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| To: | Sam Dent, VEIC; Jennifer Morris, David Brightwell, ICC; Vince Gutierrez, Erin Daughton, ComEd |
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| From: | Rick Berry, Charles Ampong, Nishant Mehta, Guidehouse |
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| Date: | August 4, 2020 |
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| Re: | Treatment of Negative Electric and Gas Savings by Evaluation |

# Introduction

Throughout the evaluation cycle there are several instances where the concepts of negative savings and heating penalties are presented. For clarification, in this memo:

* “negative savings” refers to savings values that correctly calculate to negative values
* “heating penalties” refers to negative interactive effects on the heating system.[[1]](#footnote-1)

While negative savings can be generated in both electric and gas programs, heating penalties are typically only generated by electric measures. This memo presents these scenarios (outlined in Table 1) to clarify how Guidehouse has historically treated them while also asking for clarification on how to treat them in the future.

Table . Guidehouse Action by Scenario

| Scenario | Traditional Guidehouse Action |
| --- | --- |
| **Appropriate Result of Project Disaggregation** (one or more individual tracking data line items are negative but part of a larger project that is net positive) | Sum the negative values with positive values at project level. |
| **Appropriate Result of Unexpected Customer or Trade Ally Action** (e.g., trade ally reducing the amount of thermostat setback to meet customer comfort) | Treat negative savings values as verified savings. |
| **Potentially Inappropriate Result of Custom Analysis** (e.g., project-level billing analysis shows an unexplained increase in energy consumption) | Treat projects that result in negative savings as zero savings. |
| **Resulting from Actions Taken to Meet Code**  (e.g., custom HVAC project involves among other things, increasing ventilation to meet code) | Treat measures that result in negative savings as zero savings. |
| **Resulting from Errors in the Illinois Technical Reference Manual (TRM)**  (e.g., the TRM v6.0 thermostat algorithm producing negative gas savings where they should be positive) | If correctable, correct the TRM error. If unable to correct, treat measures that result in negative savings as zero savings. |
| **Resulting from Fuel-Switching Measures** (e.g., ductless heat pump with gas heated baseline) | If switching from gas to electric technology, assume an electric baseline in accordance with the TRM, which produces no negative electric impact. Negative gas savings result after midlife adjustment and are treated as verified savings, per the TRM.  Switching from electric to gas technology is rare and Guidehouse does not have a traditional course of action for this scenario. |
| **Electric Heating Penalties** | When calculable, the negative heating savings are summed with the positive values at the project level. These values are reported in the final evaluation reports. |
| **Gas Heating Penalties** | Gas heating penalties are not added to any positive gas savings values. These values are reported in the final evaluation reports. |
| **Ambiguity in Determining the Heating System Fuel Source** | It is not clear how evaluators or implementers should categorize the heating systems. |

# Negative Savings

Negative savings typically occurs as an interactive effect for lighting or furnace blower motors or when the tracking data relies on a custom input.

### Requests for Clarification

1. How should evaluation treat measure installations that result in negative savings?

## Appropriate Result of Project Disaggregation

In some cases, negative energy savings is an expected outcome. In the ComEd Standard Program, interior lighting projects may include several lighting measures, each correlating to a particular space or fixture type. In this scenario, it is common for one or several measures to result in negative energy savings, but the project results in net energy savings.

**Traditional Guidehouse Action.** In these cases, Guidehouse has always counted the negative savings in the project (and program) as verified savings.

## Appropriate Result of Unexpected Customer or Trade Ally Action

In other cases, negative energy savings is an unexpected outcome. There are several examples of this occurring:

* In the previously existing ComEd AirCare Plus Program,[[2]](#footnote-2) the program tracked custom algorithm input values for the thermostat adjustment measure. In rare cases, the amount of thermostat setback decreased (e.g., 10°F of setback reduced to 8°F of setback, typically for customer comfort) from the adjustment, resulting in negative energy savings.
* A customer raises their water heater temperature instead of lowering it.
* A customer installs a chiller that is less efficient than local energy code.
* A customer purchases LED lamps from a midstream program but then returns them.

**Traditional Guidehouse Action.** In these cases, Guidehouse has counted the negative savings in the project (and program) as verified savings. This agrees with comments received from Jennifer Morris on a previous evaluation report.[[3]](#footnote-3)

### Request for Clarification

1. How should evaluation treat projects that result in negative savings due to unexpected customer or trade ally action?

## Potentially Inappropriate Result of Custom Analysis

An example of this scenario involves the ComEd Standard Program’s Energy Management System (EMS) measure. This is a prescriptive non-TRM measure that is typically evaluated using a regression analysis at the project level. The EMS measure has a tremendous amount of variability that can be a function of a number of different building characteristics: type, size (ft2), HVAC systems, existing HVAC control strategies, etc. The evaluation team has limited tools to evaluate this type of measure when it is administered prescriptively,[[4]](#footnote-4) and we have recognized that regression analysis is sometimes an imperfect tool for evaluating this measure. Occasionally, regression analyses will show that energy consumption has increased after the installation of a new EMS. While this measure is a prescriptive measure for ComEd, it is a custom measure for the gas utilities and has the same potential for negative savings.

**Traditional Guidehouse Action.** In these cases, Guidehouse has not counted the negative savings as verified savings, but rather as zero verified savings. This is due to the recognition that there are a large number of unknown factors in the analysis that could have led to this result (e.g., increased occupancy, increasing ventilation to comply with code, increased in occupant demands) which we cannot control for and which would explain the increase in energy usage.

### Request for Clarification

1. How should evaluation treat projects that result in negative savings due to custom analysis?

## Resulting from Actions Taken to Meet Code

Occasionally, there are cases where the negative energy savings is a result of the customer becoming compliant with local energy code. An example of this scenario is the aforementioned thermostat adjustment measure in the ComEd AirCare Plus Program. In rare cases, the tracking data would show that a commercial thermostat had its fan mode adjusted from intermittent to continuous operation. This adjustment increases the energy consumption of the HVAC fan, but brings the customer in compliance with the commercial energy code.[[5]](#footnote-5)

**Traditional Guidehouse Action.** In these cases, Guidehouse has not typically counted the negative savings as verified savings, but rather as zero verified savings. This is because Guidehouse felt it inappropriate to penalize the program for actions that would benefit the health and safety of the public.

### Request for Clarification

1. How should evaluation treat projects that result in negative savings due to actions taken to meet code?

## Resulting from Errors in the TRM

**Traditional Guidehouse Action.** In cases where negative savings were determined to result from an error in the TRM, Guidehouse has attempted to correct the error. In cases where the TRM could not be corrected,[[6]](#footnote-6) Guidehouse has not counted the negative savings as verified savings, but rather as zero verified savings.

## Resulting from Fuel-Switching Measures

In fuel-switching measures such as ductless and ground source heat pumps, the TRM instructs the user to assume an electric baseline when calculating electric energy savings (for both early replacement and time-of-sale scenarios). The TRM does not instruct the user to calculate negative savings, reflecting the increase in electric load seen by the utility. Guidehouse does not encounter electric-to-gas fuel switching in its evaluation.

However, when calculating gas savings for early replacement scenarios, the TRM algorithms result in negative gas savings after the mid-life adjustment. Negative gas energy savings result due to a baseline shift from the AFUEexist to the AFUEbaseER after some years (midlife adjustment), which in some cases can be more efficient than the newly installed equipment.

**Traditional Guidehouse Action.** In these cases, Guidehouse has calculated energy savings in accordance with the TRM. The electric energy savings are always positive while the gas savings for fuel-switching heat pump measures are negative after the midlife adjustment. This effect is seen only in the CPAS tables that include gas savings.[[7]](#footnote-7)

### Request for Clarification

1. The TRM’s approach to fuel-switching heat pumps intention appears inconsistent. It applies a negative impact for increased load to the gas savings but not the electric savings (i.e., the electric utility does not account for the added electric load). Was this intentional or an oversight?

# Heating Penalties

With the exception of fuel-switching projects, gas measures do not generate interactive heating penalties. This section focuses primarily on penalties that affect electric utility programs. Interactive heating penalties are generated by types of measures: all interior lighting measures and residential furnace blower motors.

## Electric Heating Penalties

In programs where heating fuel source data is tracked, electric heating penalties are likely to exist for some measures, primarily resulting from lighting improvements. Most programs do not track this value and the TRM instructs users to assume natural gas heating if the information is not known.[[8]](#footnote-8) In a program that does track this information, Guidehouse calculates electric heating penalties for projects where the heating fuel is electric.

**Traditional Guidehouse Action.** In these cases, Guidehouse has typically netted these penalties out in the project-level verified savings.

### Request for Clarification

1. How should evaluation treat electric heating penalties? Should they continue to be added to the verified savings?

## Gas Heating Penalties

The most common source of gas heating penalties results from lighting improvements. Since most gas penalties result from lighting improvements, this section only applies to electric utility programs.

**Traditional Guidehouse Action.** Historically, Guidehouse has not counted gas heating penalties against the electric utility programs’ gas savings. This approach predates the FEJA legislation and was intended to avoid penalizing one utility for program effects from another utility’s program. However, this approach overstates the total savings, electric and gas, that result from an energy efficiency portfolio.

As an alternative, we present three options to account for the gas heating penalties.

* **Portfolio-level** – The portfolio’s total gas savings is added to the portfolio’s total gas heating penalties. This approach would have a tremendous effect. In the CY2019 ComEd Summary Report, the portfolio generated 7,612,287 verified gross therms savings (Table 2-4, Summary Report) and counted 3,761,357 verified gross therms toward goal (Table 2-5, Summary Report). However, accounting for just the programs with the five largest heating penalties results in a significant negative balance as shown in Table 2. The effect of netting out the gas heating penalties at the portfolio level would be to eliminate the converted gas savings for electric utilities.
* **Program-level** – For each program with gas measures, the total gas savings is added to the total gas heating penalties. This approach has the effect of dramatically reducing the heating penalties attributed to the portfolio. For example, four of the six programs identified in Table 2 (Lighting Discounts, Instant Discounts, Food Bank LED Distribution, Retail (Lighting) Discounts – Income Eligible) would not have a negative savings value associated with it.
* **Project-level** – For each project with gas measures, the total gas savings is added to the total gas heating penalties. This would have the effect of virtually negating the effect of gas heating penalties on the gas portfolio savings. This is because it is relatively uncommon for projects to contain both gas savings and gas heating penalties.

Table . CY2019 Heating Penalty for Programs > 1,000,000 therms

| Program | Gross Heating Penalty (therms) |
| --- | --- |
| Lighting Discounts | -6,334,101 |
| Instant Discounts | -5,963,086 |
| Standard | -2,354,866 |
| Small Business | -2,118,017 |
| Food Bank LED Distribution | -1,479,811 |
| Retail (Lighting) Discounts - Income Eligible | -1,319,518 |
| **Total** | **-19,569,399** |

Source: ComEd CY2019 Summary Evaluation Report. Can be found at <https://www.ilsag.info/evaluation-documents/final-evaluation-reports/>

### Request for Clarification

1. How should evaluation treat gas heating penalties with respect to converted gas savings? Should these be netted out at the project level. program level, portfolio level, or at all?

## Ambiguity in Determining the Heating System Fuel Source

The TRM categorizes heating systems as either electric resistance, electric heat pump or gas heated. In reality, commercial facilities commonly have both gas and electric heat sources.

* Gas-fired rooftop units with electric reheat boxes.
* Gas boiler-fed air handling units with electric resistance perimeter heat.

Based on the current TRM guidance, it is not clear how programs or evaluators should categorize these types of systems.

### Request for Clarification

1. How should more complex heating systems be categorized for TRM application?

1. There are interactive cooling effects, though these are typically positive values. One exception is 4.6.13 Add Doors to Open Refrigerated Display Cases, proposed in TRM v9.0. This measure generates an electric cooling penalty which is embedded in the annual energy savings equation. [↑](#footnote-ref-1)
2. ComEd operated this program from PY8 to CY2018. [↑](#footnote-ref-2)
3. “This [negative savings] needs to be netted out of the overall program savings.” Jennifer Morris provided this comment on the ComEd AirCare Plus CY2018 Impact Evaluation Report on March 21, 2019. [↑](#footnote-ref-3)
4. EMS is typically administered as a custom measure which allows for greater possibilities for information gathering and more appropriate project-specific calculations can be utilized. [↑](#footnote-ref-4)
5. At the time this was IECC 2015. [↑](#footnote-ref-5)
6. Such a case was the IL TRM v6.0 Thermostat Replacement and Thermostat Adjustment algorithms. The algorithm produced negative gas savings for certain applications where it appeared that the gas savings should have been positive. [↑](#footnote-ref-6)
7. See the Table 4-2 of the ComEd Residential HVAC CY2019 Impact Evaluation Report (April 21, 2020) for an example of this. [↑](#footnote-ref-7)
8. “Heating Penalty if fossil fuel heated building (or if heating fuel is unknown)” Illinois Statewide Technical Reference Manual, 4.5.4 LED Bulbs and Fixtures. [↑](#footnote-ref-8)