HOME ENERGY REPORT INITIATIVE

Home Energy Report Impact and Process Evaluation Final Report

Energy Trust of Oregon

Date: December 5, 2024

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1 EXECUTIVE SUMMARY

DNV and subcontractor Rouj (the DNV team) conducted an impact and process evaluation for Energy Trust of Oregon's (Energy Trust) Home Energy Report (HER) initiative with Pacific Power.

1.1 Program background

Launched in October 2020, the HER initiative involves implementer Bidgely sending customers reports analyzing and comparing their home energy usage and recommending paths to reducing consumption. Energy Trust and Pacific Power designed the initiative to reduce energy usage by encouraging no-cost and low-cost energy conservation actions and promoting the installation of energy-saving measures.

Since its launch, the initiative has implemented three waves that started at different times and targeted different customer segments. Within each wave, the initiative randomly assigned customers to either the treatment or the control group, using a randomized control trial (RCT) design. The treatment group receives either paper HERs or digital HERS (eHERs), while the control group receives neither. Waves 1 and 2 used eHERs while Wave 3 used paper HERs.

Energy Trust claims deemed electric energy savings from the initiative. Initially, the deemed savings was based on performance-based estimates of savings from Pacific Power customers in Washington state. After the first 15-months, Bidgely reported the first performance-based savings estimates for the Oregon customers in the HER initiative. These estimates were lower than the deemed savings Energy Trust initially claimed. By the start of the initiative's third year, Energy Trust had reduced the deemed savings assumptions to align claims with performance-based results. Due to volatility between savings estimates to date, Energy Trust identified the need for this third-party evaluation to verify initiative savings, among other objectives.

1.2 Evaluation methodology and goals

This is the first evaluation of the initiative. It addresses the program period beginning on October 1, 2020, and ending on December 31, 2023. Our evaluation involved a data review and fielding of web-based surveys with nearly 4,000 Pacific Power customers. Leveraging electric interval data, electric and gas billing data, downstream program tracking data, and claimed and reported savings reports, the impact evaluation analysis:

- Estimated overall and subpopulation savings attributable to the program.
- Compared the claimed and evaluated savings for the evaluation period to arrive at realization rates.
- Verified the rate of attrition over the evaluation period.

Using survey results, our process evaluation efforts:

- Explored differences in energy efficient program participation, behaviors, and attitudes between treatment and control group households.
- Assessed participant awareness, engagement, barriers, and satisfaction.

Table 1-1 outlines the pre-treatment periods and treatment years covered by this evaluation. DNV conducted this evaluation from September 2023 to September 2024 and fielded the process evaluation surveys from January to April 2024.

Table 1-1. Evaluation periods

Wave	CY2019				CY2020				CY2021				CY2022				CY2023			
	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4
Wave 1				Pre-treatment period					Treatment Year 1				Treatment Year 2				Treatment Year 3			
Wave 2													Pre-treatment period				Treatment Year 1			
Wave 3																	Pre-treatment period			
																	Treatment Year 1			

1.3 Impact evaluation key findings

The DNV team evaluated savings by wave and treatment year (TY). Table 1-2 summarizes total savings results. We estimated that 23.1 million kWh and 48 thousand therms of savings are attributable to the initiative's efforts from the time-period being evaluated. We refer to these as the unadjusted savings. We recommend Energy Trust claims 21.8 million kWh and 47 thousand therms of savings at the portfolio level, to avoid double-counting HER initiative savings with the downstream program savings. We refer to the otherwise double-counted savings as downstream joint savings and the savings Energy Trust should claim as adjusted savings.

Table 1-2. Total savings summary (kWh)

Wave	Unadjusted savings	Downstream joint savings	Adjusted savings
Wave 1 – TY1	5,737,743	29,667	5,708,076
Wave 1 – TY2	5,598,137	409,980	5,188,157
Wave 1 – TY3	8,885,007	613,532	8,271,475
Wave 2 – TY1	1,355,731	185,519	1,170,211
Wave 3 – TY1	1,480,462	0	1,480,462
Total	**23,057,081**	**1,238,699**	**21,818,382**

When comparing our estimated total adjusted savings (21.8 million kWh) to the savings claimed by Energy Trust (39.7 million kWh), we found a portfolio realization rate of 55%. Energy Trust claims deemed savings, while our estimated savings are performance-based. We observed that Energy Trust's methodology for claiming savings improved over the course of the evaluation period and became increasingly accurate.

Table 1-3. Realization rates for Energy Trust savings claims (kWh)

Wave	Adjusted savings	Energy Trust claimed savings	Realization rate (adjusted / claimed)
eHER CY20Q4 – CY21Q3	5,708,076	11,448,513	50%
eHER CY21Q4 – CY22Q3	5,188,157	15,872,358	33%
eHER CY22Q4 – CY23Q3	9,441,687	11,202,583	84%
HER CY23Q1 – CY23Q4	1,480,462	1,149,305	129%
Total	**21,818,382**	**39,672,759**	**55%**

We estimated a realization rate of 99% when comparing our estimated total unadjusted savings (23.1 million kWh) to the savings reported by Bidgely (23.3 million kWh). There were larger differences for individual wave-years (up to 21%). DNV and Bidgely each estimate performance-based savings. The wave-level differences between Bidgely's and DNV's estimated savings are likely due to minor differences in data handling and modelling approaches, such as outlier identification and adjustments, remaining household calculations, and panel versus site-level modelling approaches.

Table 1-4. Realization rates for Bidgely reported savings (kWh)

Wave	Unadjusted savings[1]	Total Bidgely reported savings	Realization rate (unadjusted / reported)
Wave 1 – TY1	5,737,743	5,558,000	103%
Wave 1 – TY2	5,598,137	5,240,255	107%
Wave 1 – TY3	8,885,007	10,063,081	88%
Wave 2 – TY1	1,355,731	1,181,301	115%
Wave 3 – TY1	1,480,462	1,224,009	121%
Total	**23,057,081**	**23,266,646**	**99%**

[1] DNV compared unadjusted savings to Bidgely reported savings because Bidgely does not adjust reported savings for downstream joint savings. Joint savings are the savings that are jointly motivated by the HER initiative and other Energy Trust programs.

We found that annual electric customer attrition ranged from 8% to 16%. It is typical to see attrition of up to 10% reflecting natural customer turnover. This rate of attrition is evident in the second and third years of Wave 1 and is higher than usual for the first years of Wave 2 and Wave 3. It was surprising that Wave 1 retained 99% of treatment and control customers by the end of TY1. We would have expected this wave to experience greater attrition than our analysis indicated, suggesting that the initiative roster used for this analysis did not include the initial design roster for Wave 1.

The use of an incomplete roster has two main implications. First, the missing initial design roster would have included Wave 1 customers that moved prior to TY2 and should have been included in estimates of per customer savings and the counts used to calculate total savings. Second, the missing initial design roster raises concerns about the validity of the Wave 1 RCT. While we assess for balance each year based on the remaining program population, it is the initial design roster that provides the fundamental evidence of a balanced original sample.

Table 1-5. Attrition summary (kWh)

Wave	Treatment customers			Control customers		
	Start of treatment year	End of treatment year	Percent annual attrition	Start of treatment year	End of treatment year	Percent annual attrition
Wave 1-TY1	146,383	145,014	0.9%	34,236	33,925	0.9%
Wave 1-TY2	144,513	130,022	10.0%	33,831	30,477	9.9%
Wave 1-TY3	128,880	118,954	7.7%	30,180	27,849	7.7%
Wave 2-TY1	39,825	35,106	11.8%	14,751	12,932	12.3%
Wave 3-TY1	29,211	24,628	15.7%	14,719	12,431	15.5%

1.4 Process evaluation key findings

Based on survey responses, we did not see a significant difference between treatment and control groups when it came to (1) making durable changes and (2) regularly taking energy/water-saving actions. Readers may wonder how the initiative generates savings if it is not motivating behavior change. We hesitate to use self-reported survey results to establish a causal link between specific interventions and savings. Surveys leverage smaller sample sizes than the impact analysis and capture limited technical specifications and interplays between measures. For example, while two respondents may have reported upgrading an appliance, one respondent may have upgraded to a program-eligible model while the other respondent may have installed a less efficient model. This inability to establish a direct link should not diminish the strength of the HER and eHER savings.

In our web surveys, we found reasonably high levels of Report awareness among treatment customers. When shown an example in the web survey, most treatment customers (82%) confirmed that they have received Reports. Interestingly, Wave 3 treatment customers (87%) were significantly more likely than their counterparts in Wave 2 (77%) to recall receiving the Reports. Wave 3 Reports had been issued only four times and were distributed by paper only. In contrast, Wave 2 Reports are issued 24 times per year and sent digitally only. It may be the case that paper HERs are more likely than eHERs to reach customers; however, given the differing characteristics between the waves, we are hesitant to decisively draw this conclusion.

Engagement with the Reports has room for growth. One in every five treatment customers who are *aware* they receive Reports do not read the content. Only one-half (53%) of treatment customers reported they read all or some of the Report content.

When asked to rate their satisfaction with various elements of the reports, engaged respondents, who read all or some Report content, were most likely to be satisfied with the illustration of their monthly usage history (80%) and least likely to be satisfied with the comparisons to similar homes (53%). Those who indicated that they were dissatisfied with the comparisons to similar homes often pointed to their skepticism with the accuracy or felt their home was being unfairly compared to homes under different circumstances.

1.5 Conclusions and recommendations

Treatment customers in the HER initiative saved 23.1 million kWh and 48 thousand therms over the evaluation period, including jointly motivated savings from Energy Trust's downstream programs.

The Energy Trust HER initiative has reduced energy usage across waves of different sizes, different start-up times, and different delivery vehicles. Wave 1 is almost four times the size of the subsequent waves, has been in place for three years, and delivered eHERs (not paper HERs). Waves 2 and 3 have only been in place for one year, and Wave 3 is testing paper HERs. The first-year per customer savings for all three waves are similar, though there is some indication in the electric results that the paper HERs may have motivated additional savings: Wave 3 first-year savings per customer was 55 kWh, while Wave 1 and Wave 2 ranged from 36 to 39 kWh per customer. Wave 1 electric savings have increased into the third year as expected, given that behavior programs like this initiative often generate greater per customer saving over time. Gas savings have been unexpectedly low and flat across all waves.

Over time, Energy Trust's realization rates improved due to changes in methodology.

We found an overall realization rate of 55% when comparing impact evaluation results (total adjusted savings) with Energy Trust's savings claims: 21.8 million kWh compared to 39.7 million kWh for the overall evaluation period. Energy Trust's claims for eHERs in TY1 and TY2 (based on Wave 1 customers) were based on performance-based estimates for Reports sent to Pacific Power customers in Washington state. The ratio of DNV's evaluated kWh savings to Energy Trust claimed savings was 50% and 33% for those years. For eHERs between October 2022 and September 2023, claims were reduced and the realization rate increased to 84% -- an indication of greater accuracy. HERs in TY1, also with reduced claims, had a realization rate of 129%. Energy Trust's more recent claims, that reflect the initiative's results, produced better realization rates.

DNV's estimated kWh savings are aligned with Bidgely reported savings.

Bidgely reported similar savings to DNV's estimates for unadjusted savings**.** Despite differences for individual wave-years that ranged from 88% to 121%, overall savings for the evaluation period had a 99% realization rate: 23.1 million kWh compared to 23.3 million kWh. Performance-based approaches to estimate behavioral savings, which Bidgely used to generate the savings estimates, are standard best practice. The wave-level differences between Bidgely's and DNV's estimated savings are likely due to minor differences in data handling and modelling approaches.

Recommendation

Integrate performance-based savings estimates into the claims process wherever possible. Fully performance-based savings estimates, reported after the fact, are a common and optimal approach to claiming HER savings. Unfortunately, this approach is frequently difficult to integrate into regulatory tracking and reporting structures. The difficulty of developing accurate deemed savings forecasts in advance to use as deemed HER savings estimates is the primary reason that the additional hassle of lagged or trued-up claims may be worth looking into. Alternatively, as demonstrated, now that Energy Trust can base projected savings on current and local performance-based savings estimates, the difference between deemed and performance-based is improved.

The Wave 1 joint savings adjustment is the largest and reflects success in promoting downstream participation.

Joint savings is the effect of the initiative from treatment customers installing Energy Trust-rebated equipment at higher frequency or greater depth than control customers. Using a tracking data analysis, we found that electric energy joint savings increased over the first three years for Wave 1, achieving 6.9% of total unadjusted savings by TY3. Wave 2 customers achieved the highest joint savings percentage of unadjusted electric energy savings at 13.7%.

In contrast, electric demand and gas joint savings achieved less than 3% of total unadjusted savings. These percent impacts are smaller than those from electric energy because treatment customers participated more frequently or deeply in rebated solar PV measures than control customers, for which Energy Trust does not claim electric demand impacts.

Recommendation

Continue or increase messaging that encourages rebated renewable improvements. This recommendation is beneficial because solar PV installations are contributing largely to joint savings, reflecting success in promoting downstream program participation.

Annual customer attrition ranges from 6% to 16%, except for Wave 1 TY1.

It is typical to see attrition of up to 10%, reflecting natural customer turnover. This rate of attrition is evident in TY2 and TY3 of Wave 1 and TY1 of Wave 2 and Wave 3. Because the initial design is set prior to the first year of the program, we expect to see attrition from the initial design counts to the counts at the end of the first year. It was surprising that Wave 1 retained 99% of treatment and control customers by the end of TY1. We would have expected this wave to experience greater attrition than our analysis indicated, suggesting that the initiative roster used for this analysis did not include the original design roster for Wave 1.

Recommendation

Maintain the initial design roster for each wave in the HER initiative. The initial design roster includes all treatment and control customers selected for the RCT at the time of design finalization and prior to sending the first Reports. This roster will allow future evaluations to fully account for the number of treatment customers generating savings, validate the RCT sample design, and track attrition for the full life of each wave.

It is difficult to establish a causal link between specific durable improvements or behavior changes and program savings.

When shown a list of measures supported by Energy Trust, respondents confirmed which home upgrades they had made in the past two years. We did not see a significant difference between treatment and control groups. Their responses also indicated that only a very small proportion of reported durable equipment installations received downstream Energy Trust rebates; this confirmed our findings from the joint savings analysis.

Most customers reported in the survey that they regularly take actions such as turning off lights when leaving a room. We did not see significant differences in the frequency of these reported actions between treatment and control groups.

It is a well-established reality of HER programs that while the savings estimates are as rigorously determined as any other type of program, the specific activities that lead to those savings are difficult to identify. The wide variety of activities that can lead to energy savings, the fact that customers pursue different activities, and the fact that HER and eHER savings are due to greater frequency or depth of those activities, helps explain the challenge. This inability to establish a direct link should not diminish the strength of the HER and eHER savings.

Customers who receive paper Reports were more likely to be aware of the Reports than those who receive digital Reports.

Across waves, we found high levels of awareness, with 82% of treatment customers able to confirm receiving the Reports. We identified a significantly higher share of Wave 3 customers (87%) who knew they were receiving Reports than Wave 2 customers (77%). Interestingly, Wave 3 Reports have been issued only four times and are distributed by paper only. In contrast, Wave 2 Reports are issued 24 times per year and sent digitally only. It may be the case that paper HERs are more likely than eHERs to reach customers; however, given the differing characteristics between the waves, we are hesitant to decisively draw this conclusion.

Only one-half of customers who receive Reports engage with them.

Only one-half (53%) of treatment customers read all or some of the Report content. Across waves, between 78% and 84% of customers who knew they received Reports confirmed reading some or all the Reports. This finding suggests that there is room to increase engagement with these Reports. Levels of engagement between digital and paper Reports did not significantly vary.

Customers appreciate the illustrations of their usage history but are less satisfied with comparisons to other homes.

When asked to rate their satisfaction with various elements of the Reports, customers who engage with the Reports were most likely to be satisfied with the illustration of their monthly usage history (80%) and least likely to be satisfied with the comparisons to similar homes (53%). Those who indicated that they were dissatisfied with the comparisons to similar homes often pointed to their skepticism with the accuracy or felt their home was being unfairly compared to homes under different circumstances.

Recommendation

Share more details, such as size and vintage, in the Reports about the homes that customers are being compared to.

Customers frequently cited cost as a barrier to acting on Report tips.

When asked if various factors prevented them from taking the actions recommended in the Reports, treatment customers most commonly confirmed that affordability constraints and uncertainty about cost savings were barriers. Additionally, roughly, one-fifth of Wave 3 respondents shared that they lacked the authority to make upgrades – significantly more than in Wave 1. In fact, customers – particularly renters – who were dissatisfied with the Report tips mentioned that the tips do not apply to their living situation.

Recommendation

Enhance messaging that helps customers navigate financial limitations to reducing energy usage. For Wave 3 customers, focus messaging on actions that do not require major home modifications or investments.

Memo

To: Energy Trust Board of Directors

From: Marshall Johnson, Sr. Program Manager, Residential
Maddy Otto, Project Manager, Residential
Sarah Castor, Evaluation & Engineering Manager

Date: January 9, 2025

Re: Staff Response to the Home Energy Report Impact and Process Evaluation

Home Energy Reports (HERs) represent a substantial portion of the electric savings claimed by Energy Trust's Residential program on behalf of Pacific Power in 2021-2023. After initial performance-based savings estimates by Bidgely, the company that distributes the reports, were much lower than expected based on a similar effort for Pacific Power customers in Washington, Energy Trust revised its deemed savings in 2022 to more closely align with the performance-based estimates. Energy Trust undertook this evaluation to determine the accuracy of reported savings, understand the contribution of downstream Energy Trust programs to HER savings, assess customer satisfaction with HERs, and determine if the reports also spurred energy-saving behaviors for natural gas use.

The HER offer uses a randomized controlled trial, randomly selecting households to receive HERs or serve as a control group that does not receive HERs so that energy savings of the reports can be easily measured as the difference in energy use between the two groups. The evaluation results are based on metered energy usage data for more than 245,000 customers and survey responses from nearly 4,000 customers, including those who received HERs and those who did not, giving us confidence in the evaluation results. These results support the accuracy of the performance-based savings that Bidgely reports and confirm Energy Trust was correct to reduce its deemed savings claims after receiving the Bidgely results for the initial HER recipients in 2022. The realization rates of 84% and 129% for the more recent electronic HERs and paper HERs distributed from late 2022 through 2023 indicate our updated deemed savings estimates have improved in accuracy over time and that we still have some room for further improvement. The evaluation also estimated about 8% of total electric savings achieved were related to customers taking actions that received downstream incentives. The evaluation did not find any significant savings for natural gas.

The evaluation of survey responses was not able to identify reasons why HER recipients saved energy, as customers who received HERs reported similar energy usage behaviors and actions as customers who did not receive HERs. As we found with Energy Trust's previous HER endeavors in the early 2010s, not all customers engage with the reports and among those who do, some express doubts about the comparisons the reports make between their home and similar homes. They also cite cost as a main barrier to acting on some of the tips for savings energy in the HERs, as well as lack of authority to make upgrades among renters. Energy Trust plans to work with Bidgely in 2025 to explore messaging adjustments to empower renters to feel comfortable taking energy saving actions.

Energy Trust and Pacific Power plan to continue offering HERs to customers in alignment with Pacific Power activities with Washington and California customers and may deliver HERs to additional customers to make up for participants lost to account changes and opt-outs. In 2025, the Residential program will revise its deemed savings values for HERs, to be used in 2026 program savings claims. At that time, the program will also consider whether to shift from claiming deemed savings to claiming performance-based savings.

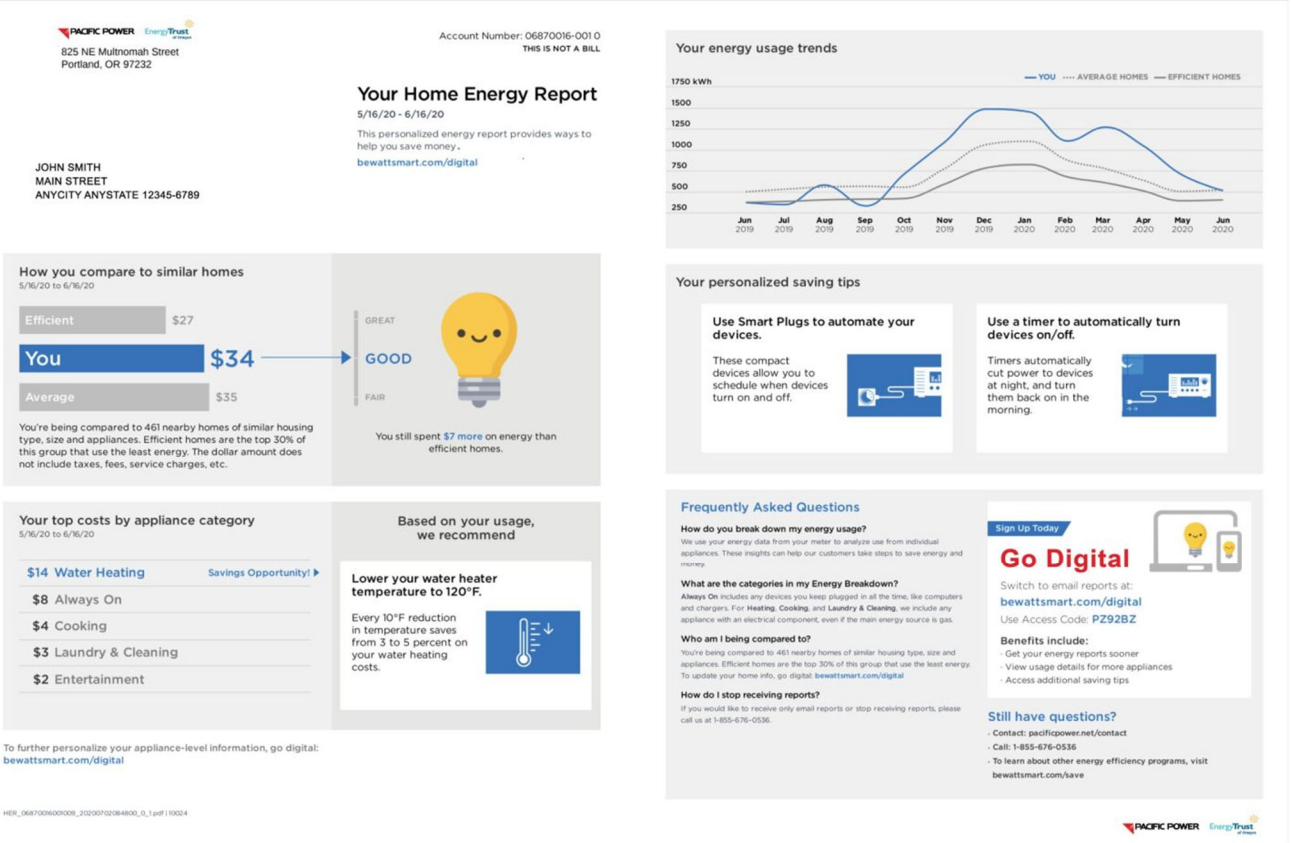
2 INTRODUCTION

DNV and subcontractor Rouj (the DNV team) conducted an impact and process evaluation for Energy Trust of Oregon's (Energy Trust) Home Energy Report (HER) initiative with Pacific Power. This was the first evaluation of this initiative. The evaluation covered the period beginning on October 1, 2020, and ending on December 31, 2023. Energy Trust and Pacific Power designed the initiative to reduce energy usage by encouraging no-cost and low-cost energy conservation actions and promoting the installation of energy-saving measures.

2.1 Background

Energy Trust's HER initiative launched in October 2020. It included three waves that started at different times and targeted different customer segments. Within each wave, the customers were randomly assigned to either the treatment or the control group, using a randomized control trial (RCT) design. The treatment group received either paper Home Energy Reports (HER) or digital Home Energy Reports (eHER), while the control group did not. This randomization meant that, except for receiving HERs or eHERs (Reports), the treatment and control group customers were alike. The RCT framework is the most effective way to establish a causal relationship between a treatment and its effect and provides unbiased estimates of the Report treatment effect. Figure 2-1 shows an example of a Bidgely HER.

Figure 2-1. Example Home Energy Report



Pacific Power, in coordination with Energy Trust, engaged Bidgely to distribute Reports to their residential electricity customers in Oregon. Energy Trust's residential program management contractor, CLEAResult, works with Bidgely to deliver the Reports and claim energy savings. This initiative is an expansion of Pacific Power's

deployment of Bidgely Reports in Washington. For the first wave ("Wave 1"), Bidgely delivered eHERs to Pacific Power electricity customers in Oregon. Two years later, Bidgely launched the second wave ("Wave 2") as an expansion of Wave 1. Wave 2 is a refill group to replace Wave 1 customers who moved away from the original RCT premise and no longer receive Reports. Customers in Waves 1 and 2 received eHERs twice per month. For the third wave ("Wave 3"), Bidgely delivered HERs to some Pacific Power electricity customers in Oregon for whom Pacific Power did not have email addresses. This wave has additional targeting, based on whether the customer was in a low-income, racially diverse, or rural census tract; whether the customer was a bill-pay assistance program participant; or whether the customer had minimal[2] or no participation in Energy Trust residential programs[3]. Customers in Wave 3 received HERs quarterly. Table 2-1 summarizes the initial design of each wave in the initiative.

Table 2-1. Summary of waves

Wave	Launch date	Treatment description	Population description	Initial treatment HH	Initial control HH
Wave 1	Oct-2020	24 eHERs / year	Pacific Power electric households (HH) in Oregon with an email address on file with Pacific Power	146,414	34,242
Wave 2	Oct-2022	24 eHERs / year	Pacific Power electric households in Oregon with an email address on file with Pacific Power	40,000	14,804
Wave 3	Jan-2023	4 HERs / year	Pacific Power electric households in Oregon that meet one or more[4] of the following criteria: • Bill-pay assistance program participant • Located in a low-income, rural, or racially diverse census tract • No email on file with Pacific Power • Minimal or no prior participation with other Energy Trust measures	30,572	15,428

Energy Trust claims deemed electric energy savings from the initiative. The deemed savings assumptions are outlined in measure approval documents. Energy Trust has submitted three separate measure approval documents for deemed savings since 2021. The first document (266.1) covers eHER savings, and the second document (277.1) covers HER savings. The third document (266.2) covers both eHERs and HERs, based on 15-month, realized savings for eHERs in Wave 1, as estimated by Bidgely. The 15-month period covered October 2020 through December 2021. Deemed first-year savings for both eHERs and HERs were notably different between the newest measure approval document and the former documents. Due to volatility between savings estimates to date, Energy Trust identified the need for this third-party evaluation to verify initiative savings, among other objectives. Table 2-2 outlines key details from the approval documents, including the different deemed savings estimates from these documents.

[2] Minimal participation includes receiving an energy saver kit, which consisted of LED light bulbs, efficient showerheads, and/or faucet aerators.
[3] CLEAResult defined the scoring that determined the extent to which customers qualify for this target group.
[4] Customers were prioritized for inclusion in the RCT based on these criteria. Some Wave 3 customers may not meet one or more of these criteria.

Table 2-2. Key details from measure approval documents

Document	Year	Treatment description	Methodology	First-year savings per customer (kWh)
266.1	2021	24 eHERs / year	Percent Savings per household (1.09%) * Average Annual Usage (11,213 kWh) * Derating Factor (90%)	110.3
277.1	2022	4 HERs / year	Percent Savings (1.03%) * Average Annual Usage (10,395 kWh) * Derating Factor (90%)	96.4
266.2	2023	24 eHERs / year	Average Monthly Savings per household (3.15 kWh) * 12 months	37.8
266.2	2023	4 HERs / year	Average Monthly Savings per household (3.15 kWh) * 12 months * Derating Factor (87.4%)	33.1

2.2 Evaluation objectives

The objectives of the impact evaluation were to:

- Verify the rate of attrition over the evaluation period.
- Estimate overall and subpopulation savings attributable to the program to arrive at realization rates.
- Compare claimed and evaluated savings for the evaluation period.

The objectives of the process evaluation were to:

- Explore differences in energy-efficient program participation, behaviors, and attitudes between treatment and control group households.
- Assess participant awareness, engagement, barriers, and satisfaction.

Table 2-3 shows the subpopulations for the impact evaluation.

Table 2-3. Subpopulations for savings estimation

Report type	Savings fuel	Gas service	Savings unit	Report wave	Treatment year	Additional slices	Outcomes of interest
Digital	Electricity	All	Total, per home	2021	1-3	Gas service, heating fuel, bill rate	kWh, heating kWh, cooling kWh, %kWh, realization rate, kW, %kW
				2022	1		
	Gas	Yes		2021	1-3	Heating fuel	Therms, heating therms, %therms
				2022	1		
Paper	Electricity	All		2023	1	Gas service, heating fuel, bill rate	kWh, heating kWh, cooling kWh, %kWh, realization rate, kW, %kW
	Gas	Yes				Heating fuel	Therms, heating therms, %therms

The evaluation covers the pre-treatment periods and treatment years outlined in Table 2-4. DNV conducted this evaluation from September 2023 to September 2024 and fielded the process evaluation surveys from January to April 2024.

Table 2-4. Evaluation periods

Wave	CY2019				CY2020				CY2021				CY2022				CY2023			
	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4
Wave 1				Pre-treatment period				Treatment Year 1				Treatment Year 2				Treatment Year 3				
Wave 2												Pre-treatment period				Treatment Year 1				
Wave 3													Pre-treatment period				Treatment Year 1			

2.3 Organization of report

Table 2-5 details the organization of the remaining sections of the report and summarizes the content of each section.

Table 2-5. Report sections

Section #	Summary
Section 3	**Methodology** describes the DNV team's detailed evaluation approach.
Section 4	**Results** documents detailed findings for the impact and process evaluation.
Section 5	**Conclusions and recommendations** provides in-depth conclusions and recommendations for select results.

3 METHODOLOGY

3.1 Evaluation data sources

initiative roster. Bidgely provided the initiative roster as of September 2023. The initiative roster contains information about the 280,000 customers included in the RCT sample design, including treatment and wave assignment, Report type/s received, and contact information. The roster defines customers by unique combinations of premise ID and Pacific Power electric account number. The roster does not include gas account information for these customers. DNV used the initiative roster for savings verification and surveys.

Electric interval data. Pacific Power provided electric interval data from 2019 through 2023 for each premise ID[5] in the initiative roster. The interval data contains information about customers' electric usage over 15- or 60-minute periods. This dataset has several billion observations and required careful and dedicated coordination between Energy Trust, Pacific Power, and DNV to procure. To minimize dataset size, stakeholders agreed to exclude electric account number from the interval data and use a separate, customer file (see below) that defines the usage associated with each customer. DNV used the electric interval data for hourly savings verification.

Gas billing data. Energy Trust provided gas billing data from 2019 through 2023 for each premise ID in the initiative roster. The billing data contains information about customers' gas usage over monthly billing periods. While this dataset included gas account numbers at each premise ID, the initiative roster did not include that information. To address this disconnect, DNV defined gas usage start and end dates for each customer in the initiative roster using the dates in the electric customer file (see below). DNV used the gas billing data for monthly savings verification.

Electric customer file. Pacific Power provided a file with electric usage start and end dates for all customers in the initiative roster. Usage start and end dates were critical because neither the electric interval data nor the gas billing data included account numbers that could be mapped to the initiative roster. DNV used each customer's electric usage start and end dates to define the periods of electric and gas usage data to include for the savings verification.

Downstream program tracking data. Energy Trust provided downstream program tracking data from 2019 through 2023. The tracking data contained information about customers' downstream rebate program participation (including program name, measure name, installation date, and claimed savings). DNV used the tracking data for the downstream joint savings analysis, which measures the uplift in downstream program participation due to the HER initiative.

Claimed and reported savings. Energy Trust provided documentation on both the HER initiative savings claimed by Energy Trust and the reported savings by Bidgely. Energy Trust claims savings using a deemed approach, while Bidgely reports savings using a performance-based approach. DNV used this data for electric energy savings realization rates.

Program documentation. Bidgely provided a sample of program documentation in September 2023. The documentation included a sample of Reports from previous years and a messaging library with tips Bidgely staff can select for the Reports. DNV used this documentation to inform the survey effort.

[5] The premise ID represents the physical site where the Pacific Power customer lives.

Survey responses. DNV collected information from nearly 4,000 Pacific Power customers through a web-based survey and a mail-push-to-web survey. DNV used the survey responses to inform the impact findings and satisfy process objectives.

3.2 Terminology

3.2.1 Savings terminology

We use the following terms throughout this section:

Unadjusted savings are the "full" savings attributable to the HER initiative, including savings that are jointly motivated by other Energy Trust programs. Unadjusted savings occur when treatment customers install Energy Trust-rebated or non-rebated energy efficient equipment and/or undertake low-and no-cost behaviors (e.g., shortening shower times) at a higher rate or greater depth than control customers. These savings are most comparable to savings calculated by Bidgely.

Joint savings are the savings that are jointly motivated by the HER initiative and other Energy Trust programs. The other programs are Energy Trust's downstream energy efficiency rebate programs[6]. These savings are included in the unadjusted savings estimates when treatment customers install Energy Trust-rebated energy efficient equipment at a higher rate or greater depth than control customers. That is, joint savings shows increased activity in Energy Trust's downstream measures that is attributable to the HER initiative. These savings are claimed by Energy Trust's downstream programs on an annual basis and reported on a lifetime basis.

Adjusted savings are the savings attributable to the HER initiative, excluding jointly motivated savings that are claimed by Energy Trust's downstream programs. To avoid double counting joint savings, DNV excludes them from the HER initiative because it is easier to exclude them from one source instead of several downstream programs. Adjusted savings includes the savings that occur when treatment customers install non-rebated energy efficient equipment and/or undertake low- and no-cost behaviors at a higher rate or greater depth than control customers. These savings are the savings we recommend when reporting portfolio savings.

3.2.2 Subpopulation definitions

DNV coded identifiers for the following customer-level subpopulations:

- **Wave:** DNV defined wave based on the RCT cohort (Wave 1, 2, or 3) in the initiative roster.
- **Report type:** DNV defined Report type based on the RCT cohort in the initiative roster. Wave 1 and 2 received digital Reports, while Wave 3 received paper Reports.
- **Rate group:** DNV defined whether a customer was low-income based on a rate code provided by Pacific Power in the electric customer file.
- **Has gas service:** DNV defined whether a customer had gas service based on whether their premise ID appeared in the gas billing data provided by Energy Trust.
- **Has electric heating:** DNV defined whether a customer *likely* had electric heating based on the ratio of heating season usage to shoulder season usage.

[6] While Reports may jointly motivate increased purchases of midstream or upstream equipment, as well as downstream program measures, we cannot assess midstream measures undertaken by HER initiative customers due to tracking data limitations.

3.2.3 Time period definitions

DNV defines the time periods used in this analysis as follows:

- **Annual (overall):** Including all usage intervals[7] for each site and treatment year
- **Heating season:** Including all usage intervals from January, February, November, and December for each site and treatment year
- **Cooling season:** Including all usage intervals from June, July, August, and September for each site and treatment year
- **Extreme temperature days:** Including all usage intervals from the three highest and lowest days, ranked by TMY3 temperatures, for each site and treatment year
- **Utility peak periods:** Including all usage intervals for the Pacific Power utility peak periods: August afternoons, December and January mornings and evenings
- **Hour of day:** Including all usage intervals for an hour of day (e.g., from midnight to one a.m.) for each site and treatment year
- **Day of week:** Including all usage intervals for a day of week (e.g., Monday) for each site and treatment year

3.3 Impact approach

3.3.1 Experimental design review

DNV reviewed the initial experimental design for each of the three waves in the HER initiative. For this review, DNV used a two-sample t-test to check if the average monthly pre-period electric and gas usage between treatment and control groups is statistically similar. DNV uses these tests to verify if the treatment and control groups were initially balanced for each of the waves. These tests are repeated for the subset of customers that remain over time to confirm that balance is maintained following program attrition. The difference-in-differences model specification (see below) corrects for any random differences DNV identified in the pre-period. While balance tests are based on energy usage, DNV also used survey results to check balance between treatment and control customers along self-reported demographic and dwelling dimensions. We included these results in APPENDIX D.

3.3.2 Unadjusted savings estimation

The DNV team leveraged the randomized controlled trial (RCT) designed by Bidgely to estimate unadjusted savings. An RCT HER design randomly assigned customers to either a treatment group that received Reports or a control group that did not. This randomization ensured that the customers in the treatment and control groups were alike except for receiving Reports. As a result, the RCT framework was the most effective way to establish a causal relationship between a treatment and its savings effect. This framework provides unbiased estimates of that effect. Estimates of unadjusted savings represent the savings attributable to the HER initiative.

DNV used a two-stage, difference-in-differences approach to estimate unadjusted savings for the variety of subpopulations, time periods, and savings types covered by this evaluation. While there are nuances to each savings type, the approach is broadly the same.

Stage 1. DNV fit a regression model to each site's observed hourly electric and average daily gas pre- and post-period usage. These regressions modeled energy usage as a function of observed weather (temperature).

[7] For gas, monthly intervals; for electric, hourly intervals.

DNV predicted pre- and post-period usage using the fit coefficients from the observed weather model and both observed and typical (TMY3) weather. Primary unadjusted savings estimates (in section 4) are predicted based on observed weather, while subpopulation unadjusted savings estimates (in Appendix C) are predicted based on typical weather.

Equation 3-1 shows the specification DNV used for the first stage of the gas analysis. The specification uses the PRISM model, which treats energy usage as a linear function of temperature, where a customer's energy usage increases or decreases in response to temperatures above or below their comfort levels (captured by temperature balance point estimates discussed below). For each site (*s*), we regressed average daily usage (*U*) in each month on an intercept (*mu*) and average daily heating degree days (*HDD*) of each month. The final term (*epsilon*) is the mean zero error estimate. For some sites, a baseload-only regression specification (only the intercept and error term) fit the site's usage better than Equation 3-1, so DNV used that specification instead.

Equation 3-1. Stage one regression model, unadjusted savings estimation (gas)

$$U_{sd} = \mu + \beta_H * HDD_{sd} + \epsilon$$

Equation 3-2 shows the calculation of HDD for the average daily model derived from monthly data. For each site, we calculated daily heating degree days using the daily temperature (*t*) and each site's heating balance point (*HBP*), then averaged those HDD values to the monthly level. We estimated each site's heating balance points by running the regression model across a range of balance points, from low to high, in one-unit increments. We selected the optimal balance point for each site based on the lowest CV(RMSE), which indicated the best model fit.

Equation 3-2. Daily heating degree days, unadjusted savings estimation (gas)

$$HDD_{sd} = average[\max(0, HBP_s - t_{sd})]$$

Equation 3-3 shows the time-of-week-and-temperature (TOWT) specification DNV used for the first stage of the electric analysis. Like the PRISM model, the TOWT model used for this analysis treats energy usage as a function of temperature; however, instead of a single, linear response to changes in temperature beyond each customer's comfort level, the TOWT model allows for different rates of energy use for different temperature bins. For each site, we regressed average hourly usage (*U*) on an intercept (*mu*), an hour-of-week fixed effect (α_h, 167 values, since the model includes an intercept), and temperature bins (*bin*). We defined temperature bins for each site and day, based on the observed temperature values for that site and day. The final term (*epsilon*) is the mean zero error estimate. DNV fit the TOWT model to each site's heating, cooling, and shoulder season usage separately.

Equation 3-3. Stage one regression model, unadjusted savings estimation (electric)

$$U_{sh} = \mu + \alpha_h + \beta_j * bin_j + \epsilon$$

Stage 2. DNV aggregated the predicted usage to the desired time period and calculated the difference between pre-and post-period usage for each site. After filtering to the desired subpopulation, DNV used a simplified regression model to estimate the remaining difference in usage between the treatment and control groups; the simplified regression modeled the pre-post differences across both treatment and control customers as a function of a treatment dummy, whose coefficient estimate captured the effect of the HER program. The estimated difference represents the savings effect of the HER initiative: A negative value indicated savings relative to the average usage of the control group customers in the subpopulation during the time period.

The two-stage approach generates estimated unadjusted savings per customer. DNV scales unadjusted savings per customer to total savings by multiplying the per household savings estimate by the number of remaining treatment customers. DNV followed standard practice and removed households (both treatment and control) that no longer receive utility service for that fuel type from the analysis and the calculation of total savings. These drops do not affect RCT validity if households had stopped receiving service because they moved away, a factor assumed to affect both treatment and control equally. To maintain RCT validity, DNV did not remove treatment customers who opted to stop receiving Reports, as the opt-out decision was available only to the treatment group. Thus, HER initiative results reflect intent-to-treat analysis since the RCT is based on the original treatment assignment, not on those who received treatment.[8]

3.3.3 Joint savings adjustments

DNV estimated average daily downstream program savings for each customer in the HER initiative. First, DNV used the best available savings shapes to determine the daily share of lifetime deemed savings for each downstream program measure installed after the start of the HER initiative through the end of the measure's estimated useful life (or sooner, if the customer stopped receiving service and drops out of the analysis). In this case, DNV allocated lifetime savings to the daily level using a flat savings profile.

DNV calculated monthly, customer-level downstream savings before averaging monthly savings across treatment and control customers. The average group downstream savings calculation included many zero savings for customers that did not participate in a downstream program. After averaging monthly downstream savings across customers in both the treatment and control group for each wave, DNV subtracted the control groups' savings from the treatment groups' savings to estimate joint savings caused by the HER initiative. A positive difference represents the higher rate or greater depth of downstream savings from Report recipients compared to non-recipients.

To calculate adjusted HER savings, DNV removed the joint savings estimates from the unadjusted savings estimates. Though the joint savings analysis appears to reduce total initiative savings, it is essential to remember that joint savings would not have occurred without the HER initiative.

3.4 Process approach

DNV fielded a joint treatment / control customer survey that included the following topics:

- Treatment / control customer comparisons
  - Distinctions between incentivized (Energy Trust-rebated) or independently installed energy-efficient appliances and equipment during 2022 and 2023, along with fuel substitution equipment
  - Adoption of energy-using technologies (e.g., smart devices, renewables, electric vehicles, etc.)
  - Prevalence and frequency of low- and no-cost savings behaviors
  - Knowledge, attitudes, and awareness of energy efficiency programs and services
  - Demographic and dwelling characteristics
- Treatment-specific topics
  - Awareness of receiving Reports
  - Engagement with the Reports

[8] Even if treatment customers do not actively opt out, they could passively do so by not looking at the Reports they receive.

- Satisfaction with the Reports
- Barriers to acting on tips from the Reports

The survey effort leveraged the RCT design to gather statistically unbiased insights about the HER initiative. The survey instrument began with generalized questions that can be asked of treatment and control customers without mentioning the HER initiative. The last section of the survey was only delivered to treatment customers and included treatment-specific topics.

After finalizing and programming the survey instrument, DNV tested the user experience to ensure the survey logic, response options, and on-screen appearance worked as intended and checked for errors in recording responses. Then, DNV conducted a soft launch as a secondary test to ensure the fielding worked as designed. Finally, DNV carried out a full launch in batches, targeting groups that still needed to meet response goals. Respondents were promised confidentiality in responses, and that results would be reported in aggregate.

To conduct the survey, DNV issued email invitations to a sample of candidate respondents with emails. These emails and the survey were co-branded with the Energy Trust and Pacific Power logos and a contact name at Energy Trust that could vouch for the legitimacy of this study. Further, the invitation email came “from” Energy Trust via an alias email (e.g., survey@energytrust.org). Also, the study was accompanied by a landing page on Energy Trust’s website that provided additional legitimizing information. Recipients clicked on a link in the body of the invitation message that provided them direct access to the online survey. Each hyperlink was unique, allowing DNV to trace individual respondents back to the unique household in the initiative roster.

DNV employed multiple approaches to fielding the survey:

First, for all waves, DNV recruited 37,500 customers from the population of treatment and control customers with email addresses. To achieve 10% relative precision at 90% confidence, the survey effort targeted 2,101 responses across strata of interest (wave and RCT group assignment). DNV administered an incentive lottery to encourage survey completion: We offered respondents the opportunity to win one of ten $100 Amazon e-gift cards. We fielded the web survey for approximately three weeks, allowing for up to four contact attempts per customer, with one email invitation and three reminder emails to non-respondents. Due to the targeting strategy for Wave 3 customers that receive paper Reports instead of emailed Reports, we expected a lower response rate from the web survey. The results in Table 3-1 support that expectation.

The second approach attempted to correct for survey response barriers associated with web surveys: DNV selected a representative sample from the population of Wave 3 treatment and control **non-respondents**. This sample was based on customers who had received the invitation and reminder emails for the web survey but did not respond. These customers received a mail-push-to-web survey in the form of a letter with a QR code and URL to the landing page for the study. DNV offered respondents the opportunity to receive a $10 completion incentive in the form of a Tango e-gift card. DNV issued one batch of 7,362 letters and left the survey open for three weeks following delivery of the letters. DNV did not follow up with households who were sampled for this mode of survey. Table 3-1 shows the strata and response rates (RR) for both the web and mail-push-to-web surveys. We achieved a 10.7% response rate overall with parity in response rates between treatment and control customers. We exceeded the target number of completes to achieve 90-10 precision for all strata, but achieved precision for individual questions varies by the number of completed responses.

Table 3-1. Survey response rate summary

Wave	Assignment	Web			Mail			Overall
		Recruited	Responded	RR	Recruited	Responded	RR	RR
Wave 1	*Treatment*	6,500	695	10.7%	N/A	N/A	N/A	10.7%
	Control	6,500	805	12.4%	N/A	N/A	N/A	12.4%
Subtotal		**13,000**	**1,500**	**11.5%**	**N/A**	**N/A**	**N/A**	**11.5%**
Wave 2	*Treatment*	6,000	620	10.3%	N/A	N/A	N/A	10.3%
	Control	6,000	644	10.7%	N/A	N/A	N/A	10.7%
Subtotal		**12,000**	**1,264**	**10.5%**	**N/A**	**N/A**	**N/A**	**10.5%**
Wave 3	*Treatment*	6,500	462	7.1%	3,850	134	3.5%	9.2%
	Control	6,000	480	8.0%	3,512	168	4.8%	10.8%
Subtotal		**12,500**	**942**	**7.5%**	**7,362**	**302**	**4.1%**	**10.0%**
Total		**37,500**	**3,706**	**9.9%**	**7,362**	**302**	**0.8%**	**10.7%**

*Realization rate (RR)

The DNV team analyzed the survey responses. For questions we asked of both the treatment and control customers, we compared results between treatment and control groups within each wave, across all waves, and across Wave 1 and Wave 2 (the two digital waves) combined. For questions we asked only the treatment customers, we compared results between waves as well as between the two digital waves and the paper wave. The DNV team conducted a thorough exploration of these comparisons to identify statistically significant differences between respondent groups. Such differences between the treatment and control groups indicate an effect caused by the HER initiative.

4 RESULTS

4.1 Savings results

4.1.1 Unadjusted savings

Table 4-1 presents the unadjusted savings attributable to the HER initiative. Unadjusted savings is the "full" effect of the initiative. These savings come from treatment customers installing Energy Trust-rebated equipment, non-rebated equipment[9], and taking low- and no-cost actions to reduce energy usage at a higher frequency or greater depth than control customers. DNV calculated these results using the two-stage modeling approach described in the methods section. The results are based on predicted usage under observed weather conditions.

The results indicated that unadjusted electric savings per customer increased for Wave 1 over the first three treatment years. These savings estimates are significantly different from zero at 90% confidence. We did not identify this trend for unadjusted gas savings for Wave 1, which had limited savings in the first year and savings estimates that were statistically indifferent from zero in all cases. Wave 3 customers achieved the highest percent electric savings during the first treatment year among all the three waves. These customers received HERs, while Wave 1 and Wave 2 customers received eHERs.

Table 4-1. Total unadjusted savings, overall, by wave

Subpopulation	Average remaining treatment customers	Average control customer (baseline) usage	Total unadjusted savings	Margin of error (90% CI)	Per customer unadjusted savings	Savings per customer as a percent of baseline usage
kWh						
Wave 1 – TY1	146,061	11,807	5,737,743	4,640,410	39.3	0.33%
Wave 1 – TY2	137,308	11,706	5,598,137	5,040,227	40.8	0.35%
Wave 1 – TY3	123,984	12,111	8,885,007	5,572,952	71.7	0.59%
Wave 2 – TY1	37,542	11,889	1,355,731	1,590,053	36.1	0.30%
Wave 3 – TY1	26,830	11,136	1,480,462	1,054,319	55.2	0.50%
Total kWh			**23,057,081**	**17,897,961**	**53.0**	**0.45%**
kW						
Wave 1 – TY1	146,061	1.35	654	529	0.004	0.33%
Wave 1 – TY2	137,308	1.34	636	577	0.005	0.35%
Wave 1 – TY3	123,984	1.39	1,019	640	0.008	0.59%
Wave 2 – TY1	37,542	1.37	157	183	0.004	0.31%
Wave 3 – TY1	26,830	1.29	168	121	0.006	0.48%
Total kW[10]			**2,633**	**2,050**	**0.006**	**0.44%**
Therms						

[9] Non-rebated through Energy Trust's downstream programs. Measures rebated through upstream or midstream offerings are included in this category.

[10] These kW results are averaged across each treatment year. See Appendix C for more detailed kW results.

Subpopulation	Average remaining treatment customers	Average control customer (baseline) usage	Total unadjusted savings	Margin of error (90% CI)	Per customer unadjusted savings	Savings per customer as a percent of baseline usage
Wave 1 – TY1	72,337	579	27,968	123,008	0.4	0.07%
Wave 1 – TY2	68,644	622	0	149,753	0.0	0.00%
Wave 1 – TY3	62,799	652	0	161,336	0.0	0.00%
Wave 2 – TY1	16,446	637	15,436	47,782	0.9	0.15%
Wave 3 – TY1	12,447	626	4,870	35,425	0.4	0.06%
Total therms			**48,274**	**517,304**	**0.6**	**0.09%**

4.1.2 Downstream joint savings

Table 4-2 presents the downstream joint savings results attributable to the HER initiative. Joint savings is the effect of the initiative from treatment customers installing Energy Trust-rebated equipment at higher frequency or greater depth than control customers. DNV calculated these results through a tracking data analysis. These results are based on lifetime deemed savings claimed by Energy Trust.

Joint savings estimates were statistically insignificant in all cases. Despite this, electric energy joint savings for Wave 1 increased over the first three years, reaching 6.9% of total unadjusted savings by the end of the evaluation period. In comparison, electric demand and gas joint savings were less than 3% of total unadjusted savings. The higher percentage of electric joint savings compared to gas and demand joint savings is attributed to treatment customers' greater adoption of rebated solar PV measures than control customers.[11] The higher percentage of electric joint savings suggests that the HER initiative effectively encourages treatment customers to adopt solar PV. When DNV removed solar PV measures from the analysis, electric joint savings dropped to less than 0.5% of unadjusted savings.

Table 4-2. Total joint savings, overall, by wave

Subpopulation	Average remaining treatment customers	Average control customer (baseline) usage	Total joint savings	Margin of error (90% CI)	Per customer joint savings	Joint savings as a percent of unadjusted savings
kWh						
Wave 1 – TY1	146,061	11,807	29,667	215,903	0.2	0.52%
Wave 1 – TY2	137,308	11,706	409,980	509,860	3.0	7.32%
Wave 1 – TY3	123,984	12,111	613,532	1,006,686	4.9	6.91%
Wave 2 – TY1	37,542	11,889	185,519	250,390	4.9	13.68%
Wave 3 – TY1	26,830	11,136	0	193,341	0.0	0.00%
Total kWh			**1,238,699**	**2,176,179**	**4.2**	**7.90%**
kW						
Wave 1 – TY1	146,061	1.35	0.00	0.03	0.000	0.00%

[11] Energy Trust does not claim downstream kW impacts for rebated solar PV measures.

Subpopulation	Average remaining treatment customers	Average control customer (baseline) usage	Total joint savings	Margin of error (90% CI)	Per customer joint savings	Joint savings as a percent of unadjusted savings
Wave 1 – TY2	137,308	1.34	0.00	0.07	0.000	0.00%
Wave 1 – TY3	123,984	1.39	<0.01	0.09	<0.001	<0.01%
Wave 2 – TY1	37,542	1.37	0.01	0.01	<0.001	<0.01%
Wave 3 – TY1	26,830	1.29	0.01	0.01	<0.001	<0.01%
Total kW			**0.02**	**0.21**	**<0.001**	**<0.01%**
Therms						
Wave 1 – TY1	72,337	579	789	2,729	<0.1	2.82%
Wave 1 – TY2	68,644	622	0	4,176	0.0	0.00%
Wave 1 – TY3	62,799	652	0	5,725	0.0	0.00%
Wave 2 – TY1	16,446	637	0	1,089	0.0	0.00%
Wave 3 – TY1	12,447	626	0	566	0.0	0.00%
Total Therms			**789**	**14,286**	**<0.1**	**1.94%**

4.1.3 Adjusted savings

Table 4-3 presents the adjusted savings attributable to the HER initiative. DNV recommends reporting adjusted savings at the portfolio level because they exclude the downstream joint savings that Energy Trust's downstream programs already claim. These savings come from treatment customers installing non-rebated[12] equipment and taking low- and no-cost actions to reduce energy usage at a higher frequency or greater depth than control customers. DNV calculated these results by subtracting downstream joint savings from unadjusted savings. The Wave 1 savings adjustment is the largest and reflects success in promoting downstream participation.

Table 4-3. Total adjusted savings, overall, by wave

Subpopulation	Average remaining treatment customers	Average control customer (baseline) usage	Total adjusted savings	Margin of error (90% CI)	Per customer adjusted savings	Savings per customer as a percent of baseline usage
kWh						
Wave 1 – TY1	146,061	11,807	5,708,076	4,645,430	39.1	0.33%
Wave 1 – TY2	137,308	11,706	5,188,157	5,065,950	37.8	0.32%
Wave 1 – TY3	123,984	12,111	8,271,475	5,663,145	66.7	0.55%
Wave 2 – TY1	37,542	11,889	1,170,211	1,609,647	31.2	0.26%
Wave 3 – TY1	26,830	11,136	1,480,462	1,071,900	55.2	0.50%
Total kWh			**21,818,382**	**18,056,071**	**49.9**	**0.42%**

[12] Non-rebated through Energy Trust's downstream programs. Measures rebated through upstream or midstream offerings are included in this category.

Subpopulation	Average remaining treatment customers	Average control customer (baseline) usage	Total adjusted savings	Margin of error (90% CI)	Per customer adjusted savings	Savings per customer as a percent of baseline usage
kW						
Wave 1 – TY1	146,061	1.35	654	529	0.004	0.33%
Wave 1 – TY2	137,308	1.34	636	577	0.005	0.35%
Wave 1 – TY3	123,984	1.39	1,019	640	0.008	0.59%
Wave 2 – TY1	37,542	1.37	157	183	0.004	0.31%
Wave 3 – TY1	26,830	1.29	168	121	0.006	0.48%
Total kW			**2,633**	**2,050**	**0.006**	**0.44%**
Therms						
Wave 1 – TY1	72,337	579	27,178	123,039	0.4	0.06%
Wave 1 – TY2	68,644	622	0	149,811	0.0	0.00%
Wave 1 – TY3	62,799	652	0	161,437	0.0	0.00%
Wave 2 – TY1	16,446	637	15,436	47,794	0.9	0.15%
Wave 3 – TY1	12,447	626	4,870	35,429	0.4	0.06%
Total therms			**47,484**	**517,511**	**0.6**	**0.09%**

4.1.4 Savings summary

Treatment customers in the HER initiative saved 23.1 million kWh, 2.6 million watts, and 48 thousand therms over the evaluation period. Wave 1 treatment customers contributed most electric and gas savings. This wave had the most treatment customers, and those customers had received Reports for the longest time. While Wave 3 is the newest wave and has the fewest treatment customers, those customers achieved the highest savings per customer in the first year (see Table 4-1). Table 4-4 summarizes total savings attributable to the HER initiative.

Table 4-4. Savings summary, overall, by wave

Subpopulation	Total unadjusted savings	Total downstream joint savings	Total adjusted savings
kWh			
Wave 1 – TY1	5,737,743	29,667	5,708,076
Wave 1 – TY2	5,598,137	409,980	5,188,157
Wave 1 – TY3	8,885,007	613,532	8,271,475
Wave 2 – TY1	1,355,731	185,519	1,170,211
Wave 3 – TY1	1,480,462	0	1,480,462
Total kWh	**23,057,081**	**1,238,699**	**21,818,382**
kW			
Wave 1 – TY1	654	0.00	654
Wave 1 – TY2	636	0.00	636

Subpopulation	Total unadjusted savings	Total downstream joint savings	Total adjusted savings
Wave 1 – TY3	1,019	<0.01	1,019
Wave 2 – TY1	157	0.01	157
Wave 3 – TY1	168	0.01	168
Total kW	**2,633**	**0.02**	**2,633**
Therms			
Wave 1 – TY1	27,968	789	27,178
Wave 1 – TY2	0	0	0
Wave 1 – TY3	0	0	0
Wave 2 – TY1	15,436	0	15,436
Wave 3 – TY1	4,870	0	4,870
Total therms	**48,274**	**789**	**47,484**

4.1.5 Savings realization rates

Table 4-5 shows Energy Trust's quarterly savings claims for HERs and eHERs[13]. As described in Section 2.1, Energy Trust claims deemed electric energy savings from the initiative.

eHERs. Energy Trust did not claim savings for the first three months of eHERs after Wave 1 launched in October 2020. For 2021 and 2022, eHER savings claims were based on the deemed savings calculation outlined in measure approval document (MAD) 266.1, then scaled by the number of customers receiving eHERs. During those years, most customers receiving eHERs were in Wave 1, and more customers were included after Wave 2 launched in October 2022. During 2022, Bidgely completed a 15-month performance-based savings analysis for eHERs, and Energy Trust used those results to create MAD 266.2, an adjusted version of MAD 266.1. MAD 266.2 deemed much lower savings per customer than MAD 266.1. Since 2023, Energy Trust claims eHER savings based on MAD 266.2. While Energy Trust claimed eHER savings in October 2023, we do not cover that quarter for eHERs in the evaluation period.

HERs. Energy Trust created MAD 277.1 for HERs in 2022 but did not claim savings for HERs until Wave 3 launched in January 2023. When Energy Trust began claimed HER savings, they used an adjusted version of the eHER deemed savings from MAD 266.2, not the original deemed savings found in MAD 277.1. Energy Trust scales deemed savings for HERs by the number of customers receiving HERs, which is much lower than number of customers receiving eHERs.

[13] Energy Trust's tracking system provides data for claimed savings by Report type and treatment year, so DNV reports results on these terms instead of by wave.

Table 4-5. Energy Trust quarterly savings claims for HER initiative

Quarter	Total Energy Trust claimed savings (eHER)	Total Energy Trust claimed savings (HER)	Wave 1 (eHER)	Wave 2 (eHER)	Wave 3 (HER)
2020-Q4	0	0	TY1		
2021-Q1	2,974,996	0	TY1		
2021-Q2	4,321,642	0	TY1		
2021-Q3	4,151,875	0	TY1		
2021-Q4	5,338,835	0	TY2		
2022-Q1	2,852,256	0	TY2		
2022-Q2	4,063,447	0	TY2		
2022-Q3	3,617,820	0	TY2		
2022-Q4	7,167,301	0	TY3	TY1	
2023-Q1	1,046,786	241,613	TY3	TY1	TY1
2023-Q2	1,499,913	224,284	TY3	TY1	TY1
2023-Q3	1,488,583	208,235	TY3	TY1	TY1
2023-Q4		475,173			TY1
Total kWh	**38,523,454**	**1,149,305**			

Table 4-6 shows the realization rates of Energy Trust claimed kWh savings. We found an overall realization rate of 55% when comparing impact evaluation results (total adjusted savings) with Energy Trust's savings claims: 21.8 million kWh compared to 39.7 million kWh for the overall evaluation period. Energy Trust's claims for eHERs in TY1 and TY2 (based on Wave 1 customers) were based on performance-based estimates for Reports sent to Pacific Power customers in Washington state. The ratio of DNV's evaluated kWh savings to Energy Trust claimed savings was 50% and 33% for those years. For eHERs between October 2022 and September 2023, claims were reduced and the realization rate increased to 84% -- an indication of greater accuracy. HERs in TY1, also with reduced claims, had a realization rate of 129%. Energy Trust's more recent claims, that reflect the initiative's results, produced better realization rates.

Table 4-6. Evaluated total adjusted kWh savings and realization rates based on Energy Trust claimed savings

Subpopulation	Total adjusted savings[14]	Total Energy Trust claimed savings	Realization rate (adjusted / claimed)
kWh			
eHER CY20Q4 – CY21Q3	5,708,076	11,448,513	50%
eHER CY21Q4 – CY22Q3	5,188,157	15,872,358	33%
eHER CY22Q4 – CY23Q4	9,441,687	11,202,583	84%
HER CY23Q1 – CY23Q4	1,480,462	1,149,305	129%
Total kWh	**21,818,382**	**39,672,759**	**55%**

Table 4-7 shows the realization rates of Bidgely reported kWh savings. Bidgely reported similar savings to DNV's estimates for unadjusted savings**.** DNV compared unadjusted savings to Bidgely reported savings because Bidgely does not adjust reported savings for downstream joint savings[15]. Despite differences for individual wave-years that ranged from 88% to 121%, overall savings for the evaluation period had a 99% realization rate: 23.1 million kWh compared to 23.3 million kWh. Performance-based approaches to estimate behavioral savings, which Bidgely used to generate the savings estimates, are standard best practice. The wave-level differences between Bidgely's and DNV's estimated savings are likely due to minor differences in data handling and modelling approaches, such as outlier identification and adjustments, remaining household calculations, and panel versus site-level modelling approaches.

Table 4-7. Evaluated total unadjusted kWh Savings and realization rates based on Bidgely reported savings

Subpopulation	Total unadjusted savings	Total adjusted savings	Total Bidgely reported savings	Realization rate (unadjusted / reported)	Realization rate (adjusted / reported)
kWh					
Wave 1 – TY1	5,737,743	5,708,076	5,558,000	103%	103%
Wave 1 – TY2	5,598,137	5,188,157	5,240,255	107%	99%
Wave 1 – TY3	8,885,007	8,271,475	10,063,081	88%	82%
Wave 2 – TY1	1,355,731	1,170,211	1,181,301	115%	99%
Wave 3 – TY1	1,480,462	1,480,462	1,224,009	121%	121%
Total kWh	**23,057,081**	**21,818,382**	**23,266,646**	**99%**	**94%**

[14] DNV compared adjusted savings to Energy Trust claimed savings because adjusted savings are the savings DNV recommends Energy Trust claim at the portfolio level.
[15] DNV included realization rates based on adjusted savings for reference.

4.2 Remaining customers

Annual customer attrition ranges from 6% to 16%, except for the first year of Wave 1. It is typical to see attrition of up to 10% reflecting natural customer turnover. This rate of attrition is evident in the second and third years of Wave 1 and is higher than usual for the first years of Wave 2 and Wave 3. Because the initial design is set prior to the first year of the program, we expected to see attrition from the initial design counts to the counts at the end of the first year. It was surprising that Wave 1 retained 99% of treatment and control customers by the end of TY1. We would have expected this wave to experience greater attrition than our analysis indicated, suggesting that the initiative roster used for this analysis did not include the initial design roster for Wave 1.

The use of an incomplete roster has two main implications. First, the missing initial design roster would have included Wave 1 customers that moved prior to TY2 and should have been included in estimates of per customer savings and the counts used to calculate total savings. Second, the missing initial design roster prevents us from validating the sample design of the Wave 1 RCT. While we assess for balance each year based on the remaining program population, it is the initial design roster that provides the fundamental evidence of a balanced original sample.

Table 4-8 summarizes the initial and final counts of customers with open electric and gas accounts. DNV includes customers in the analysis until their account closes, a factor assumed to affect treatment and control customers equally. DNV does not remove customers who actively opt out of receiving Reports from the analysis. Customers who either actively or passively opt out are thus included in this table.

Table 4-8. Remaining customers

Wave	Treatment customers			Control customers		
	Start of treatment year	End of treatment year	Percent annual attrition	Start of treatment year	End of treatment year	Percent annual attrition
kWh						
Wave 1-TY1	146,383	145,014	0.9%	34,236	33,925	0.9%
Wave 1-TY2	144,513	130,022	10.0%	33,831	30,477	9.9%
Wave 1-TY3	128,880	118,954	7.7%	30,180	27,849	7.7%
Wave 2-TY1	39,825	35,106	11.8%	14,751	12,932	12.3%
Wave 3-TY1	29,211	24,628	15.7%	14,719	12,431	15.5%
Therms						
Wave 1-TY1	72,433	72,003	0.6%	17,126	17,025	0.6%
Wave 1-TY2	71,807	65,338	9.0%	16,996	15,516	8.7%
Wave 1-TY3	64,826	60,628	6.5%	15,386	14,351	6.7%
Wave 2-TY1	17,200	15,586	9.4%	6,338	5,698	10.1%
Wave 3-TY1	13,237	11,690	11.7%	6,651	5,911	11.1%

*We identified significantly higher shares of reported renters in Wave 3, which supports the higher annual attrition than other waves. See Appendix D for details.

4.3 RCT sample design review

Because the initiative roster provided for this analysis does not appear to reflect the initial design roster for Wave 1, DNV could not verify the randomization of the Bidgely sample design for that wave. Based on the initial counts from the initiative roster, DNV did not identify any significant differences between average treatment and

control electric energy usage over the twelve months before wave launch. We identified imbalances in the RCT over time and controlled those imbalances using the difference-in-differences approach to savings estimation.

4.4 Savings explanations

This section outlines the savings generated by the Reports and the factors that might limit their potential to produce savings. These savings are typically small compared to control group usage and can result from various low- or no-cost behaviors or durable equipment installations. As a result, providing a detailed explanation of how these savings occurred can be challenging.

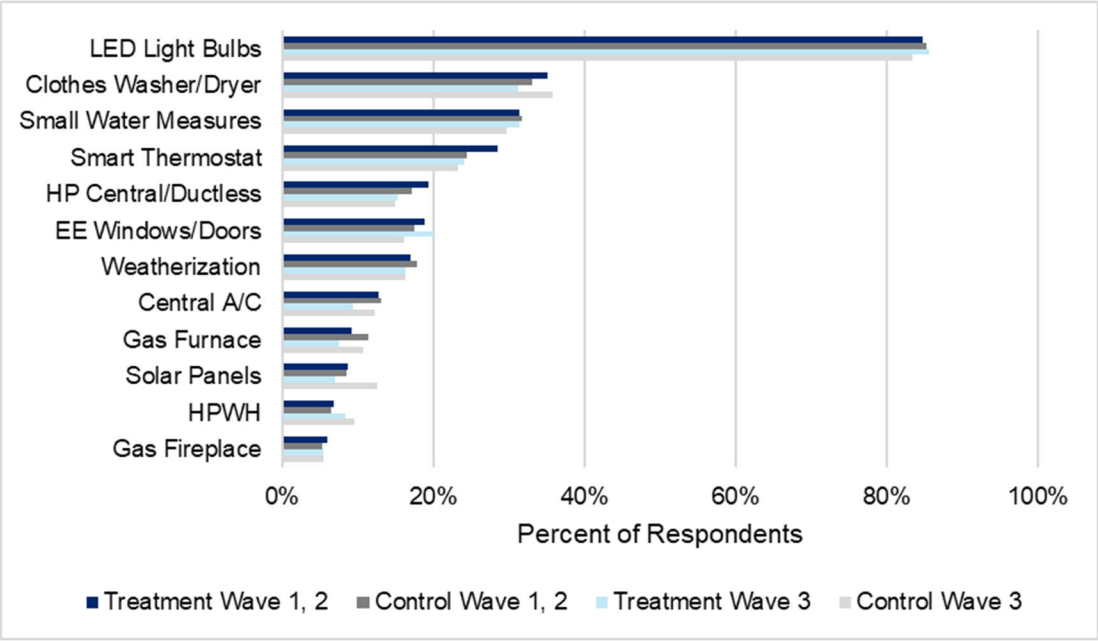
We hesitate to use self-reported survey results to establish a causal link between specific interventions and savings. Surveys leverage smaller sample sizes than the impact analysis and capture limited technical specifications and interplays between measures. For example, while two respondents may have reported upgrading an appliance, one respondent may have upgraded to a program-eligible model while the other respondent may have installed a less efficient model. This inability to establish a direct link should not diminish the strength of the HER and eHER savings.

4.4.1 Upgrades

DNV did not identify any significant differences in the type of durable improvements between treatment and control groups. We asked customers whether they installed twelve different durable measures over the last two years. As summarized in Figure 4-1, small, low-cost measures were the most frequently reported improvements, and large, more expensive equipment like HVAC and solar PV were the least frequently reported.

We calculated similar rates of self-reported, durable improvements between treatment and control groups, suggesting that the Reports are not motivating treatment customers to make durable changes that control customers are not making. However, this survey did not cover whether the treatment customers were installing more efficient versions of the improvements than the control customers were making. Initiative savings may come from those improvement decisions.

Figure 4-1. Reported durable savings improvements[16]



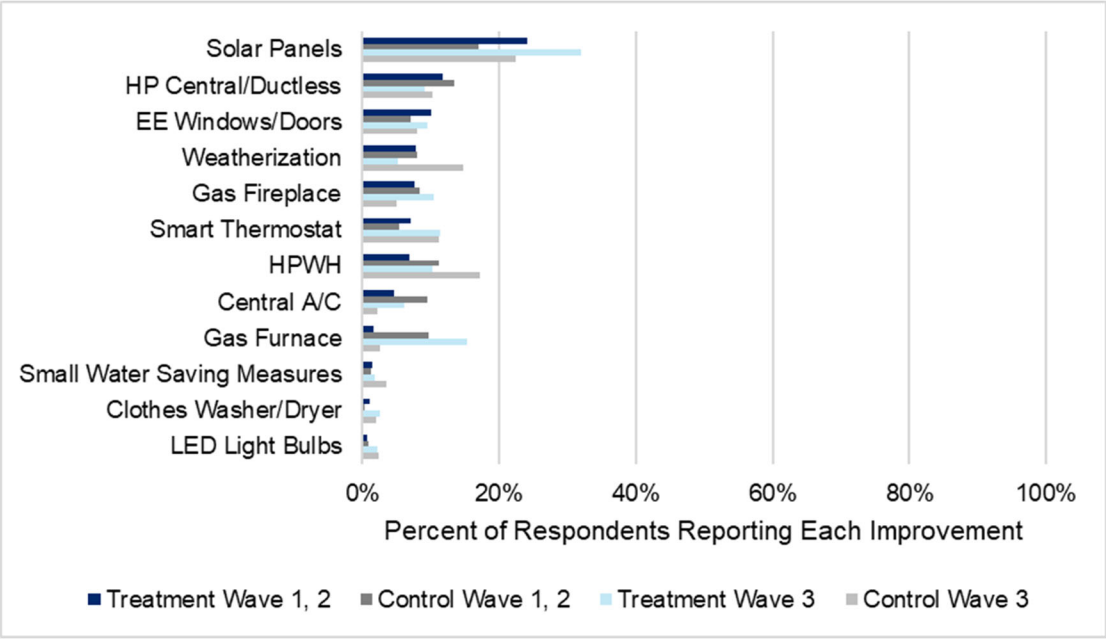
Q8: Within the past two years, which of the following upgrades have you installed?

A small proportion of savings are due to rebated durable improvements. If respondents reported they made durable improvements, we asked whether they received an Energy Trust rebate for those improvements. As summarized in Figure 4-2, the large, more expensive measures were the most commonly reported rebated improvements, while the small, no-cost measures were the least frequently reported. Higher shares of respondents reported receiving rebates for solar PV measures than other measure categories, ranging from 17% to 32% across respondent groups. These percentages reflect small sample sizes, ranging from 1 to 17 responses across various measure types and respondent groups. The limited number of respondents makes it challenging to identify significant differences between the improvements in treatment and control group rebates.

The downstream joint savings analysis, which reviews the population of rebated improvements in the treatment and control groups, identified low shares of total unadjusted savings from rebated improvements (except for solar PV). These findings suggest that non-rebated improvements comprise most savings from durable behaviors.

[16] Acronyms in this graphic: Light-emitting diode (LED); Heat pump (HP); Energy efficient (EE); Air conditioner (A/C); Heat pump water heater (HPWH).

Figure 4-2. Reported durable savings improvements, Energy Trust rebated[17]



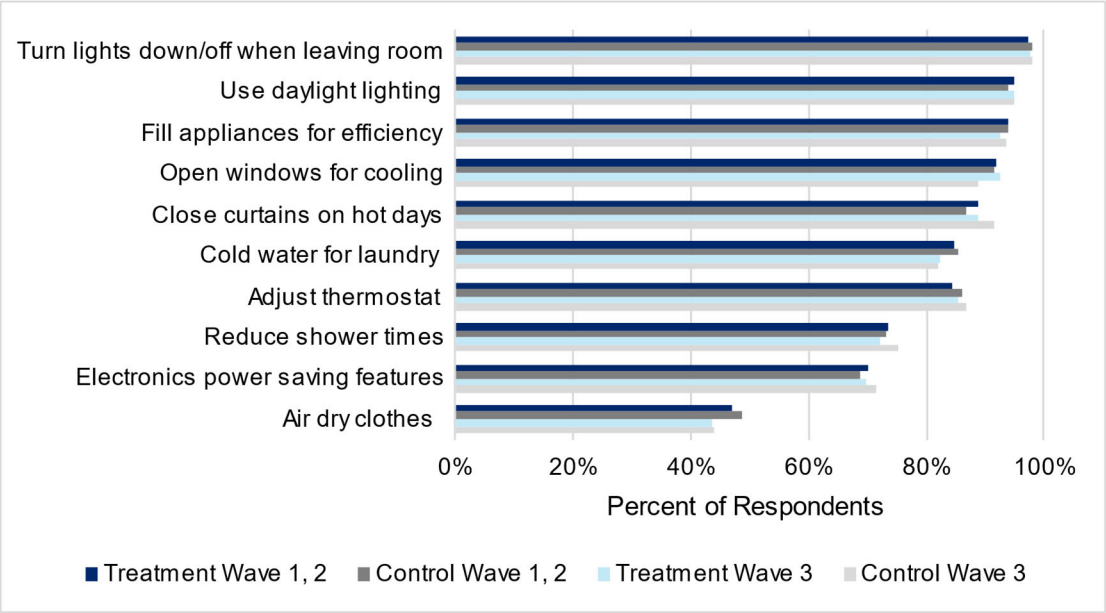
Q9: Did you get a rebate from Energy Trust for this installation?

4.4.2 Behaviors

Most HER initiative customers reported taking low- and no-cost savings actions, with no significant differences between treatment and control groups. In the web-survey, we asked customers how regularly their households take certain energy- and/or water-saving actions. If a respondent said “Always”, “Often”, or “Sometimes”, we classified them as a respondent who regularly takes that action. As summarized in Figure 4-3, lighting-related behaviors were most commonly reported. We did not identify significant differences in the frequency of these actions between treatment and control groups. As described above, surveys leverage smaller sample sizes than the impact analysis, which restricts our ability to explain the specific behaviors driving unadjusted savings. These behaviors still contribute to the savings, though at undetected rates.

[17] Acronyms in this graphic: Light-emitting diode (LED); Heat pump (HP); Energy efficient (EE); Air conditioner (A/C); Heat pump water heater (HPWH).

Figure 4-3. Reported low- and no-cost savings behaviors



Q15: Does your household regularly take any of the following energy- and/or water-saving actions?

4.5 Participant experience

This section summarizes findings on Report awareness and engagement, satisfaction, and barriers to taking action.

4.5.1 Awareness and engagement

Customers who receive paper Reports were more likely to be aware of the Reports than those who receive digital Reports. We showed respondents an image of an anonymized Report and asked whether they recall receiving these Reports in the mail or by email (Q16). Across waves, we found high levels of awareness. However, we identified a significantly higher share of Wave 3 customers (87%) who knew they were receiving Reports than Wave 2 customers (77%). We would expect high levels of awareness for the digital Reports that Bidgely sends out 24 times per year; however, surprisingly, the paper Reports that Bidgely sends out four times per year are more salient. It may be the case that paper HERs are more likely than eHERs to reach customers; however, given the differing characteristics between the waves, we are hesitant to decisively draw this conclusion.

We asked aware respondents if they recalled four Report elements, as well (Q19). They were most likely (97%-98% across waves) to recall the monthly usage summary, and least likely to recall the energy use by appliance summary (78%-85%). Compared to Wave 2 respondents, Wave 3 respondents were significantly more likely to remember seeing the comparison to similar homes (92% compared to 81%). Behavioral research suggests that the comparison to similar homes is key to motivating savings behaviors by leveraging social norms and competition. This finding suggests that Wave 3 customers may pay more attention to that messaging than Wave 2 customers.

Only one-half of customers who receive Reports engage with them. We asked aware respondents what they do with the Reports they receive (Q17). If a respondent said “Read the reports thoroughly”, “Read some of the report content”, or “Glance at the pictures or graphics”, we classified them as a respondent who is engaged.

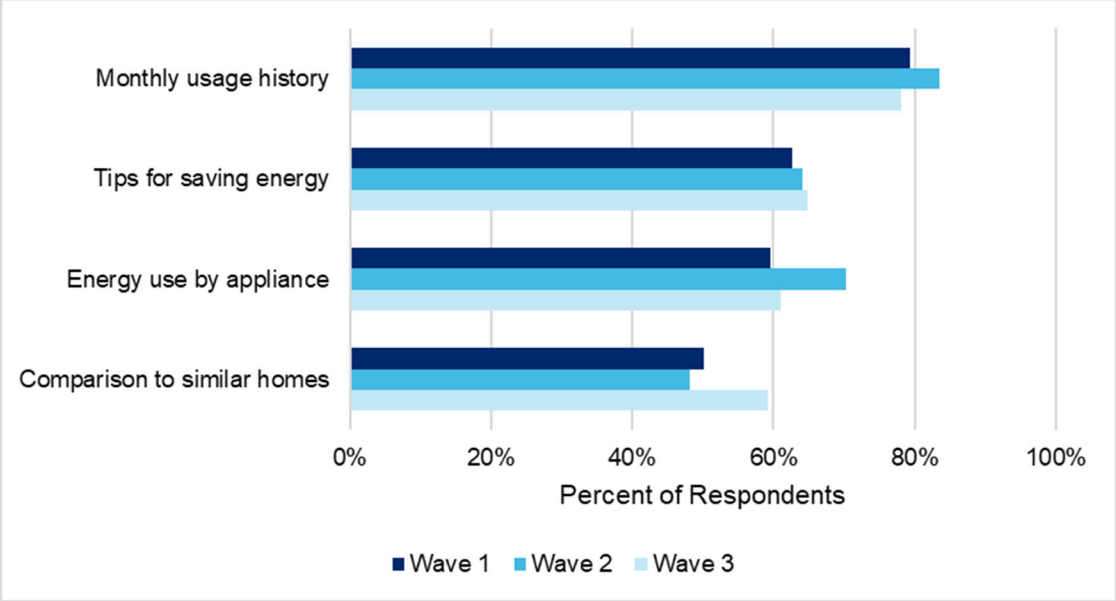
We did not identify significant differences in engagement between customers who receive digital and paper Reports. Across waves, between 78% and 84% of aware customers (53% of all treatment customers) reported reading some or all the Reports they received. This finding suggests that there is room to increase engagement with these Reports.

Paper Reports may be the preferred option for increased engagement simply because customers were more likely to be aware of receiving and engaging with them than digital Reports. However, other factors, such as respondent characteristics, may contribute to this finding.

4.5.2 Satisfaction

Customers appreciate the illustrations of their usage history but are less satisfied with comparisons to other homes. We asked aware respondents to rank satisfaction with four Report elements on a five-point scale (respondents needed to be aware of these elements to provide a satisfaction response). We defined "satisfied" as either "Very satisfied" or "Somewhat satisfied". As summarized in Figure 4-4, most respondents were satisfied with the monthly usage history summary, and the fewest respondents were satisfied with the comparison to similar homes. We did not identify any significant differences in satisfaction across waves.

Figure 4-4. Reported satisfaction with Report elements



Q20: How satisfied are you with the information presented in this section of the Reports?

We asked dissatisfied respondents to explain their concerns about each element of the Reports. DNV categorized these responses, and while they may not represent the broader program population, several recurring themes emerged. These themes indicate that improving the data behind the Reports could enhance their integrity.

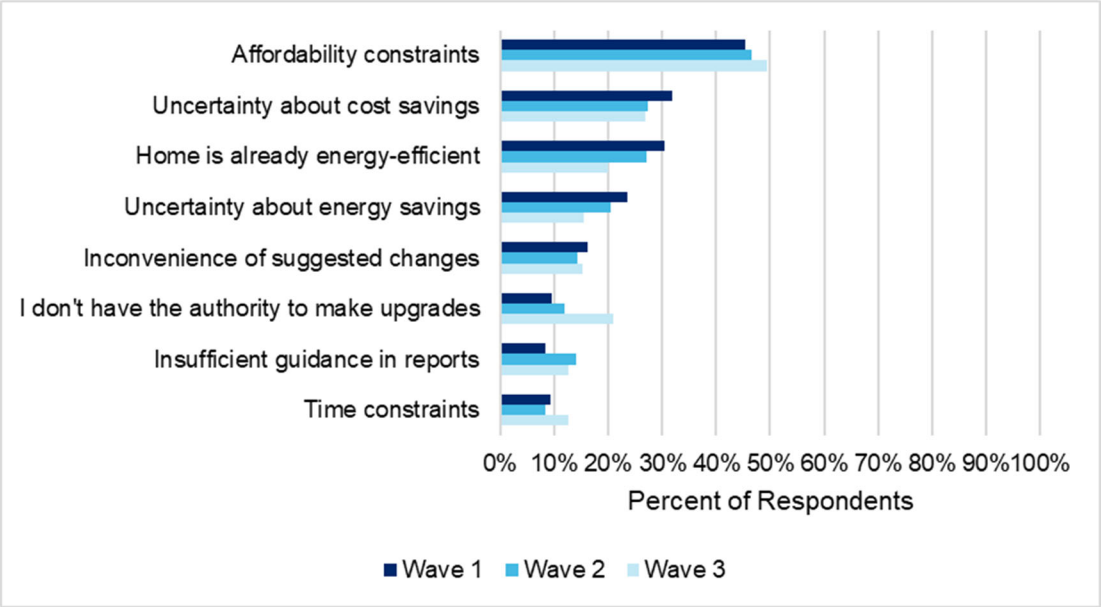
- *Energy use by appliance*. Customers were skeptical because the element includes appliances that are not in their homes ("I don't have some of the appliances named"); the element says their gas appliances use electricity ("kept saying my water heater used the most electricity when I have a gas water heater"); and the data source behind the element is unknown ("Don't see how you can break that down to the appliance level").

- *Comparison to similar homes*. Customers were skeptical because the comparison did not correctly account for home area, vintage, and type; number of members; occupancy status; and prevalence of energy-using technologies like solar, electric vehicles, pool heaters, fish tanks, or oxygen machines. The Reports do not specify the characteristics of the comparison homes.
- *Tips for saving energy*. Customers mentioned that the tips do not apply to their living situation, especially renters ("Mostly for home saving, not apartment"); they do not seem to affect the bill ("Have utilized all the tips and I do not see changes in the bill"); and do not offer new avenues for savings ("We do them all- there is no guidance that has any substance").

4.5.3 Barriers to action

Customers frequently cited cost as a barrier to acting on Report tips. We asked aware treatment respondents whether any of eight different barriers prevented them from taking actions presented in the Reports. As summarized in Figure 4-5, they most commonly confirmed that affordability constraints and uncertainty about cost savings were barriers. Roughly, one-fifth of Wave 3 respondents shared that they lacked the authority to make upgrades – a significantly higher share than in Wave 1.

Figure 4-5. Reported barriers to acting on Report tips



Q22: Have you experienced any of the following reasons for not taking the energy saving actions recommended in the Report? Please select up to three reasons.

5 CONCLUSIONS AND RECOMMENDATIONS

Treatment customers in the HER initiative saved 23.1 million kWh and 48 thousand therms over the evaluation period, including jointly motivated savings from Energy Trust's downstream programs.

The Energy Trust HER initiative has reduced energy usage across waves of different sizes, different start-up times, and different delivery vehicles. Wave 1 is almost four times the size of the subsequent waves, has been in place for three years, and delivered eHERs (not paper HERs). Waves 2 and 3 have only been in place for one year, and Wave 3 is testing paper HERs. The first-year per customer savings for all three waves are similar, though there is some indication in the electric results that the paper HERs may have motivated additional savings: Wave 3 first-year savings per customer was 55 kWh, while Wave 1 and Wave 2 ranged from 36 to 39 kWh per customer. Wave 1 electric savings have increased into the third year as expected, given that behavior programs like this initiative often generate greater per customer saving over time. Gas savings have been unexpectedly low and flat across all waves.

Over time, Energy Trust's realization rates improved due to changes in methodology.

We found an overall realization rate of 55% when comparing impact evaluation results (total adjusted savings) with Energy Trust's savings claims: 21.8 million kWh compared to 39.7 million kWh for the overall evaluation period. Energy Trust's claims for eHERs in TY1 and TY2 (based on Wave 1 customers) were based on performance-based estimates for Reports sent to Pacific Power customers in Washington state. The ratio of DNV's evaluated kWh savings to Energy Trust claimed savings was 50% and 33% for those years. For eHERs between October 2022 and September 2023, claims were reduced and the realization rate increased to 84% -- an indication of greater accuracy. HERs in TY1, also with reduced claims, had a realization rate of 129%. Energy Trust's more recent claims, that reflect the initiative's results, produced better realization rates.

DNV's estimated kWh savings are aligned with Bidgely reported savings.

Bidgely reported similar savings to DNV's estimates for unadjusted savings**.** Despite differences for individual wave-years that ranged from 88% to 121%, overall savings for the evaluation period had a 99% realization rate: 23.1 million kWh compared to 23.3 million kWh. Performance-based approaches to estimate behavioral savings, which Bidgely used to generate the savings estimates, are standard best practice. The wave-level differences between Bidgely's and DNV's estimated savings are likely due to minor differences in data handling and modelling approaches.

Recommendation

Integrate performance-based savings estimates into the claims process wherever possible. Fully performance-based savings estimates, reported after the fact, are a common and optimal approach to claiming HER savings. Unfortunately, this approach is frequently difficult to integrate into regulatory tracking and reporting structures. The difficulty of developing accurate deemed savings forecasts in advance to use as deemed HER savings estimates is the primary reason that the additional hassle of lagged or trued-up claims may be worth looking into. Alternatively, as demonstrated, now that Energy Trust can base projected savings on current and local performance-based savings estimates, the difference between deemed and performance-based is improved.

The Wave 1 joint savings adjustment is the largest and reflects success in promoting downstream participation.

Joint savings is the effect of the initiative from treatment customers installing Energy Trust-rebated equipment at higher frequency or greater depth than control customers. Using a tracking data analysis, we found that electric energy joint savings increased over the first three years for Wave 1, achieving 6.9% of total unadjusted savings by TY3. Wave 2 customers achieved the highest joint savings percentage of unadjusted electric energy savings at 13.7%.

In contrast, electric demand and gas joint savings achieved less than 3% of total unadjusted savings. These percent impacts are smaller than those from electric energy because treatment customers participated more frequently or deeply in rebated solar PV measures than control customers, for which Energy Trust does not claim electric demand impacts.

Recommendation

Continue or increase messaging that encourages rebated renewable improvements. This recommendation is beneficial because solar PV installations are contributing largely to joint savings, reflecting success in promoting downstream program participation.

Annual customer attrition ranges from 6% to 16%, except for Wave 1 TY1.

It is typical to see attrition of up to 10%, reflecting natural customer turnover. This rate of attrition is evident in TY2 and TY3 of Wave 1 and TY1 of Wave 2 and Wave 3. Because the initial design is set prior to the first year of the program, we expect to see attrition from the initial design counts to the counts at the end of the first year. It was surprising that Wave 1 retained 99% of treatment and control customers by the end of TY1. We would have expected this wave to experience greater attrition than our analysis indicated, suggesting that the initiative roster used for this analysis did not include the original design roster for Wave 1.

Recommendation

Maintain the initial design roster for each wave in the HER initiative. The initial design roster includes all treatment and control customers selected for the RCT at the time of design finalization and prior to sending the first Reports. This roster will allow future evaluations to fully account for the number of treatment customers generating savings, validate the RCT sample design, and track attrition for the full life of each wave.

It is difficult to establish a causal link between specific durable improvements or behavior changes and program savings.

When shown a list of measures supported by Energy Trust, respondents confirmed which home upgrades they had made in the past two years. We did not see a significant difference between treatment and control groups. Their responses also indicated that only a very small proportion of reported durable equipment installations received downstream Energy Trust rebates; this confirmed our findings from the joint savings analysis.

Most customers reported in the survey that they regularly take actions such as turning off lights when leaving a room. We did not see significant differences in the frequency of these reported actions between treatment and control groups.

It is a well-established reality of HER programs that while the savings estimates are as rigorously determined as any other type of program, the specific activities that lead to those savings are difficult to identify. The wide variety of activities that can lead to energy savings, the fact that customers pursue different activities, and the fact that HER and eHER savings are due to greater frequency or depth of those activities, helps explain the challenge. This inability to establish a direct link should not diminish the strength of the HER and eHER savings.

Customers who receive paper Reports were more likely to be aware of the Reports than those who receive digital Reports.

Across waves, we found high levels of awareness, with 82% of treatment customers able to confirm receiving the Reports. We identified a significantly higher share of Wave 3 customers (87%) who knew they were receiving Reports than Wave 2 customers (77%). Interestingly, Wave 3 Reports have been issued only four times and are distributed by paper only. In contrast, Wave 2 Reports are issued 24 times per year and sent digitally only. It may be the case that paper HERs are more likely than eHERs to reach customers; however, given the differing characteristics between the waves, we are hesitant to decisively draw this conclusion.

Only one-half of customers who receive Reports engage with them.

Only one-half (53%) of treatment customers read all or some of the Report content. Across waves, between 78% and 84% of customers who knew they received Reports confirmed reading some or all the Reports. This finding suggests that there is room to increase engagement with these Reports. Levels of engagement between digital and paper Reports did not significantly vary.

Customers appreciate the illustrations of their usage history but are less satisfied with comparisons to other homes.

When asked to rate their satisfaction with various elements of the Reports, customers who engage with the Reports were most likely to be satisfied with the illustration of their monthly usage history (80%) and least likely to be satisfied with the comparisons to similar homes (53%). Those who indicated that they were dissatisfied with the comparisons to similar homes often pointed to their skepticism with the accuracy or felt their home was being unfairly compared to homes under different circumstances.

Recommendation

Share more details, such as size and vintage, in the Reports about the homes that customers are being compared to.

Customers frequently cited cost as a barrier to acting on Report tips.

When asked if various factors prevented them from taking the actions recommended in the Reports, treatment customers most commonly confirmed that affordability constraints and uncertainty about cost savings were barriers. Additionally, roughly, one-fifth of Wave 3 respondents shared that they lacked the authority to make upgrades – significantly more than in Wave 1. In fact, customers – particularly renters – who were dissatisfied with the Report tips mentioned that the tips do not apply to their living situation.

Recommendation

Enhance messaging that helps customers navigate financial limitations to reducing energy usage. For Wave 3 customers, focus messaging on actions that do not require major home modifications or investments.

APPENDIX A. SAVINGS PERSISTENCE

Home Energy Report program savings are generally attached to the customer that first receives the Reports. This is consistent with their description as behavioral programs. Accordingly, we remove customers' usage data from the savings estimation analysis at the time they move. A recent paper from Johns Hopkins provided evidence that, in addition to behavioral savings, there were durable savings at customers' homes that did not necessarily stop when the customers moved. This insight points to HER savings that may exist beyond the tenure of the original customers but still may be causally connected to the HER program efforts. This analysis tested the hypothesis of this kind of savings persistence.

Premise-level savings may persist when (1) treatment group customers make durable changes to their premises that generate savings relative to control group customers, (2) those treatment group customers move out of those premises, then (3) new customers move in and continue to generate savings relative to control group customers because they inherit a premise that had been durably improved. These new customers do not need to be selected into a new RCT cohort as treatment group customers to achieve these savings. The approach to estimating these savings effectively makes the premise the participating unit and assumes that claimed savings do not require ongoing Reports.

DNV conducted an evaluability assessment using electric billing data and initiative roster. Like the gas billing data used for the core impact analysis, DNV requested electric billing data for all premises in the initiative roster from January 2019 through December 2023. Periods of this dataset represent the electricity consumption for customers in the HER initiative, while the rest of the dataset covers the electricity consumption for customers who either lived at a premise before an initiative customer, or who moved into a premise after an initiative customer. Across waves, DNV identified 470,227 unique customers (defined by unique combinations of premise ID and account ID) in the electric billing data, of which 279,390 customers from the initiative roster have data. DNV identified 278,558 unique premises in the billing data.

To leverage the RCT, a persistence analysis requires a large sample of premises where the original active customer has been replaced by a new occupant. DNV identified roughly 222,000 premises where the original customer is still in place and 55,000 premises with multiple customers during the evaluation period. While a premise has the original HER initiative customer, DNV classifies it as an "active" premise. After the next, non-initiative customer moves into that premise, DNV re-classifies it as a "mover" premise.

Figure 5-1 shows the percentage of Wave 1 active and mover premises over the evaluation period, relative to the initial active premises. Twenty percent of initial active premises had become movers by the end of the evaluation period for Wave 1 which had the longest post-period of any wave. Wave 2 and Wave 3 had only slightly lower percentages of movers, at 15% and 19%, despite a post-period that is half as long. These similar attrition levels despite different wave tenures, as well as the limited attrition demonstrated by Wave 1 in its first two years, is evidence that we did not receive the initial design roster for each wave. We discuss this finding in section 4.2. It does not affect the savings persistence analysis other than reducing the number of movers available for the analysis. As expected, percentages of movers, which is not correlated with receiving treatment, were relatively balanced between treatment and control group premises.

Figure 5-1. Premise counts, Wave 1

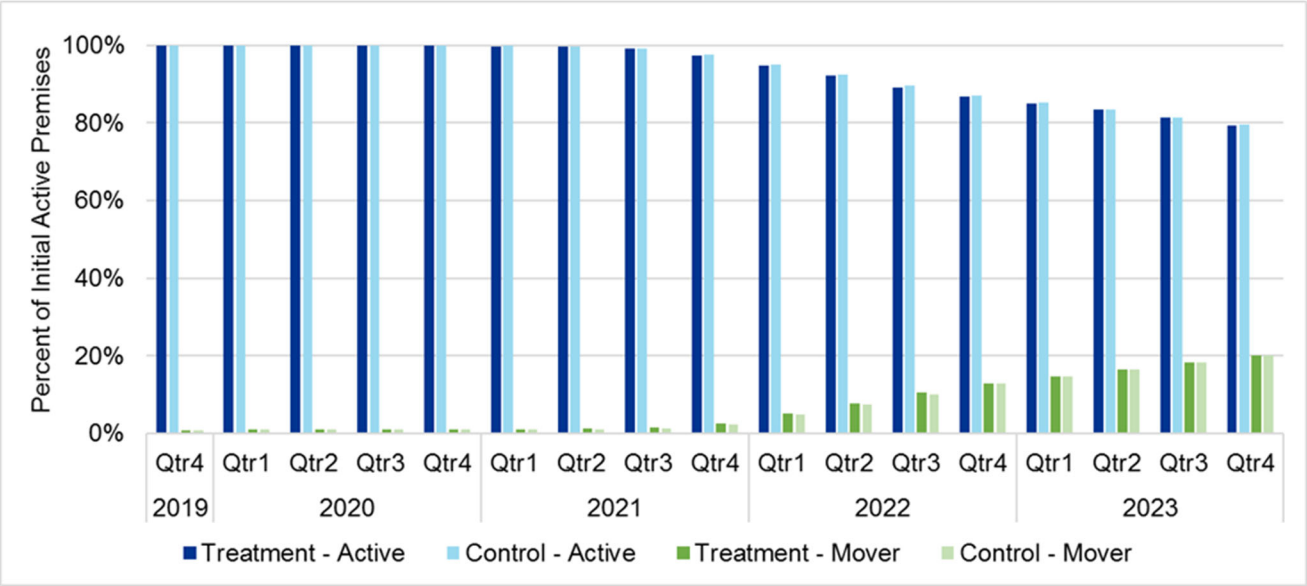


Figure 5-2 provides the average daily kWh usage for both active and mover, and treatment and control customers in Wave 1. As expected, the two lines representing the active customers are almost identical and, to the extent that they start to differentiate in the later years, the treatment customers have slightly lower consumption. This picture is consistent with a program that is generating roughly 0.5% kWh savings from the Reports. The mover consumption lines are supported by a small number of customers until late 2022. The initial divergence between the lines, due to random differences between treatment and control movers, mostly disappears once a large enough sample of movers are present. By the end of the TY3, treatment and control movers are almost identical, as expected, but there is no evidence of a slight, remaining reduction from treatment movers' usage.

Figure 5-2. Average daily kWh usage, Wave 1

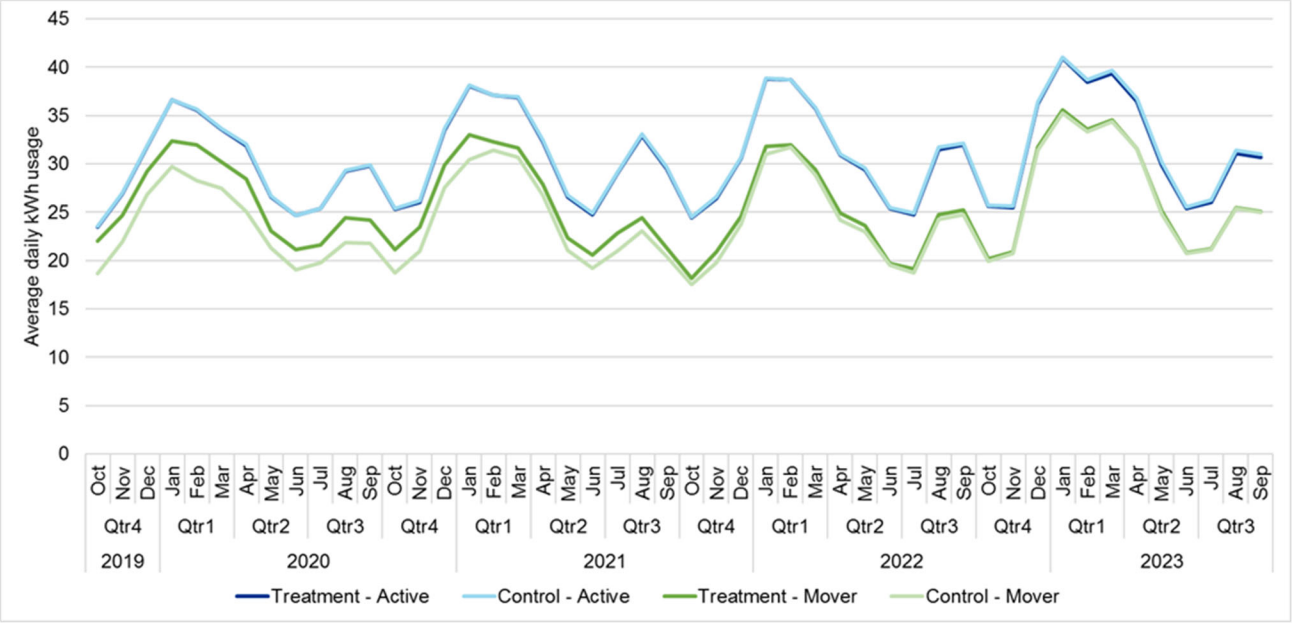
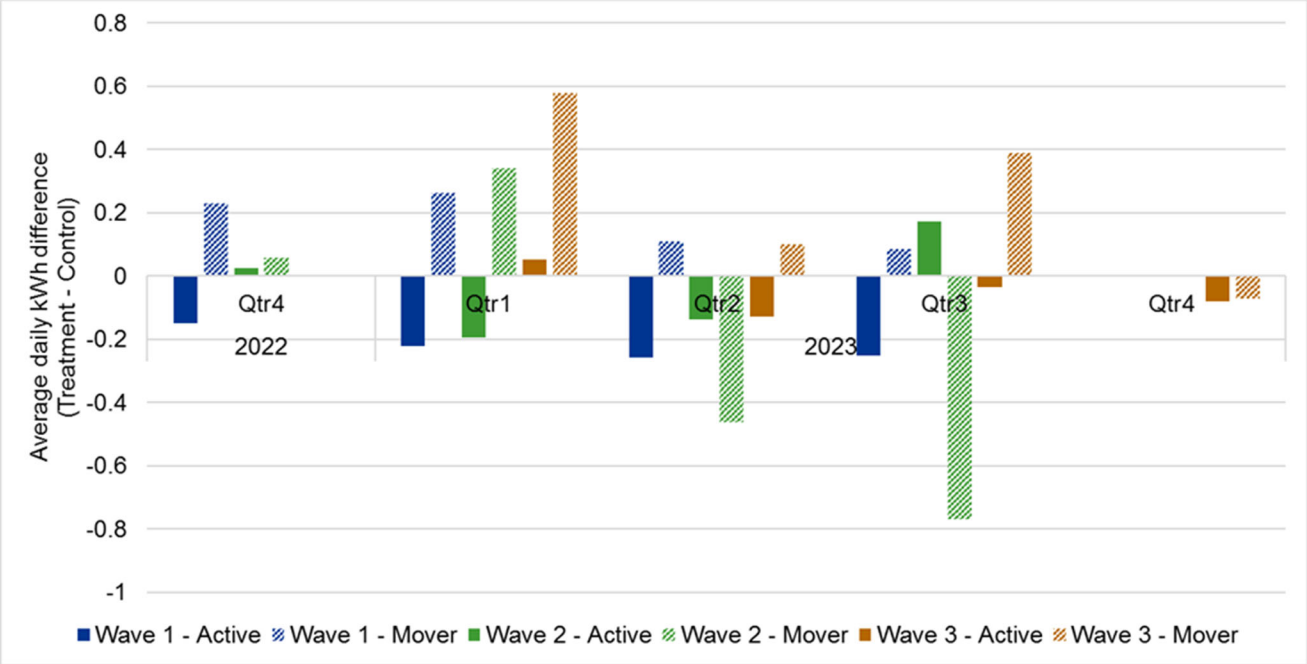


Figure 5-3 quantifies the differences between treatment and control customers' usage for both active and mover premises for all three waves for the most recent five quarters. Each wave has two bars of the same color: the first solid color bar is the active premise impact result, while the crosshatched bar of the same color is the mover premise impact result. Waves 1, 2, and 3 are blue, green, and brown, respectively. Savings are presented as a reduction in usage.

All results from Wave 1 active premises show savings, while Wave 2 and Wave 3 results vary across quarters but with an overall tendency toward savings. In contrast, the results from Wave 1 mover premises are all positive, indicating no savings correlated with the prior customer having received Reports. Both Wave 2 and Wave 3 are, again, variable.

The most likely explanation for the Wave 1 results is that the sample of treatment mover premises is randomly larger than their control mover counterparts. In Figure 5-2, we can see that early in the post-period, when the mover population is small, treatment mover premises had substantially higher usage than control mover premises. As the population of movers increases, usage begins to move to the expected similar levels, but those random differences are likely still present and appear to be more than counteracting any possible persistent savings. Wave 2 and Wave 3 mover groups are so small that the results have not yet settled down.

Figure 5-3. Average daily kWh differences, by wave



APPENDIX B. INTENT TO TREAT SAVINGS ESTIMATES

DNV estimated annual savings excluding treatment customers who actively opted-out of receiving Reports. DNV defined these customers using the opt-out dates in the initiative roster. Opt-out customers comprised fewer than one percent of total treatment customers, leading to a minimal effect on estimated savings per customer.

This analysis is more common in a randomized encouragement design (RED) context, in which customers are encouraged to opt in to receive treatment, many of whom do not. While the randomized control trial design does not face that challenge, there are likely large numbers of treatment customers who passively opt out by ignoring the Reports they receive. The unadjusted savings estimates include the effect of passively opted-out customers.

Field names in these and other tables in the appendices are abbreviated to condense information:

- "HH" shows the average remaining treatment households
- "Baseline" shows the average control group usage
- "Cust" shows the per customer unadjusted savings
- "Intent to treat adjustment factor" shows the ratio of per customer savings excluding opt-outs to that including opt-outs

Table B-1. Savings intent summary

Subgroup	HH	Baseline	Unadjusted, incl. opt outs Cust	Unadjusted, excl. opt outs Cust	Intent to treat adjustment factor
kWh					
Wave 1 - TY1	146,061	11,537	39.3	39.3	100%
Wave 1 - TY2	137,308	11,456	40.8	40.8	100%
Wave 1 - TY3	123,984	11,644	71.7	71.7	100%
Wave 2 - TY1	37,542	11,430	36.1	31.1	86%
Wave 3 - TY1	26,830	10,960	55.2	55.2	100%
Therms					
Wave 1 - TY1	72,337	612	0.4	0.4	100%
Wave 1 - TY2	68,644	620	0.0	0.0	NA
Wave 1 - TY3	62,799	621	0.0	0.0	NA
Wave 2 - TY1	16,446	607	0.9	1.0	102%
Wave 3 - TY1	12,447	626	0.4	0.4	98%*

*Adjustment factor calculations are based on more decimal places than reported in this table

APPENDIX C. SUBPOPULATION SAVINGS ESTIMATES

DNV estimated weather normalized savings for several subpopulations, time periods, and savings types. The tables in this section provide savings by subpopulation (see section 3.2.2 for definitions) and the time period (see section 3.2.3 for definitions).

We summarize findings here. An asterisk indicates an estimate that is not significantly different from zero at 90% confidence:

- Top savings conditions (therms):
  - Wave 1 low-income customers in TY1: 3.9 therms per customer* (compared to 0.3 overall)
    - Savings are from 5% of Wave 1 treatment customers in TY1.
    - 60% of savings occurred during the heating season.
  - Wave 2 non-electric heating customers in TY1: 3.7 therms per customer (compared to 0.7 overall)
    - Savings are from 86% of Wave 2 treatment customers in TY1.
    - 30% of savings occurred during the heating season.
  - Wave 2 low-income customers in TY1: 2.4 therms per customer* (compared to 0.4 overall)
    - Savings are from 6% of Wave 2 treatment customers in TY1.
    - 88% of savings occurred during the heating season.
- Top savings conditions (kWh):
  - Wave 1 low-income customers in TY3: 233 kWh per customer (compared to 68 overall)
    - Savings are from 9% of Wave 1 treatment customers in TY3.
    - 35% of savings occurred during the heating season; 33% during the cooling season.
  - Wave 1 low-income customers in TY2: 167 kWh per customer (compared to 41 overall)
    - Savings are from 8% of Wave 1 treatment customers in TY2.
    - 20% of savings occurred during the heating season; 44% during the cooling season.
  - Wave 1 electric heating customers in TY3: 149 kWh per customer (compared to 68 overall)
    - Savings are from 34% of Wave 1 treatment customers in TY3.
    - 50% of savings occurred during the heating season; 17% during the cooling season.
  - Wave 2 low-income customers in TY1: 147 kWh per customer (compared to 37 overall)
    - Savings are from 11% of Wave 2 treatment customers in TY1.
    - 63% of savings occurred during the heating season; 12% during the cooling season.
- Top savings conditions (kW)
  - Wave 1 low-income customers in TY3: 0.027 kW per customer (compared to 0.008 overall)
    - Savings are consistent across time periods, ranging from 0.026 during the cooling season and utility peak periods to 0.029 during the heating season and extreme temperature days.
  - Wave 1 low-income customers in TY2: 0.019 kW per customer (compared to 0.005 overall)
    - Savings peak during the cooling season (0.025) and are lowest during the heating season (0.012).
  - Wave 1 electric heating customers in TY3: 0.017 kW per customer (compared to 0.008 overall)
    - Savings are highest during the heating season (0.026) and lowest during the cooling season (0.009).
  - Wave 2 low-income customers in TY1: 0.017 kW per customer (compared to 0.004 overall)
    - Savings are highest during the heating season and utility peak periods (0.032) and lowest during the cooling season (0.006).

Table C-1. Subgroup kWh savings, by Report type

Subgroup	HH	Baseline	Unadjusted Cust	Unadjusted Perc	Unadjusted MOE
Annual					
Wave 1 - TY1 - Email	146,061	11,537	38.0	0.33%	0.27%
Wave 1 - TY2 - Email	137,308	11,456	40.6	0.35%	0.32%
Wave 1 - TY3 - Email	123,984	11,644	68.4	0.59%	0.38%
Wave 2 - TY1 - Email	37,542	11,430	36.6	0.32%	0.36%
Wave 3 - TY1 - Paper	26,830	10,960	51.9	0.47%	0.36%
Heating Season					
Wave 1 - TY1 - Email	146,061	4,704	12.6	0.27%	0.38%
Wave 1 - TY2 - Email	137,308	4,623	17.9	0.39%	0.40%
Wave 1 - TY3 - Email	123,984	4,761	25.1	0.53%	0.47%
Wave 2 - TY1 - Email	37,542	4,711	6.1	0.13%	0.50%
Wave 3 - TY1 - Paper	26,830	4,429	12.9	0.29%	0.40%
Cooling Season					
Wave 1 - TY1 - Email	146,061	3,296	12.5	0.38%	0.34%
Wave 1 - TY2 - Email	137,308	3,304	11.1	0.33%	0.37%
Wave 1 - TY3 - Email	123,984	3,309	18.4	0.56%	0.44%
Wave 2 - TY1 - Email	37,542	3,217	17.6	0.55%	0.45%
Wave 3 - TY1 - Paper	26,830	3,162	19.2	0.61%	0.48%

Table C-2. Subgroup kWh savings, by gas service

Subgroup	HH	Baseline	Unadjusted Cust	Unadjusted Perc	Unadjusted MOE
Annual					
Wave 1 - TY1 - Has Gas	72,337	9,579	54.6	0.57%	0.40%
Wave 1 - TY2 - Has Gas	68,644	9,550	40.9	0.43%	0.47%
Wave 1 - TY3 - Has Gas	62,799	9,647	29.9	0.31%	0.56%
Wave 2 - TY1 - Has Gas	16,446	9,358	8.2	0.09%	0.58%
Wave 3 - TY1 - Has Gas	12,447	9,685	-	0.00%	0.56%
Wave 1 - TY1 - No Gas	73,725	13,542	20.3	0.15%	0.37%
Wave 1 - TY2 - No Gas	68,664	13,485	43.9	0.33%	0.43%
Wave 1 - TY3 - No Gas	61,185	13,832	114.8	0.83%	0.51%
Wave 2 - TY1 - No Gas	21,096	13,076	59.1	0.45%	0.46%
Wave 3 - TY1 - No Gas	14,382	12,132	103.2	0.85%	0.47%
Heating Season					
Wave 1 - TY1 - Has Gas	72,337	3,541	13.1	0.37%	0.59%
Wave 1 - TY2 - Has Gas	68,644	3,487	23.7	0.68%	0.63%
Wave 1 - TY3 - Has Gas	62,799	3,552	8.2	0.23%	0.73%

Subgroup	HH	Baseline	Unadjusted Cust	Unadjusted Perc	Unadjusted MOE
Wave 2 - TY1 - Has Gas	16,446	3,408	-	0.00%	0.85%
Wave 3 - TY1 - Has Gas	12,447	3,482	-	0.00%	0.67%
Wave 1 - TY1 - No Gas	73,725	5,894	11.4	0.19%	0.49%
Wave 1 - TY2 - No Gas	68,664	5,834	13.4	0.23%	0.53%
Wave 1 - TY3 - No Gas	61,185	6,085	46.9	0.77%	0.60%
Wave 2 - TY1 - No Gas	21,096	5,747	16.1	0.28%	0.61%
Wave 3 - TY1 - No Gas	14,382	5,299	37.2	0.70%	0.50%
Cooling Season					
Wave 1 - TY1 - Has Gas	72,337	3,153	17.9	0.57%	0.46%
Wave 1 - TY2 - Has Gas	68,644	3,178	-	0.00%	0.51%
Wave 1 - TY3 - Has Gas	62,799	3,174	6.4	0.20%	0.59%
Wave 2 - TY1 - Has Gas	16,446	3,138	14.7	0.47%	0.66%
Wave 3 - TY1 - Has Gas	12,447	3,289	15.0	0.46%	0.66%
Wave 1 - TY1 - No Gas	73,725	3,442	7.4	0.21%	0.49%
Wave 1 - TY2 - No Gas	68,664	3,438	24.4	0.71%	0.54%
Wave 1 - TY3 - No Gas	61,185	3,458	31.9	0.92%	0.66%
Wave 2 - TY1 - No Gas	21,096	3,279	20.2	0.61%	0.62%
Wave 3 - TY1 - No Gas	14,382	3,046	23.1	0.76%	0.70%

Table C-3. Subgroup kWh savings, by inferred heating type

Subgroup	HH	Baseline	Unadjusted Cust	Unadjusted Perc	Unadjusted MOE
Annual					
Wave 1 - TY1 - Electric	43,025	12,930	61.6	0.48%	0.46%
Wave 1 - TY2 - Electric	39,902	12,843	69.6	0.54%	0.52%
Wave 1 - TY3 - Electric	35,368	13,174	148.6	1.13%	0.61%
Wave 2 - TY1 - Electric	10,492	12,607	66.6	0.53%	0.56%
Wave 3 - TY1 - Electric	8,236	12,008	118.7	0.99%	0.55%
Wave 1 - TY1 - Other	80,841	10,814	24.1	0.22%	0.34%
Wave 1 - TY2 - Other	76,573	10,716	24.8	0.23%	0.40%
Wave 1 - TY3 - Other	69,793	10,837	26.2	0.24%	0.48%
Wave 2 - TY1 - Other	20,559	10,701	19.2	0.18%	0.47%
Wave 3 - TY1 - Other	15,452	10,336	14.9	0.14%	0.47%
Heating Season					
Wave 1 - TY1 - Electric	43,025	5,919	18.0	0.30%	0.59%
Wave 1 - TY2 - Electric	39,902	5,802	35.9	0.62%	0.62%
Wave 1 - TY3 - Electric	35,368	6,032	73.9	1.23%	0.71%
Wave 2 - TY1 - Electric	10,492	5,802	35.9	0.62%	0.74%

Subgroup	HH	Baseline	Unadjusted		
			Cust	Perc	MOE
Wave 3 - TY1 - Electric	8,236	5,526	32.7	0.59%	0.59%
Wave 1 - TY1 - Other	80,841	4,073	7.2	0.18%	0.48%
Wave 1 - TY2 - Other	76,573	3,995	6.0	0.15%	0.52%
Wave 1 - TY3 - Other	69,793	4,090	-	0.00%	0.61%
Wave 2 - TY1 - Other	20,559	4,036	-	0.00%	0.66%
Wave 3 - TY1 - Other	15,452	3,775	-	0.00%	0.54%
Cooling Season					
Wave 1 - TY1 - Electric	43,025	3,117	21.6	0.69%	0.62%
Wave 1 - TY2 - Electric	39,902	3,119	8.7	0.28%	0.66%
Wave 1 - TY3 - Electric	35,368	3,153	26.2	0.83%	0.79%
Wave 2 - TY1 - Electric	10,492	3,021	14.1	0.47%	0.74%
Wave 3 - TY1 - Electric	8,236	2,811	34.5	1.23%	0.85%
Wave 1 - TY1 - Other	80,841	3,389	8.4	0.25%	0.41%
Wave 1 - TY2 - Other	76,573	3,403	13.2	0.39%	0.45%
Wave 1 - TY3 - Other	69,793	3,392	14.6	0.43%	0.53%
Wave 2 - TY1 - Other	20,559	3,338	19.4	0.58%	0.57%
Wave 3 - TY1 - Other	15,452	3,371	11.7	0.35%	0.58%

Table C-4. Subgroup kWh savings, by rate group

Subgroup	HH	Baseline	Unadjusted		
			Cust	Perc	MOE
Annual					
Wave 1 - TY1 - LI	11,416	12,359	122.3	0.99%	0.96%
Wave 1 - TY2 - LI	11,414	12,462	167.2	1.34%	1.08%
Wave 1 - TY3 - LI	11,072	12,682	233.4	1.84%	1.26%
Wave 2 - TY1 - LI	4,053	12,367	147.3	1.19%	1.06%
Wave 3 - TY1 - LI	3,359	12,147	84.8	0.70%	0.99%
Wave 1 - TY1 - Not LI	134,645	11,456	29.6	0.26%	0.29%
Wave 1 - TY2 - Not LI	125,893	11,356	27.5	0.24%	0.33%
Wave 1 - TY3 - Not LI	112,912	11,540	51.0	0.44%	0.39%
Wave 2 - TY1 - Not LI	33,489	11,308	21.7	0.19%	0.38%
Wave 3 - TY1 - Not LI	23,471	10,777	46.5	0.43%	0.39%
Heating Season					
Wave 1 - TY1 - LI	11,416	5,124	32.9	0.64%	1.29%
Wave 1 - TY2 - LI	11,414	5,137	34.4	0.67%	1.32%
Wave 1 - TY3 - LI	11,072	5,331	82.3	1.54%	1.55%
Wave 2 - TY1 - LI	4,053	5,295	92.3	1.74%	1.43%
Wave 3 - TY1 - LI	3,359	5,095	19.5	0.38%	1.07%

Subgroup	HH	Baseline	Unadjusted		
			Cust	Perc	MOE
Wave 1 - TY1 - Not LI	134,645	4,662	10.6	0.23%	0.40%
Wave 1 - TY2 - Not LI	125,893	4,573	16.1	0.35%	0.42%
Wave 1 - TY3 - Not LI	112,912	4,703	19.1	0.41%	0.49%
Wave 2 - TY1 - Not LI	33,489	4,635	-	0.00%	0.53%
Wave 3 - TY1 - Not LI	23,471	4,326	11.9	0.27%	0.43%
Cooling Season					
Wave 1 - TY1 - LI	11,416	3,416	41.7	1.22%	1.25%
Wave 1 - TY2 - LI	11,414	3,456	72.6	2.10%	1.30%
Wave 1 - TY3 - LI	11,072	3,437	75.9	2.21%	1.54%
Wave 2 - TY1 - LI	4,053	3,248	17.2	0.53%	1.49%
Wave 3 - TY1 - LI	3,359	3,271	33.6	1.03%	1.45%
Wave 1 - TY1 - Not LI	134,645	3,284	9.5	0.29%	0.35%
Wave 1 - TY2 - Not LI	125,893	3,289	4.7	0.14%	0.39%
Wave 1 - TY3 - Not LI	112,912	3,296	12.4	0.38%	0.46%
Wave 2 - TY1 - Not LI	33,489	3,213	17.5	0.55%	0.48%
Wave 3 - TY1 - Not LI	23,471	3,146	17.0	0.54%	0.51%

Table C-5. Subgroup therm savings, by Report type

Subgroup	HH	Baseline	Unadjusted		
			Cust	Perc	MOE
Annual					
Wave 1 - TY1 - Email	72,337	612	0.3	0.06%	0.28%
Wave 1 - TY2 - Email	68,644	620	-	0.00%	0.36%
Wave 1 - TY3 - Email	62,799	621	-	0.00%	0.41%
Wave 2 - TY1 - Email	16,446	607	0.7	0.12%	0.49%
Wave 3 - TY1 - Paper	12,447	626	0.4	0.06%	0.47%
Heating Season					
Wave 1 - TY1 - Email	72,337	352	-	0.00%	0.30%
Wave 1 - TY2 - Email	68,644	353	-	0.00%	0.37%
Wave 1 - TY3 - Email	62,799	350	-	0.00%	0.42%
Wave 2 - TY1 - Email	16,446	343	-	0.00%	0.52%
Wave 3 - TY1 - Paper	12,447	368	0.3	0.09%	0.47%

Table C-6. Subgroup therm savings, by inferred heating type

Subgroup	HH	Baseline	Unadjusted		
			Cust	Perc	MOE
Annual					

Subgroup	HH	Baseline	Unadjusted		
			Cust	Perc	MOE
Wave 1 - TY1 - Electric	9,574	521	-	0.00%	0.96%
Wave 1 - TY2 - Electric	9,035	527	-	0.00%	1.21%
Wave 1 - TY3 - Electric	8,234	524	-	0.00%	1.31%
Wave 2 - TY1 - Electric	1,929	497	-	0.00%	1.68%
Wave 3 - TY1 - Electric	1,652	475	-	0.00%	1.84%
Wave 1 - TY1 - Other	51,000	634	0.2	0.04%	0.30%
Wave 1 - TY2 - Other	48,453	640	-	0.00%	0.40%
Wave 1 - TY3 - Other	44,349	642	-	0.00%	0.46%
Wave 2 - TY1 - Other	11,629	630	3.7	0.58%	0.54%
Wave 3 - TY1 - Other	9,325	654	1.3	0.20%	0.48%
Heating Season					
Wave 1 - TY1 - Electric	9,574	292	-	0.00%	1.08%
Wave 1 - TY2 - Electric	9,035	293	-	0.00%	1.30%
Wave 1 - TY3 - Electric	8,234	289	-	0.00%	1.40%
Wave 2 - TY1 - Electric	1,929	277	-	0.00%	1.82%
Wave 3 - TY1 - Electric	1,652	269	-	0.00%	1.93%
Wave 1 - TY1 - Other	51,000	367	-	0.00%	0.33%
Wave 1 - TY2 - Other	48,453	367	-	0.00%	0.41%
Wave 1 - TY3 - Other	44,349	364	-	0.00%	0.46%
Wave 2 - TY1 - Other	11,629	357	1.1	0.29%	0.57%
Wave 3 - TY1 - Other	9,325	387	0.1	0.03%	0.49%

Table C-7. Subgroup therm savings, by rate group

Subgroup	HH	Baseline	Unadjusted		
			Cust	Perc	MOE
Annual					
Wave 1 - TY1 - LI	3,460	540	3.9	0.72%	1.62%
Wave 1 - TY2 - LI	3,460	539	-	0.00%	1.93%
Wave 1 - TY3 - LI	3,367	543	-	0.00%	2.06%
Wave 2 - TY1 - LI	1,047	532	2.4	0.45%	2.43%
Wave 3 - TY1 - LI	941	543	-	0.00%	2.11%
Wave 1 - TY1 - Not LI	68,877	616	0.2	0.03%	0.28%
Wave 1 - TY2 - Not LI	65,185	624	-	0.00%	0.37%
Wave 1 - TY3 - Not LI	59,433	625	-	0.00%	0.42%
Wave 2 - TY1 - Not LI	15,399	612	0.6	0.10%	0.50%
Wave 3 - TY1 - Not LI	11,506	633	0.6	0.09%	0.48%
Heating Season					
Wave 1 - TY1 - LI	3,460	308	2.4	0.77%	1.83%

Subgroup	HH	Baseline	Unadjusted		
			Cust	Perc	MOE
Wave 1 - TY2 - LI	3,460	305	-	0.00%	2.08%
Wave 1 - TY3 - LI	3,367	302	-	0.00%	2.15%
Wave 2 - TY1 - LI	1,047	299	2.1	0.70%	2.66%
Wave 3 - TY1 - LI	941	314	0.9	0.28%	2.13%
Wave 1 - TY1 - Not LI	68,877	354	-	0.00%	0.30%
Wave 1 - TY2 - Not LI	65,185	356	-	0.00%	0.38%
Wave 1 - TY3 - Not LI	59,433	353	-	0.00%	0.43%
Wave 2 - TY1 - Not LI	15,399	346	-	0.00%	0.53%
Wave 3 - TY1 - Not LI	11,506	372	0.3	0.08%	0.48%

Table C-8. Subgroup kW savings, by Report type

Subgroup	HH	Baseline	Unadjusted		
			Cust	Perc	MOE
Annual					
Wave 1 - TY1 - Email	146,061	1.32	<0.01	0.33%	0.27%
Wave 1 - TY2 - Email	137,308	1.31	<0.01	0.35%	0.32%
Wave 1 - TY3 - Email	123,984	1.33	0.01	0.59%	0.38%
Wave 2 - TY1 - Email	37,542	1.30	<0.01	0.32%	0.36%
Wave 3 - TY1 - Paper	26,830	1.25	0.01	0.47%	0.36%
Heating Season					
Wave 1 - TY1 - Email	146,061	1.63	<0.01	0.27%	0.38%
Wave 1 - TY2 - Email	137,308	1.60	0.01	0.39%	0.40%
Wave 1 - TY3 - Email	123,984	1.65	0.01	0.53%	0.47%
Wave 2 - TY1 - Email	37,542	1.64	<0.01	0.13%	0.50%
Wave 3 - TY1 - Paper	26,830	1.54	<0.01	0.29%	0.40%
Cooling Season					
Wave 1 - TY1 - Email	146,061	1.13	<0.01	0.38%	0.34%
Wave 1 - TY2 - Email	137,308	1.13	<0.01	0.33%	0.37%
Wave 1 - TY3 - Email	123,984	1.13	0.01	0.56%	0.44%
Wave 2 - TY1 - Email	37,542	1.10	0.01	0.55%	0.45%
Wave 3 - TY1 - Paper	26,830	1.08	0.01	0.61%	0.48%
Extreme Temp Days					
Wave 1 - TY1 - Email	146,061	1.52	<0.01	0.33%	0.28%
Wave 1 - TY2 - Email	137,308	1.51	<0.01	0.32%	0.32%
Wave 1 - TY3 - Email	123,984	1.53	0.01	0.49%	0.38%
Wave 2 - TY1 - Email	37,542	1.49	<0.01	0.26%	0.37%
Wave 3 - TY1 - Paper	26,830	1.43	0.01	0.39%	0.35%
Utility Peak Period					

Subgroup	HH	Baseline	Unadjusted		
			Cust	Perc	MOE
Wave 1 - TY1 - Email	146,061	1.78	<0.01	0.18%	0.28%
Wave 1 - TY2 - Email	137,308	1.76	<0.01	0.27%	0.32%
Wave 1 - TY3 - Email	123,984	1.78	0.01	0.37%	0.38%
Wave 2 - TY1 - Email	37,542	1.78	0.01	0.30%	0.37%
Wave 3 - TY1 - Paper	26,830	1.67	<0.01	0.27%	0.35%

Table C-9. Subgroup kW savings, by gas service

Subgroup	HH	Baseline	Unadjusted		
			Cust	Perc	MOE
Annual					
Wave 1 - TY1 - Has Gas	72,337	1.09	0.01	0.57%	0.40%
Wave 1 - TY2 - Has Gas	68,644	1.09	<0.01	0.43%	0.47%
Wave 1 - TY3 - Has Gas	62,799	1.10	<0.01	0.31%	0.56%
Wave 2 - TY1 - Has Gas	16,446	1.07	<0.01	0.09%	0.58%
Wave 3 - TY1 - Has Gas	12,447	1.11	-	0.00%	0.56%
Wave 1 - TY1 - No Gas	73,725	1.55	<0.01	0.15%	0.37%
Wave 1 - TY2 - No Gas	68,664	1.54	0.01	0.33%	0.43%
Wave 1 - TY3 - No Gas	61,185	1.58	0.01	0.83%	0.51%
Wave 2 - TY1 - No Gas	21,096	1.49	0.01	0.45%	0.46%
Wave 3 - TY1 - No Gas	14,382	1.38	0.01	0.85%	0.47%
Heating Season					
Wave 1 - TY1 - Has Gas	72,337	1.23	<0.01	0.37%	0.59%
Wave 1 - TY2 - Has Gas	68,644	1.21	0.01	0.68%	0.63%
Wave 1 - TY3 - Has Gas	62,799	1.23	<0.01	0.23%	0.73%
Wave 2 - TY1 - Has Gas	16,446	1.18	-	0.00%	0.85%
Wave 3 - TY1 - Has Gas	12,447	1.21	-	0.00%	0.67%
Wave 1 - TY1 - No Gas	73,725	2.05	<0.01	0.19%	0.49%
Wave 1 - TY2 - No Gas	68,664	2.02	<0.01	0.23%	0.53%
Wave 1 - TY3 - No Gas	61,185	2.11	0.02	0.77%	0.60%
Wave 2 - TY1 - No Gas	21,096	1.99	0.01	0.28%	0.61%
Wave 3 - TY1 - No Gas	14,382	1.84	0.01	0.70%	0.50%
Cooling Season					
Wave 1 - TY1 - Has Gas	72,337	1.08	0.01	0.57%	0.46%
Wave 1 - TY2 - Has Gas	68,644	1.09	-	0.00%	0.51%
Wave 1 - TY3 - Has Gas	62,799	1.08	<0.01	0.20%	0.59%
Wave 2 - TY1 - Has Gas	16,446	1.07	0.01	0.47%	0.66%
Wave 3 - TY1 - Has Gas	12,447	1.12	0.01	0.46%	0.66%
Wave 1 - TY1 - No Gas	73,725	1.18	<0.01	0.21%	0.49%

Subgroup	HH	Baseline	Unadjusted		
			Cust	Perc	MOE
Wave 1 - TY2 - No Gas	68,664	1.17	0.01	0.71%	0.54%
Wave 1 - TY3 - No Gas	61,185	1.18	0.01	0.92%	0.66%
Wave 2 - TY1 - No Gas	21,096	1.12	0.01	0.61%	0.62%
Wave 3 - TY1 - No Gas	14,382	1.04	0.01	0.76%	0.70%
Extreme Temp Days					
Wave 1 - TY1 - Has Gas	72,337	1.32	0.01	0.51%	0.41%
Wave 1 - TY2 - Has Gas	68,644	1.31	<0.01	0.27%	0.47%
Wave 1 - TY3 - Has Gas	62,799	1.32	<0.01	0.20%	0.55%
Wave 2 - TY1 - Has Gas	16,446	1.27	<0.01	0.07%	0.58%
Wave 3 - TY1 - Has Gas	12,447	1.31	<0.01	0.19%	0.54%
Wave 1 - TY1 - No Gas	73,725	1.73	<0.01	0.19%	0.38%
Wave 1 - TY2 - No Gas	68,664	1.71	0.01	0.39%	0.44%
Wave 1 - TY3 - No Gas	61,185	1.76	0.01	0.76%	0.52%
Wave 2 - TY1 - No Gas	21,096	1.66	0.01	0.38%	0.48%
Wave 3 - TY1 - No Gas	14,382	1.55	0.01	0.55%	0.46%
Utility Peak Period					
Wave 1 - TY1 - Has Gas	72,337	1.51	<0.01	0.27%	0.40%
Wave 1 - TY2 - Has Gas	68,644	1.50	<0.01	0.21%	0.45%
Wave 1 - TY3 - Has Gas	62,799	1.51	<0.01	0.05%	0.54%
Wave 2 - TY1 - Has Gas	16,446	1.49	-	0.00%	0.56%
Wave 3 - TY1 - Has Gas	12,447	1.52	<0.01	0.05%	0.53%
Wave 1 - TY1 - No Gas	73,725	2.05	<0.01	0.09%	0.39%
Wave 1 - TY2 - No Gas	68,664	2.03	0.01	0.33%	0.44%
Wave 1 - TY3 - No Gas	61,185	2.09	0.01	0.64%	0.52%
Wave 2 - TY1 - No Gas	21,096	2.00	0.01	0.51%	0.48%
Wave 3 - TY1 - No Gas	14,382	1.81	0.01	0.44%	0.46%

Table C-10. Subgroup kW savings, by inferred heating type

Subgroup	HH	Baseline	Unadjusted		
			Cust	Perc	MOE
Annual					
Wave 1 - TY1 - Electric	43,025	1.48	0.01	0.48%	0.46%
Wave 1 - TY2 - Electric	39,902	1.47	0.01	0.54%	0.52%
Wave 1 - TY3 - Electric	35,368	1.50	0.02	1.13%	0.61%
Wave 2 - TY1 - Electric	10,492	1.44	0.01	0.53%	0.56%
Wave 3 - TY1 - Electric	8,236	1.37	0.01	0.99%	0.55%
Wave 1 - TY1 - Other	80,841	1.23	<0.01	0.22%	0.34%
Wave 1 - TY2 - Other	76,573	1.22	<0.01	0.23%	0.40%

Subgroup	HH	Baseline	Unadjusted Cust	Unadjusted Perc	Unadjusted MOE
Wave 1 - TY3 - Other	69,793	1.24	<0.01	0.24%	0.48%
Wave 2 - TY1 - Other	20,559	1.22	<0.01	0.18%	0.47%
Wave 3 - TY1 - Other	15,452	1.18	<0.01	0.14%	0.47%
Heating Season					
Wave 1 - TY1 - Electric	43,025	2.05	0.01	0.30%	0.59%
Wave 1 - TY2 - Electric	39,902	2.01	0.01	0.62%	0.62%
Wave 1 - TY3 - Electric	35,368	2.09	0.03	1.23%	0.71%
Wave 2 - TY1 - Electric	10,492	2.01	0.01	0.62%	0.74%
Wave 3 - TY1 - Electric	8,236	1.92	0.01	0.59%	0.59%
Wave 1 - TY1 - Other	80,841	1.41	<0.01	0.18%	0.48%
Wave 1 - TY2 - Other	76,573	1.39	<0.01	0.15%	0.52%
Wave 1 - TY3 - Other	69,793	1.42	-	0.00%	0.61%
Wave 2 - TY1 - Other	20,559	1.40	-	0.00%	0.66%
Wave 3 - TY1 - Other	15,452	1.31	-	0.00%	0.54%
Cooling Season					
Wave 1 - TY1 - Electric	43,025	1.06	0.01	0.69%	0.62%
Wave 1 - TY2 - Electric	39,902	1.07	<0.01	0.28%	0.66%
Wave 1 - TY3 - Electric	35,368	1.08	0.01	0.83%	0.79%
Wave 2 - TY1 - Electric	10,492	1.03	<0.01	0.47%	0.74%
Wave 3 - TY1 - Electric	8,236	0.96	0.01	1.23%	0.85%
Wave 1 - TY1 - Other	80,841	1.16	<0.01	0.25%	0.41%
Wave 1 - TY2 - Other	76,573	1.16	<0.01	0.39%	0.45%
Wave 1 - TY3 - Other	69,793	1.16	<0.01	0.43%	0.53%
Wave 2 - TY1 - Other	20,559	1.14	0.01	0.58%	0.57%
Wave 3 - TY1 - Other	15,452	1.15	<0.01	0.35%	0.58%
Extreme Temp Days					
Wave 1 - TY1 - Electric	43,025	1.70	0.01	0.46%	0.47%
Wave 1 - TY2 - Electric	39,902	1.67	0.01	0.51%	0.53%
Wave 1 - TY3 - Electric	35,368	1.71	0.02	1.09%	0.61%
Wave 2 - TY1 - Electric	10,492	1.64	0.01	0.62%	0.58%
Wave 3 - TY1 - Electric	8,236	1.57	0.01	0.69%	0.55%
Wave 1 - TY1 - Other	80,841	1.43	<0.01	0.22%	0.34%
Wave 1 - TY2 - Other	76,573	1.42	<0.01	0.19%	0.40%
Wave 1 - TY3 - Other	69,793	1.43	<0.01	0.10%	0.48%
Wave 2 - TY1 - Other	20,559	1.39	<0.01	0.02%	0.48%
Wave 3 - TY1 - Other	15,452	1.36	<0.01	0.19%	0.45%
Utility Peak Period					
Wave 1 - TY1 - Electric	43,025	2.01	<0.01	0.15%	0.48%

Subgroup	HH	Baseline	Unadjusted		
			Cust	Perc	MOE
Wave 1 - TY2 - Electric	39,902	1.97	0.01	0.33%	0.53%
Wave 1 - TY3 - Electric	35,368	2.02	0.02	0.89%	0.62%
Wave 2 - TY1 - Electric	10,492	1.99	0.01	0.50%	0.59%
Wave 3 - TY1 - Electric	8,236	1.82	0.01	0.52%	0.55%
Wave 1 - TY1 - Other	80,841	1.66	<0.01	0.17%	0.34%
Wave 1 - TY2 - Other	76,573	1.64	<0.01	0.22%	0.40%
Wave 1 - TY3 - Other	69,793	1.66	<0.01	0.02%	0.47%
Wave 2 - TY1 - Other	20,559	1.64	<0.01	0.18%	0.47%
Wave 3 - TY1 - Other	15,452	1.58	<0.01	0.10%	0.45%

Table C-11. Subgroup kW savings, by rate group

Subgroup	HH	Baseline	Unadjusted		
			Cust	Perc	MOE
Annual					
Wave 1 - TY1 - LI	11,416	1.41	0.01	0.99%	0.96%
Wave 1 - TY2 - LI	11,414	1.42	0.02	1.34%	1.08%
Wave 1 - TY3 - LI	11,072	1.45	0.03	1.84%	1.26%
Wave 2 - TY1 - LI	4,053	1.41	0.02	1.19%	1.06%
Wave 3 - TY1 - LI	3,359	1.39	0.01	0.70%	0.99%
Wave 1 - TY1 - Not LI	134,645	1.31	<0.01	0.26%	0.29%
Wave 1 - TY2 - Not LI	125,893	1.30	<0.01	0.24%	0.33%
Wave 1 - TY3 - Not LI	112,912	1.32	0.01	0.44%	0.39%
Wave 2 - TY1 - Not LI	33,489	1.29	<0.01	0.19%	0.38%
Wave 3 - TY1 - Not LI	23,471	1.23	0.01	0.43%	0.39%
Heating Season					
Wave 1 - TY1 - LI	11,416	1.78	0.01	0.64%	1.29%
Wave 1 - TY2 - LI	11,414	1.78	0.01	0.67%	1.32%
Wave 1 - TY3 - LI	11,072	1.85	0.03	1.54%	1.55%
Wave 2 - TY1 - LI	4,053	1.84	0.03	1.74%	1.43%
Wave 3 - TY1 - LI	3,359	1.77	0.01	0.38%	1.07%
Wave 1 - TY1 - Not LI	134,645	1.62	<0.01	0.23%	0.40%
Wave 1 - TY2 - Not LI	125,893	1.59	0.01	0.35%	0.42%
Wave 1 - TY3 - Not LI	112,912	1.63	0.01	0.41%	0.49%
Wave 2 - TY1 - Not LI	33,489	1.61	-	0.00%	0.53%
Wave 3 - TY1 - Not LI	23,471	1.50	<0.01	0.27%	0.43%
Cooling Season					
Wave 1 - TY1 - LI	11,416	1.17	0.01	1.22%	1.25%
Wave 1 - TY2 - LI	11,414	1.18	0.02	2.10%	1.30%

Subgroup	HH	Baseline	Unadjusted		
			Cust	Perc	MOE
Wave 1 - TY3 - LI	11,072	1.17	0.03	2.21%	1.54%
Wave 2 - TY1 - LI	4,053	1.11	0.01	0.53%	1.49%
Wave 3 - TY1 - LI	3,359	1.12	0.01	1.03%	1.45%
Wave 1 - TY1 - Not LI	134,645	1.12	<0.01	0.29%	0.35%
Wave 1 - TY2 - Not LI	125,893	1.12	<0.01	0.14%	0.39%
Wave 1 - TY3 - Not LI	112,912	1.13	<0.01	0.38%	0.46%
Wave 2 - TY1 - Not LI	33,489	1.10	0.01	0.55%	0.48%
Wave 3 - TY1 - Not LI	23,471	1.07	0.01	0.54%	0.51%
Extreme Temp Days					
Wave 1 - TY1 - LI	11,416	1.59	0.02	1.04%	0.97%
Wave 1 - TY2 - LI	11,414	1.60	0.02	1.45%	1.08%
Wave 1 - TY3 - LI	11,072	1.63	0.03	1.77%	1.26%
Wave 2 - TY1 - LI	4,053	1.58	0.02	1.21%	1.08%
Wave 3 - TY1 - LI	3,359	1.55	0.01	0.55%	0.99%
Wave 1 - TY1 - Not LI	134,645	1.51	<0.01	0.25%	0.29%
Wave 1 - TY2 - Not LI	125,893	1.50	<0.01	0.20%	0.33%
Wave 1 - TY3 - Not LI	112,912	1.52	0.01	0.34%	0.39%
Wave 2 - TY1 - Not LI	33,489	1.48	<0.01	0.13%	0.39%
Wave 3 - TY1 - Not LI	23,471	1.42	0.01	0.36%	0.37%
Utility Peak Period					
Wave 1 - TY1 - LI	11,416	1.83	0.01	0.65%	0.99%
Wave 1 - TY2 - LI	11,414	1.84	0.02	0.98%	1.08%
Wave 1 - TY3 - LI	11,072	1.87	0.03	1.38%	1.25%
Wave 2 - TY1 - LI	4,053	1.85	0.03	1.73%	1.09%
Wave 3 - TY1 - LI	3,359	1.77	0.01	0.42%	0.96%
Wave 1 - TY1 - Not LI	134,645	1.77	<0.01	0.13%	0.29%
Wave 1 - TY2 - Not LI	125,893	1.75	<0.01	0.20%	0.33%
Wave 1 - TY3 - Not LI	112,912	1.78	<0.01	0.26%	0.40%
Wave 2 - TY1 - Not LI	33,489	1.77	<0.01	0.11%	0.39%
Wave 3 - TY1 - Not LI	23,471	1.66	<0.01	0.24%	0.37%

APPENDIX D. DETAILED KW SAVINGS ESTIMATES

This section summarizes the day of week and hour of day kW savings by wave and treatment year.

Figure D-1. Subgroup kW savings, by day of week

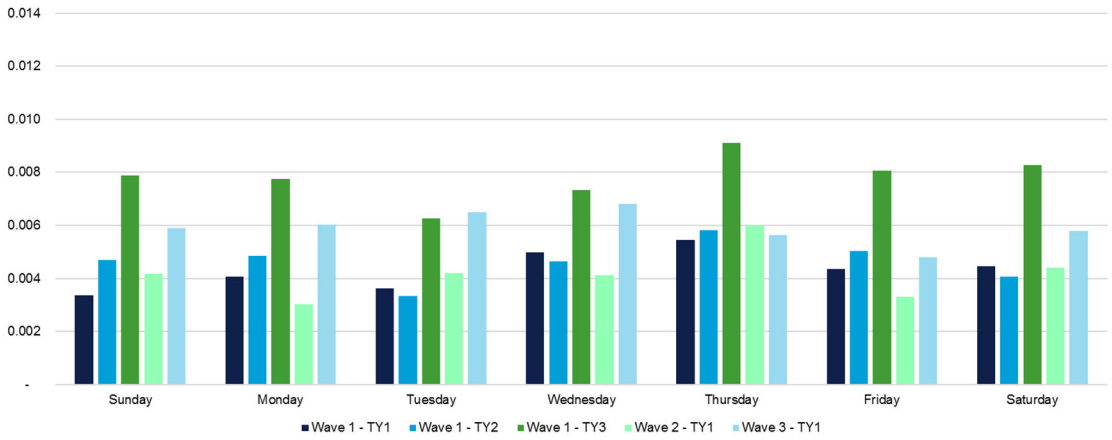
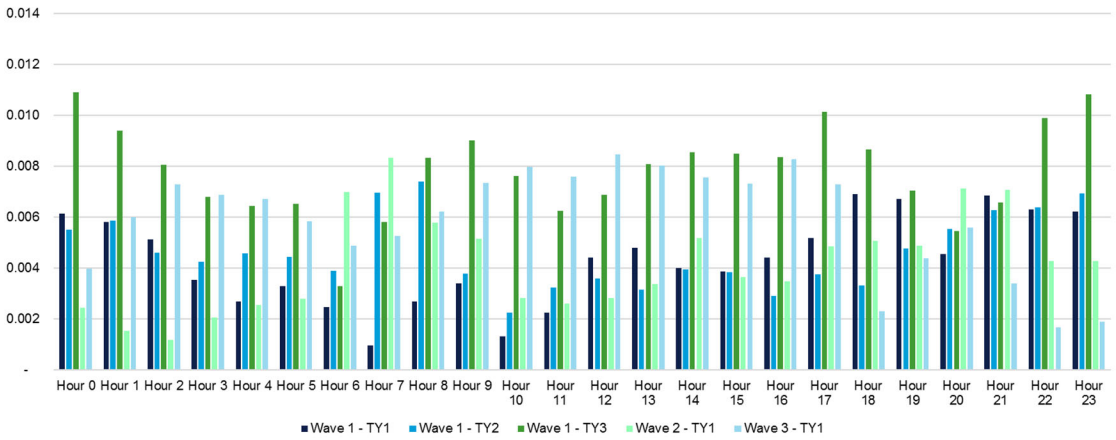


Figure D-2. Subgroup kW savings, by hour of day



APPENDIX E. DWELLING AND DEMOGRAPHIC COMPARISONS

This section summarizes self-reported demographic characteristics for treatment and control customers and dwelling characteristics for their associated RCT premises. We designed each figure to review results within a wave and RCT group (the darker green colors indicate higher response percentages), across waves within an RCT group, and within a wave across RCT groups. We highlight key takeaways here:

- **Building type / ownership status.** Owner-occupied single-family premises are most prevalent. Wave 3 had a lower percentage of reported single-family homes, but it is not significantly different from reported shares in Wave 1 and Wave 2. Wave 3 had a significantly higher share of renters than Wave 1.
- **Primary heating type**. Gas furnaces are most prevalent. Electric heat pumps are the second most prevalent.
- **Primary cooling type.** Central air conditioners are most prevalent. Still, notable shares of respondents reported using less energy intensive cooling types like ceiling fans and opening windows.
- **Language and ethnicity.** Results were similar across waves and treatment groups.
- **Income**. Respondents are evenly distributed across income groups, with most reporting they are not energy burdened.

Figure E-1. Reported building type at RCT premise

Treatment	Wave 1				Wave 2				Wave 3			
Building Type	N	Lower	Percent	Upper	N	Lower	Percent	Upper	N	Lower	Percent	Upper
Single-family home	339	71%	79%	86%	259	62%	71%	80%	282	56%	65%	73%
Duplex	11	0%	3%	5%	16	0%	4%	8%	19	1%	4%	8%
Multi-family (three or more units)	29	2%	7%	11%	28	2%	8%	13%	60	7%	14%	20%
Other	51	6%	12%	18%	63	10%	17%	25%	76	10%	17%	24%
No response	245				247				141			

Control	Wave 1				Wave 2				Wave 3			
Building Type	N	Lower	Percent	Upper	N	Lower	Percent	Upper	N	Lower	Percent	Upper
Single-family home	148	64%	76%	87%	120	61%	75%	88%	195	56%	67%	78%
Duplex	6	0%	3%	8%	2	0%	1%	5%	12	0%	4%	9%
Multi-family (three or more units)	10	0%	5%	11%	10	0%	6%	13%	38	5%	13%	21%
Other	32	6%	16%	26%	29	6%	18%	30%	46	8%	16%	24%
No response	597				469				338			

Q25: Which category best describes the home building type located at: [CUSTOMER ADDRESS]?

Figure E-2. Reported primary heating type at RCT premise

Treatment	Wave 1				Wave 2				Wave 3			
Primary Heat	N	Lower	Percent	Upper	N	Lower	Percent	Upper	N	Lower	Percent	Upper
Gas furnace	201	40%	50%	59%	142	32%	42%	52%	165	31%	40%	50%
Gas radiant heat	12	0%	3%	6%	7	0%	2%	5%	16	0%	4%	8%
Electric furnace	35	3%	9%	14%	46	6%	14%	21%	53	7%	13%	19%
Electric central heat pump	103	17%	25%	34%	87	17%	26%	35%	74	11%	18%	25%
Electric mini-split heat pump	40	4%	10%	16%	25	2%	7%	13%	52	6%	13%	19%
Electric strip heat	37	4%	9%	15%	51	8%	15%	22%	70	10%	17%	24%
Electric radiant heat	9	0%	2%	5%	11	0%	3%	7%	16	0%	4%	8%
Oil furnace	9	0%	2%	5%	9	0%	3%	6%	7	0%	2%	4%
Propane furnace	12	0%	3%	6%	8	0%	2%	6%	7	0%	2%	4%
Wood stove	60	8%	15%	22%	52	8%	15%	23%	48	6%	12%	18%
No heating	-	0%	<1%	0%	1	0%	<1%	1%	1	0%	<1%	1%
Other	46	3%	7%	11%	33	2%	5%	9%	42	3%	7%	11%
No response	270				273				168			

Control	Wave 1				Wave 2				Wave 3			
Primary Heat	N	Lower	Percent	Upper	N	Lower	Percent	Upper	N	Lower	Percent	Upper
Gas furnace	72	26%	40%	54%	64	28%	44%	60%	119	32%	44%	55%
Gas radiant heat	11	0%	6%	13%	4	0%	3%	8%	10	0%	4%	8%
Electric furnace	23	3%	13%	22%	30	8%	21%	34%	36	5%	13%	21%
Electric central heat pump	46	13%	26%	38%	31	8%	21%	34%	64	14%	24%	33%
Electric mini-split heat pump	10	0%	6%	12%	10	0%	7%	15%	20	1%	7%	13%
Electric strip heat	18	1%	10%	19%	14	0%	10%	19%	48	9%	18%	26%
Electric radiant heat	7	0%	4%	9%	8	0%	6%	13%	12	0%	4%	9%
Oil furnace	2	0%	1%	4%	4	0%	3%	8%	2	0%	<1%	3%
Propane furnace	8	0%	4%	10%	4	0%	3%	8%	8	0%	3%	7%
Wood stove	30	6%	17%	27%	22	4%	15%	27%	28	3%	10%	17%
No heating	1	0%	<1%	3%	-	0%	<1%	0%	1	0%	<1%	2%
Other	13	0%	2%	3%	9	0%	1%	3%	17	0%	3%	5%
No response	614				485				357			

Q26: What are the main heating system type(s) used to heat the home? Please select up to two system types.

Figure E-3. Reported primary cooling type at RCT premise

Treatment	Wave 1				Wave 2				Wave 3			
Primary Cooling	N	Lower	Percent	Upper	N	Lower	Percent	Upper	N	Lower	Percent	Upper
Central air conditioner	160	29%	38%	47%	110	22%	31%	41%	153	27%	36%	44%
Central heat pump	104	17%	25%	33%	79	14%	23%	31%	63	8%	15%	21%
Mini-split heat pump	47	5%	11%	17%	28	2%	8%	14%	58	7%	13%	20%
Window air conditioner	56	7%	13%	20%	54	8%	15%	23%	62	8%	14%	21%
Portable air conditioner	36	3%	9%	14%	36	4%	10%	17%	47	5%	11%	17%
Ceiling fan	109	18%	26%	34%	79	14%	23%	31%	78	11%	18%	25%
Whole house fan	3	0%	<1%	2%	7	0%	2%	5%	10	0%	2%	5%
Evaporative / swamp cooler	4	0%	<1%	3%	4	0%	1%	3%	4	0%	<1%	3%
Open windows	121	20%	29%	37%	108	21%	31%	40%	131	22%	30%	39%
No cooling	15	0%	4%	7%	19	1%	5%	10%	28	2%	7%	11%
Other	14	0%	2%	4%	17	0%	3%	5%	8	0%	1%	3%
No response	254				263				148			

Control	Wave 1				Wave 2				Wave 3			
Primary Cooling	N	Lower	Percent	Upper	N	Lower	Percent	Upper	N	Lower	Percent	Upper
Central air conditioner	62	20%	33%	46%	53	20%	35%	50%	114	29%	40%	52%
Central heat pump	48	13%	26%	38%	31	8%	21%	33%	53	10%	19%	28%
Mini-split heat pump	18	1%	10%	18%	11	0%	7%	15%	21	1%	7%	13%
Window air conditioner	27	5%	14%	24%	25	5%	17%	28%	42	7%	15%	23%
Portable air conditioner	18	1%	10%	18%	19	2%	13%	23%	31	4%	11%	18%
Ceiling fan	44	12%	23%	35%	33	9%	22%	35%	79	18%	28%	38%
Whole house fan	3	0%	2%	5%	3	0%	2%	6%	4	0%	1%	4%
Evaporative / swamp cooler	1	0%	<1%	3%	3	0%	2%	6%	1	0%	<1%	2%
Open windows	56	17%	30%	43%	40	13%	26%	40%	84	19%	30%	40%
No cooling	12	0%	6%	13%	8	0%	5%	12%	7	0%	2%	6%
Other	4	0%	<1%	1%	2	0%	<1%	1%	5	0%	<1%	2%
No response	605				479				347			

Q27: What are the main cooling system type(s) used to cool the home? Please select up to two system types.

Figure E-4. Reported building use at RCT premise

Treatment	Wave 1				Wave 2				Wave 3			
Building Use	N	Lower	Percent	Upper	N	Lower	Percent	Upper	N	Lower	Percent	Upper
Primary home	564	93%	96%	99%	480	89%	93%	97%	483	93%	96%	100%
Secondary home	17	0%	3%	6%	24	1%	5%	8%	8	0%	2%	4%
Rented to others	4	0%	<1%	2%	4	0%	<1%	2%	5	0%	<1%	3%
Other	4	0%	<1%	2%	9	0%	2%	4%	5	0%	<1%	3%
No response	86				96				77			

Control	Wave 1				Wave 2				Wave 3			
Building Use	N	Lower	Percent	Upper	N	Lower	Percent	Upper	N	Lower	Percent	Upper
Primary home	671	92%	95%	98%	493	89%	93%	97%	535	92%	96%	99%
Secondary home	18	0%	3%	5%	18	0%	3%	6%	12	0%	2%	4%
Rented to others	4	0%	<1%	2%	3	0%	<1%	2%	8	0%	1%	3%
Other	13	0%	2%	4%	15	0%	3%	6%	4	0%	<1%	2%
No response	87				101				70			

Q28: What is the primary use of the building at [CUSTOMER ADDRESS]?

Figure E-5. Reported ownership status at RCT premise

Treatment	Wave 1				Wave 2				Wave 3			
Ownership	N	Lower	Percent	Upper	N	Lower	Percent	Upper	N	Lower	Percent	Upper
Owner occupied	516	83%	88%	93%	430	78%	84%	90%	370	67%	74%	82%
Renter occupied	67	6%	11%	16%	80	9%	16%	22%	126	18%	25%	33%
Occupant, does not pay rent	3	0%	<1%	2%	3	0%	<1%	2%	2	0%	<1%	1%
No response	89				100				80			

Control	Wave 1				Wave 2				Wave 3			
Ownership	N	Lower	Percent	Upper	N	Lower	Percent	Upper	N	Lower	Percent	Upper
Owner occupied	620	83%	88%	93%	440	78%	84%	90%	403	66%	73%	80%
Renter occupied	84	7%	12%	17%	83	10%	16%	22%	147	19%	27%	34%
Occupant, does not pay rent	1	0%	<1%	1%	2	0%	<1%	1%	1	0%	<1%	1%
No response	88				105				78			

Q29: Do you own or rent?

Figure E-6. Reported primary language at RCT premise

Treatment	Wave 1				Wave 2				Wave 3			
Primary Language	N	Lower	Percent	Upper	N	Lower	Percent	Upper	N	Lower	Percent	Upper
English	562	78%	83%	89%	501	76%	82%	88%	483	78%	84%	89%
Spanish	4	0%	<1%	2%	5	0%	<1%	2%	2	0%	<1%	1%
Other	109	11%	16%	22%	107	12%	17%	23%	93	10%	16%	22%

Control	Wave 1				Wave 2				Wave 3			
Primary Language	N	Lower	Percent	Upper	N	Lower	Percent	Upper	N	Lower	Percent	Upper
English	684	82%	86%	91%	505	74%	80%	86%	530	79%	84%	90%
Spanish	5	0%	<1%	2%	7	0%	1%	3%	6	0%	<1%	2%
Other	104	9%	13%	18%	118	13%	19%	25%	93	9%	15%	20%

Q31: What is the primary language spoken in your home?

Figure E-7. Reported ethnicity at RCT premise

Treatment	Wave 1				Wave 2				Wave 3			
Ethnicity	N	Lower	Percent	Upper	N	Lower	Percent	Upper	N	Lower	Percent	Upper
White, Caucasian, or European	502	81%	87%	92%	432	80%	86%	92%	424	80%	86%	92%
Black or African American	11	0%	2%	4%	8	0%	2%	4%	12	0%	2%	5%
Asian	131	14%	19%	25%	150	18%	24%	31%	126	15%	22%	28%
Hispanic, Latino, or Spanish	19	0%	3%	6%	33	2%	7%	11%	27	2%	5%	9%
Middle Eastern or North African	2	0%	<1%	1%	1	0%	<1%	1%	5	0%	1%	3%
Native	110	11%	16%	22%	131	15%	21%	28%	105	12%	18%	24%
Other	5	0%	<1%	2%	5	0%	<1%	2%	6	0%	1%	3%
No response	146				151				120			

Control	Wave 1				Wave 2				Wave 3			
Ethnicity	N	Lower	Percent	Upper	N	Lower	Percent	Upper	N	Lower	Percent	Upper
White, Caucasian, or European	624	85%	89%	94%	446	81%	87%	93%	475	82%	87%	93%
Black or African American	10	0%	1%	3%	7	0%	1%	3%	8	0%	1%	3%
Asian	136	12%	17%	22%	151	17%	24%	30%	137	15%	22%	28%
Hispanic, Latino, or Spanish	25	1%	4%	6%	21	1%	4%	7%	37	3%	7%	11%
Middle Eastern or North African	1	0%	<1%	1%	-	0%	<1%	0%	3	0%	<1%	2%
Native	118	10%	15%	20%	132	15%	21%	27%	104	11%	17%	22%
Other	4	0%	<1%	1%	5	0%	<1%	2%	3	0%	<1%	2%
No response	145				157				120			

Q32: Which category best describes your race, ethnicity, or origin? Select all that apply.

Figure E-8. Reported frequency of late or unaffordable energy bills over the last year at RCT premise

Treatment	Wave 1				Wave 2				Wave 3			
Energy Burden	N	Lower	Percent	Upper	N	Lower	Percent	Upper	N	Lower	Percent	Upper
Never	493	80%	86%	91%	434	82%	87%	93%	389	74%	81%	88%
Once or twice	44	3%	8%	12%	30	2%	6%	10%	43	4%	9%	14%
Three to six times	26	1%	5%	8%	21	1%	4%	8%	22	1%	5%	8%
More than six times	11	0%	2%	4%	12	0%	2%	5%	27	2%	6%	10%
No response	101				116				97			

Control	Wave 1				Wave 2				Wave 3			
Energy Burden	N	Lower	Percent	Upper	N	Lower	Percent	Upper	N	Lower	Percent	Upper
Never	606	83%	88%	93%	431	78%	85%	91%	424	74%	80%	87%
Once or twice	52	4%	8%	11%	50	5%	10%	15%	58	6%	11%	16%
Three to six times	21	1%	3%	6%	19	1%	4%	7%	28	2%	5%	9%
More than six times	10	0%	1%	3%	10	0%	2%	4%	18	0%	3%	6%
No response	104				120				101			

Q33: In the last 12 months, how often were you late or unable to pay the full energy bill on time?

Figure E-9. Reported income bracket at RCT premise

Treatment	Wave 1				Wave 2				Wave 3			
Income Bracket	N	Lower	Percent	Upper	N	Lower	Percent	Upper	N	Lower	Percent	Upper
Less than $25,000	54	6%	11%	17%	63	8%	15%	22%	77	11%	19%	26%
$25,000 - $34,999	55	6%	11%	17%	43	5%	10%	16%	42	4%	10%	16%
$35,000 - $49,999	66	8%	14%	20%	64	9%	15%	22%	43	5%	10%	16%
$50,000 - $74,999	78	10%	16%	23%	71	10%	17%	24%	77	11%	19%	26%
$75,000 - $99,999	69	8%	14%	20%	66	9%	16%	23%	59	8%	14%	21%
$100,000 - $149,999	84	11%	17%	24%	62	8%	15%	22%	44	5%	11%	17%
$150,000 - $199,999	43	4%	9%	14%	19	1%	5%	9%	39	4%	9%	15%
$200,000 or more	34	3%	7%	11%	25	2%	6%	11%	30	2%	7%	12%
No response	192				200				167			

Control	Wave 1				Wave 2				Wave 3			
Income Bracket	N	Lower	Percent	Upper	N	Lower	Percent	Upper	N	Lower	Percent	Upper
Less than $25,000	75	8%	14%	19%	55	7%	13%	19%	72	9%	16%	23%
$25,000 - $34,999	57	5%	10%	15%	58	7%	14%	20%	58	7%	13%	19%
$35,000 - $49,999	84	9%	15%	21%	47	5%	11%	17%	57	7%	13%	19%
$50,000 - $74,999	94	11%	17%	23%	90	14%	21%	29%	86	12%	19%	26%
$75,000 - $99,999	77	8%	14%	20%	61	8%	14%	21%	47	5%	11%	16%
$100,000 - $149,999	93	11%	17%	23%	75	11%	18%	25%	75	10%	17%	24%
$150,000 - $199,999	38	3%	7%	11%	23	1%	5%	10%	30	2%	7%	11%
$200,000 or more	36	2%	6%	11%	13	0%	3%	6%	21	1%	5%	9%
No response	239				208				183			

Q34: Select the income range that best describes your household’s total annual income for 2023.

APPENDIX F. SURVEY QUESTIONS

ENERGY TRUST: HOME ENERGY REPORT SURVEY

Objective: This survey will explore differences between treatment and control customers and assess treatment-specific aspects of the initiative.

Anticipated timing (survey length): 10 minutes

Anticipated timing (in/out of field): January 2024

Method of data collection: Mixed-mode: Web and mail-push-to-web

Table F-1. Research objectives mapped to questions in this instrument

Research Objectives	Survey Questions Address the Objectives
Explore differences in knowledge, attitude, and awareness of downstream programs / services between treatment and control customers.	Q1-Q6
Explore differences in measure installations between treatment and control customers (including electrification, incentives used, installation plans, and adoption of energy-using technologies).	Q7-Q14
Explore differences in low- and no-cost behaviors between treatment and control customers.	Q15
Assess customer treatment awareness, engagement, satisfaction, and barriers to action.	Q16-Q24
Gather demographic and dwelling characteristics from treatment and control customers.	Q25-Q34

Table F-2. Overview of data collection approach

Data Collection	Description
Population Description	Residential customers from the Bidgely initiative roster
Population Size/Sample Frame	~200,000 customers
Type of Sampling	Stratified Random
Target Sample - Survey Completions	TBD
Instrument Type	Mixed-mode Survey
Survey Length	10 minutes
Description of Contact Sought	Residential customers from the Bidgely initiative roster

Table F-3. Database information piped into the survey instrument

Variable Name	Variable Description and Values
Customer ID	Anonymized customer ID, primary key between responses and sample frame
Customer Email	Customer email address
Customer Name	Customer full name
Customer Address	Customer full address

SURVEY MATERIALS

Study Landing Page

Example URL: https://www.energytrust.org/about/energy-use-survey

Based on the language found here: Customer Survey - Energy Trust of Oregon

Information about Energy Trust's 2024 Home Energy Use Survey

Pacific Power and Energy Trust of Oregon are conducting a survey with a randomly selected group of households to gather feedback concerning home energy use and energy efficiency. We take our commitment to serving utility customers very seriously—we've helped households and businesses save over $10.6 billion on energy bills over time. By learning about our customers and what they already know about Energy Trust and its services, we can meet people on their journey to saving energy and money and provide more help where it's needed.

Your input is very important, and it will help us serve Oregonians better. As a token of our gratitude for your time, we are pleased to offer you a spot in our free drawing toward one of ten $100 Amazon e-gift cards. Winners will be notified in February 2024.

To administer the survey, Energy Trust has hired DNV Energy Insights, an international research firm that specializes in energy efficiency research and evaluations. If you receive an invitation to take this 10-minute survey, simply follow the web link or QR code provided in your invitation and take the survey online.

We value your time and privacy. Your contact information, and anything you share in the survey, will be kept confidential. The results will only be reported in aggregate.

If you did not get a letter, postcard, or email from Energy Trust directly inviting you to participate, you do not need to complete the survey.

About DNV Energy Insights

DNV is a global quality assurance and risk management company. Driven by our purpose of safeguarding life, property, and the environment, we enable our customers to advance the safety and sustainability of their business. We provide classification, technical assurance, software, and independent expert advisory services to the maritime, oil & gas, power, and renewables industries. We also provide certification, supply chain and data management services to customers across a wide range of industries. Operating in more than 100 countries, our experts are dedicated to helping customers make the world safer, smarter, and greener. Please see our website for more information: https://www.dnv.com/.

Email Survey Invitation Letter

From: Home Energy Use Surveys energyuse.survey@energytrust.org

Subject: Help Us Help You with the Home Energy Use Survey

Dear [CUSTOMER NAME],

Pacific Power and the Energy Trust of Oregon are currently gathering feedback on customers' experiences, knowledge, and attitudes concerning home energy use and energy efficiency. We invite you to share your insights by participating in this brief online survey.

To get started, click on this link: Take the Survey

As a token of our gratitude for your time, we are pleased to offer you a spot in our free drawing to win one of ten $100 Amazon e-gift cards. Winners will be notified in February 2024.

To administer the survey, Energy Trust has retained DNV Energy Insights, an international research firm that specializes in energy efficiency research and evaluations. To check the legitimacy of this survey, you can visit our website at: https://www.energytrust.org/about/energy-use-survey.

We value your time and privacy. Your contact information, and anything you share in the survey, will be kept confidential. The results will only be reported in aggregate.

Thank you for being an integral part of our mission to improve energy efficiency programs in Oregon. Your contribution is instrumental, and we are grateful for your involvement.

[SPONSOR SIGNATURE]

Mail-Push-To-Web Survey Invitation Letter

From: [TBD]

Dear [CUSTOMER NAME],

Pacific Power and the Energy Trust of Oregon are currently gathering feedback on customers' experiences, knowledge, and attitudes concerning home energy use and energy efficiency. We invite you to share your insights by participating in this brief online survey.

To get started, scan the QR code below:

[QR CODE]

Or visit our website at: https://www.energytrust.org/about/energy-use-survey

When prompted, enter your unique survey passcode: [UNIQUE SURVEY PASSCODE].

As a token of our gratitude for your time, we are pleased to offer you a $10 Amazon e-gift card upon completion of this survey.

To administer the survey, Energy Trust has retained DNV Energy Insights, an international research firm that specializes in energy efficiency research and evaluations. To check the legitimacy of this survey, you can visit our website at: https://www.energytrust.org/about/energy-use-survey.

We value your time and privacy. Your contact information, and anything you share in the survey, will be kept confidential. The results will only be reported in aggregate.

Thank you for being an integral part of our mission to improve energy efficiency programs in Oregon. Your contribution is instrumental, and we are grateful for your involvement.

[SPONSOR SIGNATURE]

Survey

Introduction Text

Hello {CUSTOMER NAME},

Survey Instructions: In this survey you will be asked questions about your home where you receive electric service from Pacific Power. When filling it out, provide responses that reflect all household occupants that share the same electric bill. Do your best to answer all questions. When using this survey, please use the arrows "Next" and "Back" at the bottom of the page. When you have completed the survey, please click "Submit". Thank you for your participation.

Footnote: Need Help? Energy Trust of Oregon hired DNV Energy to manage this study. The DNV survey support team can be reached at: support@impact.dnv.com

Knowledge, Attitudes, And Awareness

Q1. Do you currently have an active account with Pacific Power at this address: [CUSTOMER ADDRESS]?

Response ID	Response	Action
01	Yes	Go to Q2
02	No	End survey

*select one

Q2. How many years have you been a customer with Pacific Power (at this address and/or another location)?

Response ID	Response	Action
01	Less than 1	Go to Q3
02	1 to 2	
03	3 to 5	
04	6 to 10	
05	More than 10 years	
97	Don't recall	

*select one

Q3. How motivated are you to reduce your home's energy use?

Response ID	Response	Action
01	5 – Very motivated	Go to Q4
02	4 – Motivated	
03	3 – No opinion	
04	2 – Not motivated	
05	1 – Not at all motivated	
97	Don't know	

*select one

Q4. How familiar are you with the residential rebates and services offered by the Energy Trust of Oregon?

Response ID	Response	Action
01	I'm not familiar with the Energy Trust of Oregon	Go to Q6
02	I've heard of the name, but that's about it.	
03	I know they provide rebates or other services, but I've not looked into them.	Go to Q5
04	I know they provide rebates or other services, and I've looked into them but haven't participated.	
05	I have participated in one or more of the rebates or other services they offer.	Go to Q6

*select one

Q5. Do you generally know how to find information about, and access incentives or services offered through the Energy Trust?

Response ID	Response	Action
01	Yes	Go to Q6
02	No	
03	I'm not responsible for making home upgrade decisions	

*select one

Q6. What is the best way for you to learn about rebates or services that can assist you in saving energy in your home? Select all that apply.

Response ID	Response	Action
01	Energy Trust or other utility website	
02	By mail e.g., postcard, flyer, or letter	
03	By email	
04	Displays in stores / from store employees	
05	Newspaper or magazine	
06	Social media	
07	Send information in my utility bills	
08	Radio or television ads	Go to Q7
09	Word of mouth / friend / family	
10	Through partnerships with employers or property managers	
11	Through community events or organizations	
12	I'm not interested in this information [exclusive]	
77	Other (please specify)	
97	Don't know	

*select all that apply

Measure Installation Behaviors

Q7. When deciding to purchase a new appliance, what are the top three factors that are most important to you?

Response ID	Response	Action
01	Availability of a rebate to offset the cost	Go to Q8
02	Energy savings	
03	Reduced cost of operation	
04	Manufacturer reputation	
05	Past experience with the equipment brand or manufacturer	
06	ENERGY STAR rating	
07	Recommendation from a subject expert, e.g., a sales representative	
08	Recommendation from a family member, co-worker, friend, etc.	
09	Online reviews	
10	Equipment availability	
11	Good for the environment	
12	Non-energy benefits, e.g., comfort, convenience, or aesthetics	
77	Other (please specify)	
97	Don't know	

*select all that apply, **up to three**, randomize list of options

Q8. Within the past two years, which of the following upgrades have you installed? Please provide a response for each item listed below.

Did you install this in the last two years?	Yes (01)	No (02)	Don't know (97)
1 – Central air conditioning, circulates cold air through vents	Go to Q9	Go to Q10	Go to Q10
2 – Gas furnace, circulates warm air through vents			
3 – Heat pump central or ductless system for space heating/cooling			
4 – Heat pump water heater			
5 – Smart thermostat			
6 – Building weatherization (e.g., insulation or duct sealing)			
7 – Energy-efficient windows or exterior doors			
8 – Gas fireplace			
9 – Clothes washer or dryer			
10 – LED light bulbs			
11 – Small, water-saving measures e.g., low flow faucet aerators or showerheads			
12 – Solar electric panels			

*select one for each option

[IF Q4.05, ASK Q9]

Q9. Did you get a rebate from Energy Trust for this installation?

Options [ONLY SHOW ROWS WHERE Q8.01-Q8.12 = "YES"]	**Yes (01)**	**No (02)**	**Don't know (97)**
1 – Central air conditioning, circulates cold air through vents	Go to Q10		
2 – Gas furnace, circulates warm air through vents			
3 – Heat pump central or ductless system for space heating/cooling			
4 – Heat pump water heater			
5 – Smart thermostat			
6 – Building weatherization (e.g., insulation or duct sealing)			
7 – Energy-efficient windows or exterior doors			
8 – Gas fireplace			
9 – Clothes washer or dryer			
10 – LED light bulbs			
11 – Small, water-saving measures e.g., low flow faucet aerators or showerheads			
12 – Solar electric panels			

*select one for each option

[IF Q8.02 OR Q8.03 = YES, ASK Q10]

Q10. In a previous question, you indicated a new heating system was installed. What type of fuel was used by the old heating system that you replaced?

Response ID	**Response**	**Action**
01	Electricity	Go to Q14
02	Natural gas	
03	Delivered fuels e.g., propane or heating oil	
04	Other fuel type	
05	I didn't replace anything; I installed a new/secondary heating system.	
97	Don't know	

*select one

[IF Q8.01 = YES, ASK Q11]

Q11. In a previous question, you indicated a new cooling system was installed. Which of the following options best describes why you installed the new cooling system?

Response ID	**Response**	**Action**
01	Replaced an existing cooling system	Go to Q14
02	Added the cooling system without removing the old system	
03	Installed in a previously uncooled (or poorly cooled) space, e.g., no prior cooling	
04	Part of a home addition	
97	Don't know	

*select one

[IF Q8.04 = YES, ASK Q12]

Q12. In a previous question, you indicated a new water heater was installed. What type of fuel was used by the old water heater that you replaced?

Response ID	Response	Action
01	Electricity	Go to Q14
02	Natural gas	
03	Delivered fuels e.g., propane or heating oil	
04	Other fuel type	
05	I didn't replace anything; I installed a new/secondary water heater	
97	Don't know	

*select one

[IF Q8.05 = YES, ASK Q13]

Q13. In a previous question, you mentioned a smart thermostat was installed. What type of thermostat did you remove/replace?

Smart Thermostat (Basic) | Smart Thermostat (Advanced) | Programmable Thermostat | Non-programmable Thermostat

Response ID	Response	Action
01	Smart thermostat	Go to Q14
02	Wi-Fi connected thermostat	
03	Programmable thermostat	
04	Non-programmable/Dial	
05	Remote control e.g., ductless or portable A/C	
06	I didn't replace anything; there was no prior thermostat	
97	Don't know	

*select one

Q14. Within the last two years, which of the following household changes have you made? Please provide a response for each item listed below.

Options	I added / increased this within the last two years (01)	I removed / reduced this within the last two years (02)	I have not done this within the last two years (03)	Don't know if this was done (97)
01- Electric vehicle charging	Go to Q15	Go to Q15	Go to Q15	Go to Q15
02- Hot tub, pool, or sauna				
03- Induction cooktop stove or range				
04- Altered square footage of the home e.g., adding or removing living space				
05- Household size e.g., number of residents increased or decreased				
06- Time-of-use rate plan e.g., added or removed household from plan				

*select one

Low- and No-Cost Behaviors

Q15. We would like to better understand your household's energy use behavior. Does your household regularly take any of the following energy- and/or water-saving actions? Select the option that best describes your energy use behavior for each of the items below.

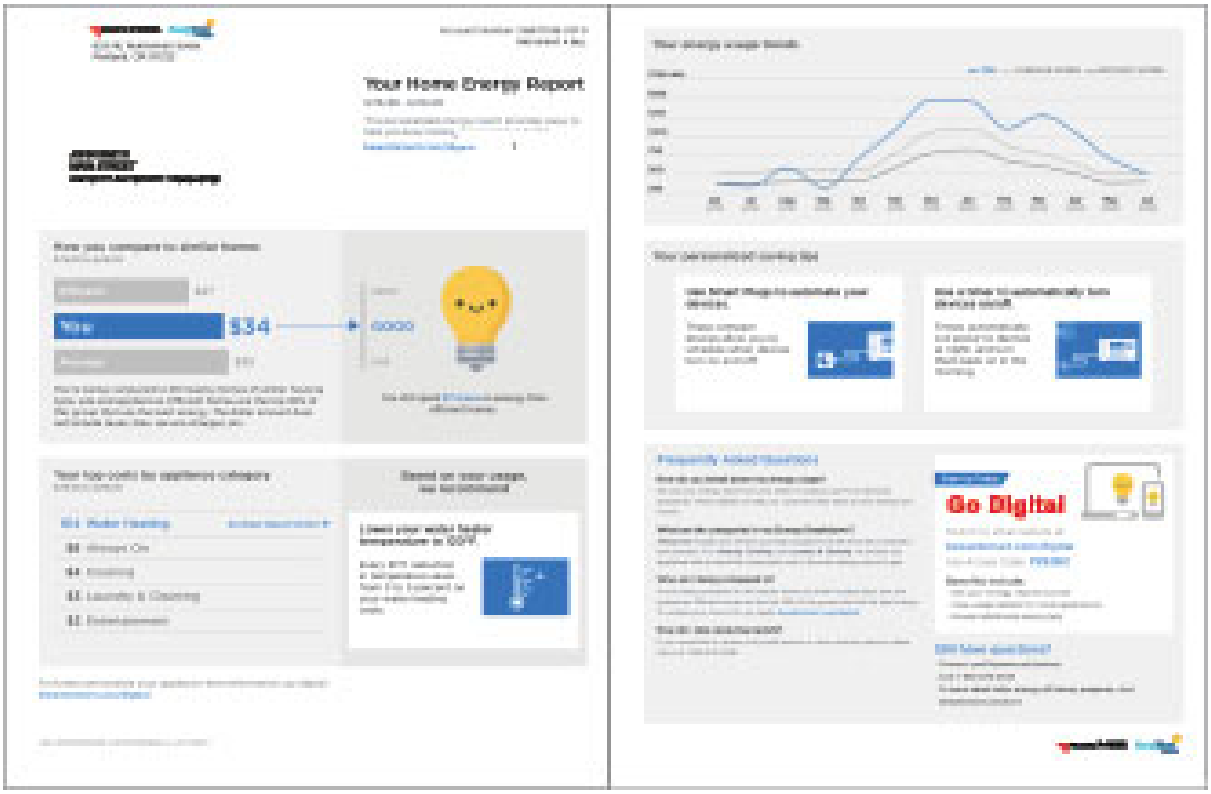
Options	Always (01)	Often (02)	Sometimes (03)	Rarely (04)	Never (05)	Not applicable (98)
01 – Adjust thermostat for energy savings: Higher on hot days, lower on cold days when away.						
02 – Save energy by using cold water for laundry						
03 – Conserve electricity: Turn off/down lights when leaving a room						
04 – Maximize appliance efficiency: Fill dishwasher, washer, and dryer loads						
05 – Reduce shower times to save water and energy						
06 – Conserve electricity: Use daylight to minimize the need for artificial lighting						
07 – Air dry clothes						
08 – Open windows for natural cooling						
09 – Keep curtains closed on hot days to cool your home						
10 – Activate power-saving features on electronics or unplug when not in use.						

*select one for each option, randomize list of options

Participation Awareness, Engagement, Satisfaction, and Barriers

[IF TREAT = 1, THEN PROCEED TO Q16; ELSE, PROCEED TO SECTION 0]

Q16. Do you recall receiving the Home Usage Insight Reports [MAIL_EMAIL]? These reports present information on home energy use, compare your usage to other households, and provide suggestions on ways you may save energy.



Response ID	Response	Action
01	Yes	Go to Q17
02	No	Go to Q25
97	Don't know	

*select one

Q17. Thinking of all the Home Usage Insight Reports you've received, what do you or members of your household typically do with them?

Response ID	Response	Action
01	Read the reports thoroughly	Go to Q19
02	Read some of the report content	
03	Glance at the pictures or graphics	
04	Do not read / discard the reports	Go to Q18
97	Don't know	

*select one

Q18. What are some of the reasons why you don't look at the Reports? Please select up to three reasons.

Response ID	Response	Action
01	Affordability issue, can't afford upgrades provided in report	Go to Q24
02	I have doubts about report accuracy	
03	Rental limit on home upgrades	
04	My home is already energy efficient	
05	Insufficient guidance in reports	
06	Time constraints/too busy	
07	Inconvenience of suggested changes	
08	Uncertain about cost savings	
09	Uncertain about energy savings	
10	Low concern for energy usage	
11	We already know how to save energy	
12	Do not want to compromise home comfort	
77	Other (please specify)	
97	Don't know [EXCLUSIVE]	

*select all that apply, **up to three,** randomize list of options

Q19. Please select a response that best describes your awareness and satisfaction with the following five Report topics presented below.

Do you recall seeing this topic in the Reports?	Yes (01)	No (02)
01 – Monthly usage history	Go to Q20	Go to Q22
02 – Energy use by appliance		
03 – Comparison of my home to similar homes		
04 – Tips for savings energy		

*select one for each option, randomize list of options

Q20. How satisfied are you with the information presented in this section of the Reports?

Options [ONLY SHOW ROWS WHERE Q19 = "YES"]	Very satisfied (05)	Some what satisfied (04)	No opinion (03)	Somewhat dissatisfied (02)	Very dissatisfied (01)
01 – Monthly usage history	Go to Q21				
02 – Energy use by appliance					
03 – Comparison of my home to similar homes					
04 – Tips for savings energy					

*select one for each option

Q21. Why are you less than satisfied with this section in the Reports? (Action: Go to Q22)

Options [ONLY SHOW ROWS WHERE Q19 = "Yes" AND Q20 < 3]	Reasons for dissatisfaction
01 – Monthly usage history	[Verbatim]
02 – Energy use by appliance	[Verbatim]
03 – Comparison of my home to similar homes	[Verbatim]
04 – Tips for savings energy	[Verbatim]

Q22. Have you experienced any of the following reasons for not taking the energy saving actions recommended in the Report? Please select up to three reasons.

Response ID	Response	Action
01	Affordability constraints	Go to Q23
02	I don't have the authority to make upgrades	
03	Home is already energy-efficient	
04	Insufficient guidance in reports	
05	Time constraints	
06	Inconvenience of suggested changes	
07	Uncertainty about cost savings	
08	Uncertainty about energy savings	
77	Other (please specify)	
97	Don't know	

*select all that apply, **up to three,** randomize list of options

Q23. Since you started receiving these Reports, is your energy bill higher, lower, or about the same as before?

Response ID	Response	Action
01	Higher	Go to Q24
02	About the same as before	
03	Lower	
97	Don't know	

*select one

Q24. [Open-Ended] Do you have any suggestions about how to improve the Home Usage Insight Reports? (Action: Go to section 0)

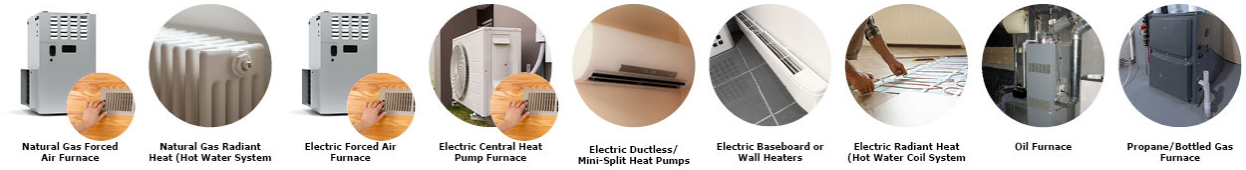
Dwelling and Demographics Characteristics

Q25. Which category that best describes the home building type located at: [CUSTOMER ADDRESS]?

Response ID	Response	Action
01	Single-family detached home	Go to Q26
02	Single-family attached home (side-by-side units with shared walls, like a townhouse or rowhouse)	
03	Duplex (2 units)	
04	Building with 3 or more units (apartments or condos)	
05	Guest house or accessory dwelling unit	
06	Mobile or manufactured home	
77	Other	
97	Don't know	

*select one

Q26. What are the main heating system type(s) used to heat the home? Please select up to two system types.



Response ID	Response	Action
01	Natural gas forced air furnace	Go to Q27
02	Natural gas radiant heat (hot water system)	
03	Electric forced air furnace	
04	Electric central heat pump	
05	Electric ductless / mini-split heat pump(s)	
06	Electric baseboards or wall heaters	
07	Electric radiant heat (hot water or electric coil system)	
08	Oil furnace	
09	Propane / bottled gas furnace	
10	Wood stove or fireplace	
11	No heating [exclusive]	
77	Other (please specify)	
97	Don't know [exclusive]	

*select all that apply, **up to two**

Q27. What are the main cooling system type(s) used to cool the home? Please select up to two system types.

Response ID	Response	Action
01	Central air conditioner	Go to Q28
02	Central heat pump	
03	Ductless / mini-split heat pump(s)	
04	Window air conditioner(s)	
05	Portable air conditioner unit(s)	
06	Ceiling fan(s)	
07	Whole house fan	
08	Evaporative / swamp cooler	
09	Open window(s)	
10	No cooling [exclusive]	
77	Other (please specify)	
97	Don't know [exclusive]	

*select all that apply, **up to two**

Q28. What is the primary use of the building at [CUSTOMER ADDRESS]?

Response ID	Response	Action
01	Primary home where I live all / most of the time	Go to Q29
02	Secondary home e.g., vacation home	
03	Property that I rent out to others	
77	Other (please specify)	
97	Don't know	

*select one

[IF Q28= 03, SKIP TO SECTION 3.7]

Q29. Do you own or rent?

Response ID	Response	Action
01	Owned by you or someone in your household	Go to Q30
02	Rent	
03	I live here, but I don't pay rent	
97	Don't know	

*select one

Q30. This information is collected for internal purposes only and remains confidential. How many people in each age group live in your home year-round?

Options	Numeric (0, 1, 2, …) Prefer not to answer
01 – Children under 5 years old	Go to Q31
02 – Children 5-17 years old	
03 – Adults 18-24 years old	
04 – Adults 25-44 years old	
05 – Adults 45-64 years old	
06 – Adults over 65 years old	

*select one for each option

Q31. What is the primary language spoken in your home?

Response ID	Response	Action
01	English	Go to Q32
02	Arabic	
03	Chinese – Cantonese	
04	Chinese – Mandarin	
05	French	
06	German	
07	Hindi	
08	Japanese	
09	Korean	
10	Persian (including Farsi)	
11	Russian	
12	Spanish	
13	Tagalog (including Filipino)	
14	Vietnamese	
77	Other (please specify)	
97	Prefer not to answer	

*select one

Q32. Which category best describes your race, ethnicity, or origin? Select all that apply.

Response ID	Response	Action
01	White, Caucasian, or European	Go to Q33
02	Black or African American	
03	Chinese	
04	Filipino	
05	Hispanic, Latino or Spanish	
06	Japanese	
07	Korean	
08	Middle Eastern or North African	

09	Native American or Alaska Native	
10	Native Hawaiian or Pacific Islander that is not listed here	
11	South Asian or Indian	
12	Vietnamese	
13	Asian Origin that is not listed here.	
14	None of these describe me. Please specify:	
15	Prefer not to answer [exclusive]	

*select one

Q33. In the last 12 months, how often were you late or unable to pay the full energy bill on time?

Response ID	Response	Action
01	Never	Go to Q34
02	Once or twice	
03	Three to six times	
04	More than six times	
05	Prefer not to answer	
06	Not applicable – I do not pay the energy bill there	
97	Don't know	

*select one

Q34. Select the income range that best describes your household's total annual income for 2023.

Response ID	Response	Action
01	Less than $25,000	Go to Q35
02	$25,000 - $34,999	
03	$35,000 - $49,999	
04	$50,000 - $74,999	
04	$75,000 - $99,999	
05	$100,000 - $149,999	
06	$150,000 - $199,999	
07	$200,000 or more	
08	Prefer not to answer	

*select one

Close-Out

Q35. [FOR WEB SURVEY] As a token of our gratitude for your time, we are pleased to offer you a spot in a free drawing for a $100 Amazon e-gift card. Do you wish to participate in the drawing? The randomly selected participants will be emailed upon completion of this study in February 2024.

[FOR MAIL-PUSH SURVEY] As a token of our gratitude for your time, we are pleased to offer you a $10 Amazon e-gift card. Do you wish to receive this e-gift card? The e-gift cards will be emailed upon completion of this study in April 2024.

Response ID	Response	Action
01	[FOR WEB SURVEY] Yes, enter me into the drawing [FOR MAIL-PUSH] Yes, send me the e-gift card	Go to Q36
02	[FOR WEB SURVEY] No, I prefer to opt-out of the drawing [FOR MAIL-PUSH] No, I prefer to opt-out of receiving an e-gift card	Go to Q37

*select one

Q36. [FOR WEB SURVEY] Please provide your preferred contact information for the drawing:

[FOR MAIL-PUSH] Please provide your preferred contact information for the e-gift card:

Response ID	Response	Action
01	Name:	Go to Q37
02	Email:	

Q37. [Open-Ended] We value your feedback. If there is anything you would like to share regarding your experience with this survey, please describe here:

About DNV

DNV is an independent assurance and risk management provider, operating in more than 100 countries, with the purpose of safeguarding life, property, and the environment. Whether assessing a new ship design, qualifying technology for a floating wind farm, analyzing sensor data from a gas pipeline or certifying a food company's supply chain, DNV enables its customers and their stakeholders to manage technological and regulatory complexity with confidence. As a trusted voice for many of the world's most successful organizations, we use our broad experience and deep expertise to advance safety and sustainable performance, set industry standards, and inspire and invent solutions.