

# MEMORANDUM

**Date:** 4/7/23

**To:** Romilee Emerick and original distribution list

**From:** EA team and R1983 Evaluation Consultants

**Subject:** Response to Email of Preliminary Questions from Eversource (Emerick) on R1983 Draft Report dated 3/28/23

## Abstract

**Summary:** *The EA and the consultant team appreciate the time and attention reflected in the comments on the R1983 draft report recently provided by Eversource. After careful review, the comments provided from Eversource precipitated no change in the program's estimated billing analysis savings, and no revisions related to weather normalization. The overall revised realization rate (RR) results have only limited overall impact of program-level gross realization rates (RR). This is because they were revised downward or remained the same for the vast majority of participants (~80%) and were revised upward for only ~20% of the participants.*

**Data effects on ex ante calculations:** *Analysis shows that a key source of deviations of the Draft Report's independently-calculated ex ante values compared to reported ex ante savings values traces to problematic evaluation / tracking data provided to the evaluators by one of the utilities. After more than a year of waiting for the evaluation data request to be fulfilled with usable data, and multiple recalled and rejected datasets, the data sets that were provided and cited as "to be used" were missing pre/post CFM and R-values for the HES-IE program. The consultants applied defensible practices and used data from the other utility to impute the missing data. This resulted in the deviation in ex ante numbers independently calculated by the evaluators compared to the tracking data ex ante savings values.<sup>1</sup> RR computations using the independently-calculated values therefore differ from those derived from the tracking data.*

**Recommendations:** *Given this and other issues described below (as well as time considerations), the EA and R1983 evaluation team propose to recommend using RRs based on the unchanged billing savings and the tracking-based ex ante savings. The resulting participant level gross realization rates (GRRs) are: Air Sealing Only participants - 17% and 10% for HES and HES-IE, respectively (~80% of participants), and 43% and 45% for Air Sealing and Insulation participants (~20% of participants). The team will need to convert these participant-level GRRs into measure-level GRRs for the TRM. Other comments from the Eversource memo will be addressed as clarifications and edits in the report revision process.*

*The EA and evaluators note that reliable (and timely) data are needed to support evaluations that inform program investments of millions of dollars, and strongly recommend continued monitoring of data quality and timeliness performance in delivery of evaluation data by the utilities.<sup>2</sup> More explanation of the responses to Eversource is included in detailed writeups provided below.*

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<sup>1</sup> Importantly, note that ex ante values for HES, which were not affected by this missing data issue, coincided well.

<sup>2</sup> Note there was a different data issue presented in the data from the other utility.

## Detailed Responses

Below are more detailed, inline responses to Eversource's preliminary comments on the draft R1983 HES and HES-IE Impact and Process Evaluation.

### A. Eversource

*We are sending over preliminary comments and questions on the R1983 report to help alleviate a time crunch before the study cut-off date (pushed out to 6/1 for this study). We are concerned the errors we found in the calculation workbook will significantly change the results of the study. We have reviewed the assumptions and calculations in the insulation tab and found a number of errors (i.e. referencing UI values for Eversource ex-ante savings and realization rates, using HES-IE values for HES realization rates, potential weighting issues, etc). Due to the degree and amount of these errors on the insulation tab, we are asking that a thorough QA/QC exercise be done for the rest of the spreadsheet before we continue reviewing. We have also included general comments and questions from our brief review of the report.*

*Comments:*

- *Insulation tab*
  - o *The ex-ante savings values for overall insulation seem to be a total of wall insulation, ceiling insulation and floor insulation values. This calculation assumes that each home is going to get every type of insulation. However, as noted in the report, most homes only get ceiling insulation so we do not feel this is an accurate representation of the program's ex-ante savings. Is there a reason a weighted average was not used instead? Also, the insulation values listed for ES are pulled from UI's tables.*
  - o *The combined ex-ante values used to calculate the Gross Realization Rates give equal weight to the Eversource and UI values. Why wouldn't it be weighted according to customer counts or distribution of savings? The breakdown between electric customers is 80/20 ES/UI.*

### **Evaluation Team: Regarding Evaluated (Ex Post) Savings And Accounting of Expected (Ex Ante) Savings**

No change in billing analysis savings: The key results of the R1983 evaluation—the ex post billing analysis results for air sealed and/or insulated participants—are unaffected by the comments provided by Eversource and therefore unchanged.

No revisions in weather normalization: Eversource's primary concern with the ex post billing analysis related to weather normalization. Our team followed the US Department of Energy (DOE) Uniform Methods Project's (UMP) recommended approach to weather normalization and

are confident in both the normalization process and results. We will add more documentation to the revised report to ensure future readers understand the process the team used.

The examination of the comments related to ex ante savings and the realization rates was more complicated.

Cell references were revised: Eversource is correct that the evaluation team inadvertently mixed ES and UI cell references and included a broader set of participants and insulation types in the previous ex ante calculation. We revised the formulae and recalculated the ex ante savings.

Resulting changes in ex ante savings led to revised Realization Rates: Table 1 compares results from the original and revised computations for ex ante savings and the resulting gross realization rates (RR) for the program’s two weatherization participant types – air sealing only participants and participants that installed insulation after receiving air sealing. Three calculations are compared:

1. **Calculated** by the evaluation team using the PSD algorithms and as shown in the draft R1983 report.
2. **Calculated** by the evaluation team using the PSD algorithms after revising the calculations to address the issues identified by Eversource).
3. **Reported** by Eversource and UI in the provided program tracking data.

Gross realization rate is computed as ex post savings / ex ante savings. In each calculation, the same numerator is used – the modeled billing analysis savings (ex post), shown in the top row of the table. Therefore, all variations in the results derive from changes in the ex ante savings.

**Table 1: Comparison of Ex Ante Savings and Realization Rates for HES and HES-IE**

|  | Metric         | HES (CCF/year)   |                          | HES-IE (CCF/year) |                          |
|--|----------------|------------------|--------------------------|-------------------|--------------------------|
|  |                | Air Sealing Only | Air Sealing & Insulation | Air Sealing Only  | Air Sealing & Insulation |
| <b>Ex Post Billing Analysis (All)</b>      | <b>Savings</b> | <b>17</b>        | <b>77</b>                | <b>11</b>         | <b>108</b>               |
| <b>1.Calculated</b> Ex Ante (Draft Report) | Savings        | 69               | 415                      | 71                | 303                      |
|  | RR             | <b>25%</b>       | <b>19%</b>               | <b>15%</b>        | <b>36%</b>               |
| <b>2.Revised</b> Ex Ante (calculated)      | Savings        | 100              | 183                      | 75                | 162                      |
|  | RR             | <b>17%</b>       | <b>42%</b>               | <b>15%</b>        | <b>67%</b>               |
| <b>3.Reported</b> Ex Ante (Tracking)       | Savings        | 100              | 181                      | 106               | 238                      |
|  | RR             | <b>17%</b>       | <b>43%</b>               | <b>10%</b>        | <b>45%</b>               |

*Realization Rate (RR) calculated as ex post (top line) divided by relevant ex ante.*

Effects on overall program-level RRs are limited: RRs fell or were the same for the vast majority (about 80%) of participants, and rose for about 20%: Compared to the Calculated ex ante results included in the Draft Report (1), the revised calculated ex ante savings (2) led to:

- Lower or similar realization rates for air sealing only participants, which represent the vast majority (~80%) of total participation
- Higher realization rates for air sealing & insulation participants, which are ~20% of total participation.

Given that the bulk of the participants are in the second group with lower or same RRs, the change to the revised realization rate has a *limited overall impact of program-level gross realization rates*. This is true for both the ex ante savings included in (2) and (3) in Table 1.

Comparisons of ex ante savings (and resulting RR) values shows one major deviation: As part of independent evaluation work, the evaluators calculate ex ante values (Table 1, Group 2). The revision brought the team's calculated savings into closer alignment with the reported savings in the program tracking data (Table 1, Group 3). However, comparing these values to the reported ex ante from the tracking data, the last two columns (HES-IE), and particularly the last one, show substantial deviations (162 vs. 238 ccf/year). This notable exception is HES-IE air sealing & insulation participants and, to a lesser extent, HES-IE air sealing only participants. As a consequence, the RRs for those entries also deviate from those calculated using the tracking data.

Underlying source for the variation in ex ante savings derives from the utility data supplied for the evaluation: After multiple rounds of data recalls and rejections, the evaluation final set of UI-approved program data supplied did not include detailed information about pre/post CFM and R-values. Therefore, the evaluation team imputed these values using averages from Eversource's HES-IE data. Potential differences between UI and Eversource's HES-IE customers are likely driving the disparity between the calculated and reported ex ante values. The issue is further exacerbated by the fact that the evaluation team had more sample points for UI than Eversource due to an unresolvable account-number-masking issue present in Eversource HES-IE data.

Recommended RRs provided below: Given these issues and the consistency between the revised calculated and reported savings for HES, and time constraints, the EA and evaluation consultants propose to *recommend using the reported savings to establish average ex ante savings for HES-IE, as well as HES*. These values are provided Table 2. The team will need to convert these participant-level GRRs into measure-level GRRs for the TRM.

**Table 2: Proposed Recommended Values for Ex Post savings and Realization Rates**

|   | Metric         | HES (CCF/year)   |                          | HES-IE (CCF/year) |                          |
|---|----------------|------------------|--------------------------|-------------------|--------------------------|
|   |                | Air Sealing Only | Air Sealing & Insulation | Air Sealing Only  | Air Sealing & Insulation |
| <b>Ex Post Billing Analysis</b>         | <b>Savings</b> | <b>17</b>        | <b>77</b>                | <b>11</b>         | <b>108</b>               |
| <b>Reported</b> Ex Ante (tracking data) | Savings        | 100              | 181                      | 106               | 238                      |
|   | RR             | <b>17%</b>       | <b>43%</b>               | <b>10%</b>        | <b>45%</b>               |

It is important to note that the gross realizations reflect the realized savings at the participant-level for customer that received these measures. This is similar to, but different than, air sealing and insulation-specific gross realization rates like those in Table A3-4 in the 2022 PSD, which are shown below, for air sealing and insulation.

- HES & HES-IE Blower Door Air Sealing, Gas: 70%
- HES Insulation, Gas: 121%
- HES-IE Insulation, Gas: 84%

Our team will send directly comparable measure-level gross realization rates by Wednesday, April 12. While the numbers in the table above and bullets are not directly comparable, the measure-level gross realization rates resulting from R1983 will be considerably lower than the PSD current values.

**B. Eversource**

*The resulting realization rates from this study should reference Gross Realization Rate 1. Instead the calculations unnecessarily apply the 2022 Realization Rates to derive the recommended realization rates in Table 3 of the report. It is not clear why the 2022 realization rates should impact results, or why the study team is directing the utilities to use Gross Realization Rate 2.*

**Evaluation Team:**

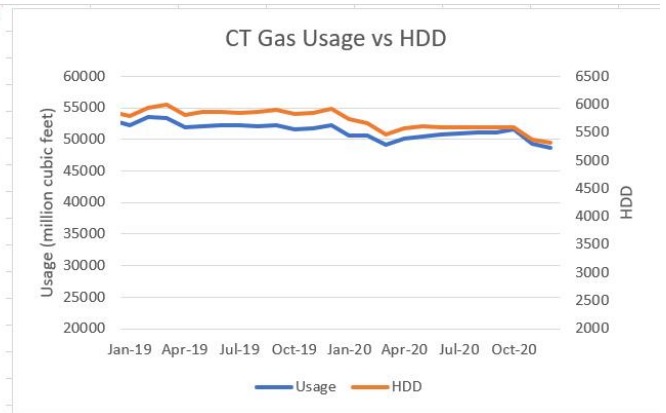
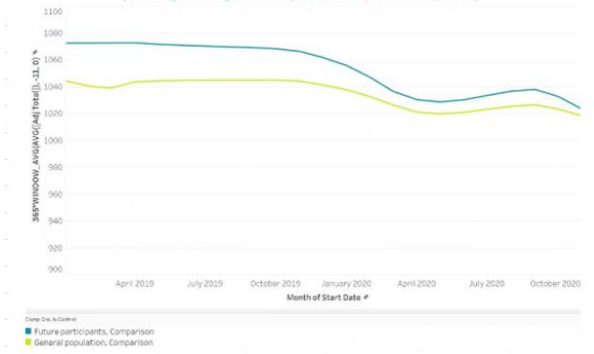
Our team included an explanation of the calculation and purpose of gross realization rates in the report and supporting workbook. We continue to believe each offers different and important perspectives that merit inclusion in the report.

Given Eversource’s comments, we will look to clarify our explanation and rationale when we revise report after receiving all stakeholder comments on the draft. We will also use that opportunity to rename “Gross Realization Rate 2” as we believe the similarity of the names is contributing to the confusion.

Specifically, we will change “Gross Realization Rate 2,” which includes application of 2022 PSD realization rate, to “Achieved Savings Rate.” This terminology not only better distinguishes it



**Figure 22: Average Normalized Annual Consumption of "Future" Participant and General Population Control Groups Customers (Rolling average of the previous 12 months, HES)**



### Evaluation Team: Weather Normalization

For the billing analysis, our team followed the two-stage process for calculating the normalized consumption as outlined in the DOE’s UMP for Whole-building Retrofit with Consumption Data Analysis Evaluation Protocol. The UMP method involves fitting parameters describing baseload and HDD components to describe actual usage of each participant based on actual HDD. Normalized consumption is calculated by using TMY3 based HDD values which are multiplied by the heating coefficient and added to the baseload described by the models for each participant.

After receiving Eversource’s comments, our team reviewed our weather normalization process with the EA Team. The review confirmed our approach and did not identify any issues. We will also add documentation to the revised draft report that provides greater detail about our weather normalization process to avoid ambiguity for future report readers.

To confirm that the UMP process yielded the usage, as described in Figure 22 of the R1983 Report, and that actual HDD is not driving the consumption curves presented, we have plotted more granular steps of the normalization process below.

Figure 1 shows the 12-month rolling average of the average annual usage and the 12-month rolling averages of the intercepts and HDD coefficients. We continue showing the values for future participants in blue and the general population in yellow.

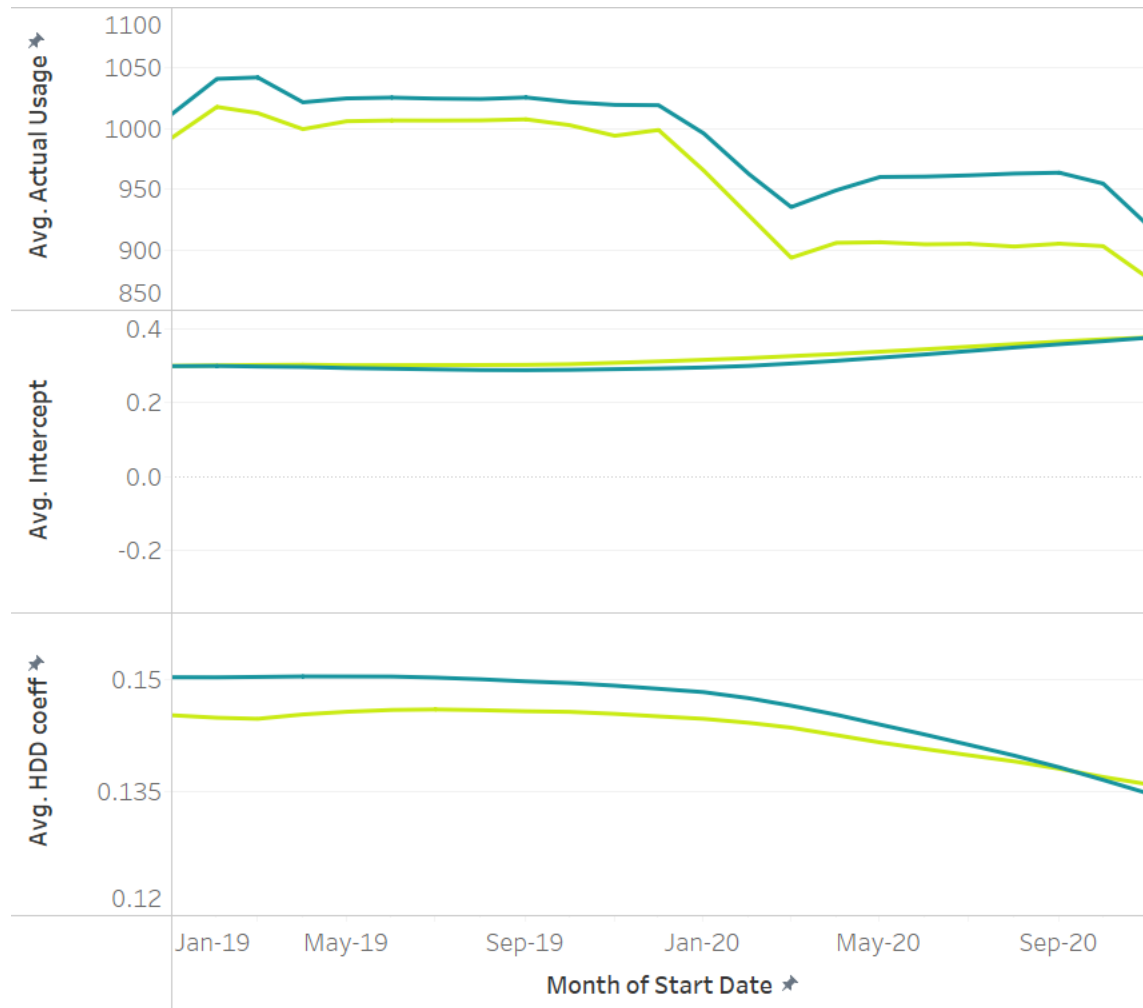


Figure 1



If the team plugs in the actual HDD values, the model closely recreates the curve shape apparent with minimal smoothing, as shown in Figure 2

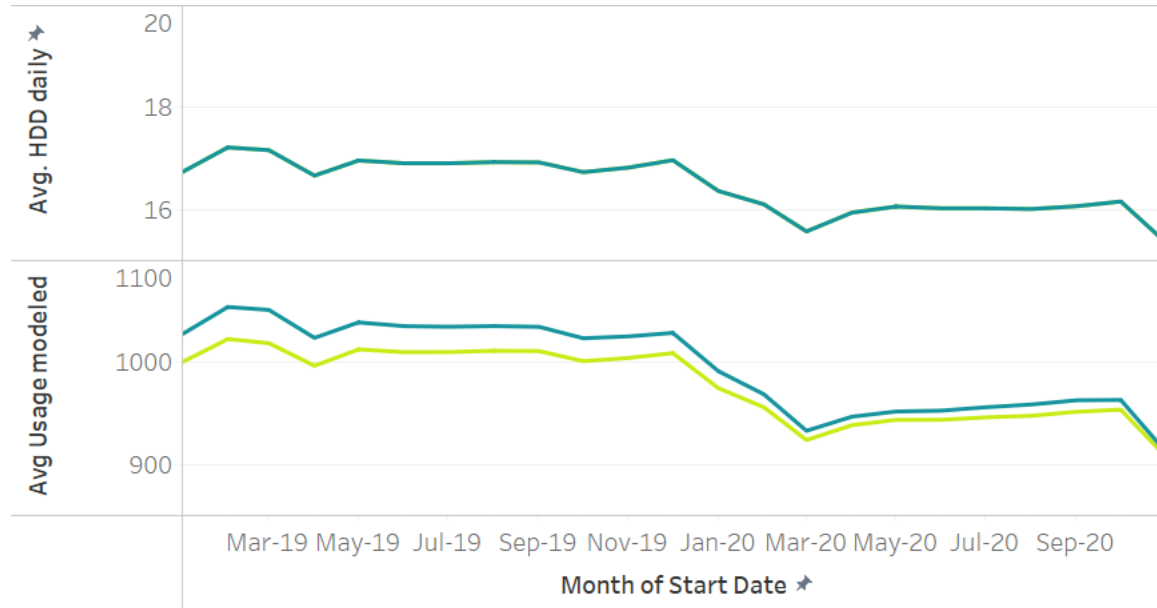


Figure 2

To weather-normalize the usage, we use the same modeled parameters for each participant, but instead plugged in HDD value derived from TMY3 data. We show the 12-month rolling average of the TMY3 HDD, and as expected, the value is flat. This is because the same values are used for each month regardless of year. By inserting these values, we see the curve in Figure 3 below, which is the curve reflected in Figure 22.

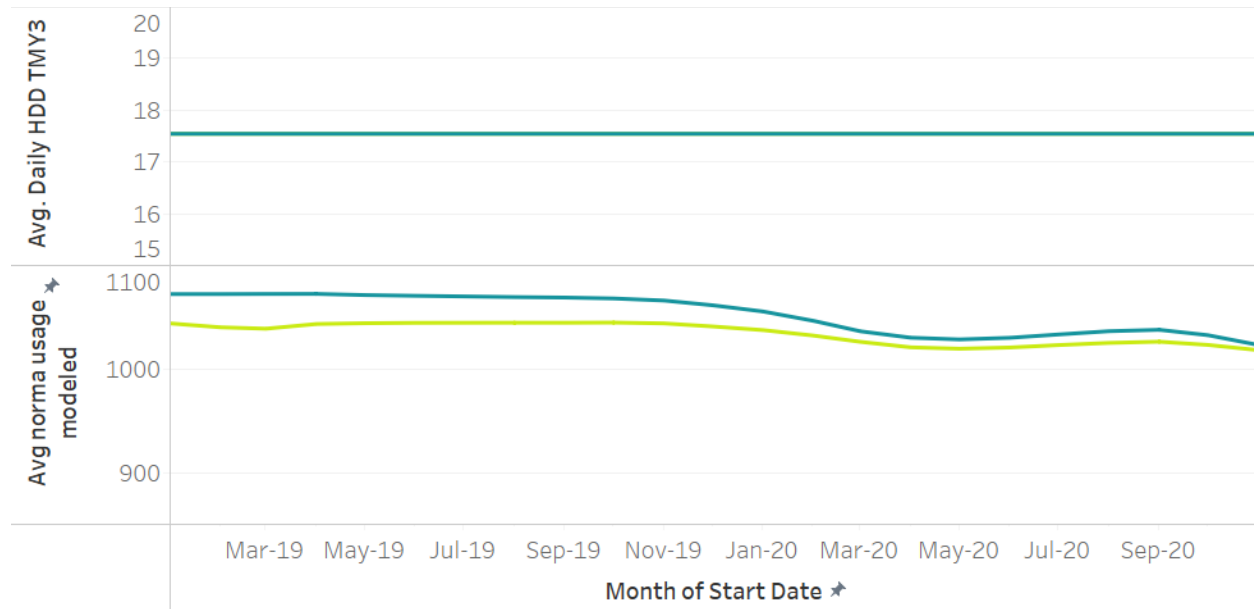


Figure 3

The dip in modeled usage is a byproduct of the modeling shifting attribution of usage to the baseline component and away from the weather dependent component.

## Other Questions

### E. Eversource

*Due to the number of errors that we have found overstating the ex-ante savings and the lower than expected ex-post savings results, we would also like to be able to review the ex-post analysis as well. Is it possible to get an anonymized (or Eversource only) summary of the ex-post savings in an Excel format with values such as customer identifier, insulation type/air sealing, pre usage, post usage, savings reported, weather normalized calculated savings, pre/post R values, pre/post cfm, sq footage of insulation and any other fields deemed useful in such a review?*

### Evaluation Team

We are happy to provide you with the data set you described but want to be clear that we do not have modeled ex post savings at the participant level. We used a pooled model as discussed in A.4.5.

However, we can provide difference-of-difference savings for individual participants (i.e., change in annualized weather normalized consumption of the participant relative to the control group of future participants). We created and used that as part of our QA/QC process. This is the “weather normalized calculated savings” in your request.

We will provide this data set as soon as possible, and no later than Wednesday, April 12, 2023.

#### **F. Eversource**

*On the program data tab, the number of ES customers with Rpre is about half of the number of customers for Rpost. Is this solely due to eliminating the R pre= 0 customers?*

#### **Evaluation Team**

That is correct.

#### **G. Eversource**

*What data field was used as the installation date to determine beginning of the post period?*

#### **Evaluation Team**

For UI, we used a field called *install\_d*, which was included in all the data set UI provided.

Eversource provided data with one date field per data set, although the field name was slightly different depending on the specific program:

- **HES core:** PROJECT\_ADD\_TO\_INVOICE\_DATE
- **HES-IE legacy:** Invoice\_Date
- **HES-IE sub 1&2:** PROJECT\_ADD\_TO\_INVOICE\_DATE
- **add-on programs:** Invoice\_Date

During a data discussion with Eversource during the data request process, we asked whether our team should use the lone date field provided (as we typically look for an installation date). Eversource told us we should use the invoice date field and that doing so would be consistent with data retrieved for past evaluation.

When a participant had multiple install/invoice dates, we used the most recent date associated with an analyzed program measure to demarcate the post period.

#### **H. Eversource**

*Table 33 and 34 note 10-12% of accounts were removed due to attic hatch only. Can you clarify what is meant by attic hatch only?*

#### **Evaluation Team**

“Attic hatch only” means a participant did not also insulate the rest of the attic or any other part of the home. They *only* received a rebate for the attic hatch measure, which is a separate PSD measure and line item in the program tracking data. We removed these participants from the billing analysis sample because including them in our definition of “insulated” customers would be inconsistent with the program’s accounting. It would also have decreased the average

savings from the billing analysis as the savings for the attic hatches are small relative to fully insulating an attic.

#### **I. Eversource**

*Table 33 and 34 show the analysis lost 66% of HES and 76% of HES IE customers. While there were enough accounts available to generate statistically significant estimates at the statewide level, we would like to see validations showing the remaining customers left in the sample were representative of the HES and HES-IE populations.*

#### **Evaluation Team**

We will also provide this data set as soon as possible, and no later than Wednesday, April 12, 2023.