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**Non-Energy Impacts Vastly Improve Cost-Effectiveness of Low-Income Efficiency Investments. (part 2 of 3)**

NOTE TO READERS

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**Considerable Research has Quantified the Non-Energy Impacts ("NEIs") of Low-Income Energy Efficiency.**

The September/October 2017 issue of FSC's Law and Economics Insights discussed the policy reasons for incorporating Non-Energy Impacts (NEIs) into the cost-effectiveness analyses of low-income energy efficiency investments. This issue of the Law and Economics Insights continues that discussion by citing examples of research that have documented and quantified such NEIs.

The research that is cited herein was presented in 2017 testimony to the New Hampshire Public Utilities Commission in the proceeding in which the NHPUC considered that state's statewide energy efficiency plan.

**Colorado**

A 2010 Colorado study examined the existing Xcel Energy (d/b/a Public Service Company of Colorado) "adder" adopted to account for NEIs. At the time of the study, Xcel used a 20% adder for its electric programs. The Xcel study concluded:

If the deemed multipliers or adders are meant to "scale up" the simple energy savings to represent the full value of the impacts of the low-income programs to the utility, society and to low income participants, the multipliers are considerably under-valued. To reflect these impacts, the

electric multiplier would need to be increased by multiple times its current value depending on the program.<sup>1</sup>

The table below sets forth the electric NEIs as a percentage of energy savings for the Energy Savings Kits and for the single family weatherization programs.<sup>2</sup> Only the NEIs from the utility’s perspective and from the participant’s perspective are presented. The Colorado report stated that the valuation methods “have been honed and demonstrated over a period of about 15 years.”<sup>3</sup>

Colorado NEIs as Percentage of Energy Savings (electric only) (2010)		
	Utility Perspective	Participant Perspective
Energy Saving Kits	14%	107%
One-Family Home Weatherization	18%	126%

The Colorado report noted that:

The work found that virtually all NEBs seemed to fit the pattern of being related fairly closely to units of energy (and on a related note for the financial metrics, dollars) saved. As the energy savings and/or dollars saved increased, the NEB values increase. For that reason, the use of a proxy multiplier for NEBs on a kWh or therm basis, with only a few exceptions, can be reasonably justified.<sup>4</sup>

<sup>1</sup> Lisa Skumatz (2010). *Non-Energy Benefits Analysis for Xcel Energy’s Low Income Energy Efficiency Programs*, at 8.

<sup>2</sup> This table excludes the NEIs for gas programs and the NEIs for the combined gas/electric programs. Moreover, the table also excludes the multi-family housing and nonprofit NEIs calculated for Colorado.

<sup>3</sup> Skumatz Colorado, at 10.

<sup>4</sup> Skumatz Colorado, at 9 (internal notes omitted).

The “exceptions” referenced in the report are not ap-

FSC discussed this 2010 Colorado NEI assessment simply to document that a 10% New Hampshire adder for a low-income program does not adequately reflect the full value of low-income NEIs. In Colorado, which at the time used a 20% adder, the NEI valuation study found that the then-existing adder “considerably under-valued” NEIs and that to reflect the NEI impacts, “the electric multiplier would need to be increased by multiple times its current value. . .”

Notwithstanding its finding that a 20% adder “considerably under-valued” NEIs, there were several instances in which the Colorado study under-stated either utility-related impacts or participant-related impacts. For example (and this is not intended to be a comprehensive list):

- The reduction in utility carrying costs on arrears was calculated using the utility’s short-term interest rate. In Colorado, however, working capital is a rate base item for the public utility. Accordingly, working capital should have been valued based on the weighted cost of capital (including the tax effect on the equity portion of the return).
- The reduction in participant reconnection expenses was limited to the value of the reconnect fee. No value was assigned to the time a household is required to devote to arranging the repayment of the underlying arrearages that gave rise to the disconnection of service in the first instance.

pllicable here.

- The reduction in participant shutoff expenses was limited to households whose power is eventually restored. No value was included for households who did not have power restored, nor was value assigned to the time households devoted to responding to a service disconnection.

Based on this discussion, the conclusion is *not* that a specific adjustment to the NEI analysis should have been made. Rather, the conclusion is that despite the understatement of the participant and utility NEIs, the Colorado valuation *still* found that Xcel’s “electric multiplier would need to increase multiple times. . .” in order to accurately reflect the value of NEIs. A 20% adder does not represent a reasonably proxy for the full value of participant-perspective NEIs let alone the combination of utility-perspective and participant-perspective NEIs.

### Massachusetts

In 2016, Three<sup>3</sup> (pronounced “Three-Cubed”) prepared a report for the Massachusetts Program Administrators (“MPA”) on low-income single family health- and safety-related non-energy impacts.<sup>5</sup> The findings of the 2016 study were reviewed, and largely accepted, by the NMR Group, a consulting firm that had authored a similar (but more comprehensive) study<sup>6</sup> five years earlier for the MPA.<sup>7</sup> The 2016 Massa-

<sup>5</sup>Bruce Hawkins et al. (2016). *Massachusetts Special and Cross Cutting Research Area: Low-Income Single-Family Health and Safety-Related Non-Energy Impacts (NEIs) Study*. Prepared for Massachusetts Program Administrators.

<sup>6</sup> By “more comprehensive, I mean to reference the fact that the NMR Group’s study of NEIs considered more than health and safety issues.

<sup>7</sup> TetraTech and NMR Group (2011). *Massachusetts Special and Cross-Sector Studies Area, Residential and Low-Income Non-Energy Impacts (NEI) Eval-*

chusetts study found the monetized participant NEIs regarding health and safety as presented in the Table below.

As can be seen, the Massachusetts study documents nearly \$4,300 only in participant health and safety benefits as NEIs. It excludes participant benefits not involving health and safety (not because they were unimportant, but rather because they were beyond the scope of this particular study).

Like Colorado above, the Massachusetts Three<sup>3</sup> report under-stated some of the specific NEIs that it studied. Unlike Colorado, the Massachusetts report *acknowledged* in the text of the analysis the ways and places where under-valuation was likely to have occurred:

- The value of reduced asthma costs was under-stated since it assumed only one admittance per year, “despite the possibility that these events may have occurred multiple times.” (page 19).
- The value of reduced asthma costs was under-stated since it was based solely on the asthma of the head of household, “which may be an underestimate of the percent of adults and children with asthma in WAP eligible homes.” (page 19).
- The value of reducing thermal stress was under-stated since “it was assumed that extreme temperatures impact only one person per household.” (page 26).

*uation: Final*. Prepared for Massachusetts Program Administrators.

- The value of reducing thermal stress was under-stated since it was based on the general population, even though “the WAP demographic consists of individuals that are more at-risk for cold- and heat-related medical conditions.” (page 26).
- The value of reducing missed days at work was under-stated since it was based only on the head of household rather than on all employed workers in the home. (page 29).
- The value of improved home productivity was understated since “only one home worker per household was included in the benefit calculation.” (page 36).

Aside from this 2016 study in Massachusetts, and the health and safety non-energy impacts it considered, other participant perspective NEIs have been documented for Massachusetts as well. In particular, the 2011 NEI study for the MPA reported that increased comfort was an important NEI. That 2011 study found:

Participants in energy efficiency programs that include HVAC components and weatherization measures commonly experience greater perceived comfort, due to fewer drafts and more even temperatures throughout the home. The literature provides strong evidence that participants experience increased thermal comfort as a result of programs that affect the heating and cooling of the home, and that they consider these increased comfort levels to be a very important program benefit, both in general

terms and in relation to other perception-based NEIs.<sup>8</sup>

Health and Safety NEI Being Valued	Present Value (\$s)	Page cite to study
Reduced asthma-related costs	\$190.92	p.18
Reduced medical treatment (without avoided death) (cold)	\$89.30	p.27
Reduced medical treatment (without avoided death) (hot)	\$158.19	p.27
Fewer missed days of work	\$2,855.12	p.30
Reduced use of short-term, high interest loans	\$90.18	p.34
Increased productivity / improved sleep	\$721.26	p.36
Reduced fire and fire-related property damages	\$186.68	p.45
Sub-total <sup>9</sup>	\$4,291.65 <sup>10</sup>	Summed

NMR recommended a non-low-income annual value of \$125 per year for shell and weatherization measures or heating and cooling equipment to reflect the NEI involving increased comfort. In addition, NMR reported that noise suppression is a valuable NEI. “Energy efficiency programs can reduce noise in participants’ homes by installing insulation and sealing doors and windows, thus reduce the extent to which outside noise can be heard inside the home.”<sup>11</sup> NMR recommended an annual noise reduction value of \$31/year for non-low-income homes.<sup>12</sup>

<sup>8</sup> NMR Massachusetts, at 5-9.

<sup>9</sup> The lower valued NEIs discussed in the Three<sup>3</sup> report have been omitted here.

<sup>10</sup> The study noted that participants would need the “full complement of major weatherization measures” to generate the identified NEIs.

<sup>11</sup> NMR Massachusetts, at 5-11.

<sup>12</sup> Rhode Island, too, has “used a readily measured test/program screen for low income; quantify utility, societal; health and safety, equipment, prop, and comfort.” Samantha Caputo, (June 2017). *Non-*

The NMR Massachusetts report does have one significant shortcoming. In Massachusetts, NMR declined to include any benefits derived from energy bill savings.<sup>13</sup> According to NMR, these benefits would have been already accounted for in the utility’s determination of Avoided Energy Supply Costs (“AESC”). The AESC, however, only considers traditional avoided energy and capacity costs associated with usage reduction.<sup>14</sup>

The AESC, however, does not even account for bill savings to customers at retail rates. NMR’s narrow approach to the treatment of bill savings is unique and artificially limits participant perspective NEIs. To argue that participant perspective NEIs are incorporated into a quantifica-

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***Energy Impacts Approaches and Values: An Examination of the Northeast, Mid-Atlantic, and Beyond***, at 38, Northeast Energy Efficiency Partnerships, prepared for New Hampshire PUC. According to NEEP, “NEIs are considered an integral part to the Rhode Island [Technical Reference Manual]. NEIs attributable to electric and gas energy efficiency programs are considered [in] its cost-effectiveness framework.” NEEP 2017, at 38. Since, however, Rhode Island uses Massachusetts as its source for NEI values, Rhode Island is not separately considered in the discussion here.

<sup>13</sup> See generally, NMR Massachusetts, at 1-4. “NMR does not recommend including any NEIs that are derived from participant bill savings because it would amount to double counting of benefits. To count benefits that derive from bill savings would amount to valuing the additional disposable income (i.e., bill savings) and the ways in which the participants spend the disposable income. . . But to count both the bill savings and the health benefits. . . that are derived entirely from the way bill savings are spent is to count the same benefit twice.” NMR Massachusetts, at 1-5, 2-6.

<sup>14</sup> “For example, avoided costs of electricity to retail customers includes avoided energy costs, avoided capacity costs, avoided environmental regulation compliance costs, demand reduction induced price effects, and avoided costs of local transmission and distribution infrastructure. . .” NMR Massachusetts, at 1-4 (internal citations omitted).

tion of avoided energy, capacity, transportation and distribution, and environmental compliance costs is in error.

To summarize, using a discount rate of 4% and a 20-year life span for the benefits, the comfort impacts would have a Net Present Value of \$1,699 while the noise reduction impacts would have an additional Net Present Value of \$421. These two impacts, alone, add \$2,120 in net present value NEIs to non-low-income energy efficiency investments. When added to the health and safety NEIs previously documented by Three<sup>3</sup>, we find more than \$6,400 of NEIs in this limited set of participant perspective NEIs alone.<sup>15</sup>

## Connecticut

In 2016, the NMR Group completed an evaluation of Connecticut’s ratepayer-funded energy efficiency programs.<sup>16</sup> NMR reported:

Participants experienced positive net impacts—household and other effects beyond energy savings—from the program. These positive NEIs far outweighed any negative NEIs. The analysis found overall NEI values of 0.8 for HES end-users [and] 0.90 for HES-IE end-users. . . Adding the NEIs derived from this study to current estimates of total program benefits relative to costs increases [Benefit Cost Ratios] for all fuels and Companies. . .<sup>17</sup>

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<sup>15</sup> Moreover, there would be a need to bring these values to current year dollars. The \$4,292 was in 2011 dollars while the \$2,120 was in 2014 dollars.

<sup>16</sup> The Home Energy Solutions (HES) program was the non-low-income program studied. The Home Energy Solutions—Income Eligible (HES-IE) was the low-income program.

<sup>17</sup> NMR Connecticut, at XL11.

NMR concluded that “in other words, the NEI values can be considered as multipliers that are applied to energy savings.”<sup>18</sup> NMR reported that “the vast majorities of HES (83%) and HES-IE (79%), and rebate-only (93%) end-user participants observed positive net impacts from NEIs. “Comfort” carried the “greatest importance” for both low-income and non-low-income participants.<sup>19</sup>

## Maryland

Two reports from Maryland contribute to an understanding of what an appropriate NEI adder might be in New Hampshire. In March 2014, Skumatz completed an assessment of non-energy impacts in Maryland for the Natural Resources Defense Council. In August 2014, ITRON completed a similar study for the EMPOWER Cost-Effectiveness Working Group.<sup>20</sup>

ITRON reports in its Maryland study that “four states in the Northeast (MA, RI, DC and VT) include comfort benefits in their cost-effectiveness tests.”<sup>21</sup> ITRON recommended that Maryland use “the comfort benefit in future ex ante and/or ex post cost-effectiveness analysis.”<sup>22</sup> In its assessment of the comfort benefit, ITRON used

the Massachusetts quantification of the dollar value of the benefit. ITRON reported that while the comfort NEI would not, *unto itself*, make either the non-low-income or low-income cost effective, “the comfort benefits would have increased the statewide TRC B/C ratio for the [non-low-income] programs from 0.6 to 0.79.” Similarly, the “comfort benefits would have increased the statewide TRC B/C ratio for the [low-income] programs from 0.55 to 0.69.”

The 2014 Maryland study by Skumatz undertook a broader review of NEIs in Maryland. The Skumatz study concluded:

Twenty years of research and measurement of traditionally-omitted program impacts, or non-energy benefits (NEBs), have provided increasingly robust and consistent results. The regulatory tests are designed to assess costs and benefits, but protocols omitted some benefits, presumably because reliable values were not available. This leads to computational bias in benefit-cost ratios (from the omission of net benefit categories, but not omission of costs), and as a result, bias in decision-making using these ratios. Zero is the wrong proxy value.<sup>23</sup>

The Skumatz study examines NEI values, both in percentage and dollar terms, and provided summaries of “the ranges and typical values for the NEB categories.” “Typical values” were defined to be “defensible values selected based on a review of mean, median, and clustering of results from multiple studies.”<sup>24</sup>

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<sup>18</sup> NMR Connecticut, at 138.

<sup>19</sup> NMR Connecticut, at 142.

<sup>20</sup> The Working Group draws on the expertise of a diverse group of stakeholders, including Commission Staff, the Maryland Energy Administration, the Office of Peoples’ Counsel, environmental organizations, and EmPOWER utilities.

<sup>21</sup> ITRON (2014). *Development and Application of Select Non-Energy Benefits for the EmPOWER Maryland Energy Efficiency Programs*, at 3-1. Prepared for EmPOWER Cost-Effectiveness Working Group.

<sup>22</sup> ITRON, at 3-5.

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<sup>23</sup> Skumatz (March 2014). *Non-Energy Benefits / Non-Energy Impacts (NEBs/NEIs) and their Role & Values in Cost-Effectiveness Tests: State of Maryland, Final Report*, at 1.

<sup>24</sup> Skumatz Maryland, at 2.

In dollar terms, Skumatz found that the “typical value” of participant-related NEIs reached 193% of the expected bill savings from Maryland’s residential weatherization programs. In percentage terms, Skumatz found that the “typical value” of participant-related NEIs reached 144% of expected energy savings.<sup>25</sup>

One value that the 2014 Skumatz Maryland study importantly introduces into the NEI quantification involves the value that customers attribute to their increased “knowledge” and “control over bills” by a weatherization program. In Maryland a typical percentage adder that would capture this customer benefit would be set at 15.7% unto itself.<sup>26</sup> Skumatz reported that this value was a “high value NEB” which exhibited little variation within a program or between measure types.<sup>27</sup> Indeed, Skumatz notes, imparting knowledge to participants so that they know how to “control their bills” is sometimes one of the primary objectives of an energy efficiency program.<sup>28</sup>

### NEI Studies

In presenting testimony to the NHPUC, FSC presented the following reports for the NHPUC, along with other stakeholders, to consider:

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<sup>25</sup> Skumatz Maryland, at 4. Skumatz explains that “the percentage and dollar values are derived independently, and in some cases, include different numbers of studies (translations weren’t possible for all studies included). Therefore, the numbers in the two sets of columns are not merely translations of each other.” Skumatz Maryland, at 27.

<sup>26</sup> Skumatz reports in Maryland that her values have been discounted to one-half to one-fifth of the full value that would be supported by current research. In other words, these values have already been discounted by between 50% and 80%.

<sup>27</sup> Skumatz Maryland, at 31.

<sup>28</sup> Skumatz Maryland, at 42.

1. Justin Brant. Including Non-Energy Benefits in Evaluating Massachusetts’ EE Programs. Prepared for Massachusetts Department of Public Utilities.
2. Samantha Caputo. Non-Energy Impacts Approaches and Values: An Examination of the Northeast, Mid-Atlantic and Beyond. Prepared for Northeast Energy Efficiency Partnership.
3. Nick Hall and Jeff Riggert. Beyond Energy Savings: A Review of the Non-Energy Benefits Estimated for Three Low-Income Programs. TecMRKT Works. Prepared for ACEEE Summer Studies Program.
4. Bruce Hawkins et al. (2016). Massachusetts Special and Cross Cutting Research Area: Low-Income Single-Family Health and Safety-Related Non-Energy Impacts (NEIs) Study. Prepared for Massachusetts Program Administrators.
5. John Howat and Jerrold Oppenheim (1999). Analysis of Low-Income Benefits in Determining Cost-Effectiveness of Energy Efficiency Programs. Prepared for National Consumer Law Center.
6. ITRON (2014). Development and Application of Select Non-Energy Benefits for the EmPOWER Maryland Energy Efficiency Programs. Prepared for EmPOWER Cost-Effectiveness Working Group.
7. Erin Malone (2014). Driving Efficiency with Non-Energy Benefits. Prepared for ACEEE National Symposium on Market Transformation.

8. Ingrid Malmgren and Lisa Skumatz (2014). Lessons from the Field: Practical Applications for Incorporating Non-Energy Benefits into Cost-Effectiveness Screening. Prepared for ACEEE Summer Studies Program.
9. Eli Nesson. Reports on Energy Affordability Programs and on Research Relevant to Program Performance. Prepared for Economic Opportunities Studies.
10. Jeff Riggert et al. (1999). An Evaluation of the Energy and Non-energy Impacts of Vermont's Weatherization Assistance Program. Prepared for Vermont State Office of Economic Opportunity.
11. Jeff Riggert et al. Non-Energy Benefits of Weatherization and Low-Income Residential Programs: The 1999 Mega-Meta Study. Prepared for ACEEE Summer Studies Program.
12. Linda Berry and Martin Schweitzer (2003). Metaevaluation of National Weatherization Assistance programs Based on State Studies: 1993 – 2002. Prepared for Oak Ridge National Laboratory.
13. Martin Schweitzer (2005). Estimating the National Effects of the U.S. Department of Energy's Weatherization Assistance Program with State Level Data: A Meta-Evaluation Using Studies from 1993 to 2005. Prepared for Oak Ridge National Laboratory.
14. Martin Schweitzer and Bruce Tonn (2002). Nonenergy Benefits from the Weatherization Assistance Program: A summary of Findings from the Recent Literature. Prepared for Oak Ridge National Laboratory.
15. Lisa Skumatz (2010). Non-Energy Benefits Analysis for Xcel Energy's Low Income Energy Efficiency Programs. Prepared for Xcel Energy Company.
16. Lisa Skumatz (2014). Non-Energy Benefits / Non-Energy Impacts (NEBs /NEIs) and their Roles & Values in Cost-Effectiveness Tests: State of Maryland. Prepared for National Resources Defense Council.
17. Lisa Skumatz (2016). Non-Energy Benefits /NEBs – Winning at Cost-Effectiveness Dominos: State Progress and TRMs. Prepared for ACEEE Summer Studies Program.
18. NMR Group. Project R4 HES/HES-IE Process Evaluation and R31 Real-time Research: Final. Prepared for Connecticut Energy Efficiency Board, Ever-source and United Illuminating.
19. TetraTech and NMR Group (2011). Massachusetts Special and Cross-Sector Studies Area, Residential and Low-Income Non-Energy Impacts (NEI) Evaluation: Final. Prepared for Massachusetts Program Administrators.
20. Tim Woolf, et al. (2012). Energy Efficiency Cost-Effectiveness Screening: How to Properly Account for 'Other Program Impacts' and Environmental Compliance Costs, Synapse Energy Economics.
21. Tim Woolf, et al. (2012). Best Practices in Energy Efficiency Program Screening: How to Ensure that the Value of Energy Efficiency is Properly Accounted For." Prepared for National Home Performance Council.
22. Tim Woolf. (2012). Best Practices in Energy Efficiency Program Screening. Prepared for NARUC Summer meetings.

23. Tim Woolf, et al. (2014). Cost Effectiveness Screening Principles and Guidelines: For Alignment with Policy Goals, Non-Energy Impacts, Discount Rates, and Environmental Compliance Costs. Prepared for Northeast Energy Efficiency Partnership, Regional Evaluation, Measurement and Verification Forum.

### **Summary and Conclusions**

Based on the above data and analysis, FSC concluded that the New Hampshire PUC should incorporate NEIs into the state's cost-effectiveness analyses of low-income energy efficiency programs.

For more information regarding low-income Non-Energy Impacts, or for a copy of Colton's New Hampshire 2017 testimony, please write:

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Fisher, Sheehan and Colton, Public Finance and General Economics (FSC) provides economic, financial and regulatory consulting. The areas in which *FSC* has worked include energy law and economics, fair housing, affordable housing development, local planning and zoning, energy efficiency planning, community economic development, poverty and telecommunications policy, regulatory economics, and public welfare policy.