

**A2C03 Heating and Cooling Equipment Rebates** (MidAmerican offers rebates on qualifying new high-efficiency heating and cooling equipment when you replace existing equipment.)

**A2C04 HomeCheck® Online** (This free home energy assessment tool offers insights into your energy use and provides personalized energy efficiency tips)

**A2C05 Free Energy Efficiency Kits** (Eligible customers who complete the HomeCheck Online home energy assessment may be eligible for a free energy efficiency kit with energy-saving items which could include LED bulbs, an advanced power strip, showerhead, and faucet aerator)

**A2C77** None of these

**A2C88** Don't know

**S2** [ASK IF QUOTA = 1 OR 3] MidAmerican mails Home Energy Reports twice a year that are separate from your electric and gas bills. The reports provide a historical record of your household's energy use, a comparison to similar homes in your area, and tips on how to save energy. Do you remember **ever** receiving one of these Home Energy Reports? *(Check one)*

- 01 Yes
- 02 No
- 88 Don't know

## ACTIONS TAKEN

### [ASK OF ALL]

B1 Next are some questions about steps your household may have taken to save energy in your home.

Please select actions that your household took in the past year.

[ROTATE 1-9, MULTIPLE RESPONSES ALLOWED] (Select all that apply)

For B1C01 through B1C88

0 Not mentioned

1 Mentioned

- B1C01** Researched rebates available from MidAmerican
- B1C02** Set your thermostat to 78 degrees or higher in the summer
- B1C03** Set your thermostat to 68 degrees or lower in the winter
- B1C04** Reduced your water heater's temperature
- B1C05** Weatherstripped windows or doors
- B1C06** Sealed leaky ducts or air leaks
- B1C07** Cleaned or replaced air filters on your air conditioner or furnace
- B1C08** Unplugged electronics or appliances when not in use
- B1C09** Replaced your refrigerator
- B1C00** None of these
- B1C97** I took other actions not listed here (Specify)
- B1C88** Don't know

**B2** Has your household purchased any light bulbs in the past year? (Check one)

01 Yes

02 No

88 Don't know

**LT3** Thinking about all of the sockets inside and outside your home that are for screw-in type light bulbs, what percent of these sockets have CFLs currently installed? Your best estimate if fine.

*(CFLs usually do not look like regular incandescent bulbs. The most common type of compact fluorescent bulb is made with a glass tube bent into a spiral, resembling soft-serve ice cream, and it fits in a regular light bulb socket.)*

\_\_\_\_ [PERCENT 0-100]

888 Don't know

**LT5** Another type of light bulb used in homes is called an LED. These bulbs look like regular light bulbs. We are not referring to battery-operated LEDs, holiday lights, or decorative strands.

Thinking about all of the sockets inside and outside your home that are for screw-in type bulbs, what percent of these sockets have LEDs currently installed? Your best estimate if fine.

\_\_\_\_ [PERCENT 0-100]

888 Don't know

## INFLUENCE OF HERs ON ACTIONS TAKEN

[ASK SECTION IF QUOTA = 1,3 AND S2 = 1 (RECALL REPORTS)]

- I1 Earlier you mentioned receiving a Home Energy Report from MidAmerican that is separate from your electric and gas bills.

To what extent, did the Home Energy Report(s) influence any of the actions your household took to save energy in the past year? *(Check one)*

- 01 No influence
- 02 Some influence
- 03 A great deal of influence
- 88 Don't know

## HERs DISPOSITION

[ASK SECTION IF QUOTA = 1,3 AND S2 = 1 (RECALL REPORTS)]

- R1 Thinking about the **most recent** Home Energy Report you received, how much of it did you read? *(Check one)*

- 01 All of it
- 02 Some of it
- 03 None of it
- 04 Glanced at the report but didn't read it
- 88 Don't know

- R2 Thinking about that **most recent** Home Energy Report, did you do any of the following with it? *(Select all that apply)*

[PROGRAMMER RANDOMIZE choices 1-3];

For R2C01 through R2C88

- 0 Not mentioned
- 1 Mentioned

- R2C01 Discuss it with someone else
- R2C02 Save it for future reference
- R2C03 Throw it away before reading it
- R2C97 I took some other action *(Specify)*
- R2C88 Don't know

- R3 [ASK IF R1 = 3, 4 OR R2C02 = 1 OR R2C03 = 1] Just to check, did you read **any** of the Home Energy Reports MidAmerican sent in the past year? *(Check one)*

- 01 Yes [SKIP TO NEXT SECTION]
- 02 No
- 88 Don't know [SKIP TO NEXT SECTION]

- R4 [ASK IF R1 = 3 OR R3 = 2] Why didn't you read the Home Energy Report?  
[OPEN VERBATIM RESPONSE]



## HERs SECTIONS AND CONTENT

[ASK SECTION IF QUOTA = 1,3 AND R1 = 1,2,4 OR R3 = 1 (IF RECALL AND READ AT LEAST ONE REPORT) ELSE SKIP TO HS1]

[PROGRAMMER NOTE: The following is broken into 4 groups. All groups should be shown to each eligible respondent. The 4 groups should be given in a randomized order.]

### **GROUP 1: SIMILAR HOMES COMPARISON**

**SHC1** Each report compares your home's energy use with similar homes in your area. Do you remember seeing this comparison? (Check one)

01 Yes

02 No

[GO TO NEXT GROUP OF QUESTIONS]

88 Don't know

[GO TO NEXT GROUP OF QUESTIONS]

**SHC2** [SHOW IF SHC1 = 1] On your most recent report, was your household's energy use... (Check one)

01 More than similar homes

02 About the same as similar homes

03 Less than similar homes

88 Don't know

**SHC3** [SHOW IF SHC1 = 1] How useful is the comparison of your home's energy use to similar homes in your area? (Check one)

01 Not at all useful

02 Somewhat useful

03 Very useful

88 Don't know

**SHC4** [ASK IF SCH3 = 1 or 2] How could the comparison to similar homes be more useful?  
[OPEN VERBATIM RESPONSE]

### **GROUP 2: TRACK YOUR PROGRESS**

**TYP1** The reports include a "Track Your Progress" section that shows your home's monthly energy use this year compared with your home's energy use for each month last year. Do you remember seeing this monthly comparison? (Check one)

01 Yes

02 No

[GO TO NEXT GROUP OF QUESTIONS]

88 Don't know

[GO TO NEXT GROUP OF QUESTIONS]

**TYP2** [SHOW IF TYP1 = 1] How useful is the "Track Your Progress" section? (Check one)

01 Not at all useful

02 Somewhat useful

03 Very useful

88 Don't know

**TYP3** [ASK IF TYP2 = 1 or 2] How could the "Track Your Progress" section be more useful?  
[OPEN VERBATIM RESPONSE]

### **GROUP 3: TIPS**

**TIPS1** The Home Energy Reports contain “Tips from Efficient Homes” with no-cost and low-cost tips. Do you remember seeing Tips from Efficient Homes? *(Check one)*

- 01 Yes
- 02 No *[GO TO NEXT GROUP OF QUESTIONS]*
- 88 Don't know *[GO TO NEXT GROUP OF QUESTIONS]*

**TIPS2** *[SHOW IF TIPS1 = 1]* How useful are the “Tips from Efficient Homes”? *(Check one)*

- 01 Not at all useful
- 02 Somewhat useful *[GO TO NEXT GROUP OF QUESTIONS]*
- 03 Very useful *[GO TO NEXT GROUP OF QUESTIONS]*
- 88 Don't know *[GO TO NEXT GROUP OF QUESTIONS]*

**TIPS3** *[ASK IF TIPS2 = 1 or 2]* How could “Tips from Efficient Homes” be more useful?  
[OPEN VERBATIM RESPONSE]

### **GROUP 4: PROGRAM RECOMMENDATIONS**

**PR1** Some Home Energy Reports that you received contained information about other MidAmerican programs you can use and equipment you could buy to save money and energy. Do you remember seeing this information about programs or equipment?

- 01 Yes
- 02 No *[GO TO NEXT GROUP OF QUESTIONS]*
- 88 Don't know *[GO TO NEXT GROUP OF QUESTIONS]*

**PR2** *[SHOW IF PR1 = 1]* How useful is the information about information about programs or equipment? *(Check one)*

- 01 Not at all useful
- 02 Somewhat useful
- 03 Very useful
- 88 Don't know

**PR3** *[ASK IF PR2 = 1 or 2]* How could information about programs or equipment be more useful?  
[OPEN VERBATIM RESPONSE]

### **SATISFACTION WITH HERs**

*[ASK SECTION IF QUOTA = 1,3 AND S2 = 1 (IF RECALL ANY REPORTS)]*

**HS1** How satisfied are you with the Home Energy Reports overall? *(Check one)*

- 01 Not at all satisfied
- 02 Somewhat satisfied
- 03 Very satisfied
- 04 Extremely satisfied
- 88 Don't know

**HS2** *[ASK IF HS1=1 or 2]* Why did you rate your satisfaction that way?  
[OPEN VERBATIM RESPONSE]

**HS3** How likely are you to recommend these reports to a friend?  
*[SHOW SLIDING SCALE, 0 to 10, where 0 is "extremely unlikely" and 10 is "extremely likely."]*

## INFLUENCE OF HERs

[ASK SECTION IF QUOTA = 1,3 AND S2 = 1 (IF RECALL ANY REPORTS)]

T1 Thinking about tips and programs in the Home Energy Reports, what prevented your household from taking actions or making changes suggested in the reports? *(Select all that apply)*

For T1C01 through T1C88

0 Not mentioned

1 Mentioned

**T1C01** My home is efficient already

**T1C02** Already doing everything we can to save energy

**T1C03** I'm too busy, don't have time, or don't see it as a priority

**T1C04** They seem complicated or a hassle

**T1C05** Thermostat settings tips are not reasonable (78 in summer is too hot / 68 in winter is too cold)

**T1C06** The tips are too expensive or sound too expensive

**T1C07** I would need a contractor's help

**T1C08** COVID-19 (anything about COVID-19)

**T1C88** Don't know

T2 [ASK IF T1C08 = 1] What about COVID-19 makes it difficult to take actions or make changes suggested in the Home Energy Reports?

[OPEN VERBATIM RESPONSE]

## FINAL PROCESS

[ASK OF ALL]

P1 Next we want to learn about how you make decisions about energy efficiency in your daily life. Thinking about your household over the next six months, how likely are you to do the following?

[PROGRAMMER NOTE: MATRIX; ROTATE A – E]

For P1A through P1E:

01 Not at all likely

02 Somewhat likely

03 Very likely

04 Extremely likely

88 Don't know

**P1A** Purchase new energy efficient equipment or appliances for my home

**P1B** Allow a contractor into my home to service existing equipment or appliances

**P1C** Look for additional ways to save energy in my home that are low cost or no cost

**P1D** Start a major home renovation or remodeling project

**P1E** Build a new home

P2 Thinking about the last five statements, did the COVID-19 pandemic influence any of your responses? *(Check one)*

01 Yes

02 No

88 Don't know

**P3** [SHOW IF P2 = 1] How did it influence your responses?  
[OPEN VERBATIM RESPONSE]

## DEMOGRAPHICS

[ASK OF ALL]

**DEM1** What type of home do you live in? Is it a . . . ? (Check one)

- 01 Single-family detached house
- 02 Single-family attached house (townhouse, row house, or duplex)
- 03 Apartment building with 2-4 units
- 04 Apartment building with 5 or more units
- 05 Mobile home or house trailer
- 06 Other (Specify)
- 88 Don't know

**DEM2** Do you own your home or are you renting? (Check one)

- 01 Own / buying
- 02 Rent
- 88 Don't know

**DEM3** In what year was your home built?

- \_\_\_\_ Year [1800 - 2021]
- 8888 Don't know

**DEM3a** [SHOW IF DEM3 = 8888] Approximately when was your home built? (Check one)

- 01 1930s or earlier
- 02 1940s
- 03 1950s
- 04 1960s
- 05 1970s
- 06 1980s
- 07 1990s
- 08 2000s
- 09 2010s
- 10 2020s
- 88 Don't know

**DEM4** What is the main fuel used to heat your home? (Check one)

- 01 Electricity
- 02 Natural gas
- 03 Bottled gas propane
- 04 Fuel oil
- 05 Wood
- 06 Other (Specify)
- 88 Don't know

**DEM6** Do you have central air conditioning in your home?

- 01 Yes
- 02 No
- 88 Don't know

**DEM7** How many working room or window air conditioners do you have in your home?

— Number of units [0-20]

88 Don't know

**DEM8** How many years have you lived in your home?

(Enter 0 if less than one full year)

— Number of years [0 - 100]

888 Don't know

**DEM9** Not including unfinished basements or crawlspace, which of the following best describes the square footage of your home? Is it... (Check one)

01 Less than 1,000 square feet

02 1,000 to 1,500 square feet

03 1,501 to 2,000 square feet

04 2,001 to 3,000 square feet

05 More than 3,000 square feet

88 Don't know

**DEM10** Counting yourself, how many people normally live in this household on a full-time basis?

— Number of people [0-20]

88 Don't know

99 Prefer not to answer

**DEM13** How old were you on your last birthday? Were you... (Check one)

01 18 to 24

02 25 to 34

03 35 to 44

04 45 to 54

05 55 to 64

06 65 or older

88 Don't know

99 Prefer not to answer

**DEM14** Including wages, salaries, pensions, Social Security and other sources of income for all members of your household, what was your total household income before taxes in 2020? Please select from the following categories. Was it... (Check one)

01 Less than \$24,000

02 \$24,000 to less than \$50,000

03 \$50,000 to less than \$75,000

04 \$75,000 to less than \$100,000

05 \$100,000 or greater

88 Don't know

99 Prefer not to answer

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## CONCLUSION

[ASK OF ALL]

**INC\_FLAG** [SET TO 1]

**INC1** [COMPLETION QUESTION] This concludes the survey.

As a thank you, you will receive a \$15 Tango gift card by email. You can then apply the Tango card to your choice of retailer or restaurant (including Amazon, Lowes, Apple Store and iTunes, Google Play, Xbox, Applebee's, and more), an online debit card (Visa® or MasterCard®), or donate to a charity (like the American Cancer Society).

Please provide the following information

- |    |                                      |                      |
|----|--------------------------------------|----------------------|
| 01 | First and Last Name                  | [OPEN VERBATIM]      |
| 02 | Email Address                        | [EMAIL entry field ] |
| 03 | Phone Number                         | [OPEN VERBATIM]      |
| 99 | I do not wish to receive a gift card | [EXCLUSIVE ANSWER]   |

**INT99** Thank you for your participation! If you requested a gift card, you should receive an email from MidAmerican with the link to your Tango card in about 4 weeks. If you do not receive an email within this timeframe, please contact Tom Stevens of Tetra Tech, our survey researcher, at Tom.Stevens@tetrattech.com.

To learn more about MidAmerican's energy efficiency options, please visit:  
<https://www.midamericanenergy.com/residential-efficiency-programs>

Please hit Submit to complete your survey.

CO Submit answers [Go to: <https://www.midamericanenergy.com/residential-efficiency-programs>]