### Adjustments to Behavior Savings to Account for Persistence

###### Description

Energy efficiency program administrators are increasingly including behavior programs as part of their portfolios. These programs are characterized by various kinds of outreach, education, and customer engagement designed to motivate increases in conservation and energy management behaviors, and most commonly include participant-specific energy usage information. Savings impacts are evaluated by ex-post billing analysis comparing consumption before and after (or with and without) program intervention, and require M&V methods that include customer-specific energy usage regression analysis and random controlled trial experimental designs, among others. As such, calculation of savings is treated as a custom protocol[[1]](#footnote-1).

An important issue for many stakeholders is whether energy savings from behavior programs continue over time (i.e., whether they persist beyond the initial program year). Behavior programs have now been delivered for a number of years in many jurisdictions. The weight of evaluation evidence indicates that the energy-saving behaviors influenced through these programs can persist beyond the initial period of program intervention, even without continued program participation[[2]](#footnote-2). This post-treatment savings persistence has implications for calculations of first year savings, measure life, and cost-effectiveness testing. Accounting for persistence will yield savings and cost-effectiveness estimates that more accurately reflect the true benefits of these programs. Because annual goals are based on first-year savings, programs should only count savings attributable to first-year spending. The effect of persistence of savings beyond the first year should be included in lifetime savings calculations and cost-effectiveness testing.

The protocol below was developed to outline the adjustments that should be made to account for the persistence of savings beyond the year of program delivery. This protocol is applicable to behavior programs of any type, delivered to residential or C&I customers, that has evaluated evidence of program persistence.

This general protocol should be used for any type of behavior program once supportable assumptions for persistence exist. The protocol will become effective for residential HERs-type programs as of June 1, 2017 - it is provided here for program planning purposes. Ongoing programs will undergo a “reset” upon institution of this protocol. Regardless of any previous history of behavior program delivery, the program year 2018 will be assumed to be Year 1 for the purpose of the incorporation of multiyear measure life/savings persistence into cost-effectiveness calculations and for the application of the adjustments to annual savings as outlined below. All residential HERs-type programs prior to June 1, 2017 will assume a 1-year measure life. The assumptions and protocols outlined below will not be applied retrospectively to any utility programs. All other types of behavior programs continue to use a 1-year measure life until supportable evidence exists for savings persistence.

###### Determination of Efficient Behavior

Behavior programs focus primarily on reducing electricity and natural gas consumption through behavioral changes; this reduction is generally measured through ex-post billing analysis after program intervention. Specific energy conservation and management behaviors are not usually directly observable. The specific definition of the efficient case is part of the design of behavioral programs and is included as part of the custom saving protocol.

###### Determination of Baseline Behavior

The ideal baseline for behavior programs is the energy usage without the program intervention. Various types of experimental, quasi-experimental, and regression-based EM&V approaches are used to present statistically valid approximations to this without-program baseline. The specific definition of the baseline case is part of the design of behavioral programs and is included as part of the custom saving protocol.

###### Deemed Lifetime/Persistence of Savings

Evaluations in Illinois have shown that savings from residential HERs-type behavior programs can persist into the year following program delivery[[3]](#footnote-3), though savings levels decay in the second year. For other behavior programs evaluated to date (residential RCT programs), savings have been shown to persist for up to 3 years year following program delivery[[4]](#footnote-4), and industry expectations are that savings likely persist beyond that. We assume here that savings persist at some level for 5 years. Savings over those 5 years are not equal, however; it is preferable that actual levels of ongoing savings should be calculated as outlined below (see Application of Persistence for Cost-effectiveness) and used in cost-effectiveness and lifetime savings calculations. Alternatively, an effective measure life can be calculated as Effective Measure Life = Total Lifetime Savings/ First Year Savings = 3.25 years. No persistence information is currently available for other behavior program types. Measure life is assumed = 1 year for such other programs.

###### Deemed Measure Cost

It is assumed that most behavior changes in residential settings can be accomplished with homeowner labor only and without investment in new equipment; measure costs in such programs may be defined as $0. Costs for C&I programs may include additional staffing, software purchases, etc. Cost is therefore program specific and is determined on a custom basis.

###### Loadshape and Coincidence Factor

###### There is evidence from analysis of AMI data that the usage loadshape for residential HERs-type programs mirrors the whole-house electric energy load pattern, which indicates a flat savings loadshape and a coincidence factor of 1.0.

Algorithm

###### Calculation of Savings

**Throughout these protocols, Year T refers to the current reporting year.**

###### Electric Energy Savings

The algorithm shown below for this measure was developed to calculate the annual electric savings in to be reported in year T after adjustment to account for the proportion of the measured savings for that program year that actually reflects persistent savings from prior years’ program activities.

ΔkWhT Adjusted = ΔkWhT Measured – (ΔkWhT-1 Adjusted \* RRT-1 \* PF1) – (ΔkWhT-2 Adjusted \* RRT-2 \* PF2)

– (ΔkWhT-3 Adjusted \* RRT-3 \* PF3) – (ΔkWhT-4 Adjusted \* RRT-4 \* PF4)

Where:

ΔkWhx Measured = total program savings as determined from custom calculation/billing analysis of participants in program during year X (input value)

ΔkWhx Adjusted = total program savings for year X after adjustments to account for persistence (calculated value)

RRX = Program retention rate in year X (input value)

= % of program participants in year X that are still in program in current year

PFY = Persistence factor (deemed value)

= % savings that persist Y years afterwards

= use table below to select the appropriate value

**Electric Persistence Factors**

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| **Program Type** | **Program Year T - record 100% of calculated savings (ΔkWhT above)** | **Percent savings from Year T activities that persist 1 year after year T** | **Percent savings from Year T activities that persist 2 years after year T** | **Percent savings from Year T activities that persist 3 years after year T** | **Percent savings from Year T activities that persist 4 years after year T** |
|  |  | PF1 | PF2 | PF3 | PF4 |
| Residential HERs-type (RCT) | 100% | 78% | 61% | 48% | 38% |

For example, a Home Energy Reports program with 60,000 participants in year T-1 and 55,000 returning and 8,000 new participants in year T records savings of 3,500 MWh in year T-1 and 4,000 MWh in year T:

ΔkWhT = (63.49 \* 63,000) – [58.33 \* (60,000 \* 0.917) \* 0.89]

= 4,000,000 – [3,208,333 \* 0.89]

= 4,000,000 – 2,859,417

= 1,144,583 kWh

Second and third year install savings should be calculated using the appropriate ISR and the delta watts and hours from the install year.

###### Summer Coincident Peak Demand Savings

Coincident peak demand savings in year T should also be adjusted to account for persistence from year T-1 using a similar algorithm.

***If peak demand is measured directly by the custom savings analysis:***

ΔkWT Adjusted = ΔkWT Measured – (ΔkWT-1 Adjusted \* RRT-1 \* PF1) – (ΔkWT-2 Adjusted \* RRT-2 \* PF2)

– (ΔkWT-3 Adjusted \* RRT-3 \* PF3) – (ΔkWT-4 Adjusted \* RRT-4 \* PF4)

Where:

ΔkWx Measured = total program demand savings as determined from custom calculation/billing analysis of participants in program during year X (input value)

ΔkWx Adjusted = total program demand savings for year X after adjustments to account for persistence (calculated value)

Other variables as defined above

***If peak demand is not measured directly by the custom savings analysis:***

ΔkWT Adjusted = ΔkWhT Adjusted / 8760

Where:

ΔkWhT Adjusted = electric energy savings calculated above

8760 = Hours per year

###### Natural Gas Energy Savings

The algorithm shown below for this measure was developed to calculate the annual Therm savings in year T after adjustment to account for the proportion of the measured savings for that program year that reflects persistent savings from the prior year’s program activities.

ΔThermsT Adjusted = ΔThermsT Measured – (ΔThermsT-1 Adjusted \* RRT-1 \* PF1) – (ΔThermsT-2 Adjusted \* RRT-2 \* PF2)

– (ΔThermsT-3 Adjusted \* RRT-3 \* PF3) – (ΔThermsT-4 Adjusted \* RRT-4 \* PF4)

Where:

ΔThermsx Measured = total program savings as determined from custom calculation/billing analysis of participants in program during year X (input value)

ΔThermsx Adjusted = total program savings for year X after adjustments to account for persistence (calculated value)

PFY = Persistence factor (deemed value)

= % savings that persist Y years afterwards

= use table below to select the appropriate value

Other variables as defined above

**Gas Persistence Factors**

| **Program Type** | **Program Year T - record 100% of calculated savings (ΔkWhT above)** | **Percent savings from Year T activities that persist 1 year after year T** | **Percent savings from Year T activities that persist 2 years after year T** | **Percent savings from Year T activities that persist 3 years after year T** | **Percent savings from Year T activities that persist 4 years after year T** |
| --- | --- | --- | --- | --- | --- |
|  |  | PF1 | PF2 | PF3 | PF4 |
| Residential HERs-type (RCT) | 100% | 43% | 18% | 8% | 3% |

###### Application of Persistence for Cost-effectiveness

The following savings should be recorded for this measure as savings for the years following program delivery when calculating lifetime savings and cost-effectiveness for year T:

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **Program Year T - record 100% of calculated savings** | **Percent savings from Year T activities that persist 1 year after year T** | **Percent savings from Year T activities that persist 2 years after year T** | **Percent savings from Year T activities that persist 3 years after year T** | **Percent savings from Year T activities that persist 4 years after year T** |
| ΔkWhT  ΔkWT  ΔThermsT | ΔkWhT \* PF1  ΔkWT \* PF1  ΔThermsT \* PF1 | ΔkWhT \* PF2  ΔkWT \* P21  ΔThermsT \* PF2 | ΔkWhT \* PF3  ΔkWT \* PF3  ΔThermsT \* PF3 | ΔkWhT \* PF4  ΔkWT \* PF4  ΔThermsT \* PF4 |

###### Water Impact Descriptions and Calculation

N/A

###### Deemed O&M Cost Adjustment Calculation

N/A

###### Measure Code: CU-BEH-XXXX-V01-170601

1. The protocol outlined here assumes that adjustments to remove the effects of program lift have been made as part of the custom calculation of savings. [↑](#footnote-ref-1)
2. Long-Run Savings and Cost-Effectiveness of Home Energy Reports Programs, Cadmus, October 2014. Also see Persistence Analysis Worksheet for specific references: IL TRM v.5 Behavior Persistence Analysis.xlsx. [↑](#footnote-ref-2)
3. ComEd Home Energy Reports Program PY6 Evaluation Report, Navigant, January 2015; Nicor Behavioral Energy Savings Programs: Home Energy Reports Persistence Study Part 1, Navigant, July 2015. [↑](#footnote-ref-3)
4. Long-Run Savings and Cost-Effectiveness of Home Energy Reports Programs, Cadmus, October 2014. Also see Persistence Analysis Worksheet for specific references: IL TRM v.5 Behavior Persistence Analysis.xlsx. [↑](#footnote-ref-4)