

**THE STATE OF NEW HAMPSHIRE**  
**BEFORE THE PUBLIC UTILITIES COMMISSION**  
**TESTIMONY OF**  
**MICHAEL R. GOLDMAN**  
**ACCOUNTING FOR NON-ENERGY IMPACTS IN**  
**NEW HAMPSHIRE’S COST-EFFECTIVENESS TEST**  
**Docket No. DE 17-XXX**

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1 **I. Introduction**

2 **Q. Please state your name and business address.**

3 A. My name is Michael R. Goldman and my business address is 247 Station Drive,  
4 Westwood, Massachusetts.

5 **Q. By whom are you employed and in what capacity?**

6 A. I am the Manager of Regulatory, Planning and Evaluation for the operating companies of  
7 Eversource Energy, including Public Service Company of New Hampshire d/b/a  
8 Eversource Energy (“Eversource”).

9 **Q. Please describe your business and educational background.**

10 A. I received a Bachelor of Arts degree from the University of Wisconsin-Madison, and a  
11 Master of Arts degree with concentrations in Energy Policy and International Finance  
12 from the Johns Hopkins School of Advanced International Studies. I have over a decade  
13 of experience in the energy industry, working as a strategy and operations management  
14 consultant in the electric industry for Deloitte Consulting and as an energy business

1 analyst at PowerAdvocate. I joined Eversource Energy in 2012 as a Senior Research  
2 Analyst and was promoted to my current position in 2016.

3 **Q. Have you previously testified before the New Hampshire Public Utilities**  
4 **Commission?**

5 A. I have not previously testified before the New Hampshire Public Utilities Commission.  
6 However, I have previously testified before the Massachusetts Department of Public  
7 Utilities on behalf of Eversource's affiliate companies including in D.P.U. 15-169 (the  
8 three-year energy efficiency plan for the 2016-2018 term), D.P.U. 15-164 (the  
9 Eversource Energy gas three-year energy efficiency plan), and in D.P.U. 16-178  
10 (Eversource's request for approval for a demand response demonstration project budget).

11 **Q. What is the purpose of this testimony?**

12 A. The purpose of this testimony is to explain the New Hampshire electric and gas utilities'  
13 (NH Utilities) proposed approach and values for incorporating non-energy impacts  
14 (NEIs) in New Hampshire's energy efficiency cost effectiveness test.

15 **II. Background**

16 **Q. Please briefly describe the types of NEIs associated with energy efficiency programs.**

17 A. NEIs are positive and negative effects attributable to energy efficiency programs, distinct  
18 from energy savings. Evaluators of energy efficiency programs recognize three general  
19 types of NEIs, categorized based on the entity to which the NEI accrues: (1) utility NEIs,  
20 such as reduced arrearages and debt collection costs; (2) participant NEIs, such as  
21 reduced operations and maintenance costs, impacts on occupant health and productivity,  
22 or increased property values; and (3) societal NEIs, such as economic development and  
23 environmental impacts.

1 **Q. Please briefly describe the current cost effectiveness test used in New Hampshire.**

2 A. The NH Utilities use the Total Resource Cost (“TRC”) test to screen programs for cost-  
3 effectiveness. TRC tests generally estimate the present value of utility system and  
4 program participant benefits, such as avoided energy and capacity costs and utility and  
5 participant NEIs (numerator), and compare that to the present value of energy efficiency  
6 program and participant costs, such as out-of-pocket costs to purchase and install energy  
7 efficiency measures (denominator). New Hampshire’s TRC test includes all energy  
8 efficiency program and participant costs, but not all benefits. To date, the TRC test has  
9 included the value of avoided water and sewer costs, but other NEIs have been excluded.

10 **Q. How long have the NH Utilities used the TRC test to screen programs for cost-  
11 effectiveness?**

12 A. The NH Utilities have used the TRC test to screen programs for cost-effectiveness for  
13 over twenty years, and it has been the basis for program benefit/cost calculations in each  
14 statewide energy efficiency plan approved by the Commission.

15 **Q. Is it common practice to include NEIs in cost effectiveness tests?**

16 A. Yes. More than 20 states and Washington, D.C. account for NEIs in some way in their  
17 cost effectiveness tests.<sup>1</sup> Regulatory bodies have adjudicated and approved inclusion of  
18 NEIs, typically allowing for one or both of the following approaches: measured NEI  
19 values and NEI adders. Measured NEI values are typically derived from independent  
20 evaluations of specific efficiency measures or programs, using methodologies such as  
21 analysis of utility data, engineering models, or surveys and interviews. NEI adders are a  
22 simpler method whereby multiplier values are applied to total energy or resource  
23 benefits. NEI adders typically range from ten to fifteen percent, with some jurisdictions

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<sup>1</sup>Modified and updated from Northeast Energy Efficiency Partnership, *Non-Energy Impacts Approaches and Values: an Examination of the Northeast, Mid-Atlantic, and Beyond*, June 2017; and ACEEE, *Guidelines for Low Income Energy Efficiency Programs*, June 2017. Modifications based on state commission filings.

1 applying an additional percentage for certain programs, such as low-income programs,  
2 which are known to have more significant non-energy benefits.

3 Adders allow jurisdictions to account for the value of NEIs, given limited resources for  
4 evaluations to precisely measure NEIs. In several states, NEI adders have been approved  
5 as temporary, conservative proxies, to be updated with measured NEI values from  
6 subsequent evaluations or evaluations in other states. For example, the Colorado Public  
7 Utilities Commission in 2008 adopted a 20 percent NEI adder for low-income programs,  
8 and directed program administrators to update the quantification of low-income NEIs  
9 prior to filing their next plan.<sup>2</sup> In 2011, the Colorado Public Utilities Commission  
10 approved program administrators' proposal to increase the low-income NEI adder to 25  
11 percent based on the results of a study commissioned pursuant to the 2008 order.<sup>3</sup>  
12 Similarly, the Vermont Public Service Board determined in 2012 that it was appropriate  
13 to adopt a fifteen percent NEI adder as a conservative estimate, subject to continued  
14 monitoring and examination and potential revision in future proceedings.<sup>4</sup>

15 **Q. Why do states include NEIs in cost effectiveness tests?**

16 A. States include NEIs in cost effective tests for several reasons.<sup>5</sup> First, because the TRC test  
17 includes participants' costs for energy efficiency measures, participant NEIs allow for a  
18 balanced assessment of the impacts of energy efficiency programs on customers.<sup>6</sup> This  
19 symmetrical treatment of costs and benefits is a core principle for developing and

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<sup>2</sup>Public Utilities Commission of the State of Colorado, Decision No. C08-0560, adopted May 23, 2008

<sup>3</sup>Public Utilities Commission of the State of Colorado, Decision No. C11-0442, adopted March 30, 2011

<sup>4</sup>State of Vermont, Public Service Board, *Order Re Cost-Effectiveness Screening of Heating and Process-Fuel Efficiency Measures and Modifications to State Cost-Effectiveness Screening Tool*, February 7, 2012

<sup>5</sup>Regulatory Assistance Project and Synapse Energy Economics, Inc., *Energy Efficiency Cost-Effectiveness Screening: How to Properly Account for 'Other Program Impacts' and Environmental Compliance Costs*, November, 2012.

<sup>6</sup>For example, the Maryland Public Service Commission adopted the use of NEIs in July 2015, stating that cost-effectiveness testing must be symmetrical in how it considers both costs and benefits, and thus an inclusion of all participant costs in a test requires the inclusion of all participant benefits, including [NEIs]. See Maryland Public Service Commission, Order No. 87082, July 16, 2015.

1 applying cost effectiveness tests, according to the National Standard Practice Manual for  
2 Assessing Cost-Effectiveness of Energy Efficiency Resources.<sup>7</sup> If NEIs are not accounted  
3 for, TRC tests will provide biased and inaccurate indications of which programs are cost  
4 effective. In addition, NEIs factor into customer decisions to install energy efficiency  
5 measures. Customers choose to pay for measures not only to save energy and money, but  
6 also to gain valuable improvements in operations and maintenance costs, comfort,  
7 aesthetics, and other benefits, and including NEIs in cost effectiveness tests allows for a  
8 better accounting of these factors.<sup>8</sup>

9 **Q. What evidence have other states used as a basis for their NEI values?**

10 A. States have based their NEI values on a large body of evidence from independent,  
11 methodologically rigorous evaluations. Literature reviews have identified over 300  
12 studies of NEIs, which have found monetized NEI values that often exceed the value of  
13 energy savings.<sup>9</sup> Numerous independent evaluation firms have conducted recent studies  
14 covering a broad range of NEIs, such as operations and maintenance impacts; occupant  
15 health, productivity and comfort impacts; economic development impacts; and reduced  
16 utility arrearages, among others. In addition, the studies have covered the full range of  
17 efficiency programs, including C&I new construction, C&I retrofit, residential, and low-  
18 income residential, along with portfolio-wide studies of NEIs.<sup>10</sup>

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<sup>7</sup>The National Standard Practice Manual provides a comprehensive framework for assessing the cost-effectiveness of energy efficiency resources. It was developed and reviewed by a nearly 50 member team representing a wide range of industry, government, and non-profit perspectives. See the National Efficiency Screening Project, *National Standard Practice Manual for Assessing Cost-Effectiveness of Energy Efficiency Resources*, May 2017.

<sup>8</sup>For example, the Vermont Department of Public Service recommended a 15 percent NEI adder be applied to account for hard-to-quantify benefits that factor into participant decision-making. State of Vermont, Public Service Board, *Order Re Cost-Effectiveness Screening of Heating and Process-Fuel Efficiency Measures and Modifications to State Cost-Effectiveness Screening Tool*, February 7, 2012

<sup>9</sup>See, for example, Lisa Skumatz, Ph.D. *Non-Energy Benefits / Non-Energy Impacts (NEBs/NEIs) and Their Role & Values in Cost-Effectiveness Tests: State of Maryland, Final Report*. March 31, 2014

<sup>10</sup>Examples of recent studies in the northeast region include DNV-GL, *Commercial and Industrial New Construction Non-Energy Impacts Study*, Mar 2016 (MA, C&I new construction); Tetra Tech, *Commercial and Industrial Non-Energy Impacts Study*, Jun 2012 (MA, C&I retrofit); NMR, *HES/HES-IE Process Evaluation and R31 Real-time Research*, Apr 2016 (CT, residential and residential low-income); Three<sup>3</sup>, *Low-Income Single-Family Health- and Safety-Related Non-Energy Impacts (NEIs) Study*, Aug 2016 (MA, low-income residential); Peregrine Energy Group, Inc., *Analysis of Job Creation from 2015 Expenditures for Energy*

1 **Q. What methodologies are used to determine NEI values, and how rigorous are they?**

2 A. A variety of evaluation methodologies are used to determine NEI values, including:

- 3 • direct analysis of utility data, for example, to assess impacts on arrearages or  
4 shutoffs/reconnects  
5 • engineering models, for example, to assess operations and maintenance impacts  
6 • surveys and in-depth interviews, for example, to assess participant health,  
7 productivity, or comfort impacts  
8 • economic or environmental models, for example, to assess employment impacts  
9 or emissions impacts

10 These methodologies have been developed and refined over time to ensure that they yield  
11 reliable and valid results.<sup>11</sup> There is a large body of research on engineering models,  
12 survey valuation methods, and the use of different cost and benefit data to measure  
13 health, economic, and other impacts. This research has led to the emergence of best  
14 practices, such as using engineering studies to supplement self-reported surveys, avoiding  
15 double counting of overlapping NEIs, and ensuring evaluations include non-energy costs  
16 as well as benefits. Methodologies used in NEI research have been successfully utilized  
17 across the social sciences, including in healthcare, real estate appraisal, and economic  
18 development. Furthermore, evaluations are conducted by trained, independent third-party  
19 evaluators, and evaluation quality and reliability is reinforced through the regulatory and  
20 stakeholder review process and through the peer-review process for evaluations presented  
21 at national and international conferences.<sup>12</sup>

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*Efficiency in Rhode Island by National Grid*, Apr 2016 (RI, portfolio-wide); Itron, *Development and Application of Select Non-Energy Benefits for the EmPOWER Maryland Energy Efficiency Programs*, Feb. 2015 (MD, portfolio-wide)

<sup>11</sup>See, for example, Stevens N., Clendenning, G., Caron, N., NMR/DNV-GL, *NEI Abbreviated Literature Review (TXC41)*, April 2017; Abdou M. et al, *EM&V Roadmap to Quantifying Challenging Non-Energy Impacts*, paper and presentation before the 2016 International Energy Program Evaluation Conference; Skumatz L., *Non-Energy Benefits / NEBs – Winning at Cost-Effectiveness Dominos: State Progress and TRMs*, 2016 ACEEE Summer Study; Clendenning, G. et al, *Measuring Participant Perspective Non-Energy Impacts (NEIs)*, 2012 ACEEE Summer Study.

<sup>12</sup>For example of NEI evaluation conference presentations, see *The (r)Evolution of Non-Energy Benefits in Energy Efficiency*, presented at the 2017 Society for Benefit-Cost Analysis (Washington, D.C.); *Saving Lives through Energy Efficiency: Valuing the Health- and Safety-Related Benefits of Weatherization in Low-Income Homes*, presented at the 2017 International Energy

1 **III. The NH Utilities' NEI Proposal**

2 **Q. How do the NH Utilities propose to account for NEIs in New Hampshire's cost**  
3 **effectiveness test?**

4 A. The NH Utilities propose an NEI adder equal to ten percent of total electric, gas, and  
5 other fuel benefits, as a conservative proxy for the full value of a multitude of known  
6 NEIs.<sup>13</sup> The proposed adder will help ensure balanced, symmetrical treatment of costs  
7 and benefits and recognition of participant benefits that factor into their decisions to  
8 install energy efficiency measures.

9 **Q. What is the evidence that supports the NH Utilities' proposed adder?**

10 A. In the absence of New Hampshire-specific NEI evaluations, the NH Utilities based their  
11 proposed adder on neighboring states' NEIs as a percentage of the total benefits of their  
12 energy efficiency portfolios, evidence from neighboring states' NEI evaluations, and  
13 adder levels in these and other states. The preponderance of the evidence supports a  
14 portfolio-wide NEI adder of at least ten percent.

15 First, the total value of NEIs associated with energy efficiency programs in New England  
16 states—including measured NEIs in Massachusetts, Connecticut, and Rhode Island, and  
17 adder-based NEIs in Vermont—are equivalent to at least twenty percent of the total  
18 resource benefits of the programs in those states, as shown in Table 1.<sup>14</sup>

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Program Evaluation Conference (Baltimore, MD); *Examining Non-Energy Benefits (NEBs) at the Measure Level and by Type of Program Participant*, presented at the 2011 International Energy Program Evaluation Conference (Boston, MA).

<sup>13</sup>Other fuels include oil, propane, wood, and kerosene. The proposed adder will not be applied to water savings, to avoid double-counting.

<sup>14</sup>Total resource benefits included in this analysis are electric energy, electric capacity, natural gas, oil, propane and water savings. The NH Utilities' proposal is to apply NEI adders to total electric, gas, and other fuel (e.g., oil and propane) benefits, and not to water savings. As a result, the NEI percentages for CT, MA, RI, and VT in this analysis are lower than they would be using the same calculation the NH Utilities are proposing.

1 **Table 1. NEIs as a Percent of Total Resource Benefits in New England States**

	Program area	Total Resource Benefits (millions) <sup>a</sup>	NEIs (millions) <sup>b</sup>	NEIs as percent of Total Resource Benefits
MA Electric & Gas (2016 actual)	Non-income eligible residential	\$847	\$182	21.46%
	Income eligible residential	\$110	\$89	80.58%
	Commercial and industrial	\$1,369	\$223	16.30%
	<b>Total</b>	<b>\$2,326</b>	<b>\$494</b>	<b>21.22%</b>
CT Electric & Gas (2017 planned)	Non-income eligible residential	\$113	\$50	43.71%
	Income eligible residential	\$27	\$23	88.20%
	Commercial and industrial	\$208	\$0	0.00%
	<b>Total</b>	<b>\$347</b>	<b>\$73</b>	<b>21.00%</b>
RI Electric & Gas (2017 planned)	Non-income eligible residential	\$68	\$17	24.50%
	Income eligible residential	\$20	\$36	177.06%
	Commercial and industrial	\$167	\$7	3.96%
	<b>Total</b>	<b>\$255</b>	<b>\$59</b>	<b>23.27%</b>
VT Electric (2016 preliminary estimates)	Non-income eligible residential	\$50	\$30	60.88%
	Income eligible residential	\$3	\$2	67.85%
	Commercial and industrial	\$66	\$35	52.93%
	<b>Total</b>	<b>\$119</b>	<b>\$67</b>	<b>56.60%</b>

2 a. Total resource benefits include electric capacity, electric energy, natural gas, oil, propane and water  
3 savings.

4 b. NEI values for all states reflect participant NEIs, such as O&M, labor, health, safety, and property  
5 values. Massachusetts' and Rhode Island's NEI values also include utility NEIs such as reduced arrearages  
6 associated with low-income customers. Vermont's participant NEIs are applied as a 15% adder to total  
7 energy benefits, with an additional 15% adder for low-income programs. In addition, Vermont NEIs  
8 include externalities based on values from the Avoided Energy Supply Component Study Group, "*Avoided  
9 Energy Supply Costs in New England: 2015 Report,*" which are in turn based on \$100/short ton of CO<sub>2</sub>  
10 emission.

11 Second, neighboring states' NEI values are based on numerous rigorous and independent  
12 evaluations of a range of NEIs across multiple sectors and program areas (see  
13 Attachments K1 – K6 for the evaluation reports cited on page 5 of this testimony). The  
14 NH Utilities reviewed these evaluations for methodological rigor and potential  
15 applicability to New Hampshire. Although the evaluated NEI values for these other states



1 may be greater or lesser than the corresponding values for New Hampshire, these  
2 evaluations provide a sound basis of support for the proposed adder. In addition, states  
3 regularly adopt NEI values from evaluations conducted in other jurisdictions, in the same  
4 manner that states regularly adopt energy savings values from evaluations conducted in  
5 other jurisdictions, in part to minimize the costs and time of conducting original NEI  
6 research. For example, the Delaware Energy Efficiency Advisory Council approved NEI  
7 values based on out-of-state evaluations, including residential weatherization health and  
8 safety NEIs from a Massachusetts evaluation and reduced low-income arrearages from a  
9 Maryland evaluation.<sup>15</sup> Similarly, Rhode Island bases many of its NEI values on  
10 Massachusetts evaluations.

11 Third, NEI adders in others states provide points of comparison that further support the  
12 proposed adder. As previously noted, many states use NEI adders ranging from ten to  
13 fifteen percent, with some jurisdictions applying an additional percentage for low-income  
14 programs.<sup>16</sup> For example, Vermont uses a fifteen percent NEI adder to account for the  
15 hard-to-quantify benefits that factor into participant decision-making, and an additional  
16 15 percent low-income NEI adder, which the Public Service Board determined was an  
17 appropriate conservative estimate of the unique benefits of low-income programs.<sup>17</sup>

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<sup>15</sup>See the DE Energy Efficiency Advisory Council website, [here](#) and [here](#).

<sup>16</sup>States including Colorado, Iowa, Illinois, Maryland, New Mexico, Oregon, Utah, Vermont, and Washington, as well as Washington, D.C. use adders to account for one or more types of participant or societal NEIs. Modified from Northeast Energy Efficiency Partnership, *Non-Energy Impacts Approaches and Values: an Examination of the Northeast, Mid-Atlantic, and Beyond*, June 2017 and ACEEE, *Guidelines for Low Income Energy Efficiency Programs*, June 2017. Modifications based on state commission filings.

<sup>17</sup>In addition to these adders, Vermont's cost effectiveness test includes (1) an additional 10 percent risk discount on measure and program costs to account for the reduced risk of demand-side resources, and (2) an environmental externalities benefit, based on a value of \$100/short ton of CO2 emissions used in the Avoided Energy Supply Component Study Group, *Avoided Energy Supply Costs in New England: 2015 Report*, March 31, 2015.

1 **Q. Why are NEIs a relatively lower percent of total resource benefits for commercial**  
2 **and industrial (C&I) programs in neighboring states, and how did the NH Utilities**  
3 **account for this in developing the proposed ten percent NEI adder?**

4 A. To date, neither Connecticut nor Rhode Island have specifically evaluated C&I NEIs in  
5 their respective states. Rhode Island has applied NEIs to its C&I programs based on a  
6 2012 Massachusetts evaluation of C&I retrofit programs, but has not yet applied NEI  
7 values from Massachusetts' more recent 2016 evaluation of NEIs associated with C&I  
8 new construction.<sup>18</sup> In Massachusetts, which has applied NEIs from both evaluations,  
9 C&I NEIs represent 16.3 percent of the total resource benefits for C&I programs—well  
10 above the NH Utilities' proposed adder. These evaluations met the same high standards  
11 for independence and methodological rigor as the other NEI evaluations from  
12 neighboring states.

13 Moreover, the NH Utilities' proposed ten percent adder is a portfolio-wide adder  
14 encompassing residential programs, which have significantly greater NEI values than  
15 C&I programs. In particular, neighboring states' low-income residential programs have  
16 NEIs ranging from nearly 68 percent to 177 percent of total resource benefits. Therefore,  
17 the proposed ten percent adder is a conservative proxy for portfolio-wide NEIs.

18 **Q. How do the NH Utilities propose to collect and analyze New Hampshire-specific NEI**  
19 **evidence?**

20 A. As proposed in Section 8.0 of the 2018-2020 Statewide Energy Efficiency Plan, ongoing  
21 review and quantification of NEIs will be discussed and determined by the EM&V  
22 Working Group. Specific evaluations will be prioritized as part of an overall strategic  
23 evaluation plan to be developed by the Working Group. Short-term priorities for NEI  
24 research may include an independent analysis of neighboring states' NEI evaluations and

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<sup>18</sup>DNV-GL, *Commercial and Industrial New Construction Non-Energy Impacts Study*, Mar 2016; Tetra Tech, *Commercial and Industrial Non-Energy Impacts Study*, Jun 2012 (C&I retrofit).

1 associated evidence to identify those values that are suitable for direct application in New  
2 Hampshire as a less costly alternative to conducting primary NEI research.

3 **IV. Conclusion**

4 **Q. Please provide a final summary of the NH Utilities' NEI proposal.**

5 A. The NH Utilities' proposed NEI adder—ten percent of total electric, gas, and other fuel  
6 benefits—represents a conservative proxy for the full value of a multitude of known  
7 NEIs, based on the preponderance of evidence from extensive research and program  
8 evaluations. The adder will help ensure that New Hampshire's cost effectiveness test  
9 reflects a balanced, symmetrical treatment of costs and benefits and accounts for benefits  
10 that factor into participants' decisions to install energy efficiency measures.

11 **Q. Does this conclude your testimony?**

12 A. Yes.