PROTECT THE GRANITE STATE

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February 14, 2017

Pamela G. Monroe, Administrator
New Hampshire Site Evaluation Committee
21 South Fruit Street, Suite 10
Concord, NH 03301

Re: SEC Docket No. 2015-06

Dear Ms. Monroe:

Protect the Granite State, a grassroots organization dedicated to giving a greater voice to the thousands of New Hampshire residents who oppose the Northern Pass transmission line, is pleased to provide these comments for consideration by the New Hampshire Site Evaluation Committee in the above-referenced docket.

Our comments consist of this letter and the attached independent analysis prepared by analysts at the Analysis Group. This report was co-authored by Susan Tierney, who among other things previously served as the Executive Director of the Massachusetts Energy Facility Siting Council, as a Commissioner of the Massachusetts Department of Public Utilities, and Secretary of Environmental Affairs in Massachusetts.

The Analysis Group found several significant flaws in the economic impact analysis done by London Economics International ("LEI") on behalf of the applicants, Northern Pass Transmission, LLC and Public Service Company of New Hampshire, including:

- The LEI report has an unusual level of hidden data, with pages and pages of redacted information, denying the public any meaningful detail as to its inputs and severely limiting any ability to objectively analyze its findings. Although the Analysis Group recognizes that parties that are formally participating in the Site Evaluation Committee's process and that have signed non-disclosure agreements may see the underlying detail, this redaction leaves the public with little information to go on. The Analysis Group report states:

We have deep experience in reviewing reports on quantitative modeling studies where the authors go to great care to summarize assumptions, data inputs, and results. The level of redaction here is categorically different from the norm.

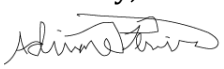
- The LEI study is not a "cost/benefit" analysis as it is titled, but rather only examines the purported benefits of Northern Pass while ignoring the substantial costs;
- The LEI study makes several incorrect assumptions in arriving at its conclusions;
- The LEI study assumes that the cost of constructing the multi-billion-dollar transmission line will only be borne by consumers outside of New Hampshire without explaining its cost allocation. The Analysis Group report estimates that the NP transmission line would likely cost $55/MWh (or 5.5 cents per kWh) above and beyond the expected cost of power. In addition, the increase in energy prices could be even larger due to the need for Hydro-Quebec to construct additional hydro resources that would be priced in as well.
- The LEI study ignores significant negative impacts, including, but not necessarily limited to: potential adverse impacts on tourism, New Hampshire's second largest industry; potential for lost jobs and property taxes from the retirements of other power plants in New Hampshire (e.g., Seabrook); and inhibiting construction of other power plants in New Hampshire which would ensure local jobs and construction dollars

In addition, the Analysis Group report provides the Site Evaluation Committee with a detailed and appropriate framework for considering the costs and benefits of a new energy facility.

It should be noted that while the Analysis Group report was completed prior to the newest ISO-NE forward capacity auction (which took place on February 6, 2017), the results of the auction are consistent with the overall findings of the Analysis Group report.

Thank you.

Sincerely,



Adrienne Pereira
Executive Director

Enc.

ANALYSIS GROUP
ECONOMIC, FINANCIAL and STRATEGY CONSULTANTS

The Proposed Northern Pass Transmission Project:

Assessing its impacts on New Hampshire

Susan F. Tierney
Pavel G. Darling

Analysis Group, Inc.

February 2017

Acknowledgments

This Report presents the results of an independent analysis of the appropriate framework for analyzing the impacts of the proposed Northern Pass high-voltage transmission project on New Hampshire's economy and electric consumers.

This study was prepared at the request of Protect the Granite State, a non-profit, non-partisan organization established to provide New Hampshire residents with information about the Northern Pass project. Our report reflects the analysis and judgment of the authors only, and does not necessarily reflect the views of Protect the Granite State.

The authors would like to recognize and thank their Analysis Group colleague, Jacob Silver, for his research support throughout the project.

About Analysis Group, Inc.

Analysis Group, Inc. provides economic, financial, and business strategy consulting to leading law firms, corporations, and government agencies. The firm has more than 700 professionals, with offices in Boston, Chicago, Dallas, Denver, Los Angeles, Menlo Park, New York, San Francisco, Washington, D.C., Montreal, and Beijing. http://www.analysisgroup.com/about/

Analysis Group's energy and environment practice area is distinguished by expertise in economics, finance, market analysis, regulatory issues, and public policy, as well as significant experience in environmental economics and energy infrastructure development. The practice has worked for a wide variety of clients including (among others) energy producers, suppliers and consumers; utilities; regulatory commissions and other public agencies; tribal governments; regional transmission organization and other power system operators; foundations; financial institutions; and start-up companies.

About the Authors

Sue Tierney was previously the Executive Director of the Massachusetts Energy Facility Siting Council, as well as a commissioner at the Department of Public Utilities and the Secretary of Environmental Affairs in Massachusetts. She also served as the Assistant Secretary for Policy at the U.S. Department of Energy. She is currently a Senior Advisor at Analysis Group.

Pavel Darling is a Manager at Analysis Group. He has worked on a wide variety of energy-related matters while consulting on behalf of utilities, state and regional organizations, and global companies, and has testified and supported testimony before state energy siting boards.

Executive Summary

The Northern Pass project is a proposal by Eversource Energy for a new system of high-voltage transmission facilities located in New Hampshire. If approved and built, Northern Pass would connect to the Hydro-Quebec grid at the U.S./Canadian border and extend 192 miles through New Hampshire, terminating in Deerfield, where it would interconnect with New England's transmission grid.

The project is under active review by state agencies and participants at the New Hampshire Site Evaluation Committee ("NH SEC"). A decision is anticipated by September 2017. Hydro-Quebec has proposed to enter into a 20-year power contract with Eversource's subsidiary company, Public Service of New Hampshire, to provide 100 MW of energy to be delivered via the Northern Pass line. This contract, whose price terms are not public, is being reviewed by New Hampshire's Public Utility Commission.

New England's wholesale power market was created in large part so that the region could rely on market forces to supply electricity requirements efficiently and avoid having consumers underwrite investment risks. Since 2000, competitive power suppliers have invested billions of dollars in new generating capacity. Although there are generating resources anticipated to retire in upcoming years, there are also over 20,000 MW of new gas-fired resources and renewable projects seeking to enter the market.

In the past few years, even as average natural gas prices and electricity costs have dropped in New England, the three states in southern New England have enacted laws that encourage proposals to supply hydroelectric supply from Canada. The Eastern Canadian utilities have similarly geared up for export markets for over a decade. In anticipation of facilitating such exports, several new high-voltage transmission projects (in addition to Northern Pass) have been proposed to link those Canadian utility systems with markets in New England and New York.

In that context, New Hampshire's public officials are considering whether Northern Pass is in the public interest. The NH SEC will review information about the impacts on jobs, gross state product, tax revenues, consumers' electricity costs, air and other emissions, natural resources, and many other factors.

Many economic studies have been prepared to assess one or more of these impacts. One in particular is titled a "cost-benefit and local economic impact analysis" prepared in 2015 by London Economics International ("LEI Study") and was prepared on behalf of Eversource.

We respectfully conclude that the LEI Study is not a "cost/benefit study," but rather a one-sided analysis that examines only the benefits side of the ledger. It is the job of the public agencies to fully evaluate both the costs and benefits of a proposed project. In this report, we offer a framework for doing just that.

Our full report includes a detailed framework for considering the costs and benefits that can accompany the introduction of a new energy facility. Using that framework, we have

sought to assess how the LEI Study measures up. Although we recognize it is being updated, this study is clearly the main platform for the agencies' and parties' current assessment of the benefits and costs of Northern Pass.

Here's what we learned:

- **The LEI Study has many omissions.**

  The LEI Study provides almost no detail as to its inputs, making it virtually impossible to verify the results. Pages upon pages of assumptions, inputs, and intermediate outputs are blacked out. We have deep experience in reviewing reports on quantitative modeling studies where the authors go to great care to summarize assumptions, data inputs, and results. The level of redaction here is categorically different from the norm.

  > The level of opaqueness in the LEI Study raises serious challenges for the public's ability to evaluate the validity of the study's results. Why refrain from publishing, for example, the assumptions about future natural gas prices over the study period? Why not provide public information about the outlook for demand for electricity? These are the fundamental building blocks of studies of electricity market conditions in New England, and do not reveal proprietary or commercially sensitive information of a market participant. This lack of transparency is quite unusual, based on our experience.

  Most public energy-facility siting processes with which we are familiar involve a significant degree of transparency, even in situations where the project developer will eventually compete in competitive processes. The LEI Study is so opaque that it raises serious challenges for the public's ability to evaluate the validity of the study's results.

- **The LEI Study has poor assumptions.**

  What little detail the LEI Study provides suggests that the fundamental conclusion reached – namely that there are significant *net* positive benefits of Northern Pass – is not supported by a thorough cost-benefit analysis.

  - ***The LEI Study does not accurately assess direct electricity market impacts on consumers.*** Most of the benefits calculated in the LEI Study occur in the region's 'capacity market,' so the assumptions used to analyze capacity-market impacts are particularly important. These results rest primarily on an assumption that there are no further power plant retirements and no new generating capacity additions between 2018 and 2024. That assumption is not reasonable and led LEI to overstate the benefits of Northern Pass. Ninety percent of the electricity market benefits calculated by LEI rest on this improper assumption.

    The benefits calculated for electric-energy-market savings are also troubling because the natural gas prices forecast appears to be based on a period of time in which gas prices had been high and when the outlook for future gas prices would be higher than would be reasonable today, and thus overstates the benefits of Northern Pass.

  - ***The LEI Study does not account for costs to electric customers.*** There is no evidence that any costs have been accounted for in the study. LEI assumes that

the $1.6 billion in transmission costs for Northern Pass will be borne by consumers in Connecticut, Massachusetts, and Rhode Island because those states are seeking long-term contracts for clean energy resources. Yet the LEI Study does not explain how these costs were allocated and they do not show up in the discussion of economic impacts to New England.

- ***The LEI Study simply assumes that Northern Pass will be funded by ratepayers in states other than New Hampshire.*** As we show in Table #**1** in our report, our calculation of the transmission-line cost recovery is roughly $55 per MWh. This would be *on top of the regular price for wholesale electricity* (i.e., the price at which it would be rational for Hydro-Quebec to offer its supply, based on "opportunity cost" principles). It is hard to imagine how such an offer would be selected as cost-effective (even assuming that Massachusetts, for example, establishes a Clean Energy Standard which credits some value for hydropower's ability to produce power without carbon emissions).

  The LEI Study assumes that all costs will be paid by consumers in southern New England. But the study does not mention these costs when considering benefits of Northern Pass to the region.
  Those costs could be $55/MWh on top of the regular price for electricity.
  This failure to account for even the most obvious cost associated with constructing the transmission line highlights the one-sided nature of the LEI Study.

  It is therefore important to incorporate a sensitivity analysis of the impacts on New Hampshire customers if the costs of transmission do not end up being borne by New England's three southern states. At the very least, a clear and transparent description of how these costs are incorporated would be necessary in a true benefit-cost study.

- ***The LEI Study also does not consider other important cost impacts in its evaluation of economic impact.*** Other potential negative impacts include:
  - adverse impacts on tourism (the state's 2nd largest industry);
  - retirements of other power plants in New Hampshire and elsewhere in the region (which could result in lower property tax and fewer jobs affected communities);
  - offsetting construction of other power plant and transmission assets, which could otherwise have provided some of the electricity attributable to Northern Pass – or, in layman's terms, a proper analysis would measure net incremental benefits;
  - energy dollars flowing out state (and out of the region) to Hydro-Quebec and the Provincial Government of Quebec.

- **The LEI Study relies on an arguably appropriate structure, but uses inappropriate and unreasonable assumptions. The devil is in the details.**

  The LEI Study's provide two quantitative assessments: (1) calculating impacts of the project on electricity consumers in New Hampshire (i.e., wholesale electricity market

impacts), and (2) assessing impacts of the project on New Hampshire's economy (e.g., jobs, gross state product, tax revenues). While the overall approach of combining different models to answer the questions posed is sensible here, the assumptions that are used, however, and the interaction of these assumptions within the models makes all the difference.

- **Finally, the LEI Study omits 'unintended consequences' and indirect impacts of disrupting the current electricity market.**

  The LEI Study calculates a price suppression effect, but then has no discussion of potential negative impacts on New England's wholesale energy market of the price-suppression outcomes that the report points to. The flip side of price suppression is that it may introduce unintended and negative consequences for the functioning of wholesale markets, and ultimately raise costs to consumers and the electric system in the long run.

  If the market works as assumed in the LEI Study, other power suppliers in the region will receive lower payments for their provision of electricity. If poorer performing power plants operate less and/or receive lower revenues and lower profits, they may retire – something that happens, of course, all of the time in markets.

  Price suppression might actually lead to retirements of power plants in New Hampshire that are performing pretty well. A prime example could be the Seabrook nuclear station, which provides power at low variable costs and with zero carbon emissions. If Seabrook were to retire as an incremental result of price suppression introduced by Northern Pass, wholesale prices would rise in New England's power market, and jobs and property taxes could drop in New Hampshire.

  Many studies have chronicled the financial stresses currently being experienced by existing nuclear reactors around the country in wholesale competitive power markets like New England's. Were Seabrook to retire prematurely as a result of price suppression from Northern Pass, then there certainly would be significant adverse economic consequences in New Hampshire, as well as wholesale price and carbon emissions impacts. These would offset some, and maybe all, of the assumed benefits of Northern Pass.

  Lastly, to the extent that Northern Pass enables 1,090 MW of new imports of hydropower from Eastern Canada, it may have an impact on the ability of other renewable projects that seek to develop in New Hampshire or the region. Such an outcome would be counter to New Hampshire's energy goals, since state officials have been in favor of new additions of renewable energy within New Hampshire's borders.

Background and Context:

Background: the Northern Pass project proposal

The Northern Pass project is a proposal for a new system of high-voltage transmission facilities that are currently under development by Northern Pass Transmission, a company owned by Eversource Energy ("Eversource").[1] Eversource also owns Public Service Company of New Hampshire ("PSNH") and other electric utility companies in New England.[2]

If approved and it enters commercial operation as proposed, Northern Pass would connect to the Hydro-Quebec grid at the U.S./Canadian border in Pittsburg, New Hampshire, and travel south for 192 miles through New Hampshire – first delivering direct-current ("DC") power into a new converter terminal[3] in Franklin, New Hampshire, and then continuing south as a new alternating- current ("AC") transmission line ending at Deerfield, New Hampshire, where it would interconnect with New England's high-voltage transmission system.[4] The current proposal is to have 132 miles of overhead transmission facilities, and 60 miles of underground lines, with 80 percent of the facilities either on existing transmission rights-of-way or beneath public roadways.[5]

As proposed, the project would be capable of delivering 1,090 MW of electricity from Quebec's electric grid into New England's power system. That amount of capacity could provide roughly 8,116,000 megawatt-hours ("MWh") per year.[6] The project has a proposed in-service date of May 31, 2019.[7]

After many years of planning and seeking of approvals from federal regulatory agencies, the proposed project was filed in October 2015 at the New Hampshire Site Evaluation Committee ("NH SEC"), where the proposal is under active review by state agencies and the many parties that are participating in the NH SEC review process.[8] A decision to approve, to approve with conditions, or to reject the proposal[9] is anticipated by no later than September 2017.[10]

In conjunction with the transmission proposal, Hydro-Quebec (through its wholly-owned subsidiary company, Hydro Renewable Energy Inc. ("HRE")), has proposed to enter into a 20-year power purchase agreement ("PPA") with PSNH to provide 100 MW of firm, on-peak energy, which would be delivered via 100 MW of the capacity on the Northern Pass line.[11] This represents approximately 9 percent of the delivery capability on the project. (New Hampshire's statewide electricity consumption is approximately 10 percent of New England's.)[12] This PPA, whose price terms are not public,[13] is being reviewed by New Hampshire's Public Utility Commission ("PUC").

Context for the Northern Pass Project

Northern Pass has been developed over many years in a complicated context that is relevant for understanding its intended purpose, its potential role in New Hampshire's and New England's energy mix, and its potential positive and negative impacts.

New England's regional power system: For over four decades, New Hampshire's electricity consumers have been served by a six-state interconnected regional grid. Originally, the utilities in New England organized the New England Power Pool ("NEPOOL") as a means to enhance reliable and efficiently produced power supply across the region. Power resources located in New England and in neighboring regions like New York and the eastern provinces of Canada have contributed to assuring supply in New Hampshire and in the rest of New England. In 1999, NEPOOL transitioned to an independent system operator ("ISO-New England" or "ISO-NE"), with responsibility to administer a new centralized wholesale power market and integrated transmission system owned by transmission companies (including utilities).

Competition in the electric industry: This regional wholesale power market was broadly supported by the New England states, most of which (including New Hampshire) restructured their electric industries many years ago. The goals of restructuring were to provide electric supply through market-based approaches, rely on competitive generation markets to identify the types of resources able to supply consumers' electricity requirements efficiently and reliably, and avoid having electricity customers underwrite the investment risks of generation suppliers.

Since the opening of the markets administered by ISO-NE, competitive power suppliers have made billions of dollars of investment in approximately 15,000 MW of new generating capacity and other electric resources.[14] At present, New England's electricity demand is relatively flat. Although there are generating resources anticipated to retire in upcoming years, there are also over 20,000 MW of new gas-fired resources and renewable projects seeking to enter the market.[15] These resources are above and beyond those (such as energy efficiency measures, rooftop solar panels, demand-response measures) located on the customers' side of the meter.

This regional system operates as an overlay to an electric industry structure in which local utilities play a critical role in assuring that retail electricity customers have access to the supplies of their choice and that the system relies on cost-beneficial infrastructure investment to deliver those supplies reliably. State-specific policies shape the responsibilities of local utilities, the approval of particular electric infrastructure projects, and the conditions under which power plants and transmission facilities may be sited, constructed and operated in a state.

New Hampshire's energy development goals: In 2014, New Hampshire published its latest State Energy Strategy, which focused on modernizing the electric grid, increasing energy efficiency and fuel diversity, relying increasingly on in-state renewable and other energy resources, and distributed energy resources.[16] The State Energy Strategy noted a concern that much of the money that the state's consumers spend on energy "left the state to pay for imported fuels, rather than being circulated in the State's economy"[17] and that this results in "lost opportunities for investments in the state's economy." The State Energy Strategy expressed a desire that a goal of "energy independence also informs our energy policies. Increasingly, states are seeking to utilize local sources of energy to keep

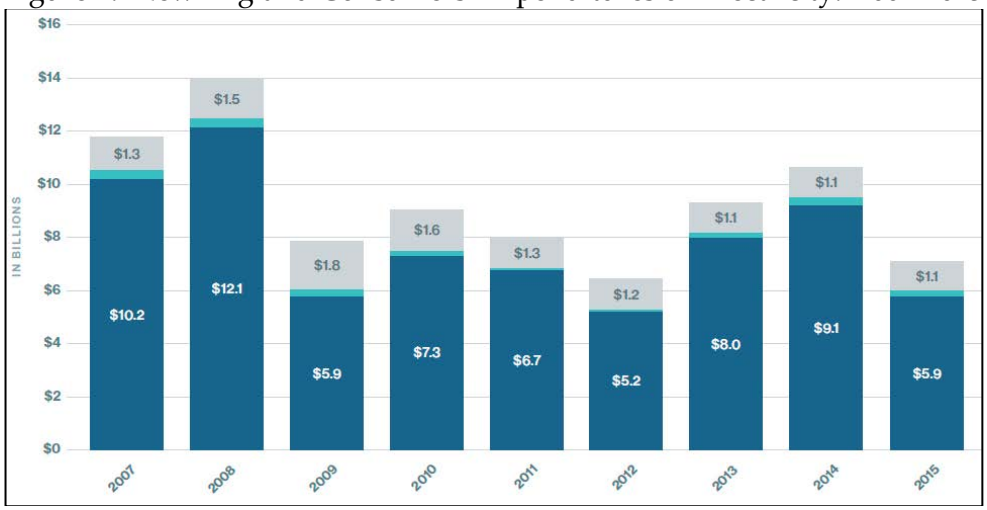
energy expenditures within their economies and to produce local jobs. This reduces our dependence on imported sources of energy and can decrease our vulnerability to supply and price volatility. In addition, because all of New Hampshire's local sources are renewable, increasing the use of in-state energy resources also provides air quality, health, and fuel diversity benefits."[18]

Target market for the power that would be delivered via Northern Pass. Although the Northern Pass project would be wholly sited in New Hampshire, the project will principally serve electricity customers elsewhere in New England.[19]

Starting around 2010, the Governors of the six New England states began to look for coordinated ways to reduce electricity prices in their states and to lessen the regional grid's reliance on power plants that use natural gas. At that time, natural gas markets had experienced several years of high and volatile prices in New England, leading to high electricity prices in the region in that same period.

The states began to explore the role that Canadian hydroelectric power resources might play in diversifying sources of electricity supply in New England. And even though natural gas prices and consumers' expenditures on electricity have declined substantially in recent years (as shown in Figure 1),[20] several of the states – notably, Connecticut, Massachusetts and Rhode Island – have continued to actively pursue policies to sign contracts for long-term supply of hydropower from Eastern Canada as well as renewable sources of electricity generation.[21]

Figure 1: New England Consumers' Expenditures on Electricity: 2007-2015



Source: ISO-NE, Regional Electricity Outlook, 2016. The dark blue portion at the bottom of each bar reflects payments for electric energy; the lighter gray portion at the top of each bar reflects payments for capacity; and small sliver of turquoise-colored area in the middle of each bar reflects payments for ancillary services.

In 2014 and 2015, Connecticut and Rhode Island lawmakers signaled their support for entering into long-term contracts with Canadian suppliers of hydropower.[22] Most recently, Massachusetts – which accounts for 45 percent of all electricity consumed in

New England[23] – enacted a new law in the summer of 2016 that, among other things, explicitly requires its electric utilities to solicit proposals for long-term contracts for renewable energy, with a preference for proposals that include firm hydroelectric supply.[24]

In spite of the existence of adequate resources in the region, the new Massachusetts law requires the state's utilities to solicit an amount of new renewable energy generating resources equivalent to one-sixth of the state's total electricity requirements, and to enter into long-term contracts with those that are cost-effective. In a related action,[25] the Massachusetts Department of Environmental Protection ("MA DEP") has just issued proposed regulations for a new Clean Energy Standard ("CES") that would cover various eligible energy resources (including renewable projects built after 2010 as well as large-scale hydroelectric supply delivered from neighboring regions into New England via a new dedicated transmission line that comes on line after 2017). Under the proposal, eligible energy resources would create "Clean Energy Credits" ("CECs") associated with their power production, which they could sell to retail electricity supplies in Massachusetts who must rely upon an increasing share of eligible energy resources over time (rising to 80 percent of electricity supply by 2050).[26]

Canadian export goals: On the other side of the U.S. border, the provincially owned electric utilities in Quebec and in Newfoundland and Labrador have also been gearing up in hopes of increasing their power-supply exports to the Northeast states. In 2010, the Provincial Government of Quebec, for example, which owns Hydro-Quebec, published a long-term strategy for power-supply exports to the U.S. that included promoting policies in the U.S. that would allow hydroelectric supply from Quebec to qualify for renewable energy south of the border, foster long-term contracts for such Canadian electricity supply and support new infrastructure to export power to the U.S.[27]

In anticipation of facilitating such exports, several new high-voltage transmission projects have been proposed to link Eastern Canadian utility systems with markets in New England and New York. These include Northern Pass, announced in 2008, as well as the New England Clean Power Link,[28] the Champlain Hudson Power Express connecting Quebec's system to New York City,[29] and several other projects in New England.[30] These projects are competing with each other, as well as with other existing and new electric resources (including new renewable energy projects) in the market to serve electricity consumers in the Northeast.

Evaluating economic impacts of the proposed electric infrastructure projects

Considering Economic Benefits and Costs of Energy Infrastructure Projects

With that context as background, we understand that New Hampshire policy officials now face two central questions relating to the Northern Pass: whether to approve the siting and construction of the facilities and whether to approve the PPA for power

supplies that depend upon those facilities. These are important questions, and the answers to them depend upon complex considerations.

Based on our experience, we know that the assessment of impacts of proposed energy facilities – power plants, transmission lines, gas pipelines, and others – involves a balancing of economic, environmental, and energy reliability issues. We have been involved in evaluating the benefits and costs to electricity consumers of various energy projects and energy resources.

We understand that each regulatory agency has different standards for reviewing projects. The NH SEC process is a one-stop, comprehensive process for evaluating the impacts of a proposed energy facility from the point of view of net benefits to the state and its residents, businesses, local government, and the local economy, taking into account environmental impacts, costs, reliability and other issues.[31] The New Hampshire PUC will determine whether the PPA provides net benefits to the electricity customers of PSNH. While both agencies will be looking at economic issues, their lenses and processes are different, because the NH SEC will be exploring the economic impacts on the state's economy and communities, taking into account effects on various groups and sectors (e.g., electricity consumers, tourism, owners of land that abut or are near the proposed facilities), while the PUC's focus is on electricity consumers of one of the state's utilities. As part of determining whether the project is in the public interest, the NH SEC will review information about the impacts (beneficial and negative) on jobs, gross state product, tax revenues, consumers' electricity costs, air and other emissions, natural resources, and many other direct and indirect factors.

Over the past few years, many economic studies have been prepared to attempt to characterize and quantify one or more of these impacts. Some have been prepared on behalf of Northern Pass Transmission,[32] and some were conducted by other sponsors.[33]

The reports focus on different sets of issues, and – notwithstanding the titles of one of the reports (the 2015 London Economics International report[34] ("LEI Study") – none of them is a comprehensive cost/benefit analysis of the project's economic impacts.

What would a comprehensive economic cost/benefit analysis encompass? In the section below, we offer a framework for considering the array of economic impacts, in hopes of informing stakeholders about the array of economic impacts that directly and indirectly accompany a major energy facility proposal, and in the final section of this report, we assess the LEI Study through the lens of this framework.

Economic Assessment Framework: Considering Economic Costs and Benefits

First and foremost, a cost/benefit study looks at both the negative and positive economic impacts on one or more groups of people and over a particular period of time. That may seem obvious, but if a study only looks at the costs that a group of people would bear, then it would only be a cost study, not a cost/benefit study. Conversely, of course, a study that only looks at benefits is also not a cost/benefit study.

Second, to the degree practical, a cost/benefit study of an energy facility proposal attempts to quantify direct economic impacts (negative and positive) associated with constructing and operating the project, and identify other indirect impacts to the extent possible. Many of these impacts can be expressed in dollars, but many others are much harder to quantify and monetize but are nonetheless real. Some impacts may also be unintended, but are still real.

Third, a cost/benefit study attempts to characterize the incremental impacts of the project: in other words, what positive or negative impacts arise as a result of a particular project that would not otherwise happen without it? For a new electric energy facility, for example, will the electric system operate differently with the facility in place compared to how it would otherwise operate without it?

Fourth, a cost/benefit study needs to be clear and consistent about the people affected by benefits and costs, and whether some groups receive mainly benefits while other groups receive mainly costs. Practically speaking, a cost/benefit study always has to identify the universe of people or systems that will be 'inside' the study (i.e., those impacted) and which ones will be outside of the study (i.e., those that may or may not be impacted but whose interests or impacts are not addressed in the analysis). For a proposed energy facility or a power-supply contract, sometimes the choice of which population to study for impacts is a function of the scope or jurisdiction of a government agency that is reviewing the facility or the contract. Inevitably in today's society, energy facilities end up imposing quite localized burdens and costs on those communities and residents that are physically close to the facilities, while facilities benefits may be diffused to a broad body of energy consumers. This makes it critical to understand the character and distribution of benefits and burdens in order for an agency to understand whether the former justifies the latter. In circumstances where there are primarily cost and/other benefit 'shifts' without producing positive gains for the group, economists would call those transfers rather than net economic benefits.

In New Hampshire, it would be understandable that the focus of attention would be the impacts on populations and the economy within the state. But a true cost/benefit study (e.g., for a proposed project in New Hampshire) should attempt to take care in tracking and analyzing incremental impacts as well as transfers of impacts from one group to another, so as to understand the burdens and benefits born by different groups and to determine whether they are worth it.

In Table 1, below, we have attempted to identify the types of direct and indirect impacts that can accompany the introduction of a new energy facility, like the proposed transmission line.

Table 1 (page 1 of 2):
Framework for Evaluating Benefits and Costs of Proposed Energy Facilities in New Hampshire

Electric system impacts – Direct and Indirect

- Impacts on the electric system and the electricity consumers in the relevant geography (in this case, consumers in NH and in the regional wholesale power market/system):
  - Benefits to electricity consumers in NH: What are the incremental benefits that result directly from the introduction of a new energy facility into a system – and which otherwise would not occur in the absence of this project?
    - Would the facility, combined with the power supply it would deliver from Quebec, help to reduce the *costs to produce electric energy* during the many hours/years in which the facility will be in operation? Over a reasonable range of assumptions affecting power production costs (such as anticipated power plant retirements and additions, demand levels, natural gas prices, changes in transmission infrastructure), are the costs to operate the power system higher or lower with the facilities in operation, compared to the system without the facilities?
    - Would the facility, combined with its associated power supply, help to lower *prices in the wholesale electric energy market* that serves electricity consumers in NH? Over a range of assumptions, it is reasonable to expect that consumers' electricity bills will go down with the facilities in operation (compared to what they would be like without the project in operation)?
    - Does the facility help to lower '*capacity costs' paid for by consumers*? Does the facility end up leading to a system with lower fixed costs to ensure that there is adequate capacity in place to meet consumers' needs with enough capacity in reserve to cover a variety of conditions in the future? Or does the project simply replace capacity that would be provided by another resource (and is therefore not contributing incremental value from the point of view of capacity)?
    - Does the facility help to produce *electricity supply with lower air emissions* than the system without the project in operation? Does it lead to a genuine net reduction in air pollution, or does it shift emissions to somewhere else (and therefore not contribute incrementally to emission reduction)? Or does it achieve the same emissions across a defined set of power plants but at a lower cost?
  - Costs to electricity consumers in NH: What are the incremental costs that must be absorbed by NH's electricity consumers in order to realize the introduction of a new energy facility into a system?
    - Are there other direct costs (e.g., payments to cover the cost of building a transmission line or to firm up power supply in a long-term contract) that will be or could be borne by NH electricity customers in order to obtain those incremental direct benefits of lower electricity production costs, lower energy prices, lower capacity costs, or emissions reductions?
    - Are there indirect costs (e.g., associated with retirements of power plants in NH) that would not otherwise have occurred in the absence of the project? Would these retirements end up offsetting some of the benefits that are attributed to the introduction of the new facility into the New England electric system?
    - Does the project shift financial risks (however difficult to quantify) to electricity consumers in NH that have otherwise been assumed to be borne by competitive electricity suppliers.
  - Do the incremental benefits to NH's electricity consumers outweigh the incremental costs they must absorb?

Table 1 (page 2 of 2):
Framework for Evaluating Benefits and Costs of Proposed Energy Facilities in New Hampshire

Macroeconomic impacts: Direct and Indirect

- Impacts on the broader economy in the relevant geography (in this case, NH and various communities within the state):
  - Benefits to the state's economy that would not otherwise occur in the absence of the project:
    - Are new jobs created by construction and/or operation of the facility?
    - Will spending on construction and other project activities increase economic activity in affected communities?
    - Will there be incremental tax revenues to the state and affected localities, associated with net assets that may be taxed?
  - Costs to the state's economy that would not otherwise occur in the absence of the project:
    - Will there (or could there likely) be adverse impacts on other power generation or other electric expenditures in NH, with local economic impacts in the communities where those other activities would have occurred, but for the introduction of this project? Does the new project and its related power supply introduce incremental changes in electricity prices and plant operations elsewhere, such that some other NH power plant (e.g., facilities like Seabrook that also provide zero-carbon supply) ends up financially stressed and either retiring (with impacts on jobs and tax revenues in other communities in the state) or seeking support payments from consumers/taxpayers (such as has occurred in some other states where potential closure of existing nuclear plants resulted in state action to address the issue)?
    - Will there be adverse impacts on economic activity in other sectors of the economy (e.g., tourism) that would not have occurred in the absence of the project?
    - Will payments for energy to non-NH power suppliers lead to a flow of dollars out of the state?
    - Will the introduction of the new taxable assets introduce reduction in property values and tax revenues in the affected communities or elsewhere?
    - Will there be indirect impacts that accrue to (and undermine) the wholesale market that serves NH's electric grid and that should be taken into consideration in terms of impacts on NH firms, their employees, and their contributions to NH (e.g. in terms of property tax revenues, other economic impacts)?
    - Does the project and related power supply lead to adverse impacts on the sustainability of the wholesale electric industry in New England?
    - Are there economic burdens and benefits to certain parties (e.g., local communities and people positively affected by the construction and operation of a new energy facility; local communities and people negatively affected by construction and operation of the new project) greater than the impacts of either continued operation of existing power plants and/or of the introduction of new energy facilities (such as local wind projects, other transmission lines) whose approval into the market would be impeded by the approval, construction, and operations of Northern Pass.
    - Are there costs that are real – however hard to monetize – associated with a power purchase agreement that is tied to the siting and construction of a new set of transmission facilities to connect Quebec with NH/New England? For example, are some such costs related to a shift in risk between consumers of such a PPA and the suppliers of power under that same PPA, in a manner that is not financially, legally, institutionally, or otherwise aligned with the legal and economic structure of NH's electric industry?
    - Are there adverse impacts (however hard to monetize) associated with NH's hosting of the facilities for the primary benefit of out-of-state entities? For example, will there be a disproportionate burden of the facility on the state's natural resources, land values, or other factors?
  - Do the direct and indirect incremental monetary benefits to NH's economy outweigh the incremental costs to NH's economy?

Assessing the Applicants' economic study of the impacts of the proposed Northern Pass Transmission Project

Introduction

Using that type of framework for evaluating benefits and costs of a proposed new electric facility, we have sought to assess how the principal Northern Pass economic study (the one performed by London Economics International ("LEI Study")) measures up. Although we recognize it is being updated,[35] this study is the main platform for the parties' current assessment of the benefits and costs of Northern Pass to New Hampshire's electric consumers and its larger economy.

The LEI Study: an appropriate general structure, yet…

The LEI Study's stated purpose is to provide two quantitative assessments: (1) calculating the impacts of the project on electricity consumers in New Hampshire (i.e., wholesale electricity market impacts), and (2) assessing the impacts of the project on New Hampshire's economy (e.g., jobs, gross state product, tax revenues).[36] To do this, LEI ran a combination of models, with the first duo of models focused on analyzing the changes in New England electricity market prices (in both energy and capacity markets, using LEI's POOLMod and FCA Simulator), and the other model (REMI's PI+) taking those resulting changes and running them through a macroeconomic model that provides economic impact outputs.

If we were constructing a study aimed at those two questions, we likely would have constructed one along the same lines that LEI did. That is, we would have used (a) a production cost simulation to estimate electric-energy-market impacts, and a separate capacity market forecasting analysis; and (b) macroeconomic modeling to estimate overall impacts on the gross state product, taxes, employment, etc. While we might have employed different models or used different techniques, the overall approach of combining different models to answer the questions posed is one that is sensible and appropriate here.

But as with any modeling exercise, the assumptions that are used and the interaction of these assumptions within the model chosen makes all the difference. This is not to say that all of the assumptions LEI has chosen are improper; rather, the point is that specific choices made can have tangible effects on how the results come out. And when doing a complicated modeling exercise where outputs of one model are then input into another model, these assumptions and their effects can sometimes become obscured by the complexity of the analysis and the interactions of the models. Said another way, if even a few input assumptions used are unsupportable or unreasonable, the conclusion reached at the end will be faulty. It is this exact phenomenon that has occurred in the LEI Study, with the implication that the benefits reported are overstated. And that is just on the benefits side of the ledger, not even taking into account the costs on the

other side that may have been misstated (i.e., costs to New England's and New Hampshire's electricity consumers and to the New Hampshire economy).

The LEI Study: …many omissions and poor assumptions

The LEI Study provides a clear presentation of its modeling results. But it is not possible to see what the inputs are, and that makes it virtually impossible to verify the quality of the results.

Pages upon pages of assumptions and intermediate outputs are redacted, and there is extremely limited transparency in how LEI conducted its analysis. We have deep experience in reviewing reports on quantitative modeling studies where the authors go to great care to summarize assumptions, data inputs, and results. The level of redaction here is categorically different from the norm. Further, most energy-facility-siting processes with which we are familiar require a significant degree of transparency, so that the parties can fully review the methodology, assumptions, outputs, and conclusions and determine whether the foundations of the study are credible, robust, etc. This is true even in situations where the project developer will eventually have to compete in competitive processes.

> Such opaqueness raises serious challenges for the public's ability to evaluate the validity of the study's results. Why refrain from publishing, for example, the assumptions about future natural gas prices over the study period? Why not provide public information about the outlook for demand for electricity? These are the fundamental building blocks of studies of electricity market conditions in New England, and do not reveal proprietary or commercially sensitive information of a market participant. This lack of transparency is quite unusual, based on our experience.

We know that some of the formal parties in the NH SEC proceeding – and certainly the decision makers and staff of the NH SEC itself – may be able to gain access to the underlying redacted information by signing confidentiality agreements.

Despite this lack of transparency, what little detail the LEI Study provides does raise serious questions about the methods and assumptions that were used and highlights that the fundamental conclusion reached – namely that there are significant *net* benefits of Northern Pass – is not supported by a thorough cost-benefit analysis.

The LEI Study fails to accurately assess direct electricity market impacts on consumers

In attempting to review the assumptions that *are* discussed in the LEI study, we have identified a number of areas where the LEI Study either used faulty inputs or where market changes over time suggest that the study's assumptions are not reasonable to rely upon as a basis for decisions. We highlight these areas as they relate specifically to the direct electricity market impacts (energy and capacity markets) below.

First, in LEI's modeling, the starting point for the quantity and mix of generating assets were the results of the ISO-NE Forward Capacity Auction ("FCA") #9,[37] which were released on February 4, 2015 and detail the combination of generating assets and

demand-side resources which are required to be available in the 2018/2019 period.[38] These results formed the supply curve used by LEI to determine whether and when new resources would need to be added as inputs into the model in later years to meet ISO-NE's Installed Capacity Requirement ("ICR").

Curiously, however, LEI assumed no other capacity would enter the market from 2019 to 2024, beyond those that cleared in FCA #9[39] (and that no additional units would retire). **In fact, we know that LEI's assumption of no new generating assets beyond those from FCA #9 is already incorrect. ISO-NE released the results of FCA #10 on February 11, 2016 – these results are for the 2019/2020 period.[40] These results show that an additional 1,459 MW of generation will be added in New England by the end of 2019.[41]** Even though LEI could not literally have known those February 2016 results when it completed its study in October 2015, it does raise questions about the study's assumptions about changing market conditions and the validity of the benefits they have estimated for Northern Pass. There were many signs in 2015 about anticipated capacity additions (and retirements) that would have suggested that changes would occur in New England's electric mix between then and 2024, and which would likely have the effect of reducing the value of supply delivered over a new major transmission line to Canada.

Also, in all likelihood, additional capacity that the LEI Study has not considered will also be added in FCA #11, which will occur in the next month. **In fact, 6,700 MW of new resources bid into FCA #10, and with only 1,459 MW having cleared, it is notable that a significant number of MW remain poised to enter the market going forward.[42]**

One other new piece of information on the capacity market that is now available since the time the LEI Study was finalized is that the ISO-NE capacity market design, with its new sloping demand curve, has gone into effect and has shown actual results in the market. The LEI Study highlights the advent of these new rules and how FCA #9's prices were significantly higher than historical clearing prices.[43] Yet FCA #10's prices were identical to FCA #8 (prior to the sloping demand curve), and approximately 25 percent lower than FCA #9. Recent market analysis suggests that FCA #11 clearing prices will be even lower.[44]

Given that approximately 90 percent of the total wholesale market benefits that LEI calculates come from the capacity market, any change in assumptions regarding future capacity market prices will have an outsize effect on the benefits claimed in the LEI Study. Furthermore, with the combination of additional generation capacity already having cleared, significant capacity available but not yet cleared (thus putting downward pressure on capacity market prices), and lower forecasts for capacity market prices than likely assumed by LEI,[45] it stands to reason that a significant portion of LEI's calculated capacity market benefits would be reduced (if not eliminated) if up-to-date and more reasonable forecasts were used for ISO-NE's capacity market. In fact, in light of the significant amount of resources that bid into FCA #10 yet did not clear, it is

very possible that **Northern Pass would have *no incremental impact on capacity market prices* at all, eliminating 90 percent of the benefits that LEI has estimated**.[46]

Even if Northern Pass *were* to be incremental, there remains a reasonable question of whether 100 percent of the capacity it supplies would actually be allowed to bid into and clear in ISO-NE's FCMs. As discussed in more detail below, if Hydro-Quebec does not have sufficient resources to supply the combination of its own internal demand, any capacity contracts it has with New England, and the additional firm (on-peak) flows on Northern Pass, ISO-NE may not allow all of Northern Pass's capacity to count in future capacity auctions. Without clearing in the capacity auctions and receiving a capacity supply obligation, some or all of the estimate capacity-market benefits of Northern Pass would not exist.[47] **The LEI study has not commented in any way on the likelihood, or even the possibility, of such an event.**

In the portion of the LEI Study that analyzes electric-energy market benefits (by contrast to capacity market benefits), there are also questions: The small amount of detail LEI has provided about relevant assumptions suggests that they do not reflect reasonable market assessments and therefore result in overstated benefits.

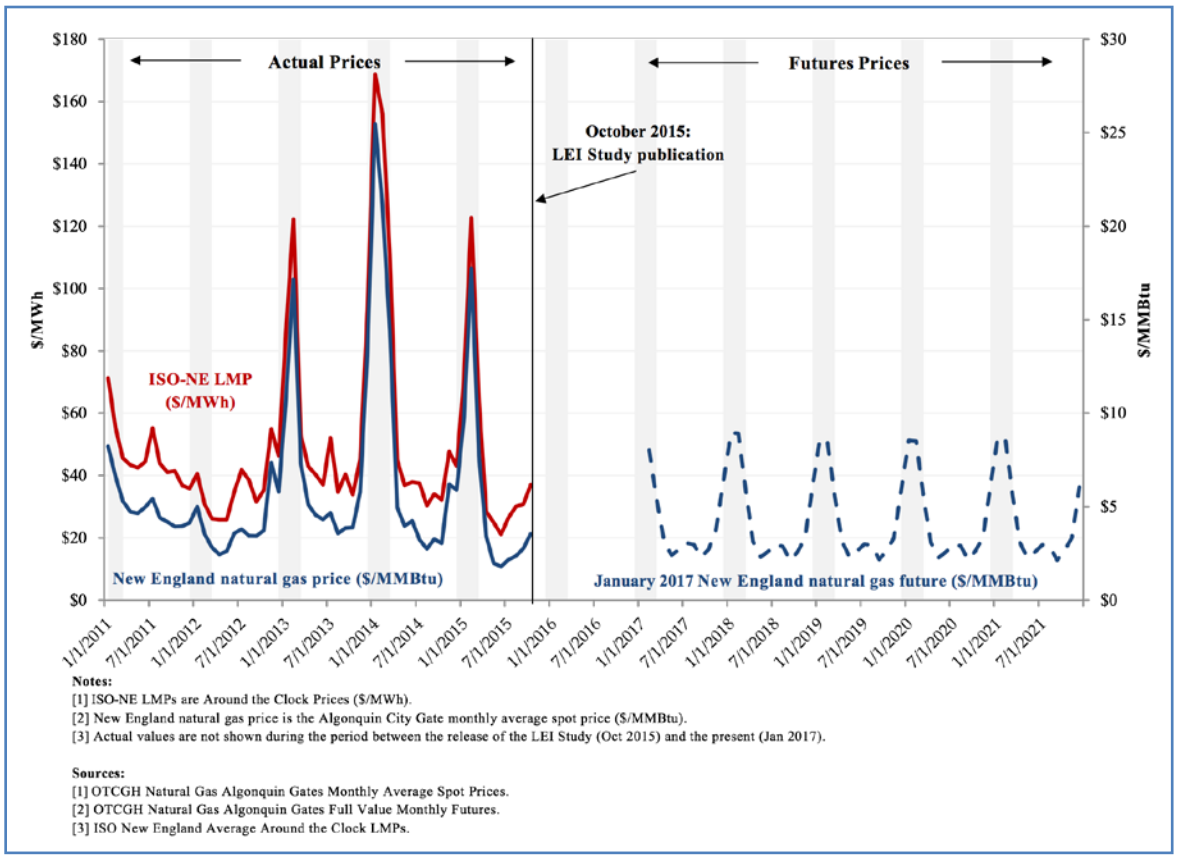
In particular, LEI's assumptions regarding natural gas fuel prices appear to be based on data that no longer reflects market realities. As highlighted in Figure 2 below, LEI's assumptions were based on data reflecting a time when, historically, New England natural gas prices had seen significant price spikes during the winter months. However, current market forecasts from natural gas futures markets have taken into account the variety of changing market conditions (including the addition of new gas pipeline capacity into New England and the presence of more generating capacity capable of fuel switching between oil and natural gas), and are projecting significantly lower natural gas prices going forward. The significance of this is highlighted in Figure 2 when viewing the historic correlation between natural gas prices and electricity prices in New England. This identifies that assumptions regarding forward looking natural gas prices will have a real impact on projections of the electricity prices in New England. As such, the LEI Study's estimates of energy market benefits likely overstate the value of Northern Pass relative to current market expectations.

The LEI Study lacks any accounting of costs to electric customers

The LEI Study purports to be a "cost-benefit" analysis (as stated in the title), yet there is no evidence that any costs have been accounted for in the results presented. As such, the LEI Study is not a "cost-benefit" analysis, but simply attempts to quantify all of the *positive* impacts while saying nothing about the offsetting *negative* impacts. Such a methodology does not provide New Hampshire stakeholders or others in the New England region with information on whether Northern Pass will actually result in *net* economic benefits. An analysis that seeks to comprehensively evaluate and weigh costs and benefits needs to include both sides of the ledger.

This point also appears to run contrary to the number of places where the LEI Study claims it is "conservative."[48] While individual pieces of the analysis may be conservative in their choice of data or assumptions, performing a cost-benefit study without taking into account the costs seems quite the opposite of a conservative assessment.

Figure 2
Historic and Forecast New England Electric and Natural Gas Prices



Notes:
[1] ISO-NE LMPs are Around the Clock Prices ($/MWh).
[2] New England natural gas price is the Algonquin City Gate monthly average spot price ($/MMBtu).
[3] Actual values are not shown during the period between the release of the LEI Study (Oct 2015) and the present (Jan 2017).

Sources:
[1] OTCGH Natural Gas Algonquin Gates Monthly Average Spot Prices.
[2] OTCGH Natural Gas Algonquin Gates Full Value Monthly Futures.
[3] ISO New England Average Around the Clock LMPs.

Section 4.1 of the LEI Study provides the entirety of the discussion on cost in the LEI Study, and notes that LEI assumed that transmission costs will be borne by consumers in Connecticut, Massachusetts, and Rhode Island as part of the three-state Clean Energy RFP.[49] Yet nowhere else in the LEI Study is there any discussion of how these costs were allocated, and the results presented throughout the report do not indicate that any such allocation has been accounted for – either in the calculation of electricity market benefits to consumers, or in the calculation of economic benefits to the broader New England region.[50]

A transmission project such as Northern Pass will have significant costs to construct and operate the line, which would have to be recouped from electric consumers. After all, Hydro Quebec has no reason to absorb such costs without passing them along to

those who purchase power and receive its delivery over Northern Pass.[51] Yet the LEI Study has not shown any such treatment. **This failure to account for even the most obvious cost associated with constructing the transmission line highlights the one-sided nature of the LEI Study.**

Furthermore, in light of Northern Pass not having been selected in the Clean Energy RFP, it stands out that the fundamental assumption of who is bearing the cost (even if it was not actually folded into the calculations) is problematic in the LEI Study. While Northern Pass is attempting to bid into a separate Massachusetts-only RFP process, there is no reason to believe that the outcome will be any different than the Clean Energy RFP, as explained in detail below in Figure 3.[52] Additionally, there should at least be a consideration of what happens to those costs if the Hydro-Quebec offer is not selected, and the only way forward for Northern Pass would be to assign at least some of the costs to New Hampshire consumers.

While we recognize that questions relating to the cost-effectiveness of the PPA are squarely before the New Hampshire PUC rather than the NH SEC, we also believe that in the context of an economic study of the benefits and costs of a proposed transmission line on New Hampshire and on New England's wholesale markets, it is appropriate to discuss questions of who pays for the capital costs of the line, and in what way do those costs affect consumers' costs and demand for electricity. The LEI Study has not accounted for these costs, even as it has focused on benefits to New England.

The LEI Study lacks an accounting of other costs in evaluation of economic impact

In addition to failing to account for the costs to electricity consumers, there are a number of other costs that the LEI Study fails to take into account. These include:

Negative impacts on tourism: Although Northern Pass has included a study on the impacts of the project on tourism, LEI is silent on the topic. Tourism is New Hampshire's second largest industry, and in a study that purports to be a cost/benefit analysis for the state's economy, it seems appropriate at least to mention potential risks.[53] Several recent studies have identified ways the project could and/or would adversely impact tourism both during construction and over the life of the project. These studies indicate that slow-moving construction vehicles, road closures, construction noise and visibility will decrease tourism while the project is being built. Over the life of the project, scenic tourism will suffer due to the inevitable forest removal and infrastructure visibility. These studies have found that Northern Pass could lead to a 9-percent decrease in tourism-related spending, thus resulting in an average annual loss of $13 million to the Gross State Product and approximately 200 jobs between 2020 and 2030.[54]

Figure 3: Potential Price Competitiveness of a Long-Term Contract for Firm Hydroelectric Supply from Hydro-Quebec that Includes the Cost of Transmission

As noted above, Massachusetts has enacted a new energy law that requires the state's utilities to solicit offers for long-term power supply from clean energy resources (which include renewables and firm hydropower supplies). In parallel, Massachusetts has proposed a new Clean Energy Standard that requires retail providers of electricity to rely on an increasing supply of clean energy (which similarly includes renewables and hydro power delivered via a new transmission line). The latter program allows clean energy resources to produce and sell Clean Energy Credits ("CECs") associated with each unit of power generation, with an effective ceiling price for such credits set at the Alternative Compliance Payment ("ACP") for CECs.[1]

A cost competitive clean energy resource would therefore need to propose a price that is at or lower than the expected cost of power plus the ACP price for CECs. (Otherwise, a load-serving entity would simply pay the ACP rather than pay the clean energy resource.)

We have prepared a rough calculation of the maximum price for firm (around-the-clock) Canadian hydropower supplies that would be cost competitive with local clean-energy resources. To be competitive, the Canadian supplier would need to recover the costs of energy production, any investment in generating capacity, and capital costs for the transmission line, at price and other terms that are better than the competition.

Assuming that Hydro-Quebec's *electricity* is priced according to opportunity-cost principles and is set at or near NE's forward spot price for energy, this part of the bid would likely be equal to forward prices.[2] Therefore, to be economically competitive, the maximum price that Hydro-Quebec could offer would be the Massachusetts CEC ACP price. The estimated cost of Northern Pass is approximately $55/MWh (based on a $40/MWh cost for the portion in New Hampshire and $15/MWh on the Quebec side) and is expected to grow with inflation at 2%.[3] This price is above the expected CEC ACP in Massachusetts, as shown in the table below.

	RPS Class I ACP Rate	Clean Energy Credit ACP (proposed)	Northern Pass Cost	Difference
2016	$66.99	$33.50	$55.00	$21.51
2017	$68.33	$34.16	$56.10	$21.94
2018	$69.70	$34.85	$57.22	$22.37
2019	$71.09	$35.55	$58.37	$22.82
2020	$72.51	$36.26	$59.53	$23.28
2021	$73.96	$36.98	$60.72	$23.74
2022	$75.44	$37.72	$61.94	$24.22
2023	$76.95	$38.48	$63.18	$24.70
2024	$78.49	$39.24	$64.44	$25.20
2025	$80.06	$40.03	$65.73	$25.70

Also, if Hydro-Quebec had to include in its offer price some amount to recover the cost of adding hydroelectric capacity (to meet demand in the winter when its local system peaks), then the difference would be even higher. Hydro-Quebec currently faces a peak demand of 38.7 GW and has an installed capacity of 36.9 GW with an additional 1.1 GW planned through 2025.[4] With this, along with Northern Pass's peak transfer capacity of 1,090 MW, it is likely that Hydro-Quebec would need to commit new hydropower gendering capacity to meet internal demand *and* provide firm hydro resources to commit to and clear in the ISO-NE capacity market. This would put further upward pressure on Northern Pass's prices.

- **Retirements of power plants in New Hampshire and New England:** While the LEI Study concluded that retirement of currently operating generation assets would not occur under the scenario where Northern Pass is constructed, this assumption does not appear reasonable in light of recent history and going-forward expectations.[55] In particular, this assumption is based on LEI's modeled capacity market outcomes, which, as discussed earlier, are highly problematic.[56] Under a more reasonable capacity market forecast, it is likely that generation retirements would occur, and the resulting loss of jobs and income to the state of New Hampshire and New England more broadly should be assessed in a cost/benefit study of impacts on New Hampshire. At the very least, a sensitivity accounting for these losses would provide important information to decision makers. (See later discussion of this topic in the section below on 'unintended consequences'.)
- **Offsetting construction of other power generation or transmission assets:** As noted previously, it is likely that at least some, if not all, of the capacity that would be supplied by Northern Pass could be supplied by some other resources. The LEI Study assumed that Northern Pass would clear in the Clean Energy RFP, but we now know it did not. Presumably, the updated LEI Study will assume that Northern Pass will be successful in the Massachusetts RFP for clean energy resources. If it does and Northern Pass is approved and constructed, then it could make it less likely that another project in New Hampshire might not move forward – which would lessen the incremental capacity benefits to New Hampshire's electricity consumers and other economic benefits to New Hampshire. Ironically, LEI's study identifies that additional generation assets would be added to New England in the absence of Northern Pass, yet the economic impact of these "lost" opportunities has not be quantified and included in LEI's Study.[57]
- **Energy expenditures flowing out of region:** The LEI Study does not account in any way for the fact that Northern Pass's construction would cause decreased energy payments to generators in New Hampshire (or elsewhere in New England) and will send dollars out of the region to Canada. While some payments to generators already leave the region in the absence of Northern Pass (given that the owners of many of New England's power plants reside outside of the region), there remain a significant number of assets within New England whose economic well-being will be harmed with the installation of a transmission line bringing power from Canada. The LEI Study has not considered or identified what offsetting effect these lost revenues could or would have on New Hampshire and New England's economies.

The LEI Study omits 'unintended consequences' and indirect impacts

The LEI Study omits any discussion of potential negative impacts on New England's wholesale energy market of the price-suppression outcomes that the report points to as

an economic benefit to consumers as a result of Northern Pass and power injections from Hydro-Quebec. The flip side of price suppression – especially as a government-led strategy – is that it may introduce unintended and negative consequences for the functioning of wholesale markets and raise costs to consumers and the electric system in the long run.

Recall that the LEI Study focuses on the role that Northern Pass would play in enabling the injection of 1,090 MW of price-taking energy supply into the wholesale market at Deerfield, New Hampshire. LEI points out the effect of such imports on lowering energy prices there and in the rest of New England. The study, however, does not address the impacts on the supplier side of the market.

If the market works as assumed in the LEI Study, other power suppliers in the region would receive lower payments for their provision of electricity. Certainly, in a competitive market, it is always possible for a new competitor to enter the market and do a better job than existing competitors. When that happens, the poorer performers may experience the consequences in the form of lower revenues and lower profits. That happens all of the time in markets. Indeed, one of the premises on which states like New Hampshire restructured their electric industries was to shift investment risk from electricity consumers to electricity suppliers.

But this is not the basis on which Northern Pass and Hydro-Quebec supplies would be entering the New England market. The new supply would enter the market through contracts that would have electricity customers underwrite investment risk – and to do so at a time when the region already has adequate supplies of electricity and relatively flat demand for electricity. If successful, the new hydropower resources would participate in lowering prices in ISO-NE's energy market, and other suppliers would feel the financial effects of lower output (because the dispatch is a zero-sum game) as well as lower prices. Poorly performing and less efficient generators would likely retire. If those affected power plants are "on the margin" in New England's electricity market, then the system could genuinely benefit from lower production costs, prices and emissions.

Perhaps more importantly, from the point of view of whether New Hampshire consumers can count on enjoying the electricity cost savings estimated in the LEI Study, and whether the New Hampshire economy will enjoy the macroeconomic benefits outlined in the report, are the broader and indirect implications of electricity price suppression impacts. Such impacts would also affect the financial viability of other power plants in New Hampshire that are not so-called 'marginal generators'.

A prime example could be the Seabrook nuclear station, which provides power at low variable costs (and thus is not on the 'margin' in ISO-NE energy markets) and with zero carbon emissions. If Seabrook were to retire as an incremental result of the price-suppression outcomes of Northern Pass and the associated hydroelectric supply from Quebec, then wholesale prices would rise in New England's power market, reducing the cost savings and economic benefits otherwise attributable to Northern Pass.

To put this in perspective: a recent analysis by Bloomberg New Energy Finance ("BNEF") of the financial stresses currently being experienced by existing nuclear reactors around the country provides some insights into the potential exposure of Seabrook to incremental price-suppression conditions in New England's electric energy prices. Other analysts have also chronicled such financial stresses, as well.[58]

BNEF examined the profitability of existing nuclear plants in an era of relatively low natural gas prices and estimates that Seabrook faces a slim but positive outlook for earnings during the 2013-2019 period.[59] That outlook, however, was developed in a context of not knowing whether Northern Pass would be approved or whether future New England prices would reflect the impact of supply from Hydro-Quebec.

Notably, BNEF estimates that another New England nuclear plant – Pilgrim station in Massachusetts – has higher estimated average annual earnings than Seabrook,[60] and yet Pilgrim's owner has announced that the plant will retire before the end of its operating license.[61] Other Northeast nuclear units that also have negative outlooks in the BNEF analysis and that have faced distressed financial conditions – such as the Ginna nuclear plant and the Fitzpatrick unit in upstate New York – apparently would have retired in the absence of action by the State of New York to provide a new, customer-supported revenue stream to compensate these units for the low-carbon energy that they provide to the region's electricity system.[62]

The point of this discussion is to suggest that there could be unintended and negative consequences for other power stations in New Hampshire (and in other parts of New England) as a result of the price-suppression outcomes that LEI identifies as a benefit of the Northern Pass project. Such potential outcomes could directly or indirectly affect New Hampshire's economy if there were ripple effects on other local power plants as a result of the Northern Pass project.

Illustratively, the closure of the Vermont Yankee power plant (which, at 620 MW, was about half the size of Seabrook (1,247 MW)[63]) resulted in a reduction of jobs at the plant from approximately 550 (at the end of 2014) to approximately 125 (at the start of 2017). A study of the economic impacts of closure indicated that the direct, indirect and induced impact of the drop in employee levels and other activity at Vermont Yankee led to a decline in total annual economic value from $493 million a year (when the plant was operating) to approximately $45 million per year as of the start of 2017.[64] With gas-fired generation being dispatched to replace Vermont Yankee in the near term at least, in 2015 wholesale prices were higher than they would have been (had Vermont Yankee continued to operate), and carbon-dioxide emissions actually rose in New England.[65]

Thus, there could be countervailing effects on wholesale prices and carbon emissions in New England that are associated with the generating system's reactions to the price-suppression effects of Northern Pass and sustainability of the wholesale markets. Northern Pass could contribute incremental pressure on existing generators that otherwise provide value to the system; this could drive baseload, zero-carbon supply (e.g., existing nuclear capacity) out, leading to much smaller (if any) clean energy

benefits from Northern Pass. This potential outcome is neither noted nor taken into account in the LEI Study. And it also raises questions about whether this is just swapping out new jobs from Northern Pass for existing jobs at Seabrook.

The New England States' energy officials (through their regional organization, the New England States Committee on Electricity ("NESCOE")) seems to understand this risk:

> *Some Potential Risks*: A significant change to New England's resource mix [through significant quantities of new hydropower imports] is not without risk. One category of risk relates to the potential implications on New England's current generation fleet. Specifically, increasing in any substantial way the level of hydro imports could have the effect of displacing existing generation units that provide service in New England today and that are needed, whether by operating characteristic or geographic location, to reliably operate the regional power system. Increasing hydro imports has the potential to depress the current New England generating fleet's energy margins, placing the continued operation of those units at risk. [66]

The wholesale market is designed so that the owner of a power plant like Seabrook is in the position to absorb such risks (and therefore, New Hampshire itself should be agnostic about it). But from the point of view of the NH SEC process, however, there could be far lower (and potentially even negative) macroeconomic benefits attributable to Northern Pass if one of its impacts were to drive other New Hampshire plants out of the market. Further, experience shows that where well-paying jobs are at risk when an existing nuclear plant is at imminent risk of retirement (as has recently occurred in Illinois and upstate New York), state policy makers have approved new policies aimed at retention of such plants with consumers pick up some costs to compensate those plants for values they provide to the electric system. In light of these considerations, these kinds of potential costs and risks to New Hampshire's economy ought to at least been mentioned in the LEI Study.

Lastly, to the extent that Northern Pass enables 1,090 MW of new imports of hydropower from Eastern Canada, it may have an impact on the ability of other renewable projects that seek to develop in New Hampshire or the region. Apparently state officials have been in favor of new additions of renewable energy within New Hampshire's borders. Such an outcome would be counter to New Hampshire's energy goals.

Conclusions: Insights about the economic impacts of the proposed Northern Pass transmission project

Our analysis indicates that while there are potential benefits of the Northern Pass project, there are also many costs. The public's understanding of such potential impacts could be enhanced through greater transparency in the studies that have attempted to estimate such impacts. To date, the LEI Study is primarily an accounting of the project's benefits, with many problematic assumptions that overstate the value of the project. Fundamentally, the study does not address the cost side of the ledger. The LEI Study offers a lopsided and inaccurate view, in our opinion, of the true net benefits of the project. Using the framework described above, we believe that decision makers should require further analysis and study of the benefits *and* costs which are likely to impact the state of New Hampshire and the larger region.

Endnotes

[1] "All of the Northern Pass transmission lines and facilities in New Hampshire will be owned by Northern Pass Transmission LLC – a New Hampshire limited liability company owned by Eversource Energy Transmission Ventures, LLC, which is a wholly owned subsidiary of Eversource Energy." http://www.northernpass.us/company-profile.htm.

[2] Eversource Energy also owns: the Connecticut Light and Power Company, NSTAR Electric Company in Massachusetts; and Western Massachusetts Electric Company. All of these companies are now doing business as "Eversource Energy." Eversource Energy, 2015 Annual Report, page 2. https://www.eversource.com/Content/docs/default-source/Investors/2015-annual-report.pdf. As of 2015, Eversource Energy serves more electricity customers than any other electric utility in New England. Eversource's subsidiaries provide electric service to 45 percent of all retail electricity customers in New England, and 58 percent of all electricity customers in New Hampshire, Connecticut and Massachusetts. U.S. Energy Information Administration ("EIA"), 861 data files, http://www.eia.gov/electricity/data/eia861/. Eversource Energy also owns NSTAR Gas Company and Yankee Gas Services Company.

[3] The northern portion of Northern Pass would be a single circuit 320-kV high voltage direct current ("HVDC") line. Because New England's six-state electric system operates on AC power, the DC power needs to be converted to AC power.

[4] http://www.northernpass.us/route-info.htm. "Franklin HVDC terminal will interconnect to Canada at the 735/230-kV Des Cantons substation in Quebec, Canada via a ± 320-kV dc transmission line from Des Cantons to Franklin and then to the United States transmission system at the Public Service of New Hampshire's 345-kV Deerfield substation ([point of interconnection]), located in Deerfield, New Hampshire, via a 345-kV ac overhead transmission line." https://www.iso-ne.com/static-assets/.../2016/08/proposed_plan_application_status.xlsx.

[5] http://www.northernpass.us/route-info.htm.

[6] This is based on 1,090 MW times 8,760 hours in a year times an 85-percent capacity factor. I note that Northern Pass, through its economic report prepared by London Economics International, assumed that supply would be available during 83 percent of the time over the course of a year: Julia Frayer, Eva Wang, Ryan Hakim, and Adnan Cheema (London Economics), "Cost-Benefit and Local Economic Impact Analysis of the Proposed Northern Pass Transmission Project," prepared on behalf of Northern Pass Transmission, LLC, October 16, 2015, page 34.

[7] https://www.iso-ne.com/static-assets/.../2016/08/proposed_plan_application_status.xlsx.

[8] http://www.northernpass.us/permit-approvals.htm; NH SEC Docket No. 2015-06, http://www.nhsec.nh.gov/projects/2015-06/2015-06.htm.

[9] New Hampshire statutes, Title XII, Chapter 162H (Energy Facility Evaluation, Siting, Construction and Operation) (hereafter referred to as the "NH Siting Statute"), Section 162-H:16.

[10] http://www.northernpass.us/permit-approvals.htm

[11] Petition of Public Service Company of New Hampshire D/B/A Eversource Energy for Approval of a Power Purchase Agreement, June 18, 2016. (PUC Docket No. DE 16-693.) The PPA stipulates that the energy purchased pursuant to the PPA would be delivered by Northern Pass and is subject to the completion of the facilities. According to James Daly, Eversource's witness in the proceeding before the PUC, "PSNH will receive a substantial supply (approximately 400,000 MWHrs/Year) of firm, on-peak energy from renewable resources equal to approximately 100 MW. The energy supply is on-peak, Monday through Friday, from

hour-ending 8 am through hour-ending 11 pm (67% of weekday hours), every week of the year for the 20-year term of the PPA." Prepared Testimony of James Daly, page 4.

[12] See: EIA, 861 data files.

[13] The PPA's pricing provisions and Eversource's testimony related specifically to them have been redacted and given confidential treatment. There are some public characterizations of the prices, however, in these documents. On page 4 of his testimony on behalf of Eversource, Mr. Daly states that the PPA has been designed to: "1) Ensure that New Hampshire receives no less than its regional load ratio share of the energy delivered over NPT during on-peak hours when energy and reliability benefits are highest to PSNH's customers; 2) Create a stable pricing formula that reduces volatility; 3) Ensure that all environmental attributes associated with the energy delivered under the PPA would be transferred to PSNH for the benefit of its customers." Mr. Daly states further on page 5 that the "pricing structure is designed to dampen volatility that has been present in the wholesale markets in recent years and provide price stability for PSNH customers. [Two lines of redacted text] Specifically, the first year contract price will be the delivery point adjusted forward market price for energy." Further, the "pricing formula used in the PPA has two key components. [Three lines of redacted text] incorporating these concepts into the PPA prevents substantial swings in the price from one year to the next and therefore helps stabilize PPA pricing in a volatile market. In addition, the contract provisions help reduce customer costs within a market environment that rises over the long term, while allowing customers to realize benefits related to falling energy costs on a year-over-year a [sic] basis." (Page 7.)

[14] Gordon van Welie, "State of the Grid: 2016," January 26, 2016. https://www.iso-ne.com/static-assets/documents/2016/01/20160126_presentation_2016stateofthegrid.pdf

[15] ISO-NE's 2016 Capacity, Energy, Load and Transmission ("CELT") Report, showing information about the region's demand projection and supply resources (including existing power plants, retirements, projected additions (including resources that have been selected in ISO-NE's forward capacity markets, and customer-sited solar resources)). See Table 1.1. There are 12,800 MW of new gas-fired combined cycle units, 1,400 MW of gas and gas/oil gas turbine peaking units, and 8,000 MW of utility-scale solar, wind projects, and small-scale hydroelectric capacity in the 'queue,' seeking to be able to enter the region's power system. ISO-NE Interconnection Queue, as of 1-2017.

[16] New Hampshire Office of Energy & Planning, "New Hampshire 10-Year State Energy Strategy," September 2014 (hereafter referred to as the "NH State Energy Strategy"), pages i-iv. https://www.nh.gov/oep/energy/programs/documents/energy-strategy.pdf.

[17] NH State Energy Strategy, page 7.

[18] NH State Energy Strategy, page 8.

[19] Northern Pass Transmission, "The Case for Northern Pass," http://www.nhsec.nh.gov/projects/2015-06/application/Volume-I/2015-06_2015-10-19_nptllc_psnh_app_executive_summary.pdf.

[20] At the time when the Northern Pass project was announced in 2008 and just before the New England Governors began to explore options to manage and lower electricity prices, New England's total wholesale electricity costs were twice what they were in 2015. Gordon van Welie, "State of the Grid: 2016," January 26, 2016, page 18.

[21] These three states have been working together through a process called the "New England Clean Energy RFP," which conducted its first solicitation of proposals during 2016. https://cleanenergyrfp.com/. Northern Pass submitted a proposal in response to this request for proposals, but was not selected for contract negotiations. Northern Pass Proposal to the Clean Energy RFP, Public Redacted Version, January 27, 2016.

https://cleanenergyrfp.com/bids/, https://cleanenergyrfp.com/2016/10/25/bidders-selected-for-contract-negotiation/.

[22] In June 2015, Connecticut enacted An Act Concerning Affordable and Reliable Energy. (Connecticut consumers use 25 percent of the region's power supply.) In the prior year, Rhode Island passed the Rhode Island Affordable Clean Energy Security Act." (Rhode Island consumers account for 6 percent.) The New England Council, "The New England Energy Landscape: History, Challenges & Outlook," 2016, page 36. Usage data from EIA, 861 data files. http://newenglandcouncil.com/assets/NEC-Energy-Report-October-2016-FINAL-Single-Page-Format.pdf.

[23] EIA, 861 data files.

[24] Massachusetts House Bill 4568, "An Act to Promote Energy Diversity" ("Massachusetts Act") enacted in August 2016. https://malegislature.gov/Bills/189/House/H4568. The bill "requires utilities to competitively solicit and contract for approximately 1,200 megawatts (MW) of clean energy generation – base load hydropower, onshore wind and solar supported by hydropower, standalone onshore wind, solar, or other Class I renewable resources." "Governor Baker Signs Comprehensive Energy Diversity Legislation," August 8, 2016 press release, http://www.mass.gov/governor/press-office/press-releases/fy2017/governor-baker-signs-comprehensive-energy-diversity-law.html. Section 83D of the Massachusetts Act describes the procurement process, with "preference to proposals that combine new Class I renewable portfolio eligible resources and firm hydroelectric generation…" Section 83D(d). The Massachusetts Act provides that the solicitation "schedule shall ensure that the distribution companies enter into cost-effective long-term contracts for clean energy generation equal to approximately 9,450,000 megawatt-hours by December 31, 2022." Section 83D(b). "Clean energy" generation includes "firm service hydroelectric generation" (i.e., "hydroelectric generation provided without interruption for 1 or more discrete periods designated in a long-term contract"), and "long-term contracts" may be for a period of 15-20 years. Section 83B. Note that as of 2015, retail sales of electricity in Massachusetts amounted to 54,494,484 MWh; the state's clean-energy procurement will be soliciting an amount of power approximately equivalent to one-sixth of the state's total electricity requirements. EIA, 861 data files, http://www.eia.gov/electricity/data/eia861/, with information about retail sales of electricity in Massachusetts in 2015. The Massachusetts Act also has solicitation requirements for another 1,500 MW of total capacity from off-shore wind projects that go into operation after January 2018, with long-term contracting requirements for cost-effective proposals. Massachusetts Act.

[25] The MA DEP's proposed regulation states that the new Clean Energy Standard is being explicitly designed to be compatible with the long-term contracting requirements of the Massachusetts Act.

[26] The MA DEP proposal would allow generators to bank CECs for use/sale in later years, if there is an oversupply in a particular year. Also, it anticipates that retail electricity suppliers may meet their CES obligations by generating and/or purchasing CECs, or by paying an alternative compliance payment ("ACP"). Thus, the ACP serves as a ceiling on the price of CECs (or the amount of above-market payments that would support the entry of new clean energy resources). For clean energy resources, the ACP is proposed to be 50 percent of the ACP for Class 1 renewable requirements, which in 2016 was $66.99/MWh and with the ACP price allowed to grow each year at the rate of inflation. (Thus, had the CES program been in place in 2016, the ACP for clean energy resources (including large-scale hydroelectric resources delivered over a new transmission line) would have been $33.50. MA DEP, "Background Document on Proposed New and Amended Regulations (310 CMR 7.00, 310 CMR 60.00) Air Pollution Control for Stationary and Mobile Sources," December 15, 2016. http://www.mass.gov/eea/agencies/massdep/climate-energy/climate/ghg/ces.html For ACP Rate see http://www.mass.gov/eea/energy-utilities-clean-tech/renewable-energy/rps-aps/retail-electric-supplier-compliance/alternative-compliance-payment-rates.html.

[27] A few years before that, in 2008: "According to the filing [for a new transmission line to New England], Hydro-Quebec is developing more than 4,000 MW of new hydro-electric generation in Quebec, which will supplement its existing vast system of hydro-electric power. Consequently, Hydro-Quebec expects to have significant amounts of surplus power available for export to the United States for at least the next two decades." SNL, "Northeast Utilities, NSTAR pursue transmission interconnection with Quebec," December 15, 2008. In 2010, the Quebec government said that: "Québec must make sure that new U.S. legislation and future policies pertaining to renewable energies will enable it to rely on a long-term approach that promotes a flexible electricity supply by: not rejecting water-generated electricity from Québec; allowing full use of existing supply infrastructure; fostering the installation of new export corridors and the signing of long-term contracts." "The Quebec Government's U.S. Strategy: Summary," 2010, pages 8-9. http://www.mrif.gouv.qc.ca/content/documents/en/Sommaire_QC_USA_en.pdf. See also: Hydro-Quebec, "Strategic Plan 2016-2020: Setting new sights with our clean energy," 2016. http://www.hydroquebec.com/publications/en/docs/strategic-plan/plan-strategique-2016-2020.pdf.

[28] The New England Clean Power Link would connect New England to Eastern Canadian utility systems with a transmission line running under Lake Champlain. The project received the Presidential Permit in December of 2016. See http://www.necplink.com/.

[29] Champlain Hudson Power Express project was announced in 2010. This proposed transmission line would run under Lake Champlain and down the Hudson River connecting the New York Metro area to Canadian resources. See http://www.chpexpress.com/.

[30] These include the Maine Green Line project, the Vermont Green Line project, the Atlantic Link project, and the Northeast Energy Link project.

[31] NH Siting Statute, Section 162-H:1. Susan Tierney and Paul Hibbard, "Siting Power Plants in the New Electric Industry Structure: Lessons California and Best Practices for Other States," *The Electricity Journal*, June 2002.

[32] For example (listed in reverse chronological order): Julia Frayer, Eva Wang, Ryan Hakim, and Adnan Cheema (London Economics), "Cost-Benefit and Local Economic Impact Analysis of the Proposed Northern Pass Transmission Project," prepared on behalf of Northern Pass Transmission, LLC, October 16, 2015 (hereafter referred to as the "LEI Study"); Dr. Lisa Shapiro, "Northern Pass Transmission Project – Estimated New Hampshire Property Tax Payments Report," prepared for Northern Pass Transmission, October 16, 2015; Nichols Tourism Group, "Northern Pass Transmission and New Hampshire's Tourism Industry," prepared on behalf of Northern Pass Transmission, September 2015; Dr. Lisa Shapiro (Gallagher, Callahan & Gartrell), "Proposed Northern Pass Transmission Project Economic Impact Update Estimated New Hampshire Jobs During 3 Year Construction Phase," prepared for Northern Pass Transmission LLC, April 2011; Charles River Associates, "LMP and Congestion Impacts of Northern Pass Transmission Project: Final Report," prepared for Northern Pass Transmission, December 7, 2010; Dr. Lisa Shapiro and Heidi Kroll (Gallagher, Callahan & Gartrell), "Preliminary Economic and Fiscal Impacts of the Proposed Northern Pass Transmission Project," prepared for Northern Pass Transmission LLC, October 2010.

[33] Samuel Newell and Jurgen Weiss (The Brattle Group), "Electricity Market Impacts of the Proposed Northern Pass Transmission Project," prepared for the New Hampshire Counsel for the Public, December 30, 2016; Michael Storace (University of Vermont Environmental Studies [Undergraduate] Thesis Collection), "The Proposed Northern Pass Transmission Project and the Power of Public Opinion," 2015; Anne Ressler, Austin Boral, Aislinn McLaughlin, and Thomas Wang (Policy Research Shop, The Nelson A. Rockefeller Center at Dartmouth College), "The Northern Pass Transmission Line: An Analysis of Transmission Line Undergrounding," prepared for the New Hampshire Senate Committee on Energy and Natural Resources, May 20, 2014; PA Consulting study, "Electricity Market Impacts of the Northern Pass Transmission Project," June 2012 (prepared on behalf of the New England Power Generators Association).

[34] Julia Frayer, Eva Wang, Ryan Hakim, and Adnan Cheema (London Economics), "Cost-Benefit and Local Economic Impact Analysis of the Proposed Northern Pass Transmission Project," prepared on behalf of Northern Pass Transmission, LLC, October 16, 2015.

[35] NH SEC, "Order on Applicant's Further Motion for Confidential Treatment," Docket No. 2015-06, December 13, 2016. http://www.nhsec.nh.gov/projects/2015-06/motions-waivers/2015-06_2016-10-28_further_mtn_treatment.pdf.

[36] LEI Study, page 12.

[37] LEI Study, page 49 ("The starting point of [sic] supply stack was based on the cleared capacity from FCA#9.")

[38] ISO-NE's FCA #9 press release available at https://www.iso-ne.com/static-assets/documents/2015/02/fca_9_result_report.pdf.

[39] This can be seen in the figures on page 105 (showing that the first year of new capacity additions is 2024). We note also that the additions shown in these figures do not appear to be consistent with the ISO-NE CELT forecast of demand in New England. The most recent forecast identifies growth in peak demand of less than 100 MW per year after 2020, once solar and demand response resources are accounted for, yet the LEI Study appears to be adding 400-500 MW of capacity in these years to meet this demand. While specific details on the methodology employed have been redacted, this inconsistency stands out. In addition, LEI's use of "on time" capacity additions seems divorced from reality, in particular given their use of "CCGT" generic capacity, which we assume is a mix of natural gas combined cycle and combustion turbines. If a combined cycle plant were to be built, recent and announced projects indicate that it would be significantly larger than 400-500 MW, and would likely be built to meet demand in years beyond its first. LEI's use of "on time" additions therefore does not capture the actual timing or size of likely future additions. While such assumptions about hypothetical "just in time" additions of capacity (or hypothetical sudden retirements of assets) are sometimes used in "what if…" types of analyses, that approach does not seem appropriate in the context of an agency review of the anticipated benefits and costs of an actual proposed facility and in determining whether the proposed project is in the public interest.

[40] ISO-NE's FCA #10 press release available at https://www.iso-ne.com/static-assets/documents/2016/02/fca_10_result_report.pdf.

[41] The ISO-NE press release details that 1,302 MW of these additions are from new dual-fuel (natural gas primary with oil secondary), with an additional 27 MW of new wind and 44 MWof new solar capacity.

[42] See ISO-NE's FCA #10 press release: "Before the auction, a total of 40,131 MW of resources, **including 6,700 MW of new resources (emphasis added)**, qualified to compete in the auction to provide the 34,151 MW Installed Capacity Requirement (ICR) for 2019-2020."

[43] LEI Study, page 96 and Figure 57.

[44] "… given our low expectations for the upcoming auctions. Mgmt. sees prospects for a decline in the next ISO-NE auction between $5-6/kW-mo down from $7.05 in the last auction, consistent with our expectations…" UBS Global Research, "Dynegy, Inc", January 18, 2017, page 2, available at https://neo.ubs.com/shared/d1dakHJYZlT7/.

[45] Note that the exact capacity market prices assumed by LEI are redacted, but that Figure 15 appears to indicate an FCA #11 clearing price of approximately $9.5/kW-month, identical to the clearing price of FCA #9, and thus significantly higher than FCA #10 and market forecasts.

[46] We note that this is essentially the same effect as Scenario 3 in which the authors, Samuel Newell and Jurgen Weiss of The Brattle Group, assume Northern Pass "may not qualify as a reliable capacity resource

and/or may not clear the capacity market." See Prefiled Direct Testimony of Samuel Newell and Jurgen Weiss, Behalf of the Counsel for the Public in State of New Hampshire Site Evaluation Committee Docket No. 2015-06 "Joint Application of Northern Pass Transmission, LLC and Public Service Company of New Hampshire D/B/A Eversource Energy for a Certificate of Site and Facility," filed on December 30, 2016 ("Brattle Testimony"), page 4.

[47] This point is also echoed in the Brattle Testimony, page 3.

[48] See, for just a few examples of this statement, LEI Study page 12 ("The Base Case also builds on conservative market-oriented expectations…") and ("We have conservatively assumed that new natural gas pipelines will be built…"), page 13 ("As such, we have conservatively quantified only the wholesale capacity market benefits for ten years…"), page 20 ("…LEI has conservatively not included this in its economic modeling.").

[49] Since the time the LEI Study was issued, Northern Pass was not selected in the Clean Energy RFP. NH SEC, "Order on Applicants Motion for Clarification and/or Rehearing on Order(s) requiring production of documents related to the Clean Energy RFP," Docket No. 2015-06, December 13, 2016.

[50] The estimated jobs and GDP benefits that the LEI Study shows as resulting from savings to consumers in the three states that are assumed to pay for the costs of a $1.6 billion transmission line are simply too high to have incorporated transmission-line costs (as described in Section 7.3 and reflected in Figures 50 and 51).

[51] As Tierney has written elsewhere, "there is no reason to believe that Canadian power will be cheap, as some would suggest." (See Susan Tierney, "The Proposed 'Clean Energy Resources' Bill: Potential costs and other implications for Massachusetts consumers and the state's and region's electric system," April 2014.) Hydro Quebec is a provincially owned Canadian utility. Its economic interests are to provide value to its owner/parent, the Provinces of Quebec, more than to New England consumers, and it would be foolish – and bad business for their provincial shareholders – to sell the power at anything but the going price of electricity in the target power market. In theory, if the going price of electricity were sufficient to cover the cost of (a) building and operating hydroelectric facilities to provide firm and/or on-peak power supply to power purchasers, and (b) building and operating new high-voltage transmission facilities, then Hydro-Quebec would not sell it at below market prices. But in reality, Hydro-Quebec's costs to construct and operate those facilities are not likely to be lower than the market prices, for the reasons we describe further below.

[52] 1. The ACP for CECs is set at 50% of the ACP for Class 1 Renewables. See Massachusetts Department of Environmental Protection, Proposed New and Amended Regulations (310 CMR 7.00, 310 CMR 60.00) Air Pollution Control for Stationary and Mobile Sources.

2. This assumption is consistent with Hydro-Quebec's proposed PPA with PSNH, where the energy price is set according to the ISO-NE Hub Price. (Petition of Public Service Company of New Hampshire D/B/A Eversource Energy for Approval of a Power Purchase Agreement, June 18, 2016. (PUC Docket No. DE 16-693.)) We think it is reasonable to assume that the energy component price would work the same way for an offer into a Massachusetts solicitation.

3. We based this on information in the PA Consulting study, "Electricity Market Impacts of the Northern Pass Transmission Project," June 2012, page 5, which reported a cost estimate for transmission of $42.50, with a low and high range between $40/MWh and $45/MWh. This estimate was for the cost of new transmission in Quebec and in New Hampshire. The portion on the U.S. side was between $27/MWh-$30/MWh, and assumed a $1.1 billion project cost for Northern Pass. Because Northern Pass's project cost is now $1.6 billion, we increased the $/MWh cost of the U.S. portion of the line by a similar increase (approximately 45%). This raised the U.S. portion to approximately $40/MWh. We adjusted the cost of the Quebec portion for inflation (9 percent since 2010), producing a cost of approximately $15/MWh on

the Quebec side. Together, this yielded a $55/MWh total cost for new transmission. This $55/MWh was assumed to grow with inflation at 2% a year.

4. See Hydro-Quebec's 2015 Annual Report and the Hydro-Quebec Strategic Plan 2016-2020.

[53] See NHPR, "New Hampshire Tourism" at http://nhpr.org/topic/new-hampshire-tourism#stream/0

[54] See the Prefiled Testimony of Adam Zysk on Behalf of the Counsel for the Public in State of New Hampshire Site Evaluation Committee Docket No. 2015-06 "Joint Application of Northern Pass Transmission, LLC and Public Service Company of New Hampshire D/B/A Eversource Energy for a Certificate of Site and Facility," filed on November 15, 2016, the Prefiled Testimony of Thomas Kavet on Behalf of the Counsel for the Public in State of New Hampshire Site Evaluation Committee Docket No. 2015-06 "Joint Application of Northern Pass Transmission, LLC and Public Service Company of New Hampshire D/B/A Eversource Energy for a Certificate of Site and Facility," filed on December 30, 2016, and the Prefiled Testimony of Miachael Buscher, James Palmer and Jeremy Jones on Behalf of the Counsel for the Public in State of New Hampshire Site Evaluation Committee Docket No. 2015-06 "Joint Application of Northern Pass Transmission, LLC and Public Service Company of New Hampshire D/B/A Eversource Energy for a Certificate of Site and Facility," filed on December 30, 2016.

[55] We note that the New England region has experienced generating-unit retirements in every single year over the past 20 years, and that the average annual MW (summer) retired over the past 5 years equals 440 MW. Approximately 1,500 MW of capacity is expected to retire this year. Data from SNL Financial.

[56] We also note that other intervenors in the NH SEC process have similar doubts about LEI's retirement assumptions. In fact, the Brattle Testimony calculates that even 500 MW of retirements would more than cut in half the capacity market benefits identified by LEI. See Brattle Testimony page 6.

[57] See LEI Study, page 105, showing generic capacity totaling 400 MW in 2024 and 500 MW in 2025 being constructed in the "base case" and not in the "project case."

[58] See: Whitney Herndon and John Larsen, "Nukes in the Crosshairs Revisited: The Market and Emissions Impacts of Retirements," Rhodium Group, November 2, 2016; http://rhg.com/notes/nukes-in-the-crosshairs-revisited Julien Dumoulin-Smith, "Do Carbon Targets Compute without the Nukes?" UBS, May 25, 2016; Julien Dumoulin-Smith, "The Nuke Retirements are Coming," September 24, 2015.

[59] BNEF, "Reactors in the red: financial health of the US nuclear fleet," July 11, 2016, Table 1. /.

[60]This is based on projected earnings during the 2016-2019 period. BNEF, "Reactors in the red: financial health of the US nuclear fleet, July 11, 2016,Table 1.

[61] Associated Press, "Pilgrim Nuclear Plant in Massachusetts to Close by 2019, Owner Says," October 13, 2015. "Entergy Corp. said Tuesday it is closing the only nuclear plant in the state because of 'poor market conditions, reduced revenues and increased operational costs.'" Also: Entergy press release, "Energy Intends to Refuel Pilgrim in 2017; Cease Operations on May 31, 2019," April 14, 2016. http://www.pilgrimpower.com/operational-update

[62] NY Public Service Commission, "Order Approving Administrative Cost Recovery, Standardized Agreements and Backstop Principles," NY PSC Case No. 15-E-0302, November 17, 2016. https://www.energymarketers.com/Documents/order_ces_nyserda_adder_std_agmts_and_backstop.pdf

[63] ISO-NE CELT report, Table 2.1.

[64] U Mass Donahue Institute – Economic and Public Policy Research, "Economic Impacts of Vermont Yankee Closure," Prepared for the Franklin Regional Council of Governments, December 2014, page 9.

[65] "Carbon dioxide emissions rose about 7% in New England last year as the loss of the Vermont Yankee nuclear plant increased fossil fuel generation, ISO-NE said last week." William Opalka, "Loss of Nuclear Plant Reverses Trend," RTO Insider, February 22, 2016, reporting on a presentation made by Patricio Silva (ISO-NE), "Environmental Update," to the ISO-NE Planning Advisory Council, February 17, 2016. https://www.rtoinsider.com/co2-new-england-22278/.

[66] NESCOE "Incremental Hydropower Imports Whitepaper: Considerations, Options and Market Overview Regarding the Potential to Increase Hydropower Imports from Eastern Canadian Provinces to New England," Fall 2013, pages 47-48. http://media.northernpasseis.us/attachments/Att_5604_Incremental_Hydropower_Imports_Whitepaper_2013.pdf.