

January 20, 2016

Lisa A. Skumatz, Ph.D.
Skumatz Economic Research Associates (SERA)
762 Eldorado Drive
Superior, CO 80027

RE: Review of Impact Evaluation Best Practices (R91)

Dear Dr. Skumatz,

Eversource Energy (“Eversource”) is pleased to submit these written comments with regard to a draft evaluation report: *Review of Impact Evaluation Best Practices* (“Report” or “Study”), December 22, 2015, The Cadmus Group, Inc. and NMR Group, Inc. (“Evaluator”). Eversource received the Report with a request to provide comments. The purpose of the Report was to survey evaluation best practices and to apply these practices to the R16 impact evaluation of the HES and HES-IE programs.

Based on the study design¹ for the Report, the Report had three primary objectives and two priority outcomes:

Objectives

1. To review the best approaches for impact evaluations – billing analysis and engineering approaches – and describe / discuss the causes of differences in results, and use illustrations from other utilities as possible;
2. To specifically drill down into the case of Connecticut’s R16 impact evaluation study, assessing the disconnects between the engineering and billing analysis performed in the study, focusing mostly (but not solely) on cases where realization rates for gas measures are low.
3. Additionally, the evaluation team will review the oil and propane treatment in the impact evaluation and assess alternative approaches – theoretical / proposed or in use elsewhere – to provide advice to future Connecticut evaluation work.

Priority Outcomes

1. Advice on best practices for impact evaluation approaches, including evaluations of oil and propane customers.

¹ Based on the “one pager” submitted to the EEB Evaluation Subcommittee for this Report: “R91: Impact Evaluation Disconnects between Engineering and Billing Analysis, and Oil / Propane Treatment in Impact Evaluation.” 4/10/15

2. Feedback on the drivers or causes for the gas realization rates in Connecticut’s recent impact evaluation – and information useful to planning and PSD inputs.

The Report provided the following six recommendations followed by Eversource responses:

1. **Update simulation models for air and duct sealing.** Revise models to use an hourly-iterative simulation software and draw upon participant home characteristics, differentiating between different building, customer, and HVAC types to award the most appropriate savings. Calibrate model prototypes to participant data to ensure that typical consumption patterns of Connecticut customers are reflected in savings computations. In future evaluations, ensure evaluators and PSD developers use an hourly-iterative software package that uses default assumptions and load shapes that are appropriate for residential applications (e.g., BEopt).

Eversource Response: The Report does not provide evidence that more sophisticated software would produce more reliable results. In fact, there is evidence that simple “spreadsheet” calculations may provide more reliable results than sophisticated modelling software.² In addition, many jurisdictions utilize simple deemed values to estimate savings. Eversource does agree with the concept of calibrating savings to billing data and requests that the Evaluator provide some insight on how to best do this. Eversource also requests the electronic REM/Rate file that was used to generate Figure 14 in the Report be provided.

2. **Differentiate savings values based on population segment.** Certain population segments may not be reflected accurately by the savings developed for an average participant home in the PSD, such as multifamily customers and the lower-income participants in the HES-IE program. By adjusting simulation or algorithm inputs and permitting appropriate savings to be awarded specific to these population segments, accuracy of the program-wide *ex ante* savings calculation may be improved.

Eversource Response: Eversource currently adjusts blower door savings for multifamily customers to common walls. Eversource does not adjust blower door savings for limited income customers because it does not have a basis for that adjustment. This Report does not provide evidence that adjusting PSD savings for population segments will increase the accuracy of the program-wide *ex ante* savings calculations.

3. **Account for interactivity between HVAC and envelope measures.** Individual measure savings are lowered if installed concurrently; for example, performing duct sealing increases distribution efficiency so that if attic insulation is then installed, heating load drops by a much smaller amount than it would if ducts remained leaky. To account for this interactivity, make an adjustment to reduce savings when multiple shell- or duct-improvement measures are implemented through the program.

² <http://www.greenbuildingadvisor.com/blogs/dept/musings/energy-modeling-isn-t-very-accurate>

Eversource Response: Eversource agrees with this recommendation. However, it should be noted that interactivity between HVAC and envelope measures does not appear to be a primary driver of low realization rates.

4. **Consider whether additional weather and location assumptions can improve savings estimates.** The PSD currently uses only a single weather profile to estimate weather patterns that influence savings, which may not reflect the geographic distribution of participants across the state. Areas where a large number of participants are identified (e.g., Bridgeport) have notably lower HDDs than reflected by the statewide average or Hartford weather profiles.

Eversource Response: Eversource does not believe the use of an average degree day values to be a significant driver of overall realization. While the PSD does use a single statewide average degree-day average in the PSD (5,885 °F-day per year), results will average out across the program: some projects will have higher estimated savings (e.g. Bridgeport with 5617 degree-days), while other projects will have lower estimated savings (Hartford with 6,235 degree-days).

5. **Verify that heating HVAC efficiency assumptions remain valid.** Current gas and oil furnace efficiency assumptions are lower than the federal standard and current market conditions, which may artificially increase savings. Lower furnace efficiencies require greater HVAC energy consumption to meet winter setpoint temperatures; therefore, measures such as insulation, air sealing, and duct sealing, which reduce heating load, have an amplified effect. Furnace efficiency assumptions influence savings calculated both through building simulation and through the algorithmic approach applied for insulation measures.

Eversource Response: The Report based this recommendation on a 75% adjustment factor that the PSD uses to adjust estimated electric resistance savings to fossil fuel savings. This factor is used throughout the PSD on all weatherization measures and represents total system efficiency (including the effects of combustion losses *and* distribution losses). The Evaluator incorrectly assumed that this factor was the Annual Fuel Utilization Efficiency (AFUE). Eversource acknowledges that the labelling in the PSD could be clearer³ but notes that the Evaluators should have realized that the equation had to include distribution losses because they were not accounted for elsewhere in the equations.

6. **Update the HDD adjustment factor for insulation measures.** For attic and wall insulation savings, the current HDD correction factor, which draws from ASHRAE's 1989 handbook, may be outdated. An updated value is not provided in more recent versions of this handbook. Provide transparency in what this value seeks to represent.

³ The 2015 PSD describes this factor as the "heating system efficiency" (not an AFUE). The 2016 PSD is clearer in that it describes this factor as the "Fossil Fuel System Efficiency including distribution loss".

Eversource Response: It is true that ASHRAE has not updated the HDD correction factor. Eversource’s understanding is that ASHRAE only updates factors when there are revisions. Based on the ASHRAE Authors and Revisers Guide, the ASHRAE Handbooks are a lasting reference, and therefore, material is not always repeated in subsequent volumes.

Eversource feels that the first objective (Review best approaches) above was adequately addressed in Section I of the Report. Section I included informative discussion of the most prevalent evaluation approaches and methodologies and advantages and disadvantages of each type. In addition, it included a literature review of standard evaluation protocols and standards. Section I of the report included an appropriate level of detail and provides relevant background information on evaluation methods. Eversource does not have any comments or suggestions in regards to this portion of the Report.

While the Report adequately met the first objective, Eversource is disappointed that the Report did not fully meet the second objective (assessing disconnects in R16). Based on the objectives of this Report, Eversource believed that this Report would *specifically* address the disconnects (i.e., the low realization rates) in the R16 impact evaluation. While the Report provides some high level guidance on adjustments that might be made to the Program Savings Documentation (PSD), these recommendations were incomplete, impractical to implement, and do not appear to tie directly to the results of the R16 impact evaluation or other work that was being performed concurrently for a separate (but related) study: *R151 Connecticut HES Air Sealing, Duct Sealing, and Insulation Practices Report*.⁴ In particular, the site visits conducted as part of the R151 study might shed some light on the low realization rates. However, the R151 findings are conspicuously missing from this Report.

Eversource expected this Report to “identify key differences in assumptions and actual values for participating homes”, to “specify root causes that drive estimates and have high differences between assumed value and actual values” and to “apply these best practices”. In general, the Report offers recommendations that would reduce the variability of savings estimates on a project-by-project basis, but not significantly impact the population-wide disconnect between estimates and actual savings. The Report provided only general PSD recommendations for consideration, whereas it should have provided specific recommendations that tie specifically to both R16 and R151, including recommendations relating to program implementation. Therefore, the Report did not fully meet its objectives because it did not conduct a comprehensive investigation including but not limited to the following factors that could have influenced reported savings.

- Improper air sealing or duct sealing techniques which may cause premature failure of measures (e.g. foil tape on ducts versus mastic) as identified in R151.

⁴Evaluation Study *R151 Connecticut HES Air Sealing, Duct Sealing, and Insulation Practices Report* was being conducted simultaneously with this report. This Report acknowledges that R151 was being researched, but fails to link the field findings in that study with the recommendations in this Report despite that these two reports shared a common author. This is an unfortunate disconnect because the R151 Study found some evidence that low realization rates may have been caused by poor quality weatherization measures.

- Low quality insulation (Grade II or Grade III) installation, missed insulation, or uneven insulation (as identified in R151).
- Improper insulation inputs including pre-installed and post installed R-values. For example, did vendors report zero R-value pre-insulation when some insulation was present?
- Abnormally low thermostat setting or large thermostat setbacks in homes or zones within homes.
- The impact of thermal regain on measures that may be incorporated into PSD formulas.
- The quality of air sealing (based on location e.g., attic air sealing versus basement air sealing) and its impact on energy savings. Should the PSD differentiate air sealing savings in the attic versus air sealing in a neutral pressure plane?
- The quality of duct sealing based on location (attic versus basement), and supply versus return ducts. Should the PSD differentiate between attic and basement duct sealing?
- Improper air sealing of basement locations as identified in R151.
- Vendor reported test results that were not supported site findings, tracking system data, or by billing data.

Eversource believes that the Evaluator should identify a subset of outlier homes that exhibit very high ex-ante savings versus actual consumption or usage. The evaluator should then review project files for these homes and possibly conduct site visits in order to assess possible drivers.⁵ In addition, the results of R151 should be incorporated into this Report. This process will allow the evaluator to identify specific trends that could be driving R16's realization rates and make firm corrective recommendations in order to meet the stated objectives of this study. Eversource is committed to identifying these root causes and making improvements to planning, the PSD, and implementation. However, without the detailed analysis that Eversource is recommending, the potential value from this Study will not be fully realized.

To help ensure efficient and timely completion of a final Report that provides utmost value, Eversource encourages clarifying questions from the Evaluator (via the established evaluation protocols) on these comments.

Sincerely,

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⁵ For example, the ECB Impact Evaluation (C20) successfully used this method to identify key drivers of realization rates.

