

**STATE OF NEW HAMPSHIRE
BEFORE THE
PUBLIC UTILITIES COMMISSION**

Docket No. DG 17-152

Liberty Utilities (EnergyNorth Natural Gas) Corp. d/b/a Liberty Utilities
Least Cost Integrated Resource Plan

REBUTTAL TESTIMONY

OF

PAUL J. HIBBARD

October 25, 2019

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1 **I. INTRODUCTION**

2 **Q. Please state your full name, business address and occupation.**

3 A. My name is Paul J. Hibbard. I am a Principal at Analysis Group, Inc., an economic, finance
4 and strategy consulting firm headquartered in Boston, Massachusetts, where I work on
5 energy and environmental economic and policy consulting. My business address is 111
6 Huntington Avenue, 14th Floor, Boston, Massachusetts.

7 **Q. On whose behalf are you submitting this rebuttal testimony?**

8 A. I am submitting this rebuttal testimony before the New Hampshire Public Utilities
9 Commission (the “Commission” or “NHPUC”) on behalf of Liberty Utilities (EnergyNorth
10 Natural Gas) Corp. d/b/a Liberty Utilities (“Liberty” or the “Company”).

11 **Q. Did you previously submit testimony in this case?**

12 A. Yes, I submitted testimony in Docket No. DG 17-152 on June 28, 2019, (“Hibbard Direct
13 Testimony” or “Direct Testimony”) on behalf of Liberty. My background and
14 qualifications are contained in and attached to the Hibbard Direct Testimony, and remain
15 unchanged from that time.

16 **Q. Would you please provide a brief summary of your Direct Testimony?**

17 A. The purpose of my Direct Testimony was to provide additional environmental impact
18 analysis related to the potential impact on Clean Air Act compliance, and the potential
19 environmental, economic, and health-related impacts of each option proposed by Liberty
20 in its Least Cost Integrated Resource Plan (“LCIRP”), in response to Order No. 26,225
21 (Mar. 13, 2019) (the “Order”). Based on analysis described in my Direct Testimony, I

1 concluded:

- 2
- Nearly every household and business in New Hampshire requires the use of some
3 type of fuel and/or electricity to meet vital heating, hot water, and process needs
4 (“service needs”), and both options proposed in Liberty’s LCIRP introduce the
5 opportunity for New Hampshire residents and businesses to switch from more
6 polluting fuels (such as oil, propane and wood) to natural gas for meeting service
7 needs.¹
 - These conversions to natural gas resulting from the Company’s proposed projects
8 will benefit New Hampshire’s efforts to comply with the Clean Air Act (“CAA”),
9 providing meaningful reductions in emissions of sulfur dioxide (“SO₂”) for heating
10 and other service needs relative to the status quo, with the Granite Bridge Pipeline
11 providing the greatest level of reductions over time.²
 - These conversions would also reduce emissions of criteria pollutants and reduce
12 costs associated with the harmful effects of pollutant emissions on public health.
13 In addition to the reductions in emissions of SO₂ noted above, the Granite Bridge
14 Pipeline will reduce emissions of nitrogen oxides (“NO_x”), particulate matter
15 (“PM”), and mercury (“Hg”).³ The reductions in SO₂, NO_x, and PM together
16
17

¹ Hibbard Direct Testimony at 4.

² Hibbard Direct Testimony at 21.

³ These emission reductions result from conversions of heating systems using more polluting fuels to natural gas that could not occur in a “status quo” scenario absent the Granite Bridge Pipeline.

1 contribute to health benefits of the Granite Bridge Pipeline of between \$1.06
2 million and \$2.39 million, relative to the status quo. I also found that the options
3 will lead to lower emissions of GHG relative to the status quo scenario, thereby
4 contributing to a lowering of the risks associated with climate change.⁴

- 5 • Finally, the Granite Bridge Pipeline will reduce large truck traffic for deliveries of
6 propane and/or liquefied natural gas (“LNG”), and will further reduce local
7 deliveries of oil and propane to residences and businesses that switch from those
8 fuels to natural gas. These reductions in truck delivery also generate emission
9 reductions and public health benefits relative to the status quo.⁵

10 On August 12, 2019, the Public Utilities Commission (“PUC” or “Commission”) issued
11 Order No. 26,286 in Docket DG 17-152. In that Order the Commission found that
12 Liberty’s supplemental filings (which included the Hibbard Direct Testimony) “compl[ie]d
13 with the directive contained in Order No. 26,255” that the Company “submit a
14 supplemental filing to address each of the specific elements required under RSA 378:38
15 and RSA 378:39.”⁶

16 **Q. Have you reviewed the testimony submitted by Staff and interveners in this case?**

17 A. Yes I have. In particular I focused on the Direct Testimony of Terry Michael Clark (“Clark
18 Direct Testimony”), the Direct Testimony of Elizabeth A. Stanton, PhD (“Stanton Direct

⁴ Hibbard Direct Testimony at 28-30.

⁵ Hibbard Direct Testimony at 31-32.

⁶ Commission Order 26,286 at page 6.

1 Testimony”), and the Direct Testimony of Paul Chernick (“Chernick Direct Testimony”).
2 The Stanton Direct Testimony and Chernick Direct Testimony were filed on behalf of the
3 Conservation Law Foundation.

4 **Q. What is the purpose of your testimony?**

5 A. The purpose of my testimony is to comment on the Clark, Stanton, and Chernick Direct
6 Testimonies with respect to their viewpoints on the likely environmental and climate
7 change impacts of the Company’s proposals to meet the LCIRP-identified need, and to
8 address errors in their analysis of my Direct Testimony.

9 **Q. Would you please summarize your analysis and conclusions?**

10 A. Yes. The intervener testimonies do not present any evidence that affects the results of my
11 analysis and findings or the conclusions I draw from them. The intervener testimonies
12 merely confuse the issue by presenting a broad set of energy and environmental policy
13 questions that are outside the scope of the very real and practical questions before the
14 Commission in this docket: namely, what resources are needed to reliably meet the current
15 and future heating and other service needs in Liberty’s service territory, and how should
16 the Company proceed to meet that need at the lowest possible cost to consumers?

17 The analysis in my Direct Testimony is focused on the obligations and options of Liberty
18 with respect to reliably meeting these customer service needs, and the CAA,
19 environmental, and climate implications of Liberty’s choices compared to the status quo.
20 Rather than focus on present circumstances, the intervener witnesses wander far off the
21 mark, and instead postulate a distant future world where: (1) residential and commercial

1 consumers have only one option for meeting heating and service needs - electric heat
2 pumps; (2) the heat pumps do not require any supplemental heating to meet customer needs
3 on cold New Hampshire days (an assumption contrary to current technology capabilities
4 and expectations); and (3) the electric system in New England has undergone a rapid
5 transition to only low- and zero-carbon forms of generation.

6 The world constructed by the intervener witnesses - and on which their observations are
7 based - is not real. It does not exist now, will not exist over the course of this LCIRP, and
8 may not exist as imagined for many years (if ever). Electric heat pumps are not, and will
9 not soon be, ubiquitous. It is not clear that electric heat pumps are economic, or are
10 sufficient without supplemental heating on cold days. There is little reason to believe the
11 level of heat pump adoption assumed by the intervener witnesses is realizable anytime
12 soon. In addition, generating the electricity to power electric heat pumps involves the
13 combustion of natural gas in power plants, which in New England are on the margin most
14 of the time, and will be for at least a decade, *even if large quantities of renewable resources*
15 *are added over time.*⁷

16 Finally, even if the state of New Hampshire does evolve towards widespread adoption of
17 electric heat pumps, this would not change the conclusions drawn in my Direct Testimony
18 for at least two reasons. First, because natural gas-fired power plants will be on the margin

⁷ ISO-NE, 2017 Economic Study: Exploration of Least-Cost Emissions-Compliant Scenarios, October 29, 2018, (hereafter “ISO-NE 2017 Economic Study”), <https://www.iso-ne.com/committees/planning/planning-advisory/?document-type=Economic%20Studies>, at 50-51.

1 most of the time in New England for long after the term of this LCIRP, and heat pumps are
2 insufficient to meet all winter demand, meeting heating needs using electric heat pumps is
3 likely higher-emitting than using natural gas for heating. Second, even under wildly
4 optimistic scenarios for adoption of electric heat pumps in New Hampshire, the *last*
5 customers to adopt heat pump technologies should be those in the service territories of
6 natural gas LDCs, who have access to less expensive and lower-emitting natural gas for
7 heating and service needs. In fact, the greatest environmental benefit (and the most
8 beneficial primary focus of conversions to electric heat pumps) should be customers that
9 (a) currently heat with oil, propane, or wood, and (b) do not have access to natural gas
10 service, and thus have no option to reduce emissions through conversion to natural gas.

11 Finally, the interveners failed to recognize that my Direct Testimony is based on an
12 assumption of only a small fraction of customers in Liberty's service territory switching to
13 natural gas for heating. My analysis is highly conservative (i.e., potentially underestimates
14 emission reduction benefits) in that it only estimates benefits from a small number of
15 conversions of customers that have or gain access to natural gas service within Liberty's
16 service territory, representing a small fraction (less than one percent annually) of customers
17 that currently use more polluting fuels in the footprint of Liberty's service territory, and a
18 tiny fraction - about one half of one percent annually - of all residential and commercial
19 customers that currently use more polluting fuels for heating in the State of New
20 Hampshire.

1 **Q. How have you organized your testimony?**

2 A. In Section II I provide my evaluation of the positions taken by the interveners' witnesses.
3 In Section III I provide my conclusions based on my review.

4 **II. INTERVENER COMMENTS**

5 **Q. Have you reviewed the Direct Testimonies of Dr. Stanton and Mr. Chernick with**
6 **respect to the use of electric heat pumps in New Hampshire?**

7 A. Yes. I have.

8 **Q. Please summarize your understanding of their viewpoint.**

9 A. Dr. Stanton and Mr. Chernick are opposed to Liberty's LCIRP in part on the basis that - in
10 their view - most (or all) new customers' demand and existing customers' conversions in
11 New Hampshire for heating and other service needs will be met through the installation of
12 electric heat pumps. Moreover, Mr. Chernick and Dr. Stanton assert or assume that the
13 total emissions associated with using natural gas for heating is greater than the total
14 emissions associated with the use of electric heat pump technologies to meet the same
15 service needs.

16 **Q. Do you agree with the viewpoints of Dr. Stanton and Mr. Chernick?**

17 A. No, I do not.

18 Dr. Stanton and Mr. Chernick expect that in the coming decades there will be a transition
19 in how the service needs of customers are met, moving away from fossil fuel consumption
20 and towards low- and zero-carbon resources, in order to meet states' GHG reduction
21 requirements and goals. Their testimonies are thus focused on a vision for the future with

1 technologies that may help achieve states' decarbonization goals two to three decades in
2 the future.

3 However, there are many potential ways for states to meet their long-term GHG reduction
4 goals, and the pathways from here to there have not yet been identified. The interveners'
5 witnesses offer a viewpoint on one potential future, but their vision for the future *does not*
6 reflect circumstances that are in place now or will be anytime soon. Nor do they represent
7 a practical framework for Commission consideration of the Company's LCIRP and its
8 proposed alternatives.

9 This is because the witnesses' discussion of electric heat pumps (a) dramatically overstates
10 any plausible scenario for growth in heat pump use by consumers in New Hampshire over
11 the coming decade, (b) overstates the ability of heat pumps to meet resident and business
12 heating and service needs during New Hampshire winters without supplemental heating,
13 and (c) incorrectly characterizes the operation of the power system - and thus the emissions
14 profile of heat pumps - over this time period.

15 **Q. Please discuss how Dr. Stanton and Mr. Chernick mischaracterize the uptake of**
16 **electric heat pumps in New Hampshire.**

17 A. In my direct testimony I estimate changes in emissions due to incremental displacement of
18 "status quo" heating technologies (oil, propane, electric baseboard, electric heat pump, and
19 wood) with new natural gas service made possible through the Company's proposed
20 alternatives. For the calculation of emission impacts, I estimate that the customers that
21 switch to natural gas do so in proportion to the use of existing fuels for heating in the region

1 where Liberty operates.⁸ Mr. Chernick and Dr. Stanton argue that rather than heating with
2 technologies in rough proportion to the technologies in current use, residents and
3 businesses will *instead*, on a going forward basis, universally adopt efficient electric heat
4 pumps, without any supplemental heating, for heating and other service needs.

5 **Q. Do you agree with this assumption?**

6 A. No, I do not. The intervener witnesses' viewpoint is aspirational and unrealistic, is focused
7 on long-term GHG reduction targets (for 2040 and 2050), and reflects only one possible
8 pathway towards decarbonization. In contrast, the options reviewed in Liberty's LCIRP
9 are immediate; they are needed to reliably meet fundamental heating and service needs
10 now, and can generate immediate reductions in emissions that, but for their proposed
11 solutions, will not be realized. Liberty's proposal will open the door to customers selecting
12 efficient natural gas technologies for heating. Absent that choice, these customers would
13 select alternative technologies, such as oil, propane, wood, or electricity (baseboard and/or
14 electric heat pumps).

15 While the witnesses may hope or wish that electric heat pumps become the technology of
16 choice for heating and service needs, it simply is *not the case* at this time, and is not likely
17 to be over the term of the Company's LCIRP. Instead, absent the option to select natural
18 gas for heating and service needs, customers will likely select alternative technologies in

⁸ Hibbard Direct Testimony at 6-7.

1 rough proportion to their current use in southern New Hampshire.

2 **Q. What are the challenges to increased adoption of electric heat pumps in New**
3 **Hampshire?**

4 A. There are two challenges to more widespread adoption of electric heat pumps in New
5 Hampshire: they are not currently a least-cost heating option, and they cannot adequately
6 meet customers' heating needs without a supplemental source of heat for cold winter days
7 in New Hampshire.

8 The most important piece of evidence related to heat pump economics is also the most
9 obvious: if electric heat pumps were a least cost heating option, there would be significantly
10 higher uptake than there has been to date in the state. And while Mr. Chernick asserts that
11 electric heat pumps are economic and sufficient without the support of a supplemental
12 heating source (such as a backup oil/propane furnace, wood stove, and/or baseboard
13 electric heating), he fails to provide any evidence supporting this conclusion other than
14 reference to the fact that there has been some uptake of electric heat pumps in states with
15 different climates, supported by supplemental funding through state grants, rebates, or tax
16 incentives (such as New Jersey, California and Massachusetts). In fact, in each state
17 referenced by Mr. Chernick, the quotes he used specifically reference financial incentives
18 or other support needed to spur increased adoption of electric heat pump technologies,

1 which support is generally only needed for more costly technologies.⁹

2 Strikingly, the American Council for an Energy-Efficient Economy (“ACEEE”) studies
3 cited by Mr. Chernick in his testimony directly contradict his conclusions. For example,
4 one ACEEE study cited by Mr. Chernick states that heat pumps “have the greatest potential
5 for adoption in cold-climate regions where natural gas is not available for space heating.”¹⁰
6 That same ACEEE study recommends that programs to promote cold-climate heat pumps
7 “should target existing homes that use electricity, propane, or heating oil as their space
8 heating fuel (not utility natural gas),”¹¹ and concludes that “[c]old climate air source heat
9 pumps have been identified for their potential to provide significant energy and cost
10 savings to homeowners without access to natural gas space heating.”¹² Another ACEEE
11 study cited by Mr. Chernick states: “In moderately cold states (as far north as Pennsylvania
12 and Massachusetts)... life-cycle costs for gas furnaces in existing homes will be lower than
13 for heat pumps.”¹³ Thus, even the studies cited by Mr. Chernick do not support the idea
14 that heat pumps are a viable or economic alternative to natural gas in cold climates like
15 New Hampshire.

⁹ Chernick Direct testimony at 17-18.

¹⁰ American Council for an Energy-Efficient Economy, Field Assessment of Cold Climate Air Source Heat Pumps, https://aceee.org/files/proceedings/2016/data/papers/1_700.pdf, at 1-2.

¹¹ Ibid, at 1-13

¹² Ibid. [Emphasis added]

¹³ American Council for an Energy-Efficient Economy, Report A1803, Energy Savings, Consumer Economics, and Greenhouse Gas Emissions Reductions from Replacing Oil and Propane Furnaces, Boilers, and Water Heaters with Air-Source Heat Pumps, July 2018, <https://aceee.org/sites/default/files/publications/researchreports/a1803.pdf>, at 2

1 Finally, Mr. Chernick's Figure 1 - showing heat pump efficiency and capacity based on the
2 ACEEE Field Assessment, demonstrates the fundamental challenge to using electric heat
3 pumps in New Hampshire. Namely, the heating capacity at ten degrees Fahrenheit is on
4 the order of a third less than the heating capacity of the technology at 50 degrees
5 Fahrenheit, and its capability declines more steeply at lower temperatures - temperatures
6 often realized in New Hampshire.¹⁴ This suggests a clear need for supplemental sources of
7 heat with the use of electric heat pumps.

8 **Q. Is it inappropriate for states to provide incentives for greater installation of electric**
9 **heat pumps?**

10 A. No, it is not. States in New England have adopted aggressive goals and requirements for
11 reducing emissions of GHGs over the next few decades, and have begun the process of
12 exploring various pathways and technologies to support achievement of these goals and
13 requirements. Exploring the *potential* contributions associated with electrification of the
14 heating sector - for example through the establishment of state grants, tax rebates, and/or
15 other incentives for the continued development and installation of electric heating
16 technologies - is an appropriate focus for the consideration in long-term state energy and
17 environmental policy.

¹⁴ Chernick Direct testimony at 12.

1 **Q. Does this mean greater installation of electric heat pumps is an appropriate focus of**
2 **Liberty's LCIRP?**

3 A. No, it does not, for two reasons. First, as demonstrated in my Direct Testimony, conversion
4 of oil, propane, and wood heating to efficient natural gas heating technologies - where there
5 is access to natural gas supply - can deliver immediate reductions in emissions of GHGs
6 and other harmful pollutants. Second, there is a massive untapped market for any state
7 incentives focused on the installation of electric heat pumps to displace oil, propane and
8 wood heating technologies in communities that do not have access to natural gas supply.
9 This means that if and to the extent the state of New Hampshire considers it appropriate to
10 promulgate policies in support of increased installations of electric heat pumps in
11 residences and businesses, the appropriate primary focus from the perspective of climate,
12 public health, environmental, and energy policy is on incentives for customers that *do not*
13 *have access to natural gas.*

14 **Q. Mr. Chernick argues that electric heat pumps are more beneficial than heating with**
15 **natural gas with respect to emissions of GHGs and other pollutants. Do you agree?**

16 A. No. Efficient natural gas heating is likely less polluting than heating systems that include
17 electric heat pump technology. This is true under the current resource mix and dispatch
18 practices of the New England region's electricity market, and in my view will continue to
19 be the case for many years.

20 **Q. Please provide more detail.**

21 A. Mr. Chernick focuses in his testimony on a lengthy and unnecessarily complicated

1 discussion of technology efficiencies, and asserts erroneously that the “...energy for
2 marginal electric load like a new heat pump would come mostly from clean renewables or
3 from natural gas.”¹⁵

4 Comparing the emission impacts of electric heat pumps and natural gas for heating is
5 relatively simple. One would compare for household heating needs the emissions from a
6 natural gas furnace (plus upstream emissions and fugitive methane associated with
7 production, processing and transportation of the gas used) with the emissions from the
8 electric system to meet the incremental electricity demand of the heat pump. These
9 marginal emissions from the electric system would include the emissions from the power
10 plant operating on the margin to meet the demand (plus upstream and fugitive emissions
11 associated with production, processing and transportation of the fuel used on the margin,
12 and taking into account the electric system transmission and distribution losses to serve the
13 load). Finally, one would identify the emissions associated with supplemental sources of
14 heat for electric heat pump installations. For example, if the supplemental heating source
15 is a retained oil or propane boiler furnace, the emission impacts of electric heat pump
16 installations could be higher than those of efficient natural gas technology.

¹⁵ Chernick Direct Testimony at 13.

1 **Q. Mr. Chernick suggests that the mix of resources to generate electricity will change,**
2 **and potentially alter, the emissions associated with electricity generation. Do you**
3 **agree?**

4 A. In part, yes. The New England states and market participants are actively pursuing
5 development and grid integration of a large amount of low/zero-carbon generating
6 resources, including large hydro, wind, and solar power plants. In addition, there continues
7 to be active growth in behind-the-meter solar photovoltaic installations. All of these factors
8 will increase the amount of energy coming annually from low emission resources.

9 However, what matters is the emission profile of units on the margin day to day - in other
10 words, the last power plants turned on to meet the incremental demand from new electric
11 heat pumps. As noted by Mr. Chernick, the marginal energy supply in 2018 was mostly
12 natural gas (70 percent), with the rest taken up by a mix of oil and coal (in small amounts),
13 and other non-emitting resources.¹⁶ My estimates of electricity-based emissions in my
14 Direct Testimony are based on the emissions associated with the region's marginal
15 generation profile.

16 Mr. Chernick implies that this marginal emission profile will change over the term of the
17 LCIRP (or beyond), and this means the emission impacts of electric heat pumps will be
18 reduced. But this is not likely to be the case. While the total annual generation from low-
19 emitting resources will likely increase, there are at least two reasons why it is a mistake to

¹⁶ Chernick Direct Testimony at 13.

1 conclude this will change the emission profile of the power system - and thus electric heat
2 pumps - over the term of this LCIRP or more generally over the next decade.

3 First, as ISO-NE has found, even with the integration of vast amounts of low-emission
4 generation, the power plants operating on the margin will remain mostly natural gas for a
5 very long time, well beyond the term of the LCIRP.¹⁷ Second, to the extent that states make
6 rapid progress in achieving GHG reductions over the coming decade, this will likely
7 require significant electrification of the transportation sector. This will place strong
8 upward pressure on the demand for electricity, tending to retain or possibly even increase
9 the demand for natural gas generation on the margin.

10 **Q. How does the population of new natural gas conversions you assumed in the Hibbard**
11 **Direct Testimony compare to the broader set of heating customers in New**
12 **Hampshire?**

13 A. The interveners failed to recognize that my Direct Testimony is based on an assumption of
14 only a small fraction of customers in Liberty's service territory switching to natural gas for
15 heating. My analysis is highly conservative (i.e., potentially underestimates emission
16 reduction benefits) in that it only estimates benefits from a small number of conversions of
17 customers that have or gain access to natural gas service within Liberty's service territory,
18 representing a small fraction (less than one percent annually) of customers that currently

¹⁷ In their 2017 Economic Analysis, ISO-NE modeled various scenarios in 2030 where between 5,500 and 13,000 MW of combined offshore and onshore wind come online. Through all of these high renewable integration scenarios, the study notes that, "[...] natural gas generation is mostly on the margin across all scenarios." ISO-NE 2017 Economic Study at 31, 50-51.

1 use more polluting fuels in the footprint of Liberty’s service territory, and a tiny fraction -
2 about one half of one percent annually - of all customers that currently use more polluting
3 fuels for heating in the State of New Hampshire.

4 **Q. Do you have any additional comments on the interveners’ testimonies?**

5 A. Yes. In the calculations included in my Direct Testimony I used a 100-year global warming
6 potential (“GWP”) of 25 for emissions of methane. Mr. Clark suggests that instead I should
7 use a twenty-year GWP for methane of 84. I disagree with his recommendation.

8 **Q. Why do you disagree with Mr. Clark’s recommendation?**

9 A. I recognize that there is debate in the literature on which time frame (e.g., 20 years or 100
10 years) is more appropriate to use for estimating the GWP of methane, depending on the
11 viewpoint of the user and the purpose of the analysis. In my Direct Testimony, I considered
12 it most appropriate to use the 100-year value, as this has been and is the most commonly-
13 used value in regulatory analyses, as noted by the IPCC, EPA, and the New Hampshire
14 DES.¹⁸ In any event, using Mr. Clark’s suggested GWP does not qualitatively change my

¹⁸ IPCC, Climate Change 2007 Synthesis Report, https://www.ipcc.ch/site/assets/uploads/2018/02/ar4_syr_full_report.pdf; IPCC, Climate Change 2014 Synthesis Report, https://www.ipcc.ch/site/assets/uploads/2018/02/SYR_AR5_FINAL_full.pdf; EPA, Emission Factors for Greenhouse Gas Inventories, Last Modified March 9, 2019, https://www.epa.gov/sites/production/files/2018-03/documents/emission-factors_mar_2018_0.pdf; EPA, Understanding Global Warming Potentials, <https://www.epa.gov/ghgemissions/understanding-global-warming-potentials>; New Hampshire Department of Environmental Services, The New Hampshire Climate Action Plan: A Plan for New Hampshire’s Energy, Environmental and Economic Development Future, March 2009, https://www.des.nh.gov/organization/divisions/air/tsb/tps/climate/action_plan/documents/nhcap_final.pdf.

1 results and would not affect the conclusions drawn in my Direct Testimony.¹⁹

2 **III. CONCLUSIONS**

3 **Q. What do you conclude based on your review of the intervenor witnesses' testimonies?**

4 A. Based on my review, I come to the following observations and conclusions:

- 5 • The intervenors' testimonies do not affect my analysis or the conclusions I drew in
6 my Direct Testimony. The options presented in the Company's LCIRP are likely
7 to generate meaningful public health and environmental benefits relative to the
8 status quo. These benefits include emissions reductions of criteria pollutants, and
9 reductions in costs associated with the harmful effects of these pollutant emissions
10 on public health. I also find that the options will lead to lower emissions of GHG
11 relative to the status quo scenario, and thereby contribute to a lowering of risks
12 associated with climate change.
- 13 • The world constructed by the intervenor witnesses - and on which their observations
14 are based - is not real. It does not exist now, will not exist over the course of this
15 LCIRP, and may not exist as imagined for many years (if ever). Electric heat pumps
16 are not, and will not soon be, ubiquitous. It is not clear that electric heat pumps are
17 economic, or are sufficient without supplemental heating on cold days. There is
18 little reason to believe the level of heat pump adoption assumed by the intervenor

¹⁹ Response to Clark Data Requests - Set 5, Request No. Clark 5-9.

1 witnesses is realizable anytime soon. And generating the electricity to power
2 electric heat pumps involves the combustion of natural gas in power plants, which
3 in New England are on the margin most of the time, and will be for at least a decade,
4 even if large quantities of renewable resources are added over time.

- 5 • Even if the state of New Hampshire does evolve towards widespread adoption of
6 electric heat pumps, this would not change the conclusions drawn in my Direct
7 Testimony for at least two reasons. First, because natural gas-fired power plants
8 will be on the margin most of the time in New England for long after the term of
9 this LCIRP, meeting heating needs with approaches that include electric heat
10 pumps is likely higher-emitting than using natural gas for heating. Second, even
11 under wildly optimistic scenarios for adoption of electric heat pumps in New
12 Hampshire, the last customers to adopt heat pump technologies should be those in
13 the service territories of natural gas LDCs, who have access to less expensive and
14 lower-emitting natural gas for heating and service needs. In fact, the greatest
15 environmental benefit (and the most beneficial first focus of conversions to electric
16 heat pumps) should be customers that (a) currently heat with oil, propane, or wood,
17 and (b) do not have access to natural gas service, and thus have no option to reduce
18 emissions through conversion to natural gas.

- 19 • The interveners failed to recognize that my Direct Testimony is based on an
20 assumption of only a small fraction of customers in Liberty's service territory
21 switching to natural gas for heating. My analysis is highly conservative (i.e.,

1 potentially underestimates emission reduction benefits) in that it only estimates
2 benefits from a small number of conversions of customers that have or gain access
3 to natural gas service within Liberty's service territory, representing a small
4 fraction (less than one percent annually) of customers that currently use more
5 polluting fuels in the footprint of Liberty's service territory, and a tiny fraction -
6 about one half of one percent annually - of all residential and commercial customers
7 that currently use more polluting fuels for heating in the State of New Hampshire.

8 **Q. Does this complete your testimony?**

9 **A. Yes.**