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PROJECT:

Behavioral Programs Come of Age: Analyzing Savings from Recent Home Energy Report Program Studies

PROJECT SPONSOR:

Oracle Utilities

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INTRODUCTION

While only one of many program designs under the broad umbrella of behavioral energy efficiency (BEE) programs, home energy report (HER) distribution has become the primary residential BEE program in energy efficiency portfolios in the past decade. HER programs focus on reducing the demand for energy in the residential sector and have a consistent history of savings as well as cost-effectiveness over time (Allcott and Rogers 2014). A recent study by the Brattle Group and Oracle Utilities found that residential demand-side programs could provide nearly twice the amount of avoided greenhouse gas (GHG) emissions than existing supply-side clean energy policies would have on their own. Moreover, while supply-side clean energy policies can take years or decades to realize GHG reductions, demand-side program offerings like HERs can be deployed rapidly to achieve decarbonization gains more quickly (Sergici et al. 2021). Securing cost-effective energy savings and GHG reductions remains a critical challenge, and it is important to understand how programs like HERs are delivering on these objectives. This meta-analysis examines two research topics:

- 1) Are HER programs still working? How have HER programs performed over recent years?
- 2) Are all HER programs the same? To what extent do savings from HER programs vary by the length of treatment, HER vendor, or program design?

This report first describes the research methods used, then summarizes of the results, and finally concludes with a brief discussion of reporting inconsistencies across HERs evaluations that limit the field's capacity to compare across studies.

Based on our meta-analysis, we made four observations. First, behavioral programs continue to save, even over many years of treatment; second, performance and program success vary by vendor; third, vendor performance can vary due to program design (e.g., print vs. digital); and fourth, wide variation in evaluation requirements makes it hard to compare programs across jurisdictions.

What is a Home Energy Report?

HERs have historically been distributed via mail as a single-page, double-sided report that includes one or more of the following components: similar-home performance comparison, historical use data for the home, tips to lower home energy use by way of behavioral changes or structural modifications that reduce electricity or natural gas usage, and promotion of energy efficiency programs and rebates offered by the customer's utility.

HER programs are informed by several behavioral science principles related to normative social influence, social proof, prospect theory, and loss aversion. People tend to behave as they believe others do and are typically motivated to do so by a desire for social approval and by the assumption that others have more knowledge about which behaviors are appropriate in social settings. Findings from decades of normative social influence research show that individuals are likely to change their behavior in response to normative information and feedback.

Descriptive norms refer to behaviors that others commonly do, while injunctive norms depict what others commonly approve or disapprove of. Behavioral science research shows that both descriptive and injunctive norms influence behavior, including behaviors to protect the natural environment (Smith et al. 2012). For

example, research has shown that simple changes to the language of public service signs, reflecting descriptive norms, can dramatically increase compliance with environmental goals (Goldstein, Cialdini, and Griskevicius 2008). Moreover, people weigh the value of potential outcomes relative to reference points, rather than as fixed end states. Research on economic behavior shows that people are typically more motivated to avoid potential losses than to acquire commensurate gains (Kahneman and Tversky, 1979). Making costs salient has been shown to have a stronger influence on behaviors like plastic bag use than emphasizing bonuses of the same size (Homonoff, 2013).

Energy utility HER programs apply these behavioral science findings by providing information to their customers about how similar households are using energy, how their recent energy use compares with their historical use, and how much money they are losing from energy costs relative to others. The goal is to encourage energy-saving behavior by making energy use descriptive norms and energy costs more visible and salient. Broadly speaking, the logic of HER programs relies on behavioral science research showing that when customers receive positive feedback about their home energy use compared to other homes, this will motivate them to maintain their lower energy use. Similarly, households who receive feedback that they are using more energy than similar neighbors will be motivated to reduce their energy use (Allcott and Rogers 2012).

HER programs employ a variety of delivery mechanisms to reach utility customers. Some HER programs deliver feedback via email in place of, or in addition to, paper reports. Other HER programs have started branching into new channels like video. Most programs use an opt-out experimental design by randomly selecting a treatment and control group from a screened group of eligible residential customers. Treatment group customers automatically receive the HER monthly, bi-monthly, quarterly, or on another cadence, while the control group customers do not receive reports. Groups assigned by this randomized controlled trial (RCT) at a point in time are a "cohort." Program implementers and evaluators measure the impact the reports have on energy use by comparing the differences in energy consumption between the treatment and control groups in a cohort from a pre-intervention period to the treatment period.

HER programs with experimental designs differ from other programs in that most eligible residential customers can be included in the intervention without acting. Treatment customers may opt out if they do not want to receive the report. Consequently, even uninterested participants will, at least initially, receive the treatment. The RCT design reduces the effect of other biases such as self-selection and free-ridership and can ensure the treatment and control groups are statistically equivalent. As such, measured differences in energy usage or other program participation uplift can be inferred to be a result of the program. The Uniform Methods Project (UMP) Residential Behavior Protocol identifies the RCT approach as the "gold standard" for residential behavior programs (Kurnik et al 2018).

These programs have been extensively researched and evaluated and are among the most rigorously tested energy efficiency program models (Ashby et al. 2017). Previous analyses have shown that behavioral savings accelerate over the first two years that customers receive HERs and continue to accrue for as long as the treatment continues. Despite the well-documented success of HER programs, utility program administrators often ask – do they still work? To what extent has the success of HERs been attributable to their novelty? Have ever-increasing bids for attention by products and marketing dampened the ability of HERs to break through customers' attentional barriers and influence their behaviors? The goal of this meta-analysis is to examine

the question: How have HER programs performed in recent years, and are they still working? Are all HERs the same? This report examines these questions by first describing the research methods used, then summarizing of the results, and finally concluding with a brief discussion of reporting inconsistencies across HERs evaluations that limit the field's capacity to compare across studies.

METHODS

Document Search

We identified a total of 111 research and evaluation reports for HER programs in the US for inclusion in this study. We identified these reports through direct requests to vendors, utility web sites, state-level evaluation repositories, and internet searches. We looked exclusively for documents from the body of "grey literature" - documents found outside of peer reviewed journals. For the internet search, we entered several search strings into the Google search engine including "home energy reports," "behavior-based energy efficiency," and "energy efficiency evaluation reports," to find publicly available program reports. We also searched for specific HER program vendors after doing a brief market scan to identify current HER program implementers, as well as any vendors who have changed names after being purchased (e.g., "Tendril"). This list of vendor search terms included "Bidgely," "DNV-GL," "Franklin," "Opower," "Oracle," "Tendril," and "Uplight." We leveraged our team's expertise to cap the number of pages of internet search results to review for each search string). The cap enabled the team to focus on the most relevant results while also optimizing study resources (project budget/timeline). We estimate that we reviewed more than 450 search results. Finally, we downloaded relevant documents we found and flagged them to be screened.

Screening Criteria

We screened the 111 studies based on several exclusion criteria:

- (1) Studies that evaluated programs in 2017 or before, to focus our analysis on the most recent findings. HERs have changed over the years and our goal is to capture the impact of more recent versions of the reports.
- (2) Studies that did not provide "unadjusted" savings. Many HER evaluations adjust savings estimates by removing "double-counted" savings that arose from customers who received HERs participating disproportionately in other energy efficiency programs. Unadjusted savings are best to use in comparisons across evaluations since the magnitude of double-counted savings will depend on what other programs a utility has and thus will vary across utilities. Utilities may place different degrees of emphasis on cross-promotion of other energy efficiency programs.
- (3) Studies that had no control group and did not cite use of a RCT in its study design. This is because it is best practice to use a control group to calculate savings values for the treatment group (Kurnik et al. 2018).
- (4) Studies that did not report the number of participants in the treatment group. This is important to allow for normalizing savings values in the analysis. It was not necessary that the evaluation report the number of participants in the control group.

In addition to these document-level exclusion criteria, we applied several cohort-level exclusion criteria:

(1) Cohorts that had been receiving HERs for less than one year. This was to ensure programs with one year of maturity could be meaningfully compared to each other.

- (2) Cohorts that did not report any dispersion statistics (standard deviation, standard error, or confidence intervals).
- (3) Cohorts that had been receiving HERs for six years or more. Greater cohort maturity has been demonstrated to be positively correlated with energy savings (ILLUME Advising, 2015). We selected five years as the maximum cohort maturity to restrict the range of this variable and allow for more meaningful comparisons between cohorts.

Of the 111 documents collected, 85 documents were completely excluded, and 19 documents had some cohorts removed from the analysis. We show the full down-selection process in Figure 1. Preliminary evaluation of the excluded documents (which notably does not normalize cohorts per document or cohorts per variable) revealed that the most prominent reasons for exclusion included too high a cohort maturity (n = 79 cohorts); missing unadjusted savings (n=62); lacking or unspecified control group (n=35); and insufficient additional detail about the study and methods such as missing participant counts, unclear wave start-date, and unspecified experiment type. While we attempted to evaluate exclusion trends as a function of program implementer, a large proportion of documents did not provide this information and thus we could not extract meaningful trends.





The remaining 26 documents which made it through this screening process by meeting all inclusion criteria cover 241 cohorts. Of these cohorts, we excluded 102 due to having fewer than ten months of program treatment, or more than five years of treatment, leaving 139 cohorts from 26 documents for the meta-analysis.

Document Coding

A coding team recorded all basic information of the full initial repository of collected documents into a "preliminary" section of a primary spreadsheet inventory. This preliminary section required the following key data, among other basic details, as available:

- Document ID (assigned)
- Document title
- Publication date
- Study author
- Public access link (if available)
- Flagged for further discussion and associated notes
- Flagged for exclusion and associated reasons

For the each of the 26 documents retained from the down-selection process described in the previous section, the team recorded the remaining key metadata where available and collated into the following categories:

- Utility and program characteristics
- Cohort year, size, and maturity
- Program targeting
- Program treatment experience
- Print report module availability and distribution frequency
- Email report module availability and distribution frequency
- Participant and control counts
- Baseline energy consumption
- Energy savings
- Uplift savings from participation in energy efficiency programs
- Realization rate
- Demand savings
- Customer satisfaction

We refined the key metrics and down-selection criteria through parallel coding of at least five documents per team member. We fully coded all documents into the primary spreadsheet inventory after this initial comparison of coding results and subsequent refinement. These then underwent a quality control (QC) process in which a team member who did not do the initial input reviewed each document's coding for completeness. This QC ensured that a) we filled all fields for the "preliminary" section applied to all collected documents; b) accurately applied inclusion or exclusion flags; and c) made sure all spreadsheet fields critical for meta-analysis were complete for those entries which met the inclusion criteria. These necessary inputs of the final QC step included treatment size, control group size, baseline usage, and unadjusted annual savings including associated standard deviation, error, and confidence interval bounds.

RESULTS

As the methods for savings uplift adjustment varies considerably among utilities, this analysis used unadjusted savings values (savings that had not been adjusted for uplift). Additionally, as many studies did not report savings at the household level, electric savings were normalized to the household level by dividing the reported estimated savings by the reported size of the treatment group. We acknowledge that this is an imperfect method, as treatment group sizes can vary throughout the year and the reporting of treatment group sizes (i.e., whether the treatment group size is calculated at the beginning of the program year or at another point in the year) varies across evaluations.

Overall Savings by Cohort

	WEIGHTED MEAN DIFFERENCE	CI LB 90%	CI UB 90%	RANGE	N (COHORTS)
Electric (kWH)	88	76.89	99.63	19 - 464	50
Gas (Thm)	4.4	3.7	5.1	0.9 - 12.3	33
Electric HH%	1.16%	1.07%	1.25%	0.6% - 1.7%	30
Gas HH%	0.87%	0.73%	1.00%	0.3% - 1.7%	26

On average, cohorts saved 88 kWh annually per household and 4.4 Thm for those using gas. Electric cohorts saved an average of 1.16% of consumption while gas cohorts saved an average of 0.87%.

The average unadjusted per-household annual electric savings by cohort ranges from 19 to 464 kWh, with a weighted mean value of 88 kWh. The average unadjusted per-household annual gas savings by cohort ranges from 0.9 to 12.3 Thm, with a weighted mean value of 4.4 Thm. The unadjusted percent electric consumption saved by cohort ranges from 0.6% to 1.7%, with a weighted mean savings value of 1.16%. The unadjusted percent gas consumption saved by cohort ranges from 0.3% to 1.7%, with a weighted mean savings of 0.87%.

Annual Household Energy Savings by Vendor

Savings can vary by vendor for a variety of reasons, including the types of components included in the reports, the content and visual characteristics of those components, the quality of the data and the algorithms used to make comparisons, and the energy saving behaviors recommended to customers. The average unadjusted electric per-household annual savings from HERs programs included in the study range from 70 to 92 kWh (Figure 2). Comparing the weighted average annual electric savings per household across program vendors shows that customers receiving Vendor 1 HERs save an average of 92 kWh, recipients of Vendor 2 HERs save 87 kWh, recipients of Vendor 3 HERs save 85 kWh, Vendor 4 HERs recipients save 71 kWh,. The electric savings for Vendor 3 have the greatest margin of error, while Vendor 1 has the smallest margin of error. This marked difference in precision is primarily due to the much larger number of Vendor 1 cohorts included in the study compared with other vendors.

The average unadjusted electric savings for Vendor 1 cohorts range from 22 to 464 kWh, with a weighted mean savings of 92 kWh. Vendor 2 cohort electric savings range between 84 and 90 kWh, with a weighted mean of 86 kWh. Savings from Vendor 3 cohorts range from 19 to 196 kWh, with a weighted mean savings of 85 kWh. Electric savings for Vendor 4 cohorts ranges from 27 to 98 kWh, with a weighted mean savings of 71 kWh.



Figure 2. Average Annual Household Electric Savings by Vendor - Weighted by Estimate Precision

Figure 2 Note: +/- values represent the margin of error for 90% confidence intervals. Required data for inclusion – confidence intervals or standard error, along with either (1) annual program-level electric savings and treatment group size or (2) household-level annual electric savings

Only Vendor 1 reported gas savings with confidence intervals or measures of disperson. The unadjusted Gas savings for Vendor 1 cohorts ranges from 0.92 to 12.32 Thm per household, with a weighted mean savings of 4.4 Thm.

The percent annual electric savings for each cohort were included in the analysis if a study either reported this value directly or if the study provided baseline annual energy consumption for a cohort. If a study provided baseline annual energy consumption, percent savings were calculated as the proportion of baseline energy consumption that was saved by the program. A weighted average of unadjusted electric savings by vendor (Figure 3) shows higher average savings for Vendor 1 cohorts (1.18%) than other vendors (0.84%). The unadjusted total percent gas savings for all Vendor 1 cohorts is 0.88% and is 0.54% for Vendor 3.

The unadjusted percent total annual electric savings for Vendor 1 cohorts ranges between 0.6% and 1.73%, with a weighted mean percent savings value of 1.18%. The unadjusted percent total annual electric savings for Vendor 2 cohorts ranges from 0.74% to 0.97%, with a weighted mean percent electric savings of 0.84%.





Figure 3 Note:+/- values represent the margin of error for 90% confidence intervals. Required data for inclusion – Confidence Intervals or Standard Error, along with either (1) % annual electric savings or (2) baseline electric consumption AND annual household electric savings

Only one non-Vendor 1 cohort met the inclusion criteria to be analyzed for unadjusted percent total gas annual savings. The single cohort from Vendor 2 achieved 0.54% total annual gas savings with a margin of error of plus-or-minus 0.62%. The unadjusted percent total annual gas savings Vendor 1 cohorts ranges between 0.30% and 1.70%, with a weighted mean percent gas savings of 0.88%.



Figure 4. Average Unadjusted % Annual Gas Savings by Vendor – Weighted by Estimate Precision

Figure 4 Note: +/- values represent the margin of error for 90% confidence intervals. Required data for inclusion – Confidence Intervals or Standard Error, along with either (1) % annual gas savings or (2) baseline gas consumption AND annual household gas savings

Percent of Program Savings Goal Achieved

A variety of factors influence program goals, including negotiations with local commissions, previous years' performance, and available budgets. Programs are consistently evaluated against filed goals across jurisdictions, regardless of how the goals are created, so it is a useful metric to compare HER vendor performance.

Any study was included in this analysis, even if it did not meet the criteria described in the methodology discussion. A study's inclusion in this analysis was based solely on whether it included the relevant savings metric (electric, demand, or gas savings) and whether it documented a goal for that metric. Treatment household counts are not reported here, as those were often unreported in studies included in these analyses. Only one study was included for each unique combination of program year and utility.

Vendor 1 programs achieved the greatest proportion of electric savings goals among vendors, saving an average of 119% of program goals, with goal achievement ranging from 81% to 178% across ten studies. The single study of Vendor 5 programs showed 86% of program goals achieved. Vendor 6 programs saved an average of 84% of program goals, with goal achievement ranging from 43% to 111% across five studies. The single study of Vendor 4 programs showed 78% of program goals achieved. Vendor 3 programs saved an average of 72% of program goals, with goal achievement ranging from 5% to 108% across 8 studies. Vendor 2 programs saved an average of 49% of program goals, with goal achievement ranging from 5% to 108% across 8 studies.





Vendor 1 programs also achieved the greatest proportion of electric demand savings goals among vendors, saving an average of 138% of program electric demand goals, with goal achievement ranging from 89% to 328% across six studies. Vendor 6 programs achieved an average of 127% of program goals, with goal achievement ranging from 99% to 155% across two studies. The single study of Vendor 4 programs showed 78% of program goals achieved. Vendor 2 programs saved an average of 46% of program goals, with goal

achievement ranging from 17% to 107% across five studies. The single study of Vendor 7 programs showed 31% of program goals achieved.





Vendor 1 programs also achieved the greatest proportion of gas savings goals among vendors, saving an average of 104% of program gas savings goals, with goal achievement ranging from 46% to 156% across studies. The single study of Vendor 6 programs showed 87% of program goals achieved. Vendor 2 programs saved an average of 43% of program gas goals, with goal achievement ranging from 6% to 88% across studies.





Annual Household Energy Savings by Cohort Maturity

Cohorts that are more mature (two to five program years) saved more electricity from HERs programs on average than cohorts who had only received one year of HERs. Cohorts with two to five years of program maturity save a greater proportion of electric and gas consumption than cohorts that have only received one year of HERs.

Cohorts with two to five years of program maturity saved more than twice as much annual electricity consumption (101 kWh) than for cohorts with a maturity of one year (35 kWh). The average unadjusted perhousehold annual electric consumption saved for cohorts whose maturity is one-year ranges from 19 to 71 kWh. The average unadjusted per-household electric consumption saved for cohorts with two to five years of maturity range between 28 and 464 kWh, with a weighted mean savings value of 101 kWh.

Cohorts with a maturity of two to five years have higher unadjusted annual percent electric savings (1.21%) than cohorts with a maturity of one year (0.66%). The unadjusted percent total annual electric savings for cohorts with a one-year maturity ranges between 0.6% and 0.7%, with a weighted mean percent savings of 0.66%. The unadjusted percent total annual electric savings for cohorts with a maturity of two to three years ranges between 0.7% and 1.73%. There was a moderately strong positive correlation between the number of years a cohort had received HERs and the annual household electric savings (r=.48). As show n in Figure **9**, there is also a small positive relationship (r=.19) between cohort maturity and annual household gas savings.





Figure 8 Note: Required data for inclusion – confidence intervals or standard error, along with either (1) annual program-level electric savings and treatment group size or (2) household-level annual electric savings



Figure 9. Unadjusted Annual Household Gas Savings by Cohort Maturity (n=33 cohorts; Pearson's r=.19)

Figure 9 Note: Required data for inclusion – confidence intervals or standard error, along with either (1) annual program-level gas savings and treatment group size or (2) household-level annual gas savings

Savings by Distribution Mode

Very few studies reported whether each cohort received paper HERs only or electronic HERs (eHERs) only, though studies that report both paper and email distribution modes are more common for all metrics except percent of gas consumption saved. Programs that sent paper HERs exclusively or a combination of paper and email HERs saved more gas and electricity than those that sent eHERs exclusively.

The few cohorts that we could confirm received paper HERs only or both paper and emailed reports, saved about twice as much annual household electricity consumption (118.3 kWh; 113.8 kWh respectively) than cohorts who received only eHERs (53.8 kWh). Cohorts that received only paper HERs saved between 90 and 145 annual household kWh. Cohorts that received both paper and email reports saved between 22 kWh and 464 kWh. Cohorts who received only eHERs saved between 27 to 67 kWh.



Figure 10. Average Unadjusted Annual Household Electric Savings by Mode - Weighted by Estimate Precision

Error! Reference source not found. Note: +/- values represent the margin of error for 90% confidence intervals. Required data for inclusion – description of distribution mode, confidence intervals or standard error, and either (1) annual program-level electric savings and treatment group size or (2) household-level annual electric savings

Cohorts that only received paper HERs saved an average of 1.29% annual electricity consumption. Cohorts that received both paper and email HERs also saved an average of 1.29% annual electric consumption. Cohorts that received only eHERs saved, on average, 1.21% of their annual electricity consumption. The unadjusted percent annual electric savings for the cohorts that received only eHERs ranged between 1.0% and 1.5%. The unadjusted percent annual electric savings for cohorts that received both paper and email

HERs ranged from 0.7% to 1.5%. The unadjusted percent annual electric savings for cohorts that received only paper HERs ranged from 1.1% to 1.3%.





The cohorts that we could confirm received paper HERs only and cohorts that received both paper and email eHERs saved more (4.0 Thm; 3.4 Thm respectively) than cohorts confirmed to receive only eHERs (2.2 Thm). The average unadjusted annual gas consumption saved for cohorts who received only eHERs ranges from 1.8 Thm to 2.4 Thm. Cohorts that received both paper and emailed HERs saved between 2.5 and 4.6 Thm. The range for cohorts that received only paper HERs is from 2.4 to 5.5 Thm.

Figure 11 Note: +/- values represent the margin of error for 90% confidence intervals. Required data for inclusion – description of distribution mode, confidence intervals or standard error, and either (1) % annual electric savings or (2) baseline electric consumption AND annual household electric savings



Figure 12. Average Unadjusted Annual Household Gas Savings by Mode - Weighted by Estimate Precision

Figure 12 Note: +/- values represent the margin of error for 90% confidence intervals. Required data for inclusion – description of distribution mode, confidence intervals or standard error, and either (1) annual program -level gas savings and treatment group size or (2) household-level annual gas savings

Cohorts that only received paper HERs saved an average of 0.96% annual gas consumption. We did not identify any studies that met our inclusion criteria where both paper and email HERs were sent to customers and that reported the gas and dispersion metrics required for the analysis. Cohorts that received only eHERs saved, on average, 0.76% of their annual gas consumption. The unadjusted percent annual gas savings for the cohorts that received only eHERs ranged between 0.70% and 0.80%. The unadjusted percent annual gas savings for cohorts that received only paper HERs ranged from 0.6% to 1.3%.



Figure 13. Average Unadjusted % Annual Gas Savings by Mode - Weighted by Estimate Precision

Figure 13 Note: +/- values represent the margin of error for 90% confidence intervals. Required data for inclusion – description of distribution mode, confidence intervals or standard error, and either (1) % annual gas savings or (2) baseline gas consumption AND annual household gas savings

DISCUSSION

The analysis shows that savings from recently evaluated HER programs remain comparable to earlier studies, which have shown one to two percent annual savings from HER programs. Electric savings from these programs have a moderately strong positive relationship with cohort maturity, suggesting that the electric savings impacts of HER programs increase as customers are exposed to more reports over time. Results show that savings vary between HER vendors and between HER programs that include emailed reports (eHERs) and those that do not. The findings suggest that HER programs that sent exclusively paper HERs saved more energy – both electricity and gas – than programs that sent exclusively eHERs. These findings are not conclusive, however, due to inconsistencies in reporting between studies.

In our analysis, we noted that there are several inconsistencies in HER program reporting formats across the evaluations we analyzed.

The primary inconsistencies we noted are:

- (1) We noticed a wide variety of naming conventions for savings values. Some evaluations reported unadjusted savings as both "net" and "gross" savings, while others noted that due to the nature of an RCT design, all savings are "net" savings. There were also a variety of names used to indicate vendor savings, evaluator-verified savings, unadjusted savings, and adjusted savings. Some of these included Relative Savings, Measured Savings, Verified Savings, Net Savings Prior to Uplift, and Savings w/ Double Counting.
- (2) We found variation in reporting of standard deviation, error, and confidence interval bounds. Many evaluations reported these values for only one savings value, which could be either total savings, per household savings, or percent savings.
- (3) Some evaluations report one value for participant counts for each cohort. Other evaluations give greater detail, reporting participant counts for the time when the cohort began and the count at the start of the program year.
- (4) Even when providing participant counts for each cohort, some evaluations provide savings values at the cohort level and some at the program level.
- (5) Some evaluations give a detailed explanation of the HERs format, detailing for each cohort whether it was printed, emailed, or both. Other evaluations may instead be vague or even omit reporting the report format.
- (6) Some evaluations provide savings values for each cohort by quarter or month instead of by year.

Despite the inconsistencies in reporting between HER studies, findings suggest that HER programs continue to generate strong electric savings and that these savings increase the longer customers are exposed to the reports. Results show that HER program performance in terms of energy savings is dependent on which vendor is running the program and the implementation and design choices they make. Overall, findings suggest that HER programs remain a cost-effective program model for reducing the electric and natural gas consumption of residential utility customers.

As utilities look for ways to meet the challenge of decarbonization and meeting energy efficiency goals, behavioral energy programs continue to be a strong source of reliable and consistent savings. Meta-analysis is a useful process to understand the effects of behavioral energy programs and how it can vary by factors such as implementer or mode across multiple utilities and states. That analysis is helpful in identifying the appropriate components and tools of a behavioral landscape. The results of this meta-analysis highlight the lack of consistency in reporting across jurisdictions and utilities which makes this useful type of analysis challenging. As the industry looks forward to improving understanding around the performance of behavioral energy efficiency, it is important to consider how more standardization can be used to allow for more robust comparisons and deeper insights.

REFERENCES

- Allcott, H., and T. Rogers. 2012. "How long do treatment effects last? Persistence and durability of a descriptive norms intervention's effect on energy conservation." *HKS Faculty Research Working Paper Series*.
- Allcott, H., and T. Rogers. 2014. "The short-run and long-run effects of behavioral interventions: Experimental evidence from energy conservation." *American Economic Review* ten4, ten: 3003-37.
- Ashby, K., Gutierrez, V., Menges, S., and Perich-Anderson, J. 2017. "Keep the change: Behavioral persistence in energy efficiency programs" [Paper presentation]. *International Energy Program Evaluation Conference*, Baltimore, MD. https://www.iepec.org/wpcontent/uploads/2018/02/2017paper_ashby_gutierrez_menges_perick-anderson.pdf
- DerSimonian, R. and N. Laird. 1986. "Meta-analysis in clinical trials." Controlled Clinical Trials, 7, 177-188.
- Goldstein, N. J., R. B. Cialdini, and V. Griskevicius. 2008. "A room with a viewpoint: Using social norms to motivate environmental conservation in hotels." *Journal of consumer Research* 35, no. 3: 472-482.
- Homonoff, T. A. 2013. "Can small incentives have large effects? The impact of taxes versus bonuses on disposable bag use." Working Paper #575. *Industrial Relations Section*. Princeton, NJ.
- ILLUME Advising, LLC. 2015. "Energy Efficiency Behavioral Programs: Literature Review, Benchmarking Analysis, and Evaluation Guidelines."
- Kahneman, D., and A. Tversky. 1979. "Prospect theory: An analysis of decision under risk." *Econometrica*, 47 (2), 263-291.
- Khawaja, M. S., and J. Stewart. 2014. "Long-run savings and cost-effectiveness of Home Energy Reports Programs." *Cadmus Group Inc.*
- Kurnik, C. W., M. Li, H. Haeri, and A. Reynolds. 2018. "The Uniform Methods Project: Methods for Determining Energy Efficiency Savings for Specific Measures." No. NREL/SR-7A40-70472. National Renewable Energy Lab (NREL), Golden, CO.
- Lewis, S., and M. Clarke. 2001. "Forest plots: Trying to see the wood and the trees." Bmj 322, no. 7300: 1479-1480.
- Sergici, S., Hledik, R., Hagerty, M., Faraqui, A., and Peters, K. 2021. "The Customer Action Pathway to National Decarbonization." *The Brattle Group*.
- Smith, J. R., W. R. Louis, D. J. Terry, K. H. Greenaway, M. R. Clarke, and X. Cheng. 2012. "Congruent or conflicted? The impact of injunctive and descriptive norms on environmental intentions." *Journal of environmental psychology* 32, 4: 353-361.

REFERENCES: INCLUDED STUDIES POST SCRENING

ADM. 2019. Evaluation of 2018 DSM Portfolio: Prepared for CenterPoint Energy, Arkansas.

- ADM. 2020. 2019 Indiana Residential Portfolio EM&V Report Volume of II: Prepared for Indiana Michigan Power.
- CADMUS. 2020. Evaluation Report of 2018-2019 Home Energy Reports Program: Prepared for PacifiCorp, Rocky Mountain Power Wyoming.
- CADMUS. 2020. Evaluation Report of 2018-2019 Home Energy Reports Program: Prepared for PacifiCorp, Rocky Mountain Power Utah.
- CADMUS. 2021. PPL Electric Utilities Annual Report to the Pennsylvania Public Utility Commission: Prepared for PPL Electric Utilities.
- CADMUS, ILLUME, Integral Analytics. 2020. 2019 Demand-Side Management Portfolio Evaluation Report: Prepared for Indianapolis Power & Light.
- CADMUS, ILLUME, Integral Analytics. 2019. 2018 DSM Portfolio Evaluation Report: Prepared for NIPSCO.
- DNV GL. 2019. 2018 Impact Evaluation Updated Report: Prepared for Puget Sound Energy.
- DNV GL. 2020. Impact Evaluation of Home Energy Reports, Residential Sector Program Year 2018: Prepared for Calif. Public Utilities Commission.
- Ellsworth A., D. Molner, N. Lieb, A. Roma, and A. Opipari. 2021. *Residential Energy Waste Reduction Certification Evaluation: Prepared for Consumers Energy.* CADMUS, ILLUME, Apex Analytics, NMR Group.
- Evergreen Economics, Demand Side Analytics, EcoMetric Research & Polling. 2020. Evaluation of the 2019 Southwestern Public Service Company's Energy Efficiency and Demand Response Programs: Prepared for Southwestern Public Service Company.
- Guidehouse. 2020. ComEd Residential Behavior Impact Evaluation Report: Prepared for ComEd.
- Guidehouse. 2020. Home Energy Reports Program 2019 Comprehensive Report: Prepared for Con Edison.
- Guidehouse. 2020. PY10 Behavioral Energy Efficiency Program Impact Evaluation Report: Prepared for Washington Gas Virginia.
- Guidehouse. 2021. Home Energy Reports Impact Evaluation Report: Prepared for Nicor Gas.
- Huckett, J., D. Vaughn, S. Wist, J. Colby. 2019. *Home Energy Report Program Impact and Process Evaluation: Prepared for Ameren Missouri.* CADMUS, Apex Analytics.

- Johnson Consulting Group. 2019. DSM Program Evaluation for PY2017 and PY2018: Prepared for Atmos Energy.
- Miller, E., S. Cofer, M. Buffman, A. Carollo, A. Chamberlain, R. Fulleman, K. Heinricj, M. Ottesen, and D. Vaughn., 2019 Demand-Side Management Portfolio Evaluation Report: Prepared for Indianapolis Power & Light. CADMUS, ILLUME, Integral Analytics.
- Minnesota Energy Resources Corporation. 2021. 2020 CIP Status Report: Prepared for Minnesota Department of Commerce, Division of Energy Resources.
- Navigant. 2019. Home Energy Report Program: Prepared for DTE.
- Navigant. 2019. Home Energy Report Program 2018 Evaluation Report: Prepared for AEP Ohio.
- Savage, A., D. Lesperance, and A. Hauser. 2021. *PG&E HER 2019 Energy and Demand Savings Early EM&V: Prepared for Pacific Gas & Electric.* Nexant.
- Thomas, A., J. Marquez, and H. Du. 2021. Evaluation of CenterPoint Energy Oklahoma Program Year 2020 Demand Side Management Portfolio: Prepared for CenterPoint Energy Oklahoma. Sacramento, Calif.: ADM.
- Thomas, A., J. Offenstein, B., Heckendorn, J., Marquez, H. Du, M. Culbertson. 2021. Evaluation of the Center Point Energy Arkansas Program Year 2020 (PY2020) Energy Efficiency (EE) Portfolio: Prepared for CenterPoint Energy Arkansas. Sacramento, Calif.: ADM.
- Xcel Energy. 2020. 2019 Energy Efficiency and Load Management Annual Report: Prepared for Southwestern Public Service Company.

APPENDIX A: POOLED SAVINGS ESTIMATES

The following formula was used to apply weights to each cohort by their relative precision using a randomeffects weight model:

$$w_k^* = \frac{1}{s_k^2 + \tau^2}$$

The τ^2 estimate of heterogeneity among intervention effects was calculated using the MetaXL software package, which applies the widely used method described by DerSimonian and Laird (1986).

The following formula was used to calculate the pooled effect size using the inverse variance method:

$$\hat{\theta} = \frac{\sum_{k=1}^{K} \hat{\theta}_k \mathbf{w}_k^*}{\sum_{k=1}^{K} w_k^*}$$

This formula uses the weights calculated for each cohort to calculate a weighted mean where each cohort's weight is inversely proportional to the precision of that cohort's study relative to the other cohorts in the model.

The tables presented below summarize the weights applied to each study for each analysis.

Table 1. Unadjusted Annual Household Electric Savings by Cohort

STUDY	КШН	LCI 90%	HCI 90%	WEIGHT (%)
E402	464	269	659	0.305678
E136	332.2	166.9	497.6	0.409047
E307	280	174	386	0.834305
E311	248.1	168.6	327.6	1.222131
E3	196.5	96	296.9	0.900945
E292	173.1	109.4	236.7	1.555976
E134	166.4	102.9	229.9	1.559557
E403	164.1	36.1	292.1	0.626201
E277	160.6	124.8	196.4	2.33439
E137	145.9	45.9	245.9	0.906646
E294	145.3	79.5	211	1.506683
E267	145.1	91.1	199.1	1.802331
E271	136.2	83.8	188.6	1.846161
E404	135.9	44.3	227.5	1.022041
E276	127.8	105.8	149.7	2.728591
E278	121.2	103.1	139.3	2.820407
E405	118.8	73.7	164	2.053634

STUDY	KWH	LCI 90%	HCI 90%	WEIGHT (%)
E249	106.7	67.1	146.3	2.219524
E309	102.8	28.3	177.3	1.318107
E306	100.8	-7.4	208.9	0.810223
E437	100.1	67.2	133	2.421531
E13	97.6	76.2	119.1	2.741149
E275	91.6	69.9	113.3	2.734892
E245	90.9	62	119.9	2.537694
E263	90	43.7	136.2	2.021341
E331	89.7	48.5	131	2.169813
E11	85.6	22	149.1	1.558362
E138	84.6	17.5	151.7	1.475826
E332	84.1	35.3	132.9	1.947514
E296	79.3	37.1	121.4	2.142809
E441	73.2	44.4	102	2.542018
E251	72.5	45.5	99.5	2.593249
E253	72.1	46.2	98	2.623886
E15	71.3	42.8	99.9	2.549207
E439	67.5	41.1	93.9	2.610029
E265	66.7	42.3	91	2.666045
E261	66.1	-2.8	135	1.435692
E135	63.3	6.7	119.9	1.73284
E14	59.3	-3	121.5	1.589711
E406	57.9	19.7	96	2.263345
E247	56.3	27.9	84.7	2.55351
E445	53.2	22.1	84.3	2.474952
E269	51.3	27.6	75.1	2.682012
E139	46	22.1	69.8	2.679365
E273	29.3	18.4	40.2	2.955059
E443	27.8	15.1	40.6	2.925789
E16	27.2	-16.1	70.5	2.108457
E255	24.3	14.5	34.2	2.969854
E407	22.3	-3.2	47.7	2.636254
E12	19.1	3.6	34.6	2.875222
Pooled	88.256426	76.88807	99.62479	100
Statistics				
I-squared	84.0710155	80.50438	86.98515	
Cochran's Q	307.61534			
Chi2, p	0			
tau2	1572.58402			

Table 2. Unadjusted Annual Household Gas Savings by Cohort	
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STUDY	ТНМ	LCI 90%	HCI 90%	WEIGHT (%)
G124	12.32	10.41	14.23	3.014125
G125	10.1	8.23	11.97	3.039288
G308	9.38	4.19	14.58	1.323142
G287	8.45	5.26	11.64	2.220434
G284	8.30	6.56	10.04	3.120136
G129	7.67	6.83	8.51	3.593036
G128	7.53	0.75	14.31	0.908608
G281	7.40	6.00	8.8	3.321109
G286	6.62	5.08	8.16	3.240634
G282	6.52	5.06	7.99	3.284209
G268	5.50	4.22	6.79	3.384153
G285	5.36	3.91	6.82	3.28994
G283	4.97	2.81	7S.13	2.855058
G295	4.63	0.39	8.87	1.688937
G293	3.98	-0.13	8.10	1.744848
G250	3.62	1.91	5.34	3.135487
G246	3.53	2.17	4.89	3.343378
G438	3.10	1.60	4.60	3.264
G440	3.10	1.20	5.00	3.020427
G444	2.90	1.70	4.00	3.453956
G254	2.69	1.51	3.86	3.441405
G442	2.60	1.10	4.00	3.292799
G297	2.52	-0.40	5.45	2.375726
G266	2.44	1.78	3.10	3.657495
G274	2.37	1.89	2.85	3.708051
G272	2.36	0.96	3.76	3.321109
G252	2.15	0.86	3.43	3.384153
G248	2.14	0.84	3.45	3.37341
G256	2.00	0.93	3.08	3.490504
G270	1.81	1.03	2.59	3.615978
G446	1.80	0.10	3.50	3.144663
G262	1.36	0.08	2.63	3.389488
G264	0.92	0	0.184	3.560315
Pooled	0.43551818	0.361325	0.509711	100
Statistics				
I-squared	90.2608677	87.90712	92.15648	
Cochran's Q	328.571366			
Chi2, p	0			
tau2	0.0540175			

Table 3. Unadjusted % Annual Electric Savings by Cohort

STUDY	%	LCI 90%	HCI 90%	WEIGHT (%)
E61	0.0173	0.0115	0.0231	2.04558
E263	0.017	0.0085	0.0264	0.953136
E271	0.016	0.0099	0.0223	1.82901
E59	0.0153	0.011	0.0196	3.266275
E276	0.015	0.0123	0.0173	6.307069
E267	0.015	0.0093	0.0204	2.199541
E245	0.015	0.0103	0.0199	2.769858
E278	0.013	0.0115	0.0155	7.609271
E277	0.013	0.0103	0.0161	5.417103
E265	0.013	0.008	0.0172	2.955452
E249	0.013	0.0083	0.018	2.725924
E58	0.0124	0.007	0.0178	2.299734
E57	0.0123	0.0079	0.0167	3.158053
E437	0.012	0.008	0.0157	3.817794
E275	0.012	0.0092	0.0149	5.520791
E261	0.012	-0.0005	0.0244	0.512186
E251	0.012	0.0078	0.0171	2.907524
E60	0.0118	0.0072	0.0164	2.955452
E56	0.0113	0.0036	0.019	1.252847
E441	0.011	0.0069	0.0159	3.05452
E439	0.011	0.007	0.0159	3.105714
E269	0.011	0.0057	0.0155	2.682929
E253	0.011	0.0073	0.0155	3.497734
E443	0.01	0.0057	0.0152	2.814753
E247	0.01	0.005	0.0153	2.481228
E331	0.0097	0.0053	0.0141	3.158053
E332	0.0074	0.0014	0.0093	3.685445
E273	0.007	0.0046	0.01	5.84474
E255	0.007	0.0044	0.0104	5.21606
E445	0.006	0.0027	0.0102	3.956225
Pooled	0.01160448	0.010694	0.012515	100
Statistics				
I-squared	30.2723532	0	52.20331	
Cochran's Q	41.5903896			
Chi2, p	0.06109701			
tau2	2.55E-06			

Table 4. Unadjusted % Annual Gas Savings by Cohort

STUDY	%	LCI 90%	HCI 90%	WEIGHT (%)
G287	0.017	0.0109	0.0241	2.230959

STUDY	%	LCI 90%	HCI 90%	WEIGHT (%)
G284	0.017	0.0134	0.0205	3.732684
G281	0.016	0.0131	0.0192	4.021224
G286	0.014	0.0108	0.0174	3.87705
G282	0.014	0.0109	0.0172	3.963659
G268	0.013	0.0097	0.0157	4.049921
G444	0.011	0.0066	0.0155	3.227418
G285	0.011	0.0082	0.0143	4.021224
G283	0.011	0.0062	0.0157	3.068211
G274	0.01	0.0076	0.0114	4.63993
G266	0.008	0.006	0.0105	4.464652
G246	0.008	0.0051	0.0114	3.963659
G440	0.007	0.0039	0.0112	3.675148
G270	0.007	0.0037	0.0094	4.135534
G254	0.007	0.0037	0.0094	4.135534
G250	0.007	0.0039	0.0109	3.761515
G442	0.006	0.0026	0.0093	3.848153
G438	0.006	0.0024	0.0098	3.646459
G272	0.006	0.0024	0.0095	3.732684
G256	0.006	0.0027	0.0091	3.934814
G334	0.0054	0.0031	0.0116	3.336566
G262	0.005	0	0.0002	5.140074
G252	0.005	0.0022	0.0086	3.934814
G248	0.005	0.0021	0.0088	3.848153
G446	0.004	0.0002	0.0075	3.675148
G264	0.003	0	0.0064	3.934814
Pooled	0.00865516	0.007345	0.009965	100
Statistics				
I-squared	86.5895919	82.45957	89.74717	
Cochran's Q	186.422366			
Chi2, p	0			
tau2	1.23E-05			

Table 5. Unadjusted Annual Household Electric Savings by Cohort - Vendor 1 Only

STUDY	KWH	LCI 90%	HCI 90%	WEIGHT (%)
E402	464	269	659	0.391611
E136	332.2	166.9	497.6	0.522805
E307	280	174	386	1.056092
E311	248.1	168.6	327.6	1.533588
E292	173.1	109.4	236.7	1.938034
E134	166.4	102.9	229.9	1.942339
E403	164.1	36.1	292.1	0.796408
E277	160.6	124.8	196.4	2.858158

STUDY	KWH	LCI 90%	HCI 90%	WEIGHT (%)
E137	145.9	45.9	245.9	1.145793
E294	145.3	79.5	211	1.878695
E267	145.1	91.1	199.1	2.23266
E271	136.2	83.8	188.6	2.284743
E404	135.9	44.3	227.5	1.288275
E276	127.8	105.8	149.7	3.312295
E278	121.2	103.1	139.3	3.416959
E405	118.8	73.7	164	2.529919
E249	106.7	67.1	146.3	2.724353
E309	102.8	28.3	177.3	1.650479
E306	100.8	-7.4	208.9	1.026167
E437	100.1	67.2	133	2.95922
E275	91.6	69.9	113.3	3.319491
E245	90.9	62	119.9	3.093346
E263	90	43.7	136.2	2.491905
E138	84.6	17.5	151.7	1.841482
E296	79.3	37.1	121.4	2.634615
E441	73.2	44.4	102	3.098325
E251	72.5	45.5	99.5	3.157252
E253	72.1	46.2	98	3.192428
E439	67.5	41.1	93.9	3.176524
E265	66.7	42.3	91	3.240757
E261	66.1	-2.8	135	1.793006
E135	63.3	6.7	119.9	2.149879
E406	57.9	19.7	96	2.775479
E247	56.3	27.9	84.7	3.111554
E445	53.2	22.1	84.3	3.020986
E269	51.3	27.6	75.1	3.259038
E139	46	22.1	69.8	3.256008
E273	29.3	18.4	40.2	3.569706
E443	27.8	15.1	40.6	3.536579
E255	24.3	14.5	34.2	3.586435
E407	22.3	-3.2	47.7	3.206615
Pooled	92.4875617	79.57491	105.4002	100
Statistics				
I-squared	85.2413925	81.63453	88.13989	
Cochran's Q	271.02828			
Chi2, p	0			
tau2	1682.4962			

Table 6. Unadjusted Annual Household Electric Savings by Cohort - Vendor 1 Only

STUDY	KWH	LCI 90%	HCI 90%	WEIGHT (%)

E13	97.6	76.2	119.1	36.74004
E15	71.3	42.8	99.9	30.53294
E14	59.3	-3	121.5	12.43071
E16	27.2	-16.1	70.5	20.29632
Pooled	70.5202687	45.19092	95.84962	100
Statistics				
I-squared	52.9204932	0	81.40552	
Cochran's Q	6.3721993			
Chi2, p	0.09484123			
tau2	475.377906			

Table 7. Unadjusted Annual Household Electric Savings by Cohort - Vendor 2 Only

STUDY	KWH	LCI 90%	HCI 90%	WEIGHT (%)
E3	196.5	96	296.9	24.56303
E11	85.6	22	149.1	33.10047
E12	19.1	3.6	34.6	42.3365
Pooled	84.6866343	8.7713	160.602	100
Statistics				
I-squared	81.3178777	51.54249	92.79737	
Cochran's Q	10.7054219			
Chi2, p	0.0047353			
tau2	4942.6094			

Table 8. Unadjusted Annual Household Electric Savings by Cohort - Vendor 3 Only

STUDY	KWH	LCI 90%	HCI 90%	WEIGHT (%)
E331	84.1	35.3	132.9	41.67429
E332	89.7	48.5	131	58.32571
Pooled	87.3662395	55.86309	118.8694	100
Statistics				
I-squared	0	NAN	NAN	
Cochran's Q	0.02078026			
Chi2, p	0.88537919			
tau2	0			

Table 9. Unadjusted Annual Household Electric Savings by Vendor

STUDY	KWH	LCI 90%	HCI 90%	WEIGHT (%)
Vendor 1 (n=4 cohorts)	70.5202687	45.19092	95.84962	17.83923
Vendor 2 (n=3 cohorts)	84.6866343	8.7713	160.602	1.985935
Vendor 3 (n=2 cohorts)	87.3662395	55.86309	118.8694	11.53231
Vendor 1 (n=41 cohorts)	92.4875617	79.57491	105.4002	68.64253

Pooled	87.8232377	77.125	98.52147	100
Statistics				
I-squared	0	0	61.67656	
Cochran's Q	1.62075701			
Chi2, p	0.65469252			
tau2	0			

Table 10. Unadjusted % Annual Electric Savings by Cohort - Vendor 1 Only

STUDY	%	LCI 90%	HCI 90%	WEIGHT (%)
E61	0.0173	0.0115	0.0231	2.164624
E263	0.017	0.0085	0.0264	1.001175
E271	0.016	0.0099	0.0223	1.932607
E59	0.0153	0.011	0.0196	3.485258
E276	0.015	0.0123	0.0173	6.873074
E267	0.015	0.0093	0.0204	2.329981
E245	0.015	0.0103	0.0199	2.945544
E278	0.013	0.0115	0.0155	8.368368
E277	0.013	0.0103	0.0161	5.866716
E265	0.013	0.008	0.0172	3.146897
E249	0.013	0.0083	0.018	2.897955
E58	0.0124	0.007	0.0178	2.437778
E57	0.0123	0.0079	0.0167	3.367284
E437	0.012	0.008	0.0157	4.089201
E275	0.012	0.0092	0.0149	5.983324
E261	0.012	-0.0005	0.0244	0.536406
E251	0.012	0.0078	0.0171	3.094851
E60	0.0118	0.0072	0.0164	3.146897
E56	0.0113	0.0036	0.019	1.318656
E441	0.011	0.0069	0.0159	3.254586
E439	0.011	0.007	0.0159	3.310292
E269	0.011	0.0057	0.0155	2.851409
E253	0.011	0.0073	0.0155	3.738162
E443	0.01	0.0057	0.0152	2.994204
E247	0.01	0.005	0.0153	2.633418
E273	0.007	0.0046	0.01	6.348721
E255	0.007	0.0044	0.0104	5.641104
E445	0.006	0.0027	0.0102	4.24151
Pooled	0.01183061	0.0109	0.012761	100
Statistics				
I-squared	28.6171505	0	51.72685	
Cochran's Q	37.8242115			

STUDY	%	LCI 90%	HCI 90%	WEIGHT (%)
Chi2, p	0.08068131			
tau2	2.34E-06			

Table 11. Unadjusted % Annual Electric Savings by Cohort - Vendor 3 Only

STUDY	%	LCI 90%	HCI 90%	WEIGHT (%)
E331	0.0097	0.0053	0.0141	44.62639
E332	0.0074	0.0014	0.0093	55.37361
Pooled	0.008426407	0.005487076	0.01136574	100
Statistics				
I-squared	0	NAN	NAN	
Cochran's Q	0.409362169			
Chi2, p	0.522293421			
tau2	0			

Table 12. Unadjusted % Annual Electric Savings by Vendor

VENDOR		LCI 90%	HCI 90%	WEIGHT (%)
Vendor 1 (n=28 cohorts)	0.011830609	0.010900307	0.01276091	62.3977
Vendor 3 (n=2 cohorts)	0.008426407	0.005487076	0.01136574	37.6023
Pooled	0.01055055	0.007838273	0.01326283	100
Statistics				
I-squared	69.68392953	0	91.3281478	
Cochran's Q	3.298580536			
Chi2, p	0.069339765			
tau2	4.04E-06			

Table 13. Unadjusted % Annual Gas Savings by Cohort - Vendor 1 Only

STUDY	%	LCI 90%	HCI 90%	WEIGHT (%)
G287	0.017	0.0109	0.0241	2.329959
G284	0.017	0.0134	0.0205	3.865855
G281	0.016	0.0131	0.0192	4.158035
G286	0.014	0.0108	0.0174	4.01216
G282	0.014	0.0109	0.0172	4.099818
G268	0.013	0.0097	0.0157	4.187043
G444	0.011	0.0066	0.0155	3.351956
G285	0.011	0.0082	0.0143	4.158035
G283	0.011	0.0062	0.0157	3.18943
G274	0.01	0.0076	0.0114	4.78141
G266	0.008	0.006	0.0105	4.605242
G246	0.008	0.0051	0.0114	4.099818
G440	0.007	0.0039	0.0112	3.807482

STUDY	%	LCI 90%	HCI 90%	WEIGHT (<u>%</u>)
G270	0.007	0.0037	0.0094	4.273529
G254	0.007	0.0037	0.0094	4.273529
G250	0.007	0.0039	0.0109	3.895092
G442	0.006	0.0026	0.0093	3.982893
G438	0.006	0.0024	0.0098	3.778361
G272	0.006	0.0024	0.0095	3.865855
G256	0.006	0.0027	0.0091	4.070633
G262	0.005	0	0.0002	5.282225
G252	0.005	0.0022	0.0086	4.070633
G248	0.005	0.0021	0.0088	3.982893
G446	0.004	0.0002	0.0075	3.807482
G264	0.003	0	0.0064	4.070633
Pooled	0.008770593	0.007423186	0.010118	100
Statistics				
I-squared	87.12502624	83.12136344	90.1790083	
Cochran's Q	186.408147			
Chi2, p	0			
tau2	1.27E-05			

Table 14. Unadjusted % Annual Gas Savings by Cohort - Vendor 3 Only

STUDY	%	LCI 90%	HCI 90%	WEIGHT (%)
G334	0.54%	0.31%	1.16%	100

Table 15. Unadjusted % Annual Gas Savings by Vendor

STUDY	%	LCI 90%	HCI 90%	WEIGHT (%)
Vendor 1 (n=25 cohorts)	0.008770593	0.007423186	0.010118	76.4287
Vendor 3 (n=1 cohort)	0.0054	0.0031	0.0116	23.5713
Pooled	0.007976101	0.005622929	0.01032927	100
Statistics				
I-squared	35.32958564	NAN	NAN	
Cochran's Q	1.546302138			
Chi2, p	0.21368218			
tau2	2.01E-06			

Table 16. Unadjusted Annual Household Electric Savings by Mode - eHERs Only

STUDY	ES		LCI 90%	HCI 90%	WEIGHT (%)
E265		66.7	42.3	91	41.19133
E269		51.3	27.6	75.1	42.68537
E16		27.2	-16.1	70.5	16.1233
Pooled	5	53.75774916	35.3284732	72.18703	100

Statistics				
l-squared	21.90433062	0	91.87648	
Cochran's Q	2.560961467			
Chi2, p	0.277903683			
tau2	60.29367697			

Table 17. Unadjusted Annual Household Electric Savings by Mode – Paper HERs Only

STUDY	ES		LCI 90%	HCI 90%	WEIGHT (%)
E265		66.7	42.3	91	41.19133
E269		51.3	27.6	75.1	42.68537
E16		27.2	-16.1	70.5	16.1233
Pooled		53.75774916	35.3284732	72.18703	100
Statistics					
l-squared		21.90433062	0	91.87648	
Cochran's Q		2.560961467			
Chi2, p		0.277903683			
tau2		60.29367697			

Table 18. Unadjusted Annual Household Gas Savings by Mode - eHERs Only

STUDY	ES		LCI 90%	HCI 90%	WEIGHT (%)
G266		0.2439	0.178	0.3098	55.79064
G270		0.1812	0.1031	0.2592	44.20936
Pooled		0.216180732	0.15514932	0.277212	100
Statistics					
I-squared		30.90524817	NAN	NAN	
Cochran's Q		1.447287925			
Chi2, p		0.228963628			
tau2		0.000607487			

Table 19. Unadjusted Annual Household Gas Savings by Mode - Paper HERs Only

STUDY	ES		LCI 90%	HCI 90%	WEIGHT (%)
G268		0.5503	0.4217	0.6789	50.4011
G272		0.2358	0.0959	0.3758	49.5989
Pooled		0.394311462	0.08611704	0.702506	100
Statistics					
I-squared		90.49268463	65.6026481	97.37221	
Cochran's Q		10.51821635			
Chi2, p		0.001182035			
tau2		0.04475327			

Table 20. Unadjusted Annual Household Electric Savings by Mode

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eHERs	53.75774916	35.3284732	72.18703	52.8031
Print	120.0277736	84.1747776	155.8808	47.1969
Pooled	85.03514687	20.1938534	149.8764	100
Statistics				
I-squared	90.36740931	65.0235506	97.34716	
Cochran's Q	10.38142316			
Chi2, p	0.001272895			
tau2	1984.340047			

Table 21. Unadjusted Annual Household Gas Savings by Mode

STUDY	ES		LCI 90%	HCI 90%	WEIGHT (%)
eHERs		2.16180732	1.5514932	2.77212	87.43447
Print		3.94311462	0.8611704	7.02506	12.56553

Pooled	2.38563804	1.2284107	3.54287	100
Statistics				
I-squared	19.01934911	NAN	NAN	
Cochran's Q	1.234862883			
Chi2, p	0.266463409			
tau2	0.003017473			

Table 22. Unadjusted % Annual Electric Savings by Mode - eHERs Only

STUDY	ES		LCI 90%	HCI 90%	WEIGHT (%)
E265		0.013	0.008	0.0172	53.15475
E269		0.011	0.0057	0.0155	46.84525
Pooled		0.012063095	0.00870936	0.015417	100
Statistics					
l-squared		0	NAN	NAN	
Cochran's Q		0.34017789			
Chi2, p		0.559726558			
tau2		0			

Table 23. Unadjusted % Annual Electric Savings by Mode - Paper Only

STUDY	ES		LCI 90%	HCI 90%	WEIGHT (%)
E271		0.016	0.0099	0.0223	27.71434

E267	0.015	0.0093	0.0204	31.73548
E331	0.0097	0.0053	0.0141	40.55017
Pooled	0.013127984	0.00904078	0.017215	100
Statistics				
l-squared	43.38662266	0	83.01856	
Cochran's Q	3.532733947			
Chi2, p	0.170952945			
tau2	5.68E-06			

Table 24. Unadjusted % Annual Gas Savings by Mode - eHERs Only

STUDY	ES		LCI 90%	HCI 90%	WEIGHT (%)
G266		0.008	0.006	0.0105	61.6041
G270		0.007	0.0037	0.0094	38.3959
Pooled		0.007616041	0.00585005	0.009382	100
Statistics					
I-squared		0	NAN	NAN	
Cochran's Q		0.291350688			
Chi2, p		0.589356276			
tau2		0			

Table 25. Unadjusted % Annual Gas Savings by Mode - Paper Only

STUDY	ES		LCI 90%	HCI 90%	WEIGHT (%)
G268		0.013	0.0097	0.0157	50.95693
G272		0.006	0.0024	0.0095	49.04307
Pooled		0.009566985	0.00270837	0.016426	100
Statistics					
I-squared		88.52343948	56.3198631	96.98464	
Cochran's Q		8.71341199			
Chi2, p		0.003158774			
tau2		2.17E-05			

Table 26. Unadjusted % Annual Electric Savings by Mode

STUDY	ES		LCI 90%	HCI 90%	WEIGHT (%)
eHERs (n=2 cohorts)	0.012063095		0.00870936	0.015417	59.76229
Print (n=3 cohorts)					
		0.013127984	0.00904078	0.017215	40.23771

Pooled	0.012491582	0.00989894	0.015084	100
Statistics				
I-squared	0	NAN	NAN	
Cochran's Q	0.155840593			
Chi2, p	0.693015217			
tau2	0			

Table 27. Unadjusted % Annual Gas Savings by Mode

ES	LCI 90%	HCI 90%	WEIGHT (%)
0.007616041	0.00585005	0.009382	93.7824
0.009566985	0.00270837	0.016426	6.2176
0.007737343	0.00602714	0.009448	100
0	NAN	NAN	
0.291497032			
0.589262792			
0			
	ES 0.007616041 0.009566985 0.007737343 0.007737343 0.007737343 0.007737343 0.007737343 0.007737343 0.007737343 0.007737343 0.007616041	ES LCI 90% 0.007616041 0.00585005 0.009566985 0.00270837 0.0007737343 0.00602714 0 NAN 0.291497032 0.589262792 0 0	ES LCI 90% HCI 90% 0.007616041 0.00585005 0.009382 0.009566985 0.00270837 0.016426 0.0007737343 0.00602714 0.009448 0 NAN NAN 0.291497032 0.589262792 0 NAN