BEFORE THE

NEW HAMPSHIRE PUBLIC UTILITIES COMMISSION

In Re.	)	
	)	
2018-2020 New Hampshire Statewide Energy Efficiency Plan	)	**Docket No. DE-17-136**
	)	
	)	

DIRECT TESTIMONY OF

ROGER D. COLTON

ON BEHALF OF THE

The Way Home

November 1, 2017

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Q. PLEASE STATE YOUR NAME AND BUSINESS ADDRESS.

A. My name is Roger Colton. My business address is 34 Warwick Road, Belmont, MA 02478.

Q. BY WHOM ARE YOU EMPLOYED AND IN WHAT POSITION?

A. I am a principal in the firm of Fisher Sheehan & Colton, Public Finance and General Economics of Belmont, Massachusetts. In that capacity, I provide technical assistance to a variety of federal and state agencies, consumer organizations and public utilities on rate and customer service issues involving telephone, water/sewer, natural gas and electric utilities.

Q. ON WHOSE BEHALF ARE YOU TESTIFYING IN THIS PROCEEDING?

A. I am testifying on behalf of The Way Home.

Q. PLEASE DESCRIBE YOUR PROFESSIONAL BACKGROUND.

A. I work primarily on low-income utility issues. This involves regulatory work on rate and customer service issues, as well as research into low-income usage, payment patterns, and affordability programs. At present, I am working on various projects in the states of Connecticut, Maryland, Pennsylvania, Michigan, Illinois and Iowa, as well as in the provinces of Ontario and British Columbia. My clients include state agencies (e.g., Pennsylvania Office of Consumer Advocate, Maryland Office of People's Counsel, Iowa Department of Human Rights), federal agencies (e.g., the U.S. Department of Health and Human Services), community-based organizations (e.g., Energy Outreach Colorado,

Action Centre Tenants Ontario), and private utilities (e.g., Unitil Corporation d/b/a Fitchburg Gas and Electric Company, Entergy Services, Xcel Energy d/b/a Public Service of Colorado). In addition to state- and utility-specific work, I engage in national work throughout the United States. For example, in 2011, I worked with the U.S. Department of Health and Human Services (the federal agency that administers the Low-Income Home Energy Assistance Program, LIHEAP)[1] to create the Home Energy Insecurity Scale and to advance its utilization as an outcomes measurement tool for LIHEAP and other low-income utility bill affordability programs. In 2016, I was part of a team that engaged in a study for the Water Research Foundation on how to reach "hard to reach" customers. A description of my professional background is provided in Appendix A.

Q. PLEASE DESCRIBE YOUR EDUCATIONAL BACKGROUND.

A. After receiving my undergraduate degree in 1975 (Iowa State University), I obtained further training in both law and economics. I received my law degree in 1981 (University of Florida). I received my Master's Degree (regulatory economics) from the MacGregor School in 1993.

Q. HAVE YOU EVER PUBLISHED ON PUBLIC UTILITY REGULATORY ISSUES?

A. Yes. I have published three books and more than 80 articles in scholarly and trade journals, primarily on low-income utility and housing issues. I have published an equal

[1] LIHEAP is the federal home energy assistance program. It is a block grant program that provides funding for states to distribute to income-eligible households.

number of technical reports for various clients on energy, water, telecommunications and other associated low-income utility issues. A list of my publications is included in Appendix A.

Q. HAVE YOU PREVIOUSLY WORKED ON ISSUES INVOLVING THE NON-ENERGY IMPACTS OF ENERGY EFFICIENCY PROGRAMS?

A. Yes. I was one of the first persons to suggest that utility-related non-energy impacts (NEIs)[2] should be considered in addition to traditional utility avoided energy and capacity costs. My analysis stated that targeted electric energy efficiency programs had advantages that went beyond the traditional energy and capacity savings associated with energy efficiency measures:

> The cost-effective reduction of system costs is relevant and important in every part of the business operations of the utility, not simply to the power supply function. Accordingly, a utility should be concerned with the problem of nonpayment, overdue payment, and partial payment of utility bills. Bad debt arises when ratepayers demand power from the system and then do not pay for it on a timely basis. . . .[A] new conservation program [can be proposed] that is justified on an avoided cost basis. The proposal rejects the historical view that avoided costs include only an energy and a capacity component. Instead, it introduces the notion of avoided bad debt. As long as the energy efficiency program costs less than the bad debt it will avoid, the program is cost-justified.[3]

In this 1987 article, "bad debt" was defined to include all aspects of costs associated with payment troubles. The term was used to include not only written-off accounts, but credit and collection expenses, working capital expenses, and a host of other expenses related to

[2] Various phrases are used to refer to such impacts: Non-Energy Benefits ("NEBs"), Other Program Impacts ("OPIs"). I will use the term "Non-Energy Impacts" ("NEIs") in this testimony. I intend this phrase to be synonymous with these other similar phrases.

[3] Roger Colton and Michael Sheehan (1987). "A New Basis for Conservation Programs for the Poor: Expanding the Concept of Avoided Costs," 21 ***Clearinghouse Review*** 135, 139.

nonpayment. Since that time, the existence and importance of such expanded avoided costs has become generally-accepted. Analysts have since repeatedly confirmed that low-income energy efficiency generates benefits beyond simply energy and capacity savings. For example, energy efficiency has been found to improve customer payment patterns and reduce arrearages; generate additional economic activity and create jobs; reduce illnesses due to both hot and cold weather; reduce lost days of work due to both reduced worker illnesses and reduced childhood illnesses requiring adult family leave; improve home comfort; and reduced home noise (both internal and external). These examples are far from a comprehensive listing of non-energy impacts. They are intended, instead, to be illustrative.

Since my 1987 article, in the past 30 years, I have worked in various states and at the federal level to document low-income NEIs and introduce these NEIs into regulatory and program evaluation processes. Consider that:

- In 2003, I created the Home Energy Insecurity Scale ("HEIS") for the U.S. Department of Health and Human Services ("HHS") to quantify changes in low-income tradeoffs associated with inability to pay.[4]

- In 1995, I prepared a survey-based study of the impacts of unaffordable home energy in Missouri on "frequent mobility" for the state association of Head Start directors,[5] and supplemented that research with a similar study in Missouri for the National Low-Income Energy Consortium ("NLIEC") in 2004.[6]

- In 2006, under contract to the Georgia Department of Human Resources, in evaluating a low-income weatherization program, I created the Low-Income

[4] Roger Colton (2003). ***Measuring the Outcomes of Home Energy Assistance through a Home Energy Insecurity Scale,*** prepared for U.S. Department of Health and Human Services, Administration for Children and Families.
[5] Roger Colton (1995). ***The Road Oft Taken: Unaffordable Home Energy Bills, Forced Mobility, and Childhood Education in Missouri***, prepared for State Association of Head Start Directors.
[6] Roger Colton (2004). ***Paid but Unaffordable: The Consequences of Energy Poverty in Missouri***, prepared for National Low-Income Energy Consortium ("NLIEC").

Energy Risk Assessment Matrix, which, like the HEIS, was designed not only to recognize NEIs but to measure the NEIs.[7]

- In 2003, for Entergy, a multi-state electric holding company, I undertook a study of the economic development and job impacts of weatherization and fuel assistance in the four Entergy states.[8]

- In 2003, I undertook a study for the Colorado Energy Assistance Foundation ("CEAF"), the largest fuel fund in the nation, of the affordable housing impacts of low-income energy efficiency,[9] which I updated for rental housing in Pennsylvania in 2009.[10]

- In 2008, while not focused on energy efficiency, I prepared, for the Iowa Department of Human Rights, an analysis of the relationship between unaffordable home energy and public health impacts, using Iowa's Behavioral Risk Factor Surveillance System ("BRFSS") survey.[11]

- In 2011, I worked with Idaho's state association of Community Action Agencies[12] to review the Cadmus evaluation of Rocky Mountain Power's low-income energy efficiency program, including its treatment of NEIs.[13]

- In January 2011, I was invited to make a presentation in Dublin (Ireland) to an International Energy Agency ("IEA") seminar on "Evaluating the Co-Benefits of Low-Income Weatherisation Programmes." My presentation focused on: (1) using the Home Energy Insecurity Scale as a way to measure some participant-perspective NEIs, and (2) using "Net Back" as a way to measure utility-perspective NEIs flowing from improved affordability associated with weatherization.[14]

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[7] Roger Colton (2006). ***Georgia REACH Project Energize: Final Program Evaluation***, prepared for Georgia Department of Human Resources.
[8] Roger Colton (2003). ***The Economic Development Impacts of Home Energy Assistance: The Entergy States***, prepared for Entergy Services, Inc.
[9] Roger Colton (2003). ***Energy Efficiency as an Affordable Housing Tool in Colorado***, prepared for Colorado Energy Assistance Foundation ("CEAF").
[10] Roger Colton (2009). ***The Contribution of Utility Bills to the Unaffordability of Low-Income Rental Housing in Pennsylvania***, prepared for Pennsylvania Utility Law Project ("PULP").
[11] Roger Colton (2008). ***Public Health Outcomes Associated with Energy Poverty: An Analysis of Behavioral Risk Factor Surveillance System (BRFSS) Data from Iowa***, prepared for Iowa Department of Human Rights.
[12] Community Action Partnership Association of Idaho ("CAPAI").
[13] Roger Colton (October 2011). ***Assessing the Cost-Effectiveness of Low-Income Weatherization in Idaho: A Review of the Rocky Mountain Power Evaluation***, prepared for Community Action Partnership of Idaho.
[14] Roger Colton (January 2011). "Quantification of NEBs: A Review of Two Options," presented to International Energy Agency Fuel Poverty Workshop, Evaluating the Co-Benefits of Low-Income Weatherisation Programmes, Dublin (Ireland).

Just this year, I filed testimony in the pending DTE (electric) general rate case before the Michigan utility commission on behalf of a coalition of environmental intervenors (e.g., Michigan Environmental Council, Sierra Club, Natural Resources Defense Council). My testimony discussed the benefits to DTE of having that utility more closely tie its low-income energy efficiency investments with the Company's response to low-income payment troubles.[15]

Q. IN PREPARING YOUR TESTIMONY FOR THIS PROCEEDING, HAVE YOU REVIEWED AND CONSIDERED ANY MATERIALS OTHER THAN YOUR OWN?

A. Yes, of course. Given the vast literature on NEIs, it is impossible to list *all* of the materials other than my own that I have considered over the past 30 years in formulating my opinions. However, an illustrative list of written materials that I have specifically read and considered for purposes of this proceeding is presented in schedule RDC-1.

Q. HAVE YOU PREVIOUSLY TESTIFIED BEFORE THE NEW HAMPSHIRE PUBLIC UTILITIES COMMISSION?

A. Yes. I have testified before the New Hampshire PUC on numerous occasions regarding low-income programs, including low-income energy efficiency programs. I have also worked directly for the New Hampshire PUC Staff, as a consultant, on issues involving low-income program design.

[15] Direct Testimony of Roger Colton. I/M/O DTE Electric Company, Case No. U-18255, filed on behalf of Environmental Intervenors (filed August 30, 2017).

Q. HAVE YOU PREVIOUSLY TESTIFIED BEFORE OTHER REGULATORY COMMISSIONS AS AN EXPERT WITNESS?

A. Yes. Over the past 30+ years, I have testified in more than 250 cases throughout the United States and Canada regarding a range of issues involving low-income programs, energy efficiency programs, and other regulatory issues.

Q. PLEASE EXPLAIN THE PURPOSE OF YOUR TESTIMONY IN THIS PROCEEDING.

A. In this proceeding, I have been asked to assess whether it is reasonable and appropriate for the New Hampshire Public Utilities Commission ("PUC") to adopt an "adder" to reflect the non-energy impacts ("NEIs") of residential energy efficiency programs in any benefit-cost analysis of those programs. I have further been asked to assess the reasonableness of adopting a separate adder specific to energy efficiency programs targeted to low-income households. In the event that I were to conclude that such adders are reasonable, I have been asked to assess what level of an adder would be appropriate.

Summary of Findings and Recommendations.

Q. PLEASE SUMMARIZE YOUR FINDINGS AND RECOMMENDATIONS IN THIS PROCEEDING.

A. Based on the data and discussion presented in my Direct Testimony below, I make the following recommendations:

- The New Hampshire PUC should adopt an adder through which to quantify the dollar benefits of Non-Energy Impacts for the state's energy utilities.

- The adder to be applied to non-low-income residential customer programs should be equal to 100% of the energy savings.

- There should be a separate adder adopted to be applied specifically to programs directed toward low-income residential customers.

- The adder to be applied to low-income residential customer programs should be equal to twice (2.0x) whatever adder is adopted for non-low-income programs.

- The low-income multiplier of two-times the non-low-income adder should be applied irrespective of the non-low-income adder that is ultimately adopted.

Part 1. The Need to Include Non-Energy Impacts in a Benefit-Cost Analysis.

Q. PLEASE EXPLAIN THE PURPOSE OF THIS SECTION OF YOUR TESTIMONY.

A. In this section of my testimony, I explain the reasons it is necessary to include a recognition of NEIs in a benefit-cost analysis of New Hampshire's ratepayer-funded residential energy efficiency programs. In addition to residential programs in general, I consider the role that NEIs play in programs directed toward low-income residential customers in particular.

Q. PLEASE EXPLAIN WHAT YOU ARE REFERRING TO WHEN YOU DISCUSS "NON-ENERGY IMPACTS."

A. Non-energy impacts ("NEIs") can be classified into three broad categories based on the perspective being studied: (1) utility impacts; (2) participant impacts; and (3) societal impacts. For example, from the utility's perspective, a reduction in arrears (and thus the working capital associated with those arrears) is an expense reduction accruing from

usage reduction and thus an NEI. Increased comfort, on the other hand, is a benefit to energy efficiency program participants and thus an NEI from the participant's perspective. Increased job creation is a societal benefit of energy efficiency and thus an NEI from the societal perspective.

Q. PLEASE EXPLAIN WHY IT IS IMPORTANT TO ADEQUATELY INCLUDE NON-ENERGY IMPACTS IN ASSESSING THE BENEFITS AND COSTS OF RATEPAYER-FUNDED ENERGY EFFICIENCY PROGRAMS.

A. First, let me acknowledge that NEIs include both costs and benefits. To date, however, no study has identified a non-energy cost of any significant magnitude. Accordingly, while I acknowledge them, I set non-energy costs aside as having no meaningful impact on a benefit-cost assessment of a ratepayer-funded program. In addition, a growing body of literature is beginning to document NEIs for commercial and industrial customers. However, since the focus of my testimony is on low-income energy efficiency, I set these commercial and industrial NEIs aside as beyond the purview of my inquiry. I instead focus on residential NEIs as being those relevant to low-income customers.[16] Having made clear the limits of the scope of my testimony, I note five reasons the New Hampshire Commission should adequately incorporate NEIs into the benefit-cost analysis of residential energy efficiency programs generally, and of low-income residential energy efficiency programs in particular.

[16] I further set aside, as well, NEIs to owners/managers of low-income multi-family housing as beyond the purview of my testimony. Again, while I acknowledge the ongoing discussions about whether such NEIs benefit the poor, my testimony focuses on directly-billed, individually-metered, low-income customers treated with energy efficiency programs.

Reason #1. Benefits as Part of Total Resource Cost ("TRC") Test.

Q. PLEASE EXPLAIN THE RELATIONSHIP BETWEEN NON-ENERGY IMPACTS AND USE OF THE TOTAL RESOURCE COST TEST IN BENEFIT-COST ANALYSIS.

A. The first reason to incorporate NEIs into the benefit-cost analysis of residential energy efficiency is that when a state chooses to use the Total Resource Cost ("TRC") test in its assessment of benefits and costs of energy efficiency investments, by necessary implication, it is choosing also to include NEIs in its future energy efficiency assessments. Use of the TRC test implies that evaluators will take into account all costs and thus all benefits. To consider all costs without incorporating all benefits into the benefit-cost analysis will skew the TRC test against energy efficiency investments and result in an under-investment in energy efficiency measures that would benefit everyone.

This necessary agreement to include NEIs when a state decides to use the TRC benefit-cost test has been acknowledged in the most recent (May 2017) National Standard Practice Manual for Assessing Cost-Effectiveness of Energy Efficiency Resources ("NSPM"). The NSPM speaks in terms of "symmetry." According to the NSPM:

> For each type of impact included in a cost-effectiveness test, it is important that both the costs and the benefits be included in a symmetrical way. Otherwise, the test may be skewed and provide misleading results. . . On the benefits side, depending on the measures or program, there may be a variety of non-energy benefits that are part of the reason a customer invested in the measure (e.g., improved comfort, improved building durability, improved business productivity, etc.). If the participant costs are included in the cost-effectiveness test, then such benefits would need to be included as well.[17]

[17] NSPM, at 12.

Reason #2. Symmetry of Treatment for Non-Energy Costs and Benefits.

Q. PLEASE EXPLAIN THE PRINCIPLE OF ALLOCATING NON-ENERGY COSTS.

A. A second reason to incorporate NEIs into the benefit-cost analysis is because utilities tend to include all energy efficiency program costs even when those costs are used to purchase non-energy benefits. The "non-energy costs" I reference here would include that portion of a total energy efficiency investment that was made for reasons other than to generate the traditional energy and capacity savings. One thing we know, for example, is that one of the primary objectives sought by residential customers investing in energy efficiency is the resulting improved comfort of the home. If 50% of the benefit being purchased through an investment, however, involves improved comfort, it would be inappropriate to include 100% of the energy efficiency costs as "energy-related" costs. Half of those costs were purchasing improved home comfort. It would be even more inappropriate to include the costs used to purchase improved comfort in the benefit-cost analysis while at the same time excluding the resulting comfort-related benefits. In fact, benefit-cost analyses do not seek to apportion energy efficiency program costs into their energy and non-energy components. If the non-energy costs are included in the benefit-cost analysis, the non-energy benefits must also be included. Failing to do so not merely makes the benefit-cost analysis misleading, but it tends to make the benefit-cost analysis meaningless.

Reason #3. Value of Non-Energy Benefits is Greater than $0.

Q. PLEASE EXPLAIN THE IMPLICIT DOLLAR VALUE GIVEN TO NON-ENERGY BENEFITS IF THEY ARE NOT INCLUDED IN A TOTAL RESOURCE COST TEST BENEFIT-COST ANALYSIS.

A. A third reason to include NEIs in a TRC benefit-cost analysis is that it is impossible to exclude them. What happens when NEIs are not considered is that the benefit-cost analysis gives the NEIs an implicit value of $0. One thing that *everyone* agrees on is that while different analyses may place higher or lower values on various NEIs, those values are, with certainly, greater than $0.

To exclude NEIs in their entirety, in other words, because people claim that they may be "hard to measure" or "uncertain" is to place the one value on them ($0) that is universally agreed to be wrong. Regulators such as the New Hampshire PUC simply do not have the analytical luxury of excluding NEIs from the benefit-cost equation. To say that NEIs will not be considered is, in effect, to include them with a value of $0. That NEI valuation is in error.

Reason #4. The Relationship between Policy and Non-Energy Benefits.

Q. PLEASE EXPLAIN THE RELATIONSHIP BETWEEN NON-ENERGY IMPACTS AND PUBLIC POLICY.

A. A fourth reason to include NEIs in New Hampshire's TRC benefit-cost analysis is that it is through NEIs that important public policies are to be pursued. From a utility perspective, for example, the improved payment patterns and reduced arrearages from

targeted low-income energy efficiency investments are not incidental benefits of the energy efficiency programs. Improved bill affordability is one of the primary reasons for targeting the program toward low-income customers in the first instance. Similarly, one of the important public policy goals of ratepayer-funded low-income energy efficiency programs is to pursue an equity in the distribution of energy efficiency funds. If low-income programs are limited due to a perceived lack of cost-effectiveness because low-income NEIs are not adequately incorporated into the TRC benefit-cost analysis, low-income ratepayers are left with paying for programs from which they are disproportionately excluded from participation. The public policy to be pursued involves the equitable distribution of energy efficiency dollars.[18]

Both the equitable distribution of benefits and the assurance of benefits to low-income households have been explicitly recognized as public policy in New Hampshire statutes. New Hampshire's RSA 374-F:3, for example, states that "Restructuring of the electric utility industry should be implemented in a manner that benefits all consumers equitably. . . Such benefits, as approved by regulators, may include, but not necessarily be limited to, programs for low-income customers . . ." (RSA 374-F:3(VI)). New Hampshire's statutes continue to recognize the need for energy efficiency investments. The legislature has provided that "Restructuring should be designed to reduce market barriers to investments in energy efficiency and provide incentives for appropriate demand-side management and not reduce cost-effective customer conservation. Utility sponsored energy efficiency programs should target cost-effective opportunities that may otherwise

[18] See generally, Roger Colton (November 2014). ***The Equities of Efficiency: Distributing Utility Usage Reduction Dollars for Affordable Multi-Family Housing***.

be lost due to market barriers." (RSA 374-F:3(X)). It has long been recognized that the market barriers which impede low-income investments in energy efficiency are far more prevalent than the market barriers that impede residential investments in general.

Q. IS THIS PUBLIC POLICY UNIQUE TO THE DISTRIBUTION OF ENERGY EFFICIENCY FUNDS?

A. No. There can be little question today but that energy usage reduction investments are an environmental amenity. They increase the comfort, safety and affordability of recipient housing. In addition, energy usage reduction is an environmental amenity in its capacity as a climate change adaptation strategy. Usage reduction increases a household's capacity to cope with the impacts of climate change. It increases a household's resilience to respond to climate change impacts.[19]

The environmental justice movement has long been concerned with the disproportionate lack of access to environmental amenities.[20] If the public policy goal of equitably funding

[19] "Climate change adaptation strategies present a particularly difficult problem for disadvantaged communities lacking sufficient financial and social resources to pursue such strategies. These resources are encapsulated into the community's "capacity to cope." "The capacity to cope is a function of such factors as a community's financial and social resources, access to health care, and geographic mobility. In other words, the extent of adverse consequences is not only a function of geographic location and physical attributes, but of socioeconomic conditions. . .Vulnerable populations will be at much greater risk from climate change unless climate change adaptation policies grapple with the underlying socioeconomic inequities that exacerbate their vulnerability. Decreasing social vulnerability requires adaptation measures that both reduce the underlying sensitivity to harm and enhance the impacted communities resilience to harm after it has occurred." Equities of Efficiency, at 12 (internal citations omitted).

[20] The distributional impacts arising from the access to, and pricing of, urban mass transit on low-income communities is another good example of taking account of the distributional impacts of services viewed as environmental amenities Robison, Jonathan. "Fares and Fairness in Urban Public Transportation: The Need for a Substantive Basis for Agency Rate Making." 43 ***U.Pitt. L.Rev.*** 903, 912 - 916 (1982); Bullard, Robert. "Addressing Urban Transportation Equity in the United States." 31 ***Fordham Urb. L.J.*** 1183, 1188 - 1191 (October 2004).In 2009, for example, Seattle University law professor Clifford Rechtschaffen documented the disparate lack of access to transportation funding by race and income. Rechtschaffen, Clifford, et al. (2d ed. 2009). ***Environmental Justice: Law, Policy and Regulation***, at 58 – 64, Seattle University School of Law: Seattle (WA). While mass transit funding, specifically, may not be particularly relevant to New Hampshire, it does present a good illustration of how the distribution of funding can be seen within the context of the distribution of environmental amenities.

low-income energy efficiency programs is to be achieved in New Hampshire, NEIs must adequately be incorporated into the TRC benefit-cost analysis.

Reason #5. Impacts on Type of Program Services and Type of Program Delivery.

Q. PLEASE EXPLAIN THE EXPECTED IMPACT OF INCLUDING NON-ENERGY IMPACTS ON ENERGY EFFICIENCY PLANNING AND PROGRAM DELIVERY IN NEW HAMPSHIRE.

A. A fifth reason to include NEIs in a TRC benefit-cost analysis is that the NEIs will have a substantive impact not only on what energy efficiency programs are delivered (on a portfolio basis), but also on how those programs are delivered. One thing we know from NEI analyses performed to date, for example, is that NEI benefits frequently, if not generally, exceed the energy savings accruing from an energy efficiency program.[21]

The inclusion of NEIs, therefore, in the benefit-cost analysis of New Hampshire's energy efficiency programs should not only affect decisions regarding the total investment in efficiency programs, but could well affect the distribution of that funding between program components. For example, an increased recognition of NEIs relating to unaffordability and low-income payment difficulties could well lead New Hampshire utilities to increase their efforts to target usage reduction investments based not only on high usage, but based on high arrearages as well.

[21] See generally, Appendix B attached to this Direct Testimony.

Part 2. Using Adders is not Inconsistent with Evidence-Based Dollar Quantification of NEIs in New Hampshire.

Q. PLEASE EXPLAIN THE PURPOSE OF THIS SECTION OF YOUR TESTIMONY.

A. In this section of my testimony, I address the need to provide evidence-based dollar quantifications for the inclusion of NEIs in a benefit-cost analysis of energy efficiency programs. As part of this discussion, I address how NEI adders are consistent with this need for evidence-based quantification.

Q. PLEASE EXPLAIN THE NEED FOR EVIDENCE-BASED QUANTIFICATION OF THE DOLLAR VALUE OF NON-ENERGY IMPACTS?

A. I do not question the need for the New Hampshire PUC to seek reasonable evidence-based quantification of the dollar value of NEIs. Including NEIs in a benefit-cost analysis should be reasonably accurate to the extent practicable. However, I also have several concerns about this observation.

Concern #1. Accurate and Feasible.

Q. WHAT IS YOUR FIRST CONCERN?

A. My first concern is that the quantification of NEIs must not only be accurate, but must be feasible. Indeed, quantification must not only be feasible, but must be practical. In regulatory discussions of lifeline utility rates for low-income customers, I have frequently come across similar regulatory attention to a desire for quantifiable impacts. Care must be taken in the pursuit of this objective. I agree with law professor Michael Hennessy, who speaks of the "myth of complete knowledge and perfect research." Hennessy observes:

> This first myth often translates into a discussion of not how much we know, but how much residual error there remains to be explained. More importantly, the myth of perfect knowledge is often used as an implicit criticism of a particular research effort rather than a measure of our general ignorance. The implication is often given that *other* researchers, *other* data bases, or *other* methodologies would have provided a more accurate, more complete, or more valid set of results. Of course, these alternative researchers, data or methods are never produced, so the actual research is always compared with some idealized concept of the possible – a sort of ideal type research design with no flaws. Given this theoretical comparison, obviously any particular research study can be found seriously defective.
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> Such techniques of research defamation have two negative consequences. First, they give the misleading impression that unflawed research is possible. McGrath has cogently argued that given the constraints of the research process and the inherently contradictory demands of "good research," it is impossible to maximize all positive features in any single research design. Hence, all research will be flawed. In fact, it is not possible to do an unflawed study. . .The power of the idealized study is contrasted nicely with the flawed (but empirical) method when McCloskey discusses theory testing. He says, "a conceivable but practically impossible test takes over the prestige of the real [but flawed] test, but free of its labor."[22]

Clearly, there is a trade-off between simplicity and precision. I do not conclude that simplicity is always the best choice in approach. However, given my experience, and given the information presented above, I do conclude that the question of how to quantify the dollar value of NEIs should focus on what is reasonable, rather than on what Professor Hennessy would label as "Complete Knowledge and Perfect Prediction."

[22] Michael Hennessy. "The Evaluation of Lifeline Electricity Rates: Methods and Myths," 8 ***Evaluation Review*** 327 (1984).

Concern #2. Search for Unnecessary Precision.

Q. WHAT IS YOUR SECOND CONCERN ON THE PURSUIT OF EVIDENCE-BASED NON-ENERGY IMPACTS?

A. A second concern I would advance is that, having reached the conclusion that the search is for reasonable answers to the quantification of NEIs rather than for "Complete Knowledge and Perfect Prediction," I note also that New Hampshire should avoid the search for unnecessary precision. Surrogate values for NEIs are available today that provide reasonable insights into the magnitude of the dollar value they represent from the utility and participant perspective. Even if there is a range of uncertainty surrounding those dollar values, within that range of uncertainty lies a dollar value that is more accurate than the $0 value of NEIs that is universally found to be absolutely in error. The fact is that there are large groups of NEIs that have been measured repeatedly with fairly consistent results. The frequency of the measurement, and the consistencies in results, should be recognized by the New Hampshire PUC in incorporating NEIs into the TRC benefit-cost analysis to be applied to New Hampshire energy efficiency programs.

Concern #3. Impact on Decisionmaking.

Q. WHAT IS YOUR THIRD CONCERN ON THE PURSUIT OF EVIDENCE-BASED NON-ENERGY IMPACTS?

A. My third concern is closely related to my concern over the search for unnecessary precision. This concern counsels that the range of certainty that the PUC can (and should) find as reasonable depends in part on the size of the NEIs and the impact which those NEIs would have on the outcome of a benefit-cost analysis. As I will discuss in

more detail in my testimony below, many NEIs have been identified and quantified to a reasonable degree of certainty. Many of these NEIs are quite large (including, but not limited to, comfort, lost wages, some aspects of health and safety). They have a substantial impact on a benefit-cost ratio using the TRC test. Other NEIs are much smaller (including, but not limited to, reductions in bad debt and credit and collection expenses flowing from reduced arrears) and would have a much lesser impact on the TRC benefit-cost analysis. I recommend that the New Hampshire PUC approach its search for a "range of reasonableness" for NEI valuations by asking the following three questions:

- What NEI categories are the most valuable?
- What values arise from the low/high values in existing research?
- Do those low/high values lead program administrators to a different conclusion (e.g., to include rather than to exclude) or to a change in the program design?

A related set of questions has been recommended in a paper prepared for sthe Northeast Energy Efficiency Project ("NEEP") in assessing NEI valuations:

- What NEIs are most likely to have an impact on the results of a benefit-cost analysis?
- Of those, what NEIs are easiest to quantify in dollar terms?
- Of the remaining, what NEIs can be reasonably represented by proxies?[23]

[23] See generally, Tom Woolf, et al. (2014). ***Cost Effectiveness Screening Principles and Guidelines: For Alignment with Policy Goals, Non-Energy Impacts, Discount Rates, and Environmental Compliance Costs***, at 25 – 31. Prepared for Northeast Energy Efficiency Partnership, Regional Evaluation, Measurement and Verification Forum.

If particular NEIs are not valuable, or within those NEIs found to be valuable, the NEIs would not change a benefit-cost conclusion (based on either the "low" or "high" end of existing research), then devoting substantial resources to debating its existence and/or value provides no value-added benefit. Resolution of the debate does not pass the "so-what?" test. Moreover, of the NEIs that are found likely to have an impact on the result, there should be an inquiry into which ones have been reasonably quantified and which others could be represented by a proxy (such as an adder). By necessary converse implications, if NEIs are *not* likely to "have an impact on the result," they can reasonably be set aside for the time-being or valued through a proxy such as an adder.

Concern #4. Avoid Imposing Higher Standard on NEIs.

Q. PLEASE EXPLAIN HOW THE ADOPTION OF NON-ENERGY IMPACT VALUES WITHIN A RANGE OF UNCERTAINTY RELATES TO OTHER ASPECTS OF A UTILITY'S BENEFIT-COST ANALYSIS OF AN ENERGY EFFICIENCY PROGRAM.

A. My fourth concern about the search for evidence-based NEI dollar valuation is that the New Hampshire PUC should not require of NEIs what is not required for other aspects of an energy efficiency benefit-cost analysis. It is important to recognize that all elements of a benefit-cost analysis for a ratepayer-funded energy efficiency program have aspects of uncertainty to them. In particular, three inherently important areas stand out in their levels of uncertainty within the preparation of an energy efficiency benefit-cost analysis: (1) determining the service lives of energy efficiency measures; (2) choosing the appropriate discount rate to use in determining the net present value of benefits accruing

over time; and (3) determining net-to-gross ("NTG") ratios. According to Skumatz, differences in values assigned to the expected life, in the NTG, and in the chosen discount rate can make a 70% or more difference in the quantification of benefits in a benefit-cost analysis, even without considering NEIs.[24]

I agree with Skumatz when she concludes:

> In summary, many elements in the B/C equations have uncertainties, and NEBs are not necessarily the weakest link in the equation. The introduction of an estimated value for NEBs automatically serves to decrease bias in the B/C test, because to omit a value effectively introduces a value of zero. The literature clearly indicates the value is positive and substantial – and definitely non-zero. . .NEB estimates include uncertainty, with different errors associated with estimates from modeling sources, impact sources, surveys, etc. NEBs have been measured repeatedly, consistently, and with good rigor. Most importantly, NEBs should not be held to an artificially higher standard than the other elements of the benefit-cost test, which are also necessarily imperfect.

I urge the New Hampshire PUC to adopt this approach in considering NEIs in this proceeding. The PUC should not impose more stringent standards on the quantification of NEIs than it imposes on other "necessarily imperfect" inputs into the benefit-cost test for the state's residential energy efficiency programs.

Concern #5. The "Chicken-and-Egg" Problem.

Q. PLEASE EXPLAIN YOUR FINAL CONCERN ABOUT THE DESIRE TO HAVE EVIDENCE-BASED QUANTIFICATION OF NON-ENERGY IMPACTS.

[24] Lisa Skumatz (2016). ***Non-Energy Benefits / NEBs – Winning at Cost-Effectiveness Dominos: State Progress and TRMs***, at 6-8, 2016 ACEEE Summer Study on Energy Efficiency in Buildings.

A. In seeking evidence-based quantification of the dollar values of NEIs for New Hampshire, the PUC should be wary of contributing to the chicken-and-egg problem for energy efficiency benefit-cost analyses. Requiring an excessively precise valuation of NEIs before including those NEIs in a benefit-cost ratio would likely result in creating an impediment to NEI valuation rather than an incentive for NEI valuation. Under such an approach, the incorporation of NEIs into utility benefit-cost analyses lags because of expressed concerns about the quality of the data. However, utilities refuse to invest funding into NEI research because the results of that research have not been incorporated into regulatory decisionmaking (and thus into utility planning and decisionmaking). Given that the research was not being put to use, in other words, additional research was not pursued. Moreover, given that additional research was not pursued, existing research was not put to use. To break this cycle, New Hampshire should incorporate existing knowledge of NEIs attributable to residential (and low-income residential) programs within the reasonable ranges identified by existing research. One thing we know about the existing research is that the value of NEIs is not $0. Another thing we know is that the value of NEIs often equals or exceeds the value of energy savings arising from residential (and low-income residential) programs.[25]

[25] See generally, Appendix B to this Direct Testimony.

Part 3. The Role of an Adder in Quantifying NEIs for New Hampshire.

Q. PLEASE EXPLAIN THE PURPOSE OF THIS SECTION OF YOUR TESTIMONY.

A. In this section of my testimony, I examine whether NEI adders would be appropriate to use in the benefit-cost analyses for residential and low-income residential energy efficiency programs in New Hampshire. I conclude that adders are reasonable, and I make recommendations on what level of adder would be reasonable to adopt.

Q. ARE THERE PARTICULAR CONDITIONS THE EXISTENCE OF WHICH COUNSELS THE USE OF AN "ADDER" TO QUANTIFY NON-ENERGY IMPACTS?

A. Yes. One set of circumstances involves when an evaluator (or planner or other decisionmaker) wants to bundle the dollar values of NEIs without apportioning those impacts to particular individual impacts. This is one reason that stakeholders beginning the process of incorporating NEIs rely upon adders. A utility, or utility commission, can know with certainty, as we all know in New Hampshire, that the value of NEIs is greater than $0. They can know with substantial certainty that the aggregated value of the NEIs approaches, if not exceeds, the aggregate value of the energy savings. That knowledge, however, does not necessarily allow the stakeholder to allocate a particular dollar value to comfort; a different dollar value to health and safety; and yet a different dollar value to avoided wage losses, whether attributable to health reasons or to frequent mobility.

Q. IS THERE A SECOND SET OF CIRCUMSTANCES APPLICABLE TO NEW HAMPSHIRE WHICH MAKES THE USE OF AN ADDER APPROPRIATE?

A. Yes. The use of an adder is appropriate when the user wanting to account for NEIs is unsure of how to account for the fact that the whole is often less than the sum of its parts. This impact is commonly referred to as the "part-whole bias."[26] Part-whole bias is not unique to the valuation of NEIs. This principle reflects the proposition that individuals often place a greater value on individual components of a transaction than they do on the transaction as a whole.[27] As this principle shows, in other words, even when one can quantify the dollar values for individual NEIs, you do not necessarily know what the appropriate value would be for NEIs as a whole. Under such circumstances, the use of an adder would be an appropriate decision.

Q. PLEASE EXPLAIN YOUR THIRD REASON FOR SUPPORTING THE USE OF AN ADDER THROUGH WHICH TO VALUE NON-ENERGY IMPACTS IN NEW HAMPSHIRE.

A. A third situation in which the use of adders is appropriate is when one state seeks to import the use of a quantification of NEIs from a different state. While the specific dollar value found to exist in one state may not be entirely transferable to another state, the value of the NEIs relative to the value of program energy savings can be. It has frequently been found that NEIs are sufficiently well-studied and well-documented that the NEIs as a percentage of savings are reasonably consistent.

[26] It is also sometimes referred to as the "sub-additivity effect." Not everyone agrees that such a bias exists in research on contingent valuations or that it cannot be reasonably remedied through proper design of the survey instrument.

[27] The classic "test" of part-whole bias involved an experiment during which respondents placed greater values on vouchers for different components of a meal at a restaurant than they placed on the meal as a whole.

Q. DO YOU HAVE A FINAL OBSERVATION ABOUT THE USE OF ADDERS AS A MECHANISM TO VALUE NON-ENERGY IMPACTS?

A. Yes. The use of adders can be appropriate if/when a state is seeking to implement specific public policies. One such public policy, for example, is to promote the delivery of energy efficiency services to low-income households. The importance of that policy can be weighed against the uncertainty inhering in the adder. The greater the importance of the policy, the closer the PUC can weight the adder to 100% of expected NEIs. The lesser the importance of the policy, the more the NEI adder can be discounted to less than 100% of its expected value. This process of weighting the importance of public policy considerations against the desire for precision in the NEI documentation is more easily implemented through the use of an adder for NEIs.

Part 4. Lessons Learned from Other States Valuing NEIs.

Q. PLEASE EXPLAIN THE PURPOSE OF THIS SECTION OF YOUR TESTIMONY.

A. In this section of my testimony, I review some of the lessons learned from recent NEI research to identify NEI values. I find that there is a growing consistency in results that would allow New Hampshire decisionmakers to adopt such values as reasonably applicable to New Hampshire. I have included, as Appendix B, an examination of the states of Colorado, Massachusetts, Connecticut and Maryland upon which I rely for this analysis.

Q. WHAT LESSONS CAN BE DERIVED FROM THE EXPERIENCE OF THE FOUR STATES YOU PRESENT IN APPENDIX B?

A. I draw the following conclusions from the data and discussion above presented in Appendix B:

First, I conclude that exclusively from the participant perspective, the non-energy impacts of ratepayer-funded energy efficiency programs are substantial. Indeed, these participant perspective NEIs can generally be expected to equal or exceed, frequently substantially, the energy savings generated by the program. At least three of the states in Appendix B support this conclusion (CO, MA, MD).

Second, I conclude that the value of the participant-perspective NEIs can be expected to dwarf the value of the utility-perspective NEIs. This is not to say that the utility-perspective NEIs are "insubstantial" or even "small." This conclusion is simply that the utility-perspective NEIs are considerably smaller in value relative to participant-perspective NEIs. All four states in Appendix B (CO, MA, MD, CT) support this conclusion.

Third, I conclude that a sufficient number of studies generating relatively consistent results, allow New Hampshire to establish considerable NEIs with some certainty of result. Just the limited number of participant-perspective NEIs I discuss in this testimony[28] would support the conclusion that the values of these participant-perspective

[28] These include: increased comfort (MA), increased noise reduction (MA), health and safety (MA), and control over bills (MD).

NEIs exceed 100% of energy savings. At least three of the states in Appendix B support this conclusion (CO, MA, MD).

Fourth, I conclude that the value of low-income participant-perspective NEIs can be expected to exceed the value of non-low-income participant-perspective NEIs on a percentage of energy savings basis. All four states in Appendix B support this conclusion (CO, MA, MD, CT).

Fifth, I conclude that the participant-perspective NEIs that have been documented in New England (and elsewhere) are not internalized in the avoided costs of energy and capacity. Accordingly, these NEIs must be separately accounted for in the benefit-cost analysis. All four states in Appendix B would support this conclusion (CO, MA, MD, CT).

More broadly than the specific conclusions I articulate above, I conclude that the preparation of a benefit-cost analysis has considerable uncertainty in many of its component parts, whether one looks at the calculation of net-to-gross ratios, or measure service lives, or the discount rate to apply to net present value analysis. The valuation of NEIs, in fact, is not necessarily the most uncertain link in this set of uncertain values.

In addition, I conclude that the use of a TRC benefit-cost test necessarily implies the incorporation of NEIs into the benefit-cost analysis. To include all program costs without incorporating all program benefits is to skew the benefit-cost analysis against energy efficiency investments. This results in an under-investment in energy efficiency.

Ultimately, I conclude that the use of an adder is a reasonable mechanism to employ in incorporating participant-perspective NEIs into a TRC benefit-cost analysis.

Q. DO YOU HAVE A SPECIFIC RECOMMENDATION FOR NEW HAMPSHIRE BASED ON THE DATA AND DISCUSSION ABOVE?

A. Yes. The limited participant-perspective NEIs I document above clearly exceed 100% of energy savings.[29] Accordingly, I recommend that, as a reasonable approach to initiating the incorporation of dollar values for NEIs in New Hampshire's benefit-cost analysis, the PUC should cap total NEI values at 100% (i.e., not to exceed energy savings). This number reflects a reasonable proxy for the full value of NEIs and presents a symmetrical treatment of costs and benefits. If New Hampshire undertakes a measured NEI study at some point in the future, this number could be higher.

Part 5. The Need to Adopt a Specific Low-Income NEI Adder.

Q. PLEASE EXPLAIN THE PURPOSE OF THIS SECTION OF YOUR TESTIMONY.

A. In this section of my testimony, I consider whether New Hampshire would be justified in adopting a larger NEI adder specifically to address the NEIs arising from the state's low-income energy efficiency programs.

[29] Consistent with my recommendation earlier in my testimony, I do not undertake to value all NEIs. Placing a value on additional NEIs would not change my conclusion that participant perspective NEIs equal or exceed 100% of energy savings.

Q. DO YOU HAVE REASON TO BELIEVE THAT LOW-INCOME NON-ENERGY IMPACTS IN NEW HAMPSHIRE EXCEED NON-LOW-INCOME NON-ENERGY IMPACTS ON A PERCENTAGE BASIS?

A. Yes. At least in New England, the fact that low-income NEIs not only exceed non-low-income NEIs, but do so by a substantial extent, is generally accepted. Consider the NEI values set forth in the Direct Testimony of Michael Goldman. With the exception of Vermont, which uses a small adder, the low-income NEIs exceed the non-low-income NEIs by a factor of 200% to 700%. The comparison taken from Mr. Goldman's Table 1 is set forth below:[30]

	Non-Low-Income NEIs	Low-Income NEIs	Ratio (LI to NLI)
MA	21.46%	80.58%	3.75:1
CT	43.70%	88.20%	2.02:1
RI	24.50%	177.06%	7.23:1
VT	60.88%	67.85%	1.11:1

Q. ARE THERE OTHER REASONS YOU FIND THAT WOULD SUPPORT A HIGHER NON-ENERGY IMPACT FOR LOW-INCOME ENERGY EFFICIENCY?

A. Yes. The determination of an NEI is a multi-tier process. One of those steps is to assign a value to a particular attribute. Another of those steps is to determine the incidence of the attribute in the low-income energy efficiency recipient population. I discussed in some detail above, for example, how the most recent Massachusetts valuation of Health and Safety NEIs acknowledges in the text of its report how it under-estimated certain values,

[30] It is, of course, important to remember that not all states have quantified the same NEIs or done so in a uniform fashion.

particularly as they relate to low-income households. In my testimony below, I introduce several more illustrations (this is certainly not a comprehensive listing) of how low-income NEIs have been under-stated. My discussion focuses below on (1) the health and safety benefits of avoided fires; (2) on the value of reduced forced absences from a home; and (3) on the participant-perspective benefits of reduced disconnections and reconnections.

Q. PLEASE EXPLAIN HOW THE BENEFITS OF REDUCED FIRES (BOTH PERSONAL INJURY AND PROPERTY DAMAGE) REDOUND TO THE BENEFIT OF LOW-INCOME HOUSEHOLDS THAT HAVE NOT YET BEEN ADEQUATELY CONSIDERED IN NON-ENERGY IMPACTS.

A. The benefits of reduced fires, along with the accompanying reduction in personal injury and property damage, have been well-documented in research regarding NEIs. The quantification of reduced numbers of fires, however, has focused exclusively on how energy efficiency investments improve the equipment that is being replaced through the efficiency programs.

In the low-income community, however, fire hazards also arise from the loss of service due to nonpayment or due to the increased use of space heaters because the use of central heating systems is perceived to be too expensive. Alternatives that low-income households use to disconnected lights also present fire hazards. The periodic survey that the National Energy Assistance Directors Association ("NEADA") performs for Congress provides the data. The 2011 NEADA survey reports that more than one-quarter

of low-income households, for example, used candles or lanterns in the last year because their electric service had been disconnected.

Moreover, a study that I performed for the National Fuel Funds Network ("NFFN") in 2001 reported that many low-income customers who lose their primary heating service due to nonpayment turn to secondary sources of heating such as portable space heaters. I found:

> While portable space heaters are not the major cause of home heating fires, they play a much more substantial role in deaths and injuries. Portable and fixed space heaters (and their related equipment such as fireplaces, chimneys and chimney collectors) accounted for roughly two of every three (65%) home heating fires in 1998 and three of every four (76%) associated deaths. Each of these devices has a higher death rate per million households using them than do the various types of central heating units or water heaters. Indeed, portable electric heaters have accounted for the highest home heating fire death toll in 10 of the past 14 years.11 No other cause of home heating fires comes even close to the fatality rate caused by portable heaters and fixed space heaters. In usage-weighted terms, while portable heaters do not cause more fires than central heating units, they are associated with significantly more deaths, more injuries, and more direct property damage, than are central units.[31]

As is evident, the literature quantifying fewer deaths, personal injuries, and property damages due to the replacement of defective home heating systems through energy efficiency programs, while accurate to the extent that it goes, under-values the extent of fire reduction that can be attributed to energy efficiency for low-income customers. This conclusion was not simply my own. The National Fire Prevention Association ("NFPA")

[31] Roger Colton (2001). ***In Harm's Way: Home Heating, Fire Hazards, and Low-Income Households***, at 1-2 (internal notes omitted).

reports that "not being able to afford utilities" is one of the "major factors of increased fire risks" for low-income households.[32]

Moreover, the literature quantifying the dollar value of reduced fire hazards attributable to energy efficiency does not account for the special exposure that low-income households have to personal injury and death. The NFPA reports that fires in low-income homes are more likely to result in death and/or injury, particularly of children, because of: (1) not always being able to afford child care and leaving children unattended or unsupervised; (2) not being able to afford a telephone; and (3) living in less fire resistant housing, as well as using less fire resistant furniture and mattresses.[33]

It is important to understand that these fire risks do not arise simply from the disconnection of utility service, but rather from the unaffordability of utility service. Reducing bills through energy efficiency will help reduce these fire risks and will give rise to increased NEIs. This occurs as a result of the energy efficiency apart from the replacement or repair of home heating systems.

Q. PLEASE DISCUSS YOUR REFERENCE TO THE FORCED ABSENCE FROM A HOME.

A. The literature quantifying NEIs has been found to develop methodologically sound, and reasonably consistent, dollar values for the frequent mobility caused by unaffordable home energy and the loss of home utility service. These values are more likely to

[32] "Burning Issues," ***NFPA Journal***, at 104 (January/February 1996).
[33] Rita Fahy and Alison Norton, "How Being Poor Affects Fire Risk. . ." ***Fire Journal***, at 29:34 (January/February 1989).

appertain to low-income households. What the literature does *not* address is how energy efficiency, by making home energy service more affordable, can be used to reduce the forced absences that low-income households experience. That reduction in forced absences will have a value greater than $0.[34]

The existence of this forced absence has been well-documented. The most recent NEADA survey of fuel assistance recipients reported that more than one-in-five respondents reported that, within the previous year, they left home for all or part of a day because the home was too hot or too cold due to their inability to pay their home energy bill. To the extent that energy efficiency can improve the home energy affordability, the incidence of this forced absence will be reduced. Again, however, more than documenting a precise value for this non-energy impact, my purpose here is simply to note that the value is greater than $0 and that it is uniquely associated with low-income (rather than non-low-income) efficiency recipients.

Q. PLEASE EXPLAIN THE UNDER-ESTIMATION OF THE BENEFITS OF REDUCED NUMBER OF DISCONNECTIONS FOR NONPAYMENT AND THE SUBSEQUENT RECONNECTION OF SERVICE.

A. A participant-perspective NEI has been calculated for the reconnection of service subsequent to the disconnection of service for nonpayment. The value that has been placed on the reconnection of service, however, has been limited to the dollar value of the reconnection fee imposed by the utility.

[34] My objective here is not to establish the increased value, but rather to simply document that there are factors that make the participant perspective NEIs for low-income households higher than the participant perspective NEIs for non-low-income.

The actual value of a reduced number of reconnections is greater than that. As I found in my study of the economic development impacts of fuel assistance and weatherization, "the reconnection of service does not 'just happen' after service has been terminated for nonpayment. The actions a customer must take to find money, contact the utility, make payment arrangements, and await the physical reconnection all take time. The lost work time devoted to the reconnection of service represents lost wages to the household. Previous studies of the lost work time devoted to the reconnection of service after a disconnection have found that households lose eight hours of work time."[35] The value of the non-energy impact of reduced numbers of disconnection (and thus reconnections) extends well beyond only the dollar value of any reconnection fee. The value extends, also, to the avoided time devoted to arranging the payment resulting in the reconnection.

Q. DO THE UTILITY-PERSPECTIVE NON-ENERGY IMPACTS SUPPORT A LARGER NON-ENERGY IMPACT ADDER FOR LOW-INCOME CUSTOMERS?

A. Yes. As the NMR Massachusetts study documents, many of the utility-perspective NEIs relate primarily, if not exclusively, to low-income programs. The adder components relating to avoided working capital, avoided bad debt, avoided disconnection and reconnection costs, and avoided collection call costs, are related to addressing the payment problems of low-income customers. In addition, of course, since New Hampshire offers a low-income electric discount, a low-income adder would need to

[35] Roger Colton (2003). ***The Economic Development Impacts of Energy Assistance: The Entergy*** States, at 15, prepared for Entergy Services (internal citations omitted).

reflect the avoided costs of the discounts that would have been provided on the reduced consumption. Each of these additional NEIs specific to low-income customers counsels for an increased adder when applied to low-income energy efficiency programs.

Q. IS THERE A FINAL SEPARATE AND INDEPENDENT REASON FOR ADOPTING A HIGHER ADDER FOR LOW-INCOME NON-ENERGY IMPACTS THAN FOR NON-LOW-INCOME NON-ENERGY IMPACTS?

A. Yes. As I discuss in more detail above, the use of an adder to reflect NEIs would allow the New Hampshire PUC to incorporate the public policy favoring the delivery of energy efficiency to low-income households into the NEI determination. The public policy favoring low-income energy efficiency is predicated on promoting an equitable distribution of efficiency investments, the improved affordability resulting from low-income efficiency investments, and the increased efficiency of low-income bill affordability programs provided through usage reduction rather than through the need for repetitive fuel assistance (or rate discounts). The presence of these public policies allows the New Hampshire PUC to weight the benefits of quantifying NEIs against the possible imprecision of establishing an NEI value differently for low-income and for non-low-income customers.

Q. PLEASE EXPLAIN YOUR FINDINGS AND CONCLUSIONS WITH RESPECT TO THE USE OF A LOW-INCOME ADDER FOR NON-ENERGY IMPACTS.

A. Based on the data and discussion presented in my testimony, including but not limited to the specific data in this section, I conclude that the monetized participant-perspective

non-energy impacts arising from energy efficiency investments will be greater for low-income than for non-low-income households. In addition, the utility-perspective payment-related non-energy impacts are greater for low-income than for non-low-income efficiency recipients. Accordingly, I conclude that to the extent that the non-energy impacts are accounted for through the use of an NEI adder, a separate and larger NEI adder is appropriate for low-income customers.

Q. WHAT DO YOU RECOMMEND?

A. In New England, setting aside Vermont as an outlier, the smallest ratio of low-income to non-low-income NEIs was roughly 200% (2:1). Accordingly, I recommend that a separate NEI adder be established for low-income customers. I recommend further that this low-income NEI adder be set equal to twice the value of the non-low-income NEI.

Q. DOES THIS COMPLETE YOUR TESTIMONY?

A. Yes, it does.

Colton Schedules

List of Written Materials Specifically Considered for this Proceeding

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, Eversource 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.

Colton Appendices

APPENDIX A: ROGER D. COLTON VITAE

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EDUCATION:

J.D. (Order of the Coif), University of Florida (1981)

M.A. (Economics), McGregor School, Antioch University (1993)

B.A. Iowa State University (1975) (journalism, political science, speech)

PROFESSIONAL EXPERIENCE:

Fisher, Sheehan and Colton, Public Finance and General Economics: 1985 - present.

As a co-founder of this economics consulting partnership, Colton provides services in a variety of areas, including: regulatory economics, poverty law and economics, public benefits, fair housing, community development, energy efficiency, utility law and economics (energy, telecommunications, water/sewer), government budgeting, and planning and zoning.

Colton has testified in state and federal courts in the United States and Canada, as well as before regulatory and legislative bodies in more than three dozen states. He is particularly noted for creative program design and implementation within tight budget constraints.

Commentator: Belmont Citizen-Herald: 2014 – present

Author of biweekly "Community Conversations" column for Belmont Citizen-Herald, weekly newspaper (June 2014 to present).

Host of biweekly "Community Conversations" podcast, Belmont Citizen-Herald, BMC Podcast Network (October 2016 to present)

National Consumer Law Center (NCLC): 1986 - 1994

As a staff attorney with NCLC, Colton worked on low-income energy and utility issues. He pioneered cost-justifications for low-income affordable energy rates, as well as developing models to quantify the non-energy benefits (*e.g.*, reduced credit and collection costs, reduced working capital) of low-income energy efficiency. He designed and implemented low-income affordable rate and fuel assistance programs across the country. Colton was

charged with developing new practical and theoretical underpinnings for solutions to low-income energy problems.

Community Action Research Group (CARG): 1981 - 1985

As staff attorney for this non-profit research and consulting organization, Colton worked primarily on energy and utility issues. He provided legal representation to low-income persons on public utility issues; provided legal and technical assistance to consumer and labor organizations; and provided legal and technical assistance to a variety of state and local governments nationwide on natural gas, electric, and telecommunications issues. He routinely appeared as an expert witness before regulatory agencies and legislative committees regarding energy and telecommunications issues.

PROFESSIONAL AFFILIATIONS:

Columnist:	Belmont Citizen-Herald
Producer:	Belmont Media Center: BMC Podcast Network
Member:	Belmont Town Meeting
Chair:	Belmont Goes Solar
Coordinator:	BelmontBudget.org (Belmont's Community Budget Forum)
Coordinator:	Belmont Affordable Shelter Fund (BASF)
Chair:	Belmont Solar Initiative Oversight Committee
Member:	City of Detroit Blue Ribbon Panel on Water Affordability
Chair:	Belmont Energy Committee
Member:	Massachusetts Municipal Energy Group (Mass Municipal Association)
Past Chair:	Housing Work Group, Belmont (MA) Comprehensive Planning Process
Past Member:	Board of Directors, Belmont Housing Trust, Inc.
Past Chair:	Waverley Square Fire Station Re-use Study Committee (Belmont MA)
Past Member:	Belmont (MA) Energy and Facilities Work Group
Past Member:	Belmont (MA) Uplands Advisory Committee
Past Member:	Advisory Board: Fair Housing Center of Greater Boston.
Past Chair:	Fair Housing Committee, Town of Belmont (MA)
Past Member:	Aggregation Advisory Committee, New York State Energy Research and Development Authority.
Past Member:	Board of Directors, Vermont Energy Investment Corporation.
Past Member:	Board of Directors, National Fuel Funds Network
Past Member:	Board of Directors, Affordable Comfort, Inc. (ACI)
Past Member:	National Advisory Committee, U.S. Department of Health and Human Services, Administration for Children and Families, Performance Goals for Low-Income Home Energy Assistance.
Past Member:	Editorial Advisory Board, International Library, *Public Utility Law Anthology*.
Past Member:	ASHRAE Guidelines Committee, GPC-8, *Energy Cost Allocation of Comfort HVAC Systems for Multiple Occupancy Buildings*
Past Member:	National Advisory Committee, U.S. Department of Housing and Urban Development, Calculation of Utility Allowances for Public Housing.

Past Member: National Advisory Board: Energy Financing Alternatives for Subsidized Housing, New York State Energy Research and Development Authority.

PROFESSIONAL ASSOCIATIONS:

National Association of Housing and Redevelopment Officials (NAHRO)
National Society of Newspaper Columnists (NSNC)
Association for Enterprise Opportunity (AEO)
Iowa State Bar Association
Energy Bar Association
Association for Institutional Thought (AFIT)
Association for Evolutionary Economics (AEE)
Society for the Study of Social Problems (SSSO)
International Society for Policy Studies
Association for Social Economics

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COLTON EXPERIENCE AS EXPERT WITNESS

1988 – PRESENT

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I'M'O DTE (electric)	Sierra Club	Case No. U-18255	Low-income energy efficiency	Michigan	17
I/M/O Merger of AltaGas and WGL Holdings	Office of People's Counsel	Case No. 9449	Low-income / charitable contributions / community impacts	Maryland	17
I/M/O Philadelphia Gas Works	Office of Consumer Advocate	R-2017-2587783	Low-income / rate design	Pennsylvania	17
I/M/O UGI-Peoples Natural Gas	Office of Consumer Advocate	R-2016-2580030	Low-income	Pennsylvania	17
I/M/O Peoples Natural Gas	Office of Attorney General	16-0376	Low-income	Illinois	17
I/M/O UGI-PNG	Office of Consumer Advocate	R-2016-2580030	Rate deisgn/EE&CP/Low-Inocme	Pennsylvania	17
I/M/O Pacific Gas and Electric Company	TURN	15-09-001	Electric bill affordability	California	16
I/M/O FirstEnergy Companies (Met Ed, Penelec, PennPower, West Penn Power)	Office of Consumer Advocate	R-2016-2537349, R-2016-2537352, R-2016-2537355, R-2016-2537359 (consolidated)	Rate design / low-income program cost recovery	Pennsylvania	16
I/M/O PGW Demand Side Management	Office of Consumer Advocate	P-2014-2459362	Demand Side Manaement	Pennsylvania	16
I/M/O Columbia Gas of Pennsylvania	Office of Consumer Advocate	R-2016-2529660	Rate deisgn / customer service / Low-income program cost recovery	Pennsylvania	16
I/M/O Philadelphia Water Department	Public Advocate, City of Philadelphia	N/A	Low-income program design	Philadelphia	16

CASE NAME	CLIENT NAME	Docket No. (if available)	TOPIC	JURIS.	YEAR
I/M/O UGI Gas	Office of Consumer Advocate	M-2015-2518438	Rate design, energy efficiency, customer service	Pennsylvania	16
Keener v. Consumers Energy	Keener (plaintiff)	15-146908-NO	Collections	State District Ct--MI	16
I/M/O Energy Efficiency and Conservation Plan, Phase III, PECO Energy	Office of Consumer Advocate	M-2015-2515691	Multi-Family Energy Efficiency	Pennsylvania	16
I/M/O Energy Efficiency and Conservation Plan, Phase III, Duquesne Light Company	Office of Consumer Advocate	M-2015-2515375	Multi-Family Energy Efficiency	Pennsylvania	16
I/M/O Energy Efficiency and Conservation Plan, Phase III, FirstEnergy Companies (Metropolitan Edison, Penelec, Penn Power, West Penn Power)	Office of Consumer Advocate	M-2015-2514767; M-2015-2514768; M-2015-2514769; M-2015-2514772	Multi-Family Energy Efficiency	Pennsylvania	16
I/M/O Energy Efficiency and Conservation Plan, Phase III, PPL Electric Corporation	Office of Consumer Advocate	M-2015-251-2515642	Multi-Family Energy Efficiency	Pennsylvania	16
I/M/O BC Hydro	Public Interest Action Centre	N/A	Rate design / terms and conditions / energy efficiency	British Columbia	15 - 16
Augustin v. Philadelphia Gas Works	Augustin (Plaintiffs)	2:14—cv-04238	Constitutional notice issues	U.S. District Court (E.D. PA)	15
I/M/O PPL Utilities	Office of Consumer Advocate	R-2015-2469275	Rate design / customer service	Pennsylvania	15
I/M/O Columbia Gas Company	Office of Consumer Advocate	R-2015-2468056	Rate design / customer service	Pennsylvania	15
I/M/O PECO Energy Company	Office of Consumer Advocate	R-2015-2468981	Rate design / customer service	Pennsylvania	15
I/M/O Philadelphia Gas Works	Office of Consumer Advocate	P-2014-2459362	Demand Side Management	Pennsylvania	15
I/M/O SBG Management v. Philadelphia Gas Works	SBG Management	C-2012-2308454	Customer service	Pennsylvania	15

CASE NAME	CLIENT NAME	Docket No. (if available)	TOPIC	JURIS.	YEAR
I/M/O Manitoba Hydro	Resource Action Centre		Low-income affordability	Manitoba	15
I/M/O FirstEnergy Companies (Met Ed, WPP, Penelec, Penn Power)	Office of Consumer Advocate	R-2014-2428742 (8743, 8744, 8745)	Rate design / customer service / storm communications	Pennsylvania	14
I/M/O Xcel Energy Company	Energy CENTS Coalition	E002/GR-13-868	Rate design / energy conservation	Minnesota	14
I/M/O Peoples Gas Light and Coke Company / North Shore Gas	Office of Attorney General	14-0224 / 14--0225	Rate design / customer service	Illinois	14
I/M/O Columbia Gas of Pennsylvania	Office of Consumer Advocate	R-2014-2406274	Rate design / customer service	Pennsylvania	14
I/M/O Duquesne Light Company Rates	Office of Consumer Advocate	R-2013-2372129	Rate design / customer service / storm communications	Pennsylvania	13
I/M/O Duquesne Light Company Universal Service	Office of Consumer Advocate	M-2013-2350946	Low-income program design	Pennsylvania	13
I/M/O Peoples-TWP	Office of Consumer Advocate	P-2013-2355886	Low-income program design / rate design	Pennsylvania	13
I/M/O PECO CAP Shopping Plan	Office of Consumer Advocate	P-2013-2283641	Retail shopping	Pennsylvania	13
I/M/O PECO Universal Service Programs	Office of Consumer Advocate	M-201202290911	Low-income program design	Pennsylvania	13
I/M/O Privacy of Consumer Information	Legal Services Advocacy Project	CI-12-1344	Privacy of SSNs & consumer information	Minnesota	13
I/M/O Atlantic City Electric Company	Division of Rate Counsel	BPU-12121071	Customer service / Storm communications	New Jersey	13
I/M/O Jersey Central Power and Light Company	Division of Rate counsel	BPU-12111052	Customer service / Storm communications	New Jersey	13
I/M/O Columbia Gas Company	Office of Consumer Advocate	R-2012-2321748	Universal service	Pennsylvania	13
I/M/O Public Service Company of Colorado Low-Income Program Design	Xcel Energy d/b/a PSCo	12A--EG	Low-income program design / cost recovery	Colorado	12
I/M/O Philadelphia Water Department.	Philadelphia Public Advocate	No. Docket No.	Customer service	Philadelphia	12
I/M/O PPL Electric Power Corporation	Office of Consumer Advocate	R-2012-2290597	Rate design / low-income programs	Pennsylvania	12

CASE NAME	CLIENT NAME	Docket No. (if available)	TOPIC	JURIS.	YEAR
I/M/O Peoples Natural Gas Company	Office of Consumer Advocate	R-2012-2285985	Rate design / low-income programs	Pennsylvania	12
I/M/O Merger of Constellation/Exelon	Office of Peoples Counsel	CASE 9271	Customer Service	Maryland	11
I/M/O Duke Energy Carolinas	North Carolina Justice Center	E-7, SUB-989	Customer service/low-income rates	North Carolina	11
Re. Duke Energy/Progress Energy merger	NC Equal Justice foundation	E-2, SUB 998	Low-income merger impacts	North Carolina	11
Re. Atlantic City Electric Company	Division of Rate Counsel	ER1186469	Customer Service	New Jersey	11
Re. Camelot Utilities	Office of Attorney General	11-0549	Rate shock	Illinois	11
Re. UGI—Central Penn Gas	Office of Consumer Advocate	R-2010-2214415	Low-income program design/cost recovery	Pennsylvania	11
Re. National Fuel Gas	Office of Consumer Advocate	M-2010-2192210	Low-income program cost recovery	Pennsylvania	11
Re. Philadelphia Gas Works	Office of Consumer Advocate	P-2010-2178610	Program design	Pennsylvania	11
Re. PPL	Office of Consumer Advocate	M-2010-2179796	Low-income program cost recovery	Pennsylvania	11
Re. Columbia Gas Company	Office of Consumer Advocate	R-2010-2215623	Rate design/Low-income program cost recovery	Pennsylvania	11
Crowder et al. v. Village of Kauffman	Crowder (plaintiffs)	3:09-CV-02181-M	Section 8 utility allowances	Texas Fed Court	11
I/M/O Peoples Natural Gas Company.	Office of Consumer Advocate	T-2010-220172	Low-income program design/cost recovery	Pennsylvania	11
I/M/O Commonwealth Edison	Office of Attorney General	10-0467	Rate design/revenue requirement	Illinois	10
I/M/O National Grid d/b/a Energy North	NH Legal Assistance	DG-10-017	Rate design/revenue requirement	New Hampshire	10
I/M/O Duquesne Light Company	Office of Consumer Advocate	R-2010-2179522	Low-income program cost recovery	Pennsylvania	10
I/M/O Avista Natural Gas Corporation	The Opportunity Council	UE-100467	Low-income assistance/rate design	Washington	10
I/M/O Manitoba Hydro	Resource Conservation Manitoba (RCM)	CASE NO. 17/10	Low-income program design	Manitoba	10
I/M/O TW Phillips	Office of Consumer Advocate	R-2010-2167797	Low-income program cost recovery	Pennsylvania	10
I/M/O PECO Energy—Gas Division	Office of Consumer Advocate	R-2010-2161592	Low-income program cost recovery	Pennsylvania	10

CASE NAME	CLIENT NAME	Docket No. (if available)	TOPIC	JURIS.	YEAR
I/M/O PECO Energy—Electric Division	Office of Consumer Advocate	R-2010-2161575	Low-income program cost recovery	Pennsylvania	10
I/M/O PPL Energy	Office of Consumer Advocate	R-2010-2161694	Low-income program cost recovery	Pennsylvania	10
I/M/O Columbia Gas Company	Office of Consumer Advocate	R-2009-2149262	Low-income program design/cost recovery	Pennsylvania	10
I/M/O Atlantic City Electric Company	Office of Rate Council	R09080664	Customer service	New Jersey	10
I/M/O Philadelphia Gas Works	Office of Consumer Advocate	R-2009-2139884	Low-income program cost recovery	Pennsylvania	10
I/M/O Philadelphia Gas Works	Office of Consumer Advocates	R-2009-2097639	Low-income program design	Pennsylvania	10
I/M/O Xcel Energy Company	Xcel Energy Company (PSCo)	085-146G	Low-income program design	Colorado	09
I/M/O Atmos Energy Company	Atmos Energy Company	09AL-507G	Low-income program funding	Colorado	09
I/M/O New Hampshire CORE Energy Efficiency Programs	New Hampshire Legal Assistance	D-09-170	Low-income efficiency funding	New Hampshire	09
I/M/O Public Service Company of New Mexico (electric)	Community Action of New Mexico	08-00273-UT	Rate Design	New Mexico	09
I/M/O UGI Pennsylvania Natural Gas Company (PNG)	Office of Consumer Advocate	R-2008-2079675	Low-income program	Pennsylvania	09
I/M/O UGI Central Penn Gas Company (CPG)	Office of Consumer Advocate	R-2008-2079660	Low-income program	Pennsylvania	09
I/M/O PECO Electric (provider of last resort)	Office of Consumer Advocate	R-2008-2028394	Low-income program	Pennsylvania	08
I/M/O Equitable Gas Company	Office of Consumer Advocate	R-2008-2029325	Low-income program	Pennsylvania	08
I/M/O Columbia Gas Company	Office of Ohio Consumers' Counsel	08-072-GA-AIR	Rate design	Ohio	08
I/M/O Dominion East Ohio Gas Company	Office of Ohio Consumers' Counsel	07-829-GA-AIR	Rate design	Ohio	08
I/M/O Vectren Energy Delivery Company	Office of Ohio Consumers' Counsel	07-1080-GA-AIR	Rate design	Ohio	08
I/M/O Public Service Company of North Carolina	NC Department of Justice	G-5, SUB 495	Rate design	North Carolina	08
I/M/O Piedmont Natural Gas Company	NC Department of Justice	G-9, SUB 550	Rate design	North Carolina	08
I/M/O National Grid	New Hampshire Legal Assistance	DG-08-009	Low-income rate assistance	New Hampshire	08
I/M/O EmPower Maryland	Office of Peoples Counsel	PC-12	Low-income energy efficiency	Maryland	08

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CASE NAME	CLIENT NAME	Docket No. (if available)	TOPIC	JURIS.	YEAR
I/M/O Duke Energy Carolinas Save-a-Watt Program	NC Equal Justice Foundation	E-7, SUB 831	Low-income energy efficiency	North Carolina	08
I/M/O Zia Natural Gas Company	Community Action New Mexico	08-00036-UT	Low-income/low-use rate design	New Mexico	08
I/M/O Universal Service Fund Support for the Affordability of Local Rural Telecomm Service	Office of Consumer Advocate	I-0004010	Telecomm service affordability	Pennsylvania	08
I/M/O Philadelphia Water Department	Public Advocate	No Docket No.	Credit and Collections	Philadelphia	08
I/M/O Portland General Electric Company	Community Action--Oregon	UE-197	General rate case	Oregon	08
I/M/O Philadelphia Electric Company (electric)	Office of Consumer Advocate	M-00061945	Low-income program	Pennsylvania	08
I/M/O Philadelphia Electric Company (gas)	Office of Consumer Advocate	R-2008-2028394	Low-income program	Pennsylvania	08
I/M/O Columbia Gas Company	Office of Consumer Advocate	R-2008-2011621	Low-income program	Pennsylvania	08
I/M/O Public Service Company of New Mexico	Community Action New Mexico	08-00092-UT	Fuel adjustment clause	New Mexico	08
I/M/O Petition of Direct Energy for Low-Income Aggregation	Office of Peoples Counsel	CASE 9117	Low-income electricity aggregation	Maryland	07
I/M/O Office of Consumer Advocate et al. v. Verizon and Verizon North	Office of Consumer Advocate	C-20077197	Lifeline telecommunications rates	Pennsylvania	07
I/M/O Pennsylvania Power Company	Office of Consumer Advocate	P-00072437	Low-income program	Pennsylvania	07
I/M/O National Fuel Gas Distribution Corporation	Office of Consumer Advocate	M-00072019	Low-income program	Pennsylvania	07
I/M/O Public Service of New Mexico–Electric	Community Action New Mexico	07-00077-UT	Low-income programs	New Mexico	07
I/M/O Citizens Gas/NIPSCO/Vectren for Universal Service Program	Citizens Gas & Coke Utility/Northern Indiana Public Service/Vectren Energy	CASE 43077	Low-income program design	Indiana	07
I/M/O PPL Electric	Office of Consumer Advocate	R-00072155	Low-income program	Pennsylvania	07
I/M/O Section 15 Challenge to NSPI Rates	Energy Affordability Coalition	P-886	Discrimination in utility regulation	Nova Scotia	07
I/M/O Philadelphia Gas Works	Office of Consumer Advocate	R-00061931	Low-income programs / credit and collections	Pennsylvania	07
I/M/O Equitable Gas Company	Office of Consumer Advocate	M-00061959	Low-income program	Pennsylvania	07

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CASE NAME	CLIENT NAME	Docket No. (if available)	TOPIC	JURIS.	YEAR
I/M/O Public Service Company of New Mexico	Community Action of New Mexico	Case No. 06-000210-UT	Late charges / winter moratorium / decoupling	New Mexico	06
I/M?O Verizon Massachusetts	ABCD	Case NO. DTE 06-26	Late charges	Massachusetts	06
I/M/O Section 11 Proceeding, Energy Restructuring	Office of Peoples Counsel	PC9074	Low-income needs and responses	Maryland	06
I/M/O Citizens Gas/NIPSCO/Vectren for Univ. Svc. Program	Citizens Gas & Coke Utility/Northern Indiana Public Service/Vectren Energy	Case No. 43077	Low-income program design	Indiana	06
I/M/O Public Service Co. of North Carolina	North Carolina Attorney General/Dept. of Justice	G-5, Sub 481	Low-income energy usage	North Carolina	06
I/M/O Electric Assistance Program	New Hampshire Legal Assistance	DE 06-079	Electric low-income program design	New Hampshire	06
I/M/O Verizon Petition for Alternative Regulation	New Hampshire Legal Assistance	DM-06-072	Basic local telephone service	New Hampshire	06
I/M/O Pennsylvania Electric Co/Metropolitan Edison Co.	Office of Consumer Advocate	N/A	Universal service cost recovery	Pennsylvania	06
I/M/O Duquesne Light Company	Office of Consumer Advocates	R-00061346	Universal service cost recovery	Pennsylvania	06
I/M/O Natural Gas DSM Planning	Low-Income Energy Network	EB-2006-0021	Low-income gas DSM program.	Ontario	06
I/M/O Union Gas Co.	Action Centre for Tenants Ontario (ACTO)	EB-2005-0520	Low-income program design	Ontario	06
I/M/O Public Service of New Mexico merchant plant	Community Action New Mexico	05-00275-UT	Low-income energy usage	New Mexico	06
I/M/O Customer Assistance Program design and cost recovery	Office of Consumer Advocate	M-00051923	Low-income program design	Pennsylvania	06
I/M/O NIPSCO Proposal to Extend Winter Warmth Program	Northern Indiana Public Service Company	Case 42927	Low-income energy program evaluation	Indiana	05
I/M/O Piedmont Natural Gas	North Carolina Attorney General/Dept. of Justice	G-9, Sub 499	Low-income energy usage	North Carolina	05
I/M/O PSEG merger with Exelon Corp.	Division of Ratepayer Advocate	EM05020106	Low-income issues	New Jersey	05
Re. Philadelphia Water Department	Public Advocate	No docket number	Water collection factors	Philadelphia	05
I/M/O statewide natural gas universal service program	New Hampshire Legal Assistance	N/A	Universal service	New Hampshire	05

CASE NAME	CLIENT NAME	Docket No. (if available)	TOPIC	JURIS.	YEAR
I/M/O Sub-metering requirements for residential rental properties	Tenants Advocacy Centre of Ontario	EB-2005-0252	Sub-metering consumer protections	Ontario	05
I/M/O National Fuel Gas Distribution Corp.	Office of Consumer Advocate	R-00049656	Universal service	Pennsylvania	05
I/M/O Philadelphia Gas Works (PGW)	Office of Consumer Advocate	R-00049157	Low-income and residential collections	Pennsylvania	04
I/M/O Nova Scotia Power, Inc.	Dalhousie Legal Aid Service	NSUARB-P-881	Universal service	Nova Scotia	04
I/M/O Lifeline Telephone Service	National Ass'n State Consumer Advocates (NASUCA)	WC 03-109	Lifeline rate eligibility	FCC	04
Mackay v. Verizon North	Office of Consumer Advocate	C20042544	Lifeline rates—vertical services	Pennsylvania	04
I/M/O PECO Energy	Office of Consumer Advocate	N/A	Low-income rates	Pennsylvania	04
I/M/O Philadelphia Gas Works	Office of Consumer Advocate	P00042090	Credit and collections	Pennsylvania	04
I/M/O Citizens Gas & Coke/Vectren	Citizens Action Coalition of Indiana	Case 42590	Universal service	Indiana	04
I/M/O PPL Electric Corporation	Office of Consumer Advocate	R00049255	Universal service	Pennsylvania	04
I/M/O Consumers New Jersey Water Company	Division of Ratepayer Advocate	N/A	Low-income water rate	New Jersey	04
I/M/O Washington Gas Light Company	Office of Peoples Counsel	Case 8982	Low-income gas rate	Maryland	04
I/M/O National Fuel Gas	Office of Consumer Advocate	R-00038168	Low-income program design	Pennsylvania	03
I/M/O Washington Gas Light Company	Office of Peoples Counsel	Case 8959	Low-income gas rate	Maryland	03
Golden v. City of Columbus	Helen Golden	C2-01-710	ECOA disparate impacts	Ohio	02
Huegel v. City of Easton	Phyllis Huegel	00-CV-5077	Credit and collection	Pennsylvania	02
I/M/O Universal Service Fund	Public Utility Commission staff	N/A	Universal service funding	New Hampshire	02
I/M/O Philadelphia Gas Works	Office of Consumer Advocate	M-00021612	Universal service	Pennsylvania	02
I/M/O Washington Gas Light Company	Office of Peoples Counsel	Case 8920	Rate design	Maryland	02
I/M/O Consumers Illinois Water Company	Illinois Citizens Utility Board	02-155	Credit and collection	Illinois	02

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CASE NAME	CLIENT NAME	Docket No. (if available)	TOPIC	JURIS.	YEAR
I/M/O Public Service Electric & Gas Rates	Division of Ratepayer Advocate	GR01050328	Universal service	New Jersey	01
I/M/O Pennsylvania-American Water Company	Office of Consumer Advocate	R-00016339	Low-income rates and water conservation	Pennsylvania	01
I/M/O Louisville Gas & Electric Prepayment Meters	Kentucky Community Action Association	200-548	Low-income energy	Kentucky	01
I/M/O NICOR Budget Billing Plan Interest Charge	Cook County State's Attorney	01-0175	Rate Design	Illinois	01
I/M/O Rules Re. Payment Plans for High Natural Gas Prices	Cook County State's Attorney	01-0789	Budget Billing Plans	Illinois	01
I/M/O Philadelphia Water Department	Office of Public Advocate	No docket number	Credit and collections	Philadelphia	01
I/M/O Missouri Gas Energy	Office of Peoples Counsel	GR-2001-292	Low-income rate relief	Missouri	01
I/M/O Bell Atlantic--New Jersey Alternative Regulation	Division of Ratepayer Advocate	T001020095	Telecommunications universal service	New Jersey	01
I/M/O Entergy Merger	Low-Income Intervenors	2000-UA925	Consumer protections	Mississippi	01
I/M/O T.W. Phillips Gas and Oil Co.	Office of Consumer Advocate	R00994790	Ratemaking of universal service costs.	Pennsylvania	00
I/M/O Peoples Natural Gas Company	Office of Consumer Advocate	R-00994782	Ratemaking of universal service costs.	Pennsylvania	00
I/M/O UGI Gas Company	Office of Consumer Advocate	R-00994786	Ratemaking of universal service costs.	Pennsylvania	00
I/M/O PFG Gas Company	Office of Consumer Advocate	R00994788	Ratemaking of universal service costs.	Pennsylvania	00
Armstrong v. Gallia Metropolitan Housing Authority	Equal Justice Foundation	2:98-CV-373	Public housing utility allowances	Ohio	00
I/M/O Bell Atlantic--New Jersey Alternative Regulation	Division of Ratepayer Advocate	T099120934	Telecommunications universal service	New Jersey	00
I/M/O Universal Service Fund for Gas and Electric Utilities	Division of Ratepayer Advocate	EX00200091	Design and funding of low-income programs	New Jersey	00
I/M/O Consolidated Edison Merger with Northeast Utilities	Save Our Homes Organization	DE 00-009	Merger impacts on low-income	New Hampshire	00
I/M/O UtiliCorp Merger with St. Joseph Light & Power	Missouri Dept. of Natural Resources	EM2000-292	Merger impacts on low-income	Missouri	00
I/M/O UtiliCorp Merger with Empire District Electric	Missouri Dept. of Natural Resources	EM2000-369	Merger impacts on low-income	Missouri	00

CASE NAME	CLIENT NAME	Docket No. (if available)	TOPIC	JURIS.	YEAR
I/M/O PacifiCorp	The Opportunity Council	UE-991832	Low-income energy affordability	Washington	00
I/M/O Public Service Co. of Colorado	Colorado Energy Assistance Foundation	99S-609G	Natural gas rate design	Colorado	00
I/M/O Avista Energy Corp.	Spokane Neighborhood Action Program	UE9911606	Low-income energy affordability	Washington	00
I/M/O TW Phillips Energy Co.	Office of Consumer Advocate	R-00994790	Universal service	Pennsylvania	00
I/M/O PECO Energy Company	Office of Consumer Advocate	R-00994787	Universal service	Pennsylvania	00
I/M/O National Fuel Gas Distribution Corp.	Office of Consumer Advocate	R-00994785	Universal service	Pennsylvania	00
I/M/O PFG Gas Company/Northern Penn Gas	Office of Consumer Advocate	R-00005277	Universal service	Pennsylvania	00
I/M/O UGI Energy Company	Office of Consumer Advocate	R-00994786	Universal service	Pennsylvania	00
Re. PSCO/NSP Merger	Colorado Energy Assistance Foundation	99A-377EG	Merger impacts on low-income	Colorado	99 - 00
I/M/O Peoples Gas Company	Office of Consumer Advocate	R-00994782	Universal service	Pennsylvania	99
I/M/O Columbia Gas Company	Office of Consumer Advocate	R-00994781	Universal service	Pennsylvania	99
I/M/O PG Energy Company	Office of Consumer Advocate	R-00994783	Universal service	Pennsylvania	99
I/M/O Equitable Gas Company	Office of Consumer Advocate	R-00994784	Universal service	Pennsylvania	99
Allerruzzo v. Klarchek	Barlow Allerruzzo	N/A	Mobile home fees and sales	Illinois	99
I/M/O Restructuring New Jersey's Natural Gas Industry	Division of Ratepayer Advocate	GO99030123	Universal service	New Jersey	99
I/M/O Bell Atlantic Local Competition	Public Utility Law Project	P-00991648	Lifeline telecommunications rates	Pennsylvania	99
I/M/O Merger Application for SBC and Ameritech Ohio	Edgemont Neighborhood Association	N/A	Merger impacts on low-income consumers	Ohio	98 - 99
Davis v. American General Finance	Thomas Davis	N/A	Damages in "loan flipping" case	Ohio	98 - 99
Griffin v. Associates Financial Service Corp.	Earlie Griffin	N/A	Damages in "loan flipping" case	Ohio	98 - 99

CASE NAME	CLIENT NAME	Docket No. (if available)	TOPIC	JURIS.	YEAR
I/M/O Baltimore Gas and Electric Restructuring Plan	Maryland Office of Peoples Counsel	Case No. 8794	Consumer protection/basic generation service	Maryland	98 - 99
I/M/O Delmarva Power and Light Restructuring Plan	Maryland Office of Peoples Counsel	Case No. 8795	Consumer protection/basic generation service	Maryland	98 - 99
I/M/O Potomac Electric Power Co. Restructuring Plan	Maryland Office of Peoples Counsel	Case No. 8796	Consumer protection/basic generation service	Maryland	98 - 99
I/M/O Potomac Edison Restructuring Plan	Maryland Office of Peoples Counsel	Case No. 8797	Consumer protection/basic generation service	Maryland	98 - 99
VMHOA v. LaPierre	Vermont Mobile Home Owners Association	N/A	Mobile home tying	Vermont	98
Re. Restructuring Plan of Virginia Electric Power	VMH Energy Services, Inc.	PUE960296	Consumer protection/basic generation service	Virginia	98
Mackey v. Spring Lake Mobile Home Estates	Timothy Mackey	N/A	Mobile home fees	State ct: Illinois	98
Re. Restructuring Plan of Atlantic City Electric	New Jersey Division of Ratepayer Advocate	E097070457	Low-income issues	New Jersey	97-98
Re. Restructuring Plan of Jersey Central Power & Light	New Jersey Division of Ratepayer Advocate	E097070466	Low-income issues	New Jersey	97-98
Re. Restructuring Plan of Public Service Electric & Gas	New Jersey Division of Ratepayer Advocate	E097070463	Low-income issues	New Jersey	97-98
Re. Restructuring Plan of Rockland Electric	New Jersey Division of Ratepayer Advocate	E09707466	Low-income issues	New Jersey	97-98
Appleby v. Metropolitan Dade County Housing Agency	Legal Services of Greater Miami	N/A	HUD utility allowances	Fed. court: So. Florida	97 - 98
Re. Restructuring Plan of PECO Energy Company	Energy Coordinating Agency of Philadelphia	R-00973953	Universal service	Pennsylvania	97
Re. IES Industries Merger	Iowa Community Action Association	SPU-96-6	Low-income issues	Iowa	97

CASE NAME	CLIENT NAME	Docket No. (if available)	TOPIC	JURIS.	YEAR
Re. New Hampshire Electric Restructuring	NH Comm. Action Ass'n	N/A	Wires charge	New Hampshire	97
Re. Merger of Atlantic City Electric and Connectiv	Division of Ratepayer Advocate	EM97020103	Low-income	New Jersey	97
Re. Connecticut Power and Light	City of Hartford	92-11-11	Low-income	Connecticut	97
Re. Comprehensive Review of RI Telecomm Industry	Consumer Intervenors	1997	Consumer protections	Rhode Island	97
Re. Natural Gas Competition in Wisconsin	Wisconsin Community Action Association	N/A	Universal service	Wisconsin	96
Re. Baltimore Gas and Electric Merger	Maryland Office of Peoples Counsel	CASE NO. 8725	Low-income issues	Maryland	96
Re. Northern States Power Merger	Energy Cents Coalition	E-002/PA-95-500	Low-income issues	Minnesota	96
Re. Public Service Co. of Colorado Merger	Colorado Energy Assistance Foundation	N/A	Low-income issues	Colorado	96
Re. Massachusetts Restructuring Regulations	Fisher, Sheehan & Colton	DPU-96-100	Low-income issues/energy efficiency	Massachusetts	96
I/M/O PGW FY1996 Tariff Revisions	Philadelphia Public Advocate	No Docket No.	Credit and collection / customer service	Philadelphia	96
Re. FERC Merger Guidelines	National Coalition of Low-Income Groups	RM-96-6-000	Low-income interests in mergers	Washington D.C.	96
Re. Joseph Keliikuli III	Joseph Keliikuli III	N/A	Damages from lack of homestead	Honolulu	96
Re. Theresa Mahaulu	Theresa Mahaulu	N/A	Damages from lack of homestead	Honolulu	95
Re. Joseph Ching, Sr.	Re. Joseph Ching, Sr.	N/A	Damages from lack of homestead	Honolulu	95
Joseph Keaulana, Jr.	Joseph Keaulana, Jr.	N/A	Damages from lack of homestead	Honolulu	95
Re. Utility Allowances for Section 8 Housing	National Coalition of Low-Income Groups	N/A	Fair Market Rent Setting	Washington D.C.	95
Re. PGW Customer Service Tariff Revisions	Philadelphia Public Advocate	No Docket No.	Credit and collection	Philadelphia	95

CASE NAME	CLIENT NAME	Docket No. (if available)	TOPIC	JURIS.	YEAR
Re. Customer Responsibility Program	Philadelphia Public Advocate	No Docket No.	Low-income rates	Philadelphia	95
Re. Houston Lighting and Power Co.	Gulf Coast Legal Services	12065	Low-Income Rates	Texas	95
I/M/O Petition to Stay PGW's Suspension of CRP customers who did Not Assign LIHEAP Grant to PGW	Philadelphia Public Advocate	No Docket No.	Low-Income rates	Philadelphia	95
Re. PGW Tariff Changes, Programs and Information Systems	Philadelphia Public Advocate	No Docket No.	Credit and collection	Philadelphia	95
Re. Request for Modification of Winter Moratorium	Philadelphia Public Advocate	No Docket No.	Credit and collection	Philadelphia	95
Re. Dept of Hawaii Homelands Trust Homestead Production	Native Hawaiian Legal Corporation	N/A	Prudence of trust management	Honolulu	94
Re. SNET Request for Modified Shutoff Procedures	Office of Consumer Counsel	94-06-73	Credit and collection	Connecticut	94
Re. Central Light and Power Co.	United Farm Workers	128280	Low-income rates/DSM	Texas	94
Blackwell v. Philadelphia Electric Co.	Gloria Blackwell	N/A	Role of shutoff regulations	Penn. courts	94
U.S. West Request for Waiver of Rules	Wash. Util. & Transp. Comm'n Staff	UT-930482	Telecommunications regulation	Washington	94
Re. U.S. West Request for Full Toll Denial	Colorado Office of Consumer Counsel	93A-6113	Telecommunications regulation	Colorado	94
Washington Gas Light Company	Community Family Life Services	Case 934	Low-income rates & energy efficiency	Washington D.C.	94
Clark v. Peterborough Electric Utility	Peterborough Community Legal Centre	6900/91	Discrimination of tenant deposits	Ontario, Canada	94
Dorsey v. Housing Auth. of Baltimore	Baltimore Legal Aide	N/A	Public housing utility allowances	Federal district court	93
Penn Bell Telephone Co.	Penn. Utility Law Project	P00930715	Low-income phone rates	Pennsylvania	93
Philadelphia Gas Works	Philadelphia Public Advocate	No Docket No.	Low-income rates	Philadelphia	93
Central Maine Power Co.	Maine Assn Ind. Neighborhoods	Docket No. 91-151-C	Low-income rates	Maine	92
New England Telephone Company	Mass Attorney General	92-100	Low-income phone rates	Massachusetts	92

CASE NAME	CLIENT NAME	Docket No. (if available)	TOPIC	JURIS.	YEAR
Philadelphia Gas Works	Philadelphia Public Advocate	No Docket No.	Low-income DSM	Philadelphia	92
Philadelphia Water Dept.	Philadelphia Public Advocate	No Docket No.	Low-income rates	Philadelphia	92
Public Service Co. of Colorado	Land and Water Fund	91A-783EG	Low-income DSM	Colorado	92
Sierra Pacific Power Co.	Washoe Legal Services	N/A	Low-income DSM	Nevada	92
Consumers Power Co.	Michigan Legal Services	No Docket No.	Low-income rates	Michigan	92
Columbia Gas	Office of Consumer Advocate (OCA)	R9013873	Energy Assurance Program	Pennsylvania	91
Mass. Elec. Co.	Mass Elec Co.	N/A	Percentage of Income Plan	Massachusetts	91
AT&T	TURN	90-07-5015	Inter-LATA competition	California	91
Generic Investigation into Uncollectibles	Office of Consumer Advocate	I-900002	Controlling uncollectibles	Pennsylvania	91
Union Heat Light & Power	Kentucky Legal Services (KLS)	90-041	Energy Assurance Program	Kentucky	90
Philadelphia Water	Philadelphia Public Advocate (PPA)	No Docket No.	Controlling accounts receivable	Philadelphia	90
Philadelphia Gas Works	PPA	No Docket No.	Controlling accounts receivable	Philadelphia	90
Mississippi Power Co.	Southeast Mississippi Legal Services Corp.	90-UN-0287	Formula ratemaking	Mississippi	90
West Kentucky Gas	KLS	90-013	Energy Assurance Program	Kentucky	90
Philadelphia Electric Co.	PPA	N/A	Low-income rate program	Philadelphia	90
Montana Power Co.	Montana Ass'n of Human Res. Council Directors	N/A	Low-income rate proposals	Montana	90
Columbia Gas Co.	Office of Consumer Advocate	R-891468	Energy Assurance Program	Pennsylvania	90
Philadelphia Gas Works	PPA	No Docket No.	Energy Assurance Program	Philadelphia	89
Southwestern Bell Telephone Co.	SEMLSC	NF-89749	Formula ratemaking	Mississippi	90

CASE NAME	CLIENT NAME	Docket No. (if available)	TOPIC	JURIS.	YEAR
Generic Investigation into Low-income Programs	Vermont State Department of Public Service	Case No. 5308	Low-income rate proposals	Vermont	89
Generic Investigation into Dmnd Side Management Measures	Vermont DPS	N/A	Low-income conservation programs	Vermont	89
National Fuel Gas	Office of Consumer Advocate	N/A	Low-income fuel funds	Pennsylvania	89
Montana Power Co.	Human Resource Develop. Council District XI	N/A	Low-income conservation	Montana	88
Washington Water Power Co.	Idaho Legal Service Corp.	N/A	Rate base, rate design, cost-allocations	Idaho	88

Appendix B:
A Review of the Valuation of Non-Energy Impacts (NEIs) in Four Selected States Presented to New Hampshire PUC

Prepared by: Roger Colton

October 2017

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1. 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.[1]

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.[2] Only the NEIs from the utility's perspective and from the participant's perspective are presented.[3] The Colorado report stated that the valuation methods "have been honed and demonstrated over a period of about 15 years."[4]

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%

[1] Lisa Skumatz (2010). ***Non-Energy Benefits Analysis for Xcel Energy's Low Income Energy Efficiency Programs***, at 8.
[2] In this table, I have excluded the NEIs for gas programs and the NEIs for the combined gas/electric programs. I have also excluded the multi-family housing and nonprofit NEIs calculated for Colorado simply as being beyond the scope of my testimony.
[3] In other words, I have excluded the societal NEIs.
[4] Skumatz Colorado, at 10.

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.[5]

I discuss 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 risk to the disconnection of service in the first instance.

- 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 devote to responding to a service disconnection.

Based on this discussion, I do not conclude 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

[5] Skumatz Colorado, at 9 (internal notes omitted). The "exceptions" referenced in the report are not applicable here.

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.

2. Massachusetts.

In 2016, Three[3] (read "Three-Cubed") prepared a report for the Massachusetts Program Administrators ("MPA") on low-income single family health- and safety-related non-energy impacts.[6] 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[7] five years earlier for the MPA.[8] The 2016 Massachusetts study found the following monetized participant NEIs regarding health and safety.

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[9]	$4,291.65[10]	Summed

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).

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[6] 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.

[7] By "more comprehensive, I mean to reference the fact that the NMR Group's study of NEIs considered more than health and safety issues.

[8] 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.

[9] The lower valued NEIs discussed in the Three[3] report have been omitted here.

[10] The study noted that participants would need the "full complement of major weatherization measures" to generate the identified NEIs.

Like Colorado above, the Massachusetts Three[3] 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).

- 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.[11]

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."[12] NMR recommended an *annual* noise reduction value of $31/year for non-low-income homes.[13]

The NMR Massachusetts report does have one significant shortcoming. In Massachusetts, NMR declined to include any benefits derived from energy bill savings.[14] 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.[15] 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 quantification 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

[11] NMR Massachusetts, at 5-9.
[12] NMR Massachusetts, at 5-11.
[13] 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-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 my discussion here.
[14] 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.
[15] "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).

value NEIs to non-low-income energy efficiency investments. When added to the health and safety NEIs previously documented by Three[3], we find more than $6,400 of NEIs in this limited set of participant perspective NEIs alone.[16]

3. Connecticut.

In 2016, the NMR Group completed an evaluation of Connecticut's ratepayer-funded energy efficiency programs.[17] 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. . .[18]

NMR concluded that "in other words, the NEI values can be considered as multipliers that are applied to energy savings."[19] 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.[20]

4. 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.[21]

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[16] 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.
[17] 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.
[18] NMR Connecticut, at XL11.
[19] NMR Connecticut, at 138.
[20] NMR Connecticut, at 142.
[21] 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.

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."[22] ITRON recommended that Maryland use "the comfort benefit in future ex ante and/or ex post cost-effectiveness analysis."[23] 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, a conclusion which I reiterate and with which I agree:

> 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.[24]

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."[25]

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.[26]

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[22] 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.
[23] ITRON, at 3-5.
[24] 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.
[25] Skumatz Maryland, at 2.
[26] 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.

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.[27] Skumatz reported that this value was a "high value NEB" which exhibited little variation within a program or between measure types.[28] 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.[29]

[27] 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%.
[28] Skumatz Maryland, at 31.
[29] Skumatz Maryland, at 42.