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Thomas M. Melone
President and
Senior General Counsel

October 3, 2017

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

Re: Northern Pass Transmission Line

Dear Ms. Monroe,

We are filing as a public comment the objections we have filed with the U.S. Forest Service to its draft record of decision. As we explain in our objections, the Northern Pass line will result in a net loss of thousands of jobs in New England and significantly higher GHG emissions as compared to alternatives.

Very truly yours,

Thomas M. Melone



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October 3, 2017

Mary Beth Borst, Reviewing Officer
USDA Forest Service, Eastern Region
626 East Wisconsin Avenue, Suite 700
Milwaukee, WI 53202
Objections-eastern-region@fs.fed.us

Via email and fedex

Re: Objections to the Draft Record of Decision (“DROD”) for the Northern Pass Project

The DROD is based upon the environmental impact statement (“EIS”) for the Northern Pass Project (the “Project”) prepared by, amongst other agencies, the Department of Energy (“DOE”) and the U.S. Forest Service (the “Forest Service”). The EIS fails to comply with the National Environmental Policy Act (“NEPA”) for the reasons discussed herein, primarily the failure of the EIS to analyze how the DOE’s energy management decisions affect energy supply and demand and the corresponding effects on emissions, American jobs, and American economic development. The DROD is also contrary to the “America First” policy of the current Administration as the Northern Pass project is one of many projects either approved or in process of approval through which Hydro Quebec intends to decimate U.S. renewable energy producers and other generators in the United States. The Northern Pass, quite simply, would export a net thousands of American jobs to Canada, and result in New England ratepayers sending billions of dollars to Canada to support Canadian jobs, schools, and economic development.

Northern Pass Is Part of Scheme to Decimate U.S.-Based Renewable Energy Generation

Hydropower from Canada is the largest source electricity imported into the U.S.. In total, according to the Congressional Research Service (“CRS”), “the value of electricity imports from Canada to the United States rose (overall) from approximately \$1.9 billion in 2011 to about \$2.95 billion in 2015.” The total value going the other way equaled approximately \$300 million. Now Hydro-Quebec through Northern Pass and similar projects seeks to be the dominant generator in ISO-New England, decimating US renewable energy producers in the process.

The EIS acknowledges the massive increase in Canadian imports, *see* S-24, and acknowledges that electricity generation from natural gas, oil, coal, and domestic hydropower would be expected to fall. The EIS falls to analyze, however, the impacts on other renewable energy forms of generation. The EIS, *see* S-24, also acknowledges that Canadian hydropower would become the dominant source of electricity in ISO-NE supplying approximately 26 percent of the total electricity supply to ISO-NE. That total would likely substantially increase if the other Canadian Hydro transmission projects are factored in, which the EIS should have but did not do. The failure to analyze wind and solar with storage as a reasonably foreseeable alternative is clear error.

The failure of the EIS to analyze the potentially devastating impacts on U.S. renewable energy producers as well as the likely outcome of a trade case against Canada to address such impacts is clear error.

The Forest Service Has Failed to Take a Hard Look at the Impacts of the Project

“NEPA is ‘essentially procedural,’ designed to ensure ‘fully informed and well-considered decision[s]’ by federal agencies.” *Del. Riverkeeper Network v. FERC*, 753 F.3d 1304, 1309-10 (D.C. Cir. 2014) (quoting *Vt. Yankee Nuclear Power Corp. v. NRDC*, 435 U.S. 519, 558 (1978)). The statute serves that purpose by requiring federal agencies to take a “hard look” at “their proposed actions’ environmental consequences in advance of deciding whether and how to proceed.” *Sierra Club v. U.S. Army Corps of Eng’rs*, 803 F.3d 31, 37, 419 U.S. App. D.C. 416 (D.C. Cir. 2015). NEPA “does not dictate particular decisional outcomes, but ‘merely prohibits uninformed—rather than unwise—agency action.’” *Id.* (quoting *Robertson v. Methow Valley Citizens Council*, 490 U.S. 332, 351 (1989)). Under NEPA regulations, agencies must consider all reasonable alternatives, including those not specifically under their authority to implement. *See* <https://ceq.doe.gov/nepa/regs/40/1-10.HTM>. *See also* *NRDC v. Morton*, 458 F.2d 827 (D.C. Cir 1972).¹

The USDA Forest Service must take a “hard look” at both the “indirect effects” of its proposed action as well as the “cumulative” impact of its decision “when added to other past, present, and reasonably foreseeable future actions.” 40 C.F.R. § 1508.7. The cumulative impact requirement ensures that agencies consider effects that result from “individually minor but collectively significant actions taking place over a period of time.” *Del. Riverkeeper*, 753 F.3d at 1319-20 (quoting 40 C.F.R. § 1508.7).

The EIS is Manifestly Inadequate

The EIS does not conform to NEPA for multiple reasons:

1. The EIS and the Forest Service fail to analyze the impacts of its decision on greenhouse gas emissions (“GHG”), including upstream effects, downstream effects, and the effects on displacement of renewable energy that is cleaner than hydroelectric. Such failure has recently caused two Federal Courts of Appeals to

¹ Allco gratefully acknowledges the contributions to these comments of the Institute for Policy Integrity at New York University School of Law.

- invalidate agency determinations and environmental reviews. *See, Sierra Club v. FERC*, 867 F.3d 1357 (D.C. Cir. 2017), *see Attachment A*; *Wildearth Guardians v. BLM*, No. 15-8109 (10th Cir. September 15, 2017), *see Attachment B*.
2. Specifically, the EIS and the Forest Service fail to analyze the GHG and other impacts of its decision that will occur as the result of massive additional flooding of land and construction of dams in order for Hydro-Quebec or other Canadian hydro producers to delivery the energy. Although those impacts are initially in Canada, GHG emissions cannot be neatly segregated by country. Higher GHG emissions in Canada from flooding or from higher use of fossil fuel generation because of hydropower being diverted to the United States, has the same impact on the United States as if the plant were located in the U.S.
 3. *The EIS Fails to Analyze the Cumulative and Life Cycle GHG Impacts of Hydro*. The EIS assumes without analysis that the ability of utilities within ISO-NE to purchase “renewable” hydropower electricity from Canada is desirable and is a solution to the strawman used by the EIS of diversity and “baseload” power supply of the ISO-NE region. The EIS assumes, again without analysis, that the hydroelectric generation that Northern Pass would carry is renewable, sustainable, and lacking in emission of atmospheric pollutants. Such an assumption does not pass muster for informed decision making. New reservoirs and dams are rarely proposed in North America, outside of Québec and Labrador. Impoundment of hydroelectric reservoirs induces decomposition of the flooded biomass (forests, peatlands and other soil types), raising GHG emissions. In addition, there are ongoing net differences between the carbon uptake and respiration of the pre-flooding and post-flooding biomes and water columns. *See, Attachment E* at 2. The result is higher greenhouse gas emissions after impoundment, mainly CO₂ and a small amount of CH₄ (methane). Hydro-Quebec even states on its website that GHG emissions generated by creating reservoirs used to produce electricity are not considered when calculating emissions or Hydro-Québec’s carbon footprint, nor do they include a life cycle analysis in their carbon footprint calculations.²
 4. The EIS and the Forest Service fail to consider the potential for other adverse effects including mass extinction of species from dams that would need to be constructed or maintained as the result of Northern Pass. *See, e.g. Attachment C*.
 5. The EIS’ description of the effects of the No-Action Alternative is manifestly erroneous.
 6. The EIS bases its entire analysis on conjecture. The EIS assumes without adequate support that
 - a. the hydroelectric energy is needed to diversify electricity sources, a need that was never analyzed. There surely cannot be informed decision making when the threshold question—need for the project—is merely based upon conjecture.
 - b. The purpose and need explored in the EIS is by its plain language limited to the border crossing. The Forest Service has a responsibility to perform an analysis of the entire Project, not just the need to cross the Canadian-US border.

² See, <http://www.hydroquebec.com/sustainable-development/documentation-center/ghg-emissions.html>.

7. The EIS and the Forest Service have failed to properly analyze the need for the Northern Pass project as they have failed to consider the impact of the already approved TDI transmission project.
8. The EIS and the Forest Service have not analyzed the market impacts of Northern Pass. *See, e.g., Attachment D.*
9. The EIS and the Forest Service assume without analysis that the energy delivered by the Northern Pass will be from Canadian Hydroelectric sources, and that such sources are “clean”. While generally cleaner than fossil fuel generation, hydroelectricity results in only a roughly 50% reduction in GHG emissions as compared to natural gas fired power plants. *See Attachment E*, at 2, Table 1.
10. The EIS and the Forest Service have given no consideration to the vulnerability of the New England electric grid from such a large scale single generation resource, as compared to diversified renewable generation spread out across New England.
11. The EIS and the Forest Service assume without any analysis that other forms of renewable energy such as wind and solar do not fill the need of the New England States. Such an assumption is patently false. It is now cost effective for renewable energy generation resources to be paired with storage in New England. *See, e.g., Attachment F*, which is testimony from Green Mountain Power Corp. explaining how its battery storage project for a solar facility located in Vermont is cost effective.
12. More strikingly, the EIS and the Forest Service fail to use basic market and economic principles in analyzing the No-Action alternative, and market and economic principles that have been used for decades for federal agencies in performing NEPA analyses. The Northern Pass might be able to be analyzed solely as an additive project as far as economic and climate change impacts if it existed in a vacuum, but it does not. Hydro-electric electricity from the Northern Pass would displace renewable energy projects (and the American jobs related to those projects) that would otherwise be built in the New England states and on the ISO-New England electricity grid. The results of New England’s recent multi-state RFP (*see, Attachment G*), and Massachusetts current RFP establishes that beyond dispute. The table below summarizes the adverse economic impacts from Northern Pass, assuming solar is used as a substitute. The jobs losses would be greater if wind projects were substituted.

	Year 1	First 25 years
Lost New England Job Years ³	80,190	122,958
Lost Economic Impacts during construction period	\$8,764,524,000	\$8,764,524,000
Lost Economic Impacts during operation	\$153,193,680	\$3,829,842,000
Lost local Property Taxes	\$ 24,931,314	\$ 615,588,000
Lost Income Tax (wages)	\$ 203,393,430	\$ 416,055,528
Total Net Economic Loss to New England	\$9,146,042,424	\$14,016,292,476

³ Lost jobs and economic impacts during construction and operation have been determined by using the National Renewable Energy Laboratory-JEDI Model, Ver. PV10.07.14.

Northern Pass Is Not In The Public Interest

For the Forest Service to approve its portion of the Project, the Forest Service must have conducted the proper NEPA analysis (which has not been done) and it must determine that the Project is in the public interest. 36 CFR §251.54. The Project is not in the public interest.

Northern Pass is not in the public interest because:

1. The Project will result in the loss of thousands of American jobs and billions of dollars of economic activity in the United States because the Project will displace renewable energy projects located in the United States.
2. The Project will raise GHG emissions in the early years of the Project as compared to natural gas generation, and overall as compared to renewable energy substitutes.
3. The Project creates vulnerabilities to the New England electric grid by concentrating so much electricity from one source. No analysis has been conducted to compare the Northern Pass to distributed generation sources near load that could form the basis for local micro-grids and reduce the grid's risk to severe weather events as well as criminal acts.
4. Making matters worse, the project's proponent, Eversource, is trying to create the purported demand for the Northern Pass project by violating its obligations under the Public Utility Regulatory Policies Act to renewable energy developers in the New England states. Eversource touts the purported and inaccurate climate change benefits from the Project for one simple reason—shareholder profits. If Eversource were really concerned with climate change, it would be honoring its obligations under federal law to sign long-term agreements with US ISO-New England locally located renewable energy projects. Allco has obtained two rulings invalidating Eversource's actions but yet Eversource is still violating the law. *See, e.g., Windham Solar LLC*, 157 FERC ¶ 61,134 (2016) and *Allco Renewable Energy Ltd. v. MA Elec. Co.*, 208 F. Supp. 3d 390 (D. Mass. 2016) *appeal docketed on different grounds* No. 17-1296 (1st Cir. March 27, 2017). The public interest cannot be served when a project's proponent, such as Eversource, ignores federal law, and it seeks an approval to further that purpose. But that is exactly what it seeks here. Nor can the public interest be served if a federal agency sanctions such violation of federal law by approving a project that would not be needed if its proponent complied with federal law.

NEPA requires all federal agencies to consider the potential environmental impacts of their actions and to identify and evaluate reasonable alternatives to proposed actions and those alternatives' environmental impacts. Specifically, for "major Federal actions significantly affecting the quality of the human environment," the agency must prepare "a detailed statement" regarding "(i) the environmental impact of the proposed action, (ii) any adverse environmental effects which cannot be avoided should the proposal be implemented, (iii) alternatives to the proposed action, (iv) the relationship between local short-term uses of man's environment and the maintenance and enhancement of long-term productivity, and (v) any irreversible and irretrievable commitments of resources which would be involved in the proposed action should it be implemented."

The EIS and the Forest Service have not adequately analyzed the No-Action alternative.

The stated need of the Northern Pass, a high-voltage transmission line, is to bring Canadian hydro-power to the New England states. That mischaracterizes the need. It also assumes without analysis that Canadian hydro-power would be beneficial as compared to other renewable alternatives. The real need, if there is a need at all, would be to bring renewable energy to New England states. As described herein and as the EIS concedes, it is questionable how “renewable” hydropower actually is. But even if the EIS’s stated need were correct, a proper analysis of a No-Action alternative would need to account for the renewable energy generation resources in New England that would fill the need if the transmission line were not built.

The EIS just brushes aside alternative generation resources that would fill the void on the basis of a suspicious rationale, that other generation resources are not the subject of the permit application itself. Such a rationale is absurd and defeats the entire purpose of analyzing viable replacements when the No-Action alternative is selected. It is also a rationale that has been rejected by the courts.

The EIS’ description of the effects of the No-Action Alternative is manifestly erroneous

The EIS describes the effects of the No-Action Alternative as follows:

ALTERNATIVE 1 – NO ACTION ALTERNATIVE

Under the No Action Alternative, there would be no impacts to any of the environmental resources analyzed. The local taxing jurisdictions would not realize any increases in tax revenues as a result of the Project and no direct or indirect economic impacts would occur within the region. No additional short-term or permanent jobs would be created. There would be no change in the wholesale price of electricity in New Hampshire or the ISO-NE region and no project related change in the level of CO2 emissions.

Those conclusions are manifestly erroneous. Local taxing jurisdictions would realize increases in tax revenues as a result of the renewable generators that would be built instead of the Project. Similarly, direct or indirect economic impacts for those alternative renewable U.S.-based generators would occur within the region under the No-Action Alternative, and indeed would *far exceed* those from the Northern Pass. There would also be a reduction in the wholesale price of electricity for those alternative U.S.-based generators, and a far greater decrease in CO2 emissions.

Quite simply, the conclusions used for the No-Action Alternative baseline are preposterous, fail to use accepted substitution analysis used by the Forest Service and other federal agencies in conducting environmental impact statements, and are the type of uninformed review that has been rejected by the courts.

Under NEPA regulations, agencies must consider all reasonable alternatives, *including those not specifically under their authority to implement.* See

<https://ceq.doe.gov/nepa/regs/40/1-10.HTM>. See also *NRDC v. Morton*, 458 F.2d 827 (D.C. Cir 1972) (explaining that it is the essence and thrust of NEPA that impact statement serve to gather in one place discussion of relative environmental impact of alternatives, and although alternatives required for discussion are those reasonably available, they should not be limited to measures which particular agency or official can adopt; when a proposed action is an integral part of a coordinated plan to deal with a broad problem, the range of alternatives which must be evaluated is broadened). Thus the failure to consider other generation resources because they would not require a Presidential Permit within DOE's jurisdiction or require a permit from the Forest Service is clear error.

As mentioned in the EIS, the results from the recent Multi-State clean energy RFP of the states of Connecticut, Massachusetts and Rhode Island clearly establish that the Northern Pass line is not needed. See, <http://cleanenergyrfp.com/>, and Attachment G. Proposals for multiples of the renewable energy requirements of the New England States were received without the need for the Northern Pass. Those results prove beyond doubt that the Northern Pass is simply not needed. The attached list (Exhibit A) shows the proposals received, one of which was the Northern Pass.

The reality shown by those RFP results is that the Northern Pass would *displace* other U.S.-based renewable energy projects. The New England States that are part of the ISO-New England electricity grid would only select a limited amount of renewable energy for that and future solicitations, and the Northern Pass would displace US-based generation. The Multi-State RFP bids proves that. If the Northern Pass were selected that would mean that renewable energy projects located in the United States would not be selected, resulting in, among other things, the loss of American jobs and revenue.

Thus the "Socioeconomic" impacts of the No-Action alternative are manifestly wrong. The No-Action alternative would result in different renewable energy projects filling its place. And because those alternative projects would be located entirely in the United States, they would *far surpass* the Northern Pass in economic benefits *to the United States*. As shown above, the full-time equivalent job years would exceed 80,000 in the first three years for alternate renewable energy projects as compared to 6,700 for Northern Pass.

The Northern Pass will result in Canadian hydropower finding its way to the United States. Canadian hydropower means more Canadian jobs and less American jobs. The overwhelming bulk of the economic benefits from such generation will be realized in Canada, not the United States. In sharp contrast, if the Northern Pass were not built, then as the Multi-State RFP results indisputably show, renewable energy projects *in the United States* would take its place.

Similarly, the analysis of the No-Action alternative for Air Quality is incorrect. As the Multi-State RFP bids prove, the Northern Pass would be replaced with renewable energy projects located closer to the actual electrical load. Those projects would have higher air quality and GHG benefits as compared to the Northern Pass because they would be more efficient, and would not require the adverse GHG impacts caused from flooding and new dam construction. Further, the farther generation is from actual load, the more electrical losses incurred.

The No-Action alternative must also take into account the fact that American jobs and tax revenues to the United States would be lost if Northern Pass were built. To be sure there would be construction jobs from the construction of the Northern Pass but all the generation facility jobs and economic benefits will be in Canada resulting in a net loss of tens of thousands of full time job years.

As the Multi-State RFP bids prove, the Northern Pass will displace American jobs related to construction and operation of renewable energy projects in the United States that would fill any void if the Northern Pass were not built. The EIS and the Forest Service have not analyzed those economic impacts and the loss of American jobs and tax revenues if the Northern Pass were built.

The EIS Fails to Adequately Compare the Impacts of Approval versus the No-Action Alternative.

By relying on an incorrect assumption about the market impacts of the failure to approve the Northern Pass project, the EIS and the DROD violate NEPA's mandate to rigorously and objectively evaluate all reasonable alternatives to proposed actions, including the "no action" alternative. *See* 42 U.S.C. § 4332(C)(iii); 40 C.F.R. § 1502.14.

The U.S Supreme Court has held that agencies must "consider and disclose the actual environmental effects" of proposed projects in a way that "brings those effects to bear on [their] decisions." *Balt. Gas & Elec. Co. v. Natural Res. Def. Council, Inc.*, 462 U.S. 87, 97 (1983). Analysis of alternatives is the "heart of the environmental impact statement." 40 C.F.R. § 1502.14. NEPA requires federal agencies to "[r]igorously explore and objectively evaluate all reasonable alternatives," including the "no action" alternative. *Id.* Agencies must "present the environmental impacts of the proposal and the alternatives in comparative form, thus sharply defining the issues and providing a clear basis for choice among options by the decisionmaker and the public." *Id.* Agencies must also analyze the "[e]nergy requirements and conservation potential of various alternatives." 40 C.F.R. § 1502.16(e). Compliance with NEPA is required "to the fullest extent possible," 42 U.S.C. § 4332, a command which the U.S. Supreme Court has affirmed is "neither accidental nor hyperbolic." *Flint Ridge Dev. Co. v. Scenic Rivers Ass'n*, 426 U.S. 776, 787 (1976).

As detailed below, the EIS's and Forest Service's assumption that the failure to approve the Northern Pass would have no effect on ISO-New England demand for renewable energy, or greenhouse gas emissions is flawed as a matter of economic theory, and disproven by the renewable energy market in ISO-NE as evidenced by, *inter alia*, the Multi-State RFP bids.

The EIS and the DROD simply fail to rigorously evaluate the No-Action Alternative or to provide a clear basis for choice among the options. The EIS and DROD must be revised to do so.

The EIS's Assumption That, Compared to No Action, Approving the Northern Pass Would Have A Positive Impact on Total Greenhouse Gas Emissions is Wrong and Departs from Basic Economic Principles and Vastly Overstates the Northern Pass' Relative Climate Impacts.

The EIS's and Forest Service's assumption that the No-Action will have no net effect on renewable energy generation, economic benefits or climate benefits contradicts fundamental economic principles. Significant changes in renewable energy supply will affect renewable energy's price and, therefore, consumption and emission levels. The Northern Pass will bring approximately 10 GWhs of electricity per year to ISO-New England. It is a serious error to assume that, under the No-Action Alternative, all 10 GWhs would not be completely replaced by renewable energy generation from other sources, with no effect on overall consumption or emissions. The EIS and the Forest Service fail to analyze how electricity from the Northern Pass directly competes with other renewable energy resources in electricity generation, such that increasing the supply of Canadian hydro-electricity results in less American renewable energy generation in ISO-New England. The EIS and the Forest Service also ignore how overall greenhouse gas emissions will vary among substitute sources of renewable energy generation. The EIS and the Forest Service should have—and easily could have—evaluated the No-Action Alternative's climate effects.

Basic Economic Principles Provide That Any Significant Change in Supply Will Change Price and Demand and, Therefore, Total Generation and Emissions.

The basic economic principles of supply and demand provide that significant changes in renewable energy supply will affect renewable energy's price and, therefore, consumption levels. Increasing the supply of any normal good (including renewable energy) puts downward pressure on that good's market price; this is a basic tenant of the law of supply and demand. N. Gregory Mankiw, *Principles of Economics* 74–78, 80–81 (5th ed. 2008). Lower renewable energy prices can result in lower electricity costs, which in turn encourages higher levels of electricity consumption, while higher renewable energy and electricity prices discourage consumption. See *id.* at 67–68.⁴

Approving the Northern Pass would increase the supply of Canadian hydro-electricity, lowering demand for U.S.-based renewable energy generation. Alternatively, in the No-Action Alternative, the demand for U.S.-based renewable energy generation would be higher, which U.S.-based generation would reduce greenhouse gas emissions, as compared to the Northern Pass' climate impacts. Similarly, in the No-Action Alternative, the higher demand for U.S.-based renewable energy generation would result in increased economic benefits for the United States, as compared to the Northern Pass' economic benefits which are largely in Canada.

Canadian hydro-electricity directly competes with other forms of renewable energy resources in the generation of electricity. Economists measure how coal, natural gas, and other fuels act as substitutes in the electricity market by analyzing “cross-price elasticity” (that is, how responsive producers are in swapping inputs when relative prices change). See Mankiw, *supra* at 99. For example, the U.S. Energy Information Administration (“EIA”) found that for the U.S.

⁴ The Forest Service may take notice of basic economic principles of supply and demand, as well as classic economic textbooks and peer reviewed articles. See *Citizens for Alternatives to Radioactive Dumping v. U.S. Dep't of Energy*, 485 F.3d 1091, 1096 (10th Cir. 2007) (“In dealing with scientific and technical evidence, extra-record evidence ‘may illuminate whether an [environmental impact statement] has neglected to mention a serious environmental consequence, failed adequately to discuss some reasonable alternative, or otherwise swept stubborn problems or serious criticism . . . under the rug.’”) (alterations in original).

market, a 10-percent increase in the ratio of the price of coal to the price of natural gas leads to a 1.4-percent increase in the use of natural gas over coal. EIA, *Fuel Competition in Power Generation and Elasticities of Substitution 1* (2012). In other words, in that example, the cross-price elasticity of demand for natural gas is 0.14 with respect to coal's price. *Id.* Other economists reach similar conclusions. James Ko & Carol Dahl, *Interfuel Substitution in U.S. Electricity Generation*, 33 APPLIED ECONOMICS 1833, 1835 (2001) (analyzing "average" cross-price elasticity). *See also* Nate Blair et al., *Long-Term National Impacts of State-Level Policies* (Nat'l Renewable Energy Lab. Conf. Paper 620-40105, June 2006) (discussing how "higher coal prices would dramatically increase" use of renewable wind energy). These estimates represent short-run elasticities; over time, substitution effects become more pronounced as power plants make technological changes that facilitate fuel-switching, and as long-term investments favor renewable energy. *See* Mankiw, *supra* at 105–106.

Changes in the relative amounts of coal, natural gas, renewable sources, and nuclear energy used to generate electricity—as well as changes in total energy demand—would, in turn, change total greenhouse gases emissions. In short, the EIS' and DROD's unexamined and unsupported assumption that the No-Action Alternative would have no effect on greenhouse gas emissions is contradicted by fundamental economics and market analyses. The EIS and the DROD fail to meet NEPA's requirements, and should be revised.

Considering the Size and Nature of the Northern Pass It Is a Fallacy to Assume that Under the No-Action Alternative There Would be No Substitution With No Effect on Price, Consumption, or Emissions.

Moving beyond theory to the specific project at issue, given the size and characteristics of the Northern Pass and the ISO-New England market, it is clear error to not analyze the substitutions that would occur if the Northern Pass were not built. A list of candidates are included in Attachment G, Exhibit A. Moreover, the list in Exhibit A does not include the most beneficial renewable energy projects in ISO-New England—locally based projects under 20MWs, including small distributed projects and net-meter projects.

The EIS' and Forest Service's assumption that there would be no substitution simply bears no relationship to reality. The Northern Pass represents an enormous amount of renewable energy that affects hundreds of miles of forest and other resources. In fact, as the Multi-State Clean Energy RFP shows, it would provide double the renewable energy that those States were seeking for the next many years, thus virtually eliminating the demand for other forms of renewable energy.

The EIS and Forest Service have also failed to consider the impact of the already and recently approved TDI-New England transmission project that would purportedly do the same thing as Northern Pass—transmit hydroelectric power to New England. TDI-New England eliminates the need for Northern Pass for the immediate future.

If the Northern Pass is not approved, utilities in ISO-New England will acquire other renewable energy production to satisfy their respective renewable energy goals and standards, and therefore, lower greenhouse gas emissions. In the No-Action Alternative, any renewable

energy substituting for the Northern Pass may provide a more positive impact on emissions and climate change. Yet, the EIS does not analyze this environmental impact in its alternatives analysis.

In short, the EIS' flawed economic assumptions renders its alternatives analysis ineffective and misleading, and the EIS and DROD must be revised.

Other Federal Agencies—during Previous NEPA Reviews—Properly Analyze the Supply and Demand of Resources and Resulting Climate Effects.

For over 35 years, in NEPA reviews, the Department of the Interior has consistently understood that a decision not to take action related to energy production will affect that energy resource's supply and price and thus trigger other actions. Interior has further analyzed how such triggered actions generate different consequences for air pollution, climate change, and overall environmental quality. The U.S. Court of Appeals for the D.C. Circuit has praised Interior's analysis of these substitution effects. As far back as 1979, Interior has assessed the different environmental effects of energy substitutes under a No-Action Alternative—including different levels of carbon dioxide emissions.

Other agencies, such as the Surface Transportation Board, the Forest Service, the State Department, the Office of Surface Mining Reclamation and Enforcement (another Interior sub-agency), the Federal Energy Regulatory Commission, and the Nuclear Regulatory Commission, have also properly analyzed the effects of their energy management decisions in NEPA reviews, consistent with the advice of the U.S. Court of Appeals for the Eighth Circuit and the U.S. District Courts of Colorado and Minnesota. DOE's mistaken assumption that taking no action on the Northern Pass would have, compared to approving it, no net effects on greenhouse gas emissions represents a substantial break with a 35-year history of proper analysis by DOE's sister agencies.

Other Federal Agencies Analyze the Connections between Supply, Price, Substitutes, Conservation, and Emissions.

Before the 1982 creation of a sub-agency within Interior responsible for offshore resources, the Office of the Secretary of the Interior developed the federal offshore oil and gas leasing program, and the Bureau of Land Management ("BLM") prepared environmental impact statements on leasing actions (then called simply "environmental statements"). In BLM's 1979 Final Environmental Statement on a proposed lease sale off the coast of Southern California, the agency analyzed the No-Action Alternative of withdrawing the sale:

[I]f the subject sale were cancelled, the following energy actions or sources might be used as substitutes: Energy Conservation; Conventional oil and gas supplies; Coal; Nuclear power; Oil shale; Hydroelectric power; Solar energy; Energy imports; . . . Vigorous energy conservation is an alternative that warrants serious consideration. The Project Independence Report of the Federal Energy Administration claims that energy conservation alone can reduce energy

demand growth by 0.7 to 1.2 percent depending on the world price of oil. . .
. The environmental impacts of a vigorous energy conservation program
will be primarily beneficial.

Final Environmental Statement, OCS Sale No. 48, Proposed 1979 Outer Continental Shelf Oil and Gas Lease Sale Offshore Southern California, 1508–09 (1979). See also BLM, Draft Environmental Statement, Proposed Five-Year OCS Oil and Gas Lease Sale Schedule 63 (1980) (“An alternative . . . to cease leasing . . . would result in the need to meet national energy needs through other sources, or to reduce energy consumption . . .”).

Thus, as early as 1979, DOE’s and the Forest Service’s sister agency recognized that canceling even a single oil and gas lease would cause the market to respond by substituting not just oil and gas from other sources, but alternative fuel types as well as increased energy conservation. BLM further recognized that the extent of energy conservation as a response depended on the price of the resource being replaced. BLM explained in 1979 to decisionmakers and the public, over the course of 25 pages of analysis, how each possible substitute for the foregone offshore leasing carried its own environmental effects: net beneficial to the extent increased energy conservation or renewable energy offset the lost offshore oil and gas; a more mixed or net negative effect on environmental quality with switches to other types and sources of fossil fuels. BLM, *Final Envtl. Stmt. on Sale No. 48, supra* at 1508– 1532. BLM even noted in this 1979 analysis that different energy substitutes generated different carbon dioxide emissions: “A number of gases are associated with geothermal systems and may pose health and pollution problems. These gases include . . . carbon dioxide However, adverse air quality impacts are generally less than those associated with fossil-fuel plants.” *Id.* at 1525.

Interior Uses Sophisticated Tools to Assess the Environmental Consequences of Substitutes, and the D.C. Circuit Has Praised Its Modeling.

Interior develops Five-Year Programs to manage the leasing of offshore (or “Outer Continental Shelf” (“OCS”)) oil and gas resources. Its current Program covers the years 2012–2017; development of that Program and the related Environmental Impact Statement first began in 2009. See BOEM, *Outer Continental Shelf Oil and Gas Leasing Program: 2012–2017—Final Programmatic Environmental Impact Statement*, 8-1 (2012). In the decision document for the current offshore Program, Interior’s Bureau of Ocean Energy Management (“BOEM”) explained:

In an environment of strong worldwide demand for oil and natural gas, a domestic supply cut equivalent to the production anticipated to result from a new Five Year Program would lead to a slight increase in world oil prices and a relatively larger increase in U.S. natural gas prices. All other things being equal, this would lead to a market response providing . . . a slight reduction in oil and natural gas consumed, a substantial increase in oil imports, and added supplies provided by onshore hydrocarbon resources.

BOEM uses its *Market Simulation Model (MarketSim)* to estimate the amount and percentage of substitutes the economy would adopt should a particular program area not be

offered to lease. *MarketSim* is based on authoritative and publicly available estimates of price elasticities of supply and demand and substitution effects. . . .

[I]n the event the NAA [No-Action Alternative] were implemented. . . . 68 percent of the oil and natural gas production foregone from this program would be replaced by greater imports, 16 percent by increased onshore production, [10 percent by other energy sources] . . . and 6 percent by a reduction in consumption.

BOEM, *Proposed Final Outer Continental Shelf Oil & Gas Leasing Program 2012–2017*, 110 (2012)13; *see also* BOEM, *2012–2017 Final Programmatic Environmental Impact Statement*, *supra* at 4-643 (“With less oil and gas available from the OCS under the No Action Alternative, consumers could obtain oil and gas from other sources, substitute to other types of energy, or consume less energy overall.”).

BOEM explained in its Final Environmental Impact Statement that, compared to leasing offshore oil and gas, the energy substitutes anticipated under a No-Action Alternative will have different environmental consequences, including for climate change. For example, BOEM detailed how “Coal consumed in place of gas under the No Action Alternative will result in environmental costs The combustion of coal in power plants or industrial boilers produces higher emissions . . . than the combustion of natural gas and results in greater CO₂ [carbon dioxide] emissions.” *Id.* at 4-647. Similarly, BOEM’s Economic Analysis Methodology calculates:

[T]he emissions for carbon dioxide and nitrous oxide [another greenhouse gas] are greater under the NSOs [No-Sale Options] than from the program. However, there is more methane from the program than the NSOs. Though these impacts are not monetized, *they are not identical between having an OCS program and having the impacts of the NSOs.*

BOEM, *Economic Analysis Methodology for the Five Year OCS Oil and Gas Leasing Program for 2012–2017*, 29–30 (2012) (emphasis added).

In a recent case challenging Interior’s 2012-2017 offshore oil and gas leasing program, the D.C. Circuit favorably reviewed Interior’s modeling of how “forgoing additional leasing on the OCS would cause an increase in the use of substitute fuels . . . and a reduction in overall domestic energy consumption from greater efforts to conserve in the face of higher prices.” *Ctr. for Sustainable Economy v. Jewell*, 779 F.3d 588, 609 (D.C. Cir. 2015). Importantly, nothing in BOEM’s modeling is unique to the offshore oil and gas context. According to BOEM, “MarketSim’s economics-based model representation of U.S. energy markets . . . simulates end-use domestic consumption of oil, natural gas, coal and electricity in four sectors (residential, commercial, industrial and transportation); primary energy production; and the transformation of primary energy into electricity.” BOEM, *The Revised Market Simulation Model (MarketSim): Model Description 2* (2012).

Interior’s sophisticated modeling of the environmental effects of energy substitutes under No-Action Alternatives is the culmination of 35 years of analysis. Interior has used the MarketSim model since at least its 2002–2007 Program for offshore leasing. *See* Minerals Mgmt. Serv. (“MMS”), *Energy Alternatives and the Environment*, 10 (2001)16 (“MMS employs the MktSim2000 model to evaluate the impact of decreased OCS production resulting from no action.”). Since at least the 1990s, Interior’s Environmental Impact Statements have calculated the percentage of offshore production expected to be substituted by various energy alternatives under a No-Action scenario. MMS *Energy Alternatives and the Environment*, 13 (1996)17 (“[F]or each unit of OCS gas not produced because of no action . . . conservation will account for about 0.14 units”); *see also id.* at 15 (“Significant environmental impacts associated with expanded importation of oil include: the generation of greenhouse gases”). And going back to the first Five-Year Program in 1980 (when BLM prepared the Environmental Statements), Interior has recognized that not all sources of the same fuel type present the same environmental effects—for example, offshore oil drilling presents lower spill risks than imported oil substituted under the no-action alternative. Interior, *5-Year OCS Leasing Program* 13b (1980).

Similarly, in a 2001 report on its offshore oil leasing program, Interior declared in no uncertain terms that “Examining other energy sources is an important aspect of the No Action Alternative” under NEPA reviews. MMS, *Energy Alternatives and the Environment* 1 (2001).

So how could it be that the DOE and the Forest Service (in this case) do not understand market dynamics and the principles of substitution, particularly when it comes to energy decisions?

Other Agencies Analyze Supply and Demand in NEPA Reviews of Energy Management Decisions.

Two other federal agencies—the Surface Transportation Board and the ***Forest Service***—began, upon remand from federal courts, conducting the proper analysis of supply and demand in NEPA reviews of their energy management decisions. Yet the Forest Service has failed to do so here. The U.S. Court of Appeals for the Eighth Circuit sharply criticized the Surface Transportation Board for “illogical[ly]” concluding that approving new railroad lines to Powder River Basin coal mines would not affect the demand for and consumption of coal, and for ignoring “widely used” models capable of forecasting such effects. *Mid States Coal. for Progress v. Surface Transp. Bd.*, 345 F.3d 520, 549–550 (8th Cir. 2003). “On remand, the Board undertook just such a study using the Energy Information Administration’s (EIA) National Energy Modeling System (NEMS) . . . [which] not only forecasts coal supply and demand but also quantifies environmental impacts.” *Mayo Found. v. Surface Transp. Bd.*, 472 F.3d 545, 555 (8th Cir. 2006). *See also* Surface Transp. Bd., *Draft Environmental Impact Statement for the Tongue River Railroad*, Appendix C.1-13 to 1-14 (2015) (analyzing how approving a new coal railroad would only increase annual U.S. coal production by 0.13 percent, which “would not be significant enough to noticeably lower delivered coal prices (which includes transportation), and thus, would not increase total demand for coal”).

Similarly, the U.S. District Court of Colorado “[could] not make sense” of the Forest Service’s assumption that approving road construction through national forests to reach Colorado

coal mines would not increase coal production and consumption. *High Country Conservation Advocates v. Forest Service*, 52 F. Supp. 3d 1174, 1197 (D. Colo. 2014). On remand, the Forest Service’s draft environmental impact statement details that while the no-action alternative “has no impact on climate change,” under the leasing option “coal mining, transportation, and combustion would increase the atmospheric concentrations of GHGs [greenhouse gases].” Forest Service, *Rulemaking for Colorado Roadless Areas—Supplemental Draft Environmental Impact Statement* 48–49 (2015).

The State Department provides another example. In its environmental impact statements, the agency has estimated how, at different oil prices, approving international oil pipelines could affect production and greenhouse gas emissions. See State Dep’t, *Final Supplemental Environmental Impact Statement for the Keystone XL Project*, ES-16 (2014)²³ (“The 2013 Draft Supplemental EIS estimated how oil sands production would be affected by long-term constraints on pipeline capacity . . . if long-term . . . oil prices were less than \$100 per barrel. The Draft Supplemental EIS also estimated a change in GHG emissions associated with such changes in production.”). This analysis was strongly encouraged by comments from the Environmental Protection Agency. See Comments from EPA, to State Dep’t, on EIS for the Keystone XL Project, at 3 (July 16, 2010) (“[I]t is reasonable to conclude that extraction will likely increase if the pipeline is constructed.”). Even when the State Department concluded that a different pipeline approval would not affect energy substitutes, the agency first assessed the market and “conclude[d] that this amount of crude oil [3% of total U.S. processing] is not expected . . . to significantly impact end-use price or demand.” *Sierra Club v. Clinton*, 746 F. Supp. 2d 1025, 1046 (D. Minn. 2010). The State Department’s practice of assessing whether its actions would affect overall energy demand stands in stark contrast with this case, where DOE simply made an unsubstantiated assumption, without conducting any analysis.

Other agencies that, during NEPA reviews, have properly analyzed how their energy management decisions might affect energy supply and demand, and so affect emissions, include the Office of Surface Mining Reclamation and Enforcement (another Interior sub-agency), the Federal Energy Regulatory Commission, and the Nuclear Regulatory Commission. See Office of Surface Mining, *Draft Stream Protection Rule Environmental Impact Statement*, at 4-175 to 4-176 (2015) (“Modeling suggests that these Alternatives [to regulate surface coal mining to protect streams] could decrease national coal production [T]his analysis anticipates that the net effect on climate resiliency is positive at the national level under each Action Alternative”); *id.* at 4-160 to 4-161 “Under some Alternatives, the mix of production type, i.e., surface or underground, may also change. As discussed . . . surface and underground mining activities have different emissions profiles.”); Fed. Energy Reg. Comm’n, *Lake Charles Liquefaction Project—Final Environmental Impact Statement*, 3-3 (2015)²⁶ (“If the No-Action Alternative is selected, it could result in the continued use of less clean-burning fossil fuels at levels that might otherwise have been reduced through replacement with LNG.”); Nuclear Reg. Comm’n, *Generic Environmental Impact Statement for License Renewal of Nuclear Plants* §8.2 (1996)²⁷ (“Denial of a renewed license . . . may lead to the selection of other electric generating sources to meet energy demands . . . [or] to conservation measures [T]he environmental impacts of such resulting alternatives would be included as the environmental impacts of the no-action alternative.”).

In short, at least nine different agencies—including Interior’s Office of the Secretary and at least three Interior sub-agencies (Office of Surface Mining, Bureau of Ocean Energy Management, and Minerals Management Service)—in NEPA analyses stretching back over 35 years, have analyzed how their energy management decisions affect energy supply and demand, and so affect emissions. The economic theory is undisputed, the economic models are easily accessible, and the practice is widespread through the government. DOE’s unexplained assumption regarding the No-Action Alternative sharply breaks with 35 years of agency practice.

Even If DOE’s and the Forest Service’s Approach to the No-Action Alternative Were Correct, Its Calculation of the Economic Benefits and Climate Impacts of the Northern Pass Would Be Overestimated and Inaccurate.

The EIS assumes that taking no action on the Northern Pass would have, compared to approval, no net effects on carbon dioxide emissions, methane emissions, or climate change. These comments have explained why that assumption is entirely inconsistent with economic theory, real market conditions, and past agency practices. Consequently, the EIS presents a deeply inaccurate and misleading comparison of the approval options and No-Action Alternative. However, even if DOE and the Forest Service were to start from the proposition that the No-Action Alternative resulted in no impacts, the EIS and DROD would be inaccurate and misleading in a different but equally problematic way.

The EIS calculates the “economic benefits” and climate impacts of Northern Pass by assuming that no other renewable energy facilities would be built to take its place if it were not built. As explained above that is simply not true. Other sources of renewable energy generation would substitute for the Northern Pass, then the EIS must subtract from its calculation of the Northern Pass’ economic, energy supply and climate benefits, the lost benefits from all those would-be sources of renewable energy generation that would no longer be built.

Once that is done Northern Pass may (and likely will) have a net negative impact on economics or climate benefits compared to its substitutes. That is particularly so when it comes to economic benefits because nearly all the economic benefits from the hydro-generation facility are realized in Canada, not the United States. And the United States would lose thousands of American jobs related to the US-based substitutes. The EIS and the DROD do not comply with NEPA because they fail to analyze those effects.

The EIS Does Not Account for Other American Projects that Will Displace the Need for Hydropower.

The EIS states that there are three reasons that justify the Project’s existence—electricity diversity, low carbon electricity supply and non-intermittent power supply. The electricity diversity section focuses on New England’s constraints on the supply of natural gas. The Northern Pass sponsor—Eversource—has a gas pipeline project that would eliminate the gas pipeline constraints. See, <http://accessnortheastenergy.com/>. Thus the need for Canadian hydropower as a means to potentially mitigate natural gas constraints is simply not needed. The natural gas constraints exist only in the winter and there is no way the Northern Pass will be built before the natural gas constraints are lifted through Eversource’s Access Northeast project. Even

under the most optimistic circumstances, where there is an ROD and State approvals in the second quarter of 2018 and no litigation thereafter, the Project would not be in-service until 2020, after the natural gas pipeline constraints go away.

A more likely scenario, however, involves litigation in the federal courts which would likely take a minimum of 3-5 years, bringing the earliest possible date for the Northern Pass' in-service date to 2021-2023. The natural gas constraints will be long gone by then.

The second stated justification for the Project is low carbon electricity supply. As shown above, there are many other renewable energy projects that are ready and willing to fill the void. The Northern Pass' project proponent—Eversource—simply does not want to have those other projects fill the void for an obvious reason: it results in lower profit and lower income for the company and its shareholders. Eversource's monetary self-interest is not a justification for issuance of the permit or failing to account for the other projects that would fill the Project's purported need.

The third stated justification for the Project is non-intermittent power supply. To be sure, hydro-electricity does not suffer from the same intermittency of wind and solar as generally deployed right now. But the ISO-New England grid has shifted to natural gas as the baseload supply until grid-scale storage for wind and solar becomes economically competitive, which it now can be. The natural gas baseload supply provides the most flexibility to integrate large amounts of wind and solar. Hydro-electricity does not provide that same quick ramp up and down, thus using hydro-electricity as baseload would harm integration of intermittent sources. Once the natural gas constraints are lifted, which they would be before the Northern Pass would be in-service, then baseload hydro is not needed, and its introduction would replace other renewables and restrict additional renewable integration into the grid.

The current solicitation in Massachusetts in which Northern Pass is competing now features cost-effective proposals from wind and solar resources paired with battery storage. That is the future of the grid, and one that the EIS and Forest Service have failed to adequately analyze.

Thus the three purported justifications for the Project are simply not there.

The Public Interest Will Not Be Served By the Project.

For the reasons stated above, the Northern Pass is not in the public interest because as shown above, it would displace renewable energy projects (and the American jobs related to those projects) that would otherwise be built in the New England states and on the ISO-New England electricity grid. It is not in the US public interest to approve a project that will result in the loss of American jobs, and the economic benefits from those projects. It will increase GHG compared to the renewable energy projects that would take its place. It will spur construction and operation of dams that will raise GHG emissions and potentially result in extinction of various species.

The Public Interest Will Not Be Served By Granting a Permit to a Proponent that Ignores Its Obligation Under Federal Law to Buy Energy From US-Based Renewable Energy Project.

The position of Eversource in sponsoring the Northern Pass project instead of domestic renewable energy projects is yet another example of what Section 210 of the Public Utility Regulatory Policies Act (“PURPA”), 16 U.S.C. § 824a-3, intended to eliminate—the reluctance of utilities to purchase energy from independent power producers in the USA. More than thirty years later, Eversource’s actions show that reluctance is still alive and well, as is the utilities’ desire to increase returns for their shareholders,.

Under PURPA, electric utilities, such as Eversource, must purchase any electricity produced by QFs. 18 C.F.R. § 292.303(a)(1). Allco and presumably other QFs have offered energy from their QF solar projects to Eversource at the long-term rate required by 18 C.F.R. § 292.304(d)(2)(ii). Eversource has violated PURPA by rejecting such projects, forcing Allco to proceed with litigation. Northern Pass is not in the public interest because the project’s proponent, Eversource, is trying to create the purported demand for the foreign Northern Pass project by violating its obligations under PURPA to domestic renewable energy developers in the New England states. The public interest cannot be served when a project’s proponent, such as Eversource, ignores federal law, and it seeks an approval to further that purpose, such as what it seeks here. Nor can the public interest be served if a federal agency sanctions such conduct by approving a project that would not be needed if its proponent complied with federal law.

Many of the deficiencies in the EIS are also further explained in Attachment H.

Respectfully Submitted,



Thomas Melone

ATTACHMENT A



2 of 22 DOCUMENTS

**SIERRA CLUB, ET AL., PETITIONERS v. FEDERAL ENERGY REGULATORY
COMMISSION, RESPONDENT. DUKE ENERGY FLORIDA, LLC, ET AL.,
INTERVENORS**

No. 16-1329 Consolidated with 16-1387

**UNITED STATES COURT OF APPEALS FOR THE DISTRICT OF COLUMBIA
CIRCUIT**

867 F.3d 1357; 2017 U.S. App. LEXIS 15911; 47 ELR 20104

**April 18, 2017, Argued
August 22, 2017, Decided**

PRIOR HISTORY: [*1] On Petitions for Review of Orders of the Federal Energy Regulatory Commission. *Fla. Southeast Connection, LLC, 156 F.E.R.C. P61160, 2016 FERC LEXIS 1518 (F.E.R.C., Sept. 7, 2016)* *Fla. Southeast Connection, LLC, 154 F.E.R.C. P61080, 2016 FERC LEXIS 138 (F.E.R.C., Feb. 2, 2016)*

COUNSEL: Elizabeth F. Benson argued the cause for petitioners Sierra Club, et al. With her on the briefs was Eric Huber. Keri N. Powell entered an appearance.

Jonathan Perry Waters argued the cause and filed the brief for petitioners G.B.A. Associates, LLC, et al.

Ross R. Fulton, Attorney, Federal Energy Regulatory Commission, argued the cause for respondent. With him on the brief were David L. Morenoff, General Counsel, Robert H. Solomon, Solicitor, and Nicholas M. Gladd, Attorney. Anand Viswanathan, Attorney, entered an appearance.

Jeremy C. Marwell argued the cause for respondent-intervenors. With him on the brief were Michael B. Wigmore, James D. Seegers, Gregory F. Miller, P. Martin Teague, James H. Jeffries, IV, Charles L. Schlumberger, Sid J. Trant, Anna M. Manasco, Brian D. O'Neill, Michael R. Pincus, and William Lavarco.

Marc J. Ayers and Emily M. Ruzic entered appearances.

Mohammad O. Jazil and David W. Childs were on the brief for amicus curiae The Florida Reliability Coordinating Council, Inc. in support of respondent.

JUDGES: Before: ROGERS, BROWN, and GRIFFITH, Circuit Judges. Opinion for the Court filed by Circuit [*2] Judge GRIFFITH. Opinion concurring in part and dissenting in part filed by Circuit Judge BROWN.

OPINION BY: GRIFFITH

OPINION

GRIFFITH, *Circuit Judge:* Environmental groups and landowners have challenged the decision of the Federal Energy Regulatory Commission to approve the construction and operation of three new interstate natural-gas pipelines in the southeastern United States. Their primary argument is that the agency's assessment of the environmental impact of the pipelines was inadequate. We agree that FERC's environmental impact statement did not contain enough information on the greenhouse-gas emissions that will result from burning the gas that the pipelines will carry. In all other respects, we conclude that FERC acted properly. We thus grant Sierra Club's petition for review and remand for

preparation of a conforming environmental impact statement.

I

The Southeast Market Pipelines Project comprises three natural-gas pipelines now under construction in Alabama, Georgia, and Florida. The linchpin of the project is the Sabal Trail pipeline, which will wend its way from Tallapoosa County in eastern Alabama, across southwestern Georgia, and down to Osceola County, Florida, just south of Orlando: a journey [*3] of nearly five hundred miles. Sabal Trail will connect the other two portions of the project. The first--the Hillabee Expansion--will boost the capacity of an existing pipeline in Alabama, which will feed gas to Sabal Trail's upstream end for transport to Florida. At the downstream end of Sabal Trail will be the Florida Southeast Connection, which will link to a power plant in Martin County, Florida, 120 miles away. Shorter spurs will join Sabal Trail to other proposed and existing power plants and pipeline networks. By its scheduled completion in 2021, the project will be able to carry over one billion cubic feet of natural gas per day.

The three segments of the project have different owners,¹ but they share a common purpose: to serve Florida's growing demand for natural gas and the electric power that natural gas can generate. At present, only two major natural-gas pipelines serve the state, and both are almost at capacity. Two major utilities, Florida Power & Light and Duke Energy Florida, have already committed to buying nearly all the gas the project will be able to transport. Florida Power & Light claims that without this new project, its gas needs will begin to exceed its supply [*4] this year. But the project's developers also indicate that the increased transport of natural gas will make it possible for utilities to retire older, dirtier coal-fired power plants.

1 Sabal Trail is owned by Spectra Energy Partners, NextEra Energy, and Duke Energy; the Hillabee Expansion is owned by the Williams Companies; and Florida Southeast Connection is owned by NextEra. Duke Energy, and NextEra's subsidiary Florida Power & Light, will also be the project's primary customers.

Despite these optimistic predictions, the project has drawn opposition from several quarters. Environmental groups fear that increased burning of natural gas will

hasten climate change and its potentially catastrophic consequences. Landowners in the pipelines' path object to the seizure of their property by eminent domain. And communities on the project's route are concerned that pipeline facilities will be built in low-income and predominantly minority areas already overburdened by industrial polluters.

Section 7 of the Natural Gas Act places these disputes into the bailiwick of the Federal Energy Regulatory Commission (FERC), which has jurisdiction to approve or deny the construction of interstate natural-gas pipelines. *See 15 U.S.C. § 717f*. Before any such pipeline can be built, FERC must grant the developer a "certificate of public convenience and necessity," *id. § 717f(c)(1)(A)*, also called a *Section 7* certificate, upon a finding that the project will serve the public interest, *see id. § 717f(e)*. FERC is also empowered to attach "reasonable terms and conditions" [*5] to the certificate, as necessary to protect the public. *Id.* A certificate holder has the ability to acquire necessary rights-of-way from unwilling landowners by eminent domain proceedings. *See id. § 717f(h)*.

FERC launched an environmental review of the proposed project in the fall of 2013. The agency understood that it would need to prepare an environmental impact statement (EIS) before approving the project, as the National Environmental Policy Act of 1969 (NEPA) requires for each "major Federal action[] significantly affecting the quality of the human environment." *See 42 U.S.C. § 4332(2)(C)*. FERC solicited public comment and held thirteen public meetings on the project's environmental effects, and made limited modifications to the project plan in response to public concerns, before releasing a draft impact statement in September 2015 and a final impact statement in December 2015. In the meantime, the pipeline developers formally applied for their *Section 7* certificates in September and November 2014.

In the Certificate Order, issued on February 2, 2016, FERC granted the requested *Section 7* certificates and approved construction of all three project segments, subject to compliance with various conditions not at issue here. *Order Issuing Certificates and Approving Abandonment, Fla. Se. Connection, LLC, 154 FERC ¶ 61,080 (2016)* (Certificate [*6] Order). This order recognized a number of parties as intervenors in the agency proceedings, among them three environmental

groups (Sierra Club, Flint Riverkeeper, and Chattahoochee Riverkeeper) and two Georgia landowners whose land Sabal Trail will cross (GBA Associates and K. Gregory Isaacs). These parties timely sought rehearing and a stay of construction; FERC agreed to entertain their arguments but denied a stay. Construction on the pipelines began in August 2016. On September 7, 2016, FERC issued its Rehearing Order, denying rehearing and declining to rescind the pipelines' certificates. *Order on Rehearing, Fla. Se. Connection, LLC*, 156 FERC ¶ 61,160 (2016) (Rehearing Order).

Both the environmental groups (collectively, "Sierra Club") and the landowners timely petitioned our court for review of the Certificate Order and the Rehearing Order. Sierra Club argues that FERC's environmental impact statement failed to adequately consider the project's contribution to greenhouse-gas emissions and its impact on low-income and minority communities. Sierra Club also contends that Sabal Trail's service rates were based on an invalid methodology. The landowners allege further oversights in the EIS, dispute the public need for the project, and assert that FERC [*7] used an insufficiently transparent process to approve the pipeline certificates. Their petitions were consolidated before us.

II

We have jurisdiction to hear these petitions under the *Natural Gas Act*. See 15 U.S.C. § 717r(b). Any party to a proceeding under the Act who is "aggrieved" by a FERC order may petition for review of that order in our court, provided that they first seek rehearing before FERC. *Id.* § 717r(a)-(b). Sierra Club was an intervenor in the proceedings on all three pipeline applications, see Certificate Order App. A, and the landowner petitioners were intervenors in the Sabal Trail proceedings, see *id.*

A party is "aggrieved" by a FERC order if it challenges the order under NEPA and asserts an environmental harm. See *Gunpowder Riverkeeper v. FERC*, 807 F.3d 267, 273-74, 420 U.S. App. D.C. 162 (D.C. Cir. 2015). A landowner forced to choose between selling to a FERC-certified developer and undergoing eminent domain proceedings is also "aggrieved" within the meaning of the Act. See *B&J Oil & Gas v. FERC*, 353 F.3d 71, 75, 359 U.S. App. D.C. 214 (D.C. Cir. 2004); *Moreau v. FERC*, 982 F.2d 556, 564 n.3, 299 U.S. App. D.C. 168 (D.C. Cir. 1993). Sierra Club falls into the former camp, and the Georgia landowners into the latter.

We also have an independent duty to ensure that at least one petitioner has standing under *Article III of the Constitution*. See *Ams. for Safe Access v. DEA*, 706 F.3d 438, 442-43, 403 U.S. App. D.C. 388 (D.C. Cir. 2013). A petitioner invoking federal-court jurisdiction has the burden to establish that she has suffered an injury in fact that is fairly traceable [*8] to the challenged action of the defendant and "likely" to be redressed by a favorable judicial decision. *WildEarth Guardians v. Jewell*, 738 F.3d 298, 305, 407 U.S. App. D.C. 309 (D.C. Cir. 2013). And an association, like Sierra Club, can sue on behalf of its members if at least one member would have standing to sue in her own right, the organization is suing to vindicate interests "germane to its purpose," and nothing about the claim asserted or the relief requested requires an individual member to be a party. *Sierra Club v. FERC*, 827 F.3d 36, 43 (D.C. Cir. 2016). On direct review of agency action, an association can establish its standing by having its individual members submit affidavits to accompany the association's opening brief. See *Pub. Citizen, Inc. v. Nat'l Highway Traffic Safety Admin.*, 489 F.3d 1279, 1289, 376 U.S. App. D.C. 443 (D.C. Cir. 2007).

Several individual Sierra Club members submitted such affidavits, explaining how the pipeline project would harm their "concrete aesthetic and recreational interests." *WildEarth*, 738 F.3d at 305. For example, one member, Robin Koon, explained that the Sabal Trail pipeline will cross his property (on an easement taken by eminent domain), that construction noise will impair his enjoyment of his daily activities, and that trees shading his house will be permanently removed. Other Sierra Club members similarly averred that the pipeline project will affect their homes and daily lives. "Such credible claims of exposure [*9] to increased noise and its disruption of daily activities, backed up by specific factual representations in an affidavit or declaration, are sufficient to satisfy Article III's injury-in-fact requirement." *Sierra Club*, 827 F.3d at 44. And nobody disputes that the prevention of this sort of injury is germane to Sierra Club's conservation-oriented purposes, or cites any reason why these individual members would need to join the petition in their own names.

Because they allege concrete injury from FERC's order certifying the pipeline project, and because that certification was based on an allegedly inadequate environmental impact statement, these Sierra Club members, and therefore Sierra Club itself, have standing

to object to any deficiency in the environmental impact statement.² See *WildEarth Guardians*, 738 F.3d at 306-08. The deficiency need not be directly tied to the members' specific injuries. For example, Sierra Club may argue that FERC did not adequately consider the pipelines' contribution to climate change. See *id.* The members' injuries are caused by the allegedly unlawful Certificate Order, and would be redressed by vacatur of that order on the basis of any defect in the environmental impact statement. See *id.* at 308.³

2 Though GBA Associates and Isaacs raise different arguments as to why the Certificate and Rehearing Orders are unlawful, the standing analysis does not differ for them, as they seek the same remedy and allege similar injuries to their property interests.

3 The same reasoning goes for Sierra Club's argument that FERC used an arbitrary and capricious methodology in determining Sabal Trail's initial rates. A finding that FERC failed to justify its approach to this issue would lead us to "hold unlawful and set aside" Sabal Trail's certificate, see 5 U.S.C. § 706(2), which would in turn redress the Sierra Club members' environmentally based injuries in fact. See *Ctr. for Biological Diversity v. U.S. Dep't of Interior*, 563 F.3d 466, 479, 385 U.S. App. D.C. 257 (D.C. Cir. 2009) (finding Article III standing on the grounds that an agency's "irrationally based" permitting program threatened the arctic animals that the petitioners wanted to observe, and that "setting aside and remanding" the program would redress this threat).

Transco, owner of the Hillabee [*10] Expansion, argues that no Sierra Club member has alleged an injury caused by Transco's section of the overall project, which would suggest that Sierra Club lacks standing to seek the vacatur of Hillabee's certificate. Transco thus implicitly argues that the Certificate Order is severable. Under this view, if Sierra Club succeeds on the merits, but has standing to challenge only Sabal Trail's certificate, we could vacate only the portion of the Certificate Order pertaining to Sabal Trail, and leave the rest intact.

The question whether an agency order is severable turns on the agency's intent. See *Epsilon Elecs., Inc. v. U.S. Dep't of Treasury*, 857 F.3d 913, 929 (D.C. Cir. 2017). "Where there is substantial doubt that the agency

would have adopted the same disposition regarding the unchallenged portion if the challenged portion were subtracted, partial affirmance is improper." *Id.* (quoting *North Carolina v. FERC*, 730 F.2d 790, 795-96, 235 U.S. App. D.C. 28 (D.C. Cir. 1984)). Since the beginning of its environmental review, FERC has treated the project as a single, integrated proposal. See Notice of Intent to Prepare an *Environmental Impact Statement for the Planned Southeast Market Pipelines Project*, 79 Fed. Reg. 10,793, 10,794 (Feb. 26, 2014) (explaining that FERC would prepare a single EIS for the three pipelines, to help the agency determine "whether the SMP Project is in the public convenience and necessity"). That characterization carried through to the Certificate [*11] Order. See J.A. 1075 (describing the pipelines as "separate but connected" and noting that the Hillabee Expansion's purpose is to give Sabal Trail's customers access to upstream gas supplies); J.A. 1096 (explaining that in the absence of Sabal Trail, existing pipelines will not be able to deliver the gas that the Florida Southeast Connection requires).

We substantially doubt that FERC would have approved the Southeast Market Pipelines Project only in part, and we especially doubt that the agency would have certified either of the other two segments if Sabal Trail were not part of the project. Because Sierra Club and the landowners have alleged injury-in-fact caused by Sabal Trail, and because the Certificate Order is not severable, both sets of petitioners have standing to challenge the Certificate Order as a whole.

Having concluded that we have jurisdiction to entertain all of petitioners' claims, we turn to the merits of those claims.

III

Both sets of petitioners rely heavily on the National Environmental Policy Act of 1969, Pub. L. No. 91-190, 83 Stat. 852 (1970). NEPA "declares a broad national commitment to protecting and promoting environmental quality," and brings that commitment to bear on the operations of the federal [*12] government. *Robertson v. Methow Valley Citizens Council*, 490 U.S. 332, 348, 109 S. Ct. 1835, 104 L. Ed. 2d 351 (1989). The statute "commands agencies to imbue their decisionmaking, through the use of certain procedures, with our country's commitment to environmental salubrity." *Citizens Against Burlington, Inc. v. Busey*, 938 F.2d 190, 193-94, 290 U.S. App. D.C. 371 (D.C. Cir. 1991). One of the

most important procedures NEPA mandates is the preparation, as part of every "major Federal action[] significantly affecting the quality of the human environment," of a "detailed statement" discussing and disclosing the environmental impact of the action. 42 U.S.C. § 4332(2)(C).

This environmental impact statement, as it has come to be called, has two purposes. It forces the agency to take a "hard look" at the environmental consequences of its actions, including alternatives to its proposed course. *See id.* § 4332(2)(C)(iii); *Balt. Gas & Elec. Co. v. Nat. Res. Def. Council, Inc.*, 462 U.S. 87, 97, 103 S. Ct. 2246, 76 L. Ed. 2d 437 (1983). It also ensures that these environmental consequences, and the agency's consideration of them, are disclosed to the public. *See WildEarth Guardians*, 738 F.3d at 302. Importantly, though, NEPA "directs agencies only to look hard at the environmental effects of their decisions, and not to take one type of action or another." *Citizens Against Burlington*, 938 F.2d at 194. That is, the statute is primarily information-forcing.

The role of the courts in reviewing agency compliance with NEPA is accordingly limited. Furthermore, because NEPA does not create a private right of action, we can entertain NEPA-based [*13] challenges only under the Administrative Procedure Act and its deferential standard of review. *See Theodore Roosevelt Conservation P'ship v. Salazar*, 616 F.3d 497, 507, 392 U.S. App. D.C. 316 (D.C. Cir. 2010). That is, our mandate "is 'simply to ensure that the agency has adequately considered and disclosed the environmental impact of its actions and that its decision is not arbitrary or capricious.'" *WildEarth Guardians*, 738 F.3d at 308 (quoting *City of Olmsted Falls v. FAA*, 292 F.3d 261, 269, 352 U.S. App. D.C. 30 (D.C. Cir. 2002)). We should not "'flyspeck' an agency's environmental analysis, looking for any deficiency no matter how minor." *Nevada v. Dep't of Energy*, 457 F.3d 78, 93, 372 U.S. App. D.C. 432 (D.C. Cir. 2006) (citation omitted).

But at the same time, we are responsible for holding agencies to the standard the statute establishes. An EIS is deficient, and the agency action it undergirds is arbitrary and capricious, if the EIS does not contain "sufficient discussion of the relevant issues and opposing viewpoints," *Nevada*, 457 F.3d at 93 (quoting *Nat. Res. Def. Council v. Hodel*, 865 F.2d 288, 294, 275 U.S. App. D.C. 69 (D.C. Cir. 1988)), or if it does not demonstrate

"reasoned decisionmaking," *Del. Riverkeeper Network v. FERC*, 753 F.3d 1304, 1313, 410 U.S. App. D.C. 137 (D.C. Cir. 2014) (quoting *Found. on Econ. Trends v. Heckler*, 756 F.2d 143, 154, 244 U.S. App. D.C. 122 (D.C. Cir. 1985)). The overarching question is whether an EIS's deficiencies are significant enough to undermine informed public comment and informed decisionmaking. *See Nevada*, 457 F.3d at 93. This is NEPA's "rule of reason." *See Dep't of Transp. v. Pub. Citizen*, 541 U.S. 752, 767, 124 S. Ct. 2204, 159 L. Ed. 2d 60 (2004).

With those principles in mind, we direct our attention to the specific deficiencies the petitioners have alleged in the EIS for the Southeast Market Pipelines Project. As noted above, FERC prepared a [*14] single unified EIS for the project's three pipelines, and no party has challenged that approach. Thus, for purposes of our NEPA analysis, we will consider the project as a whole.

A

The principle of environmental justice encourages agencies to consider whether the projects they sanction will have a "disproportionately high and adverse" impact on low-income and predominantly minority communities.⁴ *See* J.A. 1353-54. Executive Order 12,898 required federal agencies to include environmental-justice analysis in their NEPA reviews, and the Council on Environmental Quality, the independent agency that implements NEPA, *see* 42 U.S.C. § 4344, has promulgated environmental-justice guidance for agencies, *see* J.A. 1369-78.

4 Like petitioners, we refer to these two types of community collectively as "environmental-justice communities."

Sierra Club argues that the EIS failed to adequately take this principle into account. Like the other components of an EIS, an environmental justice analysis is measured against the arbitrary-and-capricious standard. *See Cmty. Against Runway Expansion, Inc. v. FAA*, 355 F.3d 678, 689, 359 U.S. App. D.C. 383 (D.C. Cir. 2004).⁵ The analysis must be "reasonable and adequately explained," but the agency's "choice among reasonable analytical methodologies is entitled to deference." *Id.* As always with NEPA, an agency is not required to select the course of action that best serves environmental justice, only to take a "hard look" [*15] at environmental justice issues. *See Latin Ams. for Social & Econ. Dev. v. Fed. Highway Admin.*, 756 F.3d 447, 475-77 (6th Cir.

2014). We conclude that FERC's discussion of environmental justice in the EIS satisfies this standard.

5 Because FERC voluntarily performed an environmental-justice review, we need not decide whether Executive Order 12,898 is binding on FERC. *See Runway Expansion*, 355 F.3d at 689 (explaining that arbitrary-and-capricious analysis applies to every section of an EIS, even sections included solely at the agency's discretion).

The EIS explained that 83.7% of the pipelines' proposed route would cross through, or within one mile of, environmental-justice communities (defined as census tracts where the population is disproportionately below the poverty line and/or disproportionately belongs to racial or ethnic minority groups). That percentage varied from 54 to 80 percent for the alternative routes proposed by stakeholders and commenters, albeit with only one option below 70 percent. This type of data appeared not only in the section of the EIS specifically dedicated to environmental justice, but also in the chapter that compared the various alternative routes. That later chapter weighed environmental-justice statistics alongside factors like total route length, wetlands impact, and the number of homes near the route. It also discussed one additional proposed route, which would cross the Gulf of Mexico and avoid Georgia completely. This option would affect far fewer environmental-justice communities, but in FERC's assessment would be infeasible because it would cost an additional [*16] two billion dollars.

FERC concluded that the various feasible alternatives "would affect a relatively similar percentage of environmental justice populations," and that the preferred route thus would not have a disproportionate impact on those populations. *See* J.A. 836. The agency also independently concluded that the project would not have a "high and adverse" impact on *any* population, meaning, in the agency's view, that it could not have a "disproportionately high and adverse" impact on any population, marginalized or otherwise.⁶

6 Sierra Club argues that the project will in fact have "high and adverse" impacts, but does so only in a brief and cursory fashion. *See CTS Corp. v. EPA*, 759 F.3d 52, 64, 411 U.S. App. D.C. 243 (D.C. Cir. 2014) (explaining that we need not address cursory arguments).

Sierra Club contends that FERC misread "disproportionately high and adverse," the standard for when a particular environmental effect raises an environmental-justice concern. By Sierra Club's lights, any effect can fulfill the test, regardless of its intensity, extent, or duration, if it is not beneficial and falls disproportionately on environmental-justice communities. But even if we assume that understanding to be correct, we cannot see how this EIS was deficient. It discussed the intensity, extent, and duration of the pipelines' environmental effects, and also separately discussed the fact that those effects will disproportionately fall on environmental-justice [*17] communities. Recall that the EIS informed readers and the agency's ultimate decisionmakers that 83.7% of the pipelines' length would be in or near environmental-justice communities. The EIS also evaluated route alternatives in part by looking at the number of environmental-justice communities each would cross, and the mileage of pipeline each would place in low-income and minority areas. FERC thus grappled with the disparate impacts of the various possible pipeline routes. Perhaps Sierra Club would have a stronger claim if the agency had refused entirely to discuss the demographics of the populations that will feel the pipelines' effects, and had justified this refusal by pointing to the limited intensity, extent, and duration of those effects. However, as the EIS stands, we see no deficiencies serious enough to defeat the statute's goals of fostering well-informed decisionmaking and public comment. *See Nevada*, 457 F.3d at 93.

The same goes for Sierra Club's other arguments. The agency's methodology was reasonable, even where it deviated from what Sierra Club would have preferred. *See Runway Expansion*, 355 F.3d at 689. Take the agency's decision to compare the demographics along the various proposed routes to each other instead of "the [*18] general population." Sierra Club Opening Br. 18. An EIS is meant to help agency heads choose among the relevant alternatives, including the alternative of taking no action, and to help the public weigh in. Thus, FERC's decision to directly compare the proposed alternatives to one another, rather than to some broader population, was reasonable under the circumstances. *See id.* (approving an environmental-justice review that compared "the population predicted to be affected by . . . [a] project to the demographics of the population that otherwise might conceivably be affected" by the project). Another methodology might be more appropriate in a case where

some feasible alternative, with a lower environmental-justice impact, has been left out of the analysis. However, no party has offered any such alternative here.

Sierra Club is particularly concerned about Sabal Trail's plan to build a compressor station (a facility that helps "pump" gas along the pipeline, and gives off air and noise pollution while doing so) in an African American neighborhood of Albany, Dougherty County, Georgia. The agency identified environmental-justice communities by looking at the demographics of census *tracts* [*19], which are county subdivisions created to organize census data. The neighborhood in question is a 100% African American census *block*, an even smaller census subdivision, but because it sits in the midst of a majority-white census tract, FERC did not designate it an environmental-justice community. Sierra Club's objection to this omission elevates form over substance. The goal of an environmental-justice analysis is satisfied if an agency recognizes and discusses a project's impacts on predominantly-minority communities, even if it does not formally label each such community an "environmental justice community." FERC *did* recognize the existence and demographics of the neighborhood in question, and discussed the neighborhood extensively. The EIS listed community features, including subdivisions, schools, and churches, along with their distances from the proposed compressor station, and explained that the station's noise and air-quality effects on these locations were expected to remain within acceptable limits.

More persuasive is Sierra Club's argument that FERC disregarded the extent to which Dougherty County is already overburdened with pollution sources. A letter to FERC from four members of Georgia's congressional delegation cites the grim statistics: southern Dougherty County has 259 hazardous-waste facilities, 78 air-polluting facilities, 20 toxic-polluting facilities, and 16 water-polluting facilities. The EIS did not mention these existing polluters in its discussion of Dougherty County. Sierra Club thus argues that FERC inadequately considered the project's "cumulative impacts," that is, its effects taken in combination with existing environmental hazards in [*20] the same area. *See* 40 C.F.R. § 1508.7; *Del. Riverkeeper*, 753 F.3d at 1319-20.

Perhaps FERC could have said more, but the discussion it undertook of the cumulative impacts of the proposed route fulfilled NEPA's goal of guiding informed

decisionmaking. The EIS acknowledged that the Sabal Trail project will generate air pollution and noise pollution in Albany, and it projected cumulative levels of both of these types of pollution from all sources in the vicinity of the compressor station, finding that both would remain below harmful thresholds.⁷ We are sensitive to Sierra Club's broader contention that it is unjust to locate a polluting facility in a community that already has a high concentration of polluting facilities, even if those older facilities produce pollution of a different type or in different locations. We note, however, that FERC took seriously commenters' concerns about locating Sabal Trail facilities in Dougherty County. The agency reopened the comment period on the EIS to seek input on relocating the compressor station, and then actually secured Sabal Trail's agreement to relocate the station, moving it in part to mitigate effects on environmental-justice communities. The EIS also considered four route alternatives proposed [*21] by Sierra Club and its fellow environmental petitioners that would have partially or completely avoided Albany, but rejected them all, mainly on the ground that they would have had a greater overall impact on residences and populated areas.

7 FERC appropriately relied on EPA's national ambient air quality standards (NAAQS) as a standard of comparison for air-quality impacts. By presenting the project's expected emissions levels and the NAAQS standards side-by-side, the EIS enabled decisionmakers and the public to meaningfully evaluate the project's air-pollution effects by reference to a generally accepted standard. *See Runway Expansion*, 355 F.3d at 689 (explaining that in an environmental-justice analysis, the agency's "choice among reasonable analytical methodologies is entitled to deference").

To sum up, the EIS acknowledged and considered the *substance* of all the concerns Sierra Club now raises: the fact that the Southeast Market Pipelines Project will travel primarily through low-income and minority communities, and the impact of the pipeline on the city of Albany and Dougherty County in particular. The EIS also laid out a variety of alternative approaches with potential to address those concerns, including those proposed by petitioners, and explained why, in FERC's view, they would do more harm than good. The EIS also gave the public and agency decisionmakers the qualitative and

quantitative tools they needed to make an informed choice for themselves. NEPA requires nothing more.

B

It's not just the journey, though, it's also the destination. All the natural gas that will travel through these pipelines will be going somewhere: specifically, to power plants in Florida, some of which already exist, others of which are in the planning [*22] stages. Those power plants will burn the gas, generating both electricity and carbon dioxide. And once in the atmosphere, that carbon dioxide will add to the greenhouse effect, which the EIS describes as "the primary contributing factor" in global climate change. J.A. 915. The next question before us is whether, and to what extent, the EIS for this pipeline project needed to discuss these "downstream" effects of the pipelines and their cargo. We conclude that at a minimum, FERC should have estimated the amount of power-plant carbon emissions that the pipelines will make possible.

An agency conducting a NEPA review must consider not only the direct effects, but also the *indirect* environmental effects, of the project under consideration. *See* 40 C.F.R. § 1502.16(b). "Indirect effects" are those that "are caused by the [project] and are later in time or farther removed in distance, but are still reasonably foreseeable." *Id.* § 1508.8(b). The phrase "reasonably foreseeable" is the key here. Effects are reasonably foreseeable if they are "sufficiently likely to occur that a person of ordinary prudence would take [them] into account in reaching a decision." *EarthReports, Inc. v. FERC*, 828 F.3d 949, 955 (D.C. Cir. 2016) (citation omitted).

What are the "reasonably foreseeable" effects [*23] of authorizing a pipeline that will transport natural gas to Florida power plants? First, that gas will be burned in those power plants. This is not just "reasonably foreseeable," it is the project's entire purpose, as the pipeline developers themselves explain. *See* Intervenor Br. 4-5 (explaining that the project "will provide capacity to transport natural gas to the electric generating plants of two Florida utilities"). It is just as foreseeable, and FERC does not dispute, that burning natural gas will release into the atmosphere the sorts of carbon compounds that contribute to climate change.

The pipeline developers deny that FERC would be the legally relevant cause of any power plant carbon

emissions, and thus contend that FERC had no obligation to consider those emissions in its NEPA analysis. They rely on *Department of Transportation v. Public Citizen*, 541 U.S. 752, 124 S. Ct. 2204, 159 L. Ed. 2d 60 (2004), a case involving the Federal Motor Carrier Safety Administration's development of safety standards for Mexican trucks operating in the United States. The agency had proposed those standards because the President planned to lift a moratorium on Mexican motor carriers operating in this country. These standards would require roadside inspections, which had the potential to create [*24] adverse environmental effects. The agency's EIS discussed the effects of these roadside inspections, but Public Citizen contended that the EIS was also required to address the environmental effects of increased truck traffic between the two countries. *See id. at 765*.

The Supreme Court sided with the agency. The Court noted that the agency would have no statutory authority to exclude Mexican trucks from the United States once the President lifted the moratorium; it would only have power to set safety rules for those trucks. *See id. at 766-67*. And because the agency could not exclude Mexican trucks from the United States, it would have no reason to gather data about the environmental harms of admitting them. The purpose of NEPA is to help agencies and the public make informed decisions. But when the agency has no *legal* power to prevent a certain environmental effect, there is no decision to inform, and the agency need not analyze the effect in its NEPA review. *See id. at 770*.

We recently applied the *Public Citizen* rule in three challenges to FERC decisions licensing liquefied natural gas (LNG) terminals. *See Sierra Club v. FERC (Freeport)*, 827 F.3d 36 (D.C. Cir. 2016); *Sierra Club v. FERC (Sabine Pass)*, 827 F.3d 59 (D.C. Cir. 2016); *EarthReports, Inc. v. FERC*, 828 F.3d 949 (D.C. Cir. 2016). Companies can export natural gas from the United States through an LNG terminal, but such natural gas exports [*25] require a license from the Department of Energy. *See Freeport*, 827 F.3d at 40. They also require physical upgrades to a terminal's facilities. The Department of Energy has delegated to FERC the authority to license those upgrades. *See id.* A question presented to us in all of these cases was whether FERC, in licensing physical upgrades for an LNG terminal, needed to evaluate the climate-change effects of exporting natural gas. Relying on *Public Citizen*, we answered no in each case. FERC had no legal authority to

consider the environmental effects of those exports, and thus no NEPA obligation stemming from those effects. *See Freeport*, 827 F.3d at 47; *accord Sabine Pass*, 827 F.3d at 68-69; *EarthReports*, 828 F.3d at 956.

An agency has no obligation to gather or consider environmental information if it has no statutory authority to act on that information. That rule was the touchstone of *Public Citizen*, see 541 U.S. at 767-68, and it distinguishes this case from the LNG-terminal trilogy. Contrary to our dissenting colleague's view, our holding in the LNG cases was not based solely on the fact that a second agency's approval was necessary before the environmental effect at issue could occur.⁸ Rather, *Freeport* and its companion cases rested on the premise that FERC had no legal authority to prevent the adverse environmental [*26] effects of natural gas exports. *See Freeport*, 827 F.3d at 47.

8 We also note that Florida Power & Light, which expects to be one of the pipelines' two primary customers, represented to FERC that "its commitments on Sabal Trail's and Florida Southeast's systems are to provide gas to existing natural gas-fired plants." Certificate Order ¶ 85, J.A. 1100. So even if the dissent were correct that Florida regulators' authority over power-plant construction excuses FERC from considering emissions from new or expanded power plants, that argument would not apply to the significant portion of these pipelines' capacity that is earmarked for existing plants.

This raises the question: what did the *Freeport* court mean by its statement that FERC could not prevent the effects of exports? After all, FERC did have legal authority to deny an upgrade license for a natural gas export terminal. *See Freeport*, 827 F.3d at 40-41. And without such an upgrade license, neither gas exports nor their environmental effects could have occurred.

The answer must be that FERC was forbidden to rely on the effects of gas exports as a justification for denying an upgrade license. *Cf. Motor Vehicle Mfrs. Ass'n of U.S. v. State Farm Mut. Auto. Ins. Co.*, 463 U.S. 29, 43, 103 S. Ct. 2856, 77 L. Ed. 2d 443 (1983) (explaining that an agency acts arbitrarily and capriciously if it makes a decision based on "factors which Congress had not intended it to consider"). The holding in *Freeport*, then, turned not on the question "What activities does FERC regulate?" but instead on the question "What factors can

FERC consider when regulating in its proper sphere?" In the LNG cases, FERC was acting not on its own statutory authority but under a narrow delegation from the Department of Energy. *See Freeport*, 827 F.3d at 40-41. Thus, the agency would have acted unlawfully had it refused an upgrade license on grounds that it did not have delegated authority to consider. *See State Farm*, 463 U.S. at 43.

Here, FERC is not so limited. Congress broadly [*27] instructed the agency to consider "the public convenience and necessity" when evaluating applications to construct and operate interstate pipelines. *See 15 U.S.C. § 717f(e)*. FERC will balance "the public benefits against the adverse effects of the project," see *Minisink Residents for Envtl. Pres. & Safety v. FERC*, 762 F.3d 97, 101-02, 412 U.S. App. D.C. 97 (D.C. Cir. 2014) (internal quotation marks omitted), including adverse environmental effects, see *Myersville Citizens for a Rural Cmty. v. FERC*, 783 F.3d 1301, 1309, 414 U.S. App. D.C. 438 (D.C. Cir. 2015). Because FERC could deny a pipeline certificate on the ground that the pipeline would be too harmful to the environment, the agency is a "legally relevant cause" of the direct and indirect environmental effects of pipelines it approves. *See Freeport*, 827 F.3d at 47. *Public Citizen* thus did not excuse FERC from considering these indirect effects.⁹

9 The dissent contends that if FERC refused to approve these pipelines, Florida utilities would find a way to deliver an equivalent amount of natural gas to the state regardless. *See* Dissenting Op. 7. This argument, however, does not bear on the question whether FERC is legally authorized to consider downstream environmental effects when evaluating a Section 7 certificate application. In any case, the record suggests that there is no other viable means of delivering the amount of gas these pipelines propose to deliver. *See* J.A. 920-25.

FERC next raises a practical objection, arguing that it is impossible to know exactly what quantity of greenhouse gases will be emitted as a result of this project being approved. True, that number depends on several uncertain variables, including the operating decisions of individual plants and the demand for electricity in the region. But we have previously held that NEPA analysis necessarily involves some "reasonable forecasting," and that agencies may sometimes need to

make educated assumptions about an uncertain future. *See Del. Riverkeeper*, 753 F.3d at 1310. Indeed, [*28] FERC has already estimated how much gas the pipelines will transport: about one million dekatherms (roughly 1.1 billion cubic feet) per day. The EIS gave no reason why this number could not be used to estimate greenhouse-gas emissions from the power plants, and even cited a Department of Energy report that gives emissions estimates per unit of energy generated for various types of plant.

We conclude that the EIS for the Southeast Market Pipelines Project should have either given a quantitative estimate of the downstream greenhouse emissions that will result from burning the natural gas that the pipelines will transport or explained more specifically why it could not have done so. As we have noted, greenhouse-gas emissions are an indirect effect of authorizing this project, which FERC could reasonably foresee, and which the agency has legal authority to mitigate. *See 15 U.S.C. § 717f(e)*. The EIS accordingly needed to include a discussion of the "significance" of this indirect effect, *see 40 C.F.R. § 1502.16(b)*, as well as "the incremental impact of the action when added to other past, present, and reasonably foreseeable future actions," *see WildEarth Guardians*, 738 F.3d at 309 (quoting 40 C.F.R. § 1508.7).

Quantification would permit the agency to compare the emissions from this [*29] project to emissions from other projects, to total emissions from the state or the region, or to regional or national emissions-control goals. Without such comparisons, it is difficult to see how FERC could engage in "informed decision making" with respect to the greenhouse-gas effects of this project, or how "informed public comment" could be possible. *See Nevada*, 457 F.3d at 93; *see also WildEarth Guardians*, 738 F.3d at 309 (accepting an agency's contention that the "estimated level of [greenhouse-gas] emissions can serve as a reasonable proxy for assessing potential climate change impacts, and provide decision makers and the public with useful information for a reasoned choice among alternatives").

We do not hold that quantification of greenhouse-gas emissions is required every time those emissions are an indirect effect of an agency action. We understand that in some cases quantification may not be feasible. *See, e.g., Sierra Club v. U.S. Dep't of Energy*, F.3d , 2017 U.S. App. LEXIS 15178, slip op. at 22 (D.C. Cir. 2017). But

FERC has not provided a satisfactory explanation for why this is such a case. We understand that "emission estimates would be largely influenced by assumptions rather than direct parameters about the project," *see* J.A. 916, but some educated assumptions are inevitable in the NEPA process, *see Scientists' Inst. for Pub. Info. v. Atomic Energy Comm'n*, 481 F.2d 1079, 1092, 156 U.S. App. D.C. 395 (D.C. Cir. 1973). And the [*30] effects of assumptions on estimates can be checked by disclosing those assumptions so that readers can take the resulting estimates with the appropriate amount of salt. *See WildEarth Guardians*, 738 F.3d at 309 (approving an EIS that took this approach).

Nor is FERC excused from making emissions estimates just because the emissions in question might be partially offset by reductions elsewhere. We thus do not agree that the EIS was absolved from estimating carbon emissions by the fact that some of the new pipelines' transport capacity will make it possible for utilities to retire dirtier, coal-fired plants. The effects an EIS is required to cover "include those resulting from actions which may have both beneficial and detrimental effects, even if on balance the agency believes that the effect will be beneficial." 40 C.F.R. § 1508.8. In other words, when an agency thinks the good consequences of a project will outweigh the bad, the agency still needs to discuss both the good and the bad. In any case, the EIS itself acknowledges that only "portions" of the pipelines' capacity will be employed to reduce coal consumption. *See* J.A. 916. An agency decisionmaker reviewing this EIS would thus have no way of knowing whether total emissions, on net, [*31] will be reduced or increased by this project, or what the degree of reduction or increase will be. In this respect, then, the EIS fails to fulfill its primary purpose.

We also recognize that the power plants in question will be subject to "state and federal air permitting processes." J.A. 917. But even if we assume that power plants' greenhouse-gas emissions will be subject to regulation in the future, *see* Exec. Order No. 13,783, § 4(a), 82 Fed. Reg. 16,093, 16,095 (Mar. 28, 2017) (instructing the EPA administrator to consider "whether to revise or withdraw" federal regulation of these emissions), the existence of permit requirements overseen by another federal agency or state permitting authority cannot substitute for a proper NEPA analysis. *See Calvert Cliffs' Coordinating Comm. v. Atomic Energy Comm'n*, 449 F.2d 1109, 1122-23, 146 U.S. App. D.C. 33 (D.C.

Cir. 1971). In any event, FERC quantified the project's expected emissions of other air pollutants, despite the fact that the project will presumably comply with the requirements of the *Clean Air Act* and state air-pollution laws.

Our discussion so far has explained that FERC must either quantify and consider the project's downstream carbon emissions or explain in more detail why it cannot do so. Sierra Club proposes a further analytical step. The EIS might have tried to link those downstream [*32] carbon emissions to particular climate impacts, like a rise in the sea level or an increased risk of severe storms. The EIS explained that there is no standard methodology for making this sort of prediction. *Cf. WildEarth Guardians, 738 F.3d at 309* ("[C]urrent science does not allow for the specificity demanded" by environmental challengers.). In its rehearing request, Sierra Club asked FERC to convert emissions estimates to concrete harms by way of the Social Cost of Carbon. This tool, developed by an interagency working group, attempts to value in dollars the long-term harm done by each ton of carbon emitted. But FERC has argued in a previous EIS that the Social Cost of Carbon is not useful for NEPA purposes, because several of its components are contested and because not every harm it accounts for is necessarily "significant" within the meaning of NEPA. *See EarthReports, 828 F.3d at 956*. We do not decide whether those arguments are applicable in this case as well, because FERC did not include them in the EIS that is now before us. On remand, FERC should explain in the EIS, as an aid to the relevant decisionmakers, whether the position on the Social Cost of Carbon that the agency took in *EarthReports* still holds, and why.

C

GBA Associates alleges two further [*33] flaws in the EIS, but we find neither charge persuasive.

First, the landowners contend that "FERC has erroneously limited the scope of its examination of alternatives" to the proposed project. GBA Assocs. Br. 21. However, GBA provides no arguments in support of this claim, nor does it cite any reasonable alternatives that FERC failed to consider. As the agency explained, the EIS considered, and ultimately rejected, twelve major route alternatives, as well as the "no action" alternative. We defer to the agency's discussion of alternatives, and uphold it "so long as the alternatives are reasonable and the agency discusses them in reasonable detail." *Citizens*

Against Burlington, 938 F.2d at 196. GBA has given us no reason to reach any other conclusion here.

GBA also accuses FERC of giving too little consideration to the safety risks involved in the construction of the pipeline, and specifically to the fact that in some places, new pipeline will cross, or run alongside, existing pipeline. As GBA's own brief recognizes, though, the EIS recognized and discussed the risk of pipeline crossings, ultimately concluding that some crossings were necessary to minimize impacts on natural resources and homes. GBA's only response is that commenters, [*34] including the owner of one of the existing pipelines, submitted letters to FERC expressing safety concerns. But the EIS responded to those comments, and GBA does not explain why the responses were insufficient. Again, NEPA does not require a particular substantive result, like the elimination of all pipeline crossings; it only requires the agency to take a "hard look" at the problem. This FERC has done.

IV

All of these pipelines, of course, are being built for a reason: to make a profit for their shareholders, and their shareholders' shareholders. But the profits they can make are constrained by the Natural Gas Act, the "fundamental purpose" of which "is to protect natural gas consumers from the monopoly power of natural gas pipelines." *Nat'l Fuel Gas Supply Corp. v. FERC, 468 F.3d 831, 833, 373 U.S. App. D.C. 351 (D.C. Cir. 2006)*. FERC carries out that purpose by, among other duties, regulating the rates that a newly authorized pipeline can charge its customers. *See Atl. Ref. Co. v. Pub. Serv. Comm'n, 360 U.S. 378, 388-91, 79 S. Ct. 1246, 3 L. Ed. 2d 1312 (1959)*. The rate derives from a complicated calculation that boils down to three elements: (1) the pipeline's cost of doing business; (2) the "rate base," which is roughly the total value of the pipeline's assets; and (3) a rate of return, calculated as a percentage of the rate base, that is "sufficient to ensure that pipeline [*35] investors are fairly compensated." *See N.C. Utils. Comm'n v. FERC (NCUC), 42 F.3d 659, 661, 310 U.S. App. D.C. 13 (D.C. Cir. 1994)*. These three factors, together, determine the total amount of revenue that a pipeline is entitled to earn through the rates it charges its customers. *See id.*¹⁰

10 For a highly simplified illustration, suppose that the rate base is \$1 billion and the rate of return allowed is 10%. In that case, the pipeline can earn a total annual return of \$100 million.

Thus, if the pipeline's annual costs are \$150 million, then the pipeline can collect total annual revenues of \$250 million, and can set its rates accordingly.

Drilling down further, we can see that the rate of return itself has two main components. Like most businesses, a pipeline company is funded by both equity (*i.e.*, investments made by shareholders) and debt. *See NCUC, 42 F.3d at 661*. A pipeline's ratio of equity financing to debt financing is called its "capital structure." *See id.* Typically, equity investors will earn a higher rate of return than debt investors (*i.e.*, creditors) because an equity investment is riskier. *See id. at 664; MarkWest Pioneer, LLC, 125 FERC ¶ 61,165, at ¶ 27 (2008)*. Therefore, all else being equal, the more a pipeline's financing takes the form of equity, the greater the total amount the pipeline will pay its investors, and the higher its rates will be. *See MarkWest, 125 FERC ¶ 61,165, at ¶ 27*. At the same time, the more indebted a pipeline is, the greater the risk to its equity investors, and the greater the return they will expect. *See NCUC, 42 F.3d at 664*. So, deciding on the capital structure, rate of return on equity, and rate of return on debt for a pipeline becomes a delicate balancing act.

In its original application for [*36] a *Section 7* certificate, Sabal Trail sought to design its rates based on a capital structure with 60% equity and 40% debt. It anticipated that the interest rate on its debt would be 6.2%, and proposed to pay a 14% return to its equity investors. The weighted average of those two rates would yield an overall rate of return of 10.88%.

FERC, however, felt that a 14% rate of return on equity was too high for a pipeline with only 40% debt. (Recall that a high rate of return must be justified by a high investment risk, and that pipelines with less debt are less risky for equity investors.) The agency explained that Sabal Trail could design its rates around a 14% return on equity if it wanted to, but only if it also changed the proposed capital structure. With a 50% equity/50% debt capital structure, FERC explained, a 14% rate of return on equity would be reasonable.

Sierra Club objects to FERC's decision to allow Sabal Trail to base its rates on a "hypothetical capital structure." It argues that, having concluded that Sabal Trail's proposed return on equity was too high, FERC should have either cut the rate of return or denied the pipeline a certificate altogether. We review FERC's

capital-structure [*37] decision under the deferential standard of the *Administrative Procedure Act*, and may disturb that decision only if it is "arbitrary, capricious, an abuse of discretion, or otherwise not in accordance with law." *See NCUC, 42 F.3d at 663* (quoting 5 *U.S.C. § 706(2)(A)*).

We think that FERC adequately explained its decision to allow Sabal Trail to employ a hypothetical capital structure. FERC's job, when evaluating a proposed rate for a new pipeline, is to see that the pipeline's investors receive a reasonable, but not excessive, return on their investment. *See id. at 661*. The returns must be proportionate to the business and financial risk the investors take on: more risk, more reward. *See id.; MarkWest, 125 FERC ¶ 61,165, at ¶ 27*. In the case of pipeline financing, as discussed above, the "risk" for investors depends in part on the pipeline's level of indebtedness, and the "reward" is the return on equity. If the risk and reward are out of alignment, there are two ways to fix the problem: decrease the reward by lowering the return on equity, or increase the risk by increasing the pipeline's debt level. FERC determined that with a 14% return on equity, and only 40% debt, the risk and reward would be out of alignment. As FERC explained, by imposing a hypothetical [*38] capital structure that raised the debt level to 50%, the agency brought the risk and reward into sync.

Sierra Club's objection stems, in part, from a misunderstanding of FERC's role in the rate-setting process. FERC does not directly control *either* the pipeline's return on equity *or* its capital structure. FERC merely approves the initial rates the pipeline will charge, a price that is based in part on an anticipated return on equity and an anticipated debt level. *See NCUC, 42 F.3d at 661, 664; MarkWest, 125 FERC ¶ 61,165, at ¶¶ 26-27*. So whichever methodology FERC chooses for ensuring that risk matches reward--lowering the hypothetical return on equity, or raising the hypothetical debt--the practical effect is the same: FERC requires the pipeline to charge a lower rate than it had originally requested.

Nothing in our precedent is to the contrary. Sierra Club claims that in *NCUC* we disapproved FERC's use of a hypothetical capital structure. That's true, but our reasoning there is inapposite here. In that case FERC had used a hypothetical capital structure to *increase*, rather than decrease, the rates the pipeline could charge, and to "mask an otherwise anomalous[ly high] return as

something more appealing." *See* 42 F.3d at 664. We expressly recognized, [*39] however, that FERC is allowed to do the opposite: use a hypothetical capital structure to *decrease* a pipeline's proposed rates, in the interest of consumer protection. *See id.* FERC has done just that here.

FERC also acted consistently with its own precedent. Its approach in this case was identical to its order in *MarkWest*. *See* 125 FERC ¶ 61,165, at ¶¶ 26-27. There, too, a pipeline proposed a 14% return on equity and a capital structure with 60% equity and 40% debt. FERC saw the proposed return on equity as too high, and rectified the situation by applying a hypothetical capital structure with 50% equity and 50% debt. *See id.* Sierra Club also points to *Panhandle Eastern Pipe Line Co.*, 71 FERC ¶ 61,228 (1995), where FERC explained that its "policy is to use the *actual* capital structure of the entity that does the financing for the regulated pipeline," *id.* at 61,827 (emphasis added). But in *Panhandle Eastern* FERC promoted a flexible approach, noting that it "may use a different capital structure where the actual capital structure is not representative of the pipeline's risk profile." *See id.* at 61,828. *Panhandle Eastern* was also decided under *section 4* of the Act (which governs existing pipelines), rather than *section 7* (new pipelines), and so is silent on what to do when a pipeline does not yet have [*40] an "actual capital structure." *Id.* at 61,822, 61,827-28. *Pine Needle LNG Co.*, 77 FERC ¶ 61,229 (1996), is also cited by Sierra Club but supports FERC's position, because it confirms that FERC has the option to "resort to a hypothetical capital structure if the equity ratio of the actual capitalization is abnormally high," *id.* at 61,916.

Though we see nothing arbitrary or capricious in FERC's choice to use a hypothetical capital structure in rate-setting, substantial evidence must support the capital structure FERC ultimately uses in the rate calculation, hypothetical or not. *See NCUC*, 42 F.3d at 663. FERC explained that a 14% return on equity, combined with a 50% equity/50% debt capital structure, was justified because FERC had approved the same combination of capital structure and return on equity in prior cases. We confess to being skeptical that a bare citation to precedent, derived from another case and another pipeline, qualifies as the requisite "substantial evidence." *See NCUC*, 42 F.3d at 664 (citing *Maine Pub. Serv. Co. v. FERC*, 964 F.2d 5, 9, 296 U.S. App. D.C. 5 (D.C. Cir. 1992), for the proposition that "FERC's use of a particular

percentage in a ratemaking calculation was not adequately justified by citation of a prior use of the same percentage without further reasoning or explanation").

However, Sierra Club does not make this argument in its opening brief, confining itself [*41] to attacking the use of a hypothetical capital structure more generally. *See* Sierra Club Opening Br. 43 ("FERC has not stated an adequate explanation for allowing a high rate of return based upon a hypothetical capital structure."); *see also*, e.g., *Fox v. Gov't of Dist. of Columbia*, 794 F.3d 25, 30, 417 U.S. App. D.C. 183 (D.C. Cir. 2015) ("[W]here a litigant has forfeited an argument by not raising it in the opening brief, we need not reach it."). On the arguments presented to us, we see no basis for setting aside FERC's ratemaking determination.

V

We turn to GBA's two remaining arguments, both of which we find unavailing.

The landowners challenge FERC's conclusion that the Southeast Market Pipelines Project will serve the public convenience and necessity. As mentioned previously, a finding that a proposed natural-gas pipeline "is or will be required by the present or future public convenience and necessity" is a prerequisite for FERC certification. *See* 15 U.S.C. § 717f(e). The "public convenience and necessity" analysis has two components. First, the applicant must show that the project will "stand on its own financially" because it meets a "market need." *See Myersville*, 783 F.3d at 1309 (internal quotation marks omitted). The applicant can make this showing by presenting evidence of "preconstruction contracts" for gas transportation [*42] service. If FERC finds market need, it will then proceed to balance the benefits and harms of the project, and will grant the certificate if the former outweigh the latter. *See id.*

The landowner petitioners take issue with FERC's market-need analysis, alleging that this project serves only the profit motive of the pipeline developers, rather than any public need. *See* GBA Opening Br. 28. That argument misunderstands our test. The criterion is "market need"--whether the pipelines will be self-supporting--which the applicants here satisfied by showing that 93% of their capacity has already been contracted for. The landowners also assert that the pipeline will be "redundant as it largely parallels existing pipelines," *see* GBA Opening Br. 29, but as FERC found,

and the petitioners do not refute, the "expansion of existing pipelines will not satisfy the identified need," *see* J.A. 1101.

The landowner petitioners also assert that FERC violated the Government in the *Sunshine Act*, 5 U.S.C. § 552b, by approving the pipelines' certificates via notational voting, a procedure where the members of a multimember agency cast their votes individually and separately, rather than at a public meeting. But we have expressly [*43] approved of notational voting, and held it to be consistent with the Sunshine Act, on multiple occasions. *See R.R. Comm'n of Tex. v. United States*, 765 F.2d 221, 230-31, 246 U.S. App. D.C. 352 (D.C. Cir. 1985) (citing cases). "The Sunshine Act does not require that meetings be held in order to conduct agency business; rather, that statute requires only that, if meetings are held, they be open to the public." *Id.* at 230 (emphasis added). GBA also suggests that there should be a presumption that meetings are required when controversial issues are under consideration, but we have rejected that exact argument as well. *See id.*

VI

The petition for review in No. 16-1329 is granted. The orders under review are vacated and remanded to FERC for the preparation of an environmental impact statement that is consistent with this opinion. The petition for review in No. 16-1387 is denied.

So ordered.

CONCUR BY: BROWN (In part)

DISSENT BY: BROWN (In part)

DISSENT

BROWN, *Circuit Judge*, concurring in part and dissenting in part: I join today's opinion on all issues save the Court's decision to vacate and remand the pipeline certificates on the issue of downstream greenhouse emissions. Case law is clear: When an agency "'has no ability to prevent a certain effect due to' [its] 'limited statutory authority over the relevant action[],' then that [*44] action 'cannot be considered a legally relevant cause'" of an indirect environmental effect under the *National Environmental Policy Act ("NEPA")*. *Sierra Club (Freeport) v. FERC*, 827 F.3d 36, 47 (D.C. Cir. 2016) (quoting *Dep't of Transp. v. Pub. Citizen*, 541 U.S.

752, 770, 124 S. Ct. 2204, 159 L. Ed. 2d 60 (2004)). Thus, when the occurrence of an indirect environmental effect is contingent upon the issuance of a license from a separate agency, the agency under review is not required to address those indirect effects in its NEPA analysis. Although this case seems indistinguishable from earlier precedent, the Court now insists the action taken by the Federal Energy Regulatory Commission ("FERC" or "the Commission") is the cause of an environmental effect, even though the agency has no authority to prevent the effect. *But see Pub. Citizen*, 541 U.S. at 767 (holding "but for" causation is insufficient to make an agency responsible for a particular effect under NEPA). More significantly, today's opinion completely omits any discussion of the role Florida's state agencies play in the construction and expansion of power plants within the state--a question that should be dispositive. Because the Court's holding is legally incorrect and contravenes our duty to examine all arguments presented, I respectfully dissent.

When examining a NEPA claim, our role is limited to ensuring the [*45] relevant agency took a "hard look at the environmental consequences" of its decisions and "adequately considered and disclosed the environmental impact of its actions." *Balt. Gas & Elec. Co. v. Nat. Res. Def. Council*, 462 U.S. 87, 97-98, 103 S. Ct. 2246, 76 L. Ed. 2d 437 (1983). We examine the agency's determinations under the "deferential rule of reason," which governs which environmental impacts the agency must discuss and the "extent to which it must discuss them." *WildEarth Guardians v. Jewell*, 738 F.3d 298, 310, 407 U.S. App. D.C. 309 (D.C. Cir. 2013). FERC thus has broad discretion to determine "whether and to what extent to [discuss environmental impacts] based on the usefulness of any new potential information to [its] decisionmaking process." *Pub. Citizen*, 541 U.S. at 767. Here, FERC declined to engage in an in-depth examination of downstream greenhouse gas emissions because there is no causal relationship between approval of the proposed pipelines and the downstream greenhouse emissions; and, even if a causal relationship exists, any additional analysis would not meaningfully contribute to its decisionmaking. Both determinations were reasonable and entitled to deference.

Regarding causation, the Court is correct that NEPA requires an environmental analysis to include indirect effects that are "reasonably foreseeable," *Freeport*, 827 F.3d at 46, but it misunderstands what qualifies as

reasonably foreseeable. The Court blithely [*46] asserts it is "not just the journey," it is "also the destination." Maj. Op. at 18. In fact, NEPA is a procedural statute that *is all about* the journey. It compels agencies to consider all environmental effects likely to result from the project under review, but it "does *not* dictate particular decisional outcomes." *Sierra Club v. U.S. Army Corps of Engineers*, 803 F.3d 31, 37, 419 U.S. App. D.C. 416 (D.C. Cir. 2015) (emphasis added). The statute therefore "requires a reasonably close causal relationship between the environmental effect and the alleged cause" that is "akin to proximate cause in tort law." *Pub. Citizen*, 541 U.S. at 754, 767. Thus, the fact that the Commission's action is a "but for" cause of an environmental effect is insufficient to make it responsible for a particular environmental effect. *Id.* Instead, the effect must be "sufficiently likely to occur that a person of ordinary prudence would take it into account in reaching a decision." *Freeport*, 827 F.3d at 47. There is a further caveat: An effect the agency is powerless to prevent does not fall within NEPA's ambit. Here, the Commission explained in its denial of rehearing that any "environmental effects resulting from end use emissions from natural gas consumption are generally neither caused by a proposed pipeline (or other natural gas infrastructure) project nor are they [*47] reasonably foreseeable consequences of our approval of an infrastructure project." JA 1330. FERC's conclusion is both logical and consistent with this Court's precedent. While the Court concludes FERC's approval of the proposed pipelines will be the cause of greenhouse gas emissions because a significant portion of the natural gas transported through the pipeline will be burned at power plants, *see* Maj. Op. at 19, the truth is that FERC has no control over whether the power plants that will emit these greenhouse gases will come into existence or remain in operation.

In several recent cases, petitioners sought review of a downstream environmental effect that fell within the oversight of another agency. We held the occurrence of a downstream environmental effect, contingent upon the issuance of a license from another agency with the sole authority to authorize the source of those downstream effects, cannot be attributed to the Commission; its actions "cannot be considered a legally relevant cause of the effect for NEPA purposes." *See Freeport*, 827 F.3d at 47; *Sierra Club (Sabine Pass) v. FERC*, 827 F.3d 59, 68 (D.C. Cir. 2016); *EarthReports, Inc. v. FERC*, 828 F.3d 949, 952 (D.C. Cir. 2016); *see also Sierra Club v. FERC*, 672 F. App'x 38, 39 (D.C. Cir. 2016). In *Freeport*, for

example, the petitioners argued the Commission failed to adequately consider the downstream greenhouse gas emissions that [*48] would result from increased exports of natural gas because the Commission authorized construction of a natural gas export facility. We said the Commission's NEPA analysis did not have to address these downstream effects because the Department of Energy ("DOE") had the "sole authority to license the export of any natural gas going through [the export facility]." *See Freeport*, 827 F.3d at 47; *see also EarthReports*, 828 F.3d at 955. Relying on binding precedent from the Supreme Court, we reasoned causation could not exist where an agency "'has no ability to prevent a certain effect due to' that agency's 'limited statutory authority over the relevant action.'" *Freeport*, 827 F.3d at 47 (quoting *Pub. Citizen*, 541 U.S. at 770) (alteration omitted); *see also EarthReports*, 828 F.3d at 955.

This case presents virtually identical circumstances. Under the *Florida Electrical Power Plant Siting Act*, "a power plant cannot be built unless a site certification is obtained" from the Florida Power Plant Siting Board ("the Board"). *Ecodyne Cooling Div. of Ecodyne Corp. v. City of Lakeland*, 893 F.2d 297, 299 (11th Cir. 1990) (citing *Fla. Stat.* §§ 403.506, 403.511). "Such certification constitutes the sole license for a power plant's construction and operation." *Id.* (citing *Fla. Stat.* § 403.511); *see also Seminole Tribe of Fla. v. Hendry Cty.*, 114 So. 3d 1073, 1075 (*Fla. Dist. Ct. App.* 2013) ("It is clear from this statutory language that the [Florida Electrical Power Plant Siting Act] is a centrally coordinated, one-stop licensing process."). Accordingly, no [*49] power plant is built or expanded in the state of Florida--and consequently no greenhouse gases are emitted from Florida power plants--without the Board's approval. *See Fla. Stat.* § 403.506(1) (stating no power plant may be constructed or expanded "without first obtaining certification" from the Board). This breaks the chain of causation. *See Pub. Citizen*, 541 U.S. at 754 (analogizing the NEPA causal relationship to "proximate cause in tort law"). NEPA does not require FERC to address indirect environmental effects resulting from the Board's licensing decision. *See Freeport*, 827 F.3d at 47-48 (holding the Commission need not address downstream environmental effects if "triggering [the] chain of events" leading to those effects requires the "critical . . . intervening action" of another agency).

Despite this clearly-controlling case law and the

exclusive authority of the state Board to license the construction and expansion of power plants in Florida, the Court concludes FERC's approval of the pipeline is a "legally relevant cause" of the greenhouse gas emissions from the Florida power plants. *See* Maj. Op. at 23. But its attempt to explain why NEPA operates more expansively when applied to pipelines compared to export terminals, as well as its arguments as to why [*50] the Florida Board should be treated differently than DOE under NEPA, are both ultimately unpersuasive. Both projects qualify as "major [f]ederal actions significantly affecting the quality of the human environment," 42 U.S.C. § 4332(C), so there is no reason why NEPA's requirement to consider indirect environmental effects would not apply equally to both. Moreover, nothing in the statutory language empowering the Commission to regulate export terminals and pipelines suggests the Commission's authority is more limited in one circumstance than another. Congress has granted the Commission "the exclusive authority to approve or deny an application for the siting, construction, expansion, or operation of an [export] terminal," 15 U.S.C. § 717b(e)(1), and to impose any conditions on those terminals the Commission finds to be "necessary or appropriate," *id.* § 717b(e)(3)(A). Thus, the Commission has the power to approve or deny the construction and operation of export terminals subject to any conditions it wishes to impose. Likewise, Congress requires any applicant seeking to construct or extend natural gas transportation facilities to obtain a "certificate of public convenience and necessity" from the Commission. *Id.* § 717f(c)(1)(A). The Commission "shall" issue a certificate [*51] if "the applicant is able and willing properly to do the acts and to perform the service proposed" and if the proposed service or construction "is or will be required by the present or future public convenience and necessity." *Id.* § 717f(e). FERC also has the "power to attach to the issuance of the certificate . . . such reasonable terms and conditions as the public convenience and necessity may require." *Id.* Accordingly, nothing in the text of either statute empowers the Commission to entirely deny the construction of an export terminal or the issuance of a certificate based solely on an adverse indirect environmental effect regulated by another agency. *See id.* §§ 717b(e), 717f(e).

The actual distinction between this case and the DOE cases discussed above is doctrinally invisible. We stated in *Freeport* that "[i]n the specific circumstances where . . . an agency has no ability to prevent a certain effect due

to that agency's limited statutory authority over the relevant action, then that action cannot be considered a legally relevant 'cause' of the effect for NEPA purposes." 827 F.3d at 47. Those "specific circumstances" exist here. FERC's statutory authority is limited by the fact that the Board, not FERC, has the "sole authority" [*52] to authorize or prohibit the construction or expansion of power plants in Florida. *See id.* at 48. If this Court wishes to apply the "touchstone of *Public Citizen*" that "[a]n agency has no obligation to gather or consider environmental information if it has no statutory authority to act on that information," Maj. Op. at 21, it must consider not only whether an agency *can act*, but whether the results of such action *would have an effect* on the indirect environmental impact.

Even if the Court is correct that the Commission has the power to deny pipeline certificates based on indirect environmental concerns, such a denial represents the limit of the Commission's statutory power. Nothing would prevent the Florida Board from independently approving the construction or expansion of the power plants at issue. In fact, the record shows the Board has already approved some of these projects prior to the Commission reaching a decision on the proposed pipelines. JA 910-11. Moreover, there is also nothing preventing the Intervenor from pursuing an alternative method of delivery to account for the same amount of natural gas. Practical considerations point in the opposite direction. Both the Board and the Commission [*53] have concluded Florida has a need for additional natural gas, and nothing in today's opinion takes issue with those holdings. Additionally, the Commission has concluded that the failure to take action to address this natural-gas shortage "could result in . . . fuel shortages" and "could lead to insufficient energy production to meet expected demands." JA 920. Given the dire consequences of failing to act, it is inconceivable that the Intervenor utility companies would stand idly by and allow a power crisis to develop. The much more likely result is that they would simply choose another alternative--albeit a much more inconvenient, expensive, and possibly environmentally-harmful alternative--in response to a denial of a certificate by FERC. *See* Oral Arg. Rec. at 59:45-59:50 (stating the Intervenor are "going to keep the lights on" regardless of whether FERC approves the pipelines).

Thus, just as FERC in the DOE cases and the Federal Motor Carrier Safety Administration in *Public Citizen* did

not have the legal power to prevent certain environmental effects, the Commission here has no authority to prevent the emission of greenhouse gases through newly-constructed or expanded power plants approved by the Board. [*54] To be sure, the Commission could make it extremely inconvenient to deliver the same amount of natural gas to the plants, but this is an issue of

practicality, which, as conceded by the majority, is irrelevant under NEPA. *See* Maj. Op. at 23. Accordingly, the Commission was not obligated under NEPA to discuss downstream greenhouse gas emissions, and I would deny the entire petition for review.

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ATTACHMENT B

September 15, 2017

Elisabeth A. Shumaker
Clerk of Court

PUBLISH

UNITED STATES COURT OF APPEALS
TENTH CIRCUIT

WILDEARTH GUARDIANS; SIERRA
CLUB,

Petitioners - Appellants,

v.

No. 15-8109

UNITED STATES BUREAU OF
LAND MANAGEMENT,

Respondent - Appellee,

and

WYOMING MINING ASSOCIATION;
BTU WESTERN RESOURCES, INC.;
STATE OF WYOMING; NATIONAL
MINING ASSOCIATION,

Respondents - Intervenors -
Appellees.

THE INSTITUTE FOR POLICY
INTEGRITY AT NEW YORK
UNIVERSITY SCHOOL OF LAW,

Amicus Curiae.

APPEAL FROM THE UNITED STATES DISTRICT COURT
FOR THE DISTRICT OF WYOMING
(D.C. No. 2:13-CV-00042-ABJ)

Nathaniel Shoaff (Nathan Matthews, Sierra Club; Samanta Ruscavage-Barz, WildEarth Guardians, with him on the briefs), Sierra Club, San Francisco, California, for Petitioners-Appellants.

Daniel W. Wolff (Kirsten L. Nathanson and Sherrie A. Armstrong, Crowell & Moring, LLP, Washington, D.C.; Michael Drysdale, Dorsey & Whitney, LLP, Minneapolis, Minnesota; Andrew C. Emrich, P.C., Holland & Hart LLP, Greenwood Village, Colorado, with him on the brief), Crowell & Moring, LLP, Washington, D.C., for Respondent-Appellees BTU Western Resources, Inc., National Mining Association, and Wyoming Mining Association.

Michael T. Gray, Attorney (Philip C. Lowe, of Counsel, United States Department of the Interior, Rocky Mountain Regional Solicitor's Office; John C. Cruden, Assistant Attorney General; John S. Most and Andrew C. Mergen, Attorneys, with him on the brief), Appellate Section, Environment and Natural Resources Division, United States Department of Justice, Jacksonville, Florida, for Respondent-Appellee, United States Bureau of Land Management.

Erik E. Petersen (Michael J. McGrady, with him on the brief), Wyoming Office of the Attorney General, Cheyenne, Wyoming, for Respondents-Intervenors-Appellee State of Wyoming.

Jayni Foley Hein and Jason A. Schwartz, Institute for Policy Integrity, New York, NY, filed an amicus curiae brief on behalf of the Institute of Policy Integrity at New York University School of Law in support of Petitioners-Appellants.

Before **BRISCOE**, **McKAY**, and **BALDOCK**, Circuit Judges.

BRISCOE, Circuit Judge.

Appellants WildEarth Guardians and Sierra Club (Plaintiffs) challenge the Bureau of Land Management's (BLM) decision to approve four coal leases in Wyoming's Powder River Basin. Plaintiffs brought an Administrative Procedure Act (APA) claim arguing that the BLM failed to comply with the National

Environmental Policy Act (NEPA) when it concluded that issuing the leases would not result in higher national carbon dioxide emissions than would declining to issue them. The district court upheld the leases. We reverse and remand with instructions to the BLM to revise its Environmental Impact Statements (EISs) and Records of Decision (RODs). We do not, however, vacate the resulting leases.

I.

A. Statutory and Regulatory Background

The NEPA, 42 U.S.C. §§ 4321–4370h, and its implementing regulations promulgated by the Council on Environmental Quality (CEQ), 40 C.F.R. §§ 1500.1–1518.4, are “our national charter for protection of the environment.” 40 C.F.R. § 1500.1(a). Section 102 of NEPA, in relevant part, requires federal agencies to

include in every recommendation or report on proposals for legislation and other major Federal actions significantly affecting the quality of the human environment, a detailed statement by the responsible official on-

- (i) the environmental impact of the proposed action,
- (ii) any adverse environmental effects which cannot be avoided should the proposal be implemented, [and]
- (iii) *alternatives to the proposed action.*

Robertson v. Methow Valley Citizens Council, 490 U.S. 332, 348–39 (1989)

(emphasis added) (quoting 42 U.S.C. § 4332(C)). In these EISs, agencies must analyze direct effects, reasonably foreseeable indirect effects, and effects that are

cumulative over time or aggregated with other forces outside the agency's proposed action. 40 C.F.R. § 1508.7, 1508.8.

The alternatives analysis “is the heart of the environmental impact statement.” § 1502.14. Agencies “should present the environmental impacts of the proposal and the alternatives in comparative form, thus sharply defining the issues and providing a clear basis for choice among options by the decisionmaker and the public,” including a “no action” alternative. *Id.* Agencies must “rigorously explore and objectively evaluate” these alternatives “so that reviewers may evaluate their comparative merits.” *Id.* “Without substantive, comparative environmental impact information regarding other possible courses of action, the ability of an EIS to inform agency deliberation and facilitate public involvement would be greatly degraded.” *New Mexico ex rel. Richardson v. BLM*, 565 F.3d 683, 708 (10th Cir. 2009). Courts often characterize NEPA’s procedural requirement as obliging agencies to take a “hard look” at the environmental consequences and alternatives. *Methow Valley*, 490 U.S. at 350; *Richardson*, 565 F.3d at 704; *Biodiversity Conservation All. v. U.S. Forest Serv.*, 765 F.3d 1264, 1267 (10th Cir. 2014). NEPA does not provide a private right of action, so we review this claim under the APA. 5 U.S.C. §§ 701–706.

B. Factual and Procedural Background

The Powder River Basin (PRB) region is the largest single contributor to United States’ domestic coal production. In 2008, PRB coal represented 55.5% of

the United States's surface-mined coal, and 38.5% of the country's total coal production. App. at 983, 988. The BLM controls much of the region and is often in the business of approving mining infrastructure and issuing mining leases under the Federal Land Policy and Management Act (FLPMA), 43 U.S.C. §§ 1701–1787, the Mineral Leasing Act, 30 U.S.C. §§ 181–287, and BLM's own regulations and plans. See 43 C.F.R. §§ 1601.0–1610.8, 43 C.F.R. §§ 3400.0-3–3487.1.

At issue in this case are four coal tracts¹ that extend the life of two existing surface mines near Wright, Wyoming: the Black Thunder mine and the North Antelope Rochelle mine. The four “Wright Area Leases” at issue here are North Hilight, South Hilight, North Porcupine, and South Porcupine. The tracts are also near, and partially within, the Thunder Basin National Grassland, a national forest.

Alone, the two existing mines account for approximately 19.7% of the United States's annual domestic coal production. App. at 637, 987.² The North

¹ BLM's environmental analysis included two additional tracts, West Hilight and West Jacobs Ranch, which are not at issue in this litigation.

² According to BLM, the new leases will maintain the same production at these mines as in the past: 135 million tons per year at Black Thunder and 95 million tons per year at North Antelope Rochelle, for a total of 230 million tons per year. And according to the Energy Information Administration's (EIA) 2008 Energy Outlook Report, relied on heavily by all parties, the United States produced 1.16 billion tons of coal in 2006, and was predicted to produce roughly the same in 2010. Using simple division, one can arrive at the percentage. Plaintiffs cite to a declaration from a resource economist for the percentage, but

and South Hilight leases will extend the life of the Black Thunder mine by approximately four years; the North and South Porcupine leases will extend the life of the North Antelope Rochelle mine by approximately nine years. Without these leases, the existing mines would cease operations after the currently leased reserves are depleted. The North Hilight lease was never sold, although the BLM did prepare a ROD for it. Mining has already commenced under three of the four leases, as counsel stated at oral argument. In total, the tracts at issue contain approximately two billion tons of recoverable coal.

Pursuant to NEPA, BLM prepared a Draft Environmental Impact Statement (DEIS) for the leases. 74 Fed. Reg. 32,642-01 (July 8, 2009). In the DEIS, BLM compared its preferred action (denominated Alternative 2 in the DEIS) to a no action alternative in which none of the coal leases would be issued, as it was required to do under CEQ regulations. 40 C.F.R. § 1502.14. Regarding carbon dioxide emissions and impacts on climate change, BLM concluded that there was no appreciable difference between the United States's total carbon dioxide emissions under its preferred alternative and the no action alternative. BLM concluded that, even if it did not approve the proposed leases, the same amount of coal would be sourced from elsewhere, and thus there was no difference between the proposed action and the no action alternative in this respect.

doing so is unnecessary and inadmissible as extra-record evidence. See App. at 267–68.

BLM then received comments on the DEIS, including from Plaintiffs. WildEarth Guardians commented that BLM's conclusion on carbon dioxide emissions under the no action alternative was "at best a gross oversimplification, and at worst entirely impossible." App. at 725. They argued that if the tracts were not leased, "it will be very difficult for domestic coal mines," or international coal mines, to replace that quantity of coal at the same price, making "other sources of electricity," with lower carbon dioxide emissions rates, "more competitive with coal." Id. at 725–26. WildEarth Guardians concluded that the authorization of the leases would have a significant effect on national carbon dioxide emissions as compared to the no action alternative, and that BLM therefore failed to adequately compare the alternatives. WildEarth Guardians did not provide BLM with any factual support for its argument against BLM's replacement theory, nor did they suggest that BLM use the economic modeling tools employed by other federal agencies under similar circumstances.

In its responses to comments, BLM stood by its conclusion regarding the comparative demand for coal and resulting carbon dioxide emissions. It acknowledged that cost is one factor which "determine[s] the potential for switching to non-carbon based electric generation," and that "if the demand for coal decreases nationwide, then coal production and coal mining would decrease." Id. at 48. But it did not acknowledge that denying the Wright Area Leases would have any effect on the price for coal or thereby demand for it. Instead, the BLM

concluded that because Energy Information Administration (EIA) projections indicated that population and energy demand would rise, and that coal would remain the largest fuel in the energy mix, demand for coal would remain static even in the face of the potential reduction in supply. The BLM stated that “[l]imiting one or even several points of fuel supply will not affect coal use because of the diverse group of national and international suppliers.” Id. at 41.

The BLM published its Final Environmental Impact Statement (FEIS) for the Wright Area Leases in July, 2010. The FEIS acknowledges some basic presumptions that no one in this litigation contests: the quantity of coal proposed in these leases would result in approximately 382 million tons of annual carbon dioxide emissions from electricity generation, id. at 987, which is the equivalent of roughly 6% of the United States’s total emissions in 2008, see id. at 984, anthropogenic carbon dioxide emissions contribute to climate change, id. at 977–80, climate change presents a litany of environmental harms disbursed throughout the globe, id. at 980–82, and if the nation’s energy mix shifts towards non-coal energy sources, less carbon dioxide would be emitted. Id. at 997–98.

However, the BLM’s contested conclusion regarding comparative carbon dioxide emissions from the no action alternative remained in the FEIS:

It is not likely that selection of the No Action alternative[] would result in a decrease of U.S. CO2 emissions attributable to coal mining and coal-burning power plants in the longer term, because there are multiple other sources of coal that, while not having the cost, environmental, or safety advantages, could supply the demand

for coal beyond the time that the Black Thunder . . . and North Antelope Rochelle mines complete recovery of the coal in their existing leases.

Id. at 988. For purposes of this conclusion, the BLM “assum[ed] that all forms of electric generation would grow at a proportional rate to meet forecast electric demand” in 2010, 2015, and 2020. Id. at 984. The FEIS relies on various governmental reports, including the EIA’s Annual Energy Outlook reports from 2008, 2009, and 2010. Under these projections, coal’s share of the energy mix continues to represent the largest portion of the United States’s energy mix. The BLM predicted that overall demand for coal in the United States was predicted to grow during the life of the Wright Area Leases.

The BLM then concluded that, because overall demand for coal was predicted to increase, the effect on the supply of coal of the no action alternative would have no consequential impact on that demand. This long logical leap presumes that either the reduced supply will have no impact on price, or that any increase in price will not make other forms of energy more attractive and decrease coal’s share of the energy mix, even slightly.

The BLM acknowledged that many forces might impact future demand for coal, but it continued to disagree that a lack of supply leading to an increase in price could be one of those forces. Additionally, BLM also repeatedly noted that PRB coal enjoys several cost advantages over coal from other regions, but again,

disavows the possibility that the no action alternative, in which half of current PRB production would stop, would impact the price of coal or the demand for it.

Following the FEIS, BLM issued a ROD for each of the four tracts, deciding to offer them for lease. Each ROD is practically identical in its discussion of the climate change implications of the no action alternative. BLM addressed this issue as follows:

Denying this proposed coal leasing is not likely to affect current or future domestic coal consumption used for electric generation.

Based on the[] studies [BLM consulted], even with a considerably more optimistic projection for renewable sources, coal use continues to be projected as the largest portion of the domestic electric fuel mix. As described in the Final EIS, the key determinant of energy consumption is population. As human population and activities have increased over time, coal and other carbon-based fuels have been utilized to provide for these additional energy demands.

Further, BLM disagrees with the comment that denying the proposed Federal coal leasing application would consequentially reduce the overall rate of national coal consumption by electric generators. Numerous mines located outside of the PRB extract and produce coal in the United States [and] many mines outside of the PRB have the capacity to replace the coal production generated by the Black Thunder Mine [and the North Antelope Rochelle mine].

The inability of the Black Thunder Mine, or any other existing PRB producer, to offer reserves in the coal market would not cause electric generators to stop burning coal. Utility companies will likely operate existing coal-burning facilities until either cost or regulatory requirements render them ineffective or they are replaced

by other reliable large scale capacity electric generation technologies capable of consistently supporting the bulk electrical demands.

Id. at 1057–58.

Finally, and somewhat contradictory to its assertions regarding replacement coal not having an effect on the market, BLM noted that:

PRB coal has competed for an increasing share of coal sales in the market primarily because it [ha]s lower cost, [is] environmentally compliant, and [its] successful post-mining reclamation has been thoroughly demonstrated. For these reasons, over the past several decades, PRB coal has been replacing other domestic coals in the open market, and would be expected to compete similarly in the future When current reserves are depleted at these mines, their production would likely be replaced by other domestic and, potentially, international coal producers with coal that is more costly, less environmentally compliant, and has greater residual environmental impact.

Id. at 1059.

Since BLM’s decision, North and South Porcupine and South Hilight have already been leased. As mentioned, North Highlight has not yet been sold. The South Hilight tract went to Ark Land Company; the Porcupine tracts are leased to BTU Western Resources, Inc.

In 2012, Plaintiffs challenged the four RODs and the FEIS in federal district court in three consolidated cases. The State of Wyoming intervened, as did a group of mining interests (BTU Western Resources, Inc., the National Mining Association, and the Wyoming Mining Association, collectively, Mining Appellees). The New York University School of Law’s Institute for Policy

Integrity (the Institute) filed a motion for leave to file an amicus brief in support of the Plaintiffs' position, which we now grant. The Plaintiffs objected to BLM's no action alternative analysis before the district court, among various other issues, but the district court did not specifically address it. In the end, the district court upheld the BLM's actions as reasonable, and Plaintiffs timely appealed this narrow issue.

II.

The Mining Appellees challenge the Plaintiffs' Article III standing. See U.S. Const. Art. 3 § 2 (limiting the jurisdiction of federal courts to "cases" and "controversies"). The remaining Appellees (BLM and the State of Wyoming) do not.

The Plaintiffs must show that their individual members have standing; that is, that they (1) have suffered or will imminently suffer a concrete and particularized injury that is (2) fairly traceable to the challenged agency action, and (3) likely to be redressed by a favorable decision. Lujan v. Defenders of Wildlife, 504 U.S. 555, 560–61 (1992). Next, the Plaintiffs must demonstrate that the "interests at stake are germane to the organization's purpose" and that "neither the claim asserted nor the relief requested requires the participation of individual members in the lawsuit." Friends of the Earth, Inc. v. Laidlaw Envtl. Servs., Inc., 528 U.S. 167, 181 (2000); Hunt v. Wash. State Apple Adver. Comm'n, 432 U.S. 333, 343 (1977). Article III standing must be established for

each form of relief sought, Summers v. Earth Island Inst., 555 U.S. 488, 493 (2009), and assessed “at the time the suit is filed.” WildEarth Guardians v. Pub. Serv. Co. of Colorado, 690 F.3d 1174, 1185 (10th Cir. 2012) (relying on Laidlaw, 528 U.S. at 189); see also Clapper v. Amnesty Int’l USA, 133 S. Ct. 1138, 1157 (2013) (“[W]e assess standing as of the time a suit is filed.”).

The Plaintiffs have standing; they have proved every element. The environmental impacts of the Wright Area Leases are germane to the purposes of both the Sierra Club and the WildEarth Guardians. As for injury in fact, Plaintiffs presented declarations from individual members establishing harms to their personal aesthetic and recreational interests in the Thunder Basin National Grasslands, which would be adversely affected by the mining leases. The Supreme Court has repeatedly acknowledged this type of injury as sufficient. Laidlaw, 528 U.S. at 183. In a NEPA challenge, “[t]o establish causation, a plaintiff need only show its increased risk is fairly traceable to the agency’s failure to comply with [NEPA]” and the agency’s resulting “uninformed decisionmaking.” Committee to Save the Rio Hondo v. Lucero, 102 F.3d 445, 451-52 (10th Cir. 1996). Here, the Plaintiffs pointed out that the increased risk of environmental harm is directly tied to BLM’s inadequate alternatives comparison. “[T]he normal standards for redressability are [also] relaxed” in the NEPA context. Id. at 452 (quoting Defenders of Wildlife, 504 U.S. at 572 n.7). “[A] plaintiff need not establish that the ultimate agency decision would change upon

[NEPA] compliance” but “rather . . . that its injury would be redressed by . . . requiring the [agency] to comply with [NEPA]’s procedures.” Id. Here, Plaintiffs argued that their injuries are redressable through the relief they seek: vacatur of the BLM’s FEIS, RODs, and the resulting leases. Sierra Club v. U.S. Dep’t of Energy, 287 F.3d 1256, 1265–66 (10th Cir. 2002) (“The alleged injury is the potential environmental impact of an uninformed decision to” move forward with a particular project. “This injury is redressable by a court order requiring the [agency] to undertake an NEPA . . . analysis in order to better inform itself of the consequences of its decision.”).

Mining Appellees argue that Plaintiffs lack standing to litigate this appeal for two alternative reasons: (1) the Plaintiffs never had standing to challenge BLM’s climate change analysis because their alleged injuries are not caused by climate change, or (2) the Plaintiffs had a form of derivative standing in the district court because they also challenged localized environmental impacts, but lost their standing on appeal by abandoning that challenge. Neither of these arguments is persuasive.

First, it is not the case that Plaintiffs’ injury must be tied to the particular deficiency alleged in the FEIS, i.e., that Plaintiffs must allege a climate-change related injury in order to have standing to challenge BLM’s analysis of climate change impacts. If anything, Supreme Court precedent indicates that we should focus on the *form of relief*, rather than the *arguments* upon which that relief might

be based. See Duke Power Co. v. Carolina Env'tl. Study Grp., Inc., 438 U.S. 59, 72–79 (1978). In Duke Power, the Court summarized the defendants' argument, and “declined to accept” it: “Since the environmental and health injuries claimed by appellees [resulting from the construction of a new nuclear power plant in their area] are not directly related to the constitutional attack on the Price-Anderson Act [authorizing construction], such injuries, the argument continues, cannot supply a predicate for standing.” Id. at 78. The Court was unconvinced because “but-for” the challenged statute, plaintiffs' injuries would not occur. Id. “Where a party champions his own rights, and where the injury alleged is a concrete and particularized one which will be prevented or redressed by the relief requested, the basic practical and prudential concerns underlying the standing doctrine are generally satisfied when the constitutional requisites are met.” Id. at 80–81.

Our own precedents indicate that the legal theory and the standing injury need not be linked as long as redressability is met. See Rio Hondo, 105 F.3d at 452; S. Utah Wilderness All. v. Office of Surface Mining Reclamation & Enf't, 620 F.3d 1227, 1233–34 (10th Cir. 2010) (concluding that aesthetic and recreational environmental injuries conferred standing to challenge agency decision on whether the mining company's time window to commence mining had expired).

We have not specifically addressed whether local, non-climate injuries may support standing for a challenge to NEPA climate change analysis, but the

District of Columbia Circuit has.³ In WildEarth Guardians v. Jewell, 738 F.3d 298 (D.C. Cir. 2013), the court concluded that WildEarth Guardians had standing to challenge inadequate NEPA analysis of climate change impacts “based on their members’ aesthetic and recreational injuries caused by local pollution,” and did not require climate-based injury because “[v]acatur of the BLM order would redress the Appellants’ members’ injuries.” Jewell, 738 F. 3d at 306. Relying on Duke Power, the District of Columbia Circuit rejected the argument that “the specific type of pollution causing the Appellants’ aesthetic injury be the same type that was inadequately considered.” Id. at 307. Such a requirement would, in that court’s words, “slice[] the salami too thin.” Id.

Alternatively, Mining Appellees argue that, even if Plaintiffs had standing to challenge the climate change analysis in the district court, they lost that standing on appeal. Mining Aplee. Br. at 9–10. We disagree. We have explained

³ Several district courts have also addressed the issue, but are not unanimous. WildEarth Guardians v. Bureau of Land Mgmt., 8 F. Supp. 3d 17, 29–30 (D.D.C. 2014), appeal dismissed, No. 14-5137, 2014 WL 3014914 (D.C. Cir. June 20, 2014) (finding Article III standing in identical situation); High Country Conservation Advocates v. U.S. Forest Serv., 52 F. Supp. 3d 1174, 1186 (D. Colo. 2014) (same); WildEarth Guardians v. U.S. Forest Serv., 828 F. Supp. 2d 1223, 1235 (D. Colo. 2011) (same); Amigos Bravos v. U.S. Bureau of Land Mgmt., 816 F. Supp. 2d 1118, 1127–36 (D.N.M. 2011) (under different facts, finding no injury or causation where injury alleged was change to New Mexico climate resulting from the oil and gas lease and there was a lack of support showing impacts to local geographic area); Kunaknana v. U.S. Army Corps of Engineers, 23 F. Supp. 3d 1063, 1081–83 (D. Alaska 2014) (affidavits did not support group’s members’ actual or imminent use of the area subject to proposed agency action, and rejecting the “contiguous ecosystem” argument).

that “[t]he plaintiff bears the burden to establish standing at the time the suit is filed, and if the defendant’s offending conduct has ceased by that time, we dismiss for lack of redressability. But if the offending conduct ceases after the suit is filed, the defendant must establish mootness by showing that its offending conduct ‘could not reasonably be expected to recur.’” WildEarth Guardians, 690 F.3d at 1185–86 (quoting Laidlaw, 528 U.S. at 189). Here, Mining Appellees point to no facts that suggest the Plaintiffs did not have standing to sue when they filed their complaint, as previously noted. Neither do the Mining Appellees argue that the facts undergirding the Plaintiffs’ standing argument have changed, causing the case to moot since the Plaintiffs filed the Complaint. We therefore conclude that the Plaintiffs have standing to bring this lawsuit.

III.

Turning to the merits, the central issue in this case is whether the BLM’s assumption that there was no real world difference between issuing the Wright area leases and declining to issue them because third party sources of coal would perfectly substitute for any volume lost on the open market should the BLM decline to issue the leases was arbitrary and capricious. We hold that it was.

A. Standard of Review

We apply the same standard of review as the district court in this administrative challenge: the familiar “arbitrary and capricious” standard. Richardson, 565 F.3d at 704-05; 5 U.S.C. § 706(2)(A) (“The reviewing court shall

. . . hold unlawful and set aside agency action, findings, and conclusions found to be . . . arbitrary, capricious, an abuse of discretion, or otherwise not in accordance with law.”). An agency’s decision is arbitrary and capricious if the agency (1) “entirely failed to consider an important aspect of the problem,” (2) “offered an explanation for its decision that runs counter to the evidence before the agency, or is so implausible that it could not be ascribed to a difference in view or the product of agency expertise,” (3) “failed to base its decision on consideration of the relevant factors,” or (4) made “a clear error of judgment.” Richardson, 565 F.3d at 704 (quoting Utah Env’tl. Cong. v. Troyer, 479 F.3d 1269, 1280 (10th Cir. 2007)). “[T]he arbitrary and capricious standard focuses on the rationality of an agency’s decision making process rather than on the rationality of the actual decision” Colo. Wild v. United States Forest Serv., 435 F.3d 1204, 1213 (10th Cir. 2006). “This standard of review is ‘very deferential’ to the agency’s determination, and a presumption of validity attaches to the agency action such that the burden of proof rests with the party challenging it.” Kobach v. United States Election Assistance Comm’n, 772 F.3d 1183, 1197 (10th Cir. 2014).

In the NEPA context, an agency’s EIS is arbitrary and capricious if it fails to take a “hard look” at the environmental effects of the alternatives before it. See All Indian Pueblo Council v. United States, 975 F.2d 1437, 1445 (10th Cir. 1992). We have characterized our review of whether agencies took the requisite “hard look” as a “rule of reason standard (essentially an abuse of discretion

standard).” Utahns for Better Transp. v. U.S. Dep’t of Transp., 305 F.3d 1152, 1163 (10th Cir. 2002), as modified on reh’g on other grounds, 319 F.3d 1207 (10th Cir. 2003); Richardson, 565 F.3d at 708-09. This means that “[a] court reviewing the adequacy of an EIS merely examines ‘whether there is a reasonable, good faith, objective presentation of’ the topics NEPA requires an EIS to cover.” Holy Cross Wilderness Fund v. Madigan, 960 F.2d 1515, 1522 (10th Cir. 1992) (quoting Johnston v. Davis, 698 F.2d 1088, 1091 (10th Cir. 1983)). We have also stated that the reasons for rejecting an alternative must be “plausible.” All Indian Pueblo Council, 975 F.2d at 1446. The agency may choose the more environmentally harmful alternative provided its reasons for doing so are disclosed and rational. See Forest Guardians v. United States Forest Serv., 495 F.3d 1162, 1173 (10th Cir. 2007) (The agency “acknowledged that the project would cause a number of significant environmental problems -- including dust, noise, and diesel fumes -- but, as noted by USFS, it opted to pursue the project anyway based on other considerations. Idiosyncratically, NEPA does not require more.”).

B. NEPA Analysis

The Plaintiffs argue the BLM’s substitution assumption rendered its comparison of the preferred alternative (issuing the leases) and the no action alternative arbitrary and capricious for two reasons: the assumption itself was arbitrary and capricious because it lacks support in the administrative record and

ignores basic supply and demand principles; and it ignored readily available tools to measure the market impact of such a large contraction in the nation's coal supply, which amounts to a failure to acquire the information "essential to a reasoned choice among alternatives." Aplt. Br. at 32 (quoting 40 C.F.R. § 1502.22(a)). Plaintiffs argue that the FEIS and RODs therefore do not comply with NEPA and CEQ regulations and should be vacated. We address these arguments in turn.

1. The Perfect Substitution Assumption

The Plaintiffs' first argument is persuasive. They assert that the BLM's assumption of "replacement" lacks any support in the administrative record. As a factual matter, we agree. The BLM did not point to any information (other than its own unsupported statements) indicating that the national coal deficit of 230 million tons per year incurred under the no action alternative could be easily filled from elsewhere, or at a comparable price. It did not refer to the nation's stores of coal or the rates at which those stores may be extracted. Nor did the BLM analyze the specific difference in price between PRB coal and other sources; such a price difference would effect substitutability.

Wyoming argues on appeal, and vigorously asserted at oral argument, that the record supports a conclusion that failing to issue the leases would not impact the nation's coal supply and thus would not impact the national price of coal because the replacement coal would come from within the PRB, and enjoy the

same cost advantages over other regions. But BLM never indicated on the record that coal from within the PRB would replace that extracted under these leases (possibly to avoid any perception of agency capture); to the contrary, its statements indicate only that replacement coal would come from outside the region.

We also agree with the Plaintiffs that the BLM's assumption was contradicted by one of the principal resources on which it relies. The BLM did not acknowledge portions of EIA's 2008 Energy Outlook which contradict its conclusion, and thus these portions of the report are not in the FEIS or RODs. However, BLM relied on other excerpts of this report, and it seems only appropriate to look to other portions of that same source for a more complete picture of the EIA's forecasts and expertise on the coal markets.

Principally, Plaintiffs point to a portion of the 2008 Energy Outlook which explains that an increase in coal prices would affect national demand for coal because it would compete less effectively against other sources of energy. Although, as BLM points out, the report generally predicts an increase in coal production, "different assumptions about economic growth (which mainly affect overall electricity demand) and about the costs of producing fossil fuels (which primarily determine the mix of supply sources for generation and petroleum products) lead to different results." App. at 580. The 2008 Energy Outlook states:

Alternative assumptions for coal mining and transportation costs affect delivered coal prices and demand. Two alternative coal cost cases developed for [this report] examine the impacts on U.S. coal markets of alternative assumptions about mining productivity, labor costs, and mine equipment costs on the production side, and about railroad productivity and rail equipment costs on the transportation side. In the high coal cost case, the average delivered coal price in 2006 dollars is \$2.76 per million Btu in 2030—52 percent higher than in the reference case (Figure 96). As a result, U.S. coal consumption is 4.8 quadrillion Btu (16 percent) lower than in the reference case in 2030, reflecting both a switch from coal to natural gas, nuclear, and renewables in the electricity sector and reduced CTL [coal-to-liquids] production. In the low coal cost case, the average delivered price in 2030 is \$1.29 per million Btu—29 percent lower than in the reference case—and total coal consumption is 2.1 quadrillion Btu (7 percent) higher than in the reference case. *Id.* at 581; *see also id.* at 678 (Table D12 of EIA 2008 Energy Outlook, showing a projected difference of 26% in coal use from the “low cost” case in 2030 to the “high cost” case).

Thus, the report supports what one might intuitively assume: when coal carries a higher price, for whatever reason that may be, the nation burns less coal in favor of other sources. A force that drives up the cost of coal could thus drive down coal consumption.

Seemingly counter to its entire argument, BLM admits that the 2008 Energy Outlook “undoubtedly predicts that coal demand may decline in response to increased coal price, and BLM has never suggested otherwise.” BLM Br. at 32. But, BLM argues, overall increased demand for electricity will override the effect of increased coal prices. But there is no evidence in the record that BLM considered the potential impact of increased price on demand but rather BLM merely concluded it would have no impact. The record contains only BLM’s conclusions that the effect on demand would be “inconsequential,” with no

reference to how, or if, it decided which demand-driving factors would prevail or why.

That this perfect substitution assumption lacks support in the record is enough for us to conclude that the analysis which rests on this assumption is arbitrary and capricious. True, “the mere presence of contradictory evidence does not invalidate the Agencies’ actions or decisions.” Wyo. Farm Bureau Fed’n v. Babbitt, 199 F.3d 1224, 1241 (10th Cir. 2000). If the agency is faced with conflicting evidence or interpretations, “[w]e cannot displace the agencies’ choice between two conflicting views, even if we would have made a different choice had the matter been before us de novo.” Custer Cty. Action Ass’n v. Garvey, 256 F.3d 1024, 1036 (10th Cir. 2001); see also Holy Cross Wilderness Fund v. Madigan, 960 F.2d 1515, 1527 (10th Cir. 1992) (quoting Friends of the Earth v. Hall, 693 F. Supp. 904, 922 (W.D. Wash. 1988) (“A federal court is not in the business of resolving scientific disagreements between plaintiffs’ experts and the [agency’s] experts.”)).

But this assumption nevertheless falls below the required level of data necessary to reasonably bolster the Bureau’s choice of alternatives. A number of our cases discuss the quality of evidentiary support sufficient to avoid our concluding that a challenged NEPA analysis is arbitrary and capricious. The evidence must be sufficient in volume and quality to “sharply defin[e] the issues and provid[e] a clear basis for choice among options.” Citizens’ Comm. to Save

Our Canyons v. Krueger, 513 F.3d 1169, 1179 (10th Cir. 2008) (quoting 40 C.F.R. § 1502.14); see also All Indian Pueblo Council, 975 F.2d at 1444 (“Concerning the requisite level of detail necessary, what is required is information sufficient to permit a reasoned choice of alternatives as far as environmental aspects are concerned.” (quotation omitted)). Here, the blanket assertion that coal would be substituted from other sources, unsupported by hard data, does not provide “information sufficient to permit a reasoned choice” between the preferred alternative and no action alternative. It provided no information.

Even if we could conclude that the agency had enough data before it to choose between the preferred and no action alternatives, we would still conclude this perfect substitution assumption arbitrary and capricious because the assumption itself is irrational (i.e., contrary to basic supply and demand principles). “We apply a rule of reason standard (essentially an abuse of discretion standard) in deciding whether claimed deficiencies in a FEIS are merely flyspecks, or are significant enough to defeat the goals of informed decisionmaking and informed public comment.” Utahns, 305 F.3d at 1163.

We have not previously addressed when the assumptions an agency makes in its EIS render its analysis unreasonable in violation of the “rule of reason.” However, the Supreme Court’s non-NEPA APA cases are helpful. We look to these cases because the APA sets the minimum procedural requirements all

agencies must satisfy when taking formal action. See Vt. Yankee Nuclear Power Corp. v. NRDC, 435 U.S. 519, 525 (1978).

In Baltimore Gas & Electric Co. v. NRDC, 462 U.S. 87 (1983), the Supreme Court upheld the Nuclear Regulatory Commission's conclusion that permanent nuclear waste storage would not have a significant environmental impact, which was based on the Commission's assumption that the waste repositories would perform perfectly. Id. at 89. The Court upheld the agency's decision based on the zero release assumption after considering three factors: (1) it had a limited purpose in the overall environmental analysis, i.e., it was not the key to deciding between two alternatives; (2) overall, the agency's estimation of the environmental effects was overstated, so this single assumption did not determine the overall direction the NEPA analysis took; and (3) courts are most deferential to agency decisions based not just on "simple findings of fact," but in the agency's "special expertise, at the frontiers of science." Id. at 102-04.

Here, the BLM's substitution assumption appears to be quite different from the Commission's zero release assumption under the three factor analysis in Baltimore Gas. First, the BLM's perfect substitution assumption was key to the ultimate decision to open bidding on the leases. In each of the four RODs, the "Reasons for Decision" section first discusses the leases' effect on coal combustion in the nation overall, then lists the other facts that influenced its decision in bullet points. In each ROD, the discussion opens with the assertion

that: “Denying this proposed coal leasing is not likely to affect current or future domestic coal consumption used for electric generation.” E.g., App. at 1057-58. Prioritizing the carbon emissions and global warming analysis in the RODs suggests that this question was critical to the decision to open the leases for bidding. Prioritizing the perfect substitution assumption within that analysis suggests it was critical to deciding between two alternatives: whether or not to issue the leases. The perfect substitution assumption was more than a “mere flyspeck” in the BLM’s NEPA analysis. Richardson, 565 F.3d at 704.

Second, the BLM’s carbon emissions analysis seems to be liberal (i.e., underestimates the effect on climate change). The RODs assume that coal will continue to be a much used source of fuel for electricity and that coal use will increase with population size. We do not owe the BLM any greater deference on the question at issue here because it does not involve “the frontiers of science.” The BLM acknowledged that climate change is a scientifically verified reality. Climate science may be better in 2017 than in 2010 when the FEIS became available, but it is not a scientific frontier as defined by the Supreme Court in Baltimore Gas, i.e., as barely emergent knowledge and technology. Balt. Gas, 462 U.S. at 92. Moreover, the climate modeling technology exists: the NEMS program is available for the BLM to use.

Plaintiffs also cite authority questioning other agency assumptions similar analytically to the perfect substitution assumption. The primarily disputed

case—Mid States Coalition for Progress v. Surface Transp. Bd., 345 F.3d 520 (8th Cir. 2003)—is not on point. In that case, the Eighth Circuit rejected an agency’s argument that it did not need to consider the effect on air quality of building a national coal railway because the exact impact was speculative. Id. at 548-50. The agency’s FEIS had concluded that any emissions the rail project caused would comply with any statutory caps and thus have only a known effect on air quality, an assumption that ignored how emissions not subject to statutory caps would affect air quality. Id. at 550.

Mid States is distinguishable from the present case. The agency there had “completely ignored the effects of increased coal consumption” and “made no attempt” to meet the CEQ regulation requirements. Id. at 550. Here, the BLM has not completely ignored the effects of increased coal consumption, but rather it has analyzed them irrationally.

This deficiency is more than a mere flyspeck. Richardson, 565 F.3d at 704. The BLM’s perfect substitution assumption was key to the ultimate decision to open bidding on the leases. In each of the four RODs, the “Reasons for Decision” section first discusses the leases’ effect on coal combustion in the nation overall, then lists the other facts that influenced its decision in bullet points. In each ROD, the discussion opens with the assertion that: “Denying this proposed coal leasing is not likely to affect current or future domestic coal consumption used for electric generation.” E.g., App. at 1057-58. Prioritizing the carbon emissions and

global warming analysis in the RODs suggests that this question was critical to the decision to open the leases for bidding. Prioritizing the perfect substitution assumption within that analysis suggests it was critical to deciding between two alternatives: whether or not to issue the leases.

Moreover, failing to adequately distinguish between these alternatives defeated NEPA's purpose. We have explained that if the EIS is so deficient as to "defeat NEPA's goals of informed decisionmaking and informed public comment," then it is arbitrary and capricious. See Richardson, 565 F.3d at 704. In order for the agency's conclusions to be upheld, "an agency must 'examine[] the relevant data and articulate[] a rational connection between the facts found and the decision made.'" Id. at 713 (quoting Citizens' Comm. to Save Our Canyons, 513 F.3d at 1176) (alterations in original). NEPA has two purposes: prevent uninformed agency decisions and provide adequate disclosure to allow public participation in those decisions. See Methow Valley, 490 U.S. at 349; Colo. Env'tl. Coal. v. Dombeck, 185 F.3d 1162, 1172 (10th Cir. 1999); see also Marsh v. Or. Nat. Res. Council, 490 U.S. 360, 371 (1989) (referring to "the Act's manifest concern with preventing uninformed action"). Failing to disclose the data critical to the key distinction between two alternatives led to what appears, on the record, to be an uninformed agency decision and did not adequately disclose the BLM's rationale to the public.

Therefore, we hold that it was an abuse of discretion to rely on an economic assumption, which contradicted basic economic principles, as the basis for distinguishing between the no action alternative and the preferred alternative.

2. Modeling Tools

The Plaintiffs argue that because the BLM assumed perfect substitution, it failed to take additional efforts to determine climate impact, a failure that “prevented the agency from ‘providing a clear basis for choice among options by the decisionmaker and the public.’” Aplt. Br. at 33 (quoting 40 C.F.R. §1502.14). It points to an available computer modeling system, National Energy Modeling System (NEMS), the BLM might have used. Contrary to BLM’s and Wyoming’s characterizations, Plaintiffs do not argue that the failure to use these models, in and of itself, was arbitrary and capricious or invalidates the FEIS or the RODs. Nor could Plaintiffs make such an argument here, since they did not argue for the necessity of modeling in their comments on the DEIS. See Gilmore v. Weatherford, 694 F.3d 1160, 1169 (10th Cir. 2012).

Plaintiffs’ modeling argument is not persuasive. “NEPA does not require agencies to adopt any particular internal decisionmaking structure.” Balt. Gas, 462 U.S. at 100; see also Utahns, 305 F.3d at 1166. Choosing not to adopt a modeling technique does not render the BLM’s EIS arbitrary and capricious; its irrational and unsupported substitution assumption does. We therefore decline to find that the EIS and RODs arbitrary and capricious for this reason.

C. Deference

Despite these deficiencies, BLM argues that it is entitled to deference in its area of expertise. BLM is correct that agencies receive deference on factual determinations made within their special area of expertise. FERC v. Elec. Power Supply Ass'n, __U.S.__, 136 S. Ct. 760, 782 (2016). Here, BLM argues that comparing the demand for coal under its proposed alternative and the no action alternative is within its area of expertise because 43 C.F.R. 3425.4(a)(1) requires it to hold a public hearing “on the environmental assessment or environmental impact statement, the proposed sale and the fair market value and maximum economic recovery on the proposed lease tract” before it issues mineral leases. It is debatable whether BLM’s conclusion on the economic implications of the no action alternative falls squarely within BLM’s expertise, especially since it needed to cite EIA and DOE for its minimal economic analysis, rather than relying on internal expertise. Cf. Balt. Gas, 462 U.S. at 99–104 (deferring to the Nuclear Regulatory Commission on impacts of nuclear waste storage, “at the frontiers of science”); Marsh, 490 U.S. at 376–83 (deferring to Corps of Engineers and Oregon Department of Fish & Wildlife internal expert opinions on turbidity and temperature impacts of a forestry project). In any case, there is nothing for the court to defer to here. BLM did not provide any reasoning or analysis for its conclusion that the no action alternative would bear no consequential difference to the proposed leases, other than noting that overall coal

demand was projected to increase under the EIA's baseline assumptions. BLM's reliance on expertise deference doctrine is therefore unhelpful.

We therefore decline to extend the additional layer of deference the BLM requests.

D. Harmless Error

The BLM argues that if it erred, any error was harmless. See 5 U.S.C. § 706 (“due account shall be taken of the rule of prejudicial error”); Richardson, 565 F.3d at 708 (“The harmless error rule applies to judicial review of administrative proceedings, and errors in such administrative proceedings will not require reversal unless Plaintiffs can show they were prejudiced.” (quoting Bar MK Ranches v. Yuetter, 994 F.2d 735, 740 (10th Cir.1993))). The BLM argues that even if it had discovered a significant difference in carbon dioxide emissions between the two alternatives, it would have proceeded with the leases nonetheless.

The BLM has forfeited any harmless error claim by failing to argue it before the district court. See Richison v. Ernest Grp., Inc., 634 F.3d 1123, 1128 (10th Cir. 2011). We therefore decline to address it.

E. Relief

Plaintiffs have requested that we:

(1) declare that BLM violated NEPA in issuing the Wright Area Final EIS and Records of Decision for the North Hilight, South Hilight, North Porcupine, and South Porcupine leases; and (2) vacate each

BLM's authorization, sale, and issuance of the North Hilight, South Hilight, North Porcupine, and South Porcupine leases, including the Wright Area Final EIS and individual Records of Decision challenged here.

Aplt. Br. at 39.⁴ They requested the same relief from the district court. To the contrary, BLM argues that the appropriate form of relief would be to “reverse and remand to the district court with instructions to remand to BLM, and not grant injunctive relief or vacatur.” BLM Br. at 40 n.6.

Under the APA, courts “shall” “hold unlawful and set aside agency action” that is found to be arbitrary or capricious. 5 U.S.C. § 706(2)(A). Vacatur of agency action is a common, and often appropriate form of injunctive relief granted by district courts. It is, however, a different question whether we may grant vacatur of BLM's decision, or if we must remand to the district court with instructions to do so.

⁴In April, 2016, while appeal before this court was pending, BTU Western's parent company, Peabody Energy Corporation, filed for chapter 11 bankruptcy. Stipulation and Consent Order Concerning Pending Litigation, at 1. BTU Western had successfully bid on and been issued the leases to North Porcupine and South Porcupine, and these properties are included in the schedule of assets in the bankruptcy proceeding. Schedule G, Voluntary Petition for Bankruptcy, at 1. Bankruptcy stays can limit litigation concerning the property. See, e.g., Bd. of Governors of the Fed. Reserve Sys. v. MCorp Fin., 502 U.S. 32, 38 (1991); see also 11 U.S.C. § 362(a)(1). Concerned about the future of their case, Plaintiffs entered a Stipulation, which the bankruptcy court approved, withdrawing their request for vacatur of the leases. Stipulation and Consent Order Concerning Pending Litigation, at 3-4. As of April 3, 2017, BTU Western was dismissed from the bankruptcy proceedings. The Plaintiffs reinstated their request for vacatur.

In the past, we have done all of the following when placed in a similar posture: (1) reversed and remanded without instructions, (2) reversed and remanded with instructions to vacate, and (3) vacated agency decisions. See Richardson, 565 F.3d at 721 (requiring BLM to conduct an EIS, rather than issuing a FONSI, but merely reversing and remanding to the district court without vacating the FONSI); Utah Envtl. Cong. v. Bosworth, 439 F.3d 1184, 1195 (10th Cir. 2006) (where agency violated requirements of the Endangered Species Act, “revers[ing] the district court’s order affirming authorization of the Project and remand[ing] to the district court with instructions to vacate the Forest Service’s approval of the Project”); Utah Envtl. Cong. v. Richmond, 483 F.3d 1127, 1140 (10th Cir. 2007) (in a challenge under the National Forest Management Act [NFMA], also under arbitrary-and-capricious review, reversing the district court’s “reject[ion]” of the plaintiff’s challenge, and “remand[ing] to the district court so it may remand to the Forest Service for further administrative action consistent with this opinion”); Ecology Ctr., Inc. v. U.S. Forest Serv., 451 F.3d 1183, 1195 (10th Cir. 2006) (in another NFMA challenge, reversing the district court’s dismissal and remanding to the district court with instructions “to enter an order vacating the Forest Service’s approval of the” project); New Mexico Cattle Growers Ass’n v. U.S. Fish & Wildlife Serv., 248 F.3d 1277, 1285-86 (10th Cir. 2001) (“set[ting] aside” Fish & Wildlife’s critical habitat designation under the

Endangered Species Act, “instruct[ing]” the Service to issue a new designation, and reversing and remanding to the district court).

We decline to vacate the leases. First, because Plaintiffs challenge a fairly narrow issue, the district court may vacate the entire FEIS and RODs, or it might fashion some narrower form of injunctive relief based on equitable arguments the parties have failed to make here. Second, the question remains what will happen to the leases which have already been issued and whether mining the lease tracts should be enjoined—a question that the parties have not touched on in their arguments before us. Third, the Appellees stated at oral argument that the three leases that were issued are currently being mined.

IV.

We hold that the BLM’s EIS and RODs were arbitrary and capricious and thus REVERSE the district court. We REMAND with instructions to enter an order requiring the BLM to revise its EIS and RODs. We do not, however, vacate the resulting leases.

BALDOCK, J., concurring.

The Administrative Procedure Act provides that courts shall “hold unlawful and set aside agency action, findings, and conclusions [that are] . . . arbitrary [and] capricious.” 5 U.S.C. § 706(2)(A). We have held that an agency engages in “arbitrary” and “capricious” action when, *inter alia*, it “offer[s] an explanation for [such action] that runs counter to the evidence before the agency.” *New Mexico ex rel. Richardson v. Bureau of Land Mgmt.*, 565 F.3d 683, 704 (10th Cir. 2009) (internal citation omitted). The question before us is whether the Bureau of Land Management (BLM) engaged in arbitrary and capricious action when it issued the Wright Area leases on the assumption that there would be no “consequential[]” reduction in coal use, and thus environmental impact, if it were to decline to issue such leases. The relevant environmental impact for purposes of this appeal is climate change, and the BLM has conceded that carbon dioxide emissions from coal use cause climate change. *See App.* at 978, 987.

The Court’s opinion ably sets forth why, in light of the BLM’s concession that coal use causes climate change, the BLM’s assumption that declining to issue the Wright Area leases would not result in less climate impact renders the decision to issue the leases arbitrary and capricious: (1) declining to issue the Wright Area leases would have the effect of removing some twenty percent of the nation’s present annual coal supply from the market; (2) replacement coal would be more costly; (3) as the cost of coal goes up, “basic supply and demand principles” predict that demand for coal goes down; and (4)

lessened demand for coal results in less use of coal, which results in less impact on the climate. To assume that declining to issue the Wright Area leases would not have a “consequential[]” impact on coal use, and thus the climate, the Court concludes, runs counter to basic supply and demand principles. Consistent with this conclusion, the Court characterizes the BLM’s analytical flaw as an “economic” one in its opinion. *See* Court’s Op. at 28.

Because the question before us is an economic one, and because in resolving that question we dispose of this appeal, I see no need to comment on matters of climate science, as the Court does when it attempts to distinguish this appeal from *Baltimore Gas & Elec. Co. v. Nat. Res. Def. Council, Inc.*, 462 U.S. 87 (1983). In *Baltimore Gas*, the Supreme Court held the Nuclear Regulatory Commission’s assumption that permanent storage of nuclear waste would not result in environmental harm was not arbitrary and capricious in part because the assumption dealt with an “area of special expertise, at the frontiers of science” and thus merited deference from the Court. *Id.* at 103-06. The obvious distinction between this appeal and *Baltimore Gas* is this appeal does not turn on scientific expertise; it turns, instead and in this Court’s words, on “basic economic principles.” *See* Court’s Op. at 29. Perplexingly, the Court does not cite this distinction in addressing *Baltimore Gas*. The Court attempts, instead, to distinguish this appeal from *Baltimore Gas* by positing that unlike assumptions about nuclear waste storage, assumptions about climate change “do[] not involve ‘the frontiers of science’” because “[c]limate science . . . is not a scientific frontier.”

The assertion that climate science is settled science is, in my view, both unnecessary to this appeal and questionable as a factual matter. Such an assertion is not necessary to this appeal because there is no disputed issue of climate science before us and thus no question of climate science we must decide whether to defer to the BLM on.¹ As set forth above, we can distinguish *Baltimore Gas* on other grounds. The assertion is questionable as a factual matter because it is contrary to evidence in the record. Section 4.2.14.1 of the Final Environmental Impact Statement (FEIS) states that “the science [of climate change] is not settled and there is strong debate among the scientific community that natural variability is the overwhelming factor influencing climate rather than the accumulation of anthropogenic GHG emissions in the atmosphere.” App. at 977. The FEIS also states that “[t]here has been, and continues to be, considerable scientific investigation and discussion as to the causes of the recent historic rise in global mean temperatures, and whether the warming trend will continue,” and “[g]lobal climate models are at this time imperfect and . . . should not be used as a basis for public policy.” *Id.* at 978, 982. The Court neither addresses these statements nor cites any authority seconding its assertion that climate science is settled science. Contrary to this Court’s

¹ Even if a question of climate science was before us, I am not inclined to agree with the Court’s view that we ought not defer to agencies on such a question. “Federal judges lack the scientific, economic, and technological resources an agency can utilize in coping with issues” involving climate change and regulation of greenhouse gas emissions. *Am. Elec. Power Co. v. Connecticut*, 564 U.S. 410, 428 (2011). “Judges may not commission scientific studies or convene groups of experts for advice” *Id.* We are, instead, “confined by a record comprising the evidence the parties present.” *Id.* In view of our limitations, it seems to me that matters of climate science and its attendant policy implications are precisely the type of questions we should defer to agencies on under the present state of the law.

assertion, the Supreme Court has recognized that opposing views exist on climate science. *See Am. Elec. Power Co. v. Connecticut*, 564 U.S. 410, 417 n.2 (2011).

In commenting on the merits of climate science, I fear the Court suggests we have adjudicated the BLM's concession about climate change as a dispositive matter, when the validity of such concession was never before us on this appeal. The oft-cited axiom that we decide only the matters before us counsels us to be more prudent with our choice of commentary. *See, e.g., Johnson v. United States*, 559 U.S. 133, 144 (2010) ("The issue is not before us, so we do not decide it."). Accordingly, I concur with the Court's analysis of the BLM's economic assumption and disposition of this appeal on that basis, without joining its conclusion about climate science.

ATTACHMENT C

ENDANGERED SPECIES

Dams seen driving 'mass extinction' of salmon

Jeremy P. Jacobs, E&E News reporter • Published: Tuesday, September 26, 2017



PacifiCorp's 126-foot "Copco 1" concrete dam on Northern California's Klamath River is one of four impoundments that block fish runs on the waterway, decimating salmon and steelhead populations. Jere P. Jacobs/E&E News

For millennia, Native Americans subsisted on a spring run of chinook salmon returning to the Klamath River in Northern California.

That changed when the last of four dams was built on the river in 1962 and the number of "springers" plunged, a catastrophic turn missed by federal regulators who lumped together the spring and fall salmon runs.

Now, new genetic research seems to confirm what the tribes have known for generations: The spring-run chinook are unique. They are fatter, look different and taste better. To survive, they must get to areas beyond the four dams on the Klamath for cold-water habitat in the spring and summer.

SPECIAL REPORT

DAMAGE

American dams — symbols of the nation's 20th century might — are crumbling. E&E News examines efforts to avert disaster as pressure grows for a new era of dam building in the arid West. [Click here](#) to view the series.

The study could spur new protections — if it's not too late.

"The extinction rate," Karuk Tribe leader Leaf Hillman said, "shows we are paying for the sins of the past 100 years of development in the West."

Klamath chinook are among many imperiled salmon subspecies in California, which has nearly 1,600 named dams. Recent research suggests the state is heading toward an epidemic of extinction, with dams playing a major role.

Within 100 years, nearly three-quarters of the state's remaining 31 species of salmon, steelhead and trout are expected to go extinct, according to research by the nonprofit California Trout Inc. and Peter Moyle, associate director of the Center for Watershed Sciences at the University of California, Davis.

Nearly half of those species will likely be gone in the next 50 years unless greater actions are taken, decimating what were once among the most productive commercial fisheries on the West Coast.

Ecosystems are complex, but freshwater fishes are on the cusp of extinction for a simple reason.

"We want the water," Moyle said.

The problem extends beyond California, although the state's 20th-century dam-building may earn it the ignoble title of the leader of mass extinction.

As journalist Elizabeth Kolbert chronicled in "The Sixth Extinction: An Unnatural History," there is a constant background extinction rate.

"Mass extinctions are different," Kolbert wrote. "Instead of a background hum, there's a crash, and disappearance rates spike."

There are signs it has already begun. The difference from the previous five major extinction events — such as the one that wiped out the dinosaurs — is that the current one is human-caused, or anthropogenic.

Kolbert largely focuses on climate change and the 365 billion metric tons of carbon dioxide that humans have added to the atmosphere since the Industrial Revolution began in the 18th century by the burning of fossil fuels.

A growing body of research, however, suggests dams — which block fish runs and sediment, regulate river flows, change water temperature, inundate habitat and spur invasive species — may be as significant. Freshwater fishes and other species including amphibians will be among the first to go.

Catherine Reidy Liermann of the University of Wisconsin, Madison, has published several papers examining the drivers of that extinction rate, such as pollution and overfishing.

"Dams are the big one," she said in an interview. "We're already seeing species losses associated with dams, and no doubt they play a role in the 'sixth extinction.'"

The problem may only get worse, Liermann added.

"There is a large proportion of the world's freshwater fisheries that could be gone just from dams," she said.

North American freshwater species are dying off fastest, and many of the extinctions are linked to the dam-building frenzy of the 20th century.

More than 120 North American freshwater species have gone extinct since 1900, Anthony Ricciardi of McGill University and Joseph Rasmussen of the University of Lethbridge found in a 1999 paper. They concluded that while the public often focuses on terrestrial endangered species — polar bears and butterflies, for example, are more compelling than mollusks and crayfish — North American freshwater species are expected to go extinct at a rate that is five times faster, making it one of the "most stressed" ecosystems on the planet.

Similar research from Noel Burkhead of the U.S. Geological Survey in 2012 concluded that since 1989, the number of extinct North American fish species has increased by 25 percent. Up to another 86 species may disappear by 2050, he found, and the new extinction rate for North American freshwater fishes is "conservatively" estimated to be 877 times greater than the natural background rate.

"Extinction in our rivers and streams in North America is the leading edge of the extinction crisis," said Noah Greenwald, endangered species director of the Center for Biological Diversity.

North America has exported the problem.

Half of the nearly 300 large river systems in the world have been fractured by dams, including some that are home to the globe's most biologically diverse ecosystems. Scientists have estimated that 10,000 to 20,000 freshwater species are extinct or at risk, a number rivaling the ice age at the end of the Pleistocene Epoch that wiped out much of the world's megafauna.

Those are conservative estimates because a larger number of freshwater species have yet to be cataloged. Many will go extinct before they are discovered.

And while there has been a downturn in major dam building in the United States, the world is entering a new phase of dam construction after a 1990s slowdown.

There are about 3,700 large hydropower dams proposed or under construction around the world, according to a database compiled by Christiane Zarfl of the University of Tübingen in Germany.

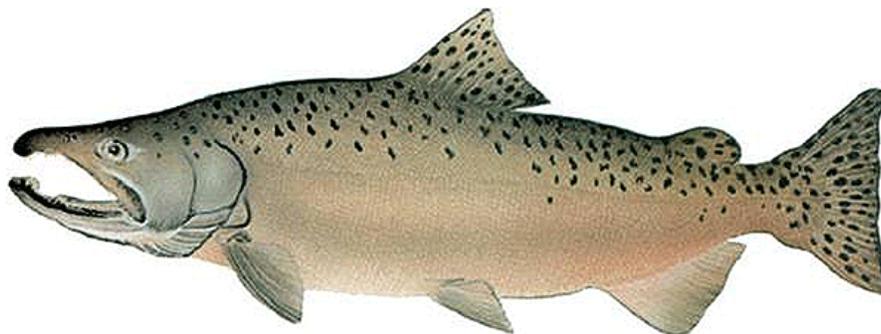
Zarfl's database underestimates the total number of dams that may be built; it includes only hydropower dams, not those used for water storage or delivery.

Yet she found that most are concentrated in developing countries with emerging economies, including nations in Southeast Asia, South America and Africa. And many will affect the world's biological hot spots, such as the Mekong River Basin in Asia and the Amazon River Basin in South America.

Zarfl concluded that the dams will be erected on more than a 20 percent of the globe's remaining free-flowing rivers.

"The current boom in hydropower dam construction is unprecedented in both scale and extent," she wrote in a 2014 paper. "The economic, ecological and social ramifications are likely to be major."

'Devastating to our fish'

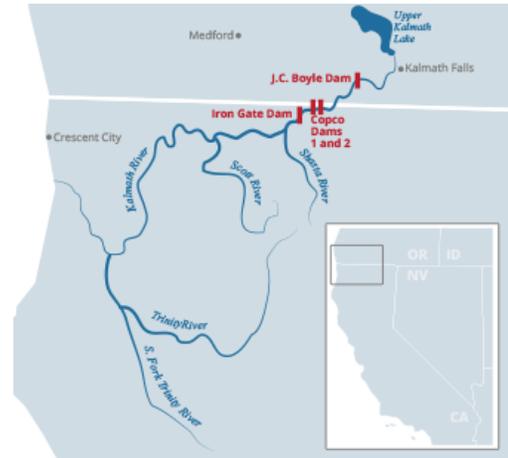


Adult chinook salmon. NOAA Fisheries

In a remote area of Northern California, the Klamath River provides a near-perfect case study of the impact of dams on fish.

The river flows 253 miles from southern Oregon through the steep Siskiyou Mountains before arriving at the Pacific Ocean near Eureka, Calif. It's the second-largest river in the state by volume, and the rugged terrain it runs through has kept it far less developed than California's other main waterways — the Sacramento and San Joaquin rivers.

Historically, the Klamath was the home of two prolific runs of chinook salmon, one in the spring and another in the fall.



[+] The Klamath River begins in the high desert of southern Oregon before snaking south and west 253 miles to the Pacific Ocean. It is considered an "upside-down" river because its water is cleaner and runs faster at its mouth than at its headwaters. Claudine Hellmuth/E&E News

Four hydroelectric dams that were constructed from 1918 to 1962 — ending at the lowermost Iron Gate Dam — blocked those runs.

The spring-run salmon once totaled more than 100,000 annually. Recent returns have averaged less than 2,000, and a survey this year found 110, the lowest return in the two decades since the counts started, according to the tribes.

"It's been devastating to our fish," said Rich Nelson, the head of the watershed program for the Yurok Tribe, which lives near the mouth of the Klamath.

The tribes have always known that the spring-run fish are different from the fall-run. New research backs them up.

Last month, researchers from the University of California, Davis, found that spring-run chinook and summer steelhead — referred to as "premature migrators" because they return to freshwater streams from the ocean to spawn earlier — are genetically different than their fall-run (for chinook) and winter-run (for steelhead) relatives.

Specifically, the research team found that a single gene differentiates the premature migrators from fall- and winter-run fish. And, importantly, that gene has only evolved once within each species.

Since 1998, however, NOAA Fisheries and state regulators have treated the two groups of fish as the same species — or "evolutionary significant unit" and "distinct population segment" under the Endangered Species Act.

The Center for Biological Diversity in 2011 petitioned NOAA Fisheries to separate the spring- and fall-run chinook, but the agency denied the request. The Karuk Tribe plans to petition again based on the new research.

A spokesman for NOAA Fisheries declined to comment on how the research could affect any listing decisions.

The predominant reasoning for grouping the two runs together has been that even if the spring-run chinook go extinct, fall-run salmon could quickly evolve into spring-run to replace them.

The [UC-Davis research](#) counters that, suggesting such an evolution would take many thousands to millions of years.

Tasha Thompson, a co-author of the study, said it's clear that the dams have "definitely had an impact" for a few reasons.

The spring chinook and summer steelhead must reach colder sections of the river farther upstream than their fall and winter counterparts.

"Being able to utilize habitat late-migrating fish gives springs and summers a big advantage — it's probably their main evolutionary reason for existing," Thompson said in an email.

The dams, she said, disrupt the natural flow regimes and temperature of the river. As a result, the fall and winter runs occupy the same habitat as the early migrators and often outcompete them for resources.

Michael Miller, another co-author of the study, added that this problem isn't unique to the Klamath. It applies to all spring salmon and summer steelhead runs in the Pacific Rim.

The results also underscore regulatory shortcomings.

Conservation efforts under the Endangered Species Act are limited to "distinct population segments" and, in the terms of NOAA regulations, "evolutionary significant units." But neither the law nor NOAA provides a clear definition of either term, which is partly why regulators have lumped the fall-run and spring-run Klamath chinook together.

"That has unbelievable ramifications — it is basically life or death for these species," Miller said. "Our results show that we definitely need to do more to protect these species."

What's 'extinction'? It's complicated

Species on the brink: Irrawaddy dolphin



The Irrawaddy Dolphin. Dan Koehl/Wikipedia

With its protruding forehead and flattened snout, Southeast Asia's Irrawaddy dolphin looks like the star of a children's book, a baby beluga whale.

One of the most imperiled Irrawaddy dolphin populations inhabits a 180-mile stretch of Laos' Mekong River.

There are 80 or so dolphins left in the river, and they are threatened by construction of the Don Sahong Dam.

The 100-foot-tall hydropower dam is being built a few miles from the Laos-Cambodia border. It will block the river's main stem — a key migratory passage for the Irrawaddy dolphin and about 70 percent of the other fish species in the river basin.

Don Sahong is part of rapid hydropower development along the 2,700-mile-long Mekong River, which begins in Tibet and winds through six countries en route to the South China Sea.

China has built at least six dams on its part of the river since the mid-1990s and plans to construct more. Laos — one of the world's poorest countries — plans to build additional dams, using financing from other countries, and to export hydropower from those projects.

James Dalton, director of the International Union for Conservation of Nature's Global Water Programme, said the dolphins are a "massively important species."

There is always an ecological trade-off in dam construction, Dalton said, but in many instances, dams can be built in areas where their ecological damages might be limited, yet they can generate enough electricity to satisfy investors.

In the Don Sahong's case, he said, the ecosystem impacts are particularly egregious.

If the dam cannot be stopped before its scheduled completion in 2019, Dalton said, it would be a "sad, sad state of affairs that shows that conservationists really aren't hitting the mark. Something really isn't working."

— *Jeremy P. Jacobs*



A Fish and Wildlife Service hatchery truck is loaded with chinook salmon from the Sacramento River. The Coleman National Fish Hatchery in Northern California was established in the 1940s in an attempt to mitigate the impact of dams on the spawning habitat for salmon and other fishes. Steve Martarano/U.S. Fish and Wildlife Service

Other biologists have turned their attention to another term with a fuzzy regulatory meaning: extinction.

In a controversial paper this April, Moyle and UC Davis colleague Jason Baumsteiger argued that regulators and conservationists need to devise a better framework for assessing extinction.

Around the world, they noted, "extinction of a lineage is not well defined legally."

In the United States the Endangered Species Act provides little guidance. The Fish and Wildlife Service may, for example, delist an endangered species as extinct. But that's a discretionary act, they note, not a mandatory one.



Staff examine salmon eggs at Iron Gate Hatchery on the Klamath River. Dr. Mark Clifford/California Department of Fish and Wildlife/Flickr

As the dispute regarding the spring-run chinook on the Klamath River demonstrates, there are countless species and subspecies that are not listed to begin with.

"Extinction is one of those things that seems to be yes or no, but actually gets complicated," Moyle said.

Many species, Moyle and Baumsteiger, who has since moved on to the University of the Pacific, conclude, may be functionally extinct, meaning they exist in such low numbers that they could disappear tomorrow and wouldn't affect the ecosystem.

More controversially, they note that a common mitigation measure for dam building in the United States in the 20th century has hastened one type of extinction.

Hatcheries, they argue, are a main driver of a phenomenon called "mitigated extinction," which they define as when a species is entirely reliant on human intervention for survival.

For example, the migratory path of winter-run chinook salmon on the Sacramento River was blocked when the 600-foot Shasta Dam, one of the country's largest impoundments, was built in the 1930s.

To mitigate that impact, a hatchery was installed, as were spawning areas below the dam.

The hatchery has significantly weakened the species by reducing its genetic diversity, according to experts. Hatchery fish tend to be less intelligent and less adaptable to their surroundings. And they compete with wild salmon for resources.

"We're essentially changing its evolutionary trajectory, so it's not the same as the fish that was there 10 to 20 years ago," Moyle said. "So what do you call it? At some point, winter-run becomes a species that survives only because it's produced in a hatchery. What do we have then?"

On the nearby Klamath, tribes like the Karuk and Yurok hope PacifiCorp's plan to remove the four farthest downstream dams will proceed in January 2020. It would be the largest dam-removal project in the country's history, although some hurdles still remain, including Federal Energy Regulatory Commission approval ([Greenwire](#), March 13).

"Short of removing dams and allowing that natural access to spawning grounds in the upper basin," Hillman of the Karuk Tribe said, "you're doing nothing but putting Band-Aids over bullet holes. You're not going to recover the species."



Karuk Tribal Leader Leaf Hillman.
Jeremy P. Jacobs/E&E News

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ATTACHMENT D

**The Proposed Northern Pass
Transmission Project:
Assessing its impacts on New Hampshire**

**Susan F. Tierney
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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.

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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.

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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.

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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.

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 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.

- **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”

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.

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).

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 terminal³ 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 proposal⁹ 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

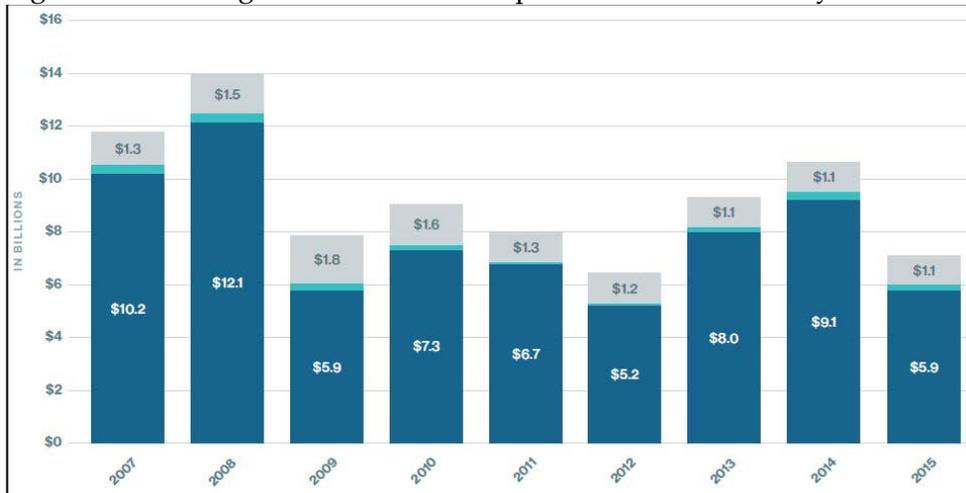
energy expenditures within their economies and to produce local jobs. This reduces our dependence on imported sources of energy and can decrease our vulnerability to supply and price volatility. In addition, because all of New Hampshire’s local sources are renewable, increasing the use of in-state energy 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 England²³ – 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 report³⁴ (“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/or 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):
 - o 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?
 - o 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.
 - o 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):
 - o 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?
 - o 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?
 - o 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 unsupported 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 #9³⁹ (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.

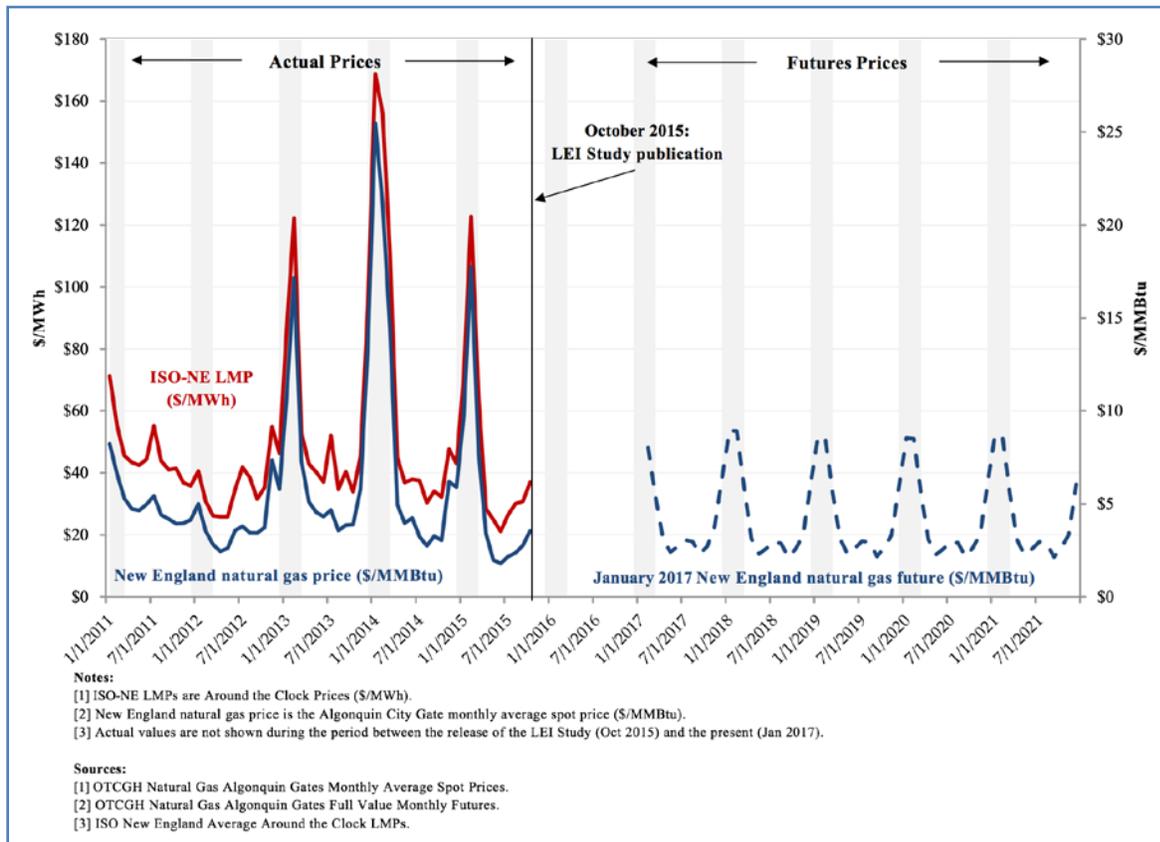
In particular, LEI's assumptions regarding natural gas fuel prices appear to be based on data that no longer reflects market realities. As highlighted in Figure 2 below, LEI's assumptions were based on data reflecting a time when, historically, New England natural gas prices had seen significant price 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



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.

	Clean Energy			
	RPS Class I ACP Rate	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 generating 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 been 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 MW of 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, “Dynergy, Inc”, January 18, 2017, page 2, available at <https://neo.ubs.com/shared/d1dakHJYZIT7/>.

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 Michael 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

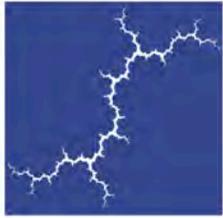
⁶³ ISO-NE CELT report, Table 2.1.

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.

ATTACHMENT E



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Hydropower Greenhouse Gas Emissions

State of the Research

February 14, 2012

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1. Introduction

A. Purpose and Scope

Hydroelectric generation of electricity (hydropower) is commonly thought of as renewable, sustainable, and lacking in emission of atmospheric pollutants; however, these assumed benefits are rarely evaluated critically in the context of policymaking, as new reservoirs and dams are rarely proposed in North America, outside of Québec and Labrador.

This report reviews the state of information regarding one key policy consideration: how hydropower stacks up against other technologies with respect to greenhouse gas (GHG) emissions—including the life cycle emissions from the construction and operation of generating capacity. An important aspect of the analysis is a comparison of not only the “typical” amount of GHG emissions from each technology, but a presentation of the range of values that may be observed. The report also discusses concerns about the way GHG emissions are measured, especially in the case of hydropower, and best practices for doing so. Finally, the report discusses a specific policy consideration: the relative trade-off (from a GHG emission perspective) of Canadian hydropower imports versus other energy options for New England.

This report approaches GHG emission estimates by critically considering a variety of primary sources for the various technologies. Section 2 provides a brief review of hydropower’s role in the electric industry in North America; a discussion of the types of GHG emissions from hydropower and other electric generation technologies; and an explanation of GHG measurement concepts. Section 3 presents the range of estimates of GHG emissions from existing hydropower facilities and compares those emissions to those from facilities using other technologies, including oil, natural gas, and coal. Section 4 discusses various issues that arise in the consideration and understanding of the GHG emission results and the methodologies used in the literature, including certain important caveats that apply to those results. Section 5 offers recommendations for use in policy-making contexts, including planning around additional Canadian hydropower imports. Section 6 lists the primary source material used.

B. Key Findings

Based on the literature reviewed, we find that hydropower development does emit greenhouse gases (GHGs), but the *rate* of emissions per unit of electric generation from hydropower (excluding tropical reservoirs) is much lower than for fossil fuel technologies.¹ This conclusion is discussed in more detail in Sections 3 and 4.

Lifecycle GHG emission ranges for hydropower and fossil fuel technologies are presented in Table 1 below.

¹ Tropical reservoir issues will be revisited below, but unless otherwise specifically stated, this report will discuss non-tropical reservoir hydropower.

Table 1. Approximate Lifecycle GHG emission rate ranges by fuel type for electricity generation²

Technology	GHG emissions rates (kg CO ₂ eq/MWh)
Hydroelectric facility (run of river or non-tropical reservoir)	0.5 – 152
Hydroelectric facility (newly flooded reservoir only, boreal)	160 – 250
Hydroelectric facility (tropical reservoirs)	1300 – 3000
Natural gas-fired power plant	400 – 500
Oil-fired power plant	790 – 900
Coal-fired power plant	900 – 1200

The largest sources of GHG emissions for hydropower are the construction of the facilities, and biomass decomposition from reservoir flooding. In addition, there are ongoing net differences between the carbon uptake and respiration of the pre-flooding and post-flooding biomes and water columns. Along with methodological disparities, biomass decomposition is the largest source of uncertainty in the GHG emission estimates; the rate of decomposition is also highly dependent not only on the climate zone (e.g., tropical, boreal, etc.), but also on the specifics of the flooded biome (e.g., old river, wetlands, forest, etc.). Emission uncertainties from biomass decomposition may remain large—and site dependent—as the relevant modeling is complex.

For fossil fuel technologies, the main sources of variability relate to potential carbon capture / sequestration technologies (for new facilities), whose efficiency, effectiveness, and infrastructure requirements are speculative, and a variety of operational issues that affect the amount of electricity produced over a plant’s lifetime for a given amount of construction / decommissioning emissions and for a given amount of fuel burned.

Overall, life cycle GHG emissions per unit of electric energy production are lower for hydropower than for fossil fuel sources (though in some cases net hydro emission ranges may be nearly 2/3 those for a natural gas power plant), and may be in the same range as other renewable sources and nuclear (though reservoir hydro emission ranges are likely higher than those for at least some other renewable options, depending on the specific site and the level of indirect emissions, which are not included in Table 1 above).

Recent studies have further shown that, during the first several years after reservoir creation, hydro GHG emissions may be higher than annual emissions for some fossil fuel sources. This is surprising, given the lower GHG emission ranges reported in earlier studies. The ultimate level to which newly flooded reservoir emissions decline over time is uncertain.

An important GHG policy question in comparing potential new generating facilities or imports is “but for the new facility or import, what emissions would have occurred?” This requires consideration of what generators (existing or new, within or without the regions in question) will not

² Note that ranges for all technologies except “hydroelectric facility (tropical reservoirs)” and “hydroelectric facility (newly flooded reservoir only, boreal)” are estimates based on figures in Raadal et al. (2011). Raadal et al. (2011) does not contain a thorough review of tropical hydro emission rates; for this emission source, Weisser (2006) and Demarty and Bastien (2011) were used. Estimates for a newly flooded boreal reservoir were derived by Synapse based on data contained in Teodoru *et al.* (2010) and are explained further below. The units used (kg CO₂eq per MWh) are explained below.

be built or will run less often if the facility under consideration is built. One approach is to examine displaced or avoided generation by looking at the marginal emissions in the affected region or regions. Due to their high fuel cost and the ability of some of them to ramp up and down fairly quickly, natural gas generators are typically the last to be dispatched in any given hour in both New England and New York. Therefore, marginal emissions in both regions are about the same as for natural gas generators. However, one study found, “. . . increased export of hydroelectricity by Hydro Québec to the United States likely was a contributor to increased generation from fossil-fuel-fired sources in other regions in Canada.”³

³ Steenhof, Paul, and C.J. Weber, 2011, An assessment of factors impacting Canada’s electricity sector’s GHG emissions, *Energy Policy* 39, 4089–4096.

2. Background

A. Hydroelectric Generation

With global demand for electric energy expected to grow steadily over the next 25 years, hydropower is being looked to as an important source of global energy production.⁴

Demarty and Bastien (2011) note that the increase in energy demand worldwide, in addition to raising concerns about GHG emissions, “have put hydroelectricity in the forefront of green energies. Indeed, according to Bates *et al.*, 2008, hydroelectricity is the only non-intermittent renewable energy and could therefore sustain the development of other renewable energies.”⁵

Hydropower has several special features that affect its role in the generation mix, beyond its energy output and capacity. For example, it does not necessarily rely on outside sources or fossil fuels to restart after an outage, making its existence, even in small amounts, quite valuable as part a utility’s plan for recovering from a blackout (its “black start plan”). Hydropower can start up on short notice, as it does not depend on gently warming up boilers or turbines, and can ramp up or down in output quite rapidly. Hydropower facilities with ponding (i.e., not run of river units) can serve an energy banking function, helping to level load and price spikes. Hydropower sources with ponding are typically energy limited rather than capacity limited. That is, the amount of energy produced in a time period, say a year, depends on the amount of water available, not just the size of the unit. These factors all affect the value, economically and from an engineering standpoint, of hydropower.

Today, hydropower is the most common form of renewable energy, accounting for 16.3% of global energy production due its long history of development and exploitation compared to other types of renewable generation. In Canada, 59% of electricity generated in the country came from hydroelectric sources in 2008, although that is down from 62% in 1990.⁶ In the U.S., data indicates that 6.6% and 22.8% of electricity generated in New England and New York, respectively, came from hydroelectric sources. (See Table 2, below.)

Table 2. 2010 Net Generation (MWh)⁷

	New England	New York
Hydroelectric	8,025,563	25,471,697
Non-hydroelectric	121,702,164	111,489,957
% Hydroelectric	6.6%	22.8%

According to the EIA, about 19% of hydropower’s potential has been developed, globally. The *World Energy Council (WEC), Survey of Energy Resources 2007*, estimates the overall technical

⁴ IEA. *International Energy Outlook – Highlights*. Report #DOE/EIA-0484 (2010).

<http://www.eia.gov/oiaf/ieo/highlights.html>.

⁵ Of course, this is not strictly correct. Geothermal generation, for example, is not necessarily intermittent, and intermittent sources can be firmed up with storage as with molten salt solar thermal facilities. The point of the quotation, however, bears thought.

⁶ Steenhof and Weber, 2011, *op. cit.*

⁷ EIA Form 923 2010, 2010 December EIA-923 Monthly Time Series File, Page 1, “Generation and Fuel Data.” New York is the host for several very large hydropower projects on the U.S. side of the St. Lawrence River.

potential for hydropower to be more than 16,400 TWh/yr; in 2008, global hydropower production totaled just 3,288 TWh.⁸ The five countries with the highest potential include China, the United States, Russia, Brazil, and Canada.⁹

While there is clearly room for hydropower to grow (from a technical standpoint), its benefits and risks are rarely evaluated critically in the context of policymaking, as new reservoirs and dams are rarely proposed in North America, outside of Québec and Labrador. One reason is that most locations on North American rivers that were economically viable in comparison to fossil fuel generation (or energy efficiency) have already been developed. In fact, some that were developed before the large, international trade in oil have been decommissioned. Remaining undeveloped sites tend to be environmentally sensitive or costly to develop for the expected output.¹⁰ Environmental pressures, especially regarding restoration of aquatic habitat, have also limited the political viability of new hydropower and even led to the decommissioning of a small number of hydropower sites in the U.S.

As noted above, Québec and Labrador are exceptions. Both have extensive untapped hydropower potential at sites that provincial utilities intend to develop.¹¹ While many of those sites are in remote areas, transmission technologies advanced between 1960 and 1980 to the point where it has become technically and economically feasible to move thousands of megawatts of hydropower from such remote locations to urban load centers in the northeastern U.S. and in Canada. As a result, exports of power from far northern Québec and Labrador to southern Québec and the U.S., as well as between British Columbia and California, became a routine commercial activity.

Measuring Electrical Output

All electric generating units, including hydropower facilities, measure their electrical output in two different but related ways. Amounts of electric energy used or produced (e.g., in a year) are measured in megawatt-hours (MWh). When discussing an amount of electric energy produced (e.g., the number of MWh produced in a given year), the terms “generation,” “generated,” or “electric output” will be used. The amount of electric power produced or consumed at a given moment will be referred to as “load” or “demand,” respectively, while the amount that *can be* produced at a given moment will be referred to as “capacity.” Capacity is measured in kilowatts (kW) or megawatts (MW). The amount of energy that *is* produced by a generator in a given period is often compared to the amount it *could* have produced if running at full capacity 100 percent of the time. That ratio, expressed as a percent or as a number between zero and one, is called the plant’s capacity factor (CF).¹²

⁸ IEA. *Renewable Energy Essentials: Hydropower*. http://www.iea.org/papers/2010/Hydropower_Essentials.pdf, (2010). Worldwide hydropower produced 3,288 TWh in 2008, yet has the potential to produce > 16,400 TWh/yr.

⁹ Ibid.

¹⁰ See Section 4.C for options in this regard.

¹¹ Province of Québec. (2011, May 6). *BUILDING NORTHERN QUÉBEC TOGETHER. The Project of a Generation*. Retrieved from <http://www.plannord.gouv.qc.ca/english/documents/action-plan.pdf>.

Hydro Quebec. (2009). Strategic Plan (2009 – 2013). Retrieved from: http://www.hydroquebec.com/publications/en/strategic_plan/pdf/plan-strategique-2009-2013.pdf

Nalcor Energy website. Accessed December 2011. <http://nalcor.ca/lower-churchill-project.asp>

¹² W. Steinhurst, (2008), *The Electric Industry at a Glance*. National Regulatory Research Inst. Available at <http://www.synapse-energy.com/Downloads/SynapseReport.2011-01.0.Elec-Industry-Overview.10-076.pdf>

B. Greenhouse Gas Emissions

There are numerous substances that act as a GHG when emitted into the air.¹³ Due to the volume of their emission in energy production, the two of primary concern are carbon dioxide and methane, CO₂ and CH₄ (the main constituent of natural gas), respectively. CO₂ is emitted by the development and operation of fossil fired generators, as well as hydropower, and some CH₄ is emitted by some fossil fuel technologies. Both are also products of biomass decomposition at hydropower facilities.¹⁴

Each GHG has a different, quantitative effectiveness in trapping heat at the earth's surface; that effectiveness is referred to as the substance's global warming potential (GWP). In addition, each GHG degrades chemically over time in the atmosphere or is gradually absorbed by the ocean or another terrestrial geochemical cycle. Thus, GWP must be defined for a specific point in time after the emission of the GHG, similar to forecasting the economic value of an inventory of perishable goods. For example, during the first year after emission, a ton of CH₄ emitted into the atmosphere has 72 times the GWP as a ton of CO₂ emitted at the same time, while it has only 21 times the GWP of CO₂ over a 100-year period after emission. This is because CH₄ cycles out of the atmosphere faster than CO₂. Over 500 years, the ratio is 7.6.¹⁵

While GWP has shortcomings for short-lived GHGs, it is useful for comparing the potential climate change associated with emissions of different greenhouse gases. According to the IPCC, "The Global Warming Potential (GWP) is a useful metric for comparing the potential climate impact of the emissions of different LLGHGs [long-lived GHGs].... Global Warming Potentials compare the integrated radiative forcing [heat trapping effectiveness] over a specified period, say 100 years, from a unit mass pulse emission and are a way of comparing the potential climate change associated with emissions of different greenhouse gases."¹⁶ A 100-year time period is often used to compare the GWP of a mix of GHGs in policy discussions.

Using a chosen time period and the resulting GWP values, it is possible to determine the GWP of a mix of gases emitted by a power plant or its fuel cycle and to convert that total to a so-called CO₂ equivalent (CO₂eq or CO₂e). CO₂ equivalent is a measure used to compare the emissions from various greenhouse gases based upon their global warming potential (GWP). CO₂ equivalent for a given amount of a gas is derived by multiplying the weight of the gas emitted by that gas's GWP. For example, with a time period of 100 years, a ton of CH₄ has a CO₂eq as follows:

$$\text{CO}_2\text{eq of CH}_4 = (\text{weight of CH}_4) * (\text{the GWP of CH}_4)$$

or,

$$\begin{aligned}\text{CO}_2\text{eq of 1 ton of CH}_4 &= 1 \text{ ton CH}_4 * 21 \\ &= 21 \text{ tons.}\end{aligned}$$

¹³ For a list of those of concern to the United Nations, see, for example, Figure TS.5 and Table TS.2, in Solomon, S., D. Qin, M. Manning, *et al.*, 2007: Technical Summary. In: *Climate Change 2007: The Physical Science Basis. Contribution of Working Group I to the Fourth Assessment Report of the Intergovernmental Panel on Climate Change* [Solomon, S., D. Qin, M. Manning, Z. Chen, *et al.*, (eds.)]. Cambridge Univ. Press, Cambridge, UK, and New York, NY, USA.

¹⁴ Robert Dones, *et al.* *Life Cycle Inventories of Energy Systems: Results for Current Systems in Switzerland and other UCTE Countries*, Ecoinvent Data V2.0.,103 (2007).

¹⁵ Table TS.2 cited in footnote 13.

¹⁶ IPCC, *Climate Change 2007: The Physical Science Basis*, p. 31 ff.

By definition, the GWP of carbon dioxide is 1.

When considering GHG emissions and emission rates, it is crucial to distinguish between different units of weight as well as between gases with different GWPs. There are two aspects to this. First, there is a difference between tons (2000 U.S. pounds, sometimes called a short ton) and tonnes (1000 kilograms, or about 2204 U.S. pounds, sometimes called a metric ton).¹⁷ European scholarly works and UN and IPCC publications typically report in tonnes. U.S. scholarly and government publications vary in which unit they use. Second, data may be reported in terms of tons (or tonnes) of CO₂ or of carbon. A ton of CO₂ gas contains about 0.273 tons of carbon. (1 g C = 0.083 mole CO₂ = 3.664 g CO₂)¹⁸ There seems to be a trend to standardize in tonnes of CO₂ for reporting total amounts, but it is important to check units on every comparison. Similarly, units for emission rates must be verified, but kg CO₂eq per MWh appear to be gaining ground over pounds per MWh.

C. Life Cycle Analysis (LCA) of Emissions

Life cycle emissions for an electric generation facility include emissions associated with the construction and eventual decommissioning of the facility (often called indirect emissions), as well as any emissions resulting from the facility's operation (often called direct emissions). Ideally, life cycle GHG emissions for a generating facility are calculated over a long enough interval to address all effects stemming from the facility and its fuel cycle, and, in the case of hydropower, for the entire watershed. With respect to residence times, a 100-year interval was recommended by the IPCC (and has been adopted by the UNFCCC) as a standard time horizon for the comparison of greenhouse gas emissions.¹⁹ Note, however, that this report did not verify the extent to which life cycle analyses in the reviewed literature employed the 100-year interval.

Best practices dictate that a plant's emissions be analyzed according to a life cycle analysis (LCA) approach. LCA evaluates the sum of emissions from the complete energy chain (including the entire life cycle of the plant and its fuel), and allows for standardized comparisons. Dones et al. (2007) shows explicit examples of the energy use and non-energy emissions resulting from each

¹⁷ A long ton, sometimes called an Imperial ton, is defined as 2,240 pounds and is no longer used except for measuring the capacity of ships.

¹⁸ *Glossary: Carbon Dioxide and Climate*, 1990. ORNL/CDIAC-39, Carbon Dioxide Information Analysis Center, Oak Ridge National Laboratory, Oak Ridge, Tennessee. Third Edition. Edited by: Fred O'Hara Jr. Also available at <http://cdiac.ornl.gov/pns/convert.html>.

¹⁹ IPCC. *Climate change: the scientific basis. Contribution of Working Group I to the Third Assessment Report of the IPCC*. New York: Cambridge University Press (2006).
UNESCO-IHA. *The UNESCO-IHA measurement specification guidance for evaluating the GHG status of man-made freshwater reservoirs*. IHP/GHG-WG/5, 15 (June 4, 2009) (<http://unesdoc.unesco.org/images/0018/001831/183167e.pdf>). Recommending net GHG emissions from hydropower be calculated over 100 years in accordance with the IPCC.
IPCC, Task Force on National Greenhouse Gas Inventories. *Frequently Asked Questions*, Q1-2-4, Q1-2-11. <http://www.ipcc-nggip.iges.or.jp/faq/faq.html>. Q1-2-4. "How can you compare emissions of different gases? A: The radiative impact of a single GHG depends on the amount emitted and its specific properties. Currently, in reporting to the UNFCCC, Parties are asked to weigh their emissions by the "Global Warming Potential" (GWP). The GWP are calculated as the ratio of the radiative forcing of one kilogramme greenhouse gas emitted to the atmosphere to that from one kilogramme CO₂ over a period of time. The precise numbers to be used are laid down by the UNFCCC and at present they are for a 100 year time horizon. More recent estimates of GWP are given in the IPCC's third and fourth assessment reports."

stage in the construction and operation of facilities, as well as the extraction, refinement, transportation, and combustion of fuel used at the facility.

According to a 2007 report, “LCA studies systematically and adequately address the environmental aspects of product systems, from raw material acquisition to final disposal (from ‘cradle to grave’).²⁰ The International Organisation for Standardisation published international standards on LCA (International Organization for Standardization (ISO) 2006a; International Organization for Standardization (ISO) 2006b).” Life Cycle Analysis of emissions applies to all technologies in varying degrees.

The following table identifies the broad categories of LCA emissions.

Table 3. Categories of LCA emissions

Category of Emissions	Emission Sources
Direct emissions (from operation)	Combustion of fuels
	Operational fuel use
	Other emissions from operation (e.g., flooded land)
	Goods and services consumed during operation
Indirect emissions	Infrastructure
	Construction work
	Materials
	Transport
	Decommissioning and waste disposal

As reported below, LCA emission levels for new hydropower facilities are generally less than those from fossil fueled generators, and may be roughly comparable to, or somewhat higher than, various other renewable technologies.

D. Methodology and Sources

In the literature, there are many, occasionally conflicting, ranges for emission rates for hydroelectric and non-hydroelectric sources. Raadal *et al.* (2011) was chosen as the primary source of data in Figure 1 due to its recent publication date, comprehensive review of the literature, and analysis of a variety of emission sources. Raadal *et al.* (2011) does not contain a thorough review of tropical hydroelectric emission rates; for this emission source, Weisser (2006) and Demarty and Bastien (2011) were used. In addition, Teodoru *et al.* (2010) provides detailed field measurements of CO₂ flux for a newly flooded boreal reservoir (Eastmain 1).

²⁰ Frischknecht R., Jungbluth N., Althaus H.-J., *et al.* (2007) *Overview and Methodology. Ecoinvent report No. 1.* Swiss Centre for Life Cycle Inventories, Dübendorf, 2007

3. Results

This section presents the range of estimates of GHG emissions from existing facilities, including hydro facilities, other renewables, nuclear, and fossil fuel power plants (oil, natural gas, and coal). While the research shows that hydropower development does lead to greenhouse gas emissions, and while there is some indication that emissions from hydropower facilities in the first ten years may be high, over a plant's life cycle it appears that the rate of GHG emissions per unit of energy produced is lower for non-tropical hydropower than for fossil fuel generation sources.

A. GHG Emissions Ranges for Various Technologies

Until recently, the literature had indicated that hydropower life cycle emissions are relatively low (ranging from 0.5 – 152 kg CO₂eq/MWh)²¹ and are comparable to geothermal, nuclear, biomass, wind, and solar photovoltaic (PV) life cycle emissions. As shown in Figure 1 (below), those earlier estimates of hydropower life cycle emissions were much lower than those for fossil fuel sources, such as natural gas, oil, and coal.

Recently, detailed multi-year field measurement of the CO₂ emissions from a newly flooded boreal reservoir (Eastmain 1 in Quebec) has provided a slightly different perspective. Teodoru *et al.* (2010) presents measured CO₂ net fluxes for that reservoir as indicated in Table 4.

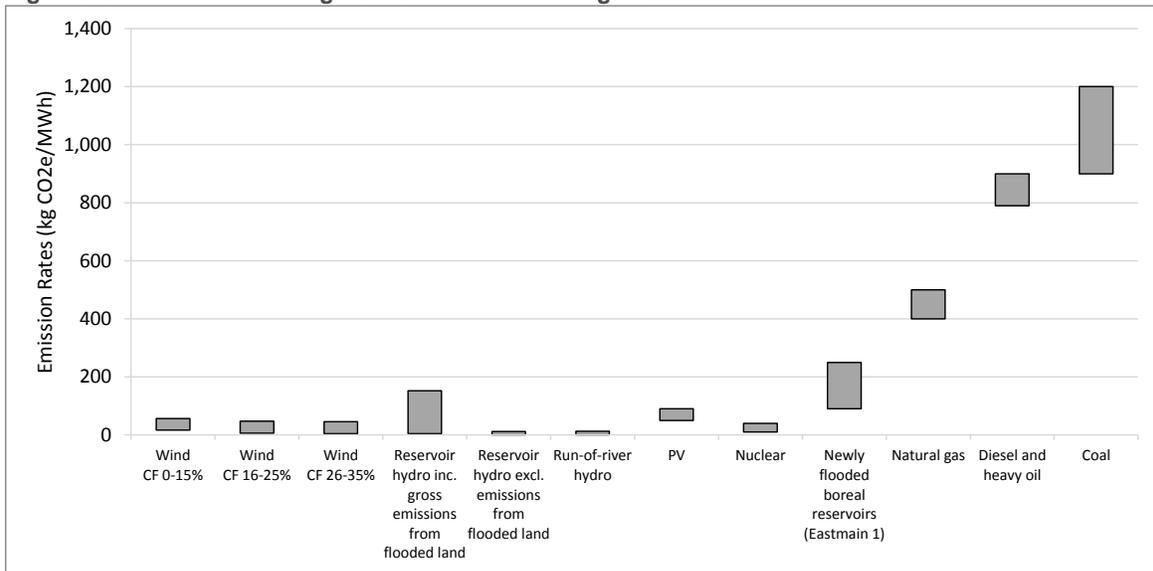
Table 4. Measured CO₂ fluxes at Eastmain 1

Year post flooding	kg CO ₂ eq/MWh
1	671
2	436
3	308
4	238

Teodoru *et al.* (2010) concludes that the rate at which emissions after Year 4 will decline is uncertain. For the purposes of this study, we assume a project lifetime of 100 years and two sets of emission rates after year 4: one set of high values representing no further decline (238 kg CO₂eq/MWh in all years beginning in Year 4), and a low-range set of values that declines linearly from the Year 4 value to a low of 147 kg CO₂eq/MWh in Year 14 and remains flat at 147 kg CO₂eq/MWh thereafter. Combining these data for CO₂ emission rates with the Eastmain 1 project's anticipated output of 2,700 GWh/year, we obtain a lifecycle average emission rate that ranges from about 160 to about 250 kg CO₂eq/MWh. This indicates that newly flooded boreal reservoirs, over their lifetime, may have CO₂ emission rates from about 1/3 to nearly 2/3 that of a natural gas combined-cycle plant.

²¹ Excluding tropical reservoirs.

Figure 1. GHG emission ranges for various technologies²²



Source: Raadal, H.L., *et al.* (2011). For newly flooded boreal reservoirs, Teodoru *et al.* (2010).

The ranges provided in Figure 1 indicate that (excluding tropical reservoirs), even the *highest* emitting hydropower GHG emission rates are less than the *lowest* emitting oil, coal, and natural gas sources.

For equal electric energy outputs, the Eastmain 1 data suggest that, in addition to any indirect emissions from facility construction, newly flooded boreal reservoirs may emit CO₂ at a rate close to 32 to 63% that of the least emitting natural gas plant. In contrast, the least emitting oil- and coal-fired facilities emit more than 3 times as much GHGs than the highest emitting hydropower facility.

Not included in the hydropower emissions estimate in Figure 1 are emissions from tropical reservoirs. Tropical reservoirs are those reservoirs in the latitudes between the Tropic of Cancer and the Tropic of Capricorn.²³ Analysis by Weisser (2006) indicates that reservoirs in tropical regions emit up to 20 times the amount of GHGs as do reservoirs in boreal regions, due to higher rates of biodegradation. As analysis by Raadal, *et al.* (2011) estimates reservoirs in boreal regions to be 0.5 – 152 kg CO₂e/MWh, the emissions factor for tropical reservoirs can be then estimated to be about 3,000 kg CO₂e/MWh. Similarly, analysis by Demarty and Bastien (2011) shows that multiple-year studies of tropical reservoirs indicate emissions factors between 1,308 – 2,222 kg

²² Note that ranges displayed in Figure 1 are estimates based on figures in Raadal *et al.* (2011), with the exception of newly flooded boreal reservoirs, which was based on Teodoru *et al.* (2010). Ranges in Figure 1 indicate the full ranges of maximum and minimum rates of emissions as analyzed in Raadal *et al.* (2011). Ranges for GHG emissions in this figure exclude emissions from grid losses, infrastructure related to the grid, and any backup power required for grid integration. Grid losses typically range from 5% to 20% at the retail meter, depending on service voltage, time of year, and customer density. The long distance transmission losses are a relatively small portion of the losses. Dones *et al.* (2007) provide some estimates of the energy requirement and emissions from transmission and distribution infrastructure in their section 15, but not in a manner readily interpretable for comparing remote generation options to more local ones. Additionally, the ranges indicating GHG emissions from wind power in Figure 1 combine data from studies with results for single wind turbines, studies with average data over a number of wind turbines, and studies that use average data from more than one study.

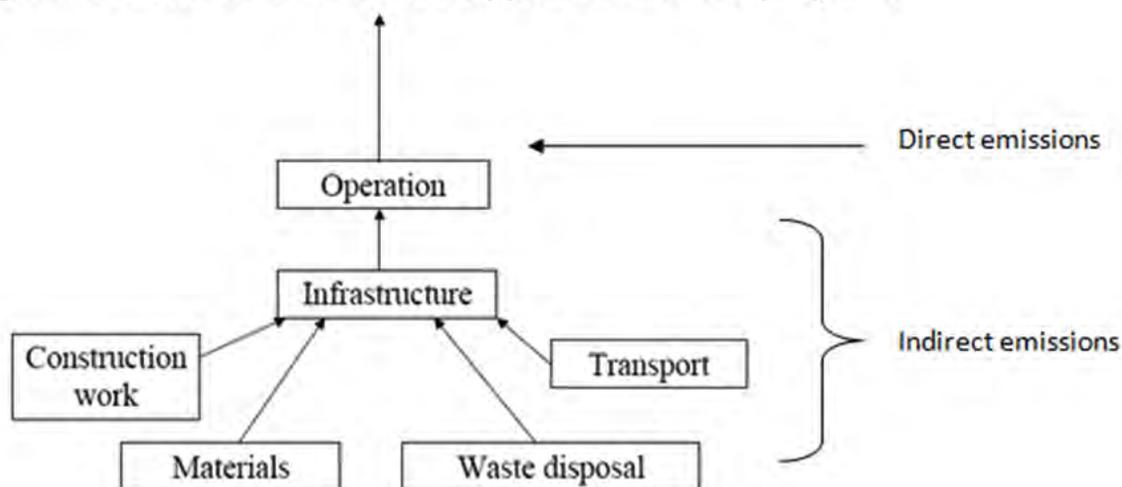
²³ This is the band of latitudes from approximately 23.5° N to 23.5° S, respectively, extending roughly from Egypt, Bangladesh, and the Bahamas on the north and Madagascar, Queensland, and southern Brazil on the south.

CO₂eq/MWh. The bottom of the resulting range (about 1300 to 3000 kg CO₂e/MWh) begins about at the level of the most emitting coal facilities and its high end is markedly higher than any other resource studied in the literature we examined. Demarty and Bastien (2011) note, however, that “to our knowledge, GHG emissions have been measured for only 18 of the 741 large dams...listed in the tropics.” They further conclude that, because of the limited scientific information available, “at this time, no global position can be taken regarding the importance and extent of GHG emissions in warm latitudes.”

B. Sources of Emissions and Variability

Life cycle emissions for hydropower include both indirect and direct emissions. The following figure distinguishes between the two.

Figure 2. Schematic overview of the electricity production chain for hydropower



Source: Robert Dones *et al.* *Life Cycle Inventories of Energy Systems: Results for Current Systems in Switzerland and other UCTE Countries*. Ecoinvent Data V2.0 (2007).

Indirect Emissions

Sources of indirect emissions for hydropower include emissions from development of infrastructure (e.g., roads and transmission lines), from construction work on the facility itself, from manufacturing of materials and equipment used in building the facility, from transportation of materials and workers, and from waste disposal and decommissioning. According to Dones *et al.* (2007), the major sources of GHG emissions for hydropower within these categories include cement and steel production, and the use of diesel and electricity.²⁴ Raadal *et al.* (2011) states that “the major contributing factors to the infrastructure GHG emissions are concrete production and the transportation of rocks in the construction of dams and tunnels.”

²⁴ Robert Dones, *et al.* *Life Cycle Inventories of Energy Systems: Results for Current Systems in Switzerland and other UCTE Countries*, Ecoinvent Data V2.0., 103 (2007). CH stands for Switzerland, FI for Finland. Reservoirs in Finland can flood large areas of peat, which is very high in organic material compared to other biomes.

Indirect emissions can account for a sizeable portion of a facility's total GHG emissions, possibly representing:²⁵

- $\leq 20\%$ of cumulative emissions for fossil fuel technology, and
- $> 90\%$ of cumulative emissions for renewable resources and nuclear.

For boreal hydropower, however, Figure 1 suggests that indirect emissions probably represent a small portion of overall emissions.

Direct Emissions

Direct emissions include emissions due to facility operation. For fossil fueled generators, this is largely from the combustion of fuel, plus the rest of the fuel cycle including extraction, refinement, and delivery, plus disposal of fuel waste and other operational waste. For hydropower facilities, decay of biomass in the soil and biome of land newly flooded by the facility's reservoir emits GHGs that diffuse up through the reservoir's water and into the atmosphere. That release of GHGs due to biomass decomposition is the largest source of direct GHG emissions for hydropower.²⁶

Unlike for indirect emissions, the range of variability for direct emissions is quite large. Raadal *et al.* (2011) note that:

“The large variations in GHG emissions from reservoir hydro power can for the most part be explained by differences in GHG emissions from flooded land... Recent research [38] shows that this data can be misleading, as the reported emissions may not represent the ‘net’ emissions for which reservoirs are responsible. Most LCAs report ‘gross’ emissions from reservoirs, as measured fluxes over reservoirs. However, there is now consensus that most natural lakes and rivers are also major sources of GHGs, as they return to the atmosphere the carbon flushed into water ways from surrounding ecosystems.”

Yet another source of variability in direct emissions stems from a lack of scientific consensus on methods for estimating GHG emissions from hydropower. This issue is discussed more in Section 4.

²⁵ Daniel Weisser, 2007. *op. cit.*

²⁶ Raadal, H., Luc Gagnon, Ingunn Saur Modahl, & Ole Jørgen Hanssen. [Life cycle greenhouse gas \(GHG\) emissions from the generation of wind and hydro power](#), *Renewable and Sustainable Energy Rev.*, 15(7), 3417-3422 (September 2011) (quoting Gagnon, L, van de Vate, J.F. Greenhouse gas emissions from hydropower: the state of research in 1996, *Energy Policy* 25, 7-13 (January 1, 1997)). The other major source of GHG emission is indirect emissions from construction activities. Alain Tremblay, *et al.* *Net Greenhouse Gas Emissions at Eastmain 1 Reservoir, Quebec, Canada*, 13 (2010). CO₂ emissions from a boreal reservoir studied in Quebec were dominated by diffusive emissions (> 99% of total emissions); degassing and bubbling represented <1% of total emissions. IPCC. *2006 IPCC Guidelines for National Greenhouse Gas Inventories, Agriculture, Forestry and Other Land Use. Possible Approach for Estimating CO₂ Emissions from Lands Converted to Permanently Flooded Land: Basis for Future Methodological Development*, 4 (Ap 2) (2006) http://www.ipcc-nggip.iges.or.jp/public/2006gl/pdf/4_Volume4/V4_p_Ap2_WetlandsCO2.pdf. IPCC's most simplistic formula (Equation 2A.1) for calculating CO₂ emissions from land converted to flooded land only uses diffusion rates, not degassing or bubbling.

Outside of the variances caused by inconsistent methodology, one of the largest sources of uncertainty in measuring direct hydropower emissions is the rate of decomposition.²⁷ Variables that impact a reservoir's decomposition rate include:

- Temperature²⁸
- Water residence time, reservoir shape and volume, and amount and type of vegetation flooded²⁹
- Depth³⁰
- Geographic location³¹
- Reservoir age^{32, 33}

In particular, reservoir age and the amount and type of vegetation play a major role in decomposition rates.³⁴ Teodoru *et al.* (2010) have shown that GHG emissions can increase dramatically immediately after reservoir creation, tend to fall off over a few years, and that further declines in emission rates are uncertain.

²⁷ IPCC, 2006, *op. cit.*

²⁸ Robert Dones, *et al.* (2007), *op. cit.*

Daniel Weisser, 2007, *op. cit.*, (quoting R. Dones, T. Heck, & S. Hirschberg, (2004), *op. cit.*). Weisser estimated average GHG emission factors of 10–60 kg CO₂ eq/MWh for boreal and temperate reservoirs; 200–3000 kg CO₂ eq/MWh for tropical reservoirs.

²⁹ Alain Tremblay, *et al.*, 2010, *op. cit.* Teodoru *et al.* (2010).

³⁰ Robert Dones, *et al.*, 2007, *op. cit.*

³¹ IPCC, 2006, *op. cit.* P. Lee, R. Cheng, M. Hanneman & C. Scheeler. *Hydropower Development in Canada: Greenhouse Gas Emissions, Energy Outputs and Review of Environmental Impacts (Hydropower Report #2)*. Global Forest Watch Canada 10th Anniversary Publication #7. Edmonton, Alberta, 17-18 (2010) (quoting D.M. Rosenberg *et al.* *Large-scale impacts of hydroelectric development*. *Environ. Rev.* 5, 27–54 (1997) <http://www.environmental-expert.com/Files%5C6455%5Carticles%5C7571%5C18sep18-A97-001.pdf>.

³² IPCC, 2006, *op. cit.* “[T]he age of reservoirs has a significant influence on CO₂ fluxes during the first 10 years. . .” (citing Huttunen, J.T., *et al.*, Fluxes of methane, carbon dioxide and nitrous oxide in boreal lakes and potential anthropogenic effects on the aquatic greenhouse gas emissions, *Chemosphere*, 52, 609-612 (2003); Huttunen, J.T., *et al.*, Fluxes of CH₄, CO₂ and N₂O in hydroelectric reservoir Lokka and Porttipahta in the northern boreal zone in Finland, *Global Biogeochemical Cycles*, 16(1), doi:10.1029/2000GB001316; Soumis, N., *et al.*, “Hydroelectric reservoirs as anthropogenic sources of greenhouse gases,” *Water Encyclopedia*, v. 3: *Surface and agricultural water*, sous la dir. De J.H. Lehr et J. Keeley. p. 203-210. Hoboken, NJ: John Wiley & Sons; Therrien, J., Tremblay, A. and Jacques. R. (2005). “CO₂ Emissions from Semi-arid Reservoirs and Natural Aquatic Ecosystems,” *In* Tremblay, A., L. Varfalvy, C. Roehm and M. Garneau (Eds.), *Greenhouse Gas Emissions: Fluxes and Processes, Hydroelectric Reservoirs and Natural Environments*, Environmental Science Series, Springer, Berlin, Heidelberg, New York, pp. 233-250; Tremblay, A., Therrien, J., Hamlin, B., Wichmann, E. and LeDrew, L. (2005). “GHG Emissions from Boreal Reservoirs and Natural Aquatic Ecosystems”, *In* Tremblay, A., L. Varfalvy, C. Roehm and M. Garneau (Eds.), 2005, *op. cit.*

³³ IPCC, 2006, *op. cit.* “The rate of the post-flooding decrease in emissions may depend on the region in which the reservoir is located, but seems to vary in about a 10-year period.” (citing Delmas, R. *et al.* (2005). *Long Term Greenhouse Gas Emissions from the Hydroelectric Reservoir of Petit Saut (French Guiana) and Potential Impacts*. *In* Tremblay, A., L. Varfalvy, C. Roehm and M. Garneau (Eds.), *op. cit.*, pp. 293-312; Abril, G. *et al.* (2005). Carbon dioxide and methane emissions and the carbon budget of a 10-year old tropical reservoir (Petit-Saut, French Guiana), *Global Biogeochemical Cycle* (in press); Tremblay, A., Therrien, J., Hamlin, B., Wichmann, E. and LeDrew, L. (2005). GHG Emissions from Boreal Reservoirs and Natural Aquatic Ecosystems,” *In* Tremblay, A., L. Varfalvy, C. Roehm and M. Garneau (Eds.), 2005, *op. cit.*

Alain Tremblay, *et al.*, 2010, *op. cit.*. Pre-flood net 3,200 C-CO₂/year within surface area of reservoir later flooded rose to 500,000 C-CO₂/year within one year of reservoir creation, but were expected to stabilize to 100,000 C-CO₂/year within ten years.

³⁴ IPCC, 2006, *op. cit.*; Alain Tremblay, *et al.*, 2010, *op. cit.*

Research done at Hydro-Québec's Eastmain 1 reservoir showed that net GHG emission rates within one year of reservoir creation increased from 3,200 to 500,000 tonnes of carbon, a 156-fold increase, over pre-flooded conditions.³⁵ This carbon increase at Eastmain 1, calculated as a rate per unit of energy output, suggests that hydropower from the reservoir produced more GHG emissions than a natural gas combined-cycle facility each year for three years after impoundment. This is surprising, given previously reported ranges of GHG emissions for hydropower reservoirs in non-tropical areas, which were much lower.

It is noteworthy that several other studies reviewed for this report reveal similar decomposition trends as the Eastmain 1 study (GHG emissions decline with reservoir age), but the methods used were substantially less rigorous, and the hydropower emission rates were not as high. This includes three studies published in a 2005 monograph also focused on Canadian boreal reservoirs.³⁶

³⁵ Alain Tremblay, *et al.*, 2010, *op. cit.*

³⁶ Alain Tremblay *et al.* (eds.). *Greenhouse Gas Emissions: Fluxes and Processes, Hydroelectric Reservoirs and Natural Env'ts*. *Envtl. Sci. Series*, Springer (2005).

4. Discussion

A. Best Practices for Estimating GHG Emission from Hydropower

Considerable effort has been invested in developing best practices for comparing the emission profiles of different generating technologies in ways that reflect life cycle emissions in a comparable manner and on a level playing field. It is noteworthy that there is not yet scientific consensus on methods for estimating GHG emissions from hydropower. To take one simple example, the proper atmospheric “dwell time” for various GHG emissions affects the global warming potential (GWP) values to be used in comparing GHG mixes. At times, certain utilities have proposed using a financial-type discount rate to compare GHG emissions at various times during the life cycles of technologies, even though that technique does not help policymakers determine the true environmental effects of the emissions. Yet without standards, there is always room for well-meaning disagreements, not to mention cherry picking results to favor one technology over another.

The UNFCCC and Kyoto Protocol monitoring, reporting, and review guidelines for national inventories incorporate the methodological Good Practice Guidance developed by the IPCC, which stipulate how emission estimates are to be prepared and what is to be included in annual inventory reports.³⁷ The IPCC guidelines for reporting GHG emission from hydropower, however, appear to be limited. For carbon, they provide specific guidance only regarding the carbon emissions resulting from the loss of biomass on flooded land. For estimating methane from hydropower, they note that “available information on CH₄ emissions is provided [in the IPCC document],” but “it is not possible, at present, to recommend a default methodology. Countries seeking to report CH₄ emissions from flooded lands should, where feasible, develop domestic emission factors.”³⁸

The lack of consensus appears to be fundamental, not just rhetorical. More research is needed and concepts need to be clarified. This has resulted in varying degrees of accuracy and precision. As noted by Raadal, *et al.*, “The wide ranging results [of GHG emissions from hydro power] indicate a need for stricter standardised rules and requirements for life-cycle assessments, in order to differentiate between variations due to methodological disparities and those due to real differences in performance of the plants.”³⁹ This is despite the adoption of directives by the European Union (EU Electricity Directive 2004/53/EG, art. 3), guidelines set out by the Society of Environmental Toxicology And Chemistry (SETAC), and an ISO Standard (ISO-14044), all addressing the issue.⁴⁰

Newly flooded reservoirs release GHGs due to the decomposition of biomass covered by the flooded reservoir as explained above. In addition, when considering new reservoirs, there is an additional GHG effect that should be considered. That effect is the elimination of a terrestrial biological community and its replacement by an aquatic biological community. Since each

³⁷ Env't Can. 2010. Nat'l Inventory Report: 1990-2008: Greenhouse Gas Sources and Sinks in Can., Part I. The Canadian Gov'ts Submission to the UN Framework Convention on Climate Change.

³⁸ IPCC, 2006, *op. cit.*

³⁹ Raadal, Hanne Lerche, *et al.*, 2011, *op. cit.*

⁴⁰ All cited in *ibid.*

biological community has a net GHG effect due to respiration of plants and animals, as well as their natural fixing or releasing of carbon during their growth and decay, there may be a substantial net GHG effect per year from this change in ecology. For example, a tropical rain forest typically fixes and stores a large net GHG amount, while a boreal tundra or forest may store a substantial amount of carbon in slow growing biomass but would have a smaller net fixing rate per year. Most of the literature reviewed does not discuss this effect or is unclear about whether that effect is or is not included in GHG emission estimates. Teodoru *et al.* (2010) provides a valuable example of how such measurements may be made.

In sum, efforts to standardize GHG flux measurements from reservoirs are ongoing.⁴¹ However, given the long-term effects of many GHGs and the long lifetimes of power plants, it seems reasonable that LCAs should cover a minimum time period of 100 years for comparisons of GWP for all projects, as well as requiring a full watershed analysis for hydropower projects, in particular.

Precision, accuracy, and validity of GHG LCA estimates depend on the amount of existing reference data. For example, as wind power technologies progress in size and capacity factor, their LCA emission rates will change, but we do not now know how. Hydropower estimates may be water-body specific, country specific, or climate specific.⁴² Hydropower emissions appear to vary markedly over the plant's lifetime as reservoir decomposition regimes evolve.

B. Displaced Generation Issues

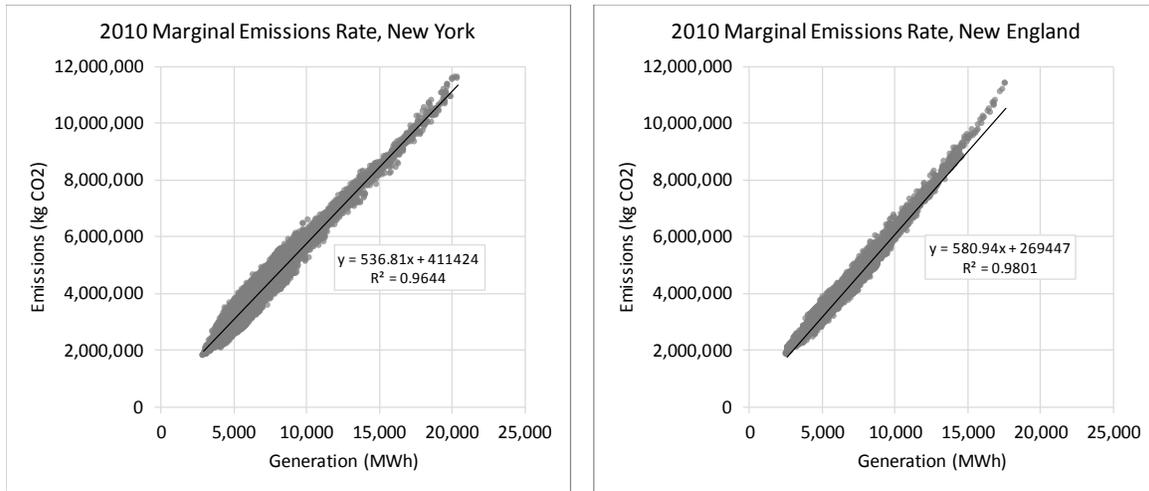
An important aspect of GHG policy comparisons for potential new generating facilities is the “but for” question. That is, but for the new facility, what emissions would have occurred. This goes beyond comparing one new generating technology with another. It requires consideration of what generators (existing or new) will not be built or will run less often if the facility under consideration is built. Similarly, for imports, even from existing facilities, this question arises for both the importing and exporting regions. It may even extend to “knock on” effects in neighboring regions, depending on the strength of the electrical interconnections between them. In a policy context, it may also be important to address the bookkeeping aspects for trades in the environmental attributes of power.

One approach to examining displaced or avoided generation is to look at the marginal emissions in the affected region or regions. Marginal emissions are the emissions from the generating plants “at the margin.” That means the plants that are the last ones to be run in any given hour. This is usually determined by the total load being experienced; the variable operating costs of the available plants, which is mainly dependent on fuel price and plant efficiency (called heat rate in combustion plants); and the potential need to run some plants out of economic order for reliability reasons.

⁴¹ IEA Hydropower. The International Energy Agency Implementing Agreement for Hydropower Technologies and Programmes. *Current Activities*. http://www.ieahydro.org/Hydro_The_Environment6.html. One objective is to standardize GHG flux evaluation methods. The following report was to be issued on March 2011: Annex XII: Hydropower and the Environment; Task 1: Managing the Carbon Balance of Freshwater Reservoirs; Volume 1: Guidelines for the Quantitative Analysis of Net GHG Emissions from Reservoirs.)

⁴² IPCC, 2006, *op. cit.*

Figure 3. 2010 Emissions (kg CO₂ / MWh) for fossil fuel units in New York and New England.⁴³



The scatter plots in Figure 3, above, indicate the emissions in kg CO₂ per MWh in New York and New England in 2010. By fitting a linear trend to the data points, a slope of marginal emissions was found, indicated in Table 5. Due to their high fuel cost and the ability of some of them to ramp up and down fairly quickly, natural gas generators are typically the last to be dispatched in any given hour in both New England and New York. Therefore, marginal emissions in both regions are about the same as for natural gas generators. Note that the curves both bend upward at high loads, so the estimates of marginal emissions may err on the low side with respect to peak load hours.

Table 5. 2010 Marginal Emissions (kg CO₂ / MWh) derived from scatter plots in Figure 3.

New York	537
New England	581

One study that specifically considered this issue found, “With nearly all of the new capacity brought online in Québec being hydro and with existing fossil-fueled electricity [being] brought offline, emissions over this period [1990 to 2008] actually decreased. Nonetheless, although an increase in generation did not directly contribute to a rise in emissions, increased export of hydroelectricity by Hydro Québec to the United States likely was a contributor to increased generation from fossil-fuel-fired sources in other regions in Canada since exporting this electricity

⁴³ Note that Figure 3 only includes emissions from fossil fuel units larger than 25 MW and omits plants run in constrained areas. The actual marginal emissions rate would be lower, once nuclear, hydropower, and other renewable units are taken into account. Data for this figure comes from EPA. Clean Air Markets Dataset. (2011)

to the United States (which is typically a higher-priced market) rather than domestic markets would inadvertently increase the requirements for fossil-fueled electricity within Canada.”⁴⁴

C. Redeveloping, Repowering and Upgrading Existing Hydropower Sites

While Section 2 of this report explained that development of major new hydropower facilities is rare in much of North America (excepting Québec and Labrador), there are some additional options for increasing total output of hydropower. Many of the existing hydropower facilities in North America are quite old and may date back to the early twentieth century or even earlier. While dam structures may remain sound, other equipment does wear out eventually, and when it does (or even earlier) it may be cost-effective to install new, more powerful and more efficient turbines, generators, and transformers. Thus, it may be possible to cost-effectively increase the electrical output of older hydropower facilities without increasing their reservoir size or dam height. This can be an attractive tradeoff from a GHG standpoint. Small dams are sometimes fitted with add-ons to the dam top that increase reservoir depth a small amount (often a few feet), but result in increased hydraulic head and controllability, and modest increases in absolute output for a given amount of water flow. Utilities that operate multiple dams on a single river system generally expend considerable effort to coordinate turbine and dam operations to maximize the total output from the river system using the same water and facilities. All of these options may be encouraged.

After an initial flourishing of privately owned industrial hydropower in the late 19th and early 20th centuries, most industries sold their dams to utilities or decommissioned them and relied on purchased electricity. Thus, there are abandoned hydropower sites around the U.S., particularly in the East and Midwest. Efforts were made after the enactment of PURPA in the 1970s to inventory and assess such sites. A modest number of them were redeveloped as qualifying facilities (QFs) under PURPA, even without any monetizing of the economic value of avoided GHG emissions, but many were not. Policy makers may wish to consider the merits of a renewed effort in that direction.

D. How Conclusive Is Current Research in Estimating GHG emissions for Hydropower Compared to Other Energy Sectors?

For reasons noted above, it is difficult to firmly answer this question. Estimates for hydropower present challenges not present for other technologies, challenges which remain unresolved. However, we believe that the literature results set out above are conclusive enough to reasonably state that hydropower (excluding tropical reservoirs) emits substantially less GHGs per unit of electrical output than do fossil fuel sources over a plant’s life cycle.

While existing approaches and LCA models are mostly appropriate for use in policy discussions, specific values for hydropower sites already studied may not be generalizable to other sites and should be considered as first approximations. Site-specific variables might vary greatly between

⁴⁴ Steenhof, Paul, and C.J. Weber, 2011, An assessment of factors impacting Canada’s electricity sector’s GHG emissions, *Energy Policy* 39, 4089–4096.

facilities.⁴⁵ Such uncertainty may possibly be reduced with site-specific studies,⁴⁶ but they are not widely performed due to complexity of estimation methods, requirements for extensive collection of field data, and cost to utilities.⁴⁷ Even the most intensive and extensive studies may contain both “known” and “unknown” sources of uncertainty.

⁴⁵ Robert Dones, *et al.*, 2007, *op. cit.* LCA models are most appropriately used as first approximations, as site specific variables might vary greatly between plants.

⁴⁶ IPCC, 2006, *op. cit.* “[E]mission factors from the various pathways (diffusive, bubble and degassing)” represents one of the two “largest sources of uncertainty in the estimation of greenhouse gas emissions from reservoirs CO₂ diffusive emissions . . . vary by one to two orders of magnitude in boreal and temperate regions, and by one to three in tropical regions. Therefore, the use of any emission factor derived from Table 2a.2 will result in high uncertainty. Since the age of reservoirs has a significant influence on CO₂ fluxes during the first 10 years, the method may result in an underestimation of CO₂ emissions. . . To reduce the uncertainties on emissions factors, countries should develop appropriate, statistically valid sampling strategies that take into account factors underlying the temporal and spatial variability of the ecosystem studied.”

⁴⁷ Alain Tremblay, *et al.*, 2010, *op. cit.*

5. Conclusions and Recommendations

Life cycle analysis (LCA) is clearly the current best practice for comparing the GHG emissions of generating facilities. With respect to imported power, consideration of displaced emissions in the importing region, exporting region, *and* neighboring regions electrically interconnected with either may be necessary to form a true picture of GHG effects.

The largest sources of GHGs for newly constructed hydropower are biomass decomposition from reservoir flooding and construction of the facility. Along with methodological disparities, biomass decomposition is the largest source of uncertainty in the GHG emission estimates for hydropower. Emission uncertainties from biomass decomposition may remain large, as the relevant modeling is complex. Further research, both theoretical studies and field measurements, should be considered prior to new construction decisions.⁴⁸ Site-specific assessments will be particularly valuable.

For fossil fuel technologies, the main sources of variability relate to potential carbon capture and sequestration technologies (for new facilities), whose efficiency, effectiveness, infrastructure requirements, and decommissioning/waste disposal and cleanup needs remain speculative. Also, a variety of operational issues that affect the amount of electricity produced over a plant's lifetime for a given amount of construction/decommissioning emissions and for a given amount of fuel burned remain to be seen. A wide range of uncertainty should be considered, perhaps via scenario analysis, prior to new construction decisions.

New hydropower development emits greenhouse gases (GHGs), but newly flooded hydropower emission rates per unit of energy produced (excluding tropical reservoirs) are much lower than for oil and coal, and are somewhat lower than natural gas combined cycle generation. Run-of-river hydropower emission rates may be roughly comparable to other renewable resources and nuclear power (assuming prompt decommissioning and permanent high level waste disposal); however, newly flooded boreal reservoirs have life cycle emissions that likely exceed those of other renewable sources. (See Figure 1 in Section 3.) Hydropower GHG emissions during the first years after reservoir creation appear to be even higher than for a natural gas combined-cycle facility, so ongoing, long-term measurement should be pursued for a variety of reservoir types.

Also noteworthy is the fact that there is not yet scientific consensus on methods for estimating GHG emissions from hydropower. This has resulted in varying degrees of accuracy and precision, despite adoption of international standards. As noted by Raadal, *et al.*, "The wide ranging results [of GHG emissions from hydro power] indicate a need for stricter standardised rules and requirements for life-cycle assessments, in order to differentiate between variations due to methodological disparities and those due to real differences in performance of the plants."⁴⁹ Teodoru *et al.* (2009) and Teodoru *et al.* (2010) provide examples of how such assessments may be grounded in field data collection before and after construction.

In light of these conclusions, we recommend that future policy decisions be supported by the following:

⁴⁸ See, for example, Teodoru *et al.* (2009).

⁴⁹ Raadal, Hanne Lerche, *et al.*, 2011, *op. cit.*

- 1) Continued documentation of both short- and long-term values of diffusion rate estimates and the LCA emission rates for hydropower development, especially:
 - a. The immediate net GHG emission increases from reservoir creation, and
 - b. The long-term net GHG emission rate decreases after reservoir creation. This should include rates from Annex I countries, as reported in their UNFCCC submissions.

Any deviations from the ranges presented in this report should raise red flags.

- 2) Consideration of the net effect of replacing terrestrial biome with an aquatic biome in the case of new flooding in estimating long-term net GHG emission rates.
- 3) Encouragement and monitoring of IEA's progress toward issuing guidelines for quantifying net GHG emissions from reservoirs.⁵⁰
- 4) Adoption by regulators, researchers, and utilities of best practices for estimating GHG emissions from all types of generators, including full life cycle analysis, in general, and full watershed evaluation for hydropower, in particular.
- 5) Adoption by regulators, researchers, ISOs/RTOs, and utilities of best practices for the assessment of displaced emissions attributed to new resources, including displaced or increased emissions in regions electrically interconnected with exporting and importing regions and environmental attribute accounting.
- 6) Resource policymaking based on best practices and life cycle analysis that reflect GHG emissions.
- 7) Review in all policy fora of evidence proffered in support of new construction, exports, or imports for consistency with the above recommendations. Emission claims that differ markedly from the values given here may or may not be warranted, but they may also be driven by analysis not conforming with best practice.

⁵⁰ See footnote 41.

Acknowledgements

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ATTACHMENT F

**STATE OF VERMONT
PUBLIC SERVICE BOARD**

Petition of Green Mountain Power for a)
Certificate of Public Good pursuant to 30 V.S.A.)
§ 248(j), authorizing the installation and operation)
of a battery storage system on the GMPSolar Panton)
Project site located in Panton, Vermont, to be known)
as the “GMP Panton Battery Storage Project”)

Case No. 17-XXXX-PET

PREFILED DIRECT TESTIMONY OF ANDREW QUINT

April 10, 2017

Summary: Mr. Quint provides testimony on the proposed additional of a battery storage system with respect to Section 248 criteria (b)(2) (need), (b)(4)(economic benefit), (b)(6) (consistency with least cost integration plan), and (b)(7) (compliance with Vermont Electric Energy Plan).

1 **Q1. Please state your name, occupation and business address.**

2 A1. My name is Andrew Quint. I am a Power and Markets Analyst for Green Mountain Power
3 (“Green Mountain Power” or “GMP”). My business address is GMP, 66 Merchants Row,
4 Rutland, VT 05701.

5
6 **Q2. Please describe your educational background and business experience.**

7 A2. I have a Bachelor of Business Administration degree from Southern Methodist University. I
8 also have a Master of Business Administration degree and a Master of Science in Finance
9 degree from Boston College. I am a Certified Public Accountant in the State of Texas. I
10 have been with Green Mountain Power for the past twelve years and in the Power Supply
11 group for the past ten years. Prior to joining GMP, I worked at Fidelity Investments for
12 twelve years in a number of financial analysis roles including Director of Finance and
13 Analysis. My resume is attached as *Exhibit GMP-AQ-1*.

14

15 **Q3. Have you previously testified before the Vermont Public Service Board (“Board”)?**

16 A3. Yes, I have testified in a number of Dockets including 8010 and 8684 on Rule 4.100 avoided
17 costs; Dockets 8569 and 8586/8685 on petitions for Rule 4.100 PPAs; and Docket 8827
18 relating to the purchase of hydroelectric generation facilities.

19

20 **Q4. What is the purpose of your testimony?**

21 A4. The purpose of my testimony is to address the proposed addition of a battery storage system
22 on the GMPSolar Panton Project site and how it meets GMP’s energy demand requirements
23 (30 V.S.A. § 248(b)(2)(need)); (ii) provides an economic benefit to GMP, its customers and

1 the State (§ 248(b)(4)(economic benefit)); (iii) is consistent with GMP's Integrated Resource
2 Plan (IRP) (§ 248(b)(6)(IRP)); and (iv) furthers the goals of the 2016 Vermont Electric Plan
3 (§ 248(b)(7)(energy plan)).
4

5 **Q5. What work have you done regarding the proposed addition of a battery storage**
6 **system to the GMP Solar Panton Project site?**

7 A5. I have reviewed the proposed battery storage system details and conducted an analysis of
8 costs and benefits associated with the project, from the perspective of GMP customers. The
9 analysis is a financial model that measures the expected lifetime benefits of the project on a
10 Net Present Value ("NPV") basis which are compared to the NPV of the costs that will
11 accrue over the same period. The costs, which can also be defined as the Project's annual
12 revenue requirements, were developed based on the total life cycle costs of the Project
13 including capital expense, operations and maintenance ("O&M") expenses, taxes, and return
14 of, and on, rate base. The quantified lifetime benefits of the Project fall into four major
15 ISO-NE product categories, which are Energy, Capacity, Transmission, and Regulation.
16 Annual benefits for each product were estimated based on the proposed battery
17 characteristics and operation profile along with expected market prices. The net result for a
18 "base case" evaluation is breakeven before considering other benefits that GMP did not
19 attempt to quantify, such as grid reliability or integration of this project with the Panton
20 Solar Array.
21
22
23

1 **Q6. Please explain the characteristics of the proposed battery storage system.**

2 A6. GMP proposes using a Tesla Powerpack that is configured as a 1 MW, four-hour battery.
3 This means that the battery will be able to provide a maximum of one MW of continuous
4 output for up to four hours, for a total of 4 MWh. The Powerpack offers a relatively high
5 round-trip efficiency, on the order of 90 percent, which along with its other characteristics
6 (e.g. operational parameters such as charge and discharge rates, depth of discharge, cycle
7 length, and length of time in standby mode) make it suitable for duty cycles that include peak
8 shaving and energy arbitrage.

9 The concept of round-trip efficiency is a measure of how the battery handles the
10 conversion process of electricity from AC on the grid to DC for storage in the battery during
11 charging and then back to AC during discharge. Typically, with conversion losses of around
12 5% from AC to DC, the battery will need around 105% of the AC kW to achieve 100%
13 charge. Similarly, the battery at 100% of its rated peak charge status (e.g. 1 MW for this
14 battery) will discharge about 95% of its rated MWh.

15 The project will also be capable of responding extremely quickly to dispatch signals,
16 allowing a battery with this configuration to provide up to 1 MW of Regulation service in the
17 ISO-NE market.

18

19 **Q7. What is the planned life of the battery?**

20 A7. Based on our discussions with the manufacturer, we assume a 25-year project life in the
21 analyses. As I explain below, this assumes that GMP contracts with the vendor for a long-
22 term capacity maintenance agreement (“CMA”).

23

1 **Q8. Does the battery degrade over its life?**

2 A8. Typically, the capacity of a battery will degrade over its life driven primarily by how many full
3 charge and discharge cycles that battery has provided. However, we are currently working
4 with Tesla, who provides a CMA option that guarantees the battery will provide its full
5 discharge capacity for an agreed upon period. This is accomplished by periodically adding
6 new cells to the battery, and designing the project to accommodate those additions. Under
7 the CMA, Tesla will also replace the inverter after ten years, and Tesla has indicated that at
8 the end of the twenty-year CMA period, the battery should maintain almost all of its original
9 capacity. Based on the battery's available capacity at the end of the CMA period, there is a
10 reasonable expectation that the battery will be able to provide at least an additional five years
11 of service subject to output degradation during this period.

12

13 **Q9. What types of benefits will the Project provide GMP and its customers?**

14 A9. GMP plans to combine, or stack, a number of different roles for this battery that will allow
15 us to maximize the value of the battery and minimize the net power costs that our customers
16 pay. Based on our understanding and analysis of the different roles that this type of battery
17 is able to fill, we anticipate that its two primary duties will be peak shaving and Regulation.
18 Discharging the battery to achieve peak shaving will allow GMP to temporarily decrease its
19 system loads that are used for calculating the company's annual Capacity Load Obligation
20 and its monthly network load used for allocating Regional Network Service ("RNS"). As we
21 operate the battery to shave peaks we also anticipate achieving some energy arbitrage
22 benefits as the battery will be charged during hours when energy market prices ("LMP") are
23 relatively low due to lower relative electricity demand, and then discharged when system

1 loads and LMPs are relatively high. Between charging and discharging for peak shaving, we
2 anticipate that the battery will be unavailable to provide other services approximately 5% of
3 the year. However, this will depend on actual operation and market conditions over the
4 project's life. Our analysis shows that the next highest value for the battery is participation
5 in the Regulation Market, which the battery would be available for when not providing peak
6 shaving.

7
8 **Q10. What assumptions were used for your analysis of the peak shaving value?**

9 A10. Our analysis shows that peak shaving during key times will likely provide the highest value
10 per MWh of output, and the largest benefit stream from the proposed battery. Based on
11 recent peak management activity, it is reasonable to expect that we will typically need to
12 discharge the battery several times per month, on average, to ensure that we lower our
13 system loads during monthly peak hours on the VELCO transmission system. In addition,
14 the shape of the assumed peaks will require the battery to discharge for up to four hours
15 during each peak shaving attempt in order to have reasonable confidence of lowering the
16 monthly peak and not just shifting it to a nearby hour. The model assumes that GMP will,
17 through effective forecasting and deployment, be able to reduce our annual Forward
18 Capacity Market ("FCM") coincident peak, which is the maximum hourly load on the ISO-
19 NE system each year, and will be able to reduce eleven of the twelve monthly RNS peaks.
20 Additionally, to account for possible losses for the DC to AC conversion we are assuming
21 that the battery is only able to discharge 95% of its 4 MWh capability.

22

23

1 **Q11. Can you please describe the ISO-NE Regulation Service market?**

2 A11. Yes. Regulation is a service that certain generators and other eligible resources provide to
3 help balance the system loads and generation by responding automatically to signals issued
4 by ISO-NE at four second intervals as system conditions fluctuate. Participants offer
5 Regulation services into the market on an hourly basis and if selected are directed by ISO-
6 NE to either increase or decrease output or consumption in amounts up to the MW volume
7 offered by the resource. For this project, GMP anticipates offering 1 MW into the market
8 for hours when neither peak shaving nor energy arbitrage opportunities appear particularly
9 profitable.

10

11 **Q12. How are Regulation benefits estimated?**

12 A12. GMP will offer 1 MW of Regulation service into the market, and for each hour that it clears
13 and provides service it would receive a credit primarily equal to the hourly Regulation
14 Clearing Price multiplied by the volume of Regulation provided. The market rate varies over
15 the course of the year and during 2016 ranged from a high of almost \$1,400/MWh to a low
16 of \$1.33/MWh.

17

18 **Q13. Can you please explain the concept of energy arbitrage?**

19 A13. Energy arbitrage is another potential benefit stream where the battery is charged during
20 hours with relatively low LMPs and discharged during hours with higher LMPs. This allows
21 the battery to increase GMP's system load by charging during low price periods and then
22 decrease GMP's load by discharging during higher priced periods. LMPs in the ISO-NE
23 market tend to follow a pattern where they are lower overnight when demand is low and

1 then higher during the day when loads increase.

2

3 **Q14. How would GMP implement an energy arbitrage strategy for this project?**

4 A14. While we do not expect energy arbitrage will be as beneficial as providing Regulation
5 Services, we will work with Tesla to implement a software solution to charge the batteries
6 when LMPs are negative (e.g. when the market is heavily supplied with generation) or below
7 a price threshold that would be specific to the month and day of the week. The software
8 solution would also look at energy market prices to determine when discharging the battery
9 maximizes the benefit and therefore value to GMP's customers.

10

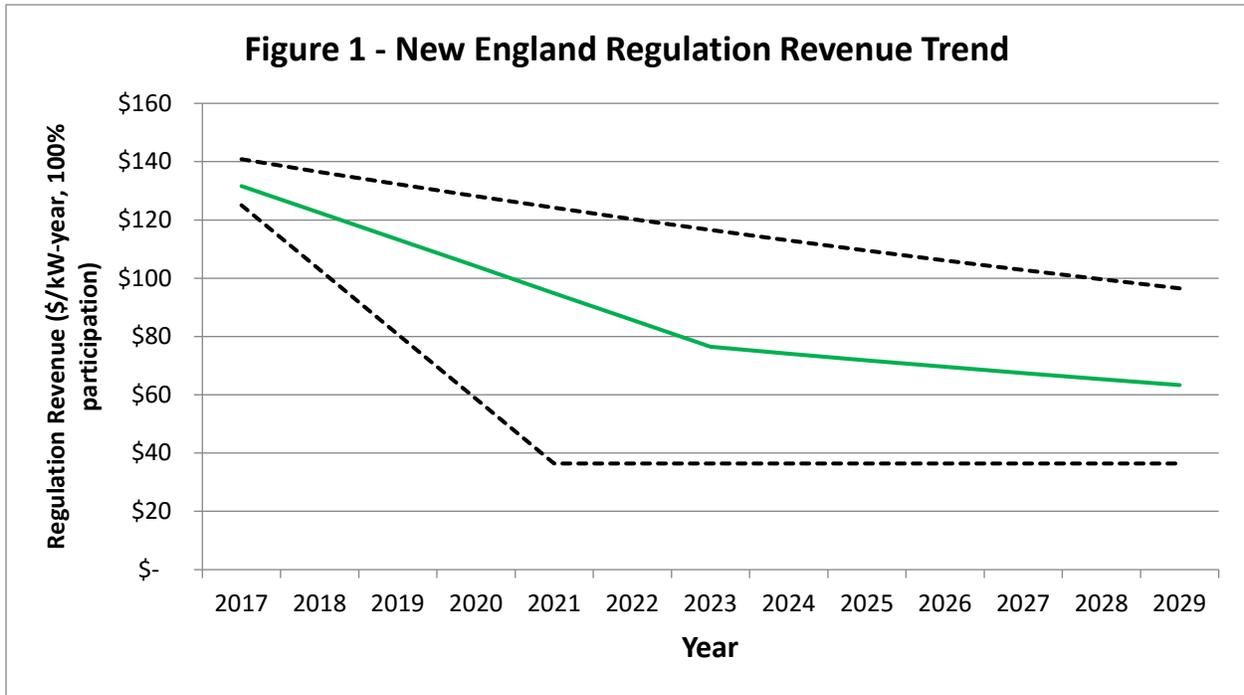
11 **Q15. Please discuss the market price assumptions used in this analysis.**

12 A15. The model developed to analyze this project relied on Energy, Capacity, and RNS price
13 estimates that were developed for other projects and are consistent with the Avoided Costs
14 GMP filed with the Vermont Public Service Board under revised Rule 4.100 in December
15 2016. We have recently reviewed these market rates and believe that they are still
16 reasonable¹.

17 The forecast Regulation Market prices are based on an outlook developed as GMP
18 worked with its consultants and Tesla to understand how batteries will be able to participate
19 in the Regulation Market, and the associated potential revenue. The model assumes that in
20 the near-term, Regulation prices are in line with the levels seen in 2015 and 2016 with a small
21 decrease, but over time as the Regulation Market matures and more batteries are deployed

¹ I expect that we will review our capacity price forecast during 2017, in light of the most recent Forward Capacity Auction (#11), which cleared at the lowest price in several years. This outcome was clearly influenced by short-term supply/demand trends and pricing factors although it is not clear how much it was also influenced by factors that should affect our longer-term expectations.

1 around New England we assume a rapid decline in Regulation prices over the next five years,
2 as shown in Figure 1 below. As this is a forecast, there is uncertainty about the timing and
3 extent of the price decline that GMP anticipates but we believe that there is value to being
4 an early participant in this market.

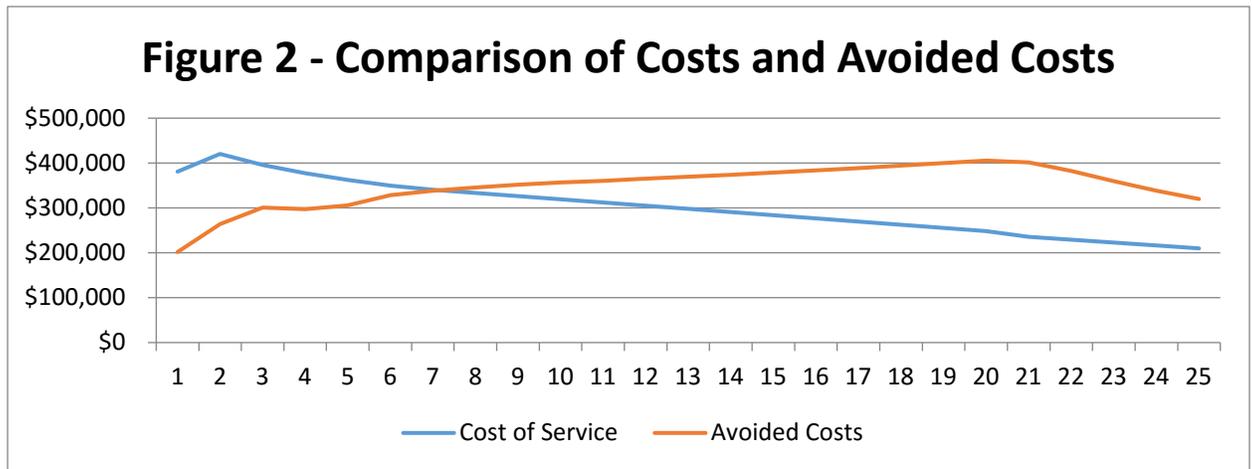


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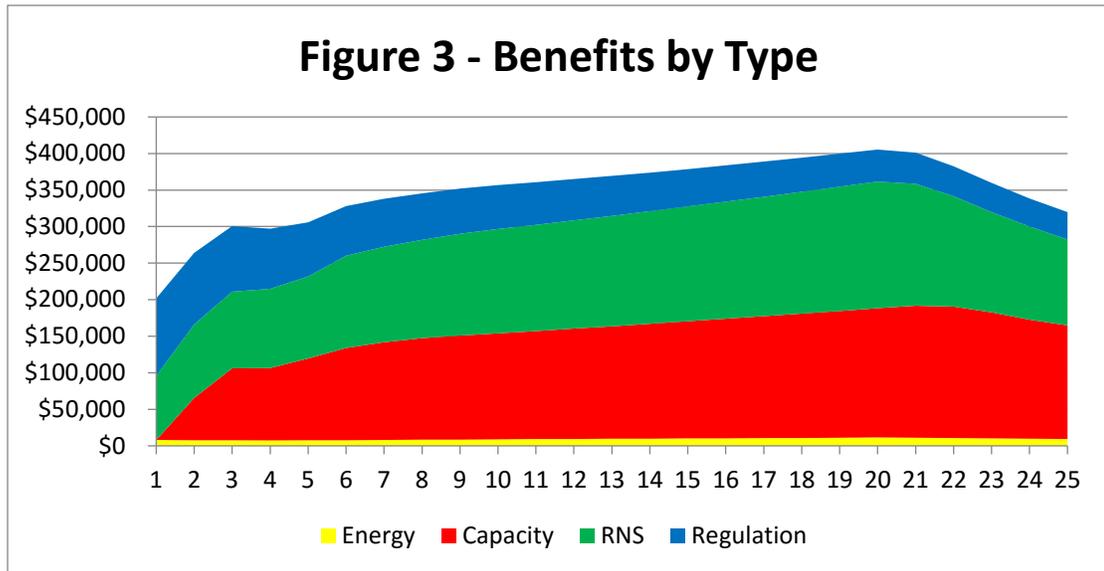
7 **Q16. Please summarize the cost benefit analysis for this Project.**

8 A16. Over the battery's twenty-five-year life, the costs and benefits net to a breakeven for
9 customers as summarized in *Exhibit GMP-AQ-2*. As shown in Figure 2, the Project's costs
10 are front-loaded reflecting cost recovery of a depreciable utility asset and exceed its benefits
11 for the first six years, although the difference will have a negligible rate impact. Starting in
12 year seven the Project begins to provide benefits that exceed the project's costs and, on an
13 NPV basis, breaks even over the life of the Project. The benefits of the Project begin to

1 diminish in year twenty-one as the battery begins to degrade at the end of the CMA period.
2 However, by this point, the expenses associated with the battery are significantly diminished.



3
4 The model assumes benefits from the four distinct revenue sources that I discussed earlier.
5 While there is uncertainty associated with any ISO-NE product, having a variety of benefits
6 helps to mitigate some of the risk through diversity. Figure 3 below shows the different
7 benefit streams by year. The revenues related to Regulation reflect our assumption that the
8 prices for the Regulation market decline rapidly over the next few years and then steadily
9 decline thereafter. The Capacity and RNS benefits grow moderately over time based on
10 projected price trends, but then begin to decline in the twenty-first year reflecting
11 degradation of the battery after the end of the CMA period. While the Base Case that we are
12 presenting assumes that the battery will be used primarily for Peak Shaving and Regulation, it
13 will also provide the flexibility to change its mode of operation if the economics of
14 Regulation and Energy Arbitrage change, or if we determine that there is another ISO-NE
15 market, either new or existing, that would provide additional value to GMP's customers.



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SECTION 248 CRITERIA

Need for the Project - 30 V.S.A. § 248(b)(2)

Q17. Will the Project fulfill a need for present and future demand for service which could not otherwise be provided in a more cost-effective manner through energy conservation programs and measures and energy-efficiency and load management measures?

A17. The battery project will provide a number of benefits to GMP customers as we work to meet our present and future demand for service. A battery, in its most basic form, is a load management device that allows load to be shifted from a period of high demand to a period of lower demand, wherein the battery is charged when loads or power market prices are relatively low and then discharged during periods of high load or high market power prices. As discussed by Mr. Belarmino, the battery storage may also serve to provide increased DG hosting capability by acting as a load increaser when charging the batteries during peak hours of solar generation, which could allow for future increases in distributed generation resources on the distribution circuit while avoiding expensive substation upgrades.

1 **Q18. Does the co-location of the Project on the GMPSolar Panton site provide any**
2 **additional load management benefits? Please explain.**

3 A18. Yes. The GMPSolar project, when teamed with battery storage, allows GMP to leverage the
4 load reduction benefits of the solar array by extending the hours where load management
5 benefits can occur. Additionally, with its own inverter, the battery can be additive to the
6 solar array's load reduction capability when peak loads occur during hours of solar output.
7 An additional benefit that GMP will realize through this project is the ability to stack benefit
8 streams as part of the value proposition. GMP believes in building the core competence of
9 constructing a system of this type, and implementing the associated technology and
10 protocols to effectively operate the system in order to maximize the various benefits of
11 expanded storage on the GMP system as we continue to evaluate other potential storage
12 projects in the future.

13
14 **Q19. Will the Project help meet Vermont's Renewable Energy Standards? If so, how?**

15 A19. Yes. Vermont's Renewable Energy Standard ("RES") has a Tier 2 requirement mandating
16 that an increasing portion of electric energy come from Distributed Generation that
17 connects to and supports the distribution system. Battery storage, as an enabling
18 technology, is consistent with this goal as it will help GMP manage the rapid growth of
19 renewable generation in Vermont, which has primarily been solar, but also includes wind and
20 hydro. One of the major challenges associated with integrating renewable generation
21 sources into a portfolio mix is that each technology has a specific generation shape, such as
22 solar which begins to generate in the morning, ramps up rapidly to a peak in the early
23 afternoon, and then trails off later in the afternoon, with a significant seasonality to the

1 shape. Over the past several years, due to the significant growth of solar on our system, we
2 have observed Vermont peak loads begin to shift toward late afternoon and early evening
3 hours, meaning that solar generation is not fully contributing at times of peak loads. Battery
4 storage will allow GMP to shift a portion of this solar generation to hours when it is more
5 valuable both in meeting load requirements and when LMPs are higher. This project will
6 also shift the shape of generation to improve GMP's ability to clip loads during monthly and
7 annual peaks as the increasing amounts of intermittent shaped generation continue to move
8 peaks to later in the day. Battery storage will also be a flexible resource enabling GMP to
9 respond to potentially costly market conditions such as hours when regional energy market
10 prices are relatively high, and intermittent renewable resources are not producing at or near
11 full output, thereby limiting their financial impact on our customers. Finally, as discussed by
12 Mr. Belarmino, battery storage could provide additional electric grid benefits that may result
13 in some distribution cost savings.

14
15 **Economic Benefit to the State – 30 V.S.A. § 248(b)(4)**

16 **Q20. Will the Project result in an economic benefit to the State and its residents? Please**
17 **explain.**

18 A20. Yes. The Project benefits that were modeled including peak shaving, regulation, and energy
19 arbitrage, with a total NPV of \$3.8 million, show the Project breaking even over twenty-five
20 years under a base case approach. See *Exhibit GMP-AQ-2*. Additionally, property and
21 income tax expenses associated with the Project will provide benefits to the Town of
22 Panton, the State, and its residents. There are additional benefits, such as the multiplier
23 effect related to the construction phase of the Project and grid reliability that we have not

1 quantified, but it is appropriate to recognize them as positive contributions when
2 determining whether the Project will provide an economic benefit to the State and its
3 residents.

4
5 **Q21. What is the basis for the estimate of Project cost used in your evaluation?**

6 A21. As discussed in Mr. Belarmino's testimony, the vast majority of costs used in this analysis
7 were provided by Tesla in the form of a signed proposal, and certain other costs, such as
8 insurance and property taxes, were based on our experience with other projects.

9
10 **Integrated Resource Planning – 30 V.S.A. § 248(b)(6)**

11 **Q22. Is the Project consistent with the resource selection principles expressed in Green**
12 **Mountain Power's IRP? Please explain.**

13 A22. Yes, as discussed in sections four and five of GMP's 2014 IRP, we proposed exploring
14 opportunities for batteries, including pairing solar and battery technologies, and using
15 batteries to address distribution reliability gaps. This project provides an opportunity for
16 GMP to enhance the existing GMPSolar Panton solar project with battery storage to gain
17 experience with colocation of solar and batteries. We look to leverage this technology in the
18 future in various locations and configurations to meet the future needs of our customers as
19 reliably and cost-competitively as possible.

20
21
22
23

1 **Compliance with Electric Energy Plan - 30 V.S.A. § 248(b)(7)**

2 **Q23. Does the Project comply with the most recent Vermont Electric Plan? Please**
3 **explain.**

4 A23. Yes, the 2016 Vermont Comprehensive Energy Plan specifically discussed how energy
5 storage will become increasingly important with the continued growth of intermittent
6 resources. This project is being proposed at a reasonable point in time as we have seen
7 battery storage costs fall substantially and on a reasonable scale. GMP expects that
8 experience gained with this project will likely enhance our understanding of the stacked
9 benefits associated with energy storage, and how to extract those benefits in future storage
10 initiatives.

11
12 **Q24. Does this conclude your testimony?**

13 A24. Yes, it does.

I, Andrew Quint, do hereby swear and affirm under the penalty of law that the information provided in the referenced prefiled testimony and exhibits is true and accurate to the best of my knowledge and that I have personal knowledge of, and am able to testify as to the validity of the information contained in my prefiled testimony and exhibits.

Dated at Rutland, Vermont this 6th day of April, 2017.

Andrew R. Quint

Andrew Quint

STATE OF Vermont

COUNTY OF Rutland

On this 6th day of April, 2017, before me personally appeared Andrew Quint, to me known to be the person who executed the forgoing instrument, and he thereupon duly acknowledged to me that he executed the same to be his free act and deed.

Subscribed and sworn to before me this 6th day of April, 2017.

[Signature]
Notary Public

My Commission Expires: 2/10/2019

Green Mountain Power Corporation
Panton Battery Storage
Benefit and Cost Analysis

Exhibit GMP-AQ-2

	Year 1	Year 2	Year 3	Year 4	Year 5	Year 6	Year 7	Year 8	Year 9	Year 10	Year 11	
NPV	2018	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028	
Rate Base												
Capital Investment - Original Share	\$ 3,391,644	\$ 3,391,644	\$ 3,391,644	\$ 3,391,644	\$ 3,391,644	\$ 3,391,644	\$ 3,391,644	\$ 3,391,644	\$ 3,391,644	\$ 3,391,644	\$ 3,391,644	
Accumulated Depreciation	\$ (136,916)	\$ (273,832)	\$ (410,747)	\$ (547,663)	\$ (684,579)	\$ (821,495)	\$ (958,410)	\$ (1,095,326)	\$ (1,232,242)	\$ (1,369,158)	\$ (1,506,073)	
Accumulated Deferred Income Taxes	\$ (765,077)	\$ (923,230)	\$ (996,521)	\$ (1,018,852)	\$ (1,041,065)	\$ (1,025,044)	\$ (970,797)	\$ (916,458)	\$ (862,103)	\$ (807,747)	\$ (753,392)	
Working Capital	\$ 2,250	\$ 2,283	\$ 2,316	\$ 2,349	\$ 2,383	\$ 2,418	\$ 2,453	\$ 2,489	\$ 2,525	\$ 2,562	\$ 2,600	
Rate Base - End of Year	\$ 2,491,901	\$ 2,196,865	\$ 1,986,691	\$ 1,827,478	\$ 1,668,383	\$ 1,547,523	\$ 1,464,889	\$ 1,382,349	\$ 1,299,825	\$ 1,217,301	\$ 1,134,778	
Average Rate Base	\$ 2,206,329	\$ 2,344,383	\$ 2,091,778	\$ 1,907,084	\$ 1,747,931	\$ 1,607,953	\$ 1,506,206	\$ 1,423,619	\$ 1,341,087	\$ 1,258,563	\$ 1,176,040	
Benefits												
Energy	\$116,112	8,696	8,329	7,547	8,444	8,695	8,840	9,159	9,780	10,018	10,308	10,565
Capacity	1,434,251	0	58,036	98,418	99,054	112,027	126,192	133,669	138,787	142,325	145,156	147,986
RNS	1,516,707	87,811	100,779	104,830	108,518	112,083	126,193	130,332	134,603	139,009	142,507	145,322
Regulation	785,172	105,745	97,812	89,878	81,945	74,011	68,022	65,913	63,870	61,890	59,972	58,112
Total Benefits	3,852,242	202,253	264,956	300,673	297,961	306,817	329,247	339,073	347,039	353,243	357,942	361,986

Year 12 2029	Year 13 2030	Year 14 2031	Year 15 2032	Year 16 2033	Year 17 2034	Year 18 2035	Year 19 2036	Year 20 2037	Year 21 2038	Year 22 2039	Year 23 2040	Year 24 2041	Year 25 2042
\$ 3,391,644	\$ 3,391,644	\$ 3,391,644	\$ 3,391,644	\$ 3,391,644	\$ 3,391,644	\$ 3,391,644	\$ 3,391,644	\$ 3,391,644	\$ 3,391,644	\$ 3,391,644	\$ 3,391,644	\$ 3,391,644	\$ 3,391,644
\$ (1,642,989)	\$ (1,779,905)	\$ (1,916,821)	\$ (2,053,736)	\$ (2,190,652)	\$ (2,327,568)	\$ (2,464,484)	\$ (2,601,399)	\$ (2,738,315)	\$ (2,868,981)	\$ (2,999,647)	\$ (3,130,312)	\$ (3,260,978)	\$ (3,391,644)
\$ (699,037)	\$ (644,682)	\$ (590,327)	\$ (535,972)	\$ (481,617)	\$ (427,262)	\$ (372,907)	\$ (318,552)	\$ (264,196)	\$ (211,809)	\$ (158,857)	\$ (105,905)	\$ (52,952)	\$ 0
\$ 2,638	\$ 2,677	\$ 2,716	\$ 2,756	\$ 2,797	\$ 2,839	\$ 2,881	\$ 2,923	\$ 2,967	\$ 3,011	\$ 3,056	\$ 3,102	\$ 3,148	\$ 3,196
\$ 1,052,256	\$ 969,734	\$ 887,213	\$ 804,692	\$ 722,172	\$ 639,653	\$ 557,134	\$ 474,616	\$ 392,099	\$ 313,865	\$ 236,197	\$ 158,529	\$ 80,862	\$ 3,196
\$ 1,093,517	\$ 1,010,995	\$ 928,473	\$ 845,952	\$ 763,432	\$ 680,912	\$ 598,394	\$ 515,875	\$ 433,358	\$ 352,982	\$ 275,031	\$ 197,363	\$ 119,695	\$ 42,029
10,829	11,100	11,378	11,662	11,954	12,253	12,559	12,873	13,195	13,017	12,303	11,723	11,287	10,823
150,982	154,013	157,067	160,181	163,377	166,632	169,969	173,366	176,845	180,383	179,945	172,367	162,870	155,353
148,193	151,121	154,108	157,155	160,262	163,432	166,665	169,963	173,327	167,030	150,796	137,400	127,321	117,541
56,311	54,565	52,874	51,235	49,646	48,107	46,616	45,171	43,771	42,414	41,099	39,825	38,590	37,394
366,315	370,799	375,427	380,232	385,239	390,424	395,810	401,373	407,137	402,845	384,143	361,314	340,069	321,111

ATTACHMENT G



ALICO RENEWABLE ENERGY LIMITED
14 Wall Street - 20th Floor
New York, New York 10005
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Thomas M. Melone
President and
Chief Executive Officer

April 4, 2016

Office of Electricity Delivery and Energy Reliability (OE-20)
U.S. Department of Energy
1000 Independence Ave. SW
Washington, DC 20585

Attention of Brian Mills, Senior Planning Advisor

Re: **Comments on the Draft EIS for the Northern Pass Project**

The Draft EIS for the Northern Pass Project (the "Project") does not conform to NEPA because it does not properly and adequately analyze the "No-Action" alternative. Under NEPA regulations, agencies must consider all reasonable alternatives, *including those not specifically under their authority to implement*. See <https://ceq.doe.gov/nepa/regs/40/1-10.HTM>. See also *NRDC v. Morton*, 458 F.2d 827 (D.C. Cir 1972). The Draft EIS fails to do that.

More strikingly, the Draft EIS fails use basic market and economic principles in analyzing the No-Action. The Northern Pass might be able to be analyzed solely as an additive project as far as economic and climate change impacts if it existed in a vacuum, but it does not. Hydro-electric electricity from the Northern Pass would displace renewable energy projects (and the American jobs related to those projects) that would otherwise be built in the New England states and on the ISO-New England electricity grid. The results of New England's multi-state RFP establishes that beyond dispute. See, Exhibit A for the summary list. For the complete list of bids, see <http://cleanenergyrfp.com/>. That is another reason why the Draft EIS does not conform to NEPA.

0740-1

Thank you for your comment. The No Action Alternative is analyzed throughout the EIS. The No Action Alternative represents a continuation of the existing condition which is described in Chapter 3 of the EIS.

0740-2

Thank you for your comment. DOE complied with the requirements of NEPA (42 United States Code [U.S.C.] Part 4321 et seq.), Council on Environmental Quality (CEQ) regulations for implementing NEPA (40 Code of Federal Regulations (CFR) Parts 1500 - 1508), and DOE implementing procedures for NEPA (10 CFR Part 1021). The No Action Alternative is analyzed throughout the EIS. The No Action Alternative represents a continuation of the existing condition which is described in Chapter 3 of the EIS. Chapter 3 describes in detail the existing condition for all resources throughout the study area. In particular, existing electricity system infrastructure is described in Section 3.1.2.5 of the EIS; this information has been updated for the final EIS. Section 1.4 of the EIS has also been updated to reflect current trends and conditions in the regional energy market. Economics impacts are addressed in Section 4.1.2 of the EIS and include an assessment of impacts on electricity rates and the anticipated mix of current and future generation types. Additionally, the Socioeconomics Technical Report includes a discussion of modeling completed for this EIS, including a projection of future base case conditions in New Hampshire and the ISO-NE region through 2030. The modeling was updated for the final EIS to incorporate current market conditions and trends. The future base case condition was modeled based on the best available information from ISO-NE; this modeling represents the potential condition under the No Action Alternative and serves as a baseline against which to analyze the potential impacts of the Project. While the EIS analyzes possible impacts to the electricity system in the socioeconomics analysis, a detailed analysis of these impacts is performed through DOE's reliability study completed in cooperation with ISO-NE via a separate process.

0740-1

0740-2

Additionally, Northern Pass is not in the public interest because the project's proponent, Eversource, is trying to create the purported demand for the Northern Pass project by violating its obligations under the Public Utility Regulatory Policies Act to renewable energy developers in the New England states. Eversource touts the purported climate change benefits from the Project for one simple reason—shareholder profits. If Eversource were really concerned with climate change, it would be honoring its obligations under federal law to sign long-term agreements with US ISO-New England locally located renewable energy projects. The public interest cannot be served when a project's proponent, such as Eversource, ignores federal law, and it seeks an approval to further that purpose. But that is exactly what it seeks here. Nor can the public interest be served if a federal agency, such as the Department of Energy ("DOE"), or the President were to sanction such violation of federal law by approving a project that would not be needed if its proponent complied with federal law.

For the DOE to issue a Presidential Permit, the DOE must find that the project is "consistent with the public interest." The DOE's determination of whether a project is "consistent with the public interest" depends on:

- The potential environmental impacts of the project, as documented and evaluated during National Environmental Policy Act (NEPA) review;
- The impacts of the project on electric system reliability; and
- Any other factors DOE views as relevant to the public interest.

NEPA requires all federal agencies to consider the potential environmental impacts of their actions and to identify and evaluate reasonable alternatives to proposed actions and those alternatives' environmental impacts. Specifically, for "major Federal actions significantly affecting the quality of the human environment," the agency must prepare "a detailed statement" regarding "(i) the environmental impact of the proposed action, (ii) any adverse environmental effects which cannot be avoided should the proposal be implemented, (iii) alternatives to the proposed action, (iv) the relationship between local short-term uses of man's environment and the maintenance and enhancement of long-term productivity, and (v) any irreversible and irretrievable commitments of resources which would be involved in the proposed action should it be implemented."

DOE has not adequately analyzed the No-Action alternative. The stated need of the Northern Pass, a high-voltage transmission line, is to bring Canadian hydro-power to the New England states. That mischaracterizes the need. The real need, if there is a need at all, would be to bring renewable energy to New England

Thank you for your comment. The Public Utility Regulatory Policies Act does not apply to DOE's determination of public interest and is outside the scope of this EIS. The Project would not be approved unless it complies with all applicable laws. As described in Section 1.1.1 of the EIS, Executive Order (E.O.) 10485, as amended by E.O. 12038, authorizes the Secretary of Energy "Upon finding the issuance of the permit to be consistent with the public interest, and, after obtaining the favorable recommendations of the Secretary of State and the Secretary of Defense thereon, to issue to the applicant, as appropriate, a permit for [the] construction, operation, maintenance, or connection" of "facilities for the transmission of electric energy between the United States and a foreign country." Thus, in deciding whether to issue a Presidential permit, DOE must determine whether doing so would be "consistent with the public interest." In addition, the Departments of State and Defense must both make "favorable recommendations" on the issuance of the permit. In deciding whether the issuance of a Presidential permit would be consistent with the public interest, DOE assesses the environmental impacts of the proposed project and reasonable alternatives, the impact of the proposed action on electric reliability, and any other factors that DOE may also consider relevant to the public interest. DOE will announce its decision whether to issue a permit - as well as the factors DOE considered in making its decision - in the Record of Decision (ROD). DOE would issue a ROD no sooner than 30 days after the EPA publishes the Notice of Availability for this final EIS in the Federal Register. The EIS analyzes potential environmental impacts to the electricity system in the socioeconomic section (see Section 4.1.2 of the EIS). The reliability study, completed in cooperation with ISO-NE, provides a separate analysis of impacts of the proposed federal action on the electricity system.

0740-4

Thank you for your comment. Northern Pass has applied to the Department of Energy for a Presidential permit for an international border crossing associated with an HVDC transmission line that would run from Quebec, Canada to Deerfield, NH. Executive Order (EO) 10485, as amended by EO 12038, "requires that executive permission be obtained for the construction and maintenance at the borders of the United States of facilities for the exportation or importation of electric energy." DOE is authorized to "receive applications for the construction, operation, maintenance, or connection, at the borders of the United States, of facilities for the transmission of electric energy between the United States and a foreign country[.]" and "[u]pon finding the issuance of the permit to be consistent with the public interest, and, after obtaining the favorable recommendations of the Secretary of State and the Secretary of Defense thereon, to issue to the applicant, as appropriate, a permit for [the] construction, operation, maintenance, or connection." (EO 10485). DOE, however, does not have siting authority for the Project. In this case, the New Hampshire Site Evaluation Committee has siting authority for the Project in the state of New Hampshire. Additionally, the USFS has siting authority for portions of the Project located in the White Mountain National Forest. (For further discussion, see Sections 1.1-1.3 of the final EIS.) While DOE's authority is limited to the approval or denial of the amended Presidential permit application (August 2015) as requested by the Applicant, DOE's policy is to analyze not only the proposed border crossing, but also the alignment of new infrastructure required between the proposed border crossing and connection to the existing U.S. electricity system as a "connected action" under NEPA. In keeping with this policy, DOE analyzed the potential environmental impacts of the alignment proposed by the Applicant. In addition, in response to input from Cooperating Agencies, other agencies, and extensive public comment, DOE analyzed a range of other alignments and underground and overhead configurations between the proposed border crossing and connection with the existing U.S. electricity system. The EIS analyzes in detail the No Action Alternative and eleven action alternatives. Additionally, seventeen alternatives were considered but eliminated from detailed analysis. Section 2.4 of the final EIS has been updated with additional information on alternatives considered but eliminated from detailed analysis. A power generation alternative was considered but was eliminated from detailed analysis in the EIS because it is not a reasonable alternative. Section 2.4.8 of the final EIS has been updated with additional information about this alternative. Section 1.4 of the final EIS has been updated to include new information

0740-4

states. But even if DOE's stated need were correct, a proper analysis of a No-Action alternative would need to account for the renewable energy generation resources in New England that would fill the need if the transmission line were not built.

The Draft EIS just brushes aside alternative generation resources that would fill the void on the basis of a suspicious rationale, that other generation resources aren't the subject of the permit application itself. Such a rationale is absurd and defeats the entire purpose of analyzing viable replacements when the No-Action alternative is selected. It is also a rationale that has been rejected by the courts.

This is what the Draft EIS says as the justification for its failure to analyze the No-Action alternative in any meaningful way:

Under this alternative, hydropower generated in Canada would not be transmitted into the U.S. Generation alternatives could include wind power, biomass, natural gas, and other generation sources in New Hampshire. DOE determined that this alternative does not meet the purpose and need for DOE's action. The purpose of, and need for, the DOE's action is to determine whether or not to grant the requested Presidential permit for the Project, which is a proposed transmission line crossing the international border carrying electricity generated by hydropower in Canada (i.e., the proposed Northern Pass project). Other sources of electricity generation are not the subject of the application for a Presidential permit, and, therefore, are outside of the scope of this draft EIS.

The Draft EIS is saying that because other generation resources would not require a Presidential Permit within DOE's jurisdiction, then the EIS does not have to analyze those alternatives. Such a conclusion is preposterous, and has been rejected by the courts.

Under NEPA regulations, agencies must consider all reasonable alternatives, *including those not specifically under their authority to implement.* See <https://ceq.doe.gov/nepa/reg/40/1-10.HTM>. See also *NRDC v. Morton*, 458 F.2d 827 (D.C. Cir 1972) (explaining that it is the essence and thrust of NEPA that impact statement serve to gather in one place discussion of relative environmental impact of alternatives, and although alternatives required for discussion are those reasonably available, they should not be limited to measures which particular agency or official can adopt; when proposed action is integral part of coordinated plan to deal with broad problem, range of alternatives which must be evaluated is

on market trends and energy use, including demand-side management and energy efficiency, since the draft EIS was published in 2015.

broadened). Thus the failure to consider other generation resources because they would not require a Presidential Permit within DOE's jurisdiction is clear error.

The results from the Multi-State clean energy RFP of the states of Connecticut, Massachusetts and Rhode Island clearly establish that the Northern Pass line is not needed. See, <http://cleanenergyrfp.com/>. Proposals for multiples of the renewable energy requirements of the New England States were received without the need for the Northern Pass. Those results prove beyond doubt that the Northern Pass is simply not needed. The attached list (Exhibit A) shows the proposals received, one of which was the Northern Pass.

The reality shown by those RFP results is that the Northern Pass would *displace* other domestic renewable energy projects. The New England States that are part of the ISO-New England electricity grid will only select a limited amount of renewable energy, and the Northern Pass would displace US-based generation. The Multi-State RFP proves that. If the Northern Pass were selected that means that renewable energy projects located in the United States would not be selected, resulting in, among other things, the loss of American jobs and revenue.

Thus the "Socioeconomic" impacts of the No-Action alternative are wrong. The No-Action alternative would result in different renewable energy projects filling its place. And because those alternative projects would be located entirely in the United States, they would far surpass the Northern Pass in economic benefits *to the United States*.

The Northern Pass will result in Canadian hydropower finding its way to the United States. *Canadian hydropower means more Canadian jobs and less American jobs*. The bulk of the economic benefits from such generation will be realized in Canada, not the United States. In sharp contrast, if the Northern Pass were not built, then as the Multi-State RFP results indisputably show, renewable energy projects *in the United States* would take its place.

Similarly, the analysis of the No-Action alternative in Section 4.10-Air Quality is incorrect. As the Multi-State RFP bids prove, the Northern Pass would be replaced with renewable energy projects located closer to the actual electrical load. Those projects would have the higher air quality benefits, and GHG benefits compared to the Northern Pass because they would be more efficient. The farther generation is from actual load, the more electrical losses incurred.

Thank you for your comment. Socioeconomic impacts are addressed in Section 4.1.2 of the EIS and include an assessment of impacts on electricity rates and the anticipated mix of current and future generation types. There is no evidence that the Project would reduce or alter the construction of new, or reliance upon existing, renewable power sources in the U.S., other than by potentially affecting the general price of electricity within the market. Section 1.4 and Appendix D of the final EIS have been updated to include other reasonably foreseeable regional energy projects.

Thank you for your comment. Section 4.1.10.2 of the EIS discusses greenhouse gas (GHG) emission impacts. Air quality and greenhouse gas analysis was conducted with GE Energy Modeling to consider future projected scenarios for electrical generation including fossil fuel and renewable sources. The GE Modeling relies upon data published by ISO-NE, including projected power plant retirements and new power generation. Please see Section 3.5 of the Air Quality and Greenhouse Gas Technical Report as well as the GE Engineering Energy Market Evaluation in the Northern Pass Transmission Project Report (Appendix 8 of the Socioeconomics Technical Report). Any future additional renewable energy produced in the region would continue to reduce criteria pollutants and GHG emissions needed to reach state and regional emission reduction goals.

The No-Action alternative must also take into account the fact that American jobs and tax revenues to the United States would be lost if Northern Pass were built. To be sure there would be construction jobs from the construction of the Northern Pass but all the generation facility jobs and economic benefits will be in Canada.

As the Multi-State RFP bids prove, the Northern Pass will displace American jobs related to construction and operation of renewable energy projects in the United States that would fill any void if the Northern Pass were not built. DOE has not analyzed those economic impacts and the loss of American jobs and tax revenues if the Northern Pass were built.

I. The Draft EIS Fails to Adequately Compare the Impacts of Approval versus the No-Action Alternative.

By relying on an incorrect assumption about the market impacts of the failure to approve the Northern Pass project, the Draft EIS violates NEPA's mandate to rigorously and objectively evaluate all reasonable alternatives to proposed actions, including the "no action" alternative. See 42 U.S.C. § 4332(C)(iii); 40 C.F.R. § 1502.14.

The U.S. Supreme Court has held that agencies must "consider and disclose the actual environmental effects" of proposed projects in a way that "brings those effects to bear on [their] decisions." *Balt. Gas & Elec. Co. v. Natural Res. Def. Council, Inc.*, 462 U.S. 87, 97 (1983). Analysis of alternatives is the "heart of the environmental impact statement." 40 C.F.R. § 1502.14. NEPA requires federal agencies to "[r]igorously explore and objectively evaluate all reasonable alternatives," including the "no action" alternative. *Id.* Agencies must "present the environmental impacts of the proposal and the alternatives in comparative form, thus sharply defining the issues and providing a clear basis for choice among options by the decisionmaker and the public." *Id.* Agencies must also analyze the "[e]nergy requirements and conservation potential of various alternatives." 40 C.F.R. § 1502.16(e). Compliance with NEPA is required "to the fullest extent possible," 42 U.S.C. § 4332, a command which the U.S. Supreme Court has affirmed is "neither accidental nor hyperbolic." *Flint Ridge Dev. Co. v. Scenic Rivers Ass'n*, 426 U.S. 776, 787 (1976).

As detailed below, DOE's assumption that the failure to approve the Northern Pass would have no effect on ISO-New England demand for renewable

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Thank you for your comment. Socioeconomic impacts are addressed in Section 4.1.2 of the EIS and include an assessment of impacts on electricity rates and the anticipated mix of current and future generation types. The analysis conducted did not find evidence that the Project would reduce or alter the construction of new, or reliance upon existing, renewable power sources in the U.S., other than by potentially affecting total expenditures for electricity within the market. Potential impacts to employment are also discussed in Section 4.1.2 of the EIS. Section 1.4 and Appendix D of the final EIS have been updated to include the other reasonably foreseeable regional energy projects.

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Thank you for your comment. The No Action Alternative is analyzed throughout the EIS. The No Action Alternative represents a continuation of the existing condition which is described in Chapter 3 of the EIS. Chapter 3 describes in detail the existing condition for all resources throughout the study area. In particular, existing electricity system infrastructure is described in Section 3.1.2.5 of the EIS; this information has been updated for the final EIS. Section 1.4 of the EIS has also been updated to reflect current trends and conditions in the regional energy market. Additionally, the Socioeconomics Technical Report includes a discussion of modeling completed for this EIS, including a projection of future base case conditions in New Hampshire and the ISO-NE region through 2030. The modeling was updated for the final EIS to incorporate current market conditions and trends. The future base case condition was modeled based on the best available information from ISO-NE; this modeling represents the potential condition under the No Action Alternative and serves as a baseline against which to analyze the potential impacts of the Project. Under the No Action Alternative, it is assumed that existing energy sources, including alternative energy generation would continue to supply the ISO-NE region and that energy efficiency measures would continue. Existing issues with the electricity supply, including diversity, would persist. While the EIS analyzes possible impacts to the electricity system in the socioeconomics analysis, a detailed analysis of these impacts is performed through DOE's reliability study completed in cooperation with ISO-NE via a separate process. Section 2.4 of the final EIS has been updated with additional information on alternatives considered but eliminated from detailed analysis. A power generation alternative was considered but was eliminated from detailed analysis in the EIS because it is not a reasonable alternative. Section 2.4.8 of

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the final EIS has been updated with additional information about this alternative.

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energy, or greenhouse gas emissions is flawed as a matter of economic theory, and disproven by the renewable energy market in ISO-NE as evidenced by, *inter alia*, the Multi-State RFP bids.

Remarkably Eversource, the proponent of Northern Pass, is also one of the participants in the ISO-NE clean energy RFP that is *seeking* bids for sources of renewable energy. The Multi-State ISO-New England RFP bids establish that building Northern Pass will have *no positive impact* on the actual renewable energy generation contracted for in ISO-New England because there are plenty of generation projects ready to take its place—none of which involve the multitude of adverse environmental impacts created by the Northern Pass that are described in the Draft EIS.

The Draft EIS simply fails to rigorously evaluate the No-Action Alternative or to provide a clear basis for choice among the options. The Draft EIS must be revised to do so.

II. DOE's Assumption That, Compared to No Action, Approving the Northern Pass Would Have Positive Impact on Total Greenhouse Gas Emissions Departs from Basic Economic Principles and Vastly Overstates the Northern Pass' Relative Climate Impacts.

The Draft EIS states:

S.8.4 ALTERNATIVE 1 – NO ACTION ALTERNATIVE

Under the No Action Alternative, there would be no impacts to any of the environmental resources analyzed. The local taxing jurisdictions would not realize any increases in tax revenues as a result of the Project and no direct or indirect economic impacts would occur within the region. No additional short-term or permanent jobs would be created. There would be no change in the wholesale price of electricity in New Hampshire or the ISO-NE region and no project related change in the level of CO₂ emissions.

DOE's assumption that the No-Action will have no net effect on renewable energy generation, economic benefits or climate benefits contradicts fundamental economic principles. Significant changes in renewable energy supply will affect renewable energy's price and, therefore, consumption and emission levels. The Northern Pass will bring approximately 10 GWs of electricity per year to ISO-New England. It is a serious error to assume that, under the No-Action Alternative, all 10 GWs would not be completely replaced by renewable energy generation from

Thank you for your comment. Socioeconomic impacts relative to the No Action alternative are addressed in the EIS, including impacts on electricity rates and both the existing and proposed mix of generation types. There is no evidence that the Project would reduce existing, or the construction of new, renewable power sources within New Hampshire. Potential impacts to air quality are analyzed throughout the EIS (see Section 4.1.10) and the Air Quality Technical Report.

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other sources, with no effect on overall consumption or emissions. The Draft EIS fails to analyze how electricity from the Northern Pass directly competes with other renewable energy resources in electricity generation, such that *increasing the supply of Canadian hydro-electricity results in less American renewable energy generation* in ISO-New England. DOE also ignored how overall greenhouse gas emissions will vary among substitute sources of renewable energy generation. DOE should have—and easily could have—evaluated the No-Action Alternative’s climate effects.

A. Basic Economic Principles Provide That Any Significant Change in Supply Will Change Price and Demand and, Therefore, Total Generation and Emissions.

The basic economic principles of supply and demand provide that significant changes in renewable energy supply will affect renewable energy’s price and, therefore, consumption levels. Increasing the supply of any normal good (including renewable energy) puts downward pressure on that good’s market price; this is a basic tenant of the law of supply and demand. N. Gregory Mankiw, *Principles of Economics* 74–78, 80–81 (5th ed. 2008). Lower renewable energy prices can result in lower electricity costs, which in turn encourages higher levels of electricity consumption, while higher renewable energy and electricity prices discourage consumption. *See id.* at 67–68.¹

Approving the Northern Pass would increase the supply of Canadian hydro-electricity, lowering demand for U.S.-based renewable energy generation. *Alternatively, in the No-Action Alternative, the demand for U.S.-based renewable energy generation would be higher, which U.S.-based generation would reduce greenhouse gas emissions, as compared to the Northern Pass’ climate impacts.* Similarly, *in the No-Action Alternative*, the higher demand for U.S.-based renewable energy generation would result *in increased economic benefits for the United States*, as compared to the Northern Pass’ economic benefits which are largely in Canada.

¹ DOE may take notice of basic economic principles of supply and demand, as well as classic economic textbooks and peer reviewed articles. *See Citizens for Alternatives to Radioactive Dumping v. U.S. Dept of Energy*, 485 F.3d 1091, 1096 (10th Cir. 2007) (“In dealing with scientific and technical evidence, extra-record evidence ‘may illuminate whether an [environmental impact statement] has neglected to mention a serious environmental consequence, failed adequately to discuss some reasonable alternative, or otherwise swept stubborn problems or serious criticism . . . under the rug.’”) (alterations in original).

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Thank you for your comment. Socioeconomic impacts are addressed in Section 4.1.2 of the EIS and include an assessment of impacts on electricity rates and the anticipated mix of current and future generation types. The analysis conducted did not find evidence that the Project would reduce or alter the construction of new, or reliance upon existing, renewable power sources in the U.S., other than by potentially affecting total expenditures for electricity within the market.

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Canadian hydro-electricity directly competes with other forms of renewable energy resources in the generation of electricity. Economists measure how coal, natural gas, and other fuels act as substitutes in the electricity market by analyzing “cross-price elasticity” (that is, how responsive producers are in swapping inputs when relative prices change). See Mankiw, *supra* at 99. For example, the U.S. Energy Information Administration (“EIA”) found that for the U.S. market, a 10-percent increase in the ratio of the price of coal to the price of natural gas leads to a 1.4-percent increase in the use of natural gas over coal. EIA, *Fuel Competition in Power Generation and Elasticities of Substitution 1* (2012). In other words, in that example, the cross-price elasticity of demand for natural gas is 0.14 with respect to coal’s price. *Id.* Other economists reach similar conclusions. James Ko & Carol Dahl, *Interfuel Substitution in U.S. Electricity Generation*, 33 APPLIED ECONOMICS 1833, 1835 (2001) (analyzing “average” cross-price elasticity). See also Nate Blair et al., *Long-Term National Impacts of State-Level Policies* (Nat’l Renewable Energy Lab. Conf. Paper 620-40105, June 2006) (discussing how “higher coal prices would dramatically increase” use of renewable wind energy). These estimates represent short-run elasticities: over time, substitution effects become more pronounced as power plants make technological changes that facilitate fuel-switching, and as long-term investments favor renewable energy. See Mankiw, *supra* at 105–106.

Changes in the relative amounts of coal, natural gas, renewable sources, and nuclear energy used to generate electricity—as well as changes in total energy demand—would, in turn, change total greenhouse gases emissions. In short, the Draft EIS’ unexamined and unsupported assumption that the No-Action Alternative would have no effect on greenhouse gas emissions is contradicted by fundamental economics and market analyses. The environmental impact statement fails to meet NEPA’s requirements, and should be revised.

B. Considering the Size and Nature of the Northern Pass It Is a Fallacy to Assume that Under the No-Action Alternative There Would be No Substitution With No Effect on Price, Consumption, or Emissions.

Moving beyond theory to the specific project at issue, given the size and characteristics of the Northern Pass and the ISO-New England market, it is clear error to not analyze the substitutions that would occur if the Northern Pass were not built. A list of candidates are included in Exhibit A. Moreover, the list in Exhibit A does not include the most beneficial renewable energy projects in ISO-New England—locally based projects under 20MWs, including small distributed projects and net-meter projects.

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Thank you for your comment. Socioeconomic impacts are addressed in Section 4.1.2 of the EIS and include an assessment of impacts on electricity rates and the anticipated mix of current and future generation types. The analysis conducted did not find evidence that the Project would reduce or alter the construction of new, or reliance upon existing, renewable power sources in the U.S., other than by potentially affecting total expenditures for electricity within the market.

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The Draft EIS' assumption that there would be no substitution simply bears no relationship to reality. The Northern Pass represents an enormous amount of renewable energy that affects hundreds of miles of forest and other resources. In fact, as the Multi-State Clean Energy RFP shows, it would provide double the renewable energy that those States are seeking for the next many years, thus virtually eliminating the demand for other forms of renewable energy.

If the Northern Pass is not approved, utilities in ISO-New England will acquire other renewable energy production to satisfy their respective renewable energy goals and standards, and therefore, lower greenhouse gas emissions. In the No-Action Alternative, any renewable energy substituting for the Northern Pass may provide a more positive impact on emissions and climate change. Yet, the Draft EIS does not analyze this environmental impact in its alternatives analysis.

In short, the Draft EIS' flawed economic assumptions renders its alternatives analysis ineffective and misleading, and the Draft EIS must be revised.

III. Other Federal Agencies—during Previous NEPA Reviews—Properly Analyze the Supply and Demand of Resources and Resulting Climate Effects.

For over 35 years, in NEPA reviews, the Department of the Interior has consistently understood that a decision not to take action related to energy production will affect that energy resource's supply and price and thus trigger other actions. Interior has further analyzed how such triggered actions generate different consequences for air pollution, climate change, and overall environmental quality. The U.S. Court of Appeals for the D.C. Circuit has praised Interior's analysis of these substitution effects. As far back as 1979, Interior has assessed the different environmental effects of energy substitutes under a No-Action Alternative—including different levels of carbon dioxide emissions.

Other agencies, such as the Surface Transportation Board, the Forest Service, the State Department, the Office of Surface Mining Reclamation and Enforcement (another Interior sub-agency), the Federal Energy Regulatory Commission, and the Nuclear Regulatory Commission, have also properly analyzed the effects of their energy management decisions in NEPA reviews, consistent with the advice of the U.S. Court of Appeals for the Eighth Circuit and the U.S. District Courts of Colorado and Minnesota. DOE's mistaken assumption that taking no action on the Northern Pass would have, compared to approving it, no net effects on

greenhouse gas emissions represents a substantial break with a 35-year history of proper analysis by DOE's sister agencies.

A. Other Federal Agencies Analyze the Connections between Supply, Price, Substitutes, Conservation, and Emissions.

Before the 1982 creation of a sub-agency within Interior responsible for offshore resources, the Office of the Secretary of the Interior developed the federal offshore oil and gas leasing program, and the Bureau of Land Management ("BLM") prepared environmental impact statements on leasing actions (then called simply "environmental statements"). In BLM's 1979 Final Environmental Statement on a proposed lease sale off the coast of Southern California, the agency analyzed the No-Action Alternative of withdrawing the sale:

[I]f the subject sale were cancelled, the following energy actions or sources might be used as substitutes: Energy Conservation; Conventional oil and gas supplies; Coal; Nuclear power; Oil shale; Hydroelectric power; Solar energy; Energy imports; . . . Vigorous energy conservation is an alternative that warrants serious consideration. The Project Independence Report of the Federal Energy Administration claims that energy conservation alone can reduce energy demand growth by 0.7 to 1.2 percent depending on the world price of oil. . . . The environmental impacts of a vigorous energy conservation program will be primarily beneficial.

Final Environmental Statement, OCS Sale No. 48, Proposed 1979 Outer Continental Shelf Oil and Gas Lease Sale Offshore Southern California, 1508-09 (1979). See also BLM, *Draft Environmental Statement, Proposed Five-Year OCS Oil and Gas Lease Sale Schedule 63* (1980) ("An alternative . . . to cease leasing . . . would result in the need to meet national energy needs through other sources, or to reduce energy consumption . . .").

Thus, as early as 1979, DOE's sister agency recognized that canceling even a single oil and gas lease would cause the market to respond by substituting not just oil and gas from other sources, but alternative fuel types as well as increased energy conservation. BLM further recognized that the extent of energy conservation as a response depended on the price of the resource being replaced. BLM explained in 1979 to decisionmakers and the public, over the course of 25 pages of analysis, how each possible substitute for the foregone offshore leasing carried its own environmental effects: net beneficial to the extent increased energy conservation or renewable energy offset the lost offshore oil and gas; a more mixed or net negative

effect on environmental quality with switches to other types and sources of fossil fuels. BLM, *Final Envtl. Stmt. on Safe No. 48*, *supra* at 1508–1532. BLM even noted in this 1979 analysis that different energy substitutes generated different carbon dioxide emissions: “A number of gases are associated with geothermal systems and may pose health and pollution problems. These gases include . . . carbon dioxide However, adverse air quality impacts are generally less than those associated with fossil-fuel plants.” *Id.* at 1525.

B. Interior Uses Sophisticated Tools to Assess the Environmental Consequences of Substitutes, and the D.C. Circuit Has Praised Its Modeling.

Interior develops Five-Year Programs to manage the leasing of offshore (or “Outer Continental Shelf” (“OCS”)) oil and gas resources. Its current Program covers the years 2012–2017; development of that Program and the related Environmental Impact Statement first began in 2009. See BOEM, *Outer Continental Shelf Oil and Gas Leasing Program: 2012–2017—Final Programmatic Environmental Impact Statement*, 8-1 (2012). In the decision document for the current offshore Program, Interior’s Bureau of Ocean Energy Management (“BOEM”) explained:

In an environment of strong worldwide demand for oil and natural gas, a domestic supply cut equivalent to the production anticipated to result from a new Five Year Program would lead to a slight increase in world oil prices and a relatively larger increase in U.S. natural gas prices. All other things being equal, this would lead to a market response providing . . . a slight reduction in oil and natural gas consumed, a substantial increase in oil imports, and added supplies provided by onshore hydrocarbon resources.

BOEM uses its *Market Simulation Model (MarketSim)* to estimate the amount and percentage of substitutes the economy would adopt should a particular program area not be offered to lease. *MarketSim* is based on authoritative and publicly available estimates of price elasticities of supply and demand and substitution effects. . . .

[I]n the event the NAA [No-Action Alternative] were implemented. . . . 68 percent of the oil and natural gas production foregone from this program would be replaced by greater imports, 16 percent by increased onshore production, [10 percent by other energy sources] . . . and 6 percent by a reduction in consumption.

BOEM, *Proposed Final Outer Continental Shelf Oil & Gas Leasing Program 2012–2017*, 110 (2012)13; see also BOEM, *2012–2017 Final Programmatic Environmental Impact Statement*, *supra* at 4-643 (“With less oil and gas available from the OCS under the No Action Alternative, consumers could obtain oil and gas from other sources, substitute to other types of energy, or consume less energy overall.”).

BOEM explained in its Final Environmental Impact Statement that, compared to leasing offshore oil and gas, the energy substitutes anticipated under a No-Action Alternative will have different environmental consequences, including for climate change. For example, BOEM detailed how “Coal consumed in place of gas under the No Action Alternative will result in environmental costs The combustion of coal in power plants or industrial boilers produces higher emissions . . . than the combustion of natural gas and results in greater CO₂ [carbon dioxide] emissions.” *Id.* at 4-647. Similarly, BOEM’s Economic Analysis Methodology calculates:

[T]he emissions for carbon dioxide and nitrous oxide [another greenhouse gas] are greater under the NSOs [No-Sale Options] than from the program. However, there is more methane from the program than the NSOs. Though these impacts are not monetized, *they are not identical between having an OCS program and having the impacts of the NSOs.*

BOEM, *Economic Analysis Methodology for the Five Year OCS Oil and Gas Leasing Program for 2012–2017*, 29–30 (2012) (emphasis added).

In a recent case challenging Interior’s 2012-2017 offshore oil and gas leasing program, the D.C. Circuit favorably reviewed Interior’s modeling of how “forgoing additional leasing on the OCS would cause an increase in the use of substitute fuels . . . and a reduction in overall domestic energy consumption from greater efforts to conserve in the face of higher prices.” *Ctr. for Sustainable Economy v. Jewell*, 779 F.3d 588, 609 (D.C. Cir. 2015). Importantly, nothing in BOEM’s modeling is unique to the offshore oil and gas context. According to BOEM, “MarketSim’s economics-based model representation of U.S. energy markets . . . simulates end-use domestic consumption of oil, natural gas, coal and electricity in four sectors (residential, commercial, industrial and transportation); primary energy production; and the transformation of primary energy into electricity.” BOEM, *The Revised Market Simulation Model (MarketSim): Model Description 2* (2012).

Interior's sophisticated modeling of the environmental effects of energy substitutes under No-Action Alternatives is the culmination of 35 years of analysis. Interior has used the MarketSim model since at least its 2002–2007 Program for offshore leasing. See Minerals Mgmt. Serv. (“MMS”), *Energy Alternatives and the Environment*, 10 (2001)16 (“MMS employs the MktSim2000 model to evaluate the impact of decreased OCS production resulting from no action.”). Since at least the 1990s, Interior's Environmental Impact Statements have calculated the percentage of offshore production expected to be substituted by various energy alternatives under a No-Action scenario. MMS *Energy Alternatives and the Environment*, 13 (1996)17 (“[F]or each unit of OCS gas not produced because of no action . . . conservation will account for about 0.14 units . . .”); see *also id.* at 15 (“Significant environmental impacts associated with expanded importation of oil include: the generation of greenhouse gases . . .”). And going back to the first Five-Year Program in 1980 (when BLM prepared the Environmental Statements), Interior has recognized that not all sources of the same fuel type present the same environmental effects—for example, offshore oil drilling presents lower spill risks than imported oil substituted under the no-action alternative. Interior, *5-Year OCS Leasing Program*, 13b (1980).

Similarly, in a 2001 report on its offshore oil leasing program, Interior declared in no uncertain terms that “Examining other energy sources is an important aspect of the No Action Alternative” under NEPA reviews. MMS, *Energy Alternatives and the Environment*, 1 (2001).

So how could it be that the DOE does not understand market dynamics and the principles of substitution, particularly when it comes to energy decisions?

C. Other Agencies Analyze Supply and Demand in NEPA Reviews of Energy Management Decisions.

Two other federal agencies—the Surface Transportation Board and the Forest Service—began, upon remand from federal courts, conducting the proper analysis of supply and demand in NEPA reviews of their energy management decisions. The U.S. Court of Appeals for the Eighth Circuit sharply criticized the Surface Transportation Board for “illogically” concluding that approving new railroad lines to Powder River Basin coal mines would not affect the demand for and consumption of coal, and for ignoring “widely used” models capable of forecasting such effects. *Mid States Coal. for Progress v. Surface Transp. Bd.*, 345 F.3d 520.

549–550 (8th Cir. 2003). “On remand, the Board undertook just such a study using the Energy Information Administration’s (EIA) National Energy Modeling System (NEMS) . . . [which] not only forecasts coal supply and demand but also quantifies environmental impacts.” *Mayo Found. v. Surface Transp. Bd.*, 472 F.3d 545, 555 (8th Cir. 2006). See also *Surface Transp. Bd., Draft Environmental Impact Statement for the Tongue River Railroad*, Appendix C.1-13 to 1-14 (2015) (analyzing how approving a new coal railroad would only increase annual U.S. coal production by 0.13 percent, which “would not be significant enough to noticeably lower delivered coal prices (which includes transportation), and thus, would not increase total demand for coal”).

Similarly, the U.S. District Court of Colorado “[could] not make sense” of the Forest Service’s assumption that approving road construction through national forests to reach Colorado coal mines would not increase coal production and consumption. *High Country Conservation Advocates v. Forest Service*, 52 F. Supp. 3d 1174, 1197 (D. Colo. 2014). On remand, the Forest Service’s draft environmental impact statement details that while the no-action alternative “has no impact on climate change,” under the leasing option “coal mining, transportation, and combustion would increase the atmospheric concentrations of GHGs [greenhouse gases].” Forest Service, *Rulemaking for Colorado Roadless Areas—Supplemental Draft Environmental Impact Statement* 48–49 (2015).

The State Department provides another example. In its environmental impact statements, the agency has estimated how, at different oil prices, approving international oil pipelines could affect production and greenhouse gas emissions. See State Dep’t, *Final Supplemental Environmental Impact Statement for the Keystone XL Project*, ES-16 (2014)23 (“The 2013 Draft Supplemental EIS estimated how oil sands production would be affected by long-term constraints on pipeline capacity . . . if long-term . . . oil prices were less than \$100 per barrel. The Draft Supplemental EIS also estimated a change in GHG emissions associated with such changes in production.”). This analysis was strongly encouraged by comments from the Environmental Protection Agency. See Comments from EPA, to State Dep’t, on Draft EIS for the Keystone XL Project, at 3 (July 16, 2010) (“[I]t is reasonable to conclude that extraction will likely increase if the pipeline is constructed.”). Even when the State Department concluded that a different pipeline approval would not affect energy substitutes, the agency first assessed the market and “conclude[d] that this amount of crude oil [3% of total U.S. processing] is not expected . . . to significantly impact end-use price or demand.” *Sierra Club v. Clinton*, 746 F. Supp. 2d 1025, 1046 (D. Minn. 2010). The State Department’s practice of assessing

whether its actions would affect overall energy demand stands in stark contrast with this case, where DOE simply made an unsubstantiated assumption, without conducting any analysis.

Other agencies that, during NEPA reviews, have properly analyzed how their energy management decisions might affect energy supply and demand, and so affect emissions, include the Office of Surface Mining Reclamation and Enforcement (another Interior sub-agency), the Federal Energy Regulatory Commission, and the Nuclear Regulatory Commission. See Office of Surface Mining, *Draft Stream Protection Rule Environmental Impact Statement*, at 4-175 to 4-176 (2015) (“Modeling suggests that these Alternatives [to regulate surface coal mining to protect streams] could decrease national coal production . . . [T]his analysis anticipates that the net effect on climate resiliency is positive at the national level under each Action Alternative . . .”); *id.* at 4-160 to 4-161 (“Under some Alternatives, the mix of production type, i.e., surface or underground, may also change. As discussed . . . surface and underground mining activities have different emissions profiles.”); Fed. Energy Reg. Comm’n, *Lake Charles Liquefaction Project—Final Environmental Impact Statement*, 3-3 (2015)26 (“If the No-Action Alternative is selected, it could result in the continued use of less clean-burning fossil fuels at levels that might otherwise have been reduced through replacement with LNG.”); Nuclear Reg. Comm’n, *Generic Environmental Impact Statement for License Renewal of Nuclear Plants* §8.2 (1996)27 (“Denial of a renewed license . . . may lead to the selection of other electric generating sources to meet energy demands . . . [or] to conservation measures . . . [T]he environmental impacts of such resulting alternatives would be included as the environmental impacts of the no-action alternative.”).

In short, at least nine different agencies—including Interior’s Office of the Secretary and at least three Interior sub-agencies (Office of Surface Mining, Bureau of Ocean Energy Management, and Minerals Management Service)—in NEPA analyses stretching back over 35 years, have analyzed how their energy management decisions affect energy supply and demand, and so affect emissions. The economic theory is undisputed, the economic models are easily accessible, and the practice is widespread through the government. DOE’s unexplained assumption regarding the No-Action Alternative sharply breaks with 35 years of agency practice.

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Thank you for your comment. Socioeconomic impacts are addressed in Section 4.1.2 of the EIS and include an assessment of impacts on electricity rates and the anticipated mix of current and future generation types. The analysis conducted did not find evidence that the Project would reduce or alter the construction of new, or reliance upon existing, renewable power sources in the U.S., other than by potentially affecting total expenditures for electricity within the market.

0740-13

Thank you for your comment. As discussed in Section 1.4 of the EIS, Northern Pass set forth a range of project objectives and benefits in its permit application. DOE and the cooperating agencies reviewed this documentation and determined that the project objectives include addressing three primary needs concerning New England's electricity supply: diverse, low-carbon, non-intermittent electricity. The project objectives in Section 1.4 of the final EIS have been updated to include new information on market trends and energy use since the draft EIS was published in 2015. The economic consequences of the Project are analyzed in detail in Section 4.1.2 of the EIS. The analysis presented in the final EIS was updated to reflect current market conditions and inputs (see Section 4.1.2 of the EIS). Section 2.4 of the EIS discusses alternatives considered but eliminated from further analysis. DOE determined that other transmission projects, power generation alternatives, and energy conservation are not reasonable alternatives. Section 2.4 has been updated to include additional information about these alternatives. The EIS analyzes in detail the potential environmental impacts of a No Action Alternative and eleven action alternatives. Under the No Action Alternative, it is assumed that existing energy sources, including distributed generation and alternative energy generation, would continue to supply the ISO-NE region and that energy efficiency measures would continue.

0740-12

IV. Even If DOE's Approach to the No-Action Alternative Were Correct, Its Calculation of the Economic Benefits and Climate Impacts of the Northern Pass Would Be Overestimated and Inaccurate.

The Draft EIS assumes that taking no action on the Northern Pass would have, compared to approval, no net effects on carbon dioxide emissions, methane emissions, or climate change. These comments have explained why that assumption is entirely inconsistent with economic theory, real market conditions, and past agency practices. Consequently, the Draft EIS presents a deeply inaccurate and misleading comparison of the approval options and No-Action Alternative. However, even if DOE were to start from the proposition that the No-Action Alternative resulted in no impacts, the Draft EIS would be inaccurate and misleading in a different but equally problematic way.

The Draft EIS calculates the "economic benefits" and climate impacts of Northern Pass by assuming that no other renewable energy facilities would be built to take its place if it were not built. As explained above that is simply not true. Other sources of renewable energy generation would substitute for the Northern Pass, then the Draft EIS must subtract from its calculation of the Northern Pass' economic, energy supply and climate benefits, the lost benefits from all those would-be sources of renewable energy generation that would no longer be built.

Once that is done Northern Pass may have a net negative impact on economics or climate benefits compared to its substitutes. That is particularly so when it comes to economic benefits because all the economic benefits from the hydro-generation facility are realized in Canada, not the United States. And the United States would lose thousands of American jobs related to the US-based substitutes. The Draft EIS does not comply with NEPA because it fails to analyze those effects.

V. The Draft EIS Does Not Account for Other American Projects that Will Displace the Need for Hydropower.

The Draft EIS states that there are three reasons that justify the Project's existence—electricity diversity, low carbon electricity supply and non-intermittent power supply. The electricity diversity section focuses on New England's constraints on the supply of natural gas. The Northern Pass sponsor—Eversource—has a gas pipeline project that is expected to be in service in the fourth quarter of 2018 which will eliminate the gas pipeline constraints. See, <http://accessnortheastenergy.com/>. Thus the need for Canadian hydropower as a

0740-13

means to potentially mitigate natural gas constraints is simply not needed. The natural gas constraints exist only in the winter and there is no way the Northern Pass will be built before the natural gas constraints are lifted through Eversource's Access Northeast project. Even under the most optimistic circumstances, where there is a Record of Decision in the fourth quarter of 2016 and no litigation thereafter, the Project would not be in-service until 2019, after the natural gas pipeline constraints go away.

A more likely scenario, however, involves litigation in the federal courts which would likely take a minimum of 3 years, bringing the earliest possible date for the Northern Pass' in-service date to 2022. The natural gas constraints will be long gone by then.

The second stated justification for the Project is low carbon electricity supply. As shown above, there are many other renewable energy projects that are ready and willing to fill the void. The Northern Pass' project proponent—Eversource—simply does not want to have those other projects fill the void for an obvious reason: it results in lower profit and lower income for the company and its shareholders. Eversource's monetary self-interest is not a justification for issuance of the permit or failing to account for the other projects that would fill the Project's purported need.

The third stated justification for the Project is non-intermittent power supply. To be sure, hydro-electricity does not suffer from the same intermittency of wind and solar right now. But the ISO-New England grid is shifting to natural gas as the baseload supply until grid-scale storage for wind and solar becomes economically competitive. The natural gas baseload supply provides the most flexibility to integrate large amounts of wind and solar. Hydro-electricity does not provide that same quick ramp up and down, thus using hydro-electricity as baseload would harm integration of intermittent sources. Once the natural gas constraints are lifted, which they would be before the Northern Pass would be in-service, then baseload hydro is not needed, and its introduction would replace other renewables and restrict additional renewable integration into the grid.

Thus the three purported justifications for the Project are simply not there.

0740-14

Thank you for your comment. The Public Utility Regulatory Policies Act does not apply to DOE's determination of public interest and is outside the scope of this EIS. The Project would not be approved unless it complies with all applicable laws. As described in Section 1.1.1 of the EIS, Executive Order (E.O.) 10485, as amended by E.O. 12038, authorizes the Secretary of Energy "Upon finding the issuance of the permit to be consistent with the public interest, and, after obtaining the favorable recommendations of the Secretary of State and the Secretary of Defense thereon, to issue to the applicant, as appropriate, a permit for [the] construction, operation, maintenance, or connection" of "facilities for the transmission of electric energy between the United States and a foreign country." Thus, in deciding whether to issue a Presidential permit, DOE must determine whether doing so would be "consistent with the public interest." In addition, the Departments of State and Defense must both make "favorable recommendations" on the issuance of the permit. In deciding whether the issuance of a Presidential permit would be consistent with the public interest, DOE assesses the environmental impacts of the proposed project and reasonable alternatives, the impact of the proposed action on electric reliability, and any other factors that DOE may also consider relevant to the public interest. DOE will announce its decision whether to issue a permit - as well as the factors DOE considered in making its decision - in the Record of Decision (ROD). DOE would issue a ROD no sooner than 30 days after the EPA publishes the Notice of Availability for this final EIS in the Federal Register. The EIS analyzes potential environmental impacts to the electricity system in the socioeconomic section (see Section 4.1.2 of the EIS). The reliability study, completed in cooperation with ISO-NE, provides a separate analysis of impacts of the proposed federal action on the electricity system.

0740-14

VI. The Public Interest Will Not Be Served By Issuance of the Permit.

The Northern Pass is not in the public interest because as shown above, it would displace renewable energy projects (and the American jobs related to those projects) that would otherwise be built in the New England states and on the ISO-New England electricity grid. It is not in the US public interest to approve a project that will result in the loss of American jobs, and the economic benefits from those projects.

VII. The Public Interest Will Not Be Served By Granting a Permit to a Proponent that Ignores Its Obligation Under Federal Law to Buy Energy From US-Based Renewable Energy Project.

The position of Eversource in sponsoring the Northern Pass project instead of domestic renewable energy projects is yet another example of what Section 210 of the Public Utility Regulatory Policies Act ("PURPA"), 16 U.S.C. § 824a-3, intended to eliminate—the reluctance of utilities to purchase energy from independent power producers in the USA. More than thirty years later, this case shows that reluctance, as well as the utilities' desire to increase returns for their shareholders, is still alive and well.

Under PURPA, electric utilities, such as Eversource, must purchase any electricity produced by QFs. 18 C.F.R. § 292.303(a)(1). Allico and presumably other QFs have offered energy from their QF solar projects to Eversource over at the long-term rate required by 18 C.F.R. § 292.304(d)(2)(ii). Eversource has violated PURPA by rejecting such projects, forcing Allico to proceed with litigation. Northern Pass is not in the public interest because the project's proponent, Eversource, is trying to create the purported demand for the foreign Northern Pass project by violating its obligations under PURPA to domestic renewable energy developers in the New England states. The public interest cannot be served when a project's proponent, such as Eversource, ignores federal law, and it seeks an approval to further that purpose, such as what it seeks here. Nor can the public interest be served if a federal agency or the President of the United States were to sanction such conduct by approving a project that would not be needed if its proponent complied with federal law.

Respectfully Submitted,



Thomas Melone

EXHIBIT A

Project Name	Developer	Size (MW)	Technology	Location
Candlewood Solar Project	Amresco	20	Solar PV	New Milford, CT
Antrim Wind	Antrim Wind Energy LLC	28.8	Wind	Antrim, NH
Beacon Falls Energy Park	Beacon Falls Energy Park LLC	63.3	Fuel Cell	Beacon Falls, CT
Blueberry Hills	Blueberry Hills LLC	249.9	Wind	Deblois, ME
Canton Mountain Wind	Patriot Renewables	22.8	Wind	Canton, ME
Cassadaga	Cassadaga Wind LLC	126	Wind	Cherry Creek, NY
Alder Stream Wind/Moose Wind	Nextera	216/245	Wind	Eusti, ME
Clean Energy Connect	Iberdrola/EDP Renewables/Brookfield Renewable	600	Hydro/Wind	Multiple states
Conowingo Hydroelectric Project	Exelon	572	Hydro	Conowingo, MD
Simsbury Solar Farm	Deepwater Wind	26.4	Solar PV	Simsbury, CT
Fitchburg Solar 1	EDP-ibvogt Solar LLC	48	Solar PV	Fitchburg, MA
Gardner Solar 1	EDP-ibvogt Solar LLC	22	Solar PV	Gardner, MA
Hopkinton Solar 1	EDP-ibvogt Solar LLC	22	Solar PV	Hopkinton, RI
Hopkinton Solar 2	EDP-ibvogt Solar LLC	22	Solar PV	Hopkinton, RI
Hopkinton Solar 3	EDP-ibvogt Solar LLC	22	Solar PV	Hopkinton, RI
Hopkinton Solar 4	EDP-ibvogt Solar LLC	22	Solar PV	Hopkinton, RI
North Stonington Solar	EDP-ibvogt Solar LLC	22	Solar PV	Stonington, CT
West Greenwich Solar	EDP-ibvogt Solar LLC	22	Solar PV	West Greenwich, RI
Aroostook County Wind	EDP Renewables	248 up to 650	Wind	Aroostook County, Maine
GRE 501 MIRA LLC	Greenskies	20	Solar PV	Windsor, MA
Hope-Scituate Solar	RES Americas	20	Solar PV	Cranston, RI
Woods Hill Solar	RES Americas	20	Solar PV	Pomfret, CT
King Pine Wind	Sundison	600	Wind	Aroostook/Penobscot Counties, ME
Maine Clean Power Connection (Moo Nextera, Sundison)	Sundison	547	Wind	Western Maine
Maine Renewable Energy Interconnection (King Pine) , EDP (Number Nine Wind,	Sundison	1250	Wind	Maine (various locations)
Alder Stream and Moose Wind, Wint Nextera	Eversource	662	Wind/Solar (151 Franklin County, ME	Wind/Solar (151 Franklin County, ME
Northern Pass Line	Transmission Line Multiple states	1090	Transmission Line	Multiple states
Chinook Solar	Ranger Solar LLC	50	Solar PV	Fitzwilliam, NH
Enfield Solar	Ranger Solar LLC	20	Solar PV	Enfield/Somers, CT
Farmington Solar	Ranger Solar LLC	50	Solar PV	Farmington, ME
Quineaug Solar	Ranger Solar LLC	50	Solar PV	Brooklyn/Canterbury, CT
Canford Airport Solar	Ranger Solar LLC	50	Solar PV	Sanford, ME
Amersit Wind	Sundison	85.8	Wind	Somerset County, ME
The Wind and Hydro Response	Invenery/Hydro-Quebec/Vermont Green Line	400	Wind/Hydro	Various locations (NY/Quebec)
Weaver Wind	Sundison	72.6	Wind	Eastbrook, ME

ATTACHMENT H

April 4, 2016

BY ELECTRONIC DELIVERY

Mr. Brian Mills
Office of Electric Delivery and Energy Reliability (OE-20)
U.S. Department of Energy
1000 Independence Avenue, SW
Washington, DC 20585

**Re: Comments of CLF on DEIS and SDEIS, Northern Pass Transmission LLC,
Presidential Permit Application, OE Docket No. PP-371**

Dear Mr. Mills:

Conservation Law Foundation (“CLF”) appreciates the opportunity to comment on the Draft Environmental Impact Statement (“DEIS”) and Supplemental Draft Environmental Impact Statement (“Supplemental DEIS” or “SDEIS”) regarding the Northern Pass Transmission Project (“Project”) application for a Presidential Permit in Docket No. PP-371. In light of the substantial public interest in the proposed Project, and the significant impacts the proposed project would have in the context of New England’s energy future and on the landscape, environment and communities of New Hampshire, we are troubled by numerous significant deficiencies in DOE’s review, including but not limited to:

- A failure to adequately analyze the proposed project, including its purported need, within the context of significant energy-related considerations in New England;
- A grossly deficient purpose and need statement, leading to an overly constrained, flawed alternatives analysis;
- A failure to analyze the No-Action Alternative, other forms of generation, including renewables and energy efficiency, and alternative transmission options, including different routes;
- A failure to identify and evaluate impacts to landscape-level historical and cultural resources; and
- A failure to analyze the Project’s impacts in Canada.

In light of these and other significant deficiencies discussed in our comments below, CLF urges DOE not to proceed to the preparation of a Final EIS. Rather, the DEIS and SDEIS



contain deficiencies that, to enable informed decision-making and meaningful public participation, warrant further supplementation of the DEIS to rectify errors.¹

I. Introduction

Northern Pass LLC filed an application on October 14, 2010 requesting that DOE grant a Presidential Permit for a high-voltage transmission line to import hydroelectric power from Quebec, Canada into New England. This was followed by an amended application on July 1, 2013, with a further amended application submitted on August 21, 2015. The current proposal is to construct a 192-mile line to transmit 1000 megawatts (“MW”) of power, with a transfer capability of up to 1090 MW, entering the United States from Canada in Pittsburg, New Hampshire and extending to an interconnection point with ISO-New England (“ISO-NE”) in Deerfield, New Hampshire. As currently proposed, the Project would entail 132 miles of overhead transmission lines, with 60.5 miles of the line to be buried including 52 miles through the White Mountain National Forest.

The Presidential Permit process requires DOE to decide whether the Project is “consistent with the public interest” of the United States and may impose on the Project “such conditions as the public interest may in its judgment require.” *See* Executive Order 10,485, as amended by Executive Order 12,038. Before determining that a Presidential Permit is in the public interest, DOE must comply with the National Environmental Policy Act (“NEPA”) and Section 106 of the National Historic Preservation Act of 1966 (“NHPA”). DOE coordinates with a number of other state and federal agencies throughout this process.

DOE issued a DEIS on the Northern Pass project in July 2015, followed by a Supplemental DEIS in November 2015 to reflect proposed changes contained in the August 21, 2015 amended application.

CLF is a non-profit, member-supported environmental advocacy organization that works to solve the environmental problems threatening the people, natural resources and communities of New England. CLF’s advocates use law, economics, and science to design and implement strategies that conserve natural resources, protect public health, and promote vital communities in our region. Founded in 1966, CLF has a long history of participation in proceedings before state utility commissions, ISO-NE, and federal agencies in a wide range of energy matters. CLF has extensive experience in the operation of New England’s wholesale electricity markets: CLF has long been a Market Participant in the New England Power Pool (“NEPOOL”), the stakeholder entity legally sanctioned by the Federal Energy Regulatory Commission to monitor

¹ Together with these comments, CLF submits twenty-three exhibits that are provided as weblinks or as attachments. In addition, per instructions received from your staff, a cd-rom containing digital copies of all exhibits has been mailed as a courtesy to your office.



ISO-NE, and CLF attorneys sit on both the NEPOOL Reliability Committee and the ISO-NE's Participants Advisory Committee that are responsible for making recommendations and determinations concerning ISO-NE's Forward Capacity Market and its load zones. CLF attorneys also sit on NEPOOL's Markets Committee that advises ISO-NE on potential changes in market rules. CLF has authored and influenced energy legislation throughout the region, and has played a key role in the development of state renewable energy laws, the Regional Greenhouse Gas Initiative ("RGGI"), and energy efficiency laws and regulations.

CLF has played an active role in DOE's Presidential Permit process to date. In connection with DOE's Presidential Permit process and related NEPA review, we have previously filed the following scoping comments and other submittals:

- Protest, Comments and Motion to Intervene of Conservation Law Foundation (12/16/10)
- Objection to Selection of EIS Contractor (filed by Conservation Law Foundation, Appalachian Mountain Club and Coos Community Benefits Alliance) (2/9/11)
- Requests for Additional Post-Scoping, Pre-Draft-EIS Report and for Written Decisions on Pending Protests, Objections, Motions, and Comments (filed by Conservation Law Foundation, Appalachian Mountain Club, The Nature Conservancy in New Hampshire, Ammonoosuc Conservation Trust, Conservation New Hampshire and the Society for the Protection of New Hampshire Forests) (3/31/11)
- Scoping Comments of the Conservation Law Foundation (4/12/11)
- Motion to Stay Proceedings and for Preparation of Comprehensive Assessment of Need for Imports of Canadian Energy into Northeastern United States (filed by Conservation Law Foundation, Ammonoosuc Conservation Trust, Appalachian Mountain Club, Gail S. Beaulieu and Joint Interveners, North Country Council, Owl's Nest Resort & Golf Club, Society for the Protection of New Hampshire Forests and Kelly M. Weiser) (4/28/11)
- Reply to Northern Pass Transmission, LLC Correspondence dated May 5, 2011 (filed by Conservation Law Foundation, Ammonoosuc Conservation Trust, Appalachian Mountain Club, Appalachian Trail Conservancy, Gail S. Beaulieu and Joint Interveners, North Country Council, Owl's Nest Resort & Golf Club, Society for the Protection of New Hampshire Forests and Kelly M. Weiser) (5/17/11)
- Supplemental Scoping Submission (6/13/11)
- Second Supplemental Scoping Submission (10/14/11)
- Third Supplemental Scoping Submission (2/14/12)
- Fourth Supplemental Scoping Submission – Objections to DOE Review and Request for Termination of NEPA Contractor Team (10/9/12)



- Comments of Conservation Law Foundation, Appalachian Mountain Club, and Society for the Protection of New Hampshire Forests on Amended Application (9/17/13)
- Scope of Environmental Impact Statement (filed by Conservation Law Foundation, Ammonoosuc Conservation Trust, Appalachian Mountain Club, Audubon Society of New Hampshire, Conservation New Hampshire, Environment New Hampshire and Society for the Protection of New Hampshire Forests) (10/30/13)
- Fifth Supplemental Scoping Submission (11/5/13)
- Response to Scoping Report Alternatives Addendum, dated May 1, 2014 (filed by Conservation Law Foundation, Appalachian Mountain Club, The Nature Conservancy – New Hampshire Chapter and the Society for the Protection of New Hampshire Forests) (6/17/14)

In addition to the above, CLF is also a consulting party in the Department of Energy’s consultations with stakeholders under Section 106 of the NHPA.

II. DOE Should State its Preferred Alternative for Public Airing

Neither the DEIS issued in July 2015 nor the SDEIS issued in November 2015 states a preferred alternative. DOE should set forth its preferred alternative as soon as possible, together with its reasoning for selecting that alternative. Public interest in the Northern Pass Project is exceptionally high. During the scoping period alone, DOE received 7,560 comments from over 6,400 individuals, businesses, municipalities, government agencies, and other organizations, including organizations with expertise in environmental and energy issues, as well as historical and cultural resources. In light of the intense public opinion surrounding the Project, it is incumbent upon DOE to conduct as transparent a process as possible. Absent an opportunity to comment upon the agency’s conclusions and reasoning prior to the FEIS, the public will lose a meaningful opportunity to provide input. CLF urges DOE to state its initial conclusion regarding a preferred alternative, together with the basis for that conclusion, in a further supplementation of the DEIS addressing the many deficiencies in the DEIS and SDEIS discussed herein.

III. It is Essential that DOE Carefully Consider the Need for the Project in Light of Current Competitive Projects as well as Overall Energy Resources in the Region, Including Energy Efficiency and Distributed Generation

In the Project Objectives section of the DEIS, DOE states that the Project “would address three primary needs concerning New England’s electricity supply.” DEIS at 1-4 to 1-6. These regional needs are identified as electricity diversity, low carbon electricity supply, and non-

intermittent power supply.² But the existence of such regional needs does not establish that there is a specific need for the Project, as there are myriad solutions available to meet each such need, individually or in combination. Based on a review of the DEIS, CLF concludes that in attempting to identify the need for the Project, DOE has failed to rigorously and comprehensively assess the current regional energy outlook, including: current competitors to Northern Pass; proposed projects that serve similar needs; and the ability of demand-side resources, such as energy efficiency, to reduce or eliminate any specific need for the Project that DOE has identified. DOE should conduct such a thorough assessment prior to drawing any final conclusions as to need for the Project.

As DOE is well aware, transmission lines are not like roads. Unlike transportation projects where two dots need to be connected with a line, regional energy needs are far more complex, and there are typically multiple (or many) means to achieve the same goal. In this case, the potential solution sets can be defined as follows: (a) projects that are like-competitors to Northern Pass, (b) projects that serve similar needs but are less directly comparable in scope or nature, and (c) energy resources that address the same underlying purposes as Northern Pass through a substantially different means.

Among the projects that are the “like-competitors” to Northern Pass are:

- New England Clean Power Link, a project of TDI New England, described by that company as follows:³

The New England Clean Power Link is a proposed 1,000 MW High Voltage direct current (HVdc) underwater and underground transmission cable that will bring clean, low-cost energy from the U.S.-Canadian border to Vermont and the New England marketplace. Once completed, the project will lower costs for consumers, reduce environmental emissions, create jobs, increase tax revenues, and diversify fuel supply in New England, all while respecting Vermont’s natural beauty by burying the cable.

² For a discussion of greenhouse gas emissions associated with hydroelectric power, see n.55 *infra* and references cited therein.

³ See <http://www.necplink.com/index.php>. CLF notes that it has entered into a settlement agreement with TDI-NE regarding the Clean Power Link, and is on record stating that, “TDI-NE sets an important example of a transmission project that successfully meets high standards for our environment, our people, and our communities.” See Approval for Transmission Under Lake Champlain to Bring Power to New England, Sandy Levine (Jan. 6, 2016) available at <http://www.clf.org/blog/approval-for-transmission-under-lake-champlain-to-bring-power-to-new-england/>; Settlement on Large Transmission Project Adds Benefits for Communities, Environment, and Climate, Sandy Levine (July 2, 2015) available at <http://www.clf.org/blog/settlement-on-large-transmission-project-adds-benefits-for-communities-environment-and-climate/>.

- The Northeast Energy Link, a project of Emera Maine and National Grid, described by those companies as follows:⁴

The Northeast Energy Link is a proposed 230-mile 1,100 MW direct current (DC) transmission line delivering renewable energy capacity and diverse supply from northern and eastern Maine and eastern Canada into southern New England. Current project planning is considering an underground transmission line route utilizing existing transportation corridors in eastern Maine, New Hampshire and Massachusetts.

- The Maine Green Line, a project proposed by Anbaric Transmission, National Grid and the Green Line Devco, LLC. The project website describes the proposal as follows:⁵

Maine Green Line will move up to 1200 megawatts (MW) of power from Maine to eastern Massachusetts. Its goals are to encourage the development of renewable resources in northern New England by providing the necessary infrastructure to bring “green” power to more densely populated areas to the south, including the Boston area, while at the same time increasing the supply of reliable energy into the largest demand center in New England.

These projects, like Northern Pass, are intended to serve the objectives of enhancing access to diverse, non-intermittent, and low-carbon energy supplies, and they are planned to provide a similar amount of total energy to the New England region. In order to determine whether the Northern Pass Project is in fact needed by New England, and whether it is environmentally advantageous, it is incumbent upon DOE to consider Northern Pass in light of New England Clean Power Link, the Maine Green Line and the Northeast Energy Link. Notably, all of these projects propose full burial of their transmission lines in land or water, unlike Northern Pass.

The responses to the New England Clean Energy Request for Proposals (“Clean Energy RFP”) contain various examples of projects that match the second solution set – i.e., projects that serve similar needs to Northern Pass but that vary in scope or nature. The Clean Energy RFP is a joint solicitation by the states of Connecticut, Rhode Island, and Massachusetts seeking proposals for low-carbon energy projects meeting a number of criteria.⁶ In recent weeks, dozens of bids have been submitted in response to the Clean Energy RFP.⁷ Although Northern Pass is

⁴ See <http://www.northeastenergylink.com/project/default.aspx>.

⁵ See <http://anbarictransmission.com/projects/mainegreenline/>.

⁶ See Clean Energy RFP website at <http://cleanenergyrfp.com/>.

⁷ See Public Versions of Bids Available at <http://cleanenergyrfp.com/2016/02/01/public-versions-of-bids-available/>.

among the RFP bidders, so are other viable projects that will provide the same or substantially similar regional energy services:⁸

- The Clean Energy Connect bid, a proposed cooperative project of Iberdrola Renewables, EDP Renewables North America, Brookfield Renewable Erie Power, Brookfield Transmission, and Eversource Energy Transmission Ventures, intended to provide to the New England power markets 600 MW of new wind together with existing run-of-the-river hydro power to providing balancing for the wind;
- The Wind and Hydro Response: Vermont Green Line bid, a proposal whereby the Vermont Green Line would transmit to New England's markets 400 MW of total combined power from Invenergy's Bull Run wind farm in connection with balancing hydroelectricity from Hydro-Quebec; and
- The Maine Renewable Energy Interconnect bid, a project proposed by Central Maine Power Company and Emera Maine to transmit energy from the wind farms of EDP Renewables and SunEdison, with the goal of making available to the ISO-NE grid as much as 1,248.6 MW of wind energy.

Each of these proposed projects is intended to address some or all of the objectives that DOE has identified for Northern Pass, and would represent a significant new power resource, though the amounts of power made available by each would vary. In order to determine whether the Northern Pass Project is in fact needed by New England, DOE should consider Northern Pass's claimed attributes in light of contemporary project proposals such as these. Notably, some of these projects feature potential benefits that Northern Pass lacks, such as the benefits that can be derived from tethering wind and hydroelectric power together, which include the potential to simultaneously address intermittency, carbon reduction goals, and the need for more low-impact renewable generation sources.

Finally, among the alternatives belonging to the third solution set are energy efficiency and distributed generation. These energy resources can address the same underlying purposes as Northern Pass through a substantially different means. They are available at a scale comparable to Northern Pass when viewed in the aggregate, as is permitted and encouraged by ISO-NE. Despite requiring a different approach than discrete transmission projects like Northern Pass, they are highly valued resources with many benefits that overlap with and likely exceed those identified by DOE relative to Northern Pass.

Energy efficiency can accomplish each of the three project objectives that DOE suggests Northern Pass can serve, but can do it with no traditional environmental impacts to speak of, at a lower cost, and with greater carbon reductions. Between 2000 and 2013, energy efficiency has

⁸ See bid documents provided at <http://cleanenergyrfp.com/2016/02/01/public-versions-of-bids-available/>.

reduced New England electricity demand by over 2 gigawatts (“GW”), saving consumers \$1.5 billion during the winter of 2014 alone.⁹ Approximately 300 MW of energy efficiency resources has cleared the ISO-NE Forward Capacity Market auction for the years 2017 and 2018.¹⁰ The Massachusetts Office of the Attorney General recently commissioned a report that demonstrating that energy efficiency and other resources will defray the need for many new investments in traditional generation and transmission-based projects.¹¹ DOE should consider the potential that energy efficiency, alone or in combination with another energy resource, will eliminate or reduce the asserted need for Northern Pass.

Distributed generation also can accomplish many of the same objectives that DOE identifies for Northern Pass, but must be balanced by an alternative energy or storage resource to address intermittency.¹² Distributed generation is an increasingly sizable resource, expected to continue its exponential growth. This year, ISO-NE adjusted the installed capacity requirement for its forward capacity auction downward by 367 to 390 MW to account for behind-the-meter distributed solar power that has already been or is projected to be installed by 2019 and is not yet embedded in load.¹³ This will likely save consumers around \$30 million in avoided capacity costs between 2019 and 2020, and possibly more.¹⁴ DOE should consider the potential that distributed generation, alone or in combination with another energy resource, will eliminate or reduce the asserted need for Northern Pass. Notably, distributed generation and energy efficiency both also have the benefit of reducing the need for costly and potentially high-impact investments in transmission lines, such as the Northern Pass Project itself.

As this discussion illustrates, the solutions to the regional energy demands that DOE addresses in the Project Objectives section of the DEIS are many. Before determining that Northern Pass is needed to satisfy these energy needs, DOE must address the regional and temporal context in which Northern Pass has been proposed. This project is being advanced at a time when developers, combined, are proposing to build more than 12,000 MW of generation to serve New England markets, including 4 GW of wind.¹⁵ It is being advanced at a time when

⁹ Acadia Center, *Winter Impacts of Energy Efficiency in New England* (Apr. 2015), available at http://acadiacenter.org/wp-content/uploads/2015/04/AcadiaCenter_Efficiency-Retrospective-Analysis_041615_Final.pdf.

¹⁰ See Challenges for Electric System Planning, Synapse Energy (July 24, 2015), Table 2 at 10, attached as Ex. 1 and available at http://www.synapse-energy.com/sites/default/files/Challenges-for-Electric-System-Planning_0.pdf.

¹¹ See Power System Reliability in New England, Analysis Group (Nov. 2015), attached as Ex. 2 and available at <http://www.mass.gov/ago/docs/energy-utilities/reros-study-final.pdf>.

¹² E.g., wind power or batteries. See *infra* Section V.B.(1) for a discussion of such solutions.

¹³ See Joint Comments on ISO New England’s Draft 2016 PV Forecast (March 9, 2016), at 1, attached as Ex. 3 and available at http://www.iso-ne.com/staticassets/documents/2016/03/joint_draft2016pvforecast_comments.pdf.

¹⁴ See *id.* n.2.

¹⁵ Stephen J. Rourke, New England’s Energy Resource Mix is Changing Rapidly (June 15, 2015), at 9 (ISO-NE presentation prepared for EIA Energy conference), attached as Ex. 4 and available at <https://www.eia.gov/conference/2015/pdf/presentations/rourke.pdf>.

creative renewable energy solutions and technologies are proliferating, including battery storage options. It is being advanced at a time when the demand for low-impact renewables and energy efficiency is greater than ever. DOE cannot reasonably conclude that Northern Pass serves the region's needs absent a rigorous assessment of need that addresses this context.

IV. The Purpose and Need Statement is Unlawfully Narrow, Establishing a Self-Fulfilling Prophecy in Favor of the Project and Unlawfully Constraining DOE's Alternatives Analysis

An EIS must include a statement of purpose and need. 40 C.F.R. § 1502.10. The agency conducting an EIS “bears the responsibility for defining at the outset the objectives of an action” and “must look hard at the factors relevant to the definition of purpose.” *Citizens Against Burlington v. Busey*, 938 F.2d 190, 196 (D.C. Cir. 1991). As CLF stated in its scoping comments dated April 12, 2011, it is axiomatic that a purpose and need statement must be defined by the nature of a proposed project and the impacts associated therewith, and that it must be framed in such a way as to allow for a reasonable range of alternatives to be identified and analyzed. *See, e.g., Border Power Plant Working Group v. Dep't of Energy*, 260 F. Supp. 2d 997, 1030 (S.D. Cal. 2003).¹⁶ Indeed, as the Seventh Circuit explained in *Simmons v. U.S. Army Corps of Engineers*, 120 F.3d 664, 666 (7th Cir. 1997):

When a federal agency prepares an Environmental Impact Statement (EIS), it must consider “all reasonable alternatives” in depth. 40 C.F.R. §1502.14. No decision is more important than delimiting what these “reasonable alternatives” are. That choice, and the ensuing analysis, forms “the heart of the environmental impact statement.” 40 C.F.R. §1502.14.. To make that decision, the first thing an agency must define is the project's purpose. *See Citizens Against Burlington, Inc. v. Busey*, 938 F.2d 190, 195-96 (D.C. Cir. 1991). The broader the purpose, the wider the range of alternatives; and vice versa. The “purpose” of a project is a slippery concept, susceptible of no hard-and-fast definition. One obvious way for an agency to slip past the strictures of NEPA is to contrive a purpose so slender as to define competing “reasonable alternatives” out of consideration (and even out of existence). The federal courts cannot condone an agency's frustration of Congressional will. If the agency constricts the definition of the project's purpose and thereby excludes what truly are reasonable alternatives, the EIS cannot fulfill its role. Nor can the agency satisfy the Act. 42 U.S.C. § 4332(2)(E).

¹⁶ In *Border Power Plant*, 260 F. Supp. 2d at 1030, the court rejected the argument that the purpose and need of the project, which was subject to DOE Presidential Permit process, pertained solely to transmission lines, to the exclusion of generating facilities in Mexico, stating in pertinent part: “There, the scope of the action relates only to the transmission lines, but the nature of the action includes the full scope of the analysis, including the effects of the action. The nature of the action therefore includes the importation of power generated in Mexico.”

At Section 1.2 of the Northern Pass DEIS (at 1-3), DOE provides the following statement of purpose and need:

The purpose of, and need for, the DOE's action is to determine whether or not to grant the requested Presidential permit for the Project at the international border crossing proposed in the amended Presidential Permit application.

There are two ways to interpret the plain meaning of DOE's purpose and need statement. They are: (1) whether or not to grant a permit for the Project as proposed by the Applicant; or (2) whether or not the proposed transmission line should be permitted *at the specified border crossing*, or at an alternate border crossing. Because DOE fails to seriously consider a border crossing other than the one proposed in the Project Application, as amended, one must conclude that DOE's purpose and need statement asks simply whether to grant a permit for the Project as proposed by the Applicant.

In constraining the issues to this binary question, DOE's purpose and need statement is unreasonably narrow and contrary to law. As the Sixth Circuit articulated in *Save Our Cumberland Mountains v. Kempthorne*, 453 F.3d 334, 345 (6th Cir. 2006), a binary purpose and need statement will generally be unacceptable:

Whether in the context of environmental assessments or environmental impact statements, other courts have been skeptical of this kind of agency solipsism—that the agency's licensing responsibility gives it authority only to say “yes” or “no” to permit applications, making these the only alternatives the agency must discuss. As these courts correctly have recognized, the National Environmental Policy Act prevents federal agencies from effectively reducing the discussion of environmentally sound alternatives to a binary choice between granting or denying an application.¹⁷

¹⁷ The court supported this proposition with the following:

See Davis v. Mineta, 302 F.3d 1104, 1122 (10th Cir.2002) (“[O]nly two alternatives were studied in detail: the no build alternative, and the preferred alternative. [The agency] acted arbitrarily and capriciously in approving an [environmental assessment] that does not provide an adequate discussion of [p]roject alternatives.”); *see also Colo. Env'tl. Coal. v. Dombeck*, 185 F.3d 1162, 1174 (10th Cir.1999) (“[T]he National Environmental Policy Act and Council on Environmental Quality Regulations require [an agency] to study in detail all ‘reasonable’ alternatives [in an environmental impact statement].... [Courts] have interpreted this requirement to preclude agencies from defining the objectives of their actions in terms so unreasonably narrow they can be accomplished by only one alternative.”); *Simmons v. United States Army Corps of Eng'rs*, 120 F.3d 664, 666-67 (7th Cir.1997) (“One obvious way for an agency to slip past the strictures of [the National Environmental Policy Act] is to contrive a purpose so slender as to define competing ‘reasonable alternatives’ out of consideration (and

DOE's critical error is that it fails to identify the *underlying purpose* of the action before it. NEPA requires that the EIS "briefly specify the underlying purpose and need" of agency action. 40 C.F.R. § 1502.13. "[T]he evaluation of 'alternatives' mandated by NEPA is to be an evaluation of alternative means to accomplish the *general goal* of an action." *Simmons v. Army Corps of Engineers*, 120 F.3d 664, 669 (7th Cir. 1997) (emphasis added) (citing *Van Abbema v. Fornell*, 807 F.2d 633, 638 (7th Cir. 1986); 40 C.F.R. § 1502.13). A purpose and need statement that is overly specific to the parameters of the proposal put forward by the project applicant, without rising to the necessary level of generality, fails to accomplish this fundamental requirement.¹⁸ That is the case here, where DOE has impermissibly constrained its purpose and need to only "whether or not to grant the requested Presidential permit for the Project at the international border crossing proposed."

It is precisely because an agency's purpose and need dictates the range of reasonable alternatives that an agency cannot define its objectives in such unreasonably narrow terms. *See City of Carmel-By-The-Sea v. U.S. Dept. of Transp.*, 123 F.3d 1142, 1155 (9th Cir. 1997). Here, as further discussed in Section V of these comments, DOE has relied upon its improperly narrow purpose and need statement to eliminate from detailed analysis a number of alternatives that *are* in fact within the reasonable range of alternatives. For example, DOE specifically relies on its purpose and need statement to summarily reject other transmission projects from detailed analysis, stating:

DOE determined that this alternative does not meet the purpose and need for DOE's action. The purpose of, and need for, the DOE's action is to determine whether or not to grant the requested Presidential permit for the Project, which is a proposed transmission line crossing the international border (i.e. the proposed Northern Pass project) in the location identified in Northern Pass's amended Presidential Permit application.

DEIS at 2-37. It rejects from detailed analysis alternative forms of power generation on similar, equally flawed grounds, stating:

even out of existence). The federal courts cannot condone an agency's frustration of Congressional will. If the agency constricts the definition of the project's purpose and thereby excludes what truly are reasonable alternatives, the [environmental impact statement] cannot fulfill its role."); *cf.* 40 C.F.R. § 1500-6 ("Each agency shall interpret the provisions of the [National Environmental Policy Act] as a supplement to its existing authority and as a mandate to view traditional policies and missions in the light of the Act's national environmental objectives.").

¹⁸ *See id.* An agency should not limit its EIS to the parameters defined by the project applicant. *See Simmons*, 120 F.3d at 669.

DOE determined that this alternative does not meet the purpose and need for DOE's action. The purpose of, and need for, the DOE's action is to determine whether or not to grant the requested Presidential permit for the Project, which is a proposed transmission line crossing the international border carrying electricity generated by hydropower in Canada (i.e., the proposed Northern Pass project). Other sources of electricity generation are not the subject of the application for a Presidential permit, and, therefore, are outside the scope of the draft EIS.

DEIS at 2-37. DOE offers the same analysis-free rationale, premised on its improperly narrow purpose and need statement, for declining detailed consideration of energy conservation. *Id.*

Executive Order 10485 imposes an expansive "public interest" review, not a cramped or constrained mandate.

Furthermore, given the purpose and need statement set forth in the DEIS at Section 1.2 is so constrained as to merely give rise to a "yes" or "no" ultimatum on the Project as proposed, DOE's selection and purported consideration of *any alternatives* outside this binary ultimatum is rendered an empty formality.

It is well-established that an agency must consider the statutory directives—or, in this case—executive directives that provide the agency with its authority to act. *See City of New York v. Dept. of Transp.*, 715 F.2d 732, 743-45 (2d Cir. 1983).¹⁹ Here, Executive Order 10485 mandates a broad "public interest" review, which DOE's purpose and need statement greatly undermines.

CLF observes that the Project Objectives section of the DEIS (Section 1.4, discussed in Section III of these comments) identifies several factors relevant to the agency's public interest review as well as the purpose and need for action. There, DOE asserts that the Project would provide three benefits to New England's electricity system, namely diversity of electricity supply; low-carbon characteristics, and non-intermittency. These three factors should be evaluated for inclusion in a revised purpose and need statement. In addition, CLF submits that DOE must consider the public interest in promoting the advancement of domestic clean energy sources and energy efficiency.

To this end, CLF urges DOE to consider adopting a statement of purpose and need that includes at least the following: the objective of serving regional need for additional low-carbon electrical energy, of a character that is either non-intermittent or appropriately balanced such that it can serve in a "baseload-like" manner as a "firming" resource to complement, without

¹⁹ *See also Citizens Against Burlington*, 938 F.2d at 196.

unnecessarily diminishing demand for, the competitive development of appropriately sited in-region renewable energy and energy efficiency.

A purpose and need statement that incorporates these factors would be consistent with Applicant's own characterization of the role of the Project, as well as the regional needs outlined by DOE at Section 1.4 of the DEIS, and the broader public interest as required by Executive Order 10485.

Absent a meaningful statement of purpose and need that is sufficiently broad and identifies the appropriate public interest factors, consistent with Executive Order 10485 and NEPA, the DOE's Presidential Permit review will be nothing more than an exercise in costly and protracted regulatory rubberstamping.

V. DOE's Alternatives Analysis is Flawed as a Matter of Law

An EIS must contain a detailed discussion of "alternatives to the proposed action." 42 U.S.C. § 4332(2)(iii). Section 102(2)(E) of NEPA calls upon each federal agency to "study, develop, and describe appropriate alternatives to recommended courses of action in any proposal which involves unresolved conflicts concerning alternative uses of available resources." *Id.* § 4332(2)(E) (1976). The alternatives analysis required by NEPA is the "the heart of the environmental impact statement." *Friends of Southeast's Future v. Morrison*, 153 F.3d 1059, 1065 (9th Cir. 1998) (quoting 40 C.F.R. § 1502.14). Accordingly, an agency issuing an EIS must "[r]igorously explore and objectively evaluate all reasonable alternatives."²⁰ The failure to consider a reasonable alternative renders an EIS invalid.²¹ As the Council on Environmental Quality has made clear:

In determining the scope of alternatives to be considered, the emphasis is on what is 'reasonable' rather than on whether the proponent or applicant likes or is itself capable of carrying out a particular alternative. Reasonable alternatives include those that are practical or feasible from the technical and economic standpoint and using common sense...

Forty Most Asked Questions Concerning CEQ's National Environmental Policy Act Regulations, 46 Fed. Reg. 18,026, 18,033. *See also* 40 C.F.R. §§ 1502.14(c)-(d). Significantly, the alternatives considered need not be within the jurisdiction of the agency to approve, nor must

²⁰ *Westlands Water Distr. v. Dept. of Interior*, 376 F.3d 853, 868 (2004) (quoting 40 C.F.R. §§ 1502.14(a), (c)).

²¹ *Friends of Southeast's Future*, 153 F.3d at 1065 (citing *Alaska Wilderness Recreation & Tourism Ass'n v. Morrison*, 67 F.3d 723, 729 (1995)).

they be within the power of the permit applicant to accomplish.²² The alternatives merely must address the project need, in whole or in part.²³

DOE's alternatives analysis fails to comply with NEPA and its implementing regulations as follows.

A. The DEIS's Alternatives Analysis is Fatally Flawed because it is Premised on an Unlawfully Narrow Purpose and Need Statement.

As discussed in Section IV, the alternatives analysis in an EIS flows from the agency's statement of purpose and need. *See supra* Section IV (citing *City of Carmel-By-The-Sea*, 123 F.3d at 1155). For this reason a cramped purpose and need statement inevitably leads to an inadequate alternatives analysis. *See id.* In order to ensure that its alternatives analysis complies with NEPA, DOE must issue a Supplement to the DEIS that rectifies the errors with its purpose and need statement and ensures a rigorous and objective analysis of reasonable alternatives.

B. The DEIS's Alternatives Analysis is Deficient Because It Excludes From Detailed Analysis a Number of Reasonable Alternatives

As stated above, DOE has an affirmative duty under NEPA to conduct a rigorous and objective analysis of all reasonable alternatives. Contrary to this obligation, however, the DEIS improperly excludes from detailed analysis numerous alternatives – including but not limited to alternative forms of power generation and alternative means of transmission – that *should* have been analyzed,²⁴ as follows.

(1) The DEIS is Deficient for its Failure to Include Power Generation Alternatives among the Reasonable Range of Alternatives For Detailed Analysis

The DEIS explicitly “considered,” but rejected from detailed analysis, power generation alternatives such as wind power, biomass and other generation sources. DEIS at 2-37. The sum

²² *See id.*; 40 C.F.R. §§ 1502.14(c)-(d). *See also Natural Resources Defense Council v. Morton*, 458 F.2d 827, 835-36 (D.C. Cir. 1972).

²³ *Natural Resources Defense Council* 458 F.2d at 836 (holding that it is not appropriate to “disregard alternatives merely because they do not offer a complete solution to the problem”).

²⁴ 40 C.F.R. § 1502.14(a). *See also Friends of the River v. FERC*, 720 F.2d 93, 104-05 (D.C. Cir. 1983) (permit to operate hydroelectric plant; alternative of purchasing power from other producers considered); *Mason County Med. Ass'n v. Knebel*, 563 F.2d 256, 262-63 (6th Cir. 1977) (permit to build coal-fired steam electric generator; alternatives of nuclear, geothermal, conservation, purchased power, and others considered); *North Carolina v. FPC*, 533 F.2d 702, 707 (D.C. Cir. 1976) (permit to build hydroelectric plant; alternative of conservation considered), *vacated on other grounds*, 429 U.S. 891 (1976).

total of its consideration, leading to DOE's decision to exclude alternative forms of power generation from its alternatives analysis, is as follows:

Under this alternative, hydropower generated in Canada would not be transmitted into the U.S. Generation alternatives could include wind power, biomass, natural gas, and other generation sources in New Hampshire.

DOE determined that this alternative does not meet the purpose and need for DOE's action. The purpose of, and need for, the DOE's action is to determine whether or not to grant the requested Presidential permit for the Project, which is a proposed transmission line crossing the international border carrying electricity generated by hydropower in Canada (i.e., the proposed Northern Pass project). Other sources of electricity generation are not the subject of the application of a Presidential permit and, therefore, are outside of the scope of this draft EIS.

Id.

The DEIS's failure to include alternative forms of power generation in its alternatives analysis is flawed for numerous reasons. First, as discussed above, it is premised on an unlawfully narrow purpose and need statement. Second, whereas Northern Pass proposes to import power to be used regionally, DOE constrained its description of power generation alternatives to "generation sources *in New Hampshire.*" *Id.* (emphasis added). There is no logical or justifiable reason for doing so, particularly given that the proposed project seeks to serve as a regional source of electricity. Any electricity imported into, or generated in, New England is bought, sold, transmitted, and distributed via the regional ISO-NE electricity grid, and all such power is equally available for use or consumption across New England. Third, the DEIS includes the arbitrary and capricious declaration that because the Applicant proposes to import electricity generated by Canadian hydropower, other forms of power generation are not the subject of the application for a Presidential permit and therefore cannot be considered. *Id.* The law's command that DOE must consider a reasonable range of feasible alternatives nowhere limits such alternatives to only those that would also require a Presidential Permit.²⁵

Declining to consider renewable energy alternatives is contrary to the public interest standard of Executive Order 10,485 and the public policy goal of reducing greenhouse gas emissions. In describing the asserted need for the Northern Pass Project, DOE states Northern Pass may assist in furthering federal, regional, and state policies intended to promote greenhouse gas reductions including the President's Climate Action Plan, RGGI, the New Hampshire Climate Action Plan, and the Massachusetts Global Warming Solutions Act. DEIS at 1-5 to 1-6.

²⁵ See, e.g., 40 C.F.R. § 1502.14.

Without a detailed analysis of generation alternatives, however, DOE lacks the requisite support to conclude that Northern Pass promotes these goals better than other reasonable alternatives.²⁶

Unlike large-scale hydroelectric power, renewable energy sources such as solar and wind power are promoted under the renewable energy policies of every state in New England. Similar to state greenhouse gas reduction goals, Renewable Portfolio Standards (“RPSs”) reflect the objective of reducing greenhouse gases by promoting the development of diverse, low-impact clean power sources.²⁷ A key difference is that these policies also restrict eligibility based on the non-carbon impacts of the power sources.²⁸ While state RPSs generally exclude large-scale hydroelectric power because of its outsized environmental impacts and lack of need for financial support, they explicitly promote the increased state and regional penetration of clean energy technologies such as wind and solar. This comparative benefit and public policy interest should be an important factor in the DEIS and in DOE’s alternatives analysis.

DOE should not discount or ignore renewable generation alternatives on the basis of scale or scalability. Wind projects proposed to serve the region total 4,200 MW (not including 800 MW of existing wind power), while regional photovoltaic solar development goals total 2,400 MW (not including 900 MW of existing solar PV).²⁹ With solar alone poised to total 2,400 MW in New England in eight years,³⁰ it is unreasonable to discount renewable energy sources in energy planning or in comparing the benefits of energy projects.

DOE also should not discount or ignore renewable generation alternatives on the basis of intermittency. Market products already support the “firming” or “balancing” of intermittent renewable power. Many of these market products began to proliferate after the Applicant conceived of and requested permitting for the Northern Pass project, making the Project’s claimed benefits to the region dated.³¹ DOE’s alternatives analysis should reflect the modern state of technology and the markets.

²⁶ For a discussion of greenhouse gas emissions associated with hydroelectric power, see n.55 *infra* and references cited therein.

²⁷ New Hampshire’s RPS statute, RSA 362-F, requires each electricity provider to meet customer load by purchasing or acquiring certificates representing generation from renewable energy based on total megawatt-hours supplied. Information on RSA 362-F can be found at http://www.puc.state.nh.us/sustainable%20energy/renewable_portfolio_standard_program.htm. A range of information on state RPSs across the country can be found at <http://www.dsireusa.org/>.

²⁸ *See id.* (www.dsireusa.org).

²⁹ ISO-NE Overview and Regional Update on the Growth of Renewables, slide 9 (Feb. 4, 2016), attached as Ex. 5 and available at <http://www.ncsl.org/Portals/1/Documents/energy/Gray-present.pdf>.

³⁰ *Id.* slide 11 (citing Final PV Forecast (April 2015)). CLF notes that ISO-NE’s solar projections consistently underestimate growth. *See* Joint Comments on ISO New England’s Draft 2016 PV Forecast, Ex. 3.

³¹ *See, e.g.*, Presidential Permit Application dated October 14, 2010 at 30-31.

Among the market products that address intermittency is energy storage. Energy storage is playing an increasingly significant role in residential, commercial, and utility-scale solar applications, and is expected to reduce the need for alternative power generation to “balance” or “integrate” intermittent resources like solar, including distributed rooftop solar. California, Hawaii, and Massachusetts are among the states working to advance energy storage solutions.³² Under AB 2514, California utilities are subject to an energy storage procurement mandate.³³ Southern California Edison has already awarded roughly 250 MW of storage contracts. *Id.* In response to a recent solicitation for 74 MW of energy storage, Pacific Gas & Electric Company received applications totaling 5,000 MW of potential storage. *Id.* In Hawaii, Hawaiian Electric Company is working to pair distributed generation with energy storage solutions that are controlled remotely.³⁴ Massachusetts is engaged in an initiative to accelerate the development of commercial storage technologies, attract energy storage companies to the state, and develop market signals appropriate to the benefits that storage technologies offer.³⁵ Storage also is featured in responses to the Clean Energy RFP discussed above, in Section III.³⁶ Solutions such as distributed generation paired with batteries and time of use rates are viable alternatives to reduce the need for new transmission projects such as Northern Pass.

Intermittency can also be addressed by tethering appropriate amounts of hydroelectric power directly to renewable energy such as wind power to produce a balanced energy product. The responses to the Clean Energy RFP discussed in Section III highlight the fact that large or small hydroelectric power projects can be tied directly to the generation of renewables including wind to ensure a balanced supply of energy. These types of pairings not only have the potential to reduce the per-MW environmental impacts of the overall energy project, they also can help to mitigate the greenhouse gas impacts of hydropower as well as the potentially harmful impacts that projects like Northern Pass may have on the growth of clean, renewable energy resources in the United States (including those supported by state RPS mandates).

In short, there is no rational basis for excluding other sources of power from the alternatives analysis, rendering the DEIS deficient as a matter of law.

³² Georgia is another such state. See <http://www.businesswire.com/news/home/20141208005012/en/Washington-Gas-Energy-Systems-Evaluate-Battery-Storage>.

³³ See, e.g., California Dreaming: 5,000 MW of Applicants for 74 MW of Energy Storage at PG&E, Greentech Media (May 28, 2015), attached as Ex. 6 and available at <http://www.greentechmedia.com/articles/read/california-dreaming-5000mw-of-applications-for-74mw-of-energy-storage-at-pg>.

³⁴ HECO, E-Gear try storage to resolve solar installation bottleneck in Hawaii, Utility Dive (Mar. 9, 2016), attached as Ex. 7 and available at <http://www.utilitydive.com/news/heco-e-gear-try-storage-to-resolve-solar-installation-bottleneck-in-hawaii/415246/#>.

³⁵ See Energy Storage Initiative, the Official Website of the Executive Office of Energy and Environmental Affairs, attached as Ex. 8 and available at <http://www.mass.gov/eea/energy-utilities-clean-tech/renewable-energy/energy-storage-initiative/>.

³⁶ See *supra* n.7 (link to public RFP responses).

(2) The DEIS is Deficient for its Failure to Include Other Transmission Projects among the Reasonable Range of Alternatives for Detailed Analysis

The DEIS is flawed because it fails to rigorously and objectively assess alternative transmission projects. The DEIS explicitly “considered,” but eliminated from its reasonable range of alternatives, other transmission projects in the region, stating:

Under this alternative, other proposed projects such as the Champlain Hudson Power Express, Northeast Energy Link, or New England Clean Power Link would serve as alternatives to the Project. This alternative could include either adding capacity to these other projects or joining Northern Pass’s Project to one of these other projects.

DOE determined that this alternative does not meet the purpose and need for DOE’s action. The purpose of, and need for, the DOE’s action is to determine whether or not to grant the requested Presidential permit for the Project, which is a proposed transmission line crossing the international border (i.e., the proposed Northern Pass project) in the location identified in Northern Pass’s amended Presidential Permit application.

DEIS at 2-37. But DOE’s analysis here is deeply flawed.

As discussed above, DOE’s analysis is premised on an unlawfully narrow purpose and need statement. Moreover, as demonstrated in Section III above, and as set forth in CLF’s comments during the scoping period,³⁷ other transmission projects in the region are, indeed, reasonable alternatives to Northern Pass. Such other projects include underground transmission projects, above-ground transmission projects, and transmission-generation pairings. Among these, in addition to the projects enumerated in the DEIS (at 2-37), are the Maine Green Line, Northeast Energy Link, New England Clean Power Link, Vermont Green Line, the Maine Renewable Energy Interconnect, and others.³⁸ Exclusion of these other transmission projects from the alternatives analysis renders the DEIS deficient and in violation of NEPA.

³⁷ CLF Scoping Comments dated Apr. 12, 2011 at 12-13; CLF Second Supplemental Scoping Submission dated Oct. 14, 2011 at 4-5; CLF Fifth Supplemental Scoping Submission dated Nov. 5, 2013 at 2-5, 7-8.

³⁸ According to ISO-NE, as of January 1, 2016, eleven elective transmission projects had been proposed in the ISO Interconnection Queue, totaling more than 7,000 MW of potential transfer capability. Gordon van Welie, State of the Grid: 2016, ISO on Background (Jan. 26, 2016), slide 35, attached as Ex. 9 and available at http://www.iso-ne.com/static-assets/documents/2016/01/20160126_presentation_2016stateofthegrid.pdf.

(3) The DEIS is Deficient for its Failure to Consider Demand-Side Management, Including Energy Efficiency, Among the Reasonable Range of Alternatives for Detailed Analysis

The DEIS is flawed because it fails to rigorously and objectively assess demand-side management, including energy efficiency, to offset the need for the generation Northern Pass proposes to transmit. At present, energy efficiency holds regional electricity demand essentially flat in New England.³⁹ Between 2014 and 2024, ISO-NE predicts that energy efficiency will grow from 1,500 MW to 3,600 MW.⁴⁰ Through 2023, state-sponsored energy efficiency programs are forecast to save New England 1,518 gigawatt-hours (“GWh”) per year.⁴¹ DOE cannot credibly render determinations regarding the need for the Project, its purported carbon benefits, or its economic impacts in the absence of analysis of demand-side management including energy efficiency.

Furthermore, promoting energy efficiency is unarguably within the scope of the public interest. Not only does DOE support energy through federal grants and other programs, each state in the region has a range of tax and energy policies designed to promote energy efficiency.⁴² The region invested approximately \$3 billion in energy efficiency from 2009-2013, and ISO-NE estimates that the region will invest an additional \$6.2 billion in energy efficiency from 2019-2024.⁴³ Indeed, the bulk of Regional Greenhouse Gas Initiative funds are directed towards energy efficiency programs precisely because of the unambiguous benefits of this low-cost and no-carbon energy resource.⁴⁴ In Docket DE15-137 of the New Hampshire Public Utilities Commission, New Hampshire is currently in the process of developing an Energy Efficiency Resource Standard that would accelerate and enhance its existing utility-run energy efficiency programs and bring it in line with the nationally prominent efficiency programs of its New England neighbors.

DOE’s failure to include demand-side management alternatives, such as energy efficiency, renders the DEIS deficient and a violation of NEPA.

³⁹ ISO-NE Overview and Regional Update on the Growth of Renewables, Ex. 5, at slide 4 (finding that energy efficiency flattens the growth in overall electricity demand to 0.1% annually in the region).

⁴⁰ *Id.* slide 9. Moreover, ISO-NE projections of energy efficiency, like its solar projections, are notoriously low relative to actual growth in this resource. See Joint Comments on ISO-NE’s Draft 2016 Energy Efficiency Forecast, March 4, 2016, attached as Ex. 10 and available at http://www.iso-ne.com/static-assets/documents/2016/03/joint_comments_on_iso_ne_draft_2016_ee_forecast.pdf.

⁴¹ See Ex. 11, ISO-NE 2015 Regional Electricity Outlook at 28.

⁴² See information on state energy efficiency programs at www.dsireusa.org.

⁴³ See Rourke, Ex. 4, slide 13 (entitled “Energy Efficiency is a Priority for New England”).

⁴⁴ See http://www.rggi.org/rggi_benefits/why_efficiency.

(4) The DEIS is Deficient for its Failure to Include a Detailed Analysis of Underground Transmission Cable in Railroad Rights-of-Way

The DEIS specifically eliminated as part of its alternatives analysis the burial of transmission cable in railroad rights of way. DEIS at 2-34 to 2-35. It did so having considered only one route, and on the basis of superficial assumptions pertaining to average right-of-way widths, non-specific observations that in some locations “property owners adjacent to the railroad corridor have constructed structures (e.g., fences/walls) along one or both edges of easement such that additional width may not be available,”⁴⁵ and based on generic historic-resources concerns. *Id.* The DEIS further states that for railroad segments owned in fee by the State of New Hampshire, “there *may be* limitations on how the land may be used. . . .” *Id.* at 2-35 (emphasis added).

DOE’s consideration of transmission burial in railroad rights-of-way, and the grounds upon which it excluded this alternative from the reasonable range of alternatives warranting detailed consideration, are deeply flawed. In the first instance, DOE considered only one route – a route consisting of railroad corridors owned by Genesee & Wyoming, Inc. and the State of New Hampshire. *Id.* However, it could have, and indeed should have, explored other railroad rights of way and route configurations.⁴⁶ Such other rights of way and route configurations should have included:

- Use of the Washington County Railroad (owned by the State of Vermont) which roughly parallels I-91 and provides a connection to the so-called Northern Line, an inactive rail right-of-way (owned by the State of New Hampshire) which connects Lebanon and Concord.
- Use of railroad rights-of-way from various New Hampshire entry points (Stewartson or North Strafford) to the Mountain Division railroad line (owned by the State of New Hampshire) to a point in Carrol, continuing via roadways to the Concord-Lincoln line (owned by the State of New Hampshire) and continuing south on such corridor to Concord.
- Use of railroad rights-of-way from various New Hampshire entry points (Stewartson or North Strafford) to the Mountain Division corridor, continuing on to the Conway Scenic railroad line, over a portion of inactive railroad to the New Hampshire

⁴⁵ The fact that Northern Pass may have to acquire temporary or permanent easements, or even interests in fee, to address such locations is by no means justification for DOE to eliminate railroad corridors from detailed evaluation. Indeed, Northern Pass has acquired significant property interests as part of its effort to assemble a route for its project proposal.

⁴⁶ See N.H. Department of Transportation Railroads map (Nov. 2015), attached as Ex. 12.

- Northcoast Railroad, continuing on to the Boston & Maine Railroad (owned by Pan Am), then west, on inactive rail line owned by the State of New Hampshire, to Raymond or Candia, and then into Deerfield.
- Use of the railroad rights-of-way from various New Hampshire entry points (Stewartson or North Strafford) to the Mountain Division corridor, continuing into Maine over the St. Lawrence and Atlantic Railroad Company line to a location near Buxton,⁴⁷ which could serve as the transmission project terminus.⁴⁸
 - Use of the configuration described in the DEIS, but using the Concord-Lincoln line rather than I-93.

More detailed consideration of a variety of routes, including those described above, would have provided DOE and the public valuable information, including information regarding: available right-of-way widths; potential areas with insufficient width and the manner in which such restrictions could be addressed (such as by purchase of temporary or permanent easements, or interests in fee); and guidance or restrictions by other railroad owners (e.g., the State of Vermont, Conway Scenic Railroad, and NH Northcoast Railroad) pertaining to the burial of underground transmission infrastructure.

DOE's decision to eliminate railroad right-of-way alternatives from its alternatives analysis is particularly disappointing in light of the significant role railroad rights-of-way have played in another project reviewed by DOE, the Champlain Hudson Power Express ("CHPE"). As described in DOE's Final EIS for that project – which will transmit 1,000 MW of Canadian power to New York – CHPE will include 127 miles of terrestrially-buried cable in the rights-of-way of the New York State Department of Transportation, and the Canadian Pacific and CSX Transportation railroads.⁴⁹ Of those 127 miles, 122 will be located in the existing railroad rights-of-way of Canadian Pacific and CSX.⁵⁰ DOE issued its Record of Decision for the CHPE project in September 2014, and issued a Presidential Permit (No. PP-362) October 6, 2014. In light of the foregoing, the DEIS is significantly flawed for its failure to include a detailed

⁴⁷ See Maine Department of Transportation Maine Rail System Map (2016), attached as Ex. 13 and available at http://www.maine.gov/mdot/downloadmaps/docs/RailSystem_2016.pdf.

⁴⁸ While CLF realizes the use of Buxton substation as a terminus would require reinforcement of AC transmission infrastructure, this alternative should nonetheless be analyzed. Even if this approach were to result in higher costs for AC infrastructure reinforcement, it may also result in lower costs with respect to the HVDC portion of the project.

⁴⁹ See Final Champlain Hudson Power Express Transmission Line Project Environmental Impact Statement Summary, DOE/EIS-0447 (Aug. 2014) (http://chpexpresseis.org/docs/library/final-eis/full/1_CHPE%20FEIS_Summary_Aug14.pdf).

⁵⁰ *Id.*

analysis of the burial of transmission line in rail rights-of-way – including multiple rail corridor configurations, in combination with highways as necessary – as part of its alternatives analysis.

(5) The DEIS is Deficient for its Failure to Include a Detailed Analysis of Alternative Border-Crossing and Termination Points

DOE’s alternatives analysis utterly fails to consider border-crossing locations other than the one proposed by the Applicant, precluding detailed analysis of alternative transmission routes and approaches that could involve lesser environmental impact, such as alternatives involving highways and railroad rights-of-way in Vermont. Because the EIS should not limit itself to the Applicant’s desired outcome, there is no reasonable explanation for failing to consider alternate border crossings. *See Simmons*, 120 F.3d at 669.

With respect to termination points, the DEIS specifically eliminates from detailed analysis alternative locations to Deerfield, New Hampshire. In doing so, the DEIS states: “DOE determined that this alternative was not reasonable because DOE is unaware of other alternative substations in NH that are capable of receiving 1,000 or 1,200 MW of power.” DEIS at 2-38. The DEIS’s failure to consider terminus locations outside of New Hampshire is arbitrary and capricious and precluded consideration of alternative project termination points such as the Buxton, Maine substation and associated alternative routes.⁵¹ The DEIS is further flawed in that it fails to assess or describe the inability of the Scobie Pond substation in Londonderry to receive the power associated with the proposed project.

C. The DEIS is Deficient for its Failure to Adequately Assess Certain Alternatives Selected for Detailed Analysis

As discussed above, NEPA mandates that agencies engage in a rigorous and “detailed statement” of the alternatives. *Dept. of Transp. v. Public Citizen*, 541 U.S. 752, 756 (2004) (quoting NEPA, 42 U.S.C. § 4332(2)(C)). The level of detail should be sufficient to sharply define the issues and provide a clear basis for choice among options by the decisionmaker and the public.⁵² DOE’s analysis of alternatives selected for detailed evaluation fails to comply with this mandate for the following reasons.

⁵¹ *See, e.g.*, discussion of Buxton, Maine as a potential termination point for a rail-corridor alternative discussed *supra* in Section IV.B.(4).

⁵² 40 C.F.R. § 1502.14; *see, e.g., Greenpeace v. National Marine Fisheries Service*, 55 F. Supp. 2d 1182, 1194 (W.D. Wash. 1999).

(1) The DEIS Is Deficient Because It Fails to Include Meaningful Analysis of the No-Action Alternative

As part of its alternatives analysis, the DEIS discusses the No-Action Alternative – an alternative that must, as a matter of law, be conducted for purposes of complying with NEPA’s mandates – as follows:

Under the No Action Alternative, DOE would not issue a Presidential permit and the USFS would not issue a SUP for the Project, the proposed transmission system would not be constructed, and the potential impacts from the Project would not occur. The CEQ and DOE regulations require consideration of the No Action Alternative. The No Action Alternative serves as a baseline against which the potential environmental impacts of the Proposed Action and alternatives are evaluated.

DEIS at 2-13. Aside from a reference to Map 5 in Appendix A of the DEIS, the above three sentences comprise the entirety of the DEIS’s discussion and evaluation of the No-Action Alternative. *Id.*

NEPA’s mandate that agencies rigorously and objectively analyze all reasonable alternatives includes the rigorous and objective analysis of No-Action alternatives. Indeed, NEPA analyses that fail to comply with this requirement have been found by courts to be invalid. *Southeast Alaska Conservation Council v. Fed. Highway Admin.*, 649 F.3d 1050, 1058 (9th Cir. 2011) (concluding that agency’s “cursory” three-paragraph description of No-Action alternative “does not represent the ‘substantial treatment’ required by NEPA’s implementing regulations to any non-construction alternatives,” and stating “[t]he EIS thus falls below NEPA’s standards because it fails to provide policymakers and the public with sufficient information ‘to make an informed comparison of the alternatives.’”) (citing 40 C.F.R. § 1502.14(b), *Animal Def. Council v. Hodel*, 840 F.2d 1432, 1439 (9th Cir. 1988), amended by 867 F.2d 1244 (9th Cir. 1989)). See also *Natural Resources Def. Council v. Hughes*, 437 F. Supp. 981, 990-991 (D.D.C. 1977) (“The Final Statement perfunctorily devoted a few paragraphs to the ‘no action’ alternative. . . . Apparently the Department and the BLM believed this to be sufficient to fulfill their regulatory obligations which specifically require the consideration of the ‘no action’ alternative. It appears, however, that the Department’s treatment of this alternative is sufficient neither under the statute nor under the regulations. . . . The cursory treatment of the ‘no action’ alternative provided in the Final EIS does not satisfy the statutory mandate of §102(C) of NEPA.”) (citations omitted).

The DEIS’s treatment of the No-Action Alternative is grossly deficient and violates DOE’s unambiguous obligations under NEPA to conduct a rigorous and objective analysis of alternatives to enable informed and meaningful participation by policymakers and the public, and informed decision-making. To meet these requirements, the DEIS should have contained a detailed and thorough analysis of circumstances *without* the proposed project. Such analysis can

and must include detailed consideration of the factors discussed above in Section III, including but not limited to *other* transmission projects that, absent Northern Pass, could nonetheless fulfill objectives associated with the proposed project. Unless and until DOE conducts a comprehensive assessment of the No-Action Alternative – premised on a valid purpose and need statement, and with meaningful opportunity for public review and comment – its proceedings will stand in stark contrast to, and will violate, the requirements of NEPA and its implementing regulations.

(2) DOE’s Analysis of Underground Cable Alternatives in Highway Corridors is Deficient

CLF appreciates DOE’s consideration of I-93 for purposes of burying HVDC cable and its determination that, as considered within certain enumerated alternatives, I-93 presents a viable option. With specific regard to I-93, however, it is CLF’s position that DOE should have analyzed an alternative that relies on burial in the I-93 corridor north of Franconia notch, into Vermont, with continued burial in the I-91 transportation corridor.⁵³ The DEIS also should have considered use of I-91 in Vermont in combination with the use of I-89 and/or railroad rights of way, such as those that would allow access from the west and northwest, as described above. Highway corridors provide an opportunity to avoid the use of overhead transmission lines and their long-term impacts and potentially at lower cost than other routes not located on transportation corridors.⁵⁴ The DEIS has not adequately assessed the important opportunity highway corridors could serve.

⁵³ This should be the case even if the portion of I-93 located in Franconia State Park was somehow deemed infeasible. In such case, detailed consideration of I-93 both north and south of Franconia State Park is warranted.

⁵⁴ In 2012, the N.H. Legislature enacted legislation (SB 361) establishing a commission, with representation from the N.H. Department of Transportation, to study the feasibility of using existing state-owned transportation rights-of-way as corridors for energy infrastructure, including electric transmission. The commission met twelve times and, receiving testimony from a broad range of interests and experts, including two N.H. Department of Transportation representatives, found, *inter alia*:

Limited access rights-of-way (interstate, turnpike and divided highways) are the only roadways where the state owns the underlying land in fee. In accordance with RSA 236:18, the state has the exclusive rights insofar as they do not conflict with any federal statute to build, lease, or utilize for any public purpose the air space directly above or below the toll highways and the interstate system highways within the state. These limited access rights-of-way could be available for use as energy infrastructure corridors.

For purposes of this report, the DOT has identified four highway corridors as possible energy infrastructure corridors. The DOT considered several factors in identifying these corridors, including but not limited to:

- a continuous corridor of significant length that is owned in fee by the state
- a corridor that provides connectivity with adjoining states
- corridors that are wide and well-defined

(3) The Analysis of Numerous Alternatives is Premised on Inaccurate Assumptions Relative to the Proposed Franklin Converter Station

The DEIS identifies the Applicants' Project as Alternative 2 and describes such alternative as involving the transmission of 1,200 MW of electricity. *See* DEIS at 2-2. It proceeds to describe the converter station associated with Alternative 2, stating in pertinent part: "The converter station would be designed for a continuous HVDC to HVAC transfer rating of 1,200 MW." *Id.* at 2-13.

The DEIS alternatives analysis considers several transmission alternatives that would transmit 1,000 MW of electricity, as opposed to 1,200 MW. *Id.* at 2-2. In describing several of those alternatives – namely, Alternatives 5A, 5C, 6A, and 6B, the DEIS cross-references the description of the Franklin converter station included as part of the description of Alternative 2. *Id.* at 2-24 (Alternative 5A), 2-28 (Alternative 5C), 2-31 (Alternative 6A), 2-33 (Alternative 6B). In other words, it incorporates a converter station designed to accommodate 1,200 MW of electricity, as opposed to the reduced amount of electricity (1,000 MW) to be transmitted by these alternatives. The Supplemental DEIS, in describing the Applicants' revised proposed project (identified as Alternative 7) – another alternative that would transmit 1,000 MWs of electricity – appears to repeat this mistake.

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- corridors which are relatively free of existing energy infrastructure

The corridors identified include I-89 (between the intersection of I-93 and the Vermont border); I-93 (between the Massachusetts border and the Vermont border); I-95 (between the Massachusetts border and the Maine border); and NH Route 101 (between the intersection of I-93 and the intersection of I-95). These State-owned transportation rights-of-way, and potentially others, could be used to locate underground energy transmission corridors.

See Final Report of SB 361 Commission (Nov. 30, 2012), attached as Ex. 14 and available at <http://www.briantilton.com/NorthernPass/361Commission-FinalReport113012.pdf>.

Of significance, legislation passed the N.H. House of Representatives this session, and is currently pending before the N.H. Senate, which, if enacted, could establish the four above-referenced highway corridors ("excepting approximately 1.7 miles of I-93 in the White Mountain National Forest north of Franconia Notch state park") as corridors within which energy infrastructure, including high voltage DC or AC electric transmission facilities of 115kV or greater, could be sited underground. HB 626-FN-A, as amended by the House, as attached as Ex. 15.

Also noteworthy, the state of Maine has adopted an approach that encourages the use of transportation corridors, including highways, for purposes of locating and constructing transmission projects.

As a result of the DEIS's and SDEIS's persistent "mismatch" of transmission and converter station capacity, DOE has failed to accurately analyze the above-referenced 1000 MW alternatives. It can and should be assumed that the cost and physical footprint associated with the Franklin converter station as described for Alternative 2 (i.e., a converter station designed to accommodate 1,200 MW of electricity) would be reduced if appropriately down-scaled to accommodate 1000 MW of electricity. The existing mismatch undermines the accuracy and validity of DOE's alternatives analysis, including but not limited to the anticipated costs of the various alternatives as set forth in Table 2-3 of the DEIS,⁵⁵ and Table 3 of the SDEIS, as well as the public's ability to understand and compare the various alternatives.

VI. DOE's Impacts Analysis is Deficient as a Matter of Law because it Entirely Fails to Address Certain Impacts and Inadequately Addresses Others

NEPA requires that agencies "take a 'hard look' at how the choices before them affect the environment, and then [] place their data and conclusions before the public." *Or. Natural Desert Ass'n v. Bureau of Land Mgmt.*, 625 F.3d 1092, 1099 (9th Cir. 2008). This "hard look" requires a "full and fair discussion of significant environmental impacts." 40 C.F.R. § 1502.1. On the basis of both omissions and inadequacies, the DEIS fails to meet this standard.

A. The DEIS is Deficient Because it Fails to Assess the Impacts of Generation and Transmission in Canada

DOE improperly omits any analysis whatsoever of the Project's foreseeable impacts in Canada, including the terrestrial and water impacts of new or expanded reservoirs, as well as increases in greenhouse gas emissions. As CLF stated in its scoping comments,⁵⁶ it is essential that DOE consider environmental impacts in Canada, particularly in light of the fact that the Applicant premises the need for the Project on claims that the power source is environmentally beneficial and will result in lower greenhouse gas emissions. DOE adopts many of the Applicant's claims as to the potential environmental benefits of the Project, yet it is impossible to

⁵⁵ Table 2-3 of the DEIS contains a significant error, inhibiting the public's ability to understand the costs associated with each alternative. The error presumably results from the erroneous assignment of costs associated with Alternative 1 (the No-Build Alternative). *Compare* DEIS Table 2-3 *with* SDEIS Table 3.

⁵⁶ CLF Scoping Comments dated Apr. 12, 2011 at 14-23. *See also* CLF Scoping Comments dated Oct. 14, 2011 at 5-7 (discussing hydropower GHG emissions and potential displacement of clean, local energy); Feb. 14, 2012 (addressing GHG emissions of hydropower and RPS eligibility); Nov. 5, 2013 at 10-11 (addressing GHG emissions of hydropower). CLF hereby incorporates by reference the facts, arguments and analysis on this subject that are contained in the April 12, 2011 scoping comments at 15-17.

test such claims without rigorous analysis of environmental impacts that occur across the border.⁵⁷

Damming natural water bodies for hydroelectric power inundates large expanses of land upstream of dams. This inundation results in impacts including:

- Dislocation of human settlements
- Elimination of existing ecosystems and habitat
- Greenhouse gas emissions⁵⁸

⁵⁷ See *Border Power Plant Working Group*, 260 F. Supp. 2d at 1012-15 (environmental impacts of generating facility that will export power through international transmission line requiring Presidential Permit must be considered under NEPA).

⁵⁸ In the Project Objectives section of the DEIS (Section 1.4.2), DOE relies on an NREL report published in 2010 to suggest that the GHG emissions of the generation source are similar to that of solar or wind:

In 2010 DOE National Renewable Energy Laboratory (NREL) conducted a Life Cycle Assessment (LCA) study to systematically review estimates of life cycle GHG emissions published between 1970 and 2010 from electricity generation technologies. The LCA considered emissions from all stages in the life cycle of an electricity generation technology, from component manufacturing, to operation of the generation facility to its decommissioning, and including acquisition, processing, and transport of any required fuels. The results of this study demonstrate that hydropower was equivalent to other sources of low-carbon power (wind and solar).

DEIS at 1-5 n. 5. DOE fails to note that the NREL report was a literature review, not an independent research study. In addition, that report grouped all forms of hydroelectric power together despite their greatly varying characteristics. NREL has issued the following qualification as to the potentially outsized GHG emissions impacts of reservoir hydroelectric power, in contrast to run-of-river or pumped storage:

The majority of life cycle greenhouse gas (GHG) emission estimates for hydropower cluster between about 4 and 14 g CO₂eq/kWh.

The outliers, which show reservoir hydropower estimates of over 150 g CO₂eq/kWh—much higher than run-of-river or pumped storage—stem from studies that included assessments of GHG emissions from land use change (LUC) from reservoir hydropower, an area of active research. In comparison to fossil energy generation technologies, the life cycle GHG emissions from hydropower systems are low.

http://www.nrel.gov/analysis/sustain_lca_hydro.html (same url cited in DEIS at 1-5 n.5). NREL notes that studies pertaining to the GHG emissions of reservoir hydroelectricity are ongoing. Expert analysis moreover indicates that GHG emissions associated with hydroelectric power can vary greatly by project:

[Life-Cycle Assessments] carried out on hydropower projects up to now have demonstrated the difficulty of generalizing estimates of lifecycle GHG emissions for hydropower projects across climatic conditions, pre-impoundment land cover types and hydropower technologies.

- Re-engineering of natural landscapes
- Loss of native plant life and wildlife
- Changes to natural water systems

Kumar, A., T. Schei, et al., 2011: Hydropower. An IPCC Special Report on Renewable Energy Sources and Climate Change Mitigation, Cambridge University Press, Cambridge, attached as Ex. 16, available at http://srren.ipcc-wg3.de/report/IPCC_SRREN_Ch05.pdf and cross-linked on NREL's website at http://www.nrel.gov/analysis/sustain_lca_hydro.html.

Furthermore, CLF has already filed in this docket a review of the literature on greenhouse gas emissions from hydroelectric power plants that is more recent than the NREL review (2012 versus 2010). *See* Third Supplemental Scoping Comments dated February 14, 2012, Exhibit A attached thereto, Hydropower Greenhouse Gas Emissions: State of the Research, Synapse Energy (Feb. 14, 2012) (available online at <http://www.clf.org/wp-content/uploads/2012/02/Hydropower-GHG-Emissions-Feb.-14-2012.pdf>). That report includes initial information from a 2010 study of the emissions associated with a new Hydro-Quebec hydroelectric reservoir at Eastmain 1. As summarized in the Synapse Energy report (at 14):

Research done at Hydro-Quebec's Eastmain 1 reservoir showed that net GHG emissions rates within one year of reservoir creation increased from 3,200 to 500,000 tonnes of carbon, a 156-fold increase, over pre-flooded conditions. This carbon increase at Eastmain 1, calculated as a rate per unit of energy output, suggests that hydropower from the reservoir produced more GHG emissions than a natural gas combined-cycle facility each year for three years after impoundment.

After completion of the Eastmain 1 study, Cristian Teodoru et al. subsequently published a detailed analysis of the study results, which found that the rates of carbon emissions of the Eastmain 1 reservoir during the initial years after inundation were as much as 77% higher than the equivalent emissions of the most efficient thermal power plants using a natural-gas combined-cycle. Cristian R. Teodoru, Julie Bastien, et al., "The net carbon footprint of a newly created boreal hydroelectric reservoir," *Global Biogeochemical Cycles*, v. 26, issue 2 (June 2012), at 11, attached as Ex. 17 and available at <http://onlinelibrary.wiley.com/doi/10.1029/2011GB004187/epdf>. Emissions dropped in later years, though for obvious reasons the entire life cycle of this new Hydro-Quebec facility has not yet been studied. *See id.*

Based on this new research, not only must the emissions from hydropower be assessed on a case-by-case basis, relative to their "climatic conditions, pre-impoundment land cover types and hydropower technologies," as indicated by the IPCC's expert analysis above—it is also important to note that the emissions impacts of constructing new Hydro-Quebec hydroelectric facilities can be very heavy in the first years following inundation. *See id.* The development of multiple such reservoirs in an effort to reduce greenhouse gas emissions thus could result in a short-term spike in such emissions, potentially contributing to near-term global warming and its associated impacts.

In sum, it is essential that DOE rigorously analyze the likely GHG impacts of Northern Pass's proposed source of power.

⁵⁸ *See Border Power Plant Working Group*, 260 F. Supp. 2d at 1012-15 (environmental impacts of generating facility that will export power through international transmission line requiring Presidential Permit must be considered under NEPA).

CLF's April 12, 2011 Scoping Comments identified these and other impacts that NEPA requires DOE to address.

The Council on Environmental Quality ("CEQ") unambiguously directs federal agencies to address cross-border impacts under NEPA, including impacts that are indirect and/or cumulative in character.⁵⁹

Neither NEPA nor the Council on Environmental Quality's (CEQ) regulations implementing the procedural provisions of NEPA define agencies' obligations to analyze effects of actions by administrative boundaries. Rather, the entire body of NEPA law directs federal agencies to analyze the effects of proposed actions to the extent they are reasonably foreseeable consequences of the proposed action, *regardless of where those impacts might occur*. Agencies must analyze indirect effects, which are caused by the action, are later in time or farther removed in distance, but are still reasonably foreseeable, including growth-inducing effects and related effects on the ecosystem, as well as cumulative effects. Case law interpreting NEPA has reinforced the need to analyze impacts regardless of geographic boundaries within the United States, and has also assumed that NEPA requires analysis of major federal actions that take place entirely outside of the United States but could have environmental effects within the United States.

Courts that have addressed impacts across the United States' borders have assumed that the same rule of law applies in a transboundary context...

In sum, based on legal and policy considerations, CEQ has determined that agencies *must include* analysis of reasonably foreseeable transboundary effects of proposed actions in their analysis of proposed actions in the United States.

Council on Environmental Quality Guidance on NEPA Analysis for Transboundary Impacts, July 1, 1997, at 2-3 (citing *Swinomish Tribal Community v. FERC*, 627 F.2d 499 (D.C. Cir. 1980); *Wilderness Society v. Morton*, 463 F.2d 1261 (D.C. Cir. 1972) (emphasis added)).

U.S. District Courts have applied this guidance to environmental impacts in both Canada and Mexico and concluded that cross-border impacts must be considered. In *Border Power Plant Working Group v. DOE*, 260 F. Supp. 2d at 1012-15, the court found infirm DOE's failure to consider power plant emissions in Mexico when power from those plants would be transmitted into the United States across a proposed transmission line subject to DOE's permitting review.

⁵⁹ See *Sierra Club v. Marsh*, 769 F.2d 868, 877-79 (1st Cir. 1985) (NEPA required Federal Highway Administration to evaluate reasonably foreseeable indirect effects of proposed construction project) (citing 40 C.F.R. § 1508.8); *Border Power Plant Working Group*, 260 F. Supp. 2d at 1030.

Similarly, in *Province of Manitoba v. Salazar*, 691 F. Supp. 2d 37, 51 (D.D.C. 2010), the court held that NEPA required the Bureau of Reclamation to consider the foreseeable environmental impacts in Canada of a proposed biota transfer in the Hudson Bay Basin.

As CLF indicated in its prior comments, the proposed project may result in the development of new reservoirs in Canada.⁶⁰ The development of new reservoirs would entail major terrestrial and water impacts in Canada, as well as air and climate impacts such as those enumerated above and in CLF’s scoping comments. The Project may also result in greenhouse gas “leakage” in Canada, to the extent that electricity from existing hydroelectric facilities is redirected to the United States and dirtier sources of energy are substituted for domestic Canadian purposes, in addition to the displacement of cleaner energy sources.⁶¹ Any foreseeable results such as these must be addressed in the EIS review process, and must be a factor as DOE compares the impacts of the proposed project to the impacts of reasonable alternatives. Its failure to do so renders its analysis incomplete and in violation of NEPA and its implementing regulations

B. The DEIS is Deficient Because it Fails to Consider Negative Impacts on the Development of Renewable Energy and Energy Efficiency in New England

DOE erred in failing to consider negative impacts that the Project, if approved, could foreseeably have on the development of clean energy projects in New Hampshire and New England, as well as energy efficiency. As noted above, there is a strong policy interest in the advancement of renewable energy—particularly RPS-eligible clean energy sources—and energy efficiency. *See, e.g.*, Section III, *supra*. This public interest is reflected in the numerous federal, state, and local policies that are designed to enhance opportunities for development and deployment of these relatively nascent and under-funded resources. An example of such a public policy-based funding stream for such resources would be a state-sanctioned and utility commission-authorized long term contract. Because the Northern Pass project seeks to be funded using this same public policy mechanism that is designed to foster and propagate renewable energy and efficiency programs, it is reasonably foreseeable that applying this tool for the benefit of hydropower generated in Canada will reduce opportunities for such contracts for other energy resources including domestically derived, in-region, renewable energy and efficiency. In failing to consider the carbon and socio-economic impacts of reducing opportunities for clean, renewable power sources and no-carbon energy efficiency in New

⁶⁰ *See* CLF Scoping Comments dated April 12, 2011 (citing Hydro-Quebec and Northern Pass witness statements supporting this possibility).

⁶¹ *See* Paul Steenhof and C.J. Weber, “An assessment of factors impacting Canada’s electricity sector’s GHG emissions,” *Energy Policy* 39, 4089–96 (June 2011).

Hampshire and New England, the DEIS is deficient. *See, e.g., Border Power Plant Working Group*, 260 F. Supp. 2d at 1030.

C. The DEIS is Deficient because it Fails to Accurately Assess Either the Value of New Hampshire’s Viewsheds or the Impacts of the Project on those Viewsheds

The DEIS accurately concludes that New Hampshire’s North Country has a high intrinsic visual quality. DEIS at 3-60. The DEIS also concludes that the area is characterized by “a very low level of development” and a low population density. *Id.* Consistent with this low population density and low level of human development, the DEIS enumerates a large number of parks available for public use in the areas of scenic concern in the North Country: White Mountain National Forest, Weeks and Dixville Notch State Parks, Coleman, Cape Horn, Percy and Nash Stream State Forests, Connecticut River National Byway, Moose Path Trail, Presidential Range Tour, White Mountain Trail Northern Loop, Pontook Reservoir, Lancaster Town Forest, and Kauffman Forest. *Id.* at 3-61.⁶²

However, the technical report to the DEIS erroneously relies on population data as the basis for conclusions as to the overall visual impact of the proposed project, including its impacts on the North Country. Section 2.4.2.5 of the Visual Impact Assessment explains that, in the absence of available data on the usage of the scenic or recreational resources in New Hampshire, DOE’s consultant, T.J. Boyle and Associates, assessed viewer exposure based on population numbers.

Use data are generally not available for scenic or recreation resources in New Hampshire. Therefore a different approach is taken—potential visual exposure is approximated as a function of population density based on 2010 U.S. Census block-level data.

Visual Impact Assessment at 40.

Applying this approach to the North Country, the Visual Impact Assessment falsely concludes that viewer impacts will be low because there are few residents (at 85):

Just over half of the Northern Section has no residents, and another 40 percent has very low population density. In most of the area, it is unlikely there will be many viewers to be affected by a visual change.

As a general matter, assessing viewer exposure based on U.S. Census data is an arbitrary and unsupportable approach due to the fact that scenic recreational areas are by definition areas

⁶² *See also* Visual Impact Assessment at 38-39, enumerating a large number of outdoor activities that take place.

that do not entail habitation. This approach leads to particularly dramatic errors when applied to less developed areas such as the North Country, which serves as a region-wide resource for outdoor activities and appreciation of the natural environment.⁶³

The North Country's intrinsic visual quality stems from the fact that it has a low population density and level of development, but a high number of parks and natural viewsapes accessible to the general, non-resident public. For this reason, resident population density is a particularly illogical basis for drawing conclusions as to visual impact, including viewer exposure. The use of U.S. Census information as a substitute for usage data inevitably leads to a substantial undervaluation of visual impacts that DOE must correct.

DOE's viewshed impacts analysis is also infected with other unsupported conclusions. For example, Table 9 of the Visual Impact Assessment (at 38), which rates the importance of scenery to the experience of various activities known to take place in New Hampshire, contains arbitrary and unsupported conclusions including:

- that although campgrounds, picnic areas, and recreation resorts are often selected based on their scenic locations, they do not rate "very high" for importance of scenery;
- that parks are not valued highly for their scenic value;
- that areas used for activities such as skiing, swimming, boating, fishing, and golfing are not highly valued for their scenic quality because of the attention they require to an activity;
- that the setting is "non-contributing" to the experience of rockhounding; and
- that special events (presumably including weddings and other celebrations) are held indoors, and therefore the scenic quality of the environment is very low value to those activities.

Among other things, it is widely known that celebrations such as weddings are often held outside, and the scenic environment can be a critical element of the experience. That the visual impacts analysis upon which DOE relies fails to engage either common sense or objective data to draw conclusions as to the importance of visual quality is in clear error, rendering the analysis of viewshed impacts grossly deficient.

⁶³ Furthermore, as to those who do live in the North Country, the value of the scenic environment is likely to rank much higher among their priorities in choosing a residence, and potentially engaging in activities, than it does among residents of more developed areas.

D. The Socioeconomic Technical Report Contains False and Unsupported Assumptions that Infect Core Conclusions of the DEIS

DOE's analysis of the socio-economic impacts of the Project is infected with errors and conclusions that are only partially supported or not supported at all. DOE's conclusions regarding the socio-economic impacts of the Project rely on the Socioeconomic Technical Report, prepared by Edgeworth Economics, together with an underlying report entitled Energy Market Evaluation of the Northern Pass Transmission Project ("GE Report"), prepared for Edgeworth Economics by GE Energy Consulting. Errors and unsupported conclusions contained in these reports include, *inter alia*:

- The assumption that the Project will operate at an average of approximately 76% of maximum capacity throughout the year (Socioeconomics Technical Report at 23; GE Report at 18), whereas the average capacity factor for hydroelectric power in ISO-NE is approximately 40%.⁶⁴
- Estimates of annual property tax impacts that do not appear to accurately or sufficiently account for property tax decreases due to visual impacts on affected regions/properties. *See* Socioeconomics Technical Report at 18 Table 7. For example, the assumption that properties 500 feet or more from the proposed transmission line will not suffer any property value impacts at all (Socioeconomics Technical Report at 28-31), failing to recognize that the mountainous topography of New Hampshire can lead to unusually extreme visual impacts over broad swathes of land and landscapes, at a distance far greater than 500 feet.
- The assumption of a base case (no Northern Pass) annual average load-weighted wholesale locational marginal price of approximately \$68 for ISO-NE in 2019 (Socioeconomics Technical Report at 25; GE Report at 20), whereas actual average prices in ISO-NE historically have been lower.⁶⁵
- Forecasts of ISO-NE peak demand for 2019 at 30,335 MW and for 2025 at 32,297 MW (GE Report at 12, Table 3-4) that appear to be outdated and over-estimated as more recently ISO-NE has predicted peak demand for 2019 at 29,975 MW and for 2025 at 31,794 MW.⁶⁶

⁶⁴ *See* ISO New England EFORd Class Averages from NERC Brochure (Nov. 1, 2011), attached as Ex. 18 and available at http://www.iso-ne.com/genrtion_resrcs/gads/class_ave_2010.pdf.

⁶⁵ *See, e.g.*, ISO-NE's Internal Market Monitor, 2014 Annual Markets Report (May 20, 2015) at 2 (Table 1-1), attached as Ex. 19 and available at <http://www.iso-ne.com/static-assets/documents/2015/05/2014-amr.pdf> and ISO-NE Monthly Market Operations Report (Jan. 2016), at 9-12, available at http://www.iso-ne.com/static-assets/documents/2016/02/2016_01_monthly_market_report.pdf.

⁶⁶ *See* Draft 2015 CELT ISO-NE Annual Energy and Summer Peak Forecast, ISO-NE Forecast Team (March 11, 2016), at slide 15, attached as Ex. 20 and available at http://www.iso-ne.com/static-assets/documents/2016/03/Final_LFC_Prelim_2016CELT_ISONE_Forecast.pdf.

- The acknowledgement that gas prices are the single largest driver of the region's electricity prices,⁶⁷ but reliance on gas price forecasts⁶⁸ significantly higher than other recent forecasts.⁶⁹ A comparison of more recent forecasts commissioned and currently utilized in state utility commission proceedings suggests GE overestimates gas prices by 35-95% for the period 2019-2025.
- The power plant retirement information and assumptions appear to be outdated and inaccurate. (GE Report at 15 Table 3-9).
- The assumption of only 113 MW of new solar installations in ISO-NE from 2014 through 2025 (GE Report at 17 Table 3-11), whereas ISO-NE estimates that the total annual nameplate capacity for solar PV will have increased 1,540.3 MW from 2014 levels by the close of 2024.⁷⁰ The report's assumption that total wind resources in ISO-NE will grow only 1655 MW from 2014 through 2025 (GE Report at 17) is also low given 3,400 MW of additional wind have already been proposed over today's levels.⁷¹
- Inflated estimates of locational marginal prices in Figure 4-1 of the GE Report (at 19) due to overestimated gas prices (*see, e.g.*, points two and four in this bullet list).
- Generation-type assumptions advanced in Section 4.3 of the GE Report (at 23), which require reassessment in light of the report's over-estimated gas price forecasts, as do the related emissions and transmission assumptions that appear in Sections 4.4 and 4.5 (at 24).

These faulty assumptions are not minor; they infect key conclusions that lie at the very core of the DEIS. Some of the most significant impacts of these errors include the following:

1. Despite recognizing that gas prices are the single most influential factor in market price forecasts in New England, the data that the DEIS relies on to determine the market impacts of Northern Pass includes grossly over-estimated gas prices. This error infects DOE's analysis as to whether the Project's impacts outweigh its purported (market) benefits.
2. DOE identifies generation source diversity as one of three objectives of the Project, yet the data that DOE relies on for regional generation analysis severely underestimates the

⁶⁷ GE Report at 12.

⁶⁸ *See* GE Report at 13, Table 3-7, putting the Algonquin Citygate Gas Price for 2019 at \$6.76 and for 2025 at \$8.22.

⁶⁹ *See, e.g.*, Maine Energy Cost Reduction Act: Cost benefit analysis of ECRC proposals, by London Economics International (Feb. 22, 2016) (public redacted version), at 31 Figure 14 (putting the Algonquin Citygate gas prices for 2019 at \$3.75 and for 2025 at \$4.15, attached as Ex. 21; Maine Energy Cost Reduction Act: Cost benefit analysis of ECRC proposals, by London Economics International (June 20, 2015) (public redacted version), at 27 Figure 15 (putting Algonquin Citygate gas prices for 2019 at \$4.00 and 2025 around \$4.75), attached as Ex. 22.

⁷⁰ Final 2015 Solar PV Forecast Details, ISO-NE, at slide 35, attached as Ex. 23 and available at http://www.iso-ne.com/static-assets/documents/2015/04/2015_solar_forecast_details_final.pdf.

⁷¹ ISO-NE Overview and Regional Update on the Growth of Renewables, Ex. 5, at slide 9.

growth of other diverse energy sources such as renewable generation. DOE cannot accurately assess the need for, or the cost-to-benefit ratio, of Northern Pass without an accurate understanding of generation trends in the New England energy markets.

3. DOE is well aware that the visual and property value impacts of the Project are a grave public concern,⁷² yet the DEIS relies on erroneous assumptions that property tax reductions due to visual impacts in mountainous areas cannot occur past 500 feet. This can only lead to a serious underestimation of the threat Northern Pass poses to New Hampshire communities.

E. The DEIS is Deficient because it Fails to Identify and Consider Impacts on Landscape-Level Historical and Cultural Resources While there is Still the Potential to Avert Those Impacts

The DEIS states that the assessment of eligibility for listing on the National Register of Historic Places (“NRHP”) will take place prior to construction of the Project but after an EIS (and potentially a permit) has been issued, stating:

NRHP eligibility has not yet been determined for all historic and cultural resources identified in Project-specific surveys to date; this determination would occur prior to construction, but after a final route has been selected or potentially approved.

DEIS at 4-58.

Consistent with this procedural approach, and in connection with the Section 106 proceeding now underway, CLF understands that DOE intends to defer the inventory and impacts analysis of landscapes, traditional cultural properties, and rural historic districts until after the agency’s permitting decision. This deferral is entirely unacceptable given the high level of public concern on this subject, and would violate the National Historic Preservation Act (“NHPA”) as well as NEPA.

Impacts on landscape-level resources lie at the heart of public concern about the Northern Pass project. The route planned by the Applicant is expected to affect many such resources, including rural historic districts; cultural and recreational landscapes, including vistas from historic properties or sites; scenic byways; and hiking trails that date back to the 19th century. In order to avoid substantial harm to public confidence in DOE’s review process, it is incumbent on

⁷² See, e.g., Geology and Soils Technical Report at 5 (“The DOE, in coordination with cooperating agencies, developed an initial list of potential alternatives in response to the issues raised during scoping... In consideration of issues raised during scoping, it became evident that alternatives with increased use of underground infrastructure and burial of project components should be analyzed in detail.”).

DOE to identify these resources, evaluate the Project's expected impacts on these resources, and afford a meaningful opportunity for public comment now.

NHPA and NEPA require DOE to address landscape-level impacts now rather than later. NHPA requires a federal agency to "take into account the effect of the undertaking" at a time "prior to the approval of the expenditure of any Federal funds on the undertaking or prior to the issuance of any license ..." 16 U.S.C. § 470f. An agency may only proceed with "conducting or authorizing non-destructive project planning activities before completing compliance with Section 106, provided that such actions do not restrict the subsequent consideration of alternatives to avoid, minimize or mitigate the undertakings' adverse effects." 36 C.F.R. § 800.1(c). NEPA similarly directs that that all federal agencies must include at the EIS stage a detailed statement on "any adverse environmental effects which cannot be avoided should the proposal be implemented." 42 U.S.C. § 4332(C)(ii).

Once a route for Northern Pass is approved and a permit granted, there will be no effective means to mitigate impacts on large, landscape-level resources. Whereas mitigation measures identified at the post-permit, pre-construction stage may serve to minimize or eliminate impacts on discrete, small-scale historic and cultural resources (e.g., a discrete archeological site), this is not the case with respect to landscape-level resources. *See generally Corridor H Alternatives, Inc. v. Slater*, 166 F.3d 368 (D.C. Cir. 1999); *New Mexico ex rel. Richardson v. Bureau of Land Management*, 459 F. Supp. 2d 1102, 1124-25 (D.N.M. 2006)⁷³ *aff'd in other part, vacated in other part, rev'd in other part*, 565 F.3d 683 (10th Cir. 2009). For this reason, NHPA and NEPA require DOE to identify and evaluate all landscape-level resources that will be

⁷³ In *New Mexico ex rel. Richardson*, 459 F. Supp. 2d at 1124-25, the court reasoned:

Unlike BLM, however, the Court finds that [traditional cultural properties ("TCPs")] may not be able to be adequately protected if the Section 106 consultation process is delayed until the APD stage, after land has already been leased for oil and gas development. BLM's argument focuses on historical sites covering relatively small areas, such as discrete archaeological sites. For such sites, mitigation of impacts can be accomplished simply by moving the proposed drill site to a different location on the leased parcel. For landscape-level TCPs that may or may not be located on the leased parcel itself, however, such movement may not be adequate mitigation. It is possible, for example, that the entire leased parcel could be located on a TCP. *See, e.g., Pueblo of Sandia, supra*, 50 F.3d at 857 (due to tribal members' varied religious uses of canyon, tribe maintained that entire canyon constituted a TCP). As discussed in the NEPA section above, once a parcel of land has been leased for oil and gas, BLM does in fact lose a great deal, if not all, of its ability to entirely preclude drilling or other development on the parcel. If BLM could stop all development the lease would likely be illusory, as the lessee would be receiving nothing in return for a substantial investment. *See, e.g., Amber Resources Co. v. United States*, 68 Fed.Cl. 535, 547 (2005). In cases where such total preclusion is necessary to protect a TCP, waiting until the APD stage to complete the Section 106 consultation process does not comply with NHPA.

impacted by the Northern Pass Project now – not once the impacts are a foregone conclusion. *See id.* CLF urges DOE to include this information in a Supplemental EIS as soon as possible.

CLF further urges DOE to be as transparent and inclusive of public participation as possible in the Section 106 and NEPA processes regarding historical and cultural properties. These processes should not be treated as a mere exercise.

F. DOE Has Failed to Comprehensively Assess Cumulative Impacts

A discussion of the cumulative environmental effects of a proposed action is an essential part of an EIS. *See, e.g., Kern v. Bureau of Land Mgmt.*, 284 F.3d 1062, 1075 (9th Cir. 2002). As the Ninth Circuit has articulated:

Consideration of cumulative impacts requires “some quantified or detailed information; ... [g]eneral statements about ‘possible’ effects and ‘some risk’ do not constitute a ‘hard look’ absent a justification regarding why more definitive information could not be provided.” *Neighbors of Cuddy Mountain*, 137 F.3d at 1379–80. The cumulative impact analysis must be more than perfunctory; it must provide a “useful analysis of the cumulative impacts of past, present, and future projects.” *Muckleshoot Indian Tribe*, 177 F.3d at 810. Finally, cumulative impact analysis must be timely. It is not appropriate to defer consideration of cumulative impacts to a future date when meaningful consideration can be given now. *See Neighbors of Cuddy Mountain*, 137 F.3d at 1380; *City of Tenakee Springs*, 915 F.2d at 1312–13. When an agency's determination of what are “reasonably foreseeable future actions” and appropriate “component parts” is “ ‘fully informed and well-considered,’ ” we will defer to that determination. *Blue Mountains Biodiversity Project v. Blackwood*, 161 F.3d 1208, 1211 (9th Cir.1998) (quoting *Save the Yaak Comm. v. Block*, 840 F.2d 714, 717 (9th Cir.1988)). But we “need not forgive a ‘clear error in judgment.’ ” *Id.*

Id.

The cumulative impacts analysis contained in the DEIS and SDEIS is deficient in numerous respects. Among the flaws in DOE’s cumulative impacts analysis are the following:

- The DEIS and SDEIS fail to identify all reasonably foreseeable energy projects for purposes of assessing cumulative impacts. For example, for cumulative impacts purposes the DEIS identifies the Tennessee Gas Pipeline Northeast Energy Direct (DEIS at 5-2), but does not identify other similar projects such as the Spectra Energy Atlantic Bridge or Access Northeast projects. It identifies the Champlain Hudson Power Express, New

England Clean Power Link, and National Grid/Anbaric Green Line, but omits the Emera Northeast Energy Link project and others. *Id.*

- The cumulative impacts analysis fails to assess the impacts that Northern Pass, combined with other hydroelectric and natural gas infrastructure projects, would have on the development of clean, renewable energy in New Hampshire and New England (and, relatedly, greenhouse gas and other emissions, air quality generally, and the ISO-NE energy markets).⁷⁴
- The cumulative impacts analysis fails to assess the cumulative emissions and other cross-border impacts of the Northern Pass project, in combination with other reasonably foreseeable projects that propose to import Canadian power, such as New England Clean Power Link, Northeast Energy Direct, and Champlain Hudson Power Express.
- False conclusions as to the economic benefits of Northern Pass, in combination with other projects, that appear to include faulty assumptions such as market data that relies on outdated and excessively high forecasts for natural gas prices. *See* DEIS at 5-7.
- The failure of the SDEIS to include rigorous, detailed analysis of Alternative 7 relative to cumulative impacts, including the extent to which Alternative 7 differs from other alternatives.⁷⁵

⁷⁴ The DEIS concludes that there will be positive cumulative impacts on air quality and emissions, as well as state and regional renewable energy (DEIS at 5-24 and 5-25), but this conclusion lacks substantial evidence absent a discussion of the extent to which a combination of new large hydroelectric and natural gas projects cumulatively will have a negative impact on the growth of clean, renewable energy that is located in New Hampshire and New England.

⁷⁵ The SDEIS contains only three paragraphs regarding the scope, nature, and extent of the cumulative impacts of Alternative 7. SDEIS at 23. These paragraphs furthermore contain little more than formulaic and conclusory assertions that are generally unsupported and lacking in substance. *See id.* The SDEIS contains the following formulaic and conclusory assertions as to the extent of the impacts associated with Alternative 7 (SDEIS at 23):

Alternative 7 would result in a moderate contribution to cumulative impacts on visual resources and soils and geology; a moderate beneficial contribution to cumulative impacts at a more localized scale on socioeconomics; a minor contribution to cumulative impacts on recreation, health and safety, noise, wildlife, vegetation, and water resources; a negligible contribution to cumulative impacts on land use; no cumulative impact to environmental justice; and a long-term beneficial contribution to cumulative impacts on air quality. Alternative 7 would result in a substantial short-term contribution to cumulative impacts on traffic and transportation. Depending on the resource, the impacts would be short-term and/or long-term in duration.

It is not clear on what basis DOE selects modifiers such as “moderate,” “minor,” and “negligible,” where these modifiers fall on an overall scale, or how DOE reached its conclusions with respect to Alternative 7.

VII. The Purpose and Need Statement for the U.S. Forest Service’s Special Use Permit Repeats the Failings of DOE’s Purpose and Need Statement

The purpose and need statement of the U.S. Forest Service (“Forest Service”), relative to the issuance of a special use permit for the construction of the Northern Pass transmission line in the White Mountain National Forest, is “to decide whether to grant a SUP [special use permit] for the Project.” DEIS at 1-4. As indicated in Section IV above, an agency’s purpose and need statement cannot – as this one is – be limited to the binary question of whether or not to approve the project as proposed, and must rise to a level of generality that enables the identification of the underlying purposes of agency action. The Forest Service’s purpose and need statement, which is binary and overly specific in nature, fails to meet this bar for the same reasons that DOE’s purpose and need statement is infirm. *See* Section IV, *supra*.

To the extent that a corrected purpose and need statement would properly lead to the consideration of alternative routes for the transmission line that do not pass through the White Mountain National Forest, such as a border crossing in Vermont, then that analysis should be incorporated into the alternatives analysis of the DEIS.⁷⁶ Because the DEIS serves as a basis for the Forest Service’s permitting decision as well as that of DOE, the DEIS must encompass reasonable alternatives to the Forest Service’s issuance of the permit under the terms proposed by the Applicant.

In addition, DOE and the Forest Service have also erred in failing to include in the SDEIS clear information addressing the extent to which recent modifications to the proposed route and configuration of the Project alter the parameters of the Forest Service’s review, including its consideration of the need for and impacts of a special use permit.

VIII. In Preparing the DEIS, DOE Committed Procedural Errors that Remain Unremediated

CLF hereby incorporates by reference its prior comments, documentation, and legal analysis as to the requirement that DOE select NEPA contractors without relying on the Applicant’s guidance.⁷⁷ CLF previously objected to the fact that the Applicant’s counsel recommended SE Group to DOE, and that the Applicant’s counsel advocated for and acted as an agent for the prospective contractor team at SE Group. *Id.* DOE also engaged in other procedural irregularities detailed in CLF’s comments during the scoping process. *Id.*

⁷⁶ The Forest Service’s review is subject to a number of factors, found at 36 C.F.R. § 251.54(g)(3)(ii)(A)-(H), and may include a consideration of alternatives. *Id.* at 251.54(g)(3)(iii).

⁷⁷ *See generally* Fourth Supplemental Scoping Comments of CLF dated Oct. 9, 2012, with attachments.



Despite CLF's concerns, DOE relied upon SE Group in the preparation of the DEIS. The DEIS details the nature of its reliance on SE Group at Chapter 6, "List of Preparers":

This section lists the individuals who filled primary roles in the preparation of this draft EIS. Brian Mills of the DOE Office of Electricity Delivery and Energy Reliability directed the preparation of the draft EIS. The EIS Preparation Team, led by Kent Sharp of the EIS contractor SE Group, provided primary support and assistance to DOE. Other members of the team included a range of resource specialists, NEPA specialists, and technical writers.

DOE provided direction to SE Group, which was responsible for developing analytical methodology and assessing the potential impacts of the alternatives, coordinating the work tasks, performing the impact analyses, and producing the document. DOE was responsible for the scope, content, and organization of the EIS data quality, and issue resolution and direction.

DOE independently evaluated all supporting information and documentation prepared by SE Group. Further, DOE retained the responsibility for determining the appropriateness and adequacy of incorporating any data, analyses, and results of other work performed by SE Group in the draft EIS. SE Group was responsible for integrating such work into the draft EIS.

An agency is "obliged to pick a contractor itself, and not to delegate the responsibility." *Citizens Against Burlington*, 938 F.2d at 383 (citing 40 C.F.R. § 1506.5(c)). To the extent that DOE has relied on a contractor recommended and/or solicited by the Applicant, DOE's actions are contrary to law. *See id.*

IX. Conclusion

Again, CLF appreciates the opportunity to comment on the DEIS and SDEIS regarding the proposed Northern Pass electric transmission project. Consistent with well-settled law, we consider NEPA's EIS process to be essential to ensuring a clear and comprehensive understanding of the context in which the project is being proposed, including the extent to which it is needed; alternatives; and the proposed project's impacts – all to enable meaningful public involvement and informed agency decision-making. For the reasons discussed above, the DEIS and SDEIS fail to meet this important standard, and to fulfill the important functions NEPA and implementing regulations require them to serve. Because many of the deficiencies in the DEIS and/or SDEIS are so fundamental to the overarching analysis – such as the DEIS's unlawfully narrow purpose and need statement, which in turn led to an unlawfully narrow analysis of alternatives – it is essential that DOE not proceed to the Final EIS stage at this time. Rather, to enable the meaningful public involvement mandated by NEPA, and the additional information and analysis that would result therefrom to the benefit of better-informed decision-



making, we urge DOE to address the deficiencies discussed in these comments in a further supplementation of the DEIS, with all attendant public review and comment opportunities.

Respectfully submitted,

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