From: Wilkinson, Eric
Sent: Wednesday, January 30, 2013 11:13 AM
To:
Cc:
Subject: VEGSPC Comments from ISO New England

Hello,

Please accept the attached comments from ISO New England.

Do not hesitate to contact me if I can provide any more information to the Commission.

Regards,
Eric Wilkinson

External Affairs
ISO New England
One Sullivan Road
Holyoke, MA 01040

Please consider the impact to the environment and your responsibility before printing this e-mail.

ISO new england

memo

To: Vermont Energy Generation Siting Policy Commission

From: Eric Wilkinson

Date: January 30, 2013

Subject: Comments of ISO New England

ISO New England (ISO) appreciates the opportunity to provide comments to the Vermont Energy Generation Siting Policy Commission (Commission). The ISO is a private, non-profit entity that serves as the regional transmission organization for New England. The ISO operates the New England bulk power system and administers New England's organized wholesale electricity markets. Planning the bulk power system is also key a responsibility of the ISO.

Part of this planning responsibility includes studying the potential reliability impacts of proposed new generation resources on the bulk power system. This is an important function as the ISO is responsible for maintaining reliability and must meet regional and national reliability criteria. The purpose of these comments is to make the Commission aware of the ISO's role in the interconnection of energy generation resources.

The Role of the ISO

The ISO does not have a role in the siting of individual generation resources; authority for the necessary approvals for siting is largely the responsibility of state and federal governmental agencies. However, the ISO is responsible for determining the requirements for new generation resources proposing to interconnect to the portions of the transmission system over which the Federal Energy Regulatory Commission (FERC) [1] exercises jurisdiction, in a manner which maintains the reliability of the grid. This process is governed by the ISO's Open Access Transmission Tariff (OATT). The procedures for interconnecting both small (generally between 2 — 20 MW) and large (more than 20 MW) generators are covered by schedules 22 and 23 of the OATT[2] respectively. Schedules 22 and 23 delineate the studies that ISO conducts in response to a request to interconnect. In general, the studies need to show that the proposed generating resource and associated interconnection-related upgrades satisfy the minimum characteristics required to interconnect in a manner that avoids any significant adverse effect on reliability, stability, and operability of the New England transmission system. Once the studies are complete, generators enter into interconnection agreements with the ISO that, among other things, govern their operating parameters.

[1] The FERC is the primary regulatory oversight agency for the ISO.

[2] See: http://www.iso-ne.com/regulatory/tariff/sect_2/index.html

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Some portions of the transmission system are not subject to FERC jurisdiction. These are mostly the lower voltage (<100 kV) systems that do not have any generators selling power into the wholesale market.[3] The interconnection process for generators seeking to interconnect to these portions of the system is governed by state interconnection procedures.

Confidentiality of Interconnection Study Information
Due to FERC requirements and concerns about the release of market-sensitive information, the details of developer proposals during the interconnection study and agreement processes are generally treated as confidential information. The interconnection studies performed by the ISO at the request of generation developers are conducted in accordance with FERC rules and the ISO's Information Policy, which prohibits the disclosure of confidential information. However, study results are typically made public by the ISO upon completion. This study/agreement process can run in parallel with the state/federal permitting process. However, it is up to the generation developer to decide whether it wants to wait for the completion of the study phase before initiating the formal siting process.

Potential Transmission Upgrades
Depending on the location, size and type of generation resource, upgrades to the transmission system may be necessary in order to ensure that the interconnection of the resource does not negatively impact the reliability of the grid. The ISO's experience with many recent studies indicates that the technical characteristics of certain wind generation facilities have created particular system performance issues, such as unacceptable voltages. Therefore, transmission upgrades are often necessary before these facilities are allowed to interconnect with the New England transmission system. The costs of transmission system upgrades are generally borne by the generation developer.

The Kingdom Community Wind project developed by Green Mountain Power is a recent example of a project that chose to interconnect in an area that ultimately required the construction of transmission system upgrades. In that case, the ISO identified the need to install a 25 MVAR reactive power device to support the power that the Kingdom Community Wind project would inject into the transmission system. Green Mountain Power indicated that the cost of installing the device was approximately $10.5 million and challenged the need for the device. In an Order dated September 4, 2012, the FERC upheld the ISO's determination.[4] FERC ruled that the ISO followed its tariff and planning procedures when it came to the conclusion that the device was necessary.

It is important to understand that the interconnection of some generation technologies, such as wind or solar, to weaker parts of the transmission system can be challenging and time consuming to study. Because of the complexity of the transmission system, the wide variation in size and type of generating resources, and the numerous contingencies that need to be analyzed, the ISO conducts interconnection studies individually for each proposed new generator.

Additional ISO Informational Resources
Three recent studies conducted by the ISO that may be of interest to the Commission are briefly summarized below.

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[3] There are some exceptions to this general rule based on the configuration of the system.
[4] See: http://www.iso-ne.com/regulatory/ferc/orders/2012/sep/er12-2214-000_9-4-12_order_accept_kingdom_wind_lgia.pdf

1. Vermont/New Hampshire Needs and Solutions Studies

Finalized in 2012, a New Hampshire and Vermont Needs Assessment looked at the reliability of the transmission system in New Hampshire and Vermont through the year 2020.[5] The Needs Assessment examined the steady-state thermal and voltage performance of the system under a number of different dispatches and transfer scenarios intended to ensure that customer demand could be reliably served at summer peak load conditions. The ISO followed the Needs Assessment with a Solutions Study to develop and analyze potential transmission solutions. The Solutions Study also identified cost-effective solution alternatives for the New Hampshire and Vermont transmission system to address the potential deficiencies identified in the Needs Assessment.

2. Market Resource Alternatives

In 2011, the ISO conducted a pilot study of the potential for generic supply and demand-side resources for Vermont and New Hampshire as an extension of the information provided in the Needs Assessment for these areas.[6] The study provided information on conceptual market resource alternatives (MRAs or non-transmission alternatives) to transmission improvements for satisfying reliability needs.

3. New England Wind Integration Study

In December 2010, the ISO completed the comprehensive *New England Wind Integration Study* (NEWIS) that highlighted the operational effects of large-scale wind integration in New England. NEWIS captured the unique characteristics of New England's electrical power system and wind resources—including historical load and ramping profiles, geography, topology, supply- and demand-side resource characteristics, and wind profiles—and the unique impacts that these characteristics can have on system operations and planning as wind power penetration increases.[7] The study also identified the need for improved wind forecasting.[8]

The ISO works closely with regional entities, including VELCO, to maintain reliability in Vermont and the rest of New England. The ISO is charged with conducting necessary studies to ensure new generation does not negatively impact the reliability of the bulk power system. The ISO encourages the Commission to reach out to the ISO for information as it prepares its report to the Governor and the legislature. Finally, the ISO encourages the Commission to be cognizant of the potential need for transmission upgrades during deliberations about siting of new resources in Vermont.

Please contact me if you need additional information.

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[5] See http://www.iso-ne.com/committees/comm_wkgrps/prtcpnts_comm/pac/reports/2012/index.html Note that the studies contain Critical Energy Infrastructure Information (CEII), a federal designation aimed a protecting the grid.

[6] See http://www.iso-ne.com/committees/comm_wkgrps/prtcpnts_comm/pac/ceii/mtrls/2011/apr132011/nta.pdf

[7] The NEWIS methodology is discussed in more detail in RSP09, http://www.iso-ne.com/trans/rsp/2009/rsp09_final.pdf.

[8] GE Energy Applications and Systems Engineering, et al, *Final Report: New England Wind Integration Study* (December 5, 2010), http://www.iso-ne.com/committees/comm_wkgrps/prtcpnts_comm/pac/reports/2010/index.html.

From: Jean Vissering
Sent: Tuesday, January 29, 2013 8:30 AM
To:
Subject: RE: energy siting evaluation committee

Hi Anne

Here are my comments. They are a bit scattered as there is so much to discuss, and I could not help getting into some specific guideline recommendations.

I look forward to the discussion on the 5th. Thanks for inviting me.

Regards,

Jean

Jean Vissering Landscape Architecture

Jean Vissering Landscape Architecture

Date: January 30, 2013

To: Vermont Energy Generation Siting Policy Commission

Re: Comments

Thank you for the opportunity to comment. I've attached my resume which includes my experience as a landscape architect in energy issues. I have worked with developers, towns, regional planning commissions, citizen groups and organizations concerning the siting and design of energy projects. I am currently on contract with the Department of Public Service to provide an independent review of those facilities seeking a CPG that may involve aesthetic impacts. I have developed methodologies for evaluating wind energy projects for the Vermont Public Service Board, the National Academy of Sciences, and the Clean Energy States Alliance (with a grant from the US DOE). Over the years I have reviewed numerous energy related projects including wind, solar, biomass, and gas as well as substations and transmission lines.

My opinions about energy projects have evolved over the years and I will share with you my current thinking and observations regarding siting and energy project review, with particular focus on wind and solar. I begin with some general comments about how we can provide the Public Service Board (PSB) and the citizens of the state with a better framework for decision making. Then I will make specific comments on the siting, design and review of wind and solar projects.

General Comments

In general I think the Section 248 process works well for the review of energy projects, but there are areas where improvements are needed. Some of my recommendations focus on providing a better framework within which the PSB makes its decisions. This would require the Public Service Department (DPS) to take a larger role in providing planning, guidance, research and assisting interveners in the process. Town and regional planning commissions also need to play a larger role.

- **Energy Planning**

  The Department of Public Service (DPS) may need to play a larger and more comprehensive role in energy planning. As our energy sources become more localized and distributed, different impacts have emerged than were envisioned years ago. Wind in particular has been extraordinarily divisive. The environmental and aesthetic costs are readily observable (turbines in many views, roads along ridges) while the public appears increasingly uncertain of the benefits as a result of numerous competing and contradictory studies (extent to which

they reduce carbon, produce harmful noise, reduce property values, etc.) DPS could serve several roles:

- Serve as a clearinghouse for research and information that is legitimate and peer reviewed, possibly even commissioning its own research into the actual impacts of existing projects (noise levels, reducing clearing and grading impacts, wildlife, runoff and erosion, etc.)
- Examine energy alternatives: can we meet our energy goals with a limited number of wind projects for example, or through smaller projects (e.g 3-7 turbines) vs. larger wind projects (e.g. 15-30 turbines); by combining in-state and out of state renewables, by emphasizing solar over wind, etc. What would these alternatives look like and what would be the costs and benefits.
- Provide Siting Guidelines (locational criteria) and Best Practice Guidelines (construction and design criteria) that provide guidance for developers and the PSB. These would need to be updated every five years or so to adapt to new technologies and research, and to address problems that have been identified.
- Provide ways to help towns and non-profit organizations participate in the 248 review process without needing huge investments in hiring legal counsel.

- **Siting Guidelines**

Siting Guidelines would identify sites or site characteristics that are appropriate for particular energy projects, and those which would raise red flags or be inappropriate[1]. These need to be resource based. Possible siting criteria are discussed in more detail for wind and solar below. We are beginning to form a reasonable picture of the kinds of sites that are being considered, and the issues that arise. We should be able to put together a matrix of potential concerns along with their priorities. ANR is working on a study that will identify priority resource lands including unfragmented habitat. Towns can be encouraged to identify particularly valued high elevation habitats or lands that are suited and unsuited to larger scale solar or wind farms. A collaborative exercise similar to the meetings DPS sponsored in 2002 in which stakeholders participated in a series of meetings in the early days of wind energy could be one way to begin this process.

- **Best Practice Guidelines**

We are already beginning to develop informal standards including for conducting impact assessments and for project construction and design, but these are not clearly identified in any documents. By incorporating best practice standards, projects would hopefully become more acceptable and provide less cause for complaints.

Some past examples of such guidance include a report prepared in the 1970s by Terry Boyle on siting and designing electrical transmission line corridors. It was because of his study that our electric lines have been much less intrusive than in other states. I don't remember who commissioned the report, but it became the guideline for siting from then on. Similar recommendations were made during the Dean administration for roadway planning that helped to narrow and reduce the size and impacts of new roads (unfortunately not always) and to change highway design standards as they pass within our town and village centers.

[1] The term *siting guidelines* is often miss-used to simply refer only to design criteria such as setbacks, landscaping, etc.

This process was the result of the collaborative efforts of many stakeholders and professionals.

- **Cumulative Impacts**

Few if any methodologies exist for evaluating cumulative impacts, but these will be essential to develop, particularly in addressing larger scale wind, solar, and biofuel projects. Identifying cumulative impact thresholds needs to occur both at the planning level and in the 248 review process. I have discussed this in more detail below regarding the cumulative aesthetic impacts of wind and solar (addressed primarily through appropriate siting).

- **Local Participation/Town Plans**

Local participation will be essential at many levels from planning to participation in the review process.

  - Towns need to be encouraged to consider the appropriate siting of large solar and wind projects. A clear rationale should be provided in identifying sites where energy projects should be excluded. Sample language might be helpful to provide to towns.

  - I have some concerns that the "clear written community standard" under the Quechee Analysis has become so narrowly interpreted that it is nearly impossible to develop language that will pass muster as a standard. This makes towns feel as though their concerns are ignored. Developers, on the other hand, need a reasonable sense of what is expected. Siting guidelines and best practice standards prepared with the participation of towns and regional commissions may help to address some of the common concerns.

  - Towns should be notified of all energy projects proposed within their boundaries including solar projects under 10MW. As noted below, these are fairly large objects appearing throughout the landscape. In cases where they are poorly sited, the zoning administrators get questioned by citizens and have no idea how these were reviewed or what considerations determined its approval. Often a local planning commission can provide advice that may lead to better siting of these projects. (I am speaking here as vice-chair of my local planning commission.)

- **Facilitating Intervener Involvement**

Fully participating in the 248 process can be prohibitively expensive for towns and non-profit organizations and yet these are often voices that should be heard, particularly when there are clear issues involved that are of meaningful concern. Particularly important are those interveners who represent a significant group of people. Many organizations and towns are hesitant to participate without legal counsel as these proceeding can be intimidating and they want to be sure not to create problems down the road.

One possible way in which these concerns could be heard would be to sponsor an informal meeting near the beginning of a review process in which DPS and PSB representatives and interveners representing a larger public (e.g. towns and non-profit organizations) could, along with the developer have an open and informal discussion

without legal representation in the room. This might be an equivalent to a "sketch plan review." Since the concerns of public agencies and non-profits are often different than those of abutting landowners, a similar meeting could be held with abutters within the local community. The intention would be for the various interveners to be heard without refutation in an informal setting. Understanding points of agreement, disagreement and potential solutions or alternatives should be encouraged.

A second approach could be for DPS to have a 248 Omsbudsman who would help to shepherd interveners through the process, possibly acting as a public advocate in certain circumstances.

- PSB Website

Compared with New Hampshire, I have found it very difficult to find documents (other than orders) on the PSB website. In New Hampshire every document that comes in related to a Site Evaluation Commission (SEC) case is posted on a web site in the order it arrives. The site is easy to find. I have found that the PSB may post initial documents but later rebuttal testimony can be very difficult to find. Orders for any project tend to be scattered everywhere (usually by date which is not helpful to most people).

Wind Energy

Wind energy has undoubtedly become one of the most divisive environmental issues the state has faced in a long while. This is in part because projects occupy such prominent and visible locations and extend over a considerable distance. They are also located on what are often highly "valued" locations either because they are part of a common view or because of our general attachment to mountain ridges and the sense that these are "wild" landscapes.[2]

My general feeling is that wind energy needs to be part of the Vermont landscape. We are blessed with abundant scenic beauty but we need to do our share with climate change. Still, I think we need to proceed with caution on wind energy. Two of my concerns are: 1) the machines are so large that it won't take many projects to make it hard to find places, especially mountain summits, from which they are not visible; and 2) utility scale wind projects involve significant alterations to mountain ridgelines for roads and turbine pads. We have to learn from the projects we've built and we need to be sure we get it right.

Many people oppose them automatically based on what they hear about them and without ever having seen one. There is also a fear that they are going to be built all over the state and that we will be seeing them on every hill top. Siting guidelines will be essential (see below). We also need better information about the link between these projects and the real contributions they make to reducing carbon within Vermont and within the larger New England region. If we are going to look at turbines out our windows and build roads along our mountain ridges, we need

[2] Wind energy is also complicated by the fact that some people find them beautiful and others ugly industrial machines. When evaluating aesthetics however, the issue is not whether any individual finds them beautiful or ugly, but rather, what resources are involved in that landscape and how will the project affect those resources.

assurance that it will make a meaningful difference. At present there are too many conflicting studies.

Wind Siting and Design Considerations (Examples)

Roads
Building roads in rugged high elevation settings isn't easy. It requires many curves and considerable cut and fill. Although they aren't particularly visible to most people (except when viewed from above such as from a mountain summit or the Long Trail), the idea of this level of terrain alteration in areas that have been relatively wild and untouched (except perhaps for logging roads) is disturbing to many people.[3] We need to figure out how to build projects with minimal site disturbance. This may require:

- Requiring construction and design techniques that minimize site disturbance. The Lowell and Sheffield projects appear to have resulted in far different levels of site disturbance and may provide lessons for the future.
- Selecting sites which require minimal regrading such as those with limited topographic change and close to or including existing roads.
- Selecting sites which have already been disturbed, for example by logging roads.
- Requiring sites to be under 2500 feet in elevation (or lower in certain circumstances).

Project Size
One question worth exploring is whether we should encourage more smaller projects (3-7 turbines) or a few large ones (15-25 turbines). Advantages of smaller projects would be that they can often be accommodated on lower, smaller ridgelines. Aesthetically these are more likely to appear as part of numerous hills or mountains rather than dominating a major ridgeline throughout a region.

Noise
Noise produces a lot of concern, much of which may be unwarranted beyond a half mile away. But we need better studies on this including examining sound (audibility) as well as noise (above identified thresholds). Many people assume that when a noise assessment finds no impact, that it means there will be no sound at all. So we need to talk honestly about sound. Identifying sound qualities in valleys and on opposite hillsides will be important.

- Get good data based on existing projects and their effects at varying distances and elevations.
- Be sure to analyze both sound and noise (above acceptable levels)
- Keep projects a reasonable distance from residences unless compensation is provided.

[3] It is true that the amount of disturbance for the 21-turbine Lowell project equaled about the same as the area required for one 2.2MW solar project (each Lowell turbine is rated at 3MW). However solar projects are usually located on already disturbed land and/or land zoned for commercial or industrial development. They also usually require minimal regrading.

Lighting
Lighting is often identified as one of the most visually disturbing parts of wind projects. With the new radar activated technologies this impact can be significantly reduced. However, it is not yet clear where the FAA will approve these kinds of systems. In Vermont where the lack of night lighting is such an important characteristic of most of landscape, the ability to employ a motion activated collision avoidance system (e.g. OCAS) will be an essential siting criterion. (This was identified in the 2012 State Energy Plan.)

Cumulative Impacts
I have seen no good methodologies for evaluating cumulative impacts but I believe we can create one. We have traditionally conducted visual assessments using a 10-mile radius around the project. Wind projects are visible up to about 20 miles away, but beyond 10 miles they become a much smaller part of any particular view. Certainly when any 10-mile radii intersects with another project's 10-mile radius, this should raise a red flag and require studies of any cumulative impacts including the number of resources affected and any resources from which both projects might be visible. As part of general planning we may want to limit the number projects of a certain size within any one region.

Importance of Wild/Natural Areas
In terms of sensitivity in evaluating the aesthetic impacts of wind projects, I believe we need to give the highest priority to places valued for an experience of nature. These are the areas we go to in order to get away from civilization. They include hiking trails, for example the Long Trail, publically accessible natural areas, and lakes or ponds which are largely undeveloped and accessible primarily to non-motorized boats. Such places are unique and irreplaceable. Most involve a commitment of public funds. Some of these areas are entirely forested and visibility would be limited. But where views exist, especially if they are relatively close and include a large number of turbines, and the view is otherwise predominantly natural in character, this should raise concerns. In my opinion, these natural views present a much greater level of concern than views from private homes or developed lakes and ponds.

Solar Energy

I have reviewed quite a few solar projects within Vermont and observed many others. Solar panels are quite large objects and are appearing across the landscape in various forms (solar farms and individual panels or groups of panels). A typical 2.2MW solar farm occupies about 15 acres of land. Most have been well sited, but given the potential for a significant number of these panels and projects around the state, along with their size and industrial character, siting guidelines at all project scales would be helpful. In a recent decision, the PSB expressed concern about a 2.2MW solar farm located in a scenic agricultural residential setting, but noted that there were no guidelines for their appropriate or inappropriate siting.[4]

<u>Solar Siting and Design Considerations (Examples)</u>

[4] Order available at: http://psb.vermont.gov/sites/psb/files/orders/2012/2012-4/7844%20OrderReInterventions.pdf

Solar Farms

- Strongly encourage solar farms on land that is within or near already developed areas especially within commercial or industrial zoning districts.
- Avoid areas of high agricultural, natural, or forest resource values (unless in commercial or industrial zones)
- Encourage Towns to identify where they would like to see projects; encourage towns to build them and/or benefit financially from them.
- If they are located in residential or rural areas they should be screened from view as much as possible. Screening is especially important if the back (north) side is visible from a public vantage point as this side tends to be light in color (often white which is highly visible) and visually cluttered.
- Consider the design and location of associated infrastructure. Inverter structures for example should be simple in design, unobtrusively located and dark in color, preferable a similar black to the solar panels themselves to keep the project simple in form and design.
- Keep the layout as compact as possible.

Individual Solar Panels or Groups of Panels

My biggest concern about the siting of individual and groups of panels is that they often appear randomly located and ignore many of the basic principles we expect in siting other forms of development. Here are a few basic recommendations:

- Keep them as close to existing development as possible (e.g barns, outbuildings, villages) vs. scattering them in valuable open space.
- Reflect the traditional landscape patterns in siting them: e.g. along existing hedgerows (at the edge rather than in the center of a field), orient them as close as possible parallel or perpendicular to nearby buildings. This is a classic pattern in the Vermont landscape. While solar panels need to be oriented south, most of our historic structures have a similar orientation that can be repeated as closely as possible.
- Keep them compactly organized. Attached panels, or closely staggered groups of three panels to break up long rows.
- If the back side (which is often white and more visual cluttered in appearance) is visible from the road or to neighbors, add some plantings to screen it or located it where natural plantings screen the back side of the panels.
- Pay particular attention to the design and location of the inverter equipment. These are often on very slapdash wooden boards that are highly unattractive and noticeable due to the light colors and thoughtless construction. Place these where they can be screened or softened with existing vegetation, and as low as possible. Developers and installers need to come up with better standard designs for these associated facilities, which can be more unattractive and noticeable than the panels themselves.

From: Ann Ingerson
Sent: Tuesday, January 29, 2013 3:06 PM
To:
Subject: comments with 3 attachments

Thank you for the opportunity to comment on the process for siting renewable energy in Vermont. Please accept the attached comments, including 3 attached documents that we believe will be helpful to the Commission.

Ann Ingerson
Economist
The Wilderness Society
PO Box 15, Craftsbury Common, VT 05827
www.wilderness.org

Facebook: www.facebook.com/TheWildernessSociety
Twitter: twitter.com/Wilderness

We protect wilderness and inspire Americans to care for our wild places

Comments to Vermont Energy Generation Siting Policy Commission
The Wilderness Society
January 30, 2013

The Wilderness Society is a national organization with a mission to protect wilderness and inspire Americans to care for our wild places. Our two Vermont-based staff work across northern New England. Over the past few years, we have focused on the need to balance two often-conflicting goals: reducing climate change impacts on our region's wildlands and protecting specific places where the human footprint remains light. We offer these comments to Vermont's Energy Generation Siting Policy Commission (hereafter "the Commission") in the hope that Vermont can build a renewable energy system while also protecting resilient natural systems as they adapt to coming climate stresses.

The Commission interprets its mandate rather narrowly to focus on the Public Service Board Section 248 siting process. Unfortunately, the current piecemeal permitting approach is unnecessarily confrontational and therefore damaging to the state's quality of life, social fabric, and the ability of natural systems to adapt to climate stresses. We need a comprehensive landscape-specific energy plan that maximizes the role of demand-reduction, acknowledges cumulative impacts of energy and other development, anticipates pending technological advancements, makes the best use of local creativity and resources, and begins now to make investments in the system that we want to see in 2050 or later. Without taking this broader view, the Commission is missing a tremendous opportunity to help Vermont develop a truly sustainable energy system for the future.

Even within a narrow focus on permitting procedures, the Commission can take some small steps to improve the energy siting process. We would like to emphasize two major areas of improvement: 1) ensuring that Criterion 2 under Section 248 is applied as intended to prioritize demand-side solutions with low environmental impact; and 2) addressing cumulative impacts by planning for ultimate build-out and by developing mitigation guidance that effectively minimizes and offsets the landscape impacts of permitted projects. We also support several improvements which, though not at the core of our land protection mission, would significantly improve the permitting process. These include: 3) requiring a pre-permit scoping process to identify and respond to significant issues and ideally develop the best energy solutions; 4) broadening the composition of the Public Service Board for large-scale projects; 5) providing funding and other support for intervenors; 6) fairly compensating those affected by a project; and 7) developing a less legalistic Section 248 process more conducive to public participation.

1. Equal Treatment for Demand-Side Solutions - Section 248 Criterion 2

The statute regulating Public Service Board proceedings, 30 V.S.A. §248, defines a number of criteria that must be considered when determining whether a project promotes the public good. Under criterion 2 a project must "meet the 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, including but not limited to those developed pursuant to the provisions of sections 209(d) [*Efficiency Vermont under Department of Public Service purview*], 218c [*Least Cost Integrated Planning*], and 218(b) [*pricing incentives to promote conservation*] of this title. In determining whether this criterion is met, the board shall assess the *environmental and* economic costs of the purchase, investment, or construction in the manner set out under subdivision 218c(a)(1)(least cost integrated plan) of this title and, as to a generation facility, shall consider whether the facility will avoid, reduce, or defer transmission or distribution system investments [*explanations and emphasis added*]."

This language suggests that proposed new supply should be compared with *potential new* demand-side solutions capable of producing equivalent amounts of power (or in this case reducing power needs by an equivalent amount) at equal or lower cost. The comparison should include environmental costs and savings due to avoided transmission investments. In the case of a new renewable energy facility, for instance, the petitioner should demonstrate that no demand-side approaches exist that would provide, or avoid use of, an equivalent amount of energy and cost less than the proposed new supply.

In energy generation dockets to-date, the Public Service Board has interpreted this criterion very narrowly. Rather than compare a proposed facility to demand-side alternatives of similar magnitude and cost, it has determined that new facilities are needed if **current** efficiency programs cannot meet the **entire** future need for electric power. Three recent wind energy dockets demonstrate how the PSB has interpreted Criterion 2.

Sheffield Docket No. 7156 Final Order, Need for Present and Future Demand for Service [30 V.S.A. § 248(b)(2)], pp. 28-29.

The petitioner – being a merchant plant rather than a utility – declined to analyze demand-side alternatives which are outside the purview of a private facility. Yet the statute does not specify that only efficiency programs operated by the petitioner are relevant. The Board accepted that a merchant plant meeting regional needs for power did not need to demonstrate benefits to Vermont. Presumably if need for a Vermont facility includes power benefits to other states, then enhanced demand reduction programs by those states are relevant alternatives to analyze. Yet the Board failed to even consider whether power needs could be addressed through demand-side alternatives. Instead, it concluded that because demand-side measures could not meet **100%** of future energy needs, there was a demonstrated need for this particular project. *"The Project would contribute to both Vermont and the region's need for renewable power, a need that cannot be met through energy efficiency, conservation, or load management measures (p. 29)."*

Georgia Mountain Docket No. 7508 Final Order, Need for Present and Future Demand for Service [30 V.S.A. § 248(b)(2)], pp. 20-21.

As for Sheffield, the Board concluded that a merchant plant can demonstrate need regionally rather than for the state, and does not need to demonstrate the lack of a cost-effective demand-side alternative to its proposed facility. *"This standard recognized the fact that the developer of a merchant plant had no obligation to provide energy efficiency and load-management services (p. 21)."* Since the Georgia Mountain project has come on-line, Burlington Electric Department has considered purchasing

the facility, which would invalidate the rationale for not considering efficiency alternatives. This inconsistency in implementing the criteria points out a flaw in the treatment of merchant plants.

Kingdom Community Wind Final Order, Docket 7628, Need for Present and Future Demand for Service [30 V.S.A. § 248(b)(2)], pp. 26-28

The petitioners' argument in this case was that expiration of VT Yankee and Hydro Quebec contracts demonstrated need for replacement energy supply, and that efficiency programs could not be expected to meet the entire need. The Board concluded that *"while it is reasonable to assume that some amount of future energy efficiency measures can be obtained by the companies at a cost less expensive than the power generated by the proposed project, it is not reasonable to assume that cost-effective energy efficiency or other demand-side resources will meet anything approaching the amount of the companies' resource needs."(p. 27).* In our opinion, Criterion 2 does **not** require the PSB to assess whether efficiency measures can meet the **entire** need for power, or even the entire targeted renewable portion. Like demand-side solutions, the Kingdom Community Wind project is also incapable of meeting the companies' total energy needs. What the petitioners need to show – and did not show for this project – is that efficiency measures cannot cost-effectively substitute for **this particular project**.

The CPG notes that the Department of Public Service projects 15% potential energy savings from efficiency programs. These "cost-effective" savings are defined as those costing less per kWh saved than the current retail cost of power. In the case of the Lowell project, power will cost approximately $0.11/kWh without the tax credits and REC payments (these are costs to taxpayers and utility customers and hence part of overall life-cycle costs). Recent Efficiency Vermont investments have cost up to approximately $0.04/kWh, so there is room for much more aggressive efficiency measures while keeping costs well under $0.11/kWh.[1] If environmental costs were included in the cost of power for the Lowell project, even more expensive efficiency measures would become viable alternatives.

The challenge for making energy efficiency an equal partner with energy supply, and the reason Vermont established an independent efficiency utility, lies in developing a mechanism to earn a return on efficiency investments. Wind and biomass developers, including utilities, earn a return for investors through retail electricity sales or power purchase agreements, often with guaranteed long-term returns. Managing dozens of individual efficiency investments and collecting receipts via service contracts would require an entirely different business plan. Hence, rejecting a project in favor of more attractive efficiency alternatives amounts to blocking all opportunities for those investors. If electric generation developers re-cast themselves as energy service providers, they might consider diverting their investment dollars into the best overall energy solution through innovative investment models. Another useful task for the VEGSPC, outside the narrow permitting process frame, would be to provide models of

[1] Second-class treatment for demand reduction also relates to whether a project's contribution toward New England state RPS targets and Vermont SPEED goals provides evidence of need. Though such programs are beyond the restricted purview of the siting committee, it is important to make the connection between program design and less-than-optimal siting decisions. When setting renewable energy targets, demand reduction should arguably be favored above new supply due to low environmental and transmission costs. Instead, the typical RPS approach biases electricity markets toward supply-side solutions. For instance, if an RPS requires that a utility increase its renewable sources to 20% of its load, efficiency programs that bring electricity demand down by 20% would leave the utility still needing to find new renewable sources that total 16% of its initial load level (20% of the new load which is 80% of the previous level). The same quantity of new supply (20% of current load) would fully meet the RPS obligation. Some states, including North Carolina, credit efficiency investments for a portion of the RPS target. Connecticut has a separate RPS tier for efficiency investments. As Vermont considers instituting an RPS, it should consider how to credit efficiency as a substitute for new supply.

viable demand-side investment vehicles. These might be identified in a pre-project scoping process as alternatives to new supply, and might even interest innovative energy developers.

We urge the Commission, working with Vermont Energy Investment Corporation, to develop a template for Section 248 Criterion 2 that, when applied to a particular project, would provide a meaningful comparison between a proposed renewable electricity production facility and a set of efficiency measures with equivalent energy savings. Ideally, the Commission would encourage development viable models for efficiency investments that might interest energy developers.

2. Cumulative Impacts and Mitigation

Aside from concerns about issues such as noise, runoff, aesthetics, wildlife, property values, and tourism impacts, much of the opposition to new renewable electricity facilities comes from fear of the unknown. If development proceeds piecemeal, without a long-term vision regarding appropriate sites or what full build-out will look like, many Vermont residents fear a loss of the iconic landscape we know and love. In fact, a robust stakeholder process to identify low conflict development areas can help ensure that public values remain protected and that resource conflicts are identified from the start. The added benefit of comprehensive planning is the opportunity for public recognition of how much renewable energy will need to be built to meet statewide targets, which can help clarify for Vermont residents the scope of the energy projects that will be built to meet demand. The last large blocks of interior forest, intact ridgelines, and the landscape connections facilitating wildlife movement across the Northern Forest from New York to northern Maine and beyond, could dwindle away over a few decades. (See attached report by The Wilderness Society, "Cumulative Landscape Impacts of Renewable Energy Alternatives for Northern New England", 2013, for a sketch of what full renewable energy build-out might look like by 2050).

The Commission is explicitly charged with determining whether existing permit criteria adequately protect resources from the cumulative impacts of multiple projects, and the Vermont Agency of Natural Resources, in its comments to the VEGSPC, emphasizes the importance of cumulative impact analysis. It is questionable whether this problem can be addressed by adding to or modifying permit criteria, since by nature it requires considering the ultimate build-out of future projects. Advance planning, including identification of appropriate locations and absolute limits to the number of projects, could guide developers to less-controversial sites and ensure protection of critical resources. Just as Act 250 was originally meant to go hand-in-glove with a state land use plan, the Act 248 process and Vermont's Comprehensive Energy Plan beg for a landscape-explicit energy plan. Such a plan could utilize the BioFinder mapping tool developed by the Agency of Natural Resources, and also incorporate local and regional land use plans and site-specific resource information.

In addition to gathering resource information, a land-based energy planning process could help advance a state-wide discussion about renewable energy impacts and trade-offs. Due to its greater experience with wind development, Maine has begun to wrestle with cumulative impacts questions. For example, last year the Maine legislature tasked the Office of Energy Independence and Security with considering cumulative scenic impacts. The resulting assessment considers the relative merits of spreading wind development widely across the entire state versus selecting a few "sacrifice zones" where impacts could be concentrated and local residents compensated accordingly (see attached "Report of Office of Energy Independence and Security, Assessment of Cumulative Visual Impacts from Wind Energy Development", 2012). Vermont needs to start its own discussion about the landscape implications of state energy goals for wind and other qualifying renewable energy resources.

We urge the Commission to recommend that the Governor continue the work of the Commission by developing a landscape-explicit energy plan, with opportunities for robust public engagement, that fleshes out the general principles in the Comprehensive Energy Plan and defines what ultimate renewable energy build-out would look like.

One challenge to limiting and managing cumulative impacts is the lack of existing permanent protection for tracts with high natural values, and the lack of funding to secure that protection. Landowners struggling to keep holdings intact view energy development as a significant new revenue stream. Guiding development away from sensitive lands will limit future options on some private lands. Conservation easements have become a popular tool to provide landowner returns while limiting development of priority habitat or productive farmland. Yet funding for purchase of easements is hard to come by. Vermont Housing and Conservation Trust Fund seldom receives its full legislatively mandated 50% of property transfer tax receipts. Mitigation funds from development projects are a minor but significant source of supplemental revenue.

Energy development projects commonly offset, as a form of mitigation, a portion of their unavoidable impacts by protecting lands either on the project property or off-site. Off-site compensatory mitigation tends to be negotiated project-by-project and outcomes depend on who participates and how loudly. Mitigation for loss of wetlands, and to some extent wildlife habitat, provides models of more systematic mitigation approaches. Principles include methods for measuring impact compared to an appropriate baseline, ratios for preserving existing resources elsewhere as a multiple of the resources lost on-site, and ways to pool project fees to ensure more effective long-term protection of high-priority resources within a region. For details, and examples of mitigation for wind projects in northern New England to-date, please see the attached draft white paper from The Wilderness Society, "Wind Project Permitting and Compensatory Mitigation in Northern New England: Potential for Addressing Cumulative Impacts", 2013.

In comments submitted to the VEGSPC, Vermont ANR suggests that well-defined standards for noise impacts, blasting protocols and decommissioning might make the permitting process more predictable. They also suggest that the Board adopt ANR standards regarding resource impacts. These currently include mitigation guidelines for deer and black bear habitat and evolving guidelines for bats and biomass harvesting. Other similar mitigation guidelines might address fragmentation, loss of high elevation plant communities, etc.

We urge the Commission to recommend development of mitigation best practices to be implemented through formal mitigation mechanisms for energy projects.

Our remaining recommendations address elements of the energy siting process that are less closely tied to our organizational mission of protecting wildlands. We believe they will result in better energy siting decisions. They are listed in order from those that would slightly tweak the existing process, to those that offer an alternative vision for renewable energy development in the state.

3. Scoping Process with Stakeholder Consultation and Public Engagement

Development plans are often kept fairly quiet until after thousands or even millions of dollars have already been invested in a site by a private developer. To avoid wasteful spending, major projects should include a pre-permit scoping process that requires developers to consult with a wide array of stakeholders well in advance, as they often do currently with state resource agencies that issue permits.

In some cases, early engagement may convince a developer that a particular site is not suitable. In others, early design changes might minimize human and resource impacts and ultimately reduce controversy. Even better, if communities of stakeholders are given free rein to suggest solutions to defined energy goals, they may identify creative low-impact ways to meet energy needs with minimal landscape disturbance. We urge the Commission to think outside the permitting box to recommend the best Vermont-style approach to developing new renewable energy infrastructure.

4. Broadening Public Service Board Composition for Large-Scale Projects

We support the proposal by the Agency of Natural Resources to add representatives of ANR and the host region to the PSB for large-scale projects. Assessing overall public good for a project requires weighing benefits versus costs, many of which are not readily quantified. Final deliberations of the Board would benefit from the presence of members who fully understand the landscape and local community repercussions of a proposed project. New Hampshire's Site Evaluation Committee has broad representation from the full suite of state agencies whose areas of expertise may be affected by a project. In Maine, the primary permitting authority is the environmental agency with oversight over state natural resources. In neither case is the public utility authority alone asked to make a final determination about whether the benefits of new electricity supply outweigh environmental and social harm. Broadening Vermont's PSB would bring similar balance into our state's permitting process.

5. Intervenor Support

Connecticut and New York both require project proponents to provide funds to support intervenor participation, and these could serve as a model for Vermont. New Hampshire's practice of assigning a Counsel for the Public from the Attorney General's office, rather than relying on the Public Utility Commission (or in Vermont the Public Service Board) to represent the public interest, is also worth considering. The PSB has a primary interest in new renewable reliable power supply, and hence cannot be expected to objectively represent the full array of public interests. The Counsel for the Public in New Hampshire has advocated for such issues as noise limits, viewshed protection, shadow flicker, bird and bat impacts, historic sites, wildlife habitat protection, and water quality. We urge the Commission to explore this model for representing public interests in the permitting process. The Vermont Agency of Natural Resources has suggested appointing a Case Manager for each project, and this position might fulfill some of the same functions as New Hampshire's Counsel for the Public.

6. Fair Compensation

Renewable energy projects do not necessarily benefit those nearest the facility. Developers often offer considerable compensation to the town where a project is located, but scenic, noise, water and other impacts may be felt mostly by other neighboring communities. We urge the Commission to request that the PSB develop community benefits guidelines that help developers quantify local impacts and determine fair compensation.

7. Less Legalistic Section 248 Process

The current contested case format for Section 248 permitting encourages confrontation rather than compromise. It also stretches out time frames and raises the cost of participation, both in terms of fees for legal counsel and time commitment. And finally, it leaves those with important information or perspectives, but who lack the resources or standing to become formal intervenors, outside the process and leaves those who testify at public hearings frustrated that their carefully-crafted statements cannot be formally considered by the Board. Vermont's small scale offers opportunities for a less formal approach that would yet maintain high standards of review for information submitted to avoid acting on hearsay alone. We urge the Commission to consider other less confrontational formats for energy facility permitting.

* * * * * * * * * * * * *

Thank you for the good work of the Commission, and for the opportunity to offer our suggestions. We look forward to reading your draft recommendations in the coming months and to helping to implement them.

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Attachment 1: Cumulative Landscape Impacts of Renewable Energy Alternatives for Northern New England, 2013, The Wilderness Society.

Cumulative Landscape Impacts of Renewable Energy Alternatives for Northern New England

Ann Ingerson
January, 2013

THE WILDERNESS SOCIETY

Mission of The Wilderness Society

To protect wilderness and inspire Americans to care for our wild places.

TWS Research Department

The Wilderness Society's Research Department consists of experts in economics, ecology, and landscape analysis. This team provides the science to answer pressing questions about energy exploration and development, forests and fire management, climate change, and many other issues affecting public lands. This information is key to understanding often complicated environmental issues, and ultimately making the right choices to achieve lasting protection for the resources and places that sustain us and our ways of life. The Research Department provides science to inform not only The Wilderness Society's own conservation campaigns, but also the decisions being made by communities, land managers, legislators, and others about the future of America's wild places.

Preferred Citation

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Available on the web at http://wilderness.org/sites/default/files/NF%20Renewable%20Energy%20Cumulative%20Impacts%201-15-13%20%282%29.pdf.

Related Reports

Ingerson, Ann. (2012). Renewable Energy in the Northern Forest. Washington, D.C., The Wilderness Society. Available on the web at http://wilderness.org/sites/default/files/Northern%20Forest%20Renewable%20Energy%20Report%20-%20September%202012.pdf.

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Foreword

The three northern New England states of Maine, New Hampshire and Vermont face similar energy opportunities and dilemmas. All have committed to significant greenhouse gas reductions and are beginning to reduce their dependence on fossil fuels. All have similar renewable energy resources, including wind, forest biomass, hydropower and solar and geothermal energy. Over the next few decades, meeting commitments to reduce greenhouse gas emissions will require major investments in new energy infrastructure – investments that will influence the basic design of the region's energy system for many decades into the future.

Building out this new system, and possibly relying more on local energy resources rather than imported ones, will have significant landscape impacts. Aside from hydroelectricity, under the jurisdiction of the Federal Energy Regulatory Commission, large-scale land-intensive renewable energy development is relatively new in this region and the traditional permitting process has generally not been designed to evaluate cumulative environmental impacts across the landscape. Better information about the long-term cumulative effects of renewable energy development can help both communities and state-level decision-makers plan responsibly and guide development to the least damaging sites and technologies. Candid information about impacts also reinforces the critical importance of reducing energy demand. We hope to provide some of that information through this report.

Our report describes – through maps and estimates of acres disturbed – landscape impacts from renewable energy build-out scenarios that provide approximately equal shares of the energy used by electricity, heating and transportation sectors by 2050. Decisions about renewable energy development require balancing benefits against costs, and many of the most important benefits and costs are not part of a project's private financial calculus. Hence the report also lists some key environmental costs and benefits for each energy scenario, and summarizes both greenhouse gas benefits and financial costs in final sections.

Effective climate policy calls for not only reducing emissions as rapidly as possible, but also protecting the wild places in our landscape that offer the best hope for natural systems to adapt under increasing climate stresses. Human residents also benefit directly from resilient ecosystems that moderate and filter storm runoff, continue to attract visitors who support local businesses, and offer residents a respite from daily stresses. Our hope is that the information in this report will contribute to energy policies and decisions that meet our region's energy needs while also supporting less visible but no less valuable wildland values.

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Introduction

In order to illustrate cumulative impacts of renewable energy development over time, this paper presents scenarios for meeting the region's projected 2050 energy use using several alternative renewable technologies. For purposes of this exercise, we assume that fossil energy must be replaced with renewable alternatives as rapidly as possible, hence we do not describe the environmental effects of fossil fuel use – which typically exceed the impacts of renewables – but rather focus on the less well-recognized impacts of renewable energy development.

Although adequate climate mitigation will require a mix of energy solutions, in order to compare impacts we set the scale for each scenario at about 25% of demand for a particular energy sector. We chose the 2050 timeframe and 25% scale to correspond with the New England Governors and Eastern Canadian Premiers 2001 Climate Change Action Plan goal to reduce greenhouse gas (GHG) emissions 75-85% by 2050 to avoid dangerous climate threats.[1] These scenarios are not predictions, but are offered as thought experiments that ask the question "what if" we were to depend on each of these sources in turn to a roughly equal degree.

Of the major energy sectors in 2009, electricity was responsible for approximately 18% of greenhouse gas emissions across these three states, transportation 46% and non-electric space heating and industrial processes 36%. Clearly, reducing nonelectric fossil fuel use is critical to minimizing climate impacts. Some of the best options for reducing emissions from heat and transport, however, involve converting to more efficient electric technologies. Hence our scenarios assume that a large portion of transportation and heating energy will come from electricity, which in turn intensifies the burden on renewable electricity sources.

For each scenario, we include a map that provides a general sense of how impacts are distributed across the northern New England landscape. We also provide estimates of acres affected – both directly through land disturbance and indirectly as fragmenting features that reduce core habitat. The *type* of disturbance may be more important than simply acres affected, so boxes under each scenario describe environmental effects that are more difficult to quantify. Since the benefits of each alternative relative to status quo energy sources also differ, we also list some of the key benefits of each alternative.

Landscape impacts are not the sole criterion that influences renewable energy choices. Policy and siting decision-makers must balance any negative impacts against overall public benefits from renewable energy developments. Those benefits include greenhouse gas reductions resulting from substituting renewable sources for fossil fuels. RPS programs and energy siting guidelines often implicitly assume, however, that all renewable sources are equally "carbon neutral". Actual climate benefits vary considerably. To support rigorous assessments of costs versus benefits, we estimate approximate GHG emissions for each scenario and compare them to emissions from current sources.

Finally, we provide general financial cost comparisons for each scenario. Financial costs largely dictate relative rates of adoption for each technology, but environmental externalities should be considered along with financial costs when making public policy choices about energy sources.[2] Although we have not monetized landscape costs and benefits here, an extensive body of work in environmental

economics indicates that the dollar value of ecosystem services approaches or even exceeds the value of goods that are traded in markets.[3] A recent synthesis of global studies indicates that loss of species from a local ecosystem may be even more critical than climate change as a driver of ecosystem degradation.[4] One way to internalize environmental costs at the project level is to require mitigation through changes in design, operations, restoration, or compensation for unavoidable impacts in the form of off-site resource projection. These measures tend to increase project costs overall. Because of the magnitude of external costs, there may be sound public policy reasons to favor energy options that cost more in narrow financial terms but also minimize environmental harm.

Renewable Energy Scenarios

In order to compare various renewable energy options, we define scenarios that provide up to 25% of energy needs for Maine, Vermont and New Hampshire combined in the electricity, transport and heating sectors by 2050. This is the magnitude of development required to achieve aggregate greenhouse gas reductions of 75-80% by 2050. Aside from Canadian hydroelectricity, scenarios are based on energy generated within the three-state region. The ultimate mix of technologies, including other out-of-region energy sources, will depend on the balance of financial, environmental and social benefits and costs and the policies that influence them. Scenarios were constructed as follows.

1. Estimate 2050 Energy Need – Estimate total demand for electricity, transportation and "other" (heat and industrial processes for residential, commercial and industrial users) in the three state region in 2050:
   - Current energy use in trillion Btu is: electricity = 291 (33%)[5]; heat and industrial processes = 318 (35%); transport = 283 (32%).
   - Project 2050 usage, assuming each use category increases through 2050 at the national rates projected by the Energy Information Administration from 2009 to 2035)[6]: electricity growing at 0.86%/year[7] = 117 trillion Btu (requires 344 in primary energy resources); nonelectric transport growing at 0.24%/year[8] = 301 trillion Btu; other uses growing at 0.55%/year[9] = 366 trillion Btu.
   - Adjust for conversion of 25% of heat and 50% of transport to electricity[10], yielding total electricity use = 192 trillion Btu, non-electric transport = 151 trillion Btu, and non-electric other uses = 275 trillion Btu.[11]
   - Convert electricity use to the more familiar gigawatt-hours (GWh) for purposes of developing scenarios = 56,192 GWh[12]. (Note that primary energy resources used to generate electricity are approximately triple this amount, since conversion to electricity is relatively inefficient. If electricity shifts increasingly to solar and wind, conversion efficiency will actually decline but the energy loss is less important given the abundance and emission-free character of the raw resource.)

2. Define Energy Generation Targets – Define targets by renewable energy source for the region. These targets reflect the degree of development needed to meet GHG reduction goals, but may not be fully feasible for a variety of social and environmental reasons. For our scenarios, each renewable energy technology meets up to 25% of regional demand - a level suggested at both state and regional levels for inland wind, which is currently the most rapidly developing renewable source.[13] Technologies with insufficient resource capability to reach that level (i.e. wood and in-region hydroelectricity) have targets set at the highest technically feasible level. These are purely theoretical targets, for purposes of illustrating comparative impacts.
   - Electricity – 56,192 GWh per year is roughly double current use (includes conversion of 50% transport and 25% heat/industrial to electricity). Scenarios for meeting up to 25% of the region's annual average electricity demand with specific technologies are defined as follows:
     - 25% from in-region onshore wind requires capacity of 5,346 MW. This level of development would utilize about 33% of the potential onshore wind resource estimated by AWS Truepower for the U.S. Department of Energy.[14] Since wind is poorly correlated with daily or seasonal peak electricity load, it would take approximately three times this capacity to meet peak loads, but intermittent wind is unlikely to serve as a peaking resource.[15]
     - 25% from in-region offshore wind requires capacity of 4,009 MW.[16] This level of development would amount to 3% of total DOE AWS Truepower offshore wind capacity for Maine and New Hampshire.
     - 21% from in-region wood biomass requires 1,497 MW of capacity (wood resources, including wastes, are insufficient to sustain the 1,725 MW necessary to meet a 25% goal). This is more than triple the current capacity of 429 MW, and would use 103-306% of available supply, depending on the source of supply estimates;
     - 23% from in-region hydro, requires capacity of 3,407 MW[17] (meeting a 25% goal would require 3,704 MW, which is more than the identified small hydro capacity for the region). At prevailing hydroelectricity capacity factors, this is about a 60% increase over current production (7,500 GWh in 2008 output, dropped to 6,635 GWh in 2010);
     - 25% from Canadian hydropower, requires 2,608 MW (assumes 67% capacity factor, consistent with current Vermont Hydro Quebec contract - considerably higher than local hydro due to high reservoir storage capacity). This is nearly 2.5 times the current estimated HQ power use by northern New England, and would require extensive new transmission capacity.
     - 25% from in-region distributed solar requires 11,879 MW of photovoltaic panels. As for wind, solar is an intermittent resource that is not always available at time of peak load, so meeting peak needs would require 1.27 times this capacity (less than the factor of 3 for wind since solar is better correlated with peak load).[18]
   - Heat – Demand in 2050 grows to 366 trillion Btu compared to 318 today (equivalent to about 2.6 billion gallons #2 fuel oil compared to 2.3 billion today). Scenarios for meeting up to 25% of the region's annual average heating demand with specific technologies are defined as follows:
     - 25% from ground-source heat pumps requires 7,157 GWh of electricity which has been included in the electricity scenarios.

- 25% from wood requires 9.0 million additional tons of wood (with about 4 million tons already used for home and institutional heating). This is 90-266% of available wood supply, depending on estimate source, including some pulp diverted to energy use and available wood waste).

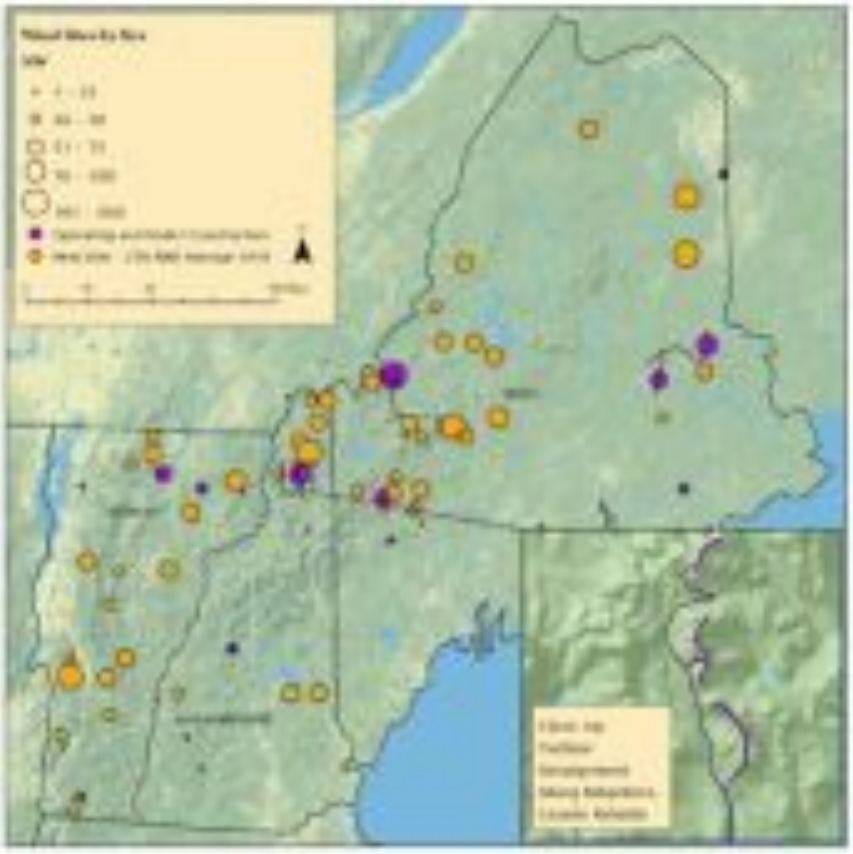
- Transport – Demand in 2050 grows to 301 trillion Btu compared to 283 today (equivalent to about 2.4 billion gallons 80/20 gas/diesel compared to 2.2 billion gallons today). Scenarios for meeting up to 25% of the region's annual average transportation energy demand with specific technologies are defined as follows:
  - 50% from electric vehicles requires 14,698 GWh of electricity which has been included in the electricity scenarios as part of increased electricity demand. As there are few viable options for lowering GHG emissions from transportation, this scenario makes up a larger portion of the sector than the standard 25%. Emissions reductions come not only from the fuel switch but also from reduced total transportation energy due to the improved efficiency of electric motors compared to combustion engines.
  - 13% from wood-based biofuels requires using 10.3 million green tons wood (103-304% of available feedstock, depending on source of supply estimates - wood resources are insufficient to meet a 25% goal.). Maximum feasible feedstock would support production of 334 million gallons of ethanol and biodiesel.
- Reducing energy use through smarter planning, demand-side solutions, and incentivizing better consumer/business choices.
  - 25% reduction (14,048 GWh) in electricity demand through demand-response tools, efficient lighting, appliances, and machinery, plus changes in behavior and consumption choices. Note that our baseline – from U.S. Department of Energy projections – uses fairly pessimistic assumptions about efficiency measures. New England as a region has been a leader in energy efficiency, and ISO-NE projections have recently been revised to reflect the important role of demand-side resources (see Appendix 3).
  - 25% reduction (91.6 trillion Btu) in heating and industrial processing demand through building and equipment efficiency improvements, smaller building size, and behavioral changes.
  - 25% reduction (75.2 trillion Btu) in demand for transportation fuels by reducing vehicle miles traveled through ride-sharing, public transportation, and smart growth settlement patterns, and by improving vehicle efficiency (e.g. fuel economy) and making behavioral changes.

Landscape Impacts of Defined Scenarios

25% Inland Wind Scenario

The map below shows, in purple, 17 wind sites currently operating or under construction (total 351 turbines and 724 MW), and in orange, 25 proposed (total 597 turbines and 1,540 MW) plus 21 theoretical large new sites[19] (total 1,034 turbines and 3,102 MW, assuming 50 3 MW turbines at each site). Together the depicted wind sites would supply 25% of projected average 2050 power needs for the three northern New England states.[20] Sites were selected based on relative capacity factors, and higher-elevation sites tend to have the best wind resources; different selection criteria might reduce estimated impacts due to shorter access roads and transmission lines. Turbine designs adapted to lower wind speeds and located at less remote sites might also reduce overall impact. Analysis by the Appalachian Mountain Club identified 63 Maine sites on mostly private land, with relatively low resource protection conflicts, and mostly within Maine's expedited wind permitting area. The 53 of these sites without existing projects or development restrictions (totaling 1,377 MW of capacity) were clustered similarly to the new theoretical sites shown in Figure 1 below.[21] On the other hand, impacts may be underestimated because additional theoretical sites in our scenario beyond those already operating or proposed are all assumed to be 120MW or larger (smaller projects reduce local impact but would require more sites and hence more overall impact).

Figure 1: Inland Wind Sites to Provide 25% Northern New England Electricity in 2050



Landscape Disturbance

Inland wind resources are concentrated atop ridgelines in this region. Development consists of turbine pads, roads and transmission lines. Turbine pads involve clearing and construction of gravel pads, with smaller concrete turbine foundations. Roads include ridgeline roads (sometimes referred to as "crane paths") between turbines, and access roads with associated cut-and-fill disturbance to link public roads to the wind farm site. Transmission lines connect the facility to the grid and, for wind penetrations contemplated under this scenario, major long-distance transmission upgrades are also required to conduct power from remote wind sites to load centers. Table 1 indicates approximate acres developed for each use. See Appendix I for computation details for all scenarios.

Table 1: Disturbance from 25% Inland Wind Scenario

Disturbance	Direct	Total, including indirect
Ridgelines developed	483 miles	483 miles
Turbine pads	4,955 acres	(see crane paths)
Crane paths	483 miles, 1,990 acres	119,081 acres
Access roads	79 miles, 230 acres	6,512 acres
Connecting transmission	282 miles, 3,885 acres	54,854 acres
Long-distance transmission	2,160 miles, 39,273 acres	211,025 acres
Total area disturbed*	**50,333 acres**	**391,472 acres**

*10% of scenario quantity already in place.

The area of direct impact depends on terrain and configuration of turbines; northern New England wind farms tend to be erected in single strings, which increases direct impact area about 34% above the average for all onshore wind configurations.[22] For perspective, total ridgeline developed under this scenario is approximately the distance from the northeastern tip of Maine to the southwestern corner of Vermont. Rugged ridgetop terrain also increases the total disturbance required to even out dips and curves in access roads and crane paths, and projects located far from load centers increase the required transmission upgrades. Also due to remote locations, affected acres tend to be concentrated in the largest remaining intact blocks of wildlife habitat, which often occur at high elevations due to difficult access. Development along north-south trending ridgelines can further disrupt habitat connections across the landscape that are important to bobcat, lynx, black bear, and other wide-ranging species.

Other impacts from ridgeline wind:

- Physical harm to birds and bats, particularly during migrations when large numbers may follow ridgeline thermals.
- Human and wildlife disruption from roads, lights and noise.
- Widespread visual impact due to location on ridgelines.
- Disruption of watershed function due to road and pad construction and resulting increase in impervious surfaces.
- Foundations use ~400,000 tons concrete.

Benefits of ridgeline wind:

- Rapid construction minimizes duration of most disruptive project phase.
- No air impacts at the site.
- No consumptive water use at the site.

25% Offshore Wind Scenario

Under a 25% offshore wind scenario, turbines would be sited off the Atlantic coasts of Maine and New Hampshire. The map below illustrates one possible configuration for 4,009 MW of offshore wind capacity.[23] We assume use of 5MW floating turbines, as designed by Maine's DeepC Wind Consortium, with 4 200-turbine farms of 1 GW each covering 8.5x8.5 miles - 3 in Maine and 1 in New Hampshire. Locations illustrated on the map are based on interconnection opportunities and areas of interest for offshore wind identified in the Maine Deepwater Offshore Wind Report. (This study looked at capacity for existing transmission to connect projects of 30MW size; 1-GW facilities would require extensive transmission upgrades.)[24]

Figure 2: Offshore Wind Sites to Provide 25% Northern New England Electricity in 2050

Landscape Disturbance

Most of the direct impact from offshore wind farms occurs along the ocean floor – at limited anchor points which nonetheless cover a large area, and from buried cables connecting offshore facilities to the grid. Transmission upgrades on land will also be required if offshore wind farms are as large as projected. However, population centers tend to be located near the coast and some high-capacity connecting points may already exist from retiring nuclear plants (e.g. Maine Yankee), so the total transmission investment would be much lower than for inland wind or imported hydroelectricity.

Table 2: Disturbance from 25% Offshore Wind Scenario

Disturbance	Direct	Total, including indirect
Cable anchors	44 acres	184,960 acres
Collecting transmission within wind farms	200 miles	200 miles
Trunk transmission to shore	80 miles, 194 acres	6,555 acres
Long-distance transmission	715 miles, 13,000 acres	69,853 acres
Total area disturbed*	**13,238 acres**	**261,368 acres**

*None currently operating.

Other impacts from offshore wind:

- Impacts on marine mammals and waterfowl are poorly understood. Direct collisions, noise, vibration, lights, and electromagnetic fields surrounding cables may disrupt normal behavior.
- Impacts to Sea Birds: American Bird Conservancy delineates much of the Gulf of Maine as a "Key Marine Area" where wind may conflict with seabird protection (http://www.abcbirds.org/extra/windmap.html).
- Large rafts of floating turbines may interfere with fisheries or increase the risk of collision for ocean-going vessels.

Benefits of offshore wind:

- Very large and relatively stable wind resource.
- No direct water or air impacts on site.
- Potential for transmission via marine cable reduces land impacts.

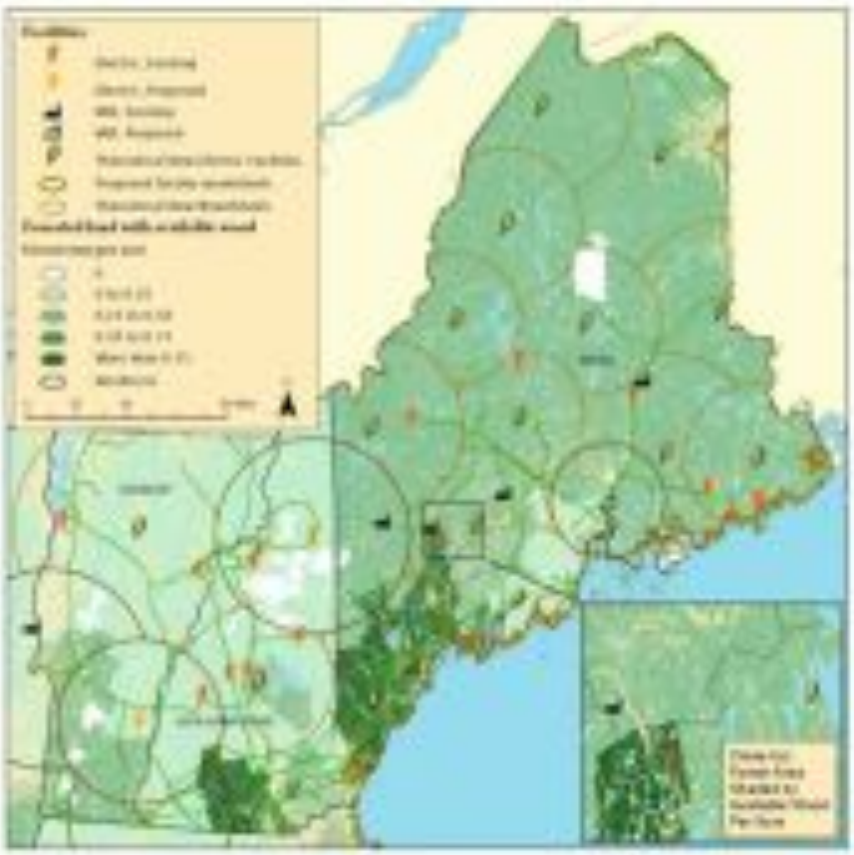
21% Woody Biomass Electricity Scenario

The map below displays locations of 16 existing biomass electricity plants with a combined capacity of 429MW, plus five proposed new facilities totaling 189MW (Berlin, NH 75MW, North Springfield, VT 35MW, Fair Haven, VT 34MW, CPD Winchester, NH 20MW, and Bucksport, ME 25MW) and 18 additional facilities of 25-60MW each, totaling 692MW (see Appendix 2 for details on methods and a list of plant sizes, wood use, and woodshed diameters). Total capacity would be 1,310MW, or up to 1,518MW if all wood waste sources were fully utilized. This is sufficient to meet 21% of average electricity use, which falls short of the standard 25% scenario. Secondary mill, construction/demolition, and municipal wood wastes as a percent of total BTS wood estimates range from 3% (Aroostook) to 33% (Knox) in Maine, 14% (Coos) to 57% (Strafford) in New Hampshire, and 20% (Windham) to 92% (Grand Isle) in Vermont, so if these materials are truly available and could be used responsibly they would substantially expand biomass energy capacity in some counties and could well raise the total potential to the full 25% target. Industry experts, however, often note that mill wastes are essentially already fully utilized.

The map also indicates the approximate area required to supply each facility, assuming exclusive use within the depicted woodshed. In actuality, woodsheds would overlap considerably, though shared use of the resource would lead to similar numbers and sizes of facilities. Wood supply estimates were adopted from the updated Billion Ton Study (BTS) and assume a price of $100/dry ton ($50/green ton) in the year 2030.[25] These are quite optimistic supply estimates, which assume that nearly all timberland is accessible for harvest (only a few reserved areas and slopes >80% are excluded), that all operations use whole-tree harvesting to remove 60-70% of all logging residues, and that widespread changes in forest management across half of harvested land result in thinning to 30% of the maximum theoretical density over 30 years, with all low-grade wood available for fuel.

New biomass electricity sites were located so as to minimize competition with current sites and where sufficient county-level wood supply is available (BTS estimates theoretically already deduct current usage so no woodsheds are shown for existing plants). Actual plants would be unlikely to locate in the more remote locations, and would likely choose locations closer to existing transmission even when that involves shipping wood a greater distance. For all these reasons, this map should not be interpreted as a prediction of where plants will be located, but rather as an indication of the aggregate number needed to supply 21% of 2050 electricity needs.

Figure 3 Wood Biomass Electricity Plants and Woodsheds to Provide 21% Northern New England Electricity in 2050



Landscape Disturbance

The direct footprint of woody biomass electricity generation facilities, including wood storage yards, would be relatively small. These tend to be located near established roadways or rail lines to accommodate heavy traffic from frequent fuel deliveries.

Most impacts from expanded wood energy use would fall on the region's forests. Producing biomass chips at a reasonable cost requires simultaneous removal of higher-value material to help cover harvesting costs. To increase low-grade wood removals by 10.6 million tons, total harvest volume for the three states would need to increase by well over 55%.[26] Biomass electricity development of this magnitude would affect essentially all accessible forest acres in the three states, about 26.5 million

acres, though at a much less intensive level than site development for installing electricity infrastructure of all kinds. If harvesting standards protect long-term forest productivity and encourage carbon accumulation, the impacts will be much less intensive than the clearing and paving associated with energy facility sites, so we classify the forest impact here as indirect.[27]

New access roads would be needed, however, to reach currently unmanaged forest stands, with attendant direct impacts from clearing, soil compaction and erosion. And some new transmission capacity will likely be needed; of the potential plants shown on the map above, five in northern Maine are located at a significant distance from existing high-voltage transmission lines. Transport from the woods to the energy facility would be greater for biomass electricity (average 32 mile radius) than for wood pellets (average 21 mile radius) but would not require transporting to the ultimate combustion site.

Table 3: Disturbance from 21% Woody Biomass Electricity Scenario

Disturbance	Direct	Total, including indirect
Facility footprint	1,950 acres	1,950 acres
Forest area		26,500,000 acres
Forest access roads	2,739 miles, 7,969 acres	225,790 acres (included in above)
Transmission	144 miles, 872 acres	12,323 acres
Total area disturbed*	**19,424acres**	**26,514,273 acres**

*29% of scenario quantity already in place.

Other impacts from woody biomass electricity:

- Degrades local air quality, especially fine particulates.
- Water use by steam boilers, evaporative loss through cooling towers and/or high-temperature water returned to waterways.
- Wood ash hazardous waste disposal if insufficient land base for application as fertilizer.
- Transport of wood fuel with traffic and associated emissions.
- More intensive cutting, need for high volume to finance specialized equipment; expanded forest road network with attendant habitat fragmentation; and reduced late succession forest and associated carbon stocks.39
- Increase in whole tree harvest, with possible damage to residual stands and regeneration, and depletion of nutrients.
- Relatively inefficient energy conversion.

Benefits of woody biomass electricity:

- Increase incentive for timber stand improvement or retaining land in forests.
- May be located near existing transmission capacity, subject to limited trucking distance for fuel.

23% Regional Hydroelectricity Scenario

Yellow circles on the map below show approximate locations of existing hydroelectric dams (total 1,535 MW capacity).[28] On November 1, 2012, the Independent System Operator for New England (ISO-NE) listed 193 run-of-river and 22 impoundment dams in these three states with rated generating capacity totaling 1,026 MW (summer) to 1,204 MW (winter).[29] The Federal Energy Regulatory Commission (FERC) has licensed 159 dams with total theoretical capacity of 1,590 MW and issued exemptions to another 87 dams with total capacity 48 MW.[30] These comparisons indicate that not all existing hydroelectric generators export electricity to the grid, and those that do often operate well below their theoretical capacity.

In 2006 the US Department of Energy Idaho National Lab identified 3,364 additional feasible small hydro sites in these three states with installed capacity totaling 1,934 MW (836 MW actual expected generating capacity based on typical capacity factors).[31] The study did not distinguish between sites with or without existing dams (unless already developed for hydroelectricity) so some of the candidate sites likely have old dams present. These new sites plus existing hydroelectric dams could generate 23% of projected 2050 electricity use (12,924 GWh). At the scale of the large map, penstocks are smaller than the hydro site symbols - see the inset for a sense of relative penstock sizes.

Sites were filtered for feasibility using criteria such as lack of restrictive land use designations and proximity to roads, transmission and population centers. Site-specific studies in Vermont using more conservative feasibility assumptions indicate capacity – at existing dams only – may be only 6% to 21% of the Idaho National Lab estimates.

Figure 4: Small Hydroelectricity Sites to Provide 23% of Northern New England Electricity in 2050

Landscape Disturbance

It is difficult to assess the impact of existing hydroelectric dams in these three states because of lack of information about reservoir area or generator design. Some existing dams have substantial reservoirs and most of these have been in place for many decades. For lack of a better approach, we estimate area of impact as the surface area of water bodies labeled "reservoirs" (see Appendix 1 for methods).

For the most part, this landscape impact would persist even if dams were not used to generate electricity, though some dams have been removed over the past several years.

For new hydro facilities, the designs most likely to be permitted are those that collect water via existing low-head dams on small streams or using weirs that do not completely block the channel of larger rivers; unconventional hydro turbines may even be submerged in stream channels. Hence our disturbance estimates assume no new reservoir acreage. Direct landscape disturbance would involve anchoring or burying pipeline along 868 miles of penstock, disturbing an area about 6 feet wide. River reaches with reduced flow would be slightly more than penstock length. Similarly to forest harvest effects for biomass, we consider this an indirect effect since disturbance falls short of land clearing or building.

Feasible sites were pre-selected to be within one mile of roads and existing transmission lines, so new roads and transmission for each individual site would be minimal to service such small facilities. Nonetheless, the sheer number of such projects implies about 328 miles of road building, much of it affecting riparian corridors. Small projects widely distributed across the landscape, that can be scheduled to meet local daily peak loads to some extent, can avoid the need for new long-distance transmission. Transmission connectors could run along the same course as access roads and were modeled at shortest direct-line distance.

Table 4: Disturbance from 23% Regional Hydroelectricity Scenario

Disturbance	Direct	Total, including indirect
Existing reservoirs	10,781 acres	10,781 acres
Power houses	31 acres	31 acres
Penstocks	868 miles, 631 acres	69,650 acres
Access roads and transmission	328 miles, 477 acres	27,433 acres
Stream flow effects		2,630 acres
Total area disturbed*	**11,920 acres**	**110,525 acres**

*69% of scenario quantity already in place.

Other impacts from regional hydroelectricity:

- Damage to aquatic organisms of all kinds has discouraged new hydro development. Impacts include interference with sediment distribution, reduced oxygen levels, changes in temperature, reduced flow during periods of high energy demand, and interference with fish passage.

Benefits of regional hydroelectricity:

- Compared to large impoundments, run-of-river dams have reduced impact, and fish passage would be relatively easy to provide.
- Many existing dams could be retrofit to generate electricity and fish passage as well.
- Air impacts at the site are negligible.
- Small widely dispersed sites can be managed to match local load peaks and alleviate transmission congestion.

25% Canadian Hydroelectricity Scenario

Relying on Canadian hydroelectricity to meet 25% of 2050 projected needs would require purchasing power from dams with 2,525 MW capacity (assumes a relatively high capacity factor of 0.615, relatively high thanks to massive storage). This power cannot be credited toward Renewable Portfolio Standards targets for the New England states, which typically limit the size or type (e.g. run-of-river) of eligible hydroelectric dams, although Vermont eliminated the size cap under its voluntary program. The map

below shows major Canadian facilities that could export electricity to the northeastern U.S. market. Hydro Quebec, the publicly-owned utility for the province of Quebec, currently exports about 16% of its power outside the province, and counts on growing U.S. markets to support future planned development. Hydro-Quebec electricity flows to northern New England across two direct interconnections in northern Vermont – at Highgate (capacity 218 MW and dedicated to long-term Vermont contracts for about 1,577 GWh of power annually) and at Averill for the Phase I/II line (capacity 2,000 MW but limited to 1,200 by reliability concerns) – plus indirect interconnections via New York and New Brunswick. Since much of this power is sold on spot markets, it is difficult to determine how much is utilized in northern New England. According to DOE, the three states together import 5,996 GWh of power from Canada[32], most of which is likely from HQ.

Landscape Disturbance

Although the primary impacts of a 25% hydroelectricity scenario are felt outside the region of this study, the impacts are significant. In northeastern Canada, Hydro Quebec maintains 579 dams, 97 control structures, and 26 large reservoirs to feed 60 hydroelectric generating stations with a total capacity of nearly 35,000 MW. HQ also markets the power from the 5,428 MW Churchill Falls hydro dam in Labrador. New developments under construction or in the planning stages include the Romaine (1,550 MW), Petit Mecatina (1,200 MW), and Magpie (850 MW) Rivers on the north shore of the St. Lawrence River, a new dam on the St. Marguerite River (440 MW), and upgrades to the Manic 2 and 3 and Tabaret complexes. Future plans to fulfill the development goals outlined in Quebec's Northern Plan call for 3,000 MW of additional development north of the 49th parallel, possibly including the Great Whale and Nastapoka rivers flowing into Hudson Bay.

Approximate area of flooding is 4,526,970 acres for the largest reservoirs of the LaGrande complex plus Manicougan, St. Marguerite, Gouin, and Pipmouacan. In addition, Smallwood Reservoir, which feeds Churchill Falls, floods approximately 1,483,000 acres. In an effort to market its own hydro resource, Newfoundland and Labrador's utility NALCOR intends to construct two more dams on the Churchill River (Gull Island and Muskrat Falls), and transmit the power via Newfoundland and under the St. Lawrence to the maritime provinces and on to Maine. 25% of the three states' projected 2050 electricity would amount to about 7% of Hydro Quebec's current power production (200,764 GWh in 2011), or about 4% for just the incremental expansion above current use.

Other impacts from Canadian hydroelectricity:

- Aside from direct destruction of habitat, flooding and other river modifications affect migration routes of caribou and fragment habitat of less wide-ranging species.
- Biologically active mercury levels rise upon flooding and remain elevated for several decades, accumulating at the top of the food chain (including in humans).
- Spawning area for Atlantic salmon is threatened by North Shore river projects.
- Damming, diverting, or augmenting flow disrupts major estuarine waterfowl nesting areas.

Benefits of Canadian hydroelectricity:

- Historically one of the lowest-cost renewable energy options.
- No direct air impacts on site.

Figure 5: Canadian Power to Provide 25% of Northern New England Electricity in 2050

Beyond reservoir flooding, Hydro Quebec projects also affect about 500 miles of river course, partially reversing or diverting flow from the Caniapiscau, Eastmain and Rupert rivers and greatly augmenting the flow of the LaGrande. Conservatively estimated, diversions might affect over 6,000 acres of river area. Since these modifications are much more drastic than the stream flow adjustments for regional hydro, we classify these impacts in the direct column.

Since HQ interconnections through Vermont at Highgate and the Phase I/II DC line through the Northeast Kingdom are already fully allocated, expanding exports to northern New England would require new transmission infrastructure - about twice the capacity of the Northern Pass line proposed for New Hampshire.

Table 5: Disturbance from 25% Imported Canadian Hydroelectricity Scenario

Disturbance	Direct	Total, including indirect
Reservoir flooding	420,698 acres	420,698 acres
Existing transmission	1,463 miles, 26,596 acres	142,910 acres
New transmission	360 miles, 6,545 acres	35,170 acres
Modified rivers	420 acres	420 acres
Total area disturbed*	**454,259 acres**	**599,198 acres**

*43% of scenario quantity already imported.

25% Distributed Solar Photovoltaics Scenario

This scenario is fundamentally different from the others, as it assumes that electricity will be generated near where it is used, eliminating the need for major long-distance transmission upgrades and focusing development on already-disturbed lands. To some extent, wind, hydro and biomass solutions could also follow a distributed energy path. 11,879 MW of solar panels could provide 25% of 2050 electricity. If 30% of the total were mounted on the roofs of buildings, 593,948 2kW units would need to be installed on about 45% of all current homes and 238,767 10kW units on businesses and institutions. 8,315 larger 1MW solar farms located in parking lots, along road rights-of-way, and in other disturbed areas could provide the remaining 70%.

A team convened by The Nature Conservancy delineated disturbed acres where conflicts over energy development might be minimized.[33] The study assumes that disturbance extends 1 kilometer beyond actual disrupted land cover. Categories of disturbed lands range from all disturbed (includes agricultural lands) - to developed (a subset of disturbed that includes mining and changes to topography) - to impervious surfaces (e.g. roofs and pavement).

Table 6: Disturbed Land - Acres and Percent of Land Area

	All Disturbed	Developed	Impervious Surfaces
Vermont	1,247,622	338,026	239,691
	20.3%	5.5%	3.9%
New Hampshire	723,021	444,480	337,805
	12.2%	7.5%	5.7%
Maine	1,564,360	699,845	494,008
	7.6%	3.4%	2.4%
Total	3,535,002	1,482,351	1,071,504
	10.8%	4.5%	3.3%

The map below illustrates the location of disturbed lands – which are correlated with population density and hence electricity load. Approximate area of solar installations is shown in yellow. Data resolution imposes a display scale of at least 1/5 acre, the size of one pixel. An installation of this size (about 40 kW) would be larger than most rooftop PV systems and smaller than many free-standing commercial installations. Hence this map should be taken only as a broad indicator of proportion of landscape affected and not as a depiction of likely locations.

Figure 6 Solar PV Sites to Provide 25% of Northern New England Power in 2050

Landscape Disturbance

3,564 MW of rooftop solar panels on residences and small businesses would require just over 4,000 acres of horizontal surface area, less than 0.4% of the total impervious surface in these three states. Free-standing panels arranged as large solar farms require more space to avoid shading and provide maintenance alleys, so these would require over 62,000 acres. Some of these large arrays might also be mounted over impervious surfaces like parking lots or on the roofs of big box stores and malls; others might be mounted in farm fields or other open spaces. However, acreage needed for large solar farms would amount to only 6% of impervious surfaces, 4% of all developed land, or 2% of all disturbed lands (including agriculture), which would allow for selecting sites with good solar potential where panels would not interfere with desired uses. Table 7 below assumes that only 10% of the solar farm area involves new landscape impacts, with associated indirect impacts occurring mostly on already-disturbed lands.

Other impacts from distributed photovoltaics:

- Land disturbance and air pollution from silica mining outside this region.
- High energy use and toxic air and water emissions during panel manufacturing where panels are produced.
- Large-scale facilities are land-intensive.

Benefits of distributed photovoltaics:

- No air or water impacts on site.
- Location near load minimizes transmission needed.

No major new transmission would be needed, since generation would be concentrated in highly-populated areas.

Table 7: Disturbance from 25% Solar Photovoltaic Electricity Scenario

Disturbance	Direct	Total, including indirect
Rooftop panels	0 acres	0 acres
Large-scale solar farms	6,236 acres	87,308 acres
Total area disturbed*	**6,236 acres**	**87,308 acres**

*Very little capacity currently developed.

25% Demand Reduction for Electricity Scenario

For demand reduction scenarios, we do not produce maps as these options typically have few, or even positive, landscape impacts. A reduction of 14,048 GW in 2050 electricity use would require decreasing electric load by 0.16% each year rather than increasing it by the predicted 0.86%. The big jump in transport and heat conversions built into our scenarios magnifies the challenge. Demand may be reduced using a variety of tools, which include active demand-response, efficiency investments, and changes in user choices (the latter two are sometimes labeled passive demand-response).

Active demand-response is perhaps the easiest to implement at lowest cost. Given the right information (including smart meters) and incentives (including higher prices during peak use periods), electricity users can reduce the need for spinning reserves or quick-start peaking sources by shifting discretionary uses to off-peak hours. Larger users may enter into contracts to shut down energy-consuming processes when requested by the grid operator, which reduces the need for spinning reserves or avoids bringing new sources on-line to meet temporary peaks in usage. Likewise smaller users, more aware of the energy draw from particular appliances and incentivized by tiered prices, can schedule their use during low-demand times of day or reduce their use altogether.

Efficiency investments can deliver the same energy services for less energy input, but generally require an upfront expenditure for improved equipment. These range from energy-efficient light-bulbs, to more efficient machinery and furnaces, to electronic devices that draw less stand-by power. Appliance labeling like the EPA's Energy Star program can support purchase of the most efficient options, even when they cost a bit more.

Changes in consumer choices and behavior can reduce the total need for energy services (choosing smaller electronic display devices or turning off un-needed lights, for instance). Like efficiency solutions, such choices may be supported by better consumer information about energy consumption.

National and regional electricity forecasts tend to neglect the potential for demand reduction – at the state level in Vermont, VELCO projects electricity growth for Vermont at only 0.4% annually through 2030, given an active demand-side program, while ISO-NE projects Vermont growth over the next decade at 0.8%.[34] A recent revision in ISO-NE's model, however, better integrates the effects of demand reduction programs, predicting savings of 215 GWh for these three states by 2021 (savings decline over

time as the easiest measures come first - see Appendix 3). These savings are based on returns to public energy efficiency programs, however, and do not incorporate possible changes in consumer behavior. A 25% drop in projected 2050 demand implies roughly 50 times this level of energy savings per year, which would require dramatic behavioral changes as well as efficiency investments. Allowing energy prices to rise rather than artificially subsidizing them, and educating the public about the high environmental costs of expanded production, would support such an unprecedented shift in consumer choices and business decisions.

Landscape Disturbance

Unlike development of new electricity supply, most demand reduction measures have few deleterious environmental impacts.

Table 8: Disturbance from 25% Electricity Demand Reduction Scenario

Disturbance	Direct	Total, including indirect
Total area disturbed	**~0 acres**	**~0 acres**

Other impacts from demand reduction:

- Energy use to manufacture and transport efficient appliances, machinery, light bulbs, etc.
- Mining impacts for special materials, such as rare earth elements.

Benefits of demand reduction:

- Reduces environmental impacts.
- Saves financial costs in the long run.

25% Ground-Source Heat Pumps Scenario

Conversion of heat to electrically-powered heat pumps largely shifts the energy burden, with its environmental impacts, to the electricity sector. Ground source heat pumps in our climate produce approximately four times the heat energy that they use in electricity, so electricity usage can be significant. In order to reflect that burden on the electricity sector, we included this scenario as part of the baseline assumptions for all electricity scenarios.

Depending on design (vertical well or horizontal piping) these systems may have negligible or fairly significant landscape impacts, but as for solar PV those impacts will occur in already developed areas. Geothermal heat currently provides about 0.1 trillion Btu. Replacing another 91.5 trillion Btu of heating fuels with heat pumps would require converting all 761,000 homes that currently heat with oil in the three states (accounting for about 76.1 trillion Btu) plus enough additional commercial and industrial buildings to use 15.4 trillion more Btu.

The map below illustrates the approximate surface area required for closed-loop horizontal systems providing 45.8 trillion Btu of heat – shown on developed but not impervious lands. We assume the other 45.8 trillion Btu of geothermal heat installations use a vertical well configuration. Since thermal loops would be installed near existing buildings, but not beneath impermeable surfaces, we show locations on developed lands.

Figure 7 Geothermal Heat Pumps to Provide 25% of Heat/Process Energy in 2050

Landscape Disturbance

Disturbed area for horizontal geothermal systems would total about 26,286 acres, with no new area disturbed for the vertical wells. This acreage amounts to only 6.4% of the 410,847 developed acres in the region that are not impervious surfaces. Since this disturbance would occur in already-developed areas and land could be fully revegetated after installation, we consider this an indirect impact only.

Table 9: Disturbance from 25% Geothermal Heat Pump Scenario

Disturbance	Direct	Total, including indirect
Horizontal systems	~0 acres	26,286 acres
Vertical well systems	~0 acres	~0 acres
Total area disturbed*	**~0 acres**	**26,286 acres**

*Only 0.11% of scenario amount currently in place.

Other impacts from heat pumps:

- Environmental impacts depend largely on the source of electricity to run the pumps.
- Open loop systems use large quantities of groundwater.
- Closed loop systems cool the ground or groundwater slightly in winter and cool it in summer, but any long term impacts are largely unknown.

Benefits of heat pumps:

- Provides summer cooling.
- Low maintenance once installed.

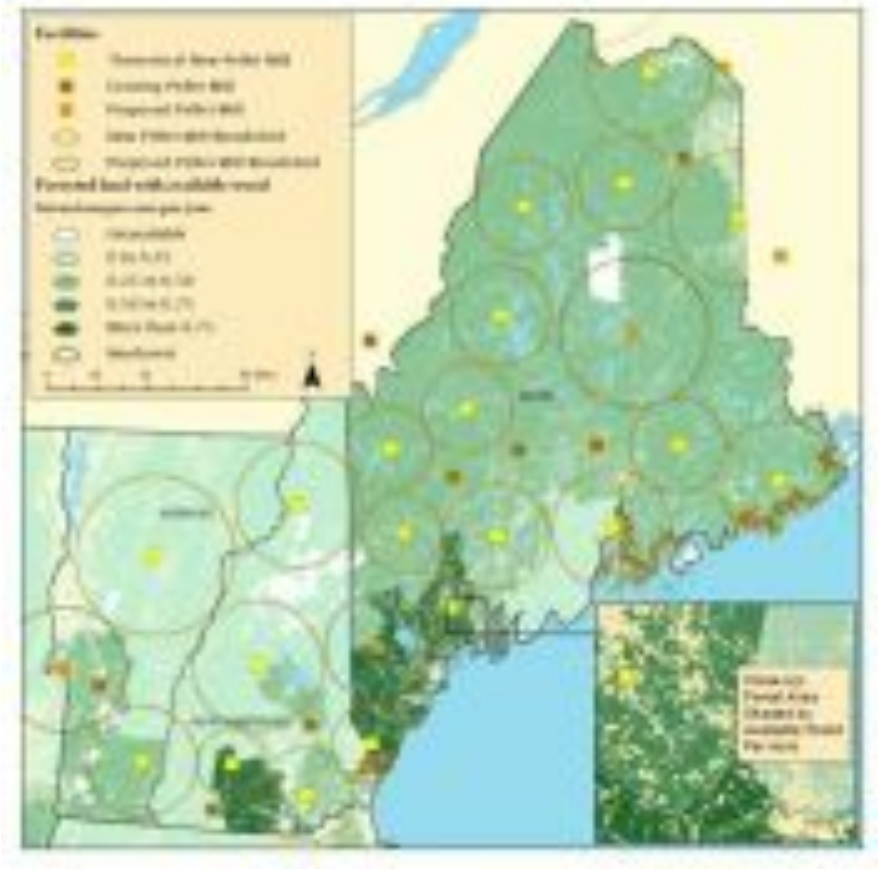
25% Wood-Based Heat/Process Energy Scenario

Beyond conversion to electric sources, renewable options for heat and transport tend to center on biogenic fuels from crops, waste or wood and solar thermal solutions for heating space and water. The electricity scenario showed that sustainable wood supplies were not sufficient to meet 25% of projected 2050 electricity needs for northern New England, so if wood electricity were maximized there would be no wood available for heating or transportation fuels. Policy-makers will need to prioritize uses to get the most energy bang for the limited wood available.

Supply estimates indicate sufficient wood available to provide 25% of projected heat/process energy. This amount of wood heat would require utilizing of 90% to 266% of available supply, depending on the source of supply estimates, and is about triple the current level of wood heat (not counting industrial use by Maine's paper plants). Homes in Vermont (59%), New Hampshire (58%) and Maine (80%)[35] are highly dependent on Number 2 heating oil for space heat, so oil is the most likely fuel to be replaced. The convenience of pellets, and low emissions at the heating site, make it likely that much wood heat expansion will be in the form of pellets.

We assume that 61% of expanded 2050 wood heat is supplied by the 7 existing pellet mills operating at full capacity, plus 3 more proposed and 20 additional new pellet mills, each producing approximately 100,000 tons of pellets annually and all producing for domestic use rather than export. (See Appendix 2 for pellet mill capacities and woodsheds.) The remainder of new wood heat is provided by firewood and chips burned directly in furnaces or boilers. To the extent that chips or firewood provide more than 39% of incremental wood heat, fewer pellet mills would be needed. There is a slight loss of material in pellet making (we assume 2.5%) which means slightly more wood is needed overall. We assume the same amount of energy is required to burn off extra moisture, whether at the pellet plant or in a chip boiler or furnace, so overall conversion efficiency is about the same regardless of the form of wood fuel (air-dried firewood requires no energy inputs for drying, but combustion is slightly less efficient at the stove or furnace). The map below shows existing, proposed and theoretical pellet mill locations, with approximate area of woodsheds assuming exclusive use. See wood electricity section for caveats about wood supply.

Figure 8 Wood Pellet Facilities to Provide (with Firewood and Wood Chips Not Shown) 25% of Northern New England Heat in 2050



Landscape Disturbance

Additional firewood processing or chipping capacity would not require large centralized processing facilities. Wood pellets do require centralized processing and more transport to those facilities and on to retail consumers. 30 pellet mills at about 20 acres each including wood yards would have a direct footprint of 600 acres total. Because pellet mills reach a viable scale at lower wood volumes than for electricity or liquid fuel facilities, woodsheds are relatively small under the heating scenario, averaging a 21 mile radius (see Appendix 2), so total transportation emissions and traffic impacts would be less than for liquid fuels (average 56 mile radius). Transportation for pellets would exceed that for chips or local firewood processing, however, as those omit the middle processing site.

Table 10: Disturbance from 25% Wood Heat Scenario

Disturbance	Direct	Total, including indirect
Facility footprint	600 acres	600 acres
Forest area		26,500,000 acres
Forest access roads	2,739 mile, 7,969 acres	225,790 (included in above)
Total area disturbed*	**17,202 acres**	**26,500,600 acres**

*32% of scenario amount already in place.

Wood for heat or biofuels draws from the same forest base that provides feedstock for electricity generation, so forestland impacts would be very similar. If most new heating uses pellets, there may be limited opportunity to use tops and limbs, since premium pellets require use of the main trunk which produces a cleaner pellet with less ash content. This approach has benefits in that it leaves more tops in the woods to maintain site productivity and wildlife habitat, but it has drawbacks in that it requires more cutting of live trees, with resulting higher net greenhouse gas emissions due to suppressed levels of forest carbon. Pellet technologies could change to accept a broader range of raw materials, so the woodsheds illustrated assume all residues are used by the facilities indicated, with firewood and chips sourced from outside the pellet woodsheds.

Other impacts from wood heat:

- Wood combustion in small devices creates localized air pollution with few pollution control options; small particulates of major concern.
- Forest impacts are similar to those for wood-fueled electricity.

Benefits of wood heat:

- Widely dispersed resource favors local sources for local use, less transport.
- Most efficient energy use for wood.
- Possible forest benefits similar to those for wood-fueled electricity.

25% Demand Reduction for Heat/Process Energy Scenario

Reducing energy demand (or reducing emissions) for heating buildings or fueling industrial processes relies on two factors: 1) using less energy (or lower-emitting fuels) per square foot heated or unit of work performed, or 2) reducing space to be heated or materials to be processed (accomplished by "dematerializing" economic activity, such as by building smaller homes or reducing paper use). Option 1 can be achieved by weather sealing and insulation or switching to more efficient heating appliances or industrial equipment. Passive solar thermal design can also be seen as a way to reduce energy used for space heating by boosting building efficiency. As for electrical efficiency, these approaches require additional upfront investment in exchange for savings over time. Financial incentives, building standards, and educational programs can ramp up energy-reduction efforts and ensure consistent standards and services. Reducing overall need for heat by as much as 25% likely requires changes in behavior and consumer or business choices, including a preference for smaller buildings and a tolerance for lower ambient temperatures or zone heating. The trends have not been favorable to-date. Area of residences per household member in the northeastern U.S. has grown from 826 square feet before 1940 to 1,061 in 2009.[36]

Landscape Disturbance

Landscape impacts from reduced use of space and process heat tend to be neutral or positive. Smaller residential, commercial and industrial buildings help reduce landscape disturbance.

Table 11: Disturbance from 25% Heating Demand Reduction Scenario

Disturbance	Direct	Total, including indirect
Total area disturbed	**~0 acres**	**~0 acres**

Other impacts from demand reduction for heat:

- Energy used to manufacture and transport insulation or other weatherization materials.

Benefits of demand reduction for heat:

- Reduced pollution from fuel combustion.
- Reduced impacts from oil and gas extraction.
- Saves financial costs in the long run.

50% Electric Vehicle Scenario

Since conversion to electric vehicles is one of the few options for reducing GHG emissions from transportation, this scenario doubles the usual share of energy use from 25 to 50%. A shift of this magnitude creates considerable additional demand for renewable electricity, and consequently increases environmental costs. Like electricity-powered geothermal heat, we include this shift in all scenarios to reflect the extra burden on the electricity sector.

Fortunately, electric vehicles are roughly three times as efficient as gasoline motors at converting energy into mechanical motion, so energy inputs are reduced as a result of this conversion. The overall energy advantage is largely cancelled out, however, due to inefficiencies in electricity generation itself.

Landscape impacts

These impacts are largely captured in the expanded electricity sector. Commercial charging stations for vehicles would require some new space, though we assume those would be installed at existing gas stations. Since this affects such a small area, we have not mapped or quantified those impacts.

Table 12: Disturbance from 50% Conversion to Electric Vehicles

Disturbance	Direct	Total, including indirect
Total area disturbed	**~0 acres**	**~0 acres**

Other impacts from electric vehicles:

- Impacts depend on the source of electricity.
- Limited life and hazardous waste from batteries.

Benefits of electric vehicles:

- Reduces pollution where vehicles are used.
- More efficient than fuel combustion vehicles.
- Smart meters may allow grid to manage vehicle batteries for storage.

13% Wood-Based Biofuels Scenario

In order to replace 39.1 trillion Btu's of liquid transportation fuels (13% of projected 2050 demand), wood-based biofuels such as cellulosic ethanol, biogas or pyrolysis oils would require about 7 plants, each producing 46 million gallons of fuel and using 1.4 million green tons of wood. The map below assumes 4 new plants in Maine, 2 in New Hampshire and 1 in Vermont. (See Appendix 2 for biofuel plant capacities and woodsheds.) Plants are distributed according to currently available forest-based wood supply (assuming sawmill waste is available in the same county where wood volume is cut). Secondary mill and waste wood would also be needed to support this amount of development, leaving *no* additional wood for heating or electricity. Some supplemental material may be available from woody crops on abandoned agricultural land or from dedicated energy crops like switchgrass, though the higher cost of agricultural feedstocks is currently an obstacle.

Figure 9 Biofuel Facilities to Provide 13% of Northern New England Transportation Energy in 2050

Landscape Disturbance

Seven biofuel manufacturing facilities would have a small footprint, slightly larger than individual biomass electricity plants due to the larger volumes of wood processed and more complex processes. We assume each facility requires 75 acres of land. Because of substantial economies of scale for biofuel plants, this option requires the largest woodsheds of any wood energy use.

See wood electricity and wood heat sections for impacts on the forested landscape.

Other impacts from wood-based biofuels:

- Air and water emissions at manufacturing sites.
- Traffic and associated pollution from shipping raw wood and finished fuel. Larger woodsheds than heat or electricity increase this impact.

Benefits of wood-based biofuels:

- See wood electricity and heat sections.

Table 13: Disturbance from 13% Wood-Based Biofuels Scenario

Disturbance	Direct	Total, including indirect
Facility footprint	525 acres	525 acres
Forest area		26,500,000 acres
Forest access roads	2,739 mile, 7,969 acres	225,790 (included in above)
Total area disturbed	**17,127 acres**	**26,500,525 acres**

25% Demand Reduction for Transportation Scenario

Like demand reduction for electricity or heat, reducing transportation energy (or reducing transport emissions) relies on two major factors: 1) fewer miles traveled, and 2) less energy (or lower-emitting fuels) per mile traveled. The first factor requires changes in behavior and consumer choices, including a willingness to walk, bike, carpool, or consolidate necessary trips, and to relocate near work or telecommute. Public transit options are limited in the rural parts of northern New England, but may also contribute in selected popular commuting corridors. The second factor may be addressed by fuel switching (from diesel to natural gas for commercial vehicles, for instance) or improving vehicle mileage through fuel economy standards and higher consumer demand for high-mph vehicles.

Landscape Disturbance

Reduced demand for transport energy creates no direct landscape impacts and may actually reduce overall disturbance. Smart Growth principles that protect open space favor reduced driving and greater reliance on public transit.

Table 14: Disturbance from 25% Transportation Demand Reduction Scenario

Disturbance	Direct	Total, including indirect
Total area disturbed	**~0 acres**	**~0 acres**

Other impacts from demand reduction for transportation:

- Energy used to manufacture new more efficient vehicles and scrap old ones.

Benefits of demand reduction for transportation:

- Reduced pollution from fuel combustion.
- Reduced impacts from oil drilling and refining.
- Saves financial costs in the long run.

Summary of Cumulative Landscape Impacts

The charts and table below summarize the quantitative acreage impacts of the renewable energy scenarios described above. Affected acres are a convenient metric, but they fail to fully reflect comparative impacts - the quality of disruption is equally important. For instance, biomass energy would affect, directly or indirectly, nearly all forest acres in the region. If managed carefully, restricted to appropriate acreage, and subject to uniform and stringent harvesting guidelines, damage to these acres would fall far short of full land use conversion.

Figure 10: Direct Land Disturbance for Electricity Scenarios
(includes existing and new development)

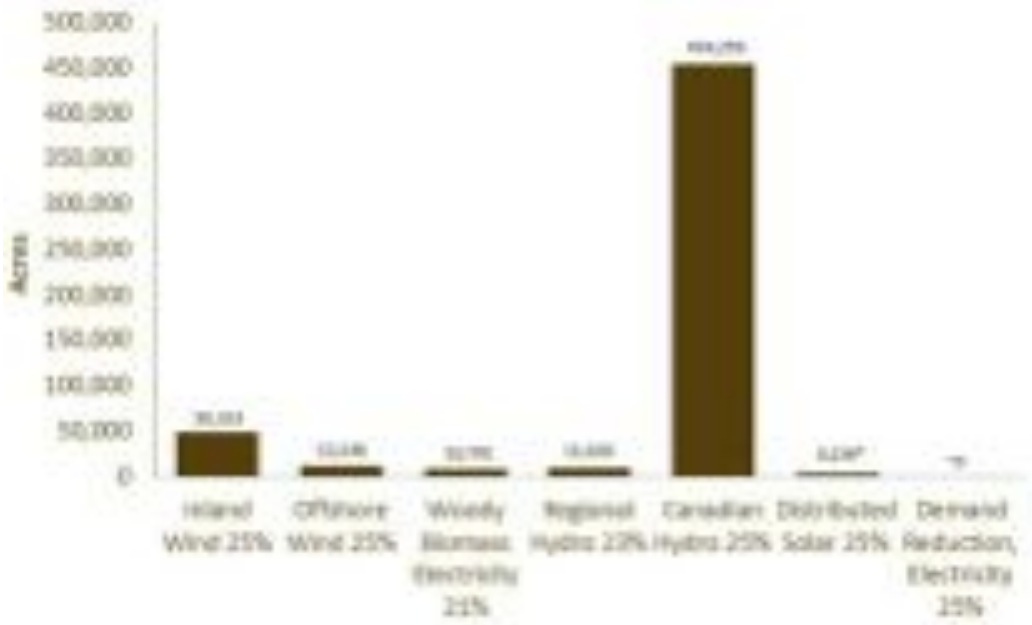
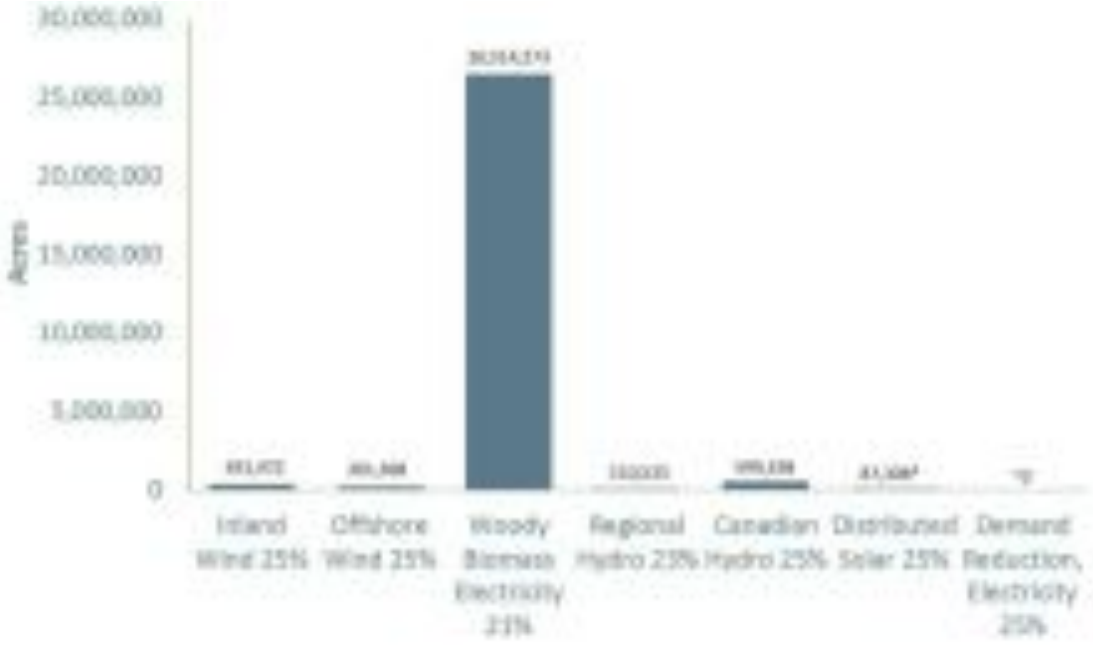


Figure 11: Total (Direct+Indirect) Land Disturbance for Electricity Scenarios
(includes existing and new development, note different vertical scales)



*Solar land area previously disturbed.

Figure 12: Direct Land Disturbance for Heat/Process and Transport Scenarios
(includes existing and new development)

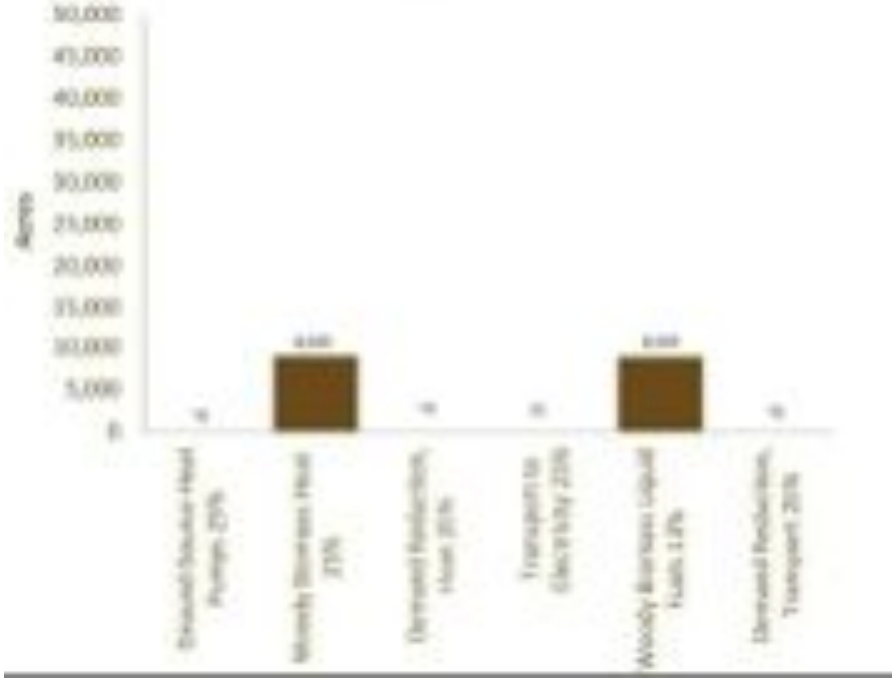
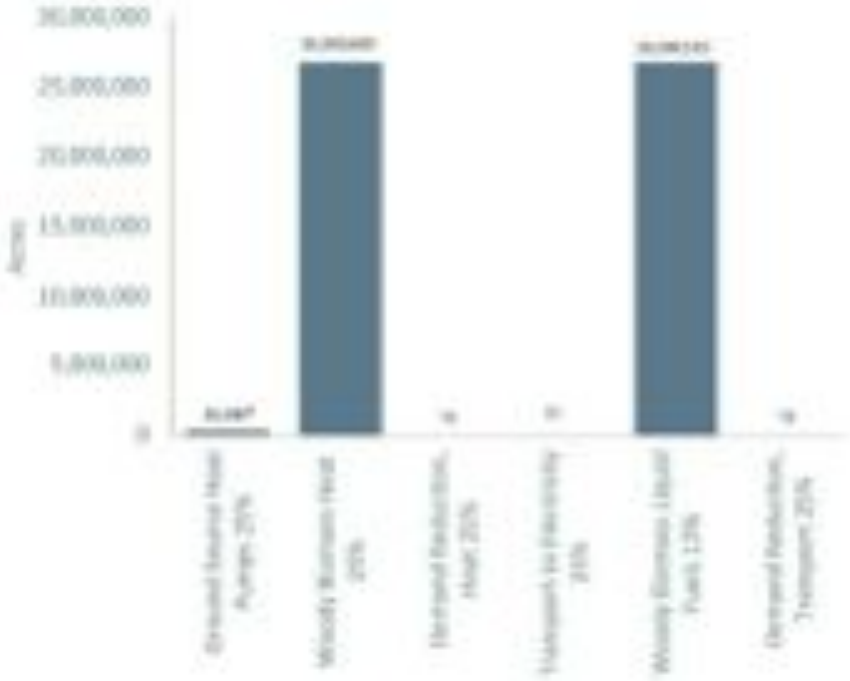


Figure 13: Total (Direct+Indirect) Land Disturbance for Heat/Process and Transport Scenarios
(includes existing and new development, note different vertical scales)



#Heat pump land area previously disturbed and revegetated.

Greenhouse Gas Reductions

In order to balance environmental impacts against climate benefits it is helpful to understand not only the degree of development required to meet GHG reduction targets, but also the extent to which each technology contributes to GHG reduction goals. Reducing greenhouse gas emissions is a primary reason for public policies that encourage development of new renewable energy sources. Maine, New Hampshire and Vermont each endorsed the goals of the New England Governors and Eastern Canadian Premiers to reduce GHG emissions to 75-85% below 2001 levels by 2050. All three states are also members of the Regional Greenhouse Gas Initiative, which will reduce emissions from large power plants to 10% below 2009 levels by 2018. Carbon dioxide emissions from combustion associated with fossil energy use in these three states were about 42.1 million metric tons CO_2 in 2009.[37] Including CH_4 and N_2O, total GHGs from energy combustion would be about 44.6 million metric tons CO_2e,[38] and indirect emissions associated with processing and transport boost the total to about 53 million metric tons CO_2e.[39] If there were no changes from today's energy mix, then growing demand for energy (see assumptions on p. 5) would push the total to approximately 59 million metric tons CO_2e by 2050.[40] Clearly, significant transformations in energy use will be required if the region is to convert this projected increase into a dramatic reduction – emitting only 11.6 million metric tons per year by 2050.

The charts below compare emissions across renewable energy scenarios, including indirect emissions required to manufacture and transport the generating equipment, as well as emissions from land use changes. Figures 14 and 15 show GHG emissions per MWh or MMbtu of energy generated and compare them to emissions from the current mix of sources or high-emission reference sources. See Appendix 4 for computation details.

Figure 14: Greenhouse Gas Emissions from Electricity

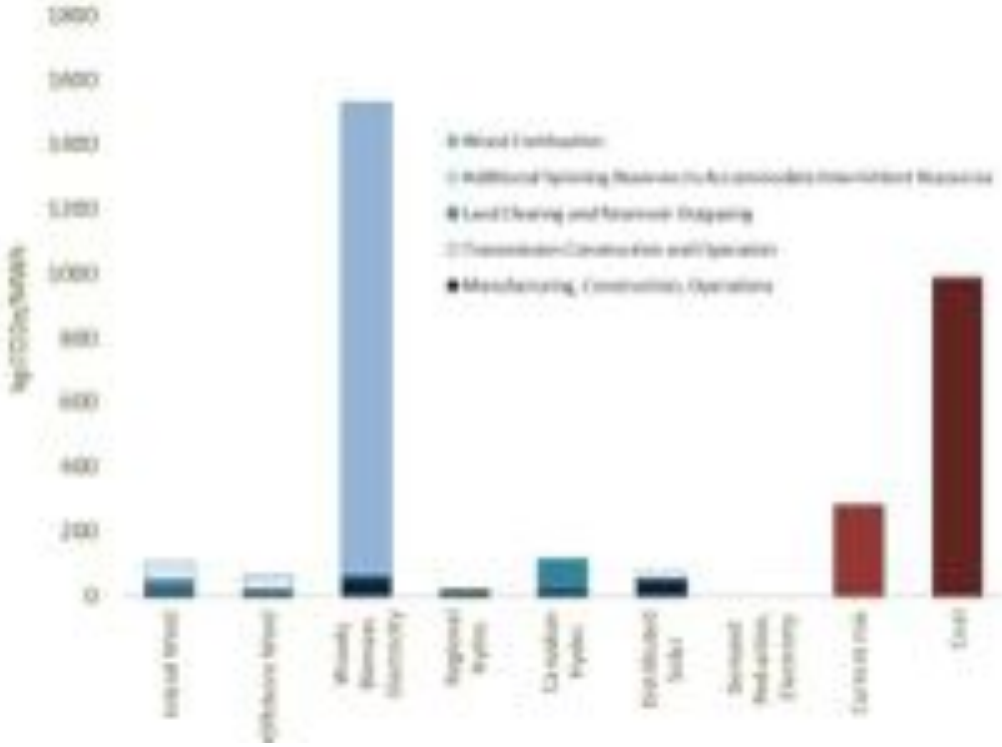
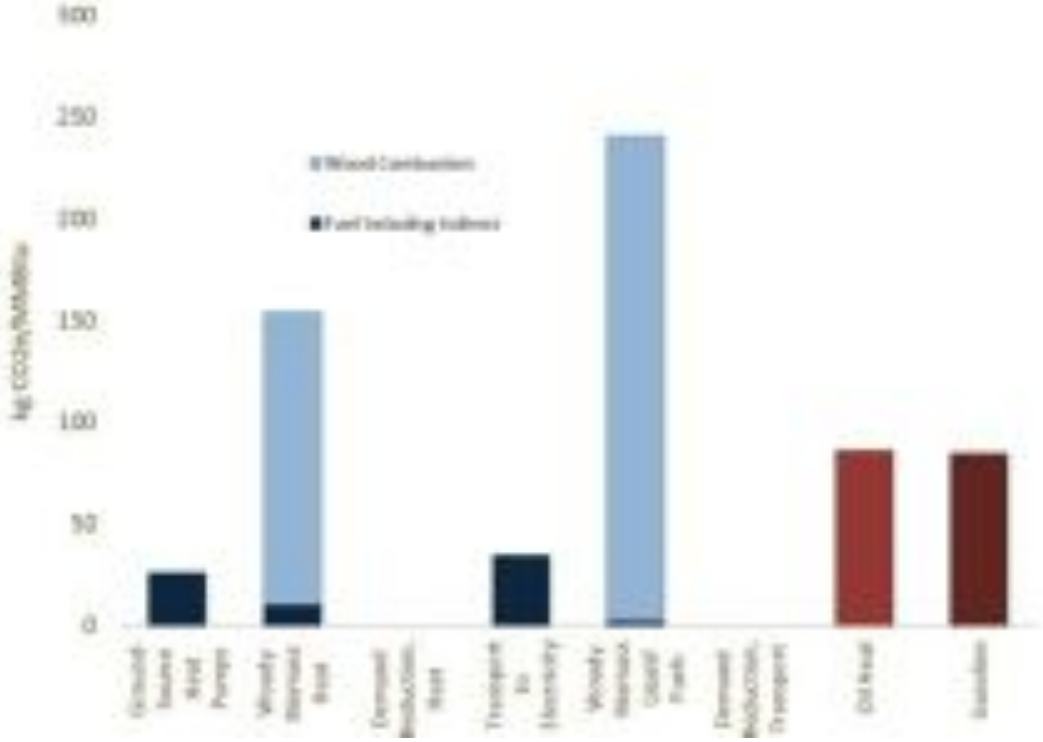


Figure 15: Greenhouse Gas Emissions from Heat/Process and Transport Energy



Tables 15 and 16 show net change in annual GHG emissions due to an incremental increase in each technology above current levels to reach the scenario target. The incremental increase varies across scenarios, as some technologies are already utilized to a greater degree and others have limited development potential. While renewable energy options do release greenhouse gases, in general they will reduce overall emissions by reducing fossil energy use. Table 15 assumes that renewable electricity first replaces coal, then oil, then nuclear (for intermittent sources, this is an optimistic assumption, as wind energy modeling predicts that natural gas will be the primary electricity resource displaced[41]). Table 16 assumes that renewable heat/process energy replaces first oil, then propane; and that renewable transportation energy replaces gas and diesel at their current 80/20 ratio.

Table 15: GHG Emissions Reductions for Renewable Electricity Scenarios

	Inland Wind 25%	Offshore Wind 25%	Woody Biomass Electricity 21%	Regional Hydro 23%	Canadian Hydro 25%	Distributed Solar 25%	Demand Reduction for Electricity 25%
Incremental increase in energy output from this source (GWh)	12,692	14,048	8,418	4,033	8,052	14,048	14,048
Annualized emissions from construction and operation (metric tons)	215,764	182,625	496,670	72,598	161,041	772,642	--
Annualized emissions from transmission construction (metric tons)	93,139	30,831	190	289	20,059	--	--
Land clearing or wood combustion emissions (metric tons)	358,649	91,520	12,384,825	8,019	767,764	--	--
Emissions from natural gas balancing (metric tons)	703,645	637,220	--	--	--	283,208	--
Reduced emissions from replaced sources (metric tons)*	3,486,334	3,512,099	3,405,130	3,321,817	3,398,175	3,512,099	3,512,099
Annual net emissions reduction (metric tons)	-2,115,137	-2,569,904	-2,839,166 to +9,476,554#	-3,240,912	-2,449,311	-2,456,249	-3,512,099

*Assumes that renewables first replace coal, then oil, then nuclear. Wind or solar alone cannot replace baseload coal or oil sources, but combining intermittent sources with natural gas reserves allows them to function similarly to today's baseload sources.
#Range for wood is without or with wood combustion emissions.

Table 16: GHG Emissions for Renewable Heat/Process Energy and Transport Scenarios

	Ground-Source Heat Pumps 25%	Woody Biomass Heat 25%	Demand Reduction, Heat 25%	Transport to Electricity 25%	Woody Biomass Liquid Fuels 13%	Demand Reduction, Transport 25%
Incremental increase in energy output (Trillion Btu)	91.5	61.8	91.6	150.1	39.1	75.2
Annualized emissions from construction and operation (metric tons)	2,380,019#	638,267	--	5,205,696#	97,821	--
Land clearing or wood combustion emissions (metric tons)	--	8,954,096	--		9,395,370	--
Reduced emissions from replaced sources (metric tons)*	7,881,810	5,919,499	7,890,424	12,823,343	3,342,803	6,428,468
Annual net emissions reduction#	-5,501,791 to -6,874,925	-5,223,018 to +3,672,864	-7,890,424	-7,617,648 to -10,621,034	-3,187,033 to +6,150,387	-6,428,468

*Heat replaces fuel oil; transport replaces gasoline (80%) and diesel (20%).
#Range of emissions for heat pumps and electric transport assumes current electricity mix or low-GHG future mix shown in Figure 14 below.

Financial Costs

In addition to landscape impacts and GHG reduction benefits, renewable energy choices will also be influenced and constrained by the financial costs of each alternative. Figure 16 and 17 below compare financial costs per kWh or kWh-equivalent for each scenario (levelized annual cost, including initial investment and annual operating costs). See Appendix 5 for computation details.

Figure 16: Levelized Cost per KWh

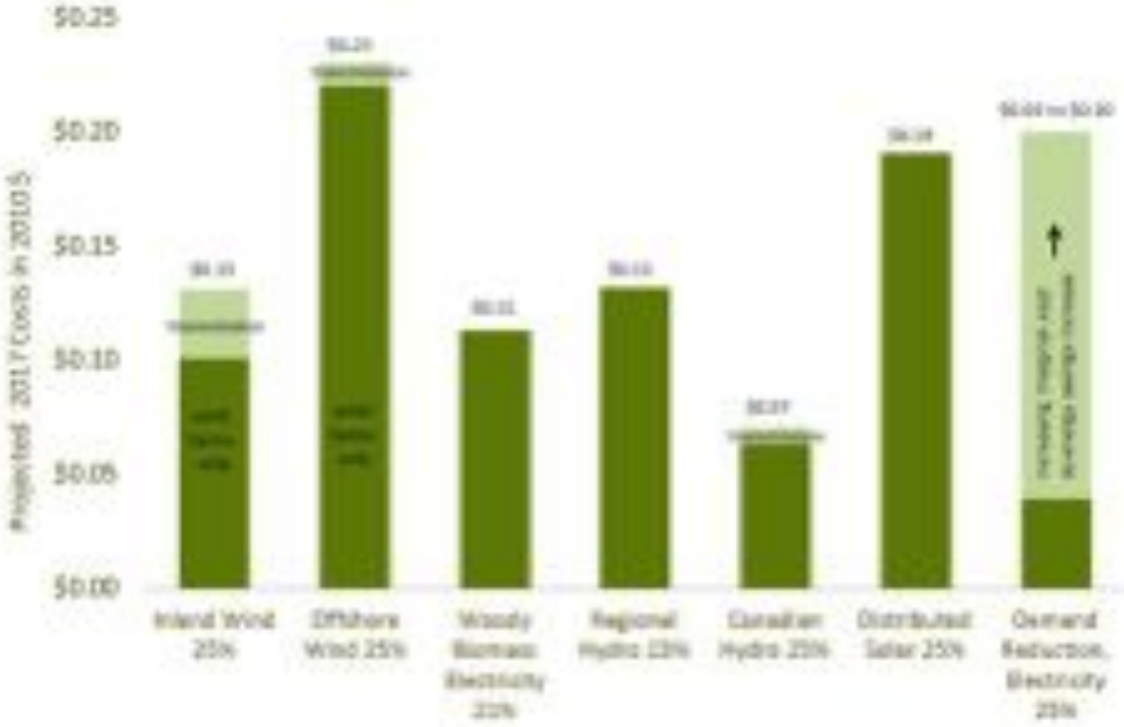


Figure 17: Levelized Cost per KWh-Equivalent

Conclusion

No single renewable energy source can provide all future energy needs for northern New England, nor is any source completely environmentally benign. Future energy choices face inevitable tradeoffs among landscape impacts, greenhouse gas reductions, and financial cost. Figure 18 illustrates one possible combination of options that would achieve an 80% reduction in GHG emissions by 2050, based on emissions reductions presented in Tables 15 and 16. By emphasizing potential reductions in demand, as well as relying on options that cost more financially but have fewer environmental costs, this sample scenario addresses both climate change and landscape impacts. This is just one example, and actually achieving these levels of renewable energy development may not be feasible. Nonetheless, it illustrates the magnitude of change required. The actual 2050 energy mix will reflect a balance among environmental factors, financial costs, and social values.

Figure 18: Sample Combined Scenario to Achieve 80% Reduction in GHG Emissions

Note: Emissions reductions from electric vehicle and heat pump conversions assume the electricity mix depicted in this chart. Woody biomass heat reductions assume half of wood combustion emissions remain in the atmosphere in 2050.

Although every energy solution has its own key costs and benefits, a few broad conclusions might be drawn about particular alternatives.

- Among electricity supply options, local hydroelectricity achieves the best emissions reductions at reasonable cost. Unfortunately, small hydro development in northern New England has limited potential and is subject to extensive federal environmental review (arguably all energy development should be subject to a similar level of review). The current trend is toward removing dams rather

than renovating. Nonetheless, new in-stream and micro-hydro technologies, and innovative approaches to retrofitting existing dams while also providing fish passage, may improve prospects for low-impact hydroelectricity.

- Canadian hydroelectricity offers limited emissions reductions at a low financial cost, but landscape impacts dwarf those of all other alternatives. This option and the wind options involve significant new transmission infrastructure which magnifies both financial and environmental costs.
- Inland wind has reasonable financial costs, but will fragment the most intact remaining wildlife habitat, especially at high elevations, that may offer refuge for sensitive species as the climate warms. Expanded transmission and the need for natural gas reserves also reduce the apparent advantages.
- Offshore wind has almost unlimited potential and relatively low environmental impact, though effects on marine wildlife are poorly understood and costs are currently the highest of any alternative.
- Woody biomass electricity is reasonable in cost due to its proven technology, but if poorly executed may threaten forest health and carbon sequestration services. Electricity from burning wood does not achieve emissions reductions in the short term, and the electricity sector must compete with heating and biofuels for limited feedstocks.
- Solar photovoltaics offer a viable option that minimizes transmission upgrades and can be concentrated on already disturbed lands. The sole obstacle for this option is its high financial cost, but this drawback may disappear if costs continue to fall. If energy prices reflected full external environmental costs, distributed generation alternatives would compare favorably with more disruptive options. Like wind, solar presents some grid integration challenges and requires readily-dispatchable balancing resources like hydro or natural gas.

Considerations for advancing sound renewable energy planning and policy:

- **Local concerns** about energy development impacts should carry due weight in energy siting decisions.
  - *Regional plans often set priorities for protected open space. At the town level, zoning or ordinances relating to energy development are becoming more common. New energy facilities in Maine must comply with local ordinances, while New Hampshire and Vermont currently may permit facilities that fail to comply with local rules or plans if statewide benefits are considered to over-ride local harm.*
- The **full costs** of new energy generation, including environmental costs, should be considered when balancing the benefits and costs of new supply. Downplaying these costs in the interest of rapid climate change action could seriously harm the ability of natural systems to adapt to changes that are already inevitable. Acknowledging them can help focus development on the least harmful alternatives.
  - *Many state policies acknowledge the generally minimal landscape impact of photovoltaics by setting specific solar class targets in RPS, or offering higher compensation for solar projects (e.g. Vermont's standard offer program and net metering solar adder). If offshore wind impacts prove minimal, it might receive similar treatment.*

- Transmission improvements needed to integrate a particular electricity source are often ignored when calculating either financial or environmental costs. Constructing and operating transmission lines adds about 3-11% to GHG emissions from U.S. electricity nationwide, but for countries like Norway with low-carbon electricity, transmission emissions exceed those from electric generation.[42] Expensive transmission grid upgrades have already begun across the region. Such investments could reinforce the current model of large-scale (and, for renewables, often remote) generating units. Alternatively, energy dollars might be dedicated to building a more distributed system.
- Of the heating options considered, ground-source heat pumps and wood heat both save costs over the long term compared to oil heat. Heat pumps require substantial electricity to operate, which puts more pressure on renewable electricity sources, and the initial investment is high compared to other options. The emission reduction benefits of woody biomass heat are delayed by several decades, since wood releases more GHGs than oil in the short run. Of the three energy options that rely on wood, heating uses the least amount of wood, ships wood over shorter distances, and emits the least short-term GHGs relative to the fossil fuel replaced.
- Transportation is perhaps the most challenging energy sector for achieving GHG reductions. Like heat pumps, electric vehicles place more pressure on scarce renewable electricity options. Wood-based biofuels require large centralized facilities and long-distance transport for both wood feedstock and finished fuel, as well as stressing forest capacity. Efficiency of wood energy conversion to biofuels is better than for electricity but lower than for heating uses, and the GHG effects are also intermediate with few net reductions by 2050.

Considerations for advancing sound renewable energy planning and policy:

- **Transmission** planning should take into consideration non-transmission alternatives like distributed generation and demand reduction, and minimize landscape impacts.
  - *ISO-NE has taken steps to better incorporate demand-side solutions in its transmission planning, but still encourages transmission over other solutions by sharing the costs of many power lines across the region.*
  - *New Hampshire determined that the proposed Northern Pass transmission line, a merchant line not required for grid reliability, may not use eminent domain to override local siting concerns.*
- To achieve needed GHG reductions at lowest financial and environmental cost, **heating and transportation** energy should receive equal attention with electricity.
  - *New Hampshire now credits limited amounts of renewable thermal energy toward its RPS targets.*
  - *Vermont is considering the design of a "total energy standard".*
- Energy policies aimed at addressing climate change should use accurate life-cycle **greenhouse gas accounting** that includes impacts on terrestrial carbon stocks and changes in grid operation to accommodate intermittent resources.
  - *Massachusetts' RPS regulations now require documented GHG reductions for eligible biomass facilities.*
  - *GHG effects of new wind facilities should be estimated by modeling grid response to cumulative wind capacity rather than output times average grid emissions.*

- Across all use sectors, reducing demand achieves the greatest emission reductions and avoids the serious environmental impacts of nearly all supply-side approaches. It appears that reductions on the order of 25% across all energy sectors should be achievable at costs below most renewable energy supply options. Unfortunately, demand reduction measures are often considered feasible only if they are "cost-effective" – meaning the cost of efficiency measures must be less than the cost of the energy saved over time. Results depend heavily on the expected price of energy, as well as on the assumed discount rate (which affects how we weigh future savings against current costs) and on the valuation of environmental externalities. Including external costs in energy prices, and using a lower "social discount rate" that reflects an equal voice for future generations, would expand the range of cost-effective efficiency options by reflecting true energy costs.
- Efficiency measures are also typically limited to investments that maintain the same level of service with less energy input. Adapting to ecological limits may require a shift in social priorities to emphasize quality-of-life values like leisure time and local community interaction rather than energy-intensive consumption. Energy-reducing choices and behavior will almost always save money rather than costing more, but old habits die hard.

Considerations for advancing sound renewable energy planning and policy:

- Measures that **reduce energy demand** should be subsidized at least as heavily as new energy supply. Most state efficiency programs limit investments to those considered cost-effective, without fully accounting for external environmental costs. Likewise, RPS programs generally focus on new supply, which can actually discourage efficiency investments.
  - *Least cost integrated plans required for Vermont utilities theoretically include efficiency on an equal basis with supply, and also consider environmental as well as financial life-cycle costs. Vermont's energy siting statute also requires a proposed facility to meet a need that cannot be addressed by "energy conservation programs and measures and energy-efficiency and load management measures" at a comparable financial and environmental cost. Other states lack these mandates, and in Vermont they are seldom applied rigorously.*
  - *North Carolina allows utilities to meet their RPS obligations through energy efficiency (up to 25% of target) or demand management (up to 100% of target).*

In the quest for climate friendly energy solutions, all supply-side approaches currently have significant environmental and/or financial costs. Understanding those costs is a prerequisite for prioritizing the least damaging options, or for minimizing or mitigating unavoidable harm. When faced with choices among renewable energy alternatives, policy incentives can guide investments toward those options with least environmental impact and associated external costs. Full recognition of the environmental impacts of renewable energy development can also help bolster public and private resolve to reduce energy use. This paper introduces a framework for understanding those impacts, and we invite corrections and supplements to flesh out the information presented here.

Appendix I: Estimating Acres Affected

Inland Wind

- Ridgeline Development - 17 wind projects that are currently operating and 25 proposed across the three states require total ridgeline development of 229 miles (a mean of 1,296 feet of ridgeline distance per turbine for 948 total turbines). Assuming that the 21 additional theoretical sites required to reach the 25% goal (1,034 additional turbines at about 49 turbines per project and 3MW turbines) have similar turbine spacing, they would cover 254 additional miles of ridgeline.[43] Total ridgeline development with current, proposed and new wind sites would be 483 miles – more than the distance from the northeastern tip of Maine to the southwestern corner of Vermont. Each turbine pad requires clearing of about 2.5 acres[44], for a total of 4,955 acres permanent clearing. Most pads require blasting or filling to achieve sufficient level surface areas. 100-400 tons of concrete is poured for each turbine foundation[45], though ridgeline projects anchoring to ledge may use less.
- Roads
  - "Crane paths" along ridges are approximately 34 feet wide, with additional disturbed width for cut and fill operations. In order to accommodate transport of long turbine parts, irregular ridgelines require extensive blasting and filling to smooth dips and curves. Total crane path length would be similar to ridgeline length at 483 miles or 1,990 acres permanent clearing (483 miles x 5,280 $^{ft.}/_{mile}$ x 34 ft. ÷ 43,560 $^{sq.ft.}/_{acre}$). Not all fill slopes, drainage ditches, and stormwater features will be revegetated, so total permanent clearing associated with ridgeline roads will be somewhat more than this.
  - Access from nearby public roads is needed for installation and maintenance. A sample of 12 current or proposed projects with mapped access routes requires 35.5 miles of roads to access 248 turbines. Some of these are logging roads that require upgrading, rather than entirely new road miles. Using the shortest distance from turbine string to the nearest road as a conservative approximation of access road length, access roads for all current and proposed projects would total 41 miles, or 0.04 $^{miles}/_{turbine}$, and roads for the 1,982 turbines needed to reach the 25% goal would total about 79 miles. At 24 feet average width (18 foot wide roadbed plus cut-and-fill and pull-outs for passing) access road clearing would total 230 acres (79 miles x 5,280 $^{ft.}/_{mile}$ x 24 ft. wide ÷ 43,560 $^{sq.ft.}/_{acre}$). As for ridgeline roads, unvegetated cut and fill slopes, ditches and stormwater features would increase this acreage.
- Transmission
  - Each project requires new local transmission to connect the project to the grid. Some lines might parallel access roads, but the most direct route may also dictate separate corridors for road and transmission access. A sample of 15 existing or proposed projects (total capacity 1,027 MW) with mapped transmission lines required 122 miles of connecting transmission. Using the shortest distance from turbine string to the nearest mapped high-voltage transmission line as a conservative approximation of connecting transmission line, transmission connectors for all current and proposed projects would total about 282 miles, or 0.12 miles per MW, and at this same rate transmission lines for the 5,346 MW needed to reach the 25% goal would total about

641 miles. At 50 feet average width of cleared corridor, connecting transmission line clearing would total 3,885 acres ((641 miles x 5,280 $^{ft.}/_{mile}$ x 50 feet wide) ÷ 43,560 $^{sq.ft.}/_{acre}$).

  - Wind development must occur in areas of concentrated wind resource, and in this region those areas frequently lack sufficient network capacity to absorb new production of the magnitude envisioned in this scenario. An ISO-NE study for the New England Governors indicated that about 4,320 miles of new high-voltage transmission line would be required for New England wind development similar in magnitude to the 25% scenario considered here.[46] Assuming for this scenario that most of the energy is used within northern New England rather than exported to the south, we assume that only 50% of the envisioned new transmission network is needed. High-voltage lines with a 150 foot right-of-way (Northern Pass proposed minimum width) would require clearing 39,273 acres (2,160 miles x 150 ft. x 5,280 $^{ft.}/_{mile}$ ÷ 43,560 $^{sq.ft.}/_{acre}$).

- Total direct impact area depends on terrain and configuration of turbines. A National Renewable Energy Laboratory study assessed land impacts of operating wind farms. Those using a single string configuration, typical of northern New England wind farms, averaged 3.3 acres of clearing per MW of capacity.[47] Selected projects constructed to-date in this region vary from much less to much more than this average.

Acres Disturbed for Selected Wind Projects in Northern New England

	Turbine Size (MW)	Total MW	Acres Cleared per MW
Kingdom Community Wind, VT	3	63	2.3
Granite Reliable, NH	3	99	2.0
Bowers, ME	1.2 and 3	69	5.4
Spruce Mountain, ME	2	20	5.1
Mars Hill, ME*	1.5	42	0.78
Stetson Mountain, ME*	1.5	57	3.4
Kibby, ME*	3	132	0.76
National average for turbines in			3.3

*Part of nation-wide NREL study.

- Concentrating wind development at a single contiguous site would make for relatively low impact at about 56,915 acres (3.3 $^{acres}/_{MW}$ x 5,346 MW plus 39,273 acres for transmission). But by nature wind development in this region must be widely disbursed and is often distant from load. If the zone of indirect impact reaches 1,000 feet on either side of the developed ridgeline (setback recommended by Maine's Office of Energy Independence and Security to protect from noise and ice throw[48]), and 328 feet (100 meters, commonly used to define interior forest habitat[49]) on either side of access roads and transmission corridors, then total impacts would affect nearly 400,000 acres. Many of these affected acres would be within the largest remaining intact blocks of wildlife habitat in the northeastern U.S., which tend to be at high elevations due to difficult access, and would disrupt east-west migration corridors.
  - 119,081 acres (483 miles x 5,280 $^{ft.}/_{mile}$ x 2,034 ft. ÷ 43,560 $^{sq.ft.}/_{acre}$) for ridgeline;
  - 6,512 acres (79 miles x 5,280 $^{ft.}/_{mile}$ x 680 ft. ÷ 43,560 $^{sq.ft.}/_{acre}$) for access roads;
  - 54,854 acres (641 miles x 5,280 $^{ft.}/_{mile}$ x 706 ft. ÷ 43,560 $^{sq.ft.}/_{acre}$) for connector transmission;

- 211,025 (2,160 miles x 5,280 $^{ft.}/_{mile}$ x 806 ft. ÷ 43,560 $^{sq.ft.}/_{acre}$) for new high voltage lines

Offshore wind

- 800 turbines with 6 paired cable anchors each would disturb about 44 acres of ocean floor (800 x 400 sq. ft. per anchor x 6 ÷ 43,560 $^{sq.ft.}/_{acre}$) spaced across 184,960 acres of total area;
- Collecting lines within each wind farm from turbines to an offshore substation total approximately 200 miles;
- Trunk lines of approximately 20 miles each would connect offshore wind farms to the grid. 80 miles of buried cable with 20 foot wide excavation zone 3 to 10 feet deep would directly disturb about 194 acres (80 miles x 5,280 $^{ft.}/_{mile}$ x 20 ft. ÷ 43,560 $^{sq.ft.}/_{acre}$) of ocean floor. If the total indirect impact zone is 328 feet on either side of the buried cable, total affected acres would be 6,555 acres (80 x 5,280 $^{ft.}/_{mile}$ x 676 ft. ÷ 43,560 $^{sq.ft.}/_{acre}$).
- Transmission improvements onshore for the 4,000MW offshore wind case in the ISO-NE 2030 study (which locates most sites in MA and CT) include 1,430 miles of new transmission at a cost of $6.1 billion. Assuming as for the inland scenario that only half is needed to power northern New England alone, direct land clearing for new high-voltage transmission would be about 13,000 acres (715 miles x 5,280 $^{ft.}/_{mile}$ x 150 ft. ÷ 43,560 $^{sq.ft.}/_{acre}$) and indirect impact about 69,853 acres (715 miles x 5,280 $^{ft.}/_{mile}$ x 806 ft. ÷ 43,560 $^{sq.ft.}/_{acre}$).

Woody biomass electricity

- For the footprint of the facilities themselves, we assume 50 acres per plant including wood storage yards (estimated from satellite imagery of existing plants), 1,150 acres total for the added plants.
- 10.6 million tons of additional low-grade wood must be harvested to support the proposed and new plants shown. The increase amounts to 53% of current harvest volume, which is about 19.9 million green tons for the three states (Maine = 14.59 million green tons; Vermont = 2.46 million green tons; New Hampshire = 2.8 million green tons[50]).
- Based on Forest Inventory and Analysis estimates, 2.3 million acres of timberland in these three states are more than 1 mile from an existing road. The FIA definition of road is restricted to improved roads (graded, ditched, etc.), so some of these areas have logging road access. If half these areas had limited access, and new roads were constructed in these areas at the average density for nonwilderness portions of National Forests (1.52 miles of road per square mile) and roads were 24 feet in width, new access roads would clear about 7,969 acres (1,153,418 acres ÷ 640 $^{acres}/_{sq.mile}$ x 1.52 $^{miles\ road}/_{square\ mile}$ = 2,739 miles of road x 5,280 $^{ft.}/_{mile}$ x 24 ft. wide ÷ 43,560 $^{sq.ft.}/_{acre}$). Indirect road impacts would affect about 225,790 acres (2,739 miles x 5,280 $^{ft.}/_{mile}$ x 680 ft. wide ÷ 43,560 $^{sq.ft.}/_{acre}$), but this area is already included as part of general forest indirect impacts.
- 144 miles of new connecting transmission line, with clearing at 50 feet width, would affect 872 acres (144 miles x 5,280 $^{ft.}/_{mile}$ x 50 ft. wide ÷ 43,560 $^{sq.ft.}/_{acre}$). Indirect effects would total 12,323 acres (144 miles x 5,280 $^{ft.}/_{mile}$ x 706 ft. wide ÷ 43,560 $^{sq.ft.}/_{acre}$).

Regional hydroelectricity

- We estimate direct impact from pre-existing hydro dams as the area of reservoirs. Since there are no consistent data on reservoir area, we selected all water bodies with the word "reservoir" in their

name from the Census TIGER data files for water (86 reservoirs) and calculated total area (10,781 acres). Since not all reservoirs are used to generate electricity, this may exaggerate impact, but we did not include impacts from roads or transmission to service these dams. This may be an overestimate, as some existing reservoirs are no longer used to generate hydropower. According to a recent DOE analysis, conventional hydroelectricity in the northeast disturbs 0.91 m^2 of land per MWh generated (assumes a capacity factor of 52% compare to our assumed factor of 43%), or about 3,000 acres for the hydro power used in Vermont, New Hampshire and Maine.[51]

- Direct impact (clearing and ground disturbance) from new hydro facilities would amount to about 31 acres (400 sq.ft x 3,364) for power houses, 631 acres for penstocks of 6 foot width (868 miles x 5,280 $^{ft.}/_{mile}$ x 6 ft. ÷ 43,560 $^{sq.ft.}/_{acre}$).
- Based on the minimum distance from penstock to the nearest road, 3,364 projects with 830 MWa of capacity would require 328 miles of access road, though these could be narrow(we assume 12 feet) to access such small sites. Assuming transmission runs along the access road, direct land disturbance for roads and transmission would total 477 acres ((328 miles x 5,280 $^{ft.}/_{mile}$ x 12 ft. ÷ 43,560 $^{sq.ft.}/_{acre}$).
- River reaches with reduced flow would be slightly more than penstock length due to sinuous stream paths (assume 1.25x), with more width (assume 20 ft.), perhaps amounting to 2,630 acres of stream affected (868 miles x 1.25 x 5,280 $^{ft.}/_{mile}$ x 20 ft. ÷ 43,560 $^{sq.ft.}/_{acre}$). Overall indirect impact area totals the 2,630 acres of affected stream channel plus a 328 foot wide impact zone for penstocks, roads and transmission: penstocks 69,650 acres (868 miles x 5,280 $^{ft.}/_{mile}$ x 662 ft. ÷ 43,560 $^{sq.ft.}/_{acre}$) and roads and transmission 27,433 acres (328 miles x 5,280 $^{ft.}/_{mile}$ x 690 ft. ÷ 43,560 $^{sq.ft.}/_{acre}$).

Canadian hydroelectricity

- Hydro Quebec reservoirs cover an area of 6,009,970 acres. 7% of the flooded area (required to meet the 25% target) is 420,698 acres, and 4% (incremental increase over current use only) is 240,399 acres.
- Existing transmission totals approximately 20,897 miles of high voltage transmission line with 150 foot right-of-way, affecting about 379,945 acres (20,897 miles x 5,280 $^{ft.}/_{mile}$ x 150 ft. ÷ 43,560 $^{sq.ft.}/_{acre}$).[52] 7% of this would be 26,596 acres affected for total use, and 4% would be 15,198 acres for incremental only. Indirect impacts for existing transmission extending to a 328 foot wide buffer would affect 2,041,574 acres (20,897 miles x 5,280 $^{ft.}/_{mile}$ x 806 ft. ÷ 43,560 $^{sq.ft.}/_{acre}$). 7% of this would be 142,910 acres and 4% 81,663 acres.
- 360 miles of new line with 150 foot right of way would directly affect another 6,545 acres, with indirect impacts extending 328 feet to each side totaling 35,170 acres (360 miles x 5,280 $^{ft.}/_{mile}$ x 806 ft. ÷ 43,560 $^{sq.ft.}/_{acre}$).

Distributed solar photovoltaics

- Each 1 kW solar panel generates about 1.135 MWh per year under typical northern New England conditions[1]. If mounted at 45°, each 1 kW panel would take up 50 square feet of area horizontal to

[1] Based on actual conditions for a net-metered panel in Craftsbury, VT - implying conservative 13% capacity factor.

the ground, so 3,564 MW of rooftop panels would require 4,091 horizontal acres of rooftops (3,564 x 50,000 $^{sq.ft.}/_{MW}$ ÷ 43,560 $^{sq.ft.}/_{acre}$).

- Large free-standing solar farms typically require 5-10 acres per MW.[53] 8,315 MW of ground-mounted panels would require 62,363 acres, but we assume only 10% of this represents direct impacts causing land use changes. If solar farms average 1 MW and 7.5 acres each, indirect impacts extending 328 feet on all sides would total 10.5 acres per farm or 87,308 acres total.

Ground-source heat pumps

- Depending on design (vertical well or horizontal piping) these systems may have negligible or fairly significant landscape impacts, but as for solar PV those impacts will occur in already developed areas. Horizontal systems with 1,000 feet of piping spaced 2.5 feet apart require 2,500 square feet of disturbed area, for a total of 52,571 acres disturbed (equivalent of 916,000 residences x 2,500 sq.ft. ÷ 43,560 $^{sq.ft.}/_{acre}$). Assuming half the systems are vertical water-based systems, the acreage would be half of this, 26,286 (6.4% of the 410,847 "other developed" acres in the region – assuming that piping will not be installed under impervious surfaces).

Wood-based heat/process energy

- 30 pellet mills with a footprint of about 20 acres each for facilities and wood yard would affect 600 acres total.
- For impacts from new woods roads, see woody biomass electricity.
- Woodsheds are relatively small under the heating scenario, averaging a 21 mile radius (see Appendix 2), so total transportation emissions and traffic impacts would be less than for the electricity scenario (32 mile radius) or liquid fuels (56 mile radius). Woodsheds, and hence transportation impacts, for pellets would exceed those for local firewood processing.

Transportation biofuels

- Seven biofuel manufacturing facilities would have a small footprint, about 70 acres at 10 acres each. If large wood storage yards are required to even out seasonal supply, acreage could increase.
- For impacts from new woods roads, see woody biomass electricity.
- Woodsheds are large under the liquid fuels scenario, averaging 57 miles (see Appendix 2), so total transportation emissions and traffic impacts would be highest of the three wood energy scenarios.

Appendix 2: Delineating Woodsheds and Estimating Wood Quantities

- All GIS steps described here use ArcGIS software. Select counties within 50 miles of VT/NH/ME border from ESRI county detail shapefile, export to new shapefile (nne50milectys), and use conversion tool "Polygon to Raster", with NLCD raster for reference cell size, to construct a raster with county fips code as value (ctyfor). Add fipsn number field and calculate fips as a number from fips as text, then use "Lookup" tool to enter fipsn in the number field of a new raster (ctyne);
- Use NLCD 2006 data to delineate forested lands that might produce wood fuel.[2] Since wood flow is based on county-wide averages, assigning wood flows to only the forested portions of the landscape avoids inclusion of significant developed areas or large water bodies within defined woodsheds. The NLCD 2006 land cover data from the USGS was the best available and most recent dataset with consistent coverage across the three-state region. The data is considered "provisional" pending completion of the accuracy assessment. It is possible that some areas classified as forest capable of providing fuel wood are actually nonforested, and vice versa. Fortunately, the discrimination of forest cover from other cover types needed for this report is typically strong in land cover classifications of Landsat satellite data. The greater inaccuracies arise from discrimination between forest types or between other types of vegetative communities not used for this work. Since the BTS Update estimated wood flows at the county level, incorrect land cover classification may affect the size of individual woodsheds, but would not affect the total potential scope of woody biomass energy development across the entire three-state region.
- Clip land cover to nne50milectys shapefile (nlcdnne); select forested pixels using "Extract by attributes" with values = 41 deciduous, 42 coniferous, 43 mixed, 52 shrub-scrub (to incorporate regenerating forest), or 90 woody wetland) (forcodenne). Use "Reclassify" to create new raster (fornne) with value =1 for each forested pixel and "No data" for nonforest pixels;
- Use "Con" tool to construct raster (forfips) that substitutes numeric fips code for value=1 for forested pixels, with no data for non-forest pixels,[3];
- Use "Con" tool to substitute 0 value for pixels that are protected land (wilderness, 2001 USFS roadless, National Parks);
- Export zip codes with number of forested pixels as text to Excel workbook btsberc, worksheet forest;
- In BTS Access database, query feedstocks by county [combined management regime = residues alone on half and integrated harvest from thinnings+residues on half (limited by 2006 state harvest volume for sawlog/pulp portion of integrated harvest - substitute all residues from current harvest if greater than combined) + other removals (mostly land clearing) + pulp diversions + primary mill residue]. Export to btsberc workbook with separate worksheet for each feedstock;
- In Excel, sum total green tons[54] woody biomass by county, multiply BTS dry ton values by 2 to approximate green tons, divide county feedstock total by forested pixels in county to get wood supply per forested pixel in each county;

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[2] Fry, J., Xian, G., Jin, S., Dewitz, J., Homer, C., Yang, L., Barnes, C., Herold, N., and Wickham, J., 2011. Completion of the 2006 National Land Cover Database for the Conterminous United States, *PE&RS*, Vol. 77(9):858-864. Data downloaded at http://www.mrlc.gov/nlcd2006.php. Satellite imagery from 1999-2003

[3] Table must be DOS text file.

- In bts_fips_table worksheet, look up gtpix (green tons per pixel) by fips, multiply by 1,000,000 to make gtpix value an integer, change fips and gtpix to number field and save as MS-DOS text file;
- In Arcmap, substitute county-level per-pixel green tons biomass for fips code in forested pixels, using "Reclassify by table" (ctywood);
- BTS theoretically accounts for only newly available wood, so wood used by existing facilities has already been deducted. Analysis considers only proposed and theoretical new facilities needed to meet 25% goal. Buffer each selected new facility with approximate woodshed radius, extract ctywood raster by woodshed polygon, add MULT field and calculate as (Count*Value) ÷ 1,000,000. Sum MULT field to get available wood in woodshed. Adjust buffer until supply approximately matches need for each theoretical plant.
- For overlapping woodsheds, do most likely plant first, then deduct that woodshed from the next most likely before calculating available wood (make buffer circle larger to accommodate the deduction, union overlapping buffers, select new woodshed segment excluding previous plant woodshed, export to new shapefile, and use this segment to extract raster values). To translate per-pixel values to green tons per acre for legend, multiply by 4.5 (there are approximately 4.5 30x30m pixels per acre) then divide by 1,000,000 to account for per-pixel factor being a million times the actual value.

Electricity plant capacity, wood use, and woodshed diameters

Facility	MW	Wood Use (green tons/year)	Woodshed Diameter (miles) [Many circles truncated by state border]
Aroostook1, ME	44	436,949	36
Aroostook2, ME	58	584,992	50
Aroostook3, ME	33	332,997	26
Piscataquis1, ME	42	423,184	30
Piscataquis2, ME	32	319,629	26
Piscataquis3, ME	42	416,792	30
Washington, ME	33	326,212	30
Hancock, ME	43	428,405	40
Somerset, ME	34	336,527	26
Kennebec, ME	33	334,473	30
Franklin, ME	52	520,291	37
Lincoln, ME	30	298,585	30
Cumberland, ME	59	587,494	25
York, ME	50	502,294	20
Belknap, NH	23	233,690	30
Rockingham, NH	51	508,025	35
Lamoille, VT	33	331,406	50
Total: 18	**692**	**6,921,945**	**32 average**

Pellet mill production, wood use, and woodshed diameters

Facility	Wood Pellets (dry tons/year)	Wood Use (green tons/year)	Woodshed Diameter (miles)
ME1	108,406	222,232	25
ME2	100,690	206,414	27
ME3	102,900	210,946	19
ME4	108,163	221,735	20
ME5	99.842	204,676	18
ME6	100,183	205,376	24
ME7	108,371	222,161	19
ME8	103,057	211,266	24
ME9	102,655	210,442	16
ME10	100,986	207,022	12
ME11	102,903	210,952	16
ME12	98,296	201,506	17
ME13	107,126	219,609	21
ME14	98,713	202,361	
NH1	98,937	202,820	25
NH2	99,318	203,602	26
NH3	99,760	204,509	14
NH4	105,118	215,491	19
VT1	103,779	212,746	32
VT2	101,118	207,291	22
Total: 20	**1,742,682**	**3,572,499**	**21 average**

Wood-based biofuel plant production, wood use, and woodshed diameters

Facility	Biofuel Produced (gallons/year) – assumes wood waste fully utilized	Wood Use (green tons/year)	Woodshed Diameter (miles)
Maine North	46,539,708	1,234,475	50
Maine Central	45,879,995	1,216,976	48
Maine East	48,571,474	1,288,368	60
Maine South	46,048,891	1,221,456	47
New Hampshire North	46,359,916	1,229,706	70
New Hampshire South	45,700,543	1,212,216	43
Vermont	45,795,019	1,214,722	74
Total: 7	**324,895,546**	**8,617,919**	**57 average**

The Billion Ton Study update[55] is used for wood supply estimates because it provides the most recent county-level estimates for the entire country. Nonetheless, there are important limitations and these should be treated as very optimistic estimates.

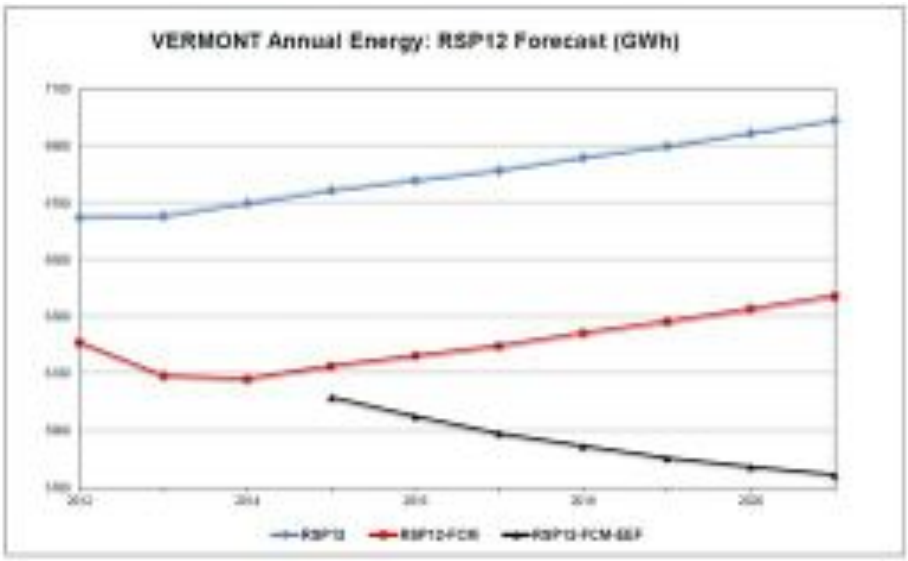
- There are no restrictions due to landowner intentions, although woodlot owner surveys indicate that most owners in this region have no intention to harvest at all – inclination to conduct whole-tree harvests for relatively low-value wood is likely to be even lower.
- Land base restrictions removed only parks and wilderness from forest eligible for harvest, with some minor limitations on quantity due to distance from road and steep terrain – and no restrictions for wetlands beyond possibly limited inventory indicated by FIA plot data. Unroaded areas are included in estimates, though cutting in these areas would occur only at higher wood prices.
- Logging residue estimates are from Timber Product Output data, which are derived from harvest volume estimates, measurements at sample harvest sites, and mill surveys. The latter two sources are considerably out-of-date for many states and likely do not reflect recent increases in

utilization of previously non-commercial tops and cull trees due to developing energy markets. Available primary mill residues are also from TPO data that are likely outdated. Because of these data limitations, the BTS update may overestimate all sources of available residues, from logging to mill.

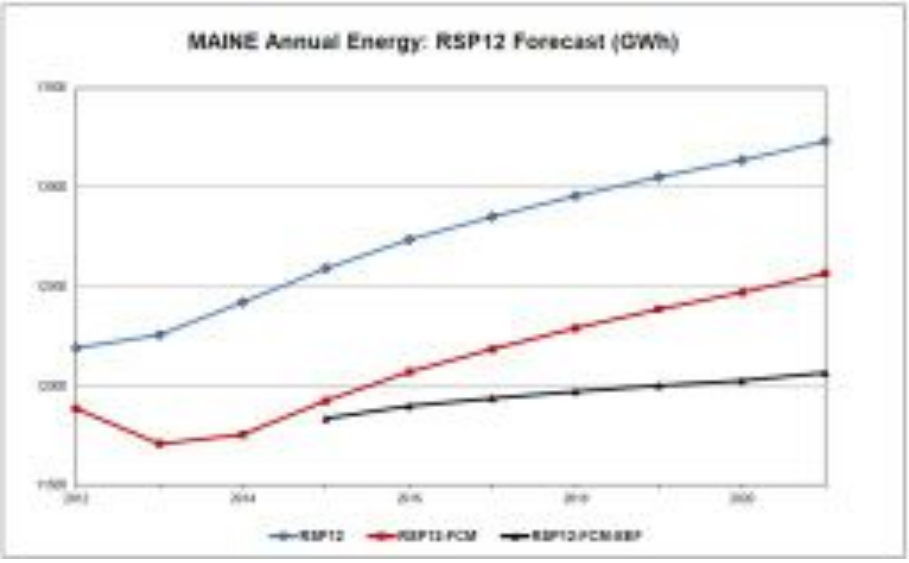
- The thinning regime for BTS integrated operations assumes that half of non-reserved forestland with density at 30% of the theoretical maximum for that forest type will be thinned (across all tree diameters down to 1") down to 30% of the maximum stand density over 30 years. (Integrated operations are described as "restoration harvests" but are not restricted to fire-prone systems with unnaturally dense stands. The future of this feedstock source after year 30 is not addressed – if these are truly "restoration" thinnings, they should not need to be repeated at frequent intervals). Since the economics of these operations depend on harvesting larger trees, integrated harvest is restricted so that pulp/sawlog material is limited to 2006 state harvest volumes (assumed to increase over time) This restriction is not limiting for Maine, but it causes New Hampshire's supply to be only 64% and Vermont's 82% of its modeled quantity for composite operations in 2012 at $100/dry ton, with the discrepancy likely much less by 2030 since processing capacity is assumed to expand over time.
- BTS does not explain the derivation of state-level estimates for secondary mill residues, and no county-level data are provided, so this source is not mapped. Construction and demolition debris and municipal solid waste are also excluded from mapping since they are not directly related to local forest capacity. We do account for secondary mill and solid waste sources by increasing wood available for each plant based on the statewide proportion of secondary waste to forest and primary mill sources.

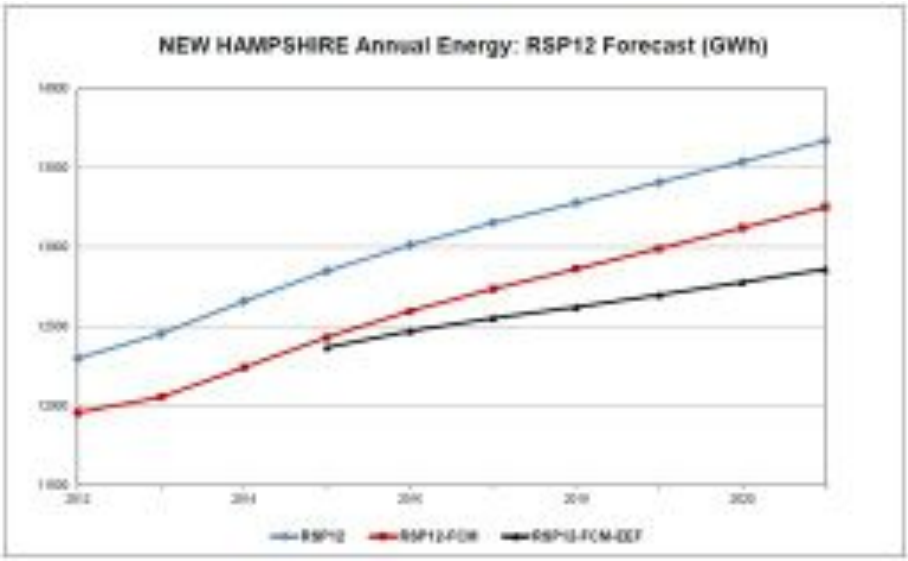
Appendix 3: Influence of Electricity Efficiency Programs on Demand – ISO-NE Modeling

ISO-New England is refining the way energy efficiency programs influence demand projections, in order to avoid investing in transmission or new capacity if cheaper solutions exist. The charts below show projections through 2021 for the three northern New England states.[4] RSP12 Forecast is a projection of by the Independent System Operator - New England (ISO-NE) of total electricity usage with no constraints on demand, as developed for the Regional System Plan issued in 2012 (RSP12). RSP12-FCM shows the effects of a forward capacity market (FCM). The FCM is designed to ensure that sufficient plans are underway today to meet future electricity needs, by offering payment up-front for promises to provide future capacity. New England's FCM accepts formal demand management arrangements as an alternative to expanding future supply. RSP12-FCM-EEF shows the additional effects of energy efficiency forecasts (EEF) resulting from programs commonly instituted in New England states, including Efficiency Vermont and Efficiency Maine. These projections are based on current programs and likely funding levels; changes in policy, pricing or consumer values could further reduce demand. Vermont's energy use is projected to fall over this period, and the others to substantially stabilize.



[4] ISO New England Staff, Energy Efficiency Forecasting Working Group. March 16, 2012. Final Energy-Efficiency Forecast, 2015-2021, accessed 1-3-13, http://www.iso-ne.com/committees/comm_wkgrps/othr/enrgy_effncy_frcst/frcst/2012/iso_ne_ee_forecast_2015_2021.pdf .


MAINE Annual Energy: RSP12 Forecast (GWh)


NEW HAMPSHIRE Annual Energy: RSP12 Forecast (GWh)

Appendix 4: Estimating GHG Emissions

Greenhouse gas emissions summarized here include those associated with manufacturing, transporting and constructing the facility. In addition, we provide estimates for emissions associated with special grid integration adjustments (emissions from increased spinning reserves – mostly natural gas generation – required to integrate highly-intermittent resources into the grid), and from wood combustion and land clearing. Since we are interested in potential GHG reductions compared to the current emissions level, we calculate both a rate of emissions per unit of energy and total emissions reductions due to an incremental increase in each source from today's level of use to the scenario amount. Unless otherwise indicated, GHG emissions of each technology are average values from two sources: 1) Weisser, Daniel. 2007. A guide to life-cycle greenhouse gas (GHG) emissions from electric supply technologies. Energy 32(9): 1543-1559, http://www.iaea.org/OurWork/ST/NE/Pess/assets/GHG_manuscript_pre-print_versionDanielWeisser.pdf , accessed 12/22/10; and 2) U.S. Department of Energy, National Renewable Energy Laboratory, Life-Cycle Analysis Harmonization Project, http://en.openei.org/apps/LCA/.

Inland Wind Electricity

- Manufacturing, construction, and maintenance emit approximately 17 $^{kgCO2e}/_{MWh}$ (range 8 to 30). 12,692,003 new MWh of wind to reach the 14,048,051 MWh goal would release 215,764 $^{metric\ tons\ CO2e}/_{year}$.
- Relatively few life-cycle assessments have been performed for long-distance transmission line construction and operation, so greenhouse gas emissions associated with this component are highly uncertain. For renewables with low emissions profiles, however, they can represent a significant portion of overall emissions. An LCA study for California, based on materials used in transmission construction and SF_6 released during operation, estimated emissions at 1,735 $^{kgCO2e}/_{MWh\text{-}km}$ for 345 kV 1,000 MW transmission line, and 1,121 $^{kgCO2e}/_{MWh\text{-}km}$ for 765 kV 2,000 MW transmission line.[56] This translates to emissions of 1,078 metric tons per mile for 345 kV line (1,735 $^{kgCO2e}/_{MWh\text{-}km}$ x 1 km x 1,000 MW x 0.6212 $^{miles}/_{km}$ / 1000 $^{kg}/_{metric\ ton}$). Total emissions for 2,160 miles of new transmission for the inland wind scenario would be 2,328,480 metric tons, or 7 kg per MWh of electricity delivered over a 25 year lifetime. (We omit emissions from local connector lines, which are relatively small and similar for all scenarios).
- Greenhouse gases from land clearing along ridges, access roads, and transmission lines take two forms: rapid losses due to converting standing forest to mulch and perhaps some wood products, and annual loss of future sequestration capacity. Forests above 2,000 feet elevation in northern New England have average above-ground forest carbon stocks of 141 metric tons CO_2e per acre, with average across all elevations at 126 metric tons.[57] Intact forests absorb about 2 metric tons CO_2e per acre per year, so loss of potential sequestration over 25 years of project life amounts to 50 more $^{tons}/_{acre}$. Clearing for turbines (4,955 acres), crane paths (1,990 acres) and access roads (230 acres) would be mostly at high elevation, while clearing for transmission lines (43,158 acres) would occur across all elevations. Carbon losses from clearing for wind facilities plus associated transmission would total about 358,649 $^{metric\ tons\ CO2e}/_{year}$ ([(7,175 acres x 191 $^{metric\ tons\ CO2e}/_{acre}$) + (43,158 acres x 176 $^{metric\ tons\ CO2e}/_{acre}$)] ÷ 25 years).

- Additional spinning reserves, plus lower efficiency for balancing sources (most likely natural gas plants) ramping up and down more frequently, result in additional emissions due to grid integration. Effects are incompletely understood, but they generally depend on wind variability, predictability, and correlation with load, the flexibility of generating sources already on the grid, and the potential for demand-response tools to help load track supply rather than vice versa. The New England Wind Integration Study (NEWIS)[58] estimates that spinning reserves would increase by about 3% of the nameplate capacity of wind (310 MW for 9,800 MW of wind) for New England as a whole. With a capacity factor of 30%, additional spinning natural gas would be about 11% of the wind power generated, which under our 25% scenario would emit 703,645 $^{\text{metric tons CO2e}}/_{\text{year}}$, or 2.5 times the emissions from manufacturing and construction.
- Total emissions from wind plus natural gas backup would be 1,284,843 $^{\text{metric tons CO2e}}/_{\text{year}}$.

Offshore Wind

- GHG emissions from manufacturing, construction, and maintenance of offshore turbines releases about 9-19 $^{\text{kgCO2e}}/_{\text{MWh}}$.[59] This scenario produces 182,625 metric tons CO_2e (14,048,051 MWh x 13 $^{\text{kg}}/_{\text{MWh}}$ ÷ 1,000 $^{\text{kg}}/_{\text{metric ton}}$) of new emissions from this source each year.
- Construction of 715 miles of new high-voltage lines would emit about 770,770 (1,078 metric tons/ mile x 715 miles), or 2 kg per MWh of electricity delivered over a 25 year lifetime.
- Emissions from land clearing would result only from transmission under this scenario. Clearing 13,000 acres for transmission lines would emit about 91,520 $^{\text{metric tons}}/_{\text{year}}$ (13,000 acres x 176 $^{\text{metric tons CO2e}}/_{\text{acre}}$) ÷ 25 years).
- As for onshore wind, additional spinning reserves plus lower efficiency for balancing sources ramping up and down require additional natural gas combustion, assumed at 9% of wind production (slightly lower than onshore due to less variable winds). 14,048,051 MWh x 0.09 x 504 $^{\text{kgCO2e}}/_{\text{MWh}}$ = 637,220 $^{\text{metric tons CO2e}}/_{\text{year}}$.
- Total emissions would be 913,670 $^{\text{metric tons CO2e}}/_{\text{year}}$ for offshore wind plus natural gas backup.

Woody Biomass Electricity

- GHG emissions from manufacturing, construction, and maintenance release 35-99 $^{\text{kgCO2e}}/_{\text{MWh}}$, so 8,418,127 new MWh of wood-fired electricity would emit about 496,670 $^{\text{metric tons CO2e}}/_{\text{year}}$.
- Construction and operation of connecting transmission would add minor amounts of new emissions.
- Assuming only half of new plants require site clearing, and including forest access roads and new transmission, land clearing would emit about 69,105 $^{\text{metric tons CO2e}}/_{\text{year}}$ ((9,816 acres x 176 $^{\text{metric tons CO2e}}/_{\text{acre}}$) ÷ 25 years).
- Additional GHGs from biomass combustion to produce incremental biomass electricity would total 12,315,720 $^{\text{metric tons CO2e}}/_{\text{year}}$ (1,463 $^{\text{kgCO2e}}/_{\text{MWh}}$ [60] x 8,418,127 MWh).
- Depending on the net climate impacts assumed for wood combustion emissions, total GHG emissions range from 565,964 to 13,477,648 $^{\text{metric tons CO2e}}/_{\text{year}}$. Assuming this source displaces all coal and oil capacity in these states plus 5 million MWh from Vermont Yankee, emissions displaced would be only 3,405,130, and wood use could actually more than triple the current level of emissions. The actual net effect depends on the source of wood and the fuel replaced. Most waste wood and tops from existing harvest would release their carbon relatively quickly if not burned for

energy, so emissions from these materials are merely accelerated by 10 to 30 years rather than representing totally new sources. Even emissions from newly-cut roundwood may be offset over time, *if* source forests are maintained in forest cover and well-managed so as to grow more quickly than unthinned forests, though the delay results in some warming effect. Accounting for reabsorption of carbon by forests, cumulative emissions from wood electricity remain about 124% higher than those from natural gas by 2050, but only 10% higher than those from coal.[61]

Regional Hydroelectricity

- GHG emissions from manufacturing, construction, and maintenance for hydroelectricity range from 1-34 $^{kgCO2e}/_{MWh}$, or 70,581 $^{metric\ tons\ CO2e}/_{year}$.
- Connecting transmission construction would add minor amounts of new emissions.
- Clearing for roads and penstocks would release greenhouse gases at about 8,019 metric tons CO_2e/year (1,139 acres x 176 $^{metric\ tons}/_{acre}$ ÷ 25 years). The new run-of-river generating facilities assumed in our scenario do not involve new impoundments, so there are no additional emissions from reservoir land clearing or outgassing.
- No additional spinning reserves are required since hydro is dispatchable on an hourly basis, despite seasonal capacity factor limits due to limited water supply.
- Total emissions from 4,033,207 MWh of new hydro generation to meet the 23% scenario are about 80,905 $^{metric\ tons\ CO2e}/_{year}$.

Canadian Hydroelectricity

- It is sometimes argued that no new net emissions would be incurred by purchasing electricity from existing hydroelectric facilities in Canada. However, incremental expansion in purchasing would presumably require added capacity, and we assume that new facilities will cause emissions at a similar rate per MWh generated (Figure 12) as those from existing operations. As for all scenarios, Table 11 applies this rate to only the incremental increase in electricity from this source.
- Manufacturing, construction, and maintenance emit 1-34 $^{kgCO2e}/_{MWh}$, with those from HQ probably toward the high end compared to the smaller regional hydro facilities. 8,052,051 $^{MWh}/_{year}$ of additional use would generate 161,041 $^{metric\ tons\ CO2e}/_{year}$ (8,052,051 MWh x 20 $^{kgCO2e}/_{MWh}$ ÷ 1000 $^{kg}/_{metric\ ton}$).
- We assume that new long-distance transmission larger than under the wind scenario at 765 kV and 2000 MW (see transmission notes under wind scenarios above). Emissions from construction and operation would be 1,393 metric tons per mile (1121 kg $^{kgCO2e}/_{MWh\text{-}km}$ x 1 km x 2,000 MW x 0.6212 $^{miles}/_{km}$ ÷ 1000 $^{kg}/_{metric\ ton}$). Total emissions from 360 miles of new line would be 501,480 metric tons, or 2.5 $^{kg}/_{MWh}$ of electricity delivered over 25 year line lifetime.
- Reservoir outgassing and carbon losses from cleared vegetation could be about 176 $^{kgCO2e}/_{MWh}$ for lands flooded within the past few decades. These emissions decline over time as reservoirs mature, so we include half this rate in the total, or 708,581 metric tons.[62] Emissions from clearing for transmission lines would total about 59,183 metric tons (7% of 26,596 acres for existing high-voltage transmission plus 6,545 acres of new transmission, divided by 25 year lifetime).
- Total emissions from 8,052,051 MWh of new HQ power would be about 961,578 $^{metric\ tons\ CO2e}/_{year}$.

Solar Photovoltaics

- Emissions from manufacturing and installation total 43-73 $^{kgCO2e}/_{MWh}$, for a total of 772,642 metric tons CO_2e (14,048,031 MWh x 55 $^{kg}/_{MWh}$ / 1,000 $^{kg}/_{metric\ ton}$).
- Since no land is cleared for solar farms, and location near load avoids new transmission investments, there are no associated emissions.
- As for wind, if solar PV reaches significant penetration there may be some emissions associated with balancing resources. On partly cloudy days, output from solar PV panels may ramp up and down by 50% within 30-90 seconds or 70% within 5-10 minutes.[63] Multiple installations are unlikely to be synchronized, however, so variability will decrease with diversity of locations. Solar is also better correlated with load, so integration effects should be considerably lower than those for wind. Data on integration needs for solar PV are scarce, but one study for southern Nevada estimates additional natural gas regulation needs for 21% large-scale and distributed solar at 4% of solar generation.[64] This would add about 283,208 $^{metric\ tons\ CO2e}/_{year}$ of natural gas emissions to the solar scenario.

Reduced Demand for Electricity

- Demand reduction reduces greenhouse gases more effectively than substituting new renewable sources, which all emit greenhouse gases at some level. Some tools, such as smart meters and energy efficient appliances, may release greenhouse gases during manufacture and transport. The process of discarding inefficient motors and appliances, and manufacturing and shipping new ones, will also generate greenhouse gases. Assuming that these effects are minor, there would be essentially no GHG emissions associated with this scenario.

Ground-Source Heat Pumps

- Emissions depend upon electricity sources, so these impacts would be reflected in the electricity sector. If 2050 electricity retained the 2010 emissions profile, this option would emit 2,380,019 metric tons CO_2e from electricity to run heat pumps. This assumes heat pumps generate 4 times as much heat energy as they require in electrical energy. 91.5 trillion Btu heat would require 22,875,000 MMBtu ÷ 3,412 $^{MMBtu}/_{GWh}$ = 6704 GWh x 355 $^{metric\ tons}/_{GWh}$ for current electricity mix). A shift toward non-fossil electricity sources would further reduce emissions. The area disturbed for horizontal systems would likely already be cleared, so we assume no emissions from land clearing.

Wood Heat

- Bringing wood heat up to 25% of the total would require 61.8 trillion Btu of additional wood heat (which requires 77.3 trillion Btu of wood at 73% conversion efficiency). Analysis for the Northeast/MidAtlantic Low Carbon Fuel Standard estimated indirect pellet emissions at 11 to 18 g/MJ (average 15 $^{kg}/_{MMBtu}$), so indirect emissions from pellets would be about 565,905 metric tons CO_2e (61,847,564 MMBtu x 0.61 portion of heat x 15 $^{kg}/_{MMBtu}$ ÷ 1,000 $^{kg}/_{metric\ ton}$). Indirect emissions from firewood and chips are much lower at about 2-4 $^{kg}/_{MMBtu}$ of combustion emissions, about 72,362 metric tons CO_2e (61,847,564 MMBtu x 0.39 portion of heat x 3 $^{kg}/_{MMBtu}$ ÷ 1,000 $^{kg}/_{metric\ ton}$), so total indirect CO_2e emissions from wood heat would be 638,267 metric tons CO_2e, similar to indirect oil emissions of 605,238 metric tons.

- Assuming half of new plants require site clearing, and including new forest access roads, land clearing would emit about 58,214 $^{\text{metric tons CO2e}}/_{\text{year}}$ ((8,269 acres x 176 $^{\text{metric tons CO2e}}/_{\text{acre}}$) ÷ 25 years).
- Direct GHG emissions from wood combustion are approximately 105 $^{\text{kg}}/_{\text{MMBtu}}$, or about 8,895,882 $^{\text{metric tons CO2e}}/_{\text{year}}$. The ultimate atmospheric impact of this burst of new wood emissions depends upon whether they would have occurred fairly soon anyway if not used for energy, and whether source forests rapidly reabsorb the carbon emitted through combustion. According to Manomet modeling under Massachusetts conditions, replacing oil with wood heat results in a cumulative reduction in net direct+indirect emissions of about 20% by 2050, a bit less using pellets due to higher indirect emissions.[65] On this basis, expanded wood heat reduces overall 2050 GHGs by about 1,183,900 metric tons CO_2e.

Reduced Demand for Heat

- According to a Vermont study, achievable cost-effective demand reduction for heating and process energy over 10 years can reduce GHG emissions by 0.067 $^{\text{metric tons CO2e}}/_{\text{MMBtu}}$ saved.[66] (Wood energy savings are not considered to generate emissions reductions since wood combustion is assumed carbon neutral. This result underlines the absurdity of the carbon neutrality assumption, since clearly burning less wood will reduce CO_2 emissions to some extent). If efficiency measures target households currently using oil heat, total reductions for this scenario would be about 6,137,200 metric tons CO_2e (91,600,000 MMBtu reduction x 0.067). Our emissions reduction figure assumes that oil heat is targeted first, so it reflects a full reduction in oil heat emissions.

Electric Vehicles

- Electric vehicle emissions depend on how the electricity is generated, so these effects are captured in the expanded electricity sector. If electricity sources stayed the same as the 2010 mix, this option would emit about 5,205,696 metric tons CO_2e associated with the electricity used (150,100,000 MMBtu ÷ 3 (reflects improved vehicle efficiency) ÷ 3,412 $^{\text{MMBtu}}/_{\text{GWh}}$ x 355 $^{\text{metric tons}}/_{\text{GWh}}$). If electricity sources shift toward fewer fossil fuels, emissions from this scenario would be lower. These emissions do not include those from energy embedded in vehicles and fueling/charging equipment.

Wood-Based Biofuels

- Analysis for a proposed Northeast/Mid-Atlantic Clean Fuels Standard reported the following life-cycle emissions rates for fuels from forestry residue: ethanol from fermentation -4.4 $^{\text{g}}/_{\text{MJ}}$ (-5 $^{\text{kg}}/_{\text{MMBtu}}$) and ethanol from gasification +9.9 $^{\text{g}}/_{\text{MJ}}$ (+10 $^{\text{kg}}/_{\text{MMBtu}}$), or about 97,821 metric tons CO_2e per year (39,128,236 MMBtu x 2.5 $^{\text{kg}}/_{\text{MMBtu}}$ ÷ 1,000 $^{\text{kg}}/_{\text{metric ton}}$). (Negative values reflect the fossil-displacement benefits of electricity produced along with the biofuels.) These emissions estimates may not fully reflect the long distances that wood needs to be transported to fuel such large facilities.
- Assuming half of new plants require site clearing, and including new forest access roads, land clearing would emit about 57,950 $^{\text{metric tons CO2e}}/_{\text{year}}$ ((8,231 acres x 176 $^{\text{metric tons CO2e}}/_{\text{acre}}$) ÷ 25 years).
- These values exclude direct emissions from combustion of wood and its byproducts. Assuming complete combustion at some point along the processing chain, a given mass of wood should emit the same amount of GHGs – though proportion of methane may vary. It takes approximately 2.3

Btu of wood to make 1 Btu of biofuel, and applying the standard wood combustion emissions factor to the total wood combusted during manufacturing and in final use yields direct emissions of 9,337,420 metric tons (39,128,236 MMBtu x 2.27 x 105 $^{kg}/_{MMBtu}$ ÷ 1,000 $^{kg}/_{metric\ ton}$). Emissions from the equivalent amount of gasoline and diesel would be about 3,342,803 metric tons CO_2e (85 and 87 $^{kg}/_{MMBtu}$ for gasoline and diesel).[67]

- As for electricity and heat, forest carbon absorption mitigates short-term emissions over time. Since the Manomet report did not model liquid fuels, we use a source from Finland that directly compares life-cycle global warming impacts from fossil and wood-based transportation fuels over time, including adjusting for changes in forest carbon (since forest conditions in Finland and New England differ considerably, this should be taken as a rough approximation only).[68] At 40 years after the start of production, diesel from forest residues reduces climate impacts by about 10% compared to fossil diesel. Applying this same relative reduction to ethanol and roundwood feedstocks likely exaggerates biofuel benefits, though the biofuel advantage increases in years after 2050. Using these figures, net biofuel GHG emissions might be about 3,008,523 $^{metric\ tons\ CO2e}/_{year}$, a reduction of 334,280 metric tons compared to gasoline and diesel.

Reduced Demand for Transportation

- Reducing transportation fuel use by 75.2 trillion Btu will reduce emissions by 6,428,468 $^{metric\ tons\ CO2e}/_{year}$.

Appendix 5: Estimating Financial Costs

Levelized costs for construction and operation are taken from the 2012 Annual Energy Outlook produced by the US Department of Energy, Energy Information Administration, including regional adjustments.

Inland Wind

Average national inland wind costs projected for 2017 are $0.097/kWh in 2010 dollars (omits the effect of federal tax credits since this is also a cost to society).[69]. Adjusting this national estimate for the 5% cost differential for Vermont, New Hampshire and Maine yields a regional cost of $0.102/kWh, though wind cost surveys by the National Renewable Energy Laboratory find northeast differentials as high as 20%[70]. This includes the cost of local transmission connection, but does not include the cost of major long distance transmission upgrades nor the effects of curtailment at high penetration levels. At about $11 billion for high-voltage lines, amortized over 25 years, transmission costs would add another $0.03/kWh to wind power costs. There will be additional costs associated with more spinning reserves and frequent ramping up and down of balancing resources, with higher prices needed to induce natural gas plants to play that role. 2010 wind projects cost 65% more per installed kW than those built from 2001 to 2004 (installed cost is a better indicator than wind power price, since the price is artificially suppressed by public subsidies), but costs declined in 2011. Operations and maintenance costs generally increase as plants age, but recently constructed facilities seem to have lower operating costs at the same plant age compared with wind farms installed in earlier years.[71]

Offshore Wind

Total levelized costs for offshore wind for 2017 are projected at $0.22/kWh in 2010 $ (omits effect of federal tax credits since this is also a cost to society).[72] The DOE estimates are based on fixed foundation turbines. DeepC Wind's goal is to produce power at $0.10/kWh by 2020, exclusive of transmission (the floating design lowers cost by building and maintaining in port and towing to sea).[73] 1 GW projects, unless connected at existing high-capacity sites such as the former location of Maine Yankee, would require considerable transmission investments. Connecting transmission is included in DOE cost estimates, though long-distance transmission upgrades are not. 705 additional miles of high-voltage transmission would add about $0.01/kWh to offshore wind electricity costs.

Woody Biomass Electricity

U.S. DOE projects levelized costs of biomass electricity in 2017 at $0.11/kWh in 2010 $ (omits effect of federal tax credits since this is also a cost to society).[74] Since fuel costs are a significant factor, costs will vary regionally, and this figure reflects costs for Vermont, New Hampshire and Maine at about 5% below the national average.

Regional Hydroelectricity

National projected 2017 costs for hydroelectricity are $0.09/kWh in 2010 $ (omits effect of federal tax credits since this is also a cost to society).[75] Since this national average is based on a very large conventional dam, we adjust the estimate upward to $0.13 to reflect higher regional costs and micro-hydro designs. A recent Vermont study found costs for hydropower (project development and

construction only) at several existing dams in New England ranging from about $0.11 to $.13/kWh.[76] We assume that micro-hydro installations would have a similar cost.

Canadian Hydroelectricity

The current Vermont contract with Hydro Quebec starts at a price of $0.058 per kWh in 2012, and adjusts up and down with the market at a limited rate. HQ also sells energy on the region's spot market, and charges a 10% premium for responding to emergency needs. Since the major positive role for this power in the future could be to help balance intermittent renewables, we've applied that price premium to the estimated cost. The other scenarios use 2017 cost projections, but low natural gas prices are expected to keep electricity prices from climbing so we assume 2017 prices will be similar to 2012. $2.2 billion for two new high-voltage power lines with a 25 year lifetime would add $0.006/kWh ($2,200,000,000 ÷ (25 x 14,048,051,000 kWh)), bringing the price to $0.07/kWh.

Solar Photovoltaics

$0.19/kWh in 2010 $ projected for 2017 (omits effect of federal tax credits since this is also a cost to society).[77] Because the EIA assumes very large centralized utility-scale solar farms, while our scenario calls for small distributed facilities, we omit the transmission portion of EIA's levelized cost for solar. Note that the cost of solar panels has been dropping dramatically in recent years with increased volume manufactured in China, though tariffs and dumping penalties may remove that cost advantage. Between 1998 and 2010, total installed costs of PV systems in the U.S. dropped 43% in real terms, from $11/kW to $6.20/kW (2010 dollars). U.S. prices remain considerably higher than those in countries with more established demand, indicating the potential for further cost savings.[78] If these trends continue, the price/kWh for solar is likely to become competitive with other sources during the next decade. As for wind, grid integration will require some additional reserves to stabilize the system, which raises overall costs at high levels of penetration. A widely distributed system has pluses and minuses – diverse locations will dampen variations in total output, but managing thousands of small grid-tied systems will be more difficult than regulating a few key sources.

Reduced Demand for Electricity

Recent demand-reduction measures financed by Efficiency Vermont and Efficiency Maine have cost about $0.03 to $0.04/kWh to-date and Vermont, New Hampshire and Maine could achieve 19-21% reductions in electricity demand by 2018 through additional cost-effective measures.[79] ISO-NE energy efficiency modeling predicts that the costs of demand reduction will rise over time to $0.044 (NH), $0.0485 (ME) and $0.0580 (VT) by 2021 – with Vermont's cost highest due to its higher past investment and hence saturation of the less expensive options.[80] A New Hampshire study predicts that marginal costs per kWh increase abruptly to over $0.20/kWh for conservation measures beyond a 20% demand reduction.[81] Behavioral changes that lower energy demand may save rather than cost money, but may have nonfinancial costs in terms of comfort or convenience.

Ground-Source Heat Pumps

A ground-source heat pump installation for one home using 100 MMBtu of heat annually costs about $30,000, plus electricity costs for about 25% of the total heat energy used. Assuming equipment lifetime of 25 years, heat would cost approximately $11/MMBtu for capital costs and $11/MMBtu for

operating, or $0.08/kWh-equivalent. This is lower than the cost of oil heating oil heating at $35/MMBtu ($3.60/gallon at 83% efficiency plus $8,000 capital cost over 20 years).

Wood Heat

The majority of wood heat costs are for equipment – pellet boilers and furnaces generally cost about $15,000 (about $7 per MMBtu over equipment life) compared to $3,000 for a woodstove (about $1/MMBtu), $8,000 for oil or $5,000 for propane (about $2-3 per MMBtu).[82] Annual wood fuel costs will generally be lower than fossil fuel costs, and the savings will likely increase over time as fossil energy costs rise. Firewood at $200 a cord costs $9.50/MMBtu, pellets at $250/ton cost about $18/MMBtu and oil at $3.60/gallon costs about $31/MMBtu. In kWh equivalents the cost of wood heat would be $0.08 and $0.04/kWh. With equipment costs spread over 20 years plus fuel costs, firewood saves about $22/MMBtu and pellets $9/MMBtu compared to the cost of oil.

Reduced Demand for Heat

The financial costs of reducing demand for space heat or process energy are largely from renovation of existing buildings, equipment replacement, and improved energy performance for new buildings and equipment. An efficiency study for Vermont estimates that non-electricity efficiency programs can achieve savings of 25.6 trillion Btu at a cost of $241 million in private and public investment over 10 years, or $9.41 per MMBtu. Since the lifetimes vary for the various investments involved, it is difficult to compare costs directly to those for new energy supply. However, converting to electricity equivalents at 1 MMBtu = 293 kWh, the cost of demand reduction for heat is about $0.032 per kWh, very similar to the cost of electricity demand reduction and much less than new supply.

As for electricity savings, costs rise rapidly once reductions reach a certain threshold. In Vermont, this threshold occurs for residential heat at about 22% savings and $30/MMBtu for oil, at 16% savings and $45/MMBtu for propane, and at 45% savings and $15/MMBtu for wood (reflecting the number of inefficient wood stoves in circulation). Corresponding break points are higher for the commercial sector (35% oil, 30% propane) and no supply curves were provided for the industrial sector.[83]

Electric Vehicles

Economic studies for the proposed Northeast/MidAtlantic Clean Fuel Standard estimated the costs of converting to electric vehicles over 10 years. The infrastructure cost (including home and commercial vehicle chargers and grid upgrades) averaged across all scenarios was $.046/kWh. Electric vehicles may cost up to $5,000 more than conventional, so a car using 5,000 kWh/year with a 10-year vehicle life could add another $0.10/kWh.84 Some conversion costs are one-time, and others will decline with market penetration for electric vehicles so costs should decline over time (for this limited modeling over just 10 years maximum fleet conversion for any scenario was 21%). Cost in kWh equivalents would be $0.146.

Wood-Based Biofuels

Economic analysis for the NE/MA Clean Fuel Standard predicts that the costs per gallon of cellulosic ethanol and biodiesel (on a gasoline-gallon-equivalent basis that accounts for lower energy content of biofuels) will be about the same or lower than the cost of gasoline or diesel through 2022. Costs of

converting to biofuels would include capital costs for the refineries, duplicate tanks for gas stations, and the cost of converting vehicles to burn higher mixes or pure biofuels. These costs, per MMBtu of biofuels used, average $17/MMBtu, or $0.06/kWh equivalent, across all scenarios.

Reduced Demand for Transportation

Conventional vehicles with higher mpg may require higher capital costs. Reducing miles traveled, on the other hand, will save money compared to the status quo – though it may come at the cost of some personal convenience or time. Since this option perhaps more than any other relies on behavioral changes and consumer choices rather than investments in new equipment, it is difficult to estimate net costs or savings.

End Notes with Citations

[1] It is also consistent with ISO-NE modeling of wind integration at 20-24% of New England's electricity. Some in-region energy resources (hydroelectricity and woody biomass for electricity and liquid fuels) are not sufficient to reach 25%, so those scenarios fall slightly below that target.

[2] Utility regulators and planners tend to consider only emissions externalities, a hold-over from the days when generation was dominated by combustion. See, for example, the discussion of externalities in Hornby, Rick, Chernick, Paul, Swanson, Carl, White, David, Gifford, Jason, Chang, Max, Hughes, Nicole, Wittenstein, Matthew, Wilson, Rachel and Biewald, Bruce. July 21, 2011 amended August 11, 2011. Avoided Energy Supply Costs in New England: 2011 Report. Synapse Energy Economics, Inc. pp. 6-89 to 6-101. Since renewable technologies generate new types of externalities, regulatory processes and policy's favoring particular alternatives will need to expand the range of environmental effects considered.

[3] Globally, one estimate placed the global value of ecosystem services at about $33 trillion compared to global gross national product of $18 trillion (Constanza, R. Robert Costanza, Ralph d'Arge, Rudolf de Groot, Stephen Farberk, Monica Grasso, Bruce Hannon, Karin Limburg, Shahid Naeem**, Robert V. O'Neill, Jose Paruelo, Robert G. Raskin, Paul Sutton & Marjan van den Belt. 1997. The value of the world's ecosystem services and natural capital. Nature 387:253-360). A similar analysis estimated the value of ecosystem services in Maine at $14.7 billion – compared to gross state product of $51.6 billion – but this estimate excluded "existence values" which do not depend on direct human uses (Troy, Austin. April, 2012. Valuing Maine's Natural Capital. Spatial Informatics Group, LLC for Manomet Center for Conservation Sciences, http://www.manomet.org/sites/manomet.org/files/reports/Troy_2012_Value_of_Maine.pdf) .

[4] Hooper, D.U., Adair, E.C., Cardinale, B.J., Byrnes, J.E.K., Hungate, B.A., Matulich, K.L., Gonzalez, A., Duffy, J. E., Gamfeldt, L., and O'Connor. M.I. 2012. A global synthesis reveals biodiversity loss as a major driver of ecosystem change**.** Nature*,* DOI: 10.1038/nature11118

[5] This is total primary energy used to generate the electricity, not the actual electrical energy used, which is only 94 trillion Btu or 27,483 GWh in 2009 (EIA SEDS Table C5-C7). Electricity is extremely inefficient at energy conversion and distribution (about 32% of primary energy). Motor vehicle engines may be only about 14-26% efficient (http://www.fueleconomy.gov/feg/atv.shtml) – which makes overall efficiency very to electric generation efficiency, while heat is typically about 60-90% efficient. Since the electricity system losses occur largely prior to the point of sale to the end user, while the transport and thermal losses occur after sale, it can be confusing to compare energy use across these sectors.

[6] US Department of Energy, Energy Information Administration. Annual Energy Outlook 2012 Early Release. The ISO New England Regional System Plan for 2012 projects similar rates of increase from 2012 to 2022 for electricity: 0.6% for Vermont, 1.2% for New Hampshire, and 0.9% for Maine (ISO-NE Regional System Plan 2012. Table 3-1, p. 30, Summary of Annual Electric Energy Use and Peak Demand for New England and the States, www.iso-ne.com/trans/rsp/2012/rsp_Final_110212.docx.)

[7] Total energy used to generate electricity grows less than use – at 0.65% annually) because of lower losses (68% in 2010 down to 66% in 2035).

[8] This rate of increase in transportation energy does not account for recently-revised fuel economy standards for light duty vehicles 2017 and later. This rule is estimated to result in transportation emissions that are 10% lower by 2035 compared to the reference case without the new CAFÉ standards (EIA Annual Energy Outlook 2012, p. 31). Our transportation demand reduction scenario might include improved fuel efficiency standards as part of the overall 25% reduction in transportation energy use, even in the face of growing population and vehicle numbers.

[9] Rate of increase for nonelectric assumes that use by sector grows at the same rate nationally and as for nonelectric portion of total at the state level (0.1% residential, 0.68% commercial, 0.57% industrial). Growth rate is applied separately to each state based on nonelectric for each sector, and weighted average annual rate of increase is calculated.

[10] These are ambitious but feasible goals for 2050. Electric vehicles are about 60-80% efficient since they generate little waste heat - Energy Economy Ratio of 3.0, from CAR – Andress et al. 2011) and ground source heat pumps are about 200-300% efficient since they tap "free" ground heat. So converting these uses to electricity actually reduces "otherwise" energy use, though to the extent low-conversion fossil electricity is still used this advantage disappears in the energy losses where electricity is made plus line losses.

[11] Conversion assumes electric cars are 3 times more efficient than gasoline/diesel and heat pumps generate 4 times the heat energy they use as electricity. These efficiencies may be a slight stretch with today's technology, but should be feasible by 2050.

[12] Multiply by 0.32 for current conversion efficiency and convert trillion Btu to GWh by multiplying by 293.

[13] Moore, James. 2009. Repowering Vermont: Replacing Vermont Yankee for a Clean Energy Future. Vermont Public Interest Research Group. GE Energy Applications and Systems Engineering, EnerNex Corporation, AWS Truepower. December 5, 2010. New England Wind Integration Study.

[14] AWS Truepower resource mapping includes all developable land with capacity factor 30% or greater, and does not account for feasible locations with concentrated potential as the EWITS and NEWIS sites do, nor for environmental or social impacts. We assume a 30% capacity factor rather than the one indicated for each site based on actual wind farm performance in the northeast to-date, and to reflect the likelihood that capacity factors will be limited at high penetration levels due to grid integration challenges. EWITS and NEWIS theoretically identify feasible locations, and minimally address environmental and social impacts by eliminating parks and wilderness, very steep sites, wetlands, and NEWIS also filters out sites near the AT.

[15] Since wind in this region is most abundant in winter and at night, meeting 25% of the region's *summer peak* load would require much greater installed capacity at about 15,868 MW. In order for wind to meet 25% of hourly *peak* use, we need to account for the hourly peak being 88% higher than average annual use (based on the one-hour summer peak in 2011 as a percent of average annual capacity used – GWh divided by hours in the year). Wind also has a lower capacity factor during the summer – from 30% average down to 19%. This discrepancy between average and peak needs is smaller for other renewables. Biomass is generally dispatchable on demand, hydro has a smaller difference in capacity factor from summer to winter, and solar's seasonal capacity factor is better correlated with seasonal demand.

[16] 11,596 MW of offshore wind capacity would be needed to generate 25% of summer one-hour peak load. The increased capacity for hourly peak versus average load is less than for on-shore wind due to higher offshore summer capacity factors.

[17] Capacity factors for New England hydro - 44.9% winter, 41.1% summer, 43.3% annual - from U.S. EPA. August, 2010. Documentation for EPA Base Case v.4.10 - Using the Integrated Planning Model, Table 3-8 p. 3-13, http://www.epa.gov/airmarkets/progsregs/epa-ipm/BaseCasev410.html. These capacity factors are higher than those assumed by ISO-NE for New England hydro (25%). It would require about 4,200 MW of hydro capacity to generate 25% of summer one-hour peak load. Despite lower summer capacity due to reduce water flow, hydro can be scheduled to meet daily peaks even during those summer months, so the excess capacity needed for summer peaking is less than for wind, or even solar. Only the seasonal, not the daily, peaks are a factor.

[18] 15,074 MW of panels would be needed to meet 25% of one-hour summer peak load. As for the wind calculations, peak one-hour load in summer is about 1.88 times annual average load, but solar summer capacity is about 1.48 times higher than winter, so peak capacity for this technology would need to be about 1.27 times average as opposed to wind at 3 times average.

[19] New sites were those identified by an eastern wind integration study, and were chosen in order by capacity factor (EnerNex Corporation. February 2011 (revised). Eastern Wind Integration and Transmission Study (EWITS). Prepared for National Renewable Energy Laboratory. Sites with latitude and longitude - http://www.nrel.gov/wind/integrationdatasets/eastern/methodology.html). EWITS used AWS Truepower wind potential maps to identify potential commercial sites with 100-1,435MW of capacity, excluding areas of open water, wetlands, parks, steep slope, non-public federal lands (sic?), CBI GAP categories, 1, 2, 7 and 8, airports and developed areas with buffer zones. A second study conducted for ISO-NE focused more narrowly on wind integration in New England (GE Energy Applications and Systems Engineering, EnerNex Corporation, AWS Truepower. December 5, 2010. New England Wind Integration Study (NEWIS)). NEWIS developed a New England Wind Resource Area Model (NEWRAM) from the larger 3,000MW of candidate sites from EWITS rather than the final 580GW set in order to filter by regional priorities rather than east-wide ones (included sites at class 3 or higher wind speed and eliminated sites above 3,000 feet or near AT or Long Trail). 164 more candidate onshore sites were identified in New England (including 107 more in Maine to total 149, 5 more in NH to total 26, and 18 more in VT to total 35). These added sites increased available inland wind from 14.4 GW to 35.6 GW (added 13,624 MW in ME, 585 MW in NH, 2,135 MW in VT but many sites were also excluded due to proximity to long-distance trails). Geographic locations in NEWRAM are not publicly available, so this paper uses EWITS sites.

[20] To meet hourly summer peak capacity targets at 25% would require 87 additional sites with 10,501 MW of total capacity (shown in yellow on the map below). Impacts for this peaking scenario would generally be about 3 times those for the 25% average power scenario but have not been described in detail in this section. Due to its intermittent nature, wind is unlikely to serve as a peaking resource.

[21] Publicover, David A., Kimball, Kenneth D. and Poppenwimer, Catherine J. 2011. Ridgeline Windpower Development in Maine Appalachian Mountain Club Technical Report 11-1, pp. 21 and 23 and Map 4.

[22] Average direct impact area for all projects surveyed by NREL was 1.0 acres; average for single-string projects was 1.34 acres. Denholm, Paul, Hand, Maureen, Jackson, Maddalena, and Ong, Sean. 2009. Land-Use Requirements of Modern Wind Power Plants in the United States. Technical Report NREL/TP-6A2-45834. Table 1, p. 10 and Table 6, p. 22.

[23] As for inland wind, meeting 25% of peak needs from offshore wind would require considerably more capacity at about 11,596MW, but wind is unlikely to meet peaking needs.

[24] University of Maine and James E. Sewall. December 2011. Maine Deepwater Offshore Wind Report.

[25] U.S. Department of Energy. 2011. *U.S. Billion-Ton Update*: *Biomass Supply for a Bioenergy and Bioproducts Industry*. R.D. Perlack and B.J. Stokes (Leads), ORNL/TM-2011/224. Oak Ridge National Laboratory, Oak Ridge, TN. 227pp. This source is used because it provides the most recent county-level estimates for the entire country. Nonetheless, there are important limitations

and these should be treated as very optimistic estimates. There are no restrictions due to landowner intentions, although woodlot owner surveys indicate that most owners in this region have no intention to harvest at all – inclination to conduct whole-tree harvests for relatively low-value wood is likely to be even lower. Land base restrictions removed only parks and wilderness from forest eligible for harvest, with some minor limitations on quantity due to distance from road and steep terrain – and no restrictions for wetlands beyond possibly limited inventory indicated by FIA plot data. Logging residue estimates are from Timber Product Output data, which are derived from harvest volume estimates, measurements at sample harvest sites, and mill surveys. The latter two sources are considerably out-of-date for many states and likely do not reflect recent increases in utilization of previously non-commercial tops and cull trees due to developing energy markets. Available primary mill residues are also from TPO data that are likely outdated. Because of these data limitations, the BTS update may overestimate all sources of available residues, from logging to mill. Data are lacking on secondary residues, BTS does not explain the derivation of state-level estimates, and no county-level data are provided, so this source has been omitted. Construction and demolition debris and municipal solid waste are also excluded here since they are not directly related to local forest capacity, there are sorting and transport challenges, and combustion of these materials is controversial. County level secondary mill, construction/demolition, and municipal wood wastes as a percent of total BTS wood feedstock estimates range from 3% (Aroostook) to 33% (Knox) in Maine, 14% (Coos) to 57% (Strafford) in New Hampshire, and 20% (Windham) to 92% (Grand Isle) in Vermont, so if these materials are truly available and could be used responsibly they would substantially expand biomass energy capacity in some counties. The thinning regime for BTS integrated operations assumes that half of non-reserved forestland with density at 30% of the theoretical maximum for that forest type will be thinned (across all tree diameters down to 1") down to 30% of the maximum stand density over 30 years. (Integrated operations are described as "restoration harvests" but are not restricted to fire-prone systems with unnaturally dense stands. The future of this feedstock source after year 30 is not addressed – if these are truly "restoration" thinnings, they should not need to be repeated at frequent intervals). Unroaded areas are included in estimates, though cutting in these areas would occur only at higher wood prices. Since the economics of these operations depend on harvesting larger trees, integrated harvest is restricted so that pulp/sawlog material is limited to 2006 state harvest volumes (assumed to increase over time) This restriction is not limiting for Maine, but it causes New Hampshire's supply to be only 64% and Vermont's only 82% of its modeled quantity for composite operations in 2012 at $100/dry ton, with the discrepancy likely much less by 2030 since processing capacity is assumed to expand over time).

[26] Total harvest volume is currently about 19.9 million green tons for the three states. Maine = 14.59 million green tons (Maine Wood Processor Report 2010); Vermont = 2.46 million green tons (Vermont Forest Resource Harvest Report, 180,184 Mbf logs + 148,846 cords pulp + 401,245 green tons chips + 788,000 green tons firewood from 2008); New Hampshire = 2.8 million (Northeast State Foresters Association. 2011. The Economic Importance of New Hampshire's Forest-Based Economy).

[27] According to a recent USDA Forest Service technical report on northern U.S. forests[27] "demand for renewable energy could lead to integrated forest management practices designed to supply renewable woody bioenergy feedstock while simultaneously improving forest health and wildlife habitat, or short-term excessive wood removal for energy could create undesirable consequences for long-term forest sustainability." The growth:removals ratio in 2007/8 was 1.0 for Maine, 1.1 for New Hampshire, and 1.7 for Vermont; these state-wide figures include lands not actively managed for timber where removals are negligible so actively managed lands, at least in Maine and New Hampshire, are likely already seeing an unsustainable level of removals.

[28] From a 2008 EPA Region 1 data source showing FERC hydropower projects in New England, http://www.epa.gov/solar/energy-and-you/affect/hydro.html .

[29] ISO-NE Seasonal Claimed Capability Report, November 1, 2012, http://www.iso-ne.com/genrtion_resrcs/snl_clmd_cap/index.html .

[30] FERC Complete List of Issued Licenses and Issued Exemptions, http://www.ferc.gov/industries/hydropower/gen-info/licensing.asp. Exempt dams have less than 5 MW capacity at a pre-existing dam.

[31] Small hydro sites were identified by analyzing the hydraulic head (vertical drop) and flow for stretches of stream defined by typical regional penstock length. All stream reaches with power potential >10kWa were candidates. Sites were classified as small hydro (1 to 3MWa), low power (100kWa to 1MWa) - conventional (>8 feet of head) or unconventional (<8 feet of head), or microhydro (10 to 100kWa). Capacity was rated as annual mean power based on the available water resource (MWa) - annual mean flow and hydraulic head, restricted to a practical % of flow used (50% or less if sufficient to generate 30MWa since this is the small hydro definition) and practical penstock length (based on typical lengths for existing plants in region, 2,000 feet low power and 4,000 feet small hydro for New England region). The study eliminated sites where land use designation makes development unlikely and those >1 mile from roads or power infrastructure or too distant from population centers (regional measure from existing plants). U.S. Department of Energy (DOE). January 2006. Resource Assessment Report - Feasibility Assessment of the Water Energy Resources of the United States for New Low Power and Small Hydro Classes of Hydroelectric Plants, DOE/ID-11263. http://hydropower.inl.gov/resourceassessment, accessed 12/15/10. Appendix, Assessment Results by State.

[32] U.S. Department of Energy Energy Information Administration. 2010. State Electricity Profiles, http://www.eia.gov/electricity/state/, accessed 5-24-12.

[33] Evans, Jeffrey W., Kiesecker, Joseph M., Fargione, Joseph, Doherty, Kevin, Foresman, Kerry R., Naugle, David E., Nibbelink, Nathan P., and Niemuth, Neal. Using Human-Induced Disturbance to Balance Conservation and Future Development. Running title: Disturbance, Conservation and future development,

[34] Vermont Department of Public Service. 2011 Vermont Comprehensive Energy Plan, www.vtenergyplan.vermont.gov. ISO-NE projects load growth over the next decade at 0.8% for Maine and 1.5% for New Hampshire (ISO-NE state profiles (ISO-NE. 2011 Regional System Plan, www.iso-ne.com/trans/rsp/2011/rsp11_final_102111.doc).

[35] U.S. Department of Energy, Energy Information Administration. State Energy Data System, http://205.254.135.7/state/seds/

[36] Energy Information Administration, Office of Energy Consumption and Efficiency Statistics. 2012. Table HC10.10 Average Square Footage of Northeast Homes, By Housing Characteristics, 2009. Data from forms EIA-457 A and C of the 2009 Residential Energy Consumption Survey.

[37] U.S. Energy Information Administration. January 2012. State-Level Energy-Related Carbon Dioxide Emissions, 2000-2009.

[38] Non-CO_2 emissions from energy-related combustion were 6% of CO_2 emissions nationally in 2010. US EPA. April 15, 2012. Inventory of U.S. Greenhouse Gas Emissions and Sinks, 1990-2010, http://www.epa.gov/climatechange/emissions/usinventoryreport.html.

[39] Indirect emissions are about 3% of coal combustion emissions, 18% of oil, and 26% of natural gas (Manomet Center for Conservation Sciences. 2010. Massachusetts Biomass Sustainability and Carbon Policy Study: Report to the Commonwealth of Massachusetts Department of Energy Resources. Walker, T. (Ed.). Contributors: Cardellichio, P., Colnes, A., Gunn, J., Kittler, B., Perschel, R., Recchia, C., Saah, D., and Walker, T. Natural Capital Initiative Report NCI-2010-03. Brunswick, Maine, Exhibit 6-6). The three northern New England states used about 6% of their fossil energy as coal, 71% as petroleum, and 23% as natural gas. Weighted average indirect emissions were thus about 19% of direct combustion emissions.

[40] The increase through 2050 is based on energy demand increases assumed for our scenario – see note

[41] GE Energy Applications and Systems Engineering, EnerNex, and AWS Truepower. December 5, 2010. New England Wind Integration Study. For ISO-NE.

[42] Average lifecycle GHG emissions for electricity generation in the U.S. are about 731 kg CO2e/MWh, and transmission adds 23 to 77 more kg/MWh, depending on type of transmission (Itten, René, Frischknecht, Rolf, and Stucki, Matthias. July, 2012. Life Cycle Inventories of Electricity Mixes and Grid. ESU-services Ltd. for Paul Scherrer Institut (PSI), Uster, http://www.ecolo.org/documents/documents_in_english/Life-cycle-analysis-PSI-05.pdf , Tables 5.1 to 5.4).

[43] These are conservative assumptions, as spacing is based on a mix of turbine sizes in current projects. Larger turbines would likely require greater distance between turbines, but large turbines and large numbers of turbines per site will both minimize number of developed sites and hence total landscape disturbance.

[44] Kingdom Community Wind clears 2.3 acres per 3MW turbine pad; Bowers wind would clear 2.25 to 3.3 acres per 3MW turbine pad; Spruce Mountain cleared 1 acre per 2MW turbine pad.

[45] Spruce Mountain estimates 100 cubic yards of concrete for each 2 MW turbine, which may be minimized by tying in to ledge; Dry Lake in Arizona estimates 386 cubuc yards for 2.1MW turbines; Elkhorn Valley Wind Farm 243 cuyds for 1.65MW turbines, Kittitas Valley Wind Farm in Washington largest foundation 340 cuyds for 2MW turbine, Antelope Ridge estimated 400 cuyd for 3MW turbine.

[46] ISO New England. February, 2010. New England 2030 Power System Study: Report to the New England Governors. 2009 Economic Study: Scenario Analysis of Renewable Resource Development.

[47] Project permits and Denholm, Paul, Hand, Maureen, Jackson, Maddalena, and Ong, Sean. 2009. Land-Use Requirements of Modern Wind Power Plants in the United States. Technical Report NREL/TP-6A2-45834. Table 6, p. 22.

[48] Maine Office of Energy Independence and Security. April, 2011. Tracking Progress Toward Meeting Maine's Wind Energy Goals, Including and Examination of Current Wind Energy Noise Guidelines and the Opportunity for Public Hearing, http://www.maine.gov/oeis/docs/FINAL%20Wind%20Tangilble%20Benefits%20and%20Noise%20Regulation%20Report%204_11.pdf.

[49] See, for instance, David E. Capen, Core Habitat data layer for Vermont, 2005, and Massachusetts Division of Fisheries and Wildlife interior forest GIS dataset, 2009.

[50] Maine Wood Processor Report 2010 ; Vermont Forest Resource Harvest Report 2010 (180,184 Mbf logs + 148,846 cords pulp + 401,245 green tons chips + 788,000 green tons firewood from 2008 survey), Northeast State Foresters Association. 2011. The Economic Importance of New Hampshire's Forest-Based Economy. (Vermont Forest Resource Harvest Report, from 2008)

[51] Skone, Timothy J. August 28, 2012. Role of Alternative Energy Sources: Hydropower Technology Assessment

DOE/NETL-2011/1519, Office of Strategic Energy Analysis and Planning, http://www.netl.doe.gov/energy-analyses/pubs/HydroTAR.pdf

[52] Hydro Quebec Annual Report 2011 and http://www.hydroquebec.com/learning/hydroelectricite/gestion-eau.html ,

[53] Stafford, Byron , Robichaud, Robi and Mosey, Gail. July, 2011. Feasibility Study of Economics and Performance of Solar Photovoltaics at Massachusetts Military Reservation: A Study Prepared in Partnership with the Environmental Protection Agency for the RE-Powering America's Land Initiative: Siting Renewable Energy on Potentially Contaminated Land and Mine Sites. NREL/TP-6A20-49417.

[54] Includes half integrated operations, half traditional yielding residues only, material diverted from pulp markets, plus sawmill residues, which are assumed to be available in the same county where wood is cut. Does not include secondary mill wastes or construction/demolition or municipal waste. The latter were assumed to supplement forest sources to increase capacity of mills.

[55] U.S. Department of Energy. 2011. *U.S. Billion-Ton Update*: *Biomass Supply for a Bioenergy and Bioproducts Industry*. R.D. Perlack and B.J. Stokes (Leads), ORNL/TM-2011/224. Oak Ridge National Laboratory, Oak Ridge, TN. 227pp.

[56] Moore, Jared, Glier, Justin and Borgert, Kyle. Greenhouse Gas Impact of Pending Renewable Electricity Transmission in California: A Life Cycle Assessment, Presentation at American Center for Life-Cycle Assessment Conference XII, http://lcacenter.org/lcaxii/final-presentations/580.pdf. A European study lists emissions per mile of high voltage DC line at 261 metric tons CO2e/km or 420 tons/mile for materials and construction alone (excluding SF_6 emissions from transformers and substations), which is much lower than the California estimates, possibly due to less transport of materials under densely settled European conditions (Jorge, Raquel Santos, Hawkins, Troy R. and Hertwich, Edgar G.. 2012. Life cycle assessment of electricity transmission and distribution—part 1: power lines and cables. International Journal of Life Cycle Assessment 17:9–15. DOI 10.1007/s11367-011-0335-1).

[57] Above-ground live biomass estimates from National Biomass and Carbon Database, Kellndorfer, J., Walker, W., LaPoint E., K. Kirsch, (2010). Statistical Fusion of Lidar, InSAR, and Optical Remote Sensing Data for Forest Stand Height Characterization: A Regional-Scale Method based on LVIS, SRTM, Landsat ETM+, and Ancillary Data Sets. Geophysical Research Letters, 115. Dead (standing and down) carbon is estimated from ratio of live above-ground to dead above-ground, by elevation, from FIA EVALidator Miles, P.D. Mon Jun 04 08:43:12 CDT 2012. Forest Inventory EVALIDator web-application version 1.5.00. St. Paul, MN: U.S. Department of Agriculture, Forest Service, Northern Research Station. [Available only on internet: http://apps.fs.fed.us/Evalidator/tmattribute.jsp].

[58] GE Energy Applications and Systems Engineering, EnerNex, and AWS Truepower. December 5, 2010. New England Wind Integration Study. For ISO-NE, pp. 22 and 235. The 20% regional scenarios for the year 2020 involve varied levels of generating capacity located in Vermont, New Hampshire and Maine: 3.3 GW (full queue plus best offshore); 3.9 GW (full queue plus distribution to meet close to 20% of needs in-state, which due to the dominance of Maine in the queue results in wind generating 58% of Maine's electricity and 20% of New Hampshire's and Vermont's); 4.2 GW (full queue plus balanced on/offshore); 8.7 GW (full queue plus best onshore sites). The general magnitudes are similar to the 5.3 GW needed for our 2050 25% scenario, so we've used the NEWIS estimates to calculate additional regulation and spinning reserve needs. Total additional operating reserves would need to increase by about 2,750 MW but the emissions effects of non-spinning reserves are already captured by the capacity factor for wind, which reflects the fact that balancing sources must be called up when the wind speed drops.

[59] These were not floating turbines, so emissions should be considerably lower without concrete foundations or pile driving.

[60] Manomet Center for Conservation Sciences. 2010. Massachusetts Biomass Sustainability and Carbon Policy Study: Report to the Commonwealth of Massachusetts Department of Energy Resources. Walker, T. (Ed.). Contributors: Cardellichio, P., Colnes, A., Gunn, J., Kittler, B., Perschel, R., Recchia, C., Saah, D., and Walker, T. Natural Capital Initiative Report NCI-2010-03. Brunswick, Maine, Exhibit 6-6 direct plus indirect emissions, converted to CO_2e.

[61] Manomet Center for Conservation Sciences. 2010. Massachusetts Biomass Sustainability and Carbon Policy Study: Report to the Commonwealth of Massachusetts Department of Energy Resources. Walker, T. (Ed.). Contributors: Cardellichio, P., Colnes, A., Gunn, J., Kittler, B., Perschel, R., Recchia, C., Saah, D., and Walker, T. Natural Capital Initiative Report NCI-2010-03. Brunswick, Maine. Average carbon recovery for all simulated scenarios, summed to assess cumulative reabsorption from 40 years of annual harvest.

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[63] ISO New England, October, 2011. Regional System Plan 2011.

[64] Navigant Consulting, Sandia National Laboratories, and Pacific Northwest National Laboratory. July 30, 2011. For NV Energy, http://www.navigant.com/~/media/WWW/Site/Insights/NVE_PV_Integration_Report_Energy.ashx .

[65] Manomet Center for Conservation Sciences. 2010. Massachusetts Biomass Sustainability and Carbon Policy Study: Report to the Commonwealth of Massachusetts Department of Energy Resources. Walker, T. (Ed.). Contributors: Cardellichio, P., Colnes, A., Gunn, J., Kittler, B., Perschel, R., Recchia, C., Saah, D., and Walker, T. Natural Capital Initiative Report NCI-2010-03. Brunswick, Maine, Exhibit 6-14.

[66] GDS Associates. January 16, 2007. Final Report: Vermont Energy Efficiency Potential Study for Oil, Propane, Kerosene and Wood Fuels. Prepared for the Vermont Department of Public Service.

[67] Northeast States Center for a Clean Air Future. July, 2009. Introducing a Low Carbon Fuel Standard in the Northeast: Technical and Policy Considerations.

[68] Johanna Kirkinen. 2010. Greenhouse impact assessment of some combustible fuels with a dynamic life cycle approach [Värdering av drivhuseffekten av vissa bränslen enligt den dynamiska livscykelsmetoden]. VTT Publications 733. 63 p. + app. 58 p, Figure 11, http://www.vtt.fi/inf/pdf/publications/2010/P733.pdf .

[69] U.S Department of Energy Annual Energy Outlook 2012, http://www.eia.doe.gov/oiaf/aeo/index.html .

[70] Wiser, Ryan and Bolinger, Mark. August, 2010. 2009 Wind Technologies Market Report. U.S. Department of Energy, National Renewable Energy Laboratory, Lawrence Berkeley National Laboratory, http://www1.eere.energy.gov/windandhydro/pdfs/2009_wind_technologies_market_report.pdf , accessed 4/7/11 and Wiser, Ryan and Bolinger, Mark. August, 2012. 2011 Wind Technologies Market Report. U.S. Department of Energy, National Renewable Energy Laboratory, Lawrence Berkeley National Laboratory http://www1.eere.energy.gov/wind/pdfs/2011_wind_technologies_market_report.pdf, accessed 11/15/12.

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[72] Table 1 at http://www.eia.gov/forecasts/aeo/electricity_generation.cfm does not include offshore wind, so costs were estimated based on capital and operating costs for offshore relative to inland wind at http://www.eia.gov/oiaf/beck_plantcosts/pdf/updatedplantcosts.pdf.

[73] University of Maine and James E. Sewall. December 2011. Maine Deepwater Offshore Wind Report.

[74] U.S Department of Energy Annual Energy Outlook 2012, http://www.eia.doe.gov/oiaf/aeo/index.html .

[75] U.S Department of Energy Annual Energy Outlook 2012, http://www.eia.doe.gov/oiaf/aeo/index.html .

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[77] U.S Department of Energy Annual Energy Outlook 2012, http://www.eia.doe.gov/oiaf/aeo/index.html. The Outlook report assumes PV arrays of 150 MW, so costs were adjusted based on capital and operating costs for 7 MW relative to 150 MW facilities from http://www.eia.gov/oiaf/beck_plantcosts/pdf/updatedplantcosts.pdf.

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[82] FutureMetrics, http://www.futuremetrics.net/CostCalculator.swf

[83] GDS Associates. January 16, 2007. Final Report: Vermont Energy Efficiency Potential Study for Oil, Propane, Kerosene and Wood Fuels. Prepared for the Vermont Department of Public Service.

[84] Northeast States for Coordinated Air Use Management. August, 2011. Final Report: Economic Analysis of a Program to Promote Clean Transportation Fuels in the Northeast/Mid-Atlantic Region, Table 3-3.

Attachment 2: Assessment of Cumulative Visual Impacts from Wind Energy Development, 2012, Maine Office of Energy Independence and Security.

Report of OEIS Assessment of Cumulative Visual Impacts from Wind Energy Development

(CVI Assessment)

March, 2012

Executive Summary

The 125th Maine Legislature's Resolve 93 (LD 1366) directs the Office of Energy Independence and Security (OEIS) to conduct an assessment of the Wind Energy Act including the method by which permitting authorities should consider the cumulative impact on scenic resources of state or national significance. OEIS worked with the Land Use Regulation Commission (LURC) to develop a process for the assessment of cumulative visual impact from wind power development based on the experiences of the state's reviewing authorities in permitting grid-scale wind projects.

This assessment process convened a study group and assembled resources for their consideration, defined and described the cumulative visual impact issues to be addressed by the assessment, developed and evaluated options for addressing cumulative visual impacts from wind energy development, and reported on the process and findings. Three experts in the fields of landscape architecture and visual resource assessment participated in the study group along with staff from OEIS, LURC and Maine Department of Environmental Protection (MDEP).

The study group identified and described a fairly large and diverse set of potential solutions and strategies and then worked on evaluating the options in a systematic manner based on the feasibility and importance of the option. The report sets out the twenty-two options the group felt merit consideration.

The options are grouped by the type of approach offered by the potential solution or strategy.

- **Threshold analysis** approaches generally look at providing a method and/ or criteria for indicating when the accumulation of visual impacts from wind power development has crossed some unacceptable threshold.
- **Cluster** approaches generally look to pre-determine (or proactively plan) where a certain amount of development could be accommodated and, conversely, where it could not.
- The **Other** approaches category includes options that do not fit either the threshold or cluster category but which may have some ability to reduce the impact on visual resources from cumulative wind power development (and in many instances from individual projects).

This study and report is understood by the study group to be part of the OEIS report conducted pursuant to LD 1366 and is not separate or independent from that report. **The study group has not made specific recommendations and this report leaves any policy choices or preferences to others.**

1. Task for the Study Group

Resolve 93 (LD 1366) directs the Office of Energy Independence and Security (OEIS) to conduct an assessment of the progress on meeting the wind energy development goals under the Wind Energy Act and to include in the assessment, to the extent resources are available, "[r]ecommendations for the method by which permitting authorities should consider the *cumulative impact on* natural resources at the state or regional level, including but not limited to mountain areas and to *scenic resources of state or national significance*" (emphasis added).

The resolve also states that OEIS may draw on existing state data and studies rather than new analyses for the assessment.

2. Study Process

The Land Use Regulation Commission (LURC) has reviewed six grid-scale wind energy projects and in doing so considered cumulative visual impact (CVI) issues on multiple occasions. These project reviews prompted LURC to seek public comment on CVI issues and to engage in a series of discussions on CVI topics over the last year. OEIS requested that LURC recommend a process for the assessment of CVI based on these experiences and also requested that LURC assist in convening the study group and managing the study process.

This CVI assessment consisted of four steps:

1. Convene study group and assemble resources
2. Define and describe the CVI issues to be addressed by the assessment
3. Develop and evaluate options
4. Provide a report to OEIS

LURC staff completed the **first step** by compiling studies, examples, and other readily available resources informative to CVI issues and the assessment process; coordinating meetings, communications, and staff participation from OEIS, DEP and LURC; and recruiting qualified experts willing to participate in the study.

The study group addressed the **second step** – defining and describing the CVI issues - during the first meeting of the group, though the scope and nature of these complex issues continued to be discussed and refined throughout the process. LURC staff provided an initial "concepts and issues" paper prior to the first meeting of the study group which served as a basis for discussion to define and describe CVI issues.

The **third step** – developing and evaluating options for addressing CVI issues – was the principal endeavor of the study group. The study group brainstormed options at its first meeting, further described and refined these options through e-mail communications and

conference calls, and then worked on evaluating the options in a systematic manner at its final meeting and through subsequent e-mail communications.

For the **fourth step** LURC staff took the lead in drafting this report for OEIS, however the content is the product of the entire study group. The initial draft was circulated for comments among all participants and the final draft is the result of revisions based on those comments.

The study group has not made specific recommendations and this report leaves any policy choices or preferences to others. However, the study group's report includes only options it concludes merit consideration.

This study and report is understood by the study group to be part of the OEIS report conducted pursuant to LD 1366 and is not separate or independent from that report.

2.1. Participants

Three experts in the fields of landscape architecture and visual resource assessment participated in the study group. The three are the only experts that have been pre-qualified by LURC and MDEP to serve as neutral peer reviewers of visual impact analyses submitted with wind power applications for review by these two agencies. They served as volunteers without compensation and did not represent any particular interests in the process. The three participating experts are:

- Terry DeWan, Terrence DeWan & Associates, Yarmouth, Maine
- James Palmer, Scenic Quality Consultants, Burlington, VT
- David Raphael, Land Works, Middlebury, VT

Other participants in the CVI assessment were Jeff Marks, OEIS; Samantha Horn-Olsen, LURC; Hugh Coxe, LURC; Marcia Spencer-Famous, LURC; Fred Todd, LURC; and Mark Margerum, MDEP.

2.2. Study Group Meetings and Communications

The study group convened for two meetings and held one conference call as well as e-mail communications as follows:

November 16, 2011 - Meeting
Discuss CVI Assessment Objectives
Identify & Describe CVI Issues
Identify & Describe Potential Solutions/ Strategies to Address CVI Issues

December, 2012 – E-mail communications
Re: Developing an Evaluation Matrix

December 29, 2012 – Conference Call
Re: Refining the Evaluation matrix

January 18, 2012 - Meeting
Evaluation of Potential Solution/ Strategies

February, 2012 – E-mail communications
Re: Draft Report

3. Potential Options

3.1. Introduction

Cumulative visual impact (CVI) can result from seeing the accumulation of more than one wind energy project in a relatively concentrated area such that they become a dominant feature of that area. CVI can also occur when turbines and associated facilities (i.e., transmission lines and access roads) are dispersed throughout a broad swath of the landscape so that they appear repeatedly as one travels through that landscape. A concentration of turbines may lead to the "**too many here**" problem (from this special place, I will see too many turbines - a few were acceptable, but more will change this from a landscape with turbines to a turbine-dominated landscape). A dispersion of turbines throughout the landscape may lead to the "**everywhere**" problem (everywhere I go in this region I'll continuously see wind turbines).

Landscape architects and scenic experts identify three types of cumulative visual impacts based on the perspective of the viewer:

1. Combined: where a viewer sees multiple wind facilities or groups of turbines from a stationary point, each separated by a minimum distance, within a typical cone of vision (45± degrees).

2. Successive: In this model the viewer would see multiple projects from a particular viewpoint, but not within the same viewing arc. I.e., viewers would have to turn their heads and/or bodies a minimum number of degrees to see another wind project.

3. Sequential: More than one wind project would be seen as the viewer travels along a linear route (e.g., hiking trail or scenic highway) or planar surface (e.g., a large water body).

Given the amount of windpower development proposed by the Wind Energy Act (WEA), some commentators feel that if wind projects are separated to reduce cumulative visual impacts, then the result will be to have projects scattered almost everywhere throughout

the state to meet the WEA goals (wind sprawl). When LURC asked for public comment about whether windpower development should be concentrated or dispersed, the general consensus was that when siting multiple wind developments within LURC jurisdiction, concentrating in a few appropriate locations may be more desirable than spreading broadly across the landscape, in order to minimize the footprint and increase the efficiency of transmission lines and access roads. However there was no consensus as to how to do that with multiple projects, over multiple years, across a large landscape. Additionally site design, turbine design, color or other visual mitigation tools play a role in minimizing CVI.

3.2. Solutions and Strategies

The study group developed the options for addressing CVI issues set out in the sections below through an initial brainstorming meeting, and primed by the following initial set of questions:

- Given what we know today, is there likely to be a CVI problem to solve?
- What is the nature of the problem?
- Can it be defined in a way that is objective?
- What are the value judgments inherent in discussing this problem?
- What aspects of the problem seem to have the most significant consequences/ are the most important to address?
- Do the existing rules/ laws help or hurt in dealing with this problem?
- Are there solutions available? What are they?
- Is clustering the best way to address CVI at the large landscape level?
- Is there anything this legislature could implement?
- Are there other solutions that could be implemented with an additional year or two of study?
- How would clustering work on multiple projects, over multiple years across a large landscape?
- How to address proactive clustering that would designate some areas that would absorb relatively intense development in order to keep that development from occurring elsewhere.

The study group further described and refined these options through e-mail communications and conference calls, and then worked on evaluating the options in a systematic manner based on the feasibility and importance of the option. For this evaluation the study group looked at <u>feasibility</u> in terms of whether significant barriers are likely to exist due to political, financial, or technical considerations and whether, if implemented, the strategy is likely to be practical, accepted and lasting. The study group looked at <u>importance</u> in terms of whether the strategy would address aspects of CVI that have the most significant consequences.

The study group identified and described a fairly large and diverse set of options – what the group termed *potential solutions and strategies*. Group members felt that with more

time and resources they may well have developed more potential solutions and strategies. The group found that there were very few examples, from wind power permitting and regulatory efforts, to inform the group and few studies or reports that specifically address cumulative visual impacts from any type of development. Most of the potential solutions and strategies the group includes in this report are adapted from other development review models or variations on existing regulations but are informed by the experts' experiences with wind power projects.

Limitations on time and resources also constrained the study group from digging deeply into the options it did identify. The study group conducted an evaluation of some of the potential solutions and strategies, but for most options did not have time for more than a cursory discussion of the strengths and weaknesses. The study group also recognized the need for public input into the issues.

The potential solutions and strategies are set out in the next sections with a description of the strategy and, in some instances, comments about the feasibility or importance of the option. All options set out in the report were determined by the study group to merit consideration but not all were discussed in depth during the evaluation meeting due to time and resource limitations. The report does not rank or score the options and provides evaluative comments only for those options the study group discussed in greater detail.

A copy of the evaluation matrix, which does include some simple scoring of some of the options, is included in the appendix, but more for purposes of providing a tool for possible future evaluation than as a record of the evaluation conducted by the current study group. For this report, and at this stage in the process, the study group believes the content of their comments, rather than an incomplete scoring record, is more indicative of the opportunities and barriers that may be associated with the various potential solutions and strategies the group identified.

The options are grouped by the type of approach offered by the potential solution or strategy. **Threshold analysis** approaches generally look at providing a method and/ or criteria for indicating when the accumulation of development has crossed some unacceptable threshold. **Cluster** approaches generally look to pre-determine (or proactively plan) where a certain amount of development could be accommodated and, conversely, where it could not. The **Other** approaches category includes options that do not fit either the threshold or cluster category but which may have some ability to reduce the impact on visual resources from cumulative wind power development (and in many instances from individual projects).

3.2.1. Threshold Analysis Approaches

1. Establish a system for identifying landscape types in the area surrounding a project.

Description: Define and describe common landscape types and the characteristics of each. Establish parameters for determining what area around a proposed project constitutes the "surrounding area" and establish a system for inventorying and analyzing the surrounding area to determine what landscape types are present.

How it addresses CVI: Provides a system to evaluate the baseline conditions of a landscape and to evaluate, in a systematic fashion that is consistent from project to project, the amount of change that occurs to a landscape due to the accumulation of impacts from development.

Comments/ information: The WEA's second evaluation criterion is "The existing character of the surrounding area." Though we use the 8-mile limit to establish the study area, this criterion is sufficiently vague that there could be little consistency in applying this criterion among projects. (It may be helpful to include an example of what this would look like, e.g, from the Forest Service[1] or from an application). A definition of 'landscape type' should also be provided (see Forest Service publication). Landscape could be topographic or based on land use. The process for establishing the system might be a regulatory negotiation. A model to consider might be an existing UMaine graduate thesis (McMann) that looks at physiographic features and establishes a common vocabulary. (However, this is a rather coarse look at landscape types, since it covers the entire state). Maybe the law could specify that landscape type be evaluated at the application level. How much change is acceptable within each landscape type (i.e., what is its visual carrying capacity)? How does a change in one landscape type (either adjacent or farther away) affect the inherent characteristics of any particular landscape type (see #2 below)? Then there's the issue of viewer sensitivity relative to types…

2. Establish a process for deciding how much shift in landscape type is acceptable over time from one or more projects.

Description: Using the common landscape types, establish a process for determining how much shift from one landscape type to another landscape type - for instance from managed industrial forest to developed - due to visual impacts from one or more wind power developments in the surrounding area is acceptable and over what period of time. The degree to which the landscape type shifts from the visual impact of wind power development, and the timeframe in which the shift occurs, are factors in determining whether the impact is acceptable.

How it addresses CVI: Provides a system to compare the baseline conditions of a landscape and to evaluate, in a systematic fashion that is consistent from project to

[1] USDA, Forest Service. 1995. *Landscape Aesthetics : A Handbook for Scenery Management*. Rev. ed, Agriculture Handbook 701. Washington, DC: USDA, Forest Service.

project, whether the amount of change that will occur to a landscape exceeds an established threshold.

Comments/ information:
This could be similar to the system used in Angus, Scotland and may be analogous to the US Forest Service's Recreational Opportunity Spectrum (ROS). This is a good planning procedure that would be applicable to any visual impact analysis (VIA) and could be a basis for reviewing other types of projects with visual impacts. A very useful tool that does not need to start from scratch. It would be highly durable but would require some regular update. It may not be feasible to achieve consensus about how much is too much but this could be used to establish regulatory limits.

3. Better identify in existing law which types of cumulative impacts (e.g. combined, successive, sequential), if any, the primary siting authority may consider in individual permit proceedings.

Description: This recommendation proposes carefully identifying questions about how the existing law applies when considering visual impacts, particularly impacts from other projects, as part of a review of an individual project. To the extent possible, written guidance should explain the effect of the law for each of these questions.

How it addresses CVI: The purpose of this is to address the fact that applicants and regulators do not have a clear and consistent interpretation of how the law currently addresses CVI. For this reason this is seen as being an important option.

Comments/ information: Would this be done on a case-by-case basis or as a general opinion? Is this a staff or AG function? OEIS could ask LURC and DEP to comment based on experience. LURC Commission may already have a sense of unreasonable thresholds but that does not mean it is supported in existing law and the commission has not articulated it. The issue for the applicants is that they do not know in advance how the reviewing authority will react – or what is acceptable.

This may be a good opportunity to discuss the concept of 'tipping point', as described in the Scottish Tourism Study. At some point XX% of the people will agree there are too many turbines, or that they are seen in disarray, or that they are simply incompatible with the landscape. This may best be done with a series of photographs/simulations that illustrates the difference between acceptable and unacceptable visual impacts and CVIs.

4. Create a matrix or checklist to quantitatively assess impacts on a single resource from one or more projects.

Description: A tool for creating a baseline evaluation of a scenic resource and for identifying and quantitatively assessing and tracking any visual impacts to that resource from any project.

How it addresses CVI: Provides a method for assessing impacts to a particular scenic resource over time and across projects.

Comments/ information: This could also be used in individual permitting processes. This should start at a baseline before any projects. This approach could be applied to other types of impact. One benefit is consistent treatment across all projects. We may want to reference the Hassell methodology as a starting point for such an evaluative matrix. However, if it is to be considered, the parameters need to be verified rather than simply accepting the values presented in Hassell.

5. Establish (measurable/ quantifiable) thresholds of cumulative impacts (levels at which the cumulative impacts become unreasonable) on classes of scenic resources for a region.

Description: This strategy looks to identify classes of resources in a given region or within the state and establish impact thresholds, from one or more project, for the class as a whole. It would allow for some level of measurable impact to that class of resource from one or more project, but only up to a certain threshold.

How it addresses CVI: This strategy would protect against over-burdening any one type of resource from visual impact so that there would not be an irreversible commitment of resources by resource class.

Comments/ information: The key task in developing this strategy would be to establish thresholds for classes – things such as % of remote ponds that can be impacted, miles of Appalachian Trail that can see turbines, etc. LURC has some criteria that may be applicable (such as remoteness to a project). This may include identifying classes of scenic resources beyond those designated in the WEA - e.g. remote ponds below the Great Pond size, scenic byways in addition to their scenic turnouts, etc. Consider how people's perception of wind power project may change over time, as they become more used to seeing them (or become tired of seeing them) and other factors come into play (price of oil?). If this strategy is considered, there should be some way of fine-tuning the threshold at some point in the future to take into account the possibility of changing attitudes and sensitivities.

6. Require cumulative impact to be addressed in VIAs (and surveys if conducted) for all permitting projects. Include a description or analysis that estimates the cumulative impacts to the scenic resources over time from one or more projects in the surrounding area.

Description: Current rules do not require Visual Impact Analyses to address cumulative visual impact. Reviewing agencies could amend their rules to require some analysis and discussion about the accumulation of visual impacts from multiple wind power projects over time for a given area. Such analyses could be described in guidelines or rules of the reviewing authority to ensure uniformity from application to application, and should be

reasonably specific about the analysis techniques to be used and the geographic extent of the analysis.

How it addresses CVI: This could address CVI by providing useful information for tracking cumulative visual impacts and assessing the impacts over time and across multiple projects. It also could be used to encourage or require that applicants design projects to minimize visual impact or with greater awareness of the effects of cumulative visual impacts.

Comments/ information: Should be addressed early in any application process. Requiring submissions not currently required by the reviewing authorities raise issues about the standards for any new submission requirement. There would need to be a good definition of what is "cumulative." Would the requirement extend beyond the 8 miles for visual impact analysis set out in the current law? This would be particularly appropriate if evaluating sequential CVI. What about looking backward in time (impacts from prior existing projects), not just forward? How would this account for the fact that people can shift their level of acceptability – any threshold may change as people acclimate to the presence of wind turbines? As part of this should the agencies require intercept surveys that address this issue, using photosimulations and descriptive questions to test public reaction? There would have to be a clear methodology established to guide the preparation of a CVI section in a VIA.

7. Establish a process for other-project mitigation for visual impacts to make it possible for projects to come in under the Unreasonable Adverse threshold by mitigating visual impacts accumulated by other prior projects. This approach would only include direct scenic-mitigation and not "compensation."

Description: This approach would allow a proposed wind power project, that might not be able to meet permitting criteria because of the cumulative visual impacts (or primary visual impacts) it would create, to mitigate visual impacts previously created (by prior projects) as a way of lessening the overall cumulative visual impacts to the area.

How it addresses CVI: The proposed project would still create some visual impacts that would contribute to the overall accumulation of visual impacts in the area, but by mitigating or reducing existing impacts from other projects in the area, the total accumulated visual impacts would stay below the undue adverse impact threshold.

Comments/ information:
The WEA does not currently permit this so it would require a law change. This could be a fund to correct prior mistakes or issues resulting in direct mitigation of overall visual impacts. This would not be site design changes. This is not part of the tangible benefits that compensate communities for impacts from hosting a wind project. Examples of impacts that might be mitigated include fixing poorly designed road cuts, undergrounding power lines, retrofitting lighting systems with radar based lighting (such as OCAS). This

method would likely work better with a well defined process such as Transfer of Development Rights.

3.2.2. Clustering Approaches

8. Establish a procedure to identify areas that can reasonably accommodate a high concentration of wind energy development (i.e., cluster) and develop more restrictive CVI standards elsewhere (cluster)

Description: This would be a landscape level planning effort that considers physical and cultural features to identify areas that have the capacity to reasonably accommodate relatively high concentrations of wind power development. Differentiated scenic standards would be developed for the areas that are identified for concentrated development and those areas where wind power development is determined to be less appropriate.

How it addresses CVI: Avoids the "sprawl" issue of potentially having wind projects spread throughout vast areas of the state in a way that they appear to be almost everywhere one looks or travels. Also would facilitate the efficient use of infrastructure related to wind power production, such as transmission lines, and reduce the visual impacts from the proliferation of such infrastructure.

Comments/ information: The expedited area set out in the WEA does this to some extent but not at the level that some commentators felt would more effectively address CVI issues. Several commentators have noted that the process of identifying appropriate and inappropriate locations would be a resource intensive effort, requiring significant data gathering and analysis, and substantial stakeholder input. This clustering concept also raises issues of fairness due to regional overload, and the need for localized benefits to offset the accompanying impacts. Another factor to consider is the quality of the wind resource and the relationship between strong wind and high scenic quality.

9. Set initial limit on pace and/ or location of development. Re-evaluate those limits after some designated period of time.

Description: This technique would designate appropriate and inappropriate locations and define acceptable rates of development for those areas. The designations and the rates of development would be re-examined, and possibly revised, in the future in order to accommodate changed circumstances or changed public perceptions.

How it addresses CVI: This would avoid wind power sprawl by initially steering certain amounts of development to certain areas but would do so only for a designated period of time before reevaluating the locations and the rates.

Comments/ information: An example of this might be a policy that calls for no more than X megawatts within Y region over the next 15 years. The appeal of this approach is that

it recognizes and plans for changed circumstances in the wind power market as well as changes in public perceptions.

10. Allow regions, counties, or other entities to voluntarily identify cluster areas and create a quasi Transfer of Development Rights program

Description: Similar to the other clustering concepts described above but allows for a more localized determination of which areas are appropriate for concentrated wind power development. Regions or jurisdictions could self-select if they want to host wind energy development but would be subject to state review and standards. Protected areas would compensate areas that take a greater share of the wind power development through a transfer program.

How it addresses CVI: This would avoid wind power sprawl by steering development to certain areas based on the local interest or willingness to absorb those visual impacts.

Comments/ information: Communities or regions that determine that the benefits of hosting wind energy development outweigh any negative impacts could make themselves available for development. This may reduce some of the political hurdles to siting wind power. Again, in order to be considered, the region or other entity would have to have a minimum level of wind to quality. Access and availability of transmission facilities would also be a consideration. The issue is how to transfer compensation to areas that are impacted. In a traditional Transfer of Development Rights (TDR), the developer is allowed additional density for protecting somewhere else. The logic for wind requires protected areas to compensate areas that take their share of the development. This might be calculated on a county or even township basis (i.e., what is each county's share of the state goal?). Is a county willing to tax itself to pay another county to take its share of wind energy development?

3.2.3. Other Approaches

11. Camouflage technology

Description: The use of techniques that reduce visual contrast of wind energy facilities with the surrounding landscape so that the facilities are less easily distinguished from their surroundings.
.

How it addresses CVI: Not specific to CVI but may help reduce visibility of any project.

Comments/ information: May include the application of color paint or film patterns to break up the large mass and straight lines of wind turbines. However, it may be difficult in Maine's landscape because it changes color significantly with the seasons..

This may be a consideration if turbines no longer have to be painted white, using radar-based lighting systems. However, they will still be visible… This may be more effective when discussing impacts on landscapes greater than a certain distance (e.g., 3-5 miles).

12. **Radar-based night lighting**

Description: An aviation lighting safety system that relies on radar detection to activate the warning lights. Lights are inactive except when aircraft approaches. This may eliminate the need for high contrast colors (white).

How it addresses CVI: Not specific to CVI but may help reduce night-time visibility of any project due to aviation safety lighting.

Comments/ information: FAA recently evaluated this technology and appears to be in the process of approving it for use in wind power development.

13. Change public expectations

Description: Through outreach assist the public to acclimate to the presence of wind power facilities in landscapes.

How it addresses CVI: Not specific to CVI but may reduce negative reaction to changes in the landscape due to wind power development.

Comments/ information: Commentators suggest that historically people have adapted to change in the landscape including the addition of man-made elements. In particular people need to understand "what's in it for them."

14. Post-occupancy evaluation to gather more data

Description: Conduct studies after a wind project has been completed to assess the actual visual impact and to determine the accuracy of the visual impact assessment submitted with the application.

How it addresses CVI: Not specific to CVI but would provide information about actual visual impacts from a particular project and, in combination with other studies, could provide information about the cumulative impact from multiple projects over time.

Comments/ information: This could be a condition of approval with the requirement that the developer conducts the study or it could be conducted independently. We are starting to develop a good understanding of public reactions, based upon photosimulatios / intercept studies.

15. Study funded by legislature

Description: This would be an appropriation by the legislature to undertake a study or studies to better understand CVI and to develop policies to address CVI. This option looks at funding options for any one of a variety of studies that could be useful in addressing CVI – it does not make a recommendation about a specific type of study.

How it addresses CVI: This would not need to be specific to CVI – it could look at visual impacts from wind power development generally - but depending on the study could address CVI issues.

Comments/ information: The commentators recognized that in lean budget times the legislature would need to consider CVI an issue of high priority in order to appropriate funds for a study.

16. Study funded by mitigation fees

Description: This fund would be collected from developers to offset impacts from the development and would be used specifically to undertake a study or studies to better understand CVI and to develop policies to address CVI. This option looks at funding options for any one of a variety of studies that could be useful in addressing CVI – it does not make a recommendation about a specific type of study

How it addresses CVI: This would not need to be specific to CVI – it could look at visual impacts from wind power development generally - but depending on the study could address CVI issues.

Comments/ information: It would require a law change to collect mitigation fees.

17. Mitigation funds to install Radar-based night lighting system on older projects

Description: This fund would be collected from developers to offset impacts from the development by reducing night lighting impacts from prior projects.

How it addresses CVI: Not specific to CVI but may help reduce night-time visibility of any project due to aviation safety lighting.

Comments/ information: It would require a law change to collect mitigation fees.

18. A process for local jurisdictions to designate locally significant scenic resources to be considered under the WEA.

Description: The current definition in law for protected scenic resources does not account for locally significant scenic resources such as sites identified in a Comprehensive Plan or Scenic Inventory that considers the preferences and values of the whole community.

Including locally significant scenic resources under the protections of the WEA would provide for more local input in the permitting process.

How it addresses CVI: Not specific to CVI but by providing some protection for locally significant scenic resources this may address cumulative visual impacts.

Comments/ information: This would require a change in the law and would need clear definition. Right now there are SRSNS that are arguably of only local significance (i.e., most of the listed historic sites are explicitly of only local significance). Significance of recreation resources could be defined as the geographic catchment of its users (i.e., international, national, state, regional or local) or the quality and exceptionalness of its landscape character/attributes. This might be extended to revisit the methodology used in the Maine's Finest Lakes Study and the Maine Wildlands Lakes Assessment.

19. Establish a process for identifying situations where scenic impacts may exist beyond the 8 mile limit designated in current law.

Description: This would provide a mechanism for extending the distance for visual impact analysis beyond 8 miles. This would occur when, because of topography, turbine placement, site conditions or other factors, visual impacts may occur beyond 8 miles and evaluation of that potential impact is warranted.

How it addresses CVI: Not specific to CVI but an evaluation of the impacts of a single project could contribute to addressing CVI issues.

Comments/ information: The 8 mile limit in the law seems to be based on the visual acuity of turbine elements (e.g., width of the blade, nacelle or tower) and does not necessarily capture the range of visual impact under certain conditions. This threshold relates to the recognition of individual turbines being installed 5 years ago. It is not based on the larger turbines being used today or the impact of viewing many turbines as a project unit from above. The process could be based on observations of existing projects under different lighting/weather conditions from a variety of distances and comparisons of actual project visibility to the photosimulations prepared for the applications.

20. Establish a process to add additional classes of SRSNSs or to adjust the existing SRSNS classes.

Description: Current law defines Scenic Resources of Sate or National Significance (SRSNS) but experience with permitting projects to date suggests the definition may not capture the range of scenic resources valued by the general public. This option suggests a process in which the classes of protected resources are re-examined and that additional scenic resources be included under the WEA if warranted.

How it addresses CVI: Not specific to CVI.

Comments/ information: Commentators suggested the current definition may be too static in some instances and that other scenic resources may need to be included. Examples include (1) Scenic Byways in addition to their turnouts, (2) new classes of scenic resources, such as protected wetlands, and (3) BPL exercising its rule making authority to revise its list of trails and Public Reserved Lands that are SRSNSs.

21. Develop additional guidance in interpreting the Act to add clarity and predictability to the procedure based in part on precedent and experience in Maine.

Description: Certain provisions in the WEA relating to visual impacts have been difficult to understand for applicants and difficult to administer by reviewing authorities. This option suggests identifying all such provisions and then developing guidance or rule changes to clarify those provisions.

How it addresses CVI: Not specific to CVI.

Comments/ information: For example, the landscape's scenic quality is not mentioned as an important attribute for most sites on the National Register of Historic Places. Another example is that a state park and its beach are SRSNS, but the body of water may not be part of the state park and may not be a SRSNS in its own right. It might be advisable to get direct input from LURC Commissioners and BEP Board Members, both current and past, to discuss other areas of confusion.

22. Update the designation studies and the role of scenery in the designation).

Description: Some of the scenic resources defined in the WEA are based on existing inventories of those scenic resources. Some of those inventories have not been reviewed or updated recently (i.e., Rivers, Lakes, Coastal areas). Some existing designations do not necessarily concern scenic quality (e.g., historic sites, national natural landmarks).. This option suggests they should be updated to ensure that the resource information is current.

How it addresses CVI: Not specific to CVI.

Comments/ information: Examples include great ponds, scenic rivers and streams, scenic viewpoints in coastal areas.

4. Appendices

1. **Resolve 93 (LD 1366)**
2. **Concepts and issues paper**
3. **Evaluation matrix**

Appendix 1

Resolve, To Clarify the Expectation for the 2012 Assessment of Progress on Meeting Wind Energy Development Goals

Sec. 1 Expectations for assessment. Resolved: That, when the Governor's Office of Energy Independence and Security, referred to in this resolve as "the office," undertakes its 2011 annual assessment of progress on meeting the wind energy development goals pursuant to Public Law 2007, chapter 661, Part A, section 8, as amended by Public Law 2009, chapter 642, Part A, section 9, it shall consider the following specific issues.

1. In its examination of the experiences from the permitting process, the office shall specifically examine:

A. Whether statewide permitting standards should be applied to wind energy development, including, but not limited to, noise standards, visual standards, setback requirements and decommissioning plans;

B. The criteria used during the permitting process to consider the visual impact of an expedited grid-scale wind energy development, the permits issued and any recommended changes to the criteria, including, but not limited to, changes to the criteria that require the primary siting authorities to consider insignificant the visual impacts greater than 8 miles from a scenic resource of state or national significance as defined in the Maine Revised Statutes, Title 35-A, section 3451, subsection 9;

C. The quality of submitted decommissioning plans and recommendations for mechanisms to provide financial assurance for funding the decommissioning; and

D. The time required for completing the permitting process, including the time required for conducting environmental surveys and preparing and submitting the applications and the associated costs.

2. In its examination of the status of this State and each of the other New England states in making progress toward reducing greenhouse gas emissions, the office shall specifically evaluate the accuracy of the estimates generated by state agencies and wind energy developers for greenhouse gas reductions that are a result of wind energy development in this State and make recommendations for a standardized protocol, if necessary.

3. In developing its recommendations regarding the wind energy development goals established in Title 35-A, section 3404, subsection 2, the office shall consider the number of wind turbines necessary to meet the goals, market conditions, development trends, emissions goals, siting policies, cumulative impacts and other factors that may indicate it is necessary to amend the wind energy development goals.

4. In developing its recommendations regarding identification of places within the State’s unorganized and deorganized areas for inclusion in the expedited permitting area established pursuant to Title 35-A, chapter 34-A, the office shall also consider whether places should be removed from the expedited permitting area, including, but not limited to, mountain area protection subdistricts, as described by the Department of Conservation, Maine Land Use Regulation Commission Rule Chapter 10.

Notwithstanding Public Law 2007, chapter 661, Part A, section 8, as amended by Public Law 2009, chapter 642, Part A, section 9, the assessment submitted in 2012 is due February 1, 2012. Following receipt and review of the report, the Joint Standing Committee on Energy, Utilities and Technology may submit a bill to the Second Regular Session of the 125th Legislature; and be it further

Sec. 2 Additional considerations. Resolved: That, to the extent resources are available, the office shall include the following in the annual assessment of progress on meeting the wind energy development goals pursuant to Public Law 2007, chapter 661, Part A, section 8, as amended by Public Law 2009, chapter 642, Part A, section 9, in the assessment submitted in 2012:

1. Recommendations for the method by which permitting authorities should consider the cumulative impact on natural resources at the state or regional level, including but not limited to mountain areas and to scenic resources of state or national significance as defined in the Maine Revised Statutes, Title 35-A, section 3451, subsection 9;

2. The economic effects of wind energy development on the tourism industry, to the extent data are available;

3. In collaboration with the Office of the Public Advocate, an evaluation of the costs associated with transmission upgrades for the purpose of transmitting wind energy; and

4. The implications of the intermittency of wind power for regional markets and the grid, including capacity charges, the forward capacity market and electricity price volatility; and be it further

Sec. 3 Use of existing data and stakeholder input. Resolved: That, when completing the assessments under sections 1 and 2, the office and the Office of the Public Advocate may draw on existing state data and studies rather than new analyses, including, but not limited to, those developed for the New England Wind Integration Study published by ISO New England in December 2010, the state climate action plan pursuant to the Maine Revised Statutes, Title 38, section 577 and progress evaluation in Title 38, section 578, the State of Maine Comprehensive Energy Plan 2008-2009 and any reports from the Department of Economic and Community Development, as well as on analyses by the Federal Government, nonprofit organizations and other parties. The office and the Office of the Public Advocate may also draw on input from stakeholders and interested parties to complete the assessments; and be it further

Sec. 4 Health effects. Resolved: That, to the extent that resources are available, the Department of Health and Human Services, Maine Center for Disease Control and Prevention shall conduct an analysis of the research on health effects from wind turbines, including effects from noise, and provide a report to the Joint Standing Committee on Energy, Utilities and Technology by February 1, 2012. The report must include recommendations for making the information in the report easily accessible to the public.

Appendix 2 **Cumulative Visual Impacts - Concepts & Issues**

The Land Use Regulation Commission (LURC) has reviewed six grid-scale wind energy projects and in the process has faced CVI issues on multiple occasions. These project reviews prompted LURC to seek public comment on CVI issues and to engage in a series of discussions on CVI topics over the last year. Based on these experiences and the information gathered, LURC identified several concepts and issues.

Types of cumulative impacts

Cumulative Visual Impact (CVI) can result from the accumulation of turbines in a relatively concentrated area such that they become a dominant feature of that area. CVI can also occur when turbines are dispersed throughout a broad swath of the landscape so that they appear repeatedly as one travels through that landscape. These types of cumulative impacts occur at separate ends of a continuum of development density types (concentrated ⇒ dispersed).

A concentration of turbines may lead to the "**too many here**" problem (from this special place, I will see too many turbines - a few were alright but more will ruin the scenery of this place). A dispersion of turbines throughout the landscape may lead to the "**everywhere**" problem (everywhere I go in this region I'll see wind turbines).

Landscape architects and scenic experts identify three types of cumulative visual impacts based on the perspective of the viewer:

4. Combined: where a viewer sees multiple wind facilities or groups of turbines from a stationary point, each separated by a minimum distance. I.e., the viewer looks out at an arc of 45± degrees.

5. Successive: In this model the viewer would see multiple projects from a particular viewpoint, but not within the same viewing arc. I.e., viewers would have to turn their heads and/or bodies a minimum number of degrees to see another wind project.

6. Sequential: More than one wind project would be seen as the viewer travels along a linear route (e.g., hiking trail or scenic highway) or planar surface (e.g., a large water body).

Concentration versus dispersion

Given the amount of windpower development proposed by the Wind Energy Act (WEA), some commentators feel that if wind projects are separated to reduce cumulative visual impacts, then the result will be to have projects scattered almost everywhere throughout the state to meet the WEA goals. When LURC asked for public comment about whether windpower development should be concentrated or dispersed, the general consensus was that when siting multiple wind developments within LURC jurisdiction "concentrating in a few locations is more desirable than spreading broadly across the landscape," in order to minimize the footprint and increase the efficiency of transmission lines and access

roads. However there was no consensus as to how to do that with multiple projects, over multiple years, across a large landscape.

Clustering

The LURC commissioners felt the best way to address CVI at the large landscape level is by clustering the development in "appropriate" locations and steering development away from "inappropriate" places. While site design, turbine design, color or other visual mitigation tools play a role in minimizing CVI, clustering is seen as the primary mechanism by which the cumulative effects of wind energy development on scenic resources across a large landscape (such as the existing expedited area) may be mitigated.

However, the clustering concept raises difficult and important **issues** such as:

- How would clustering work on multiple projects, over multiple years across a large landscape?
- Does LURC/ DEP/ State have the time or resources to figure out how to cluster projects?
- Does LURC/ DEP/ State want to take on a large **proactive clustering** effort - identifying locations for clustering and implementing policies and practices that accomplish that?
- Does the expedited area, as set out in the WEA, already identify locations for clustering (or act as the de facto clustering mechanism)?
- If not, does LURC/ DEP/ State have the authority to identify locations for clustering, or does it need to seek authority?
- What clustering tools are currently available?
- If new or different tools are needed, by what process can the reviewing authority get them (e.g. request to legislature, rulemaking, proposed legislation, etc.).
- If proactive clustering is not feasible, but projects can be denied based on their cumulative impact, such denials may have the unintended consequence of further dispersion of projects.
- Proactive clustering would necessarily result in creating some "sacrificial" areas – areas that would absorb relatively intense development in order to keep that development from occurring elsewhere. Such denser concentrations may have substantial negative impacts to those areas receiving the additional development. Among other things, this may raise fairness or social justice concerns.
- A proactive clustering approach that identifies appropriate areas through a landscape level analysis may have limitations in terms of resources that would be required to conduct the analysis and develop tools, and the effectiveness of the tools in achieving the desired result.
- A landscape level analysis to identify appropriate and inappropriate locations, would have to be done at a less than site level of detail, and thus would not provide a very precise evaluation.

Appendix 3

[illegible]	[illegible]				[illegible]		[illegible]
	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
Threshold Analysis Approaches							
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	1, 2, 4	[illegible]	
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	1, 2, 4		
[illegible]							
[illegible]							
[illegible]							
[illegible]							
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	1, 2, 3, 4, 5		

	Potential Emission Strategy	Feasibility (vs. Base) Case				Implications		Impact (Mt CO_2)
		Positive	Promising	Exploratory	Dry Hole	Industry stakeholders	Consumers/non-stakeholders	Indicative Projects
1	Process or formulation changes to be adopted in order (semi-)complete if conditions for accumulating products. Additions/adds to any substantial products and include in [illegible] analysis that summarise the cumulative impacts in the sector. Reductions over time from now to most projects in this technology link	Many	No	Yes	No	Eg. No. 2, 3		Yes
2	Standard accounts for carbon project mitigation for known capacity. Final NO_2 sales not currently [illegible] to model if possible for projects in some [illegible] Consequential Advanced Accounts by mitigating accumulation [illegible] (e.g., activity designed [illegible] under [illegible] [illegible] specifying CCA2 capacity. This approach would only include [illegible] to be mitigation and not [illegible] of total form of [illegible]	Less	No	Yes	Most			
	Scrubbing Approaches							
3	Standard accounts to identify [illegible] that can handle high concentration and deliver CO_2 [illegible]	Many	Most	Most	Most			
4	[illegible] or [illegible] [illegible] [illegible]

	Potential Solution Strategy	Feasibility (at least low)				Importance		Applicable to Individual Projects
		Political	Resource	Technical	Durability	Impact addressed	Consequence addressed	
[illegible]	Policy-based night lighting							
[illegible]	Change public expectations							
[illegible]	Preliminary [illegible]	[illegible]	[illegible]	[illegible]				
[illegible]	Study harvesting regulations							
[illegible]	Study harvesting mitigation fees							
[illegible]	Mitigation fundamental [illegible]							
[illegible]	[illegible]							
[illegible]	[illegible]							
[illegible]	[illegible]							
[illegible]	[illegible]							

	Knowledge and skills base				Implications		Impact (effect) on [illegible]
Prescribed education strategy	Positive	Problematic	Exceptional	Non-existent	Impact on [illegible]	Consequences on [illegible]	
1.1 Informal conference guidance on [illegible] (See A.1.1.1 e.g. [illegible] as [illegible] measures [illegible] [illegible] [illegible]

Attachment 3: Wind Project Permitting and Compensatory Mitigation in Northern New England: Potential for Addressing Cumulative Impacts, 2013, The Wilderness Society.

Wind Project Permitting and Compensatory Mitigation in Northern New England: Potential for Addressing Cumulative Impacts

Meeting the renewable energy goals of the three northern New England states will require significant landscape disturbance from new renewable energy facilities, including wind projects for which the best sites are often remote and ecologically intact ridgelines. The cumulative landscape impacts of multiple developments are difficult to assess piecemeal through individual siting decisions. While broad agreement on siting principles, or even designation of appropriate energy development areas, would help guide wind development away from the most sensitive sites, mitigation funding can permanently protect a few of the highest-priority sites. Mitigation measures may be incorporated as permit conditions to reduce environmental impacts by modifying project design or operations or ensuring effective restoration. Mitigation may also help reduce cumulative landscape-scale impacts by protecting similar resources in another location through fee or easement purchases. Such off-site "compensatory mitigation" reimburses landowners in areas of high conservation value who are willing to forego development in exchange for conservation payments. Mitigation funding can also help compensate communities affected by intensive development.

In the case of northern New England wind projects, regulators with the authority to impose mitigation conditions include public service departments and environmental and natural resources agencies that issue facility permits.[1] All three states commonly impose mitigation requirements on wind projects, but mitigation terms often depend on pressure applied by intervenors or other interested parties, and may even involve agreements negotiated outside the permitting process. Hence mitigation practice to-date varies widely from project to project.

Wetlands mitigation banks and in lieu fee programs, and to a lesser extent wildlife habitat banking in areas with designated critical habitat for federally listed species, have emerged as systematic but relatively flexible tools to partially offset the environmental damage caused by development. Developers appreciate the predictability of these mechanisms which allow them to address project impacts quickly and effectively. Natural areas benefit from funding targeted to high-priority landscapes rather than fragmented efforts. These programs may serve as models for a systematic mitigation program that applies to the full set of permitting criteria, including habitat fragmentation and recreational and scenic resources.

The first section of this paper reviews the criteria included in energy permitting processes in the three northern New England states. These criteria define the impacts for which mitigation might be required in order to reach a finding of no undue or unreasonable adverse impact from a permitted project. We also describe agency or public processes related specifically to wind impacts that feed into and influence the permitting process. The second section summarizes mitigation standards and practices for wetlands and endangered species habitat, including in lieu fee programs established in Vermont, New Hampshire and Maine. The final section summarizes the use of compensatory mitigation for natural resource impacts for northern New England wind projects, and suggests how a more systematic approach might be developed.

[1] These include Vermont's Public Service Board and Agency of Natural Resources - Departments of Fish and Wildlife and Environmental Conservation; New Hampshire's Site Evaluation Committee and Departments of Environmental Services, Fish and Game, and Resources and Economic Development - Division of Forests and Lands; and Maine's Departments of Environmental Protection and Inland Fisheries and Wildlife. Until 2012, Maine's Land Use Regulation Commission permitted energy developments in the unorganized parts of the state, but since reorganization as the Land Use Planning Commission site permitting has now been united under the DEP. Wind developments in previously protected zones still need LUPC rezoning approval.

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Wind Permitting Process in Northern New England

Maine

Maine's Department of Environmental Protection issues Site Location of Development permits that cover multiple environmental requirements. DEP also ensures that projects meet resource protection criteria as defined in the Natural Resources Protection Act.

Maine Site Location Law

Wind facilities must comply with Maine Site Location Law which governs all development activities.[2] Maine's Site Law defines standards for development that include: financial capacity, "no adverse effect on the natural environment", appropriate soil types and storm water management, groundwater, municipal services, flooding, and blasting. Regulations implementing the law define "no adverse effect on the natural environment" to include several subcategories:

1. No unreasonable adverse effect on air quality;
2. No unreasonable alteration of climate;
3. No unreasonable alteration of natural drainage ways;
4. No unreasonable effect on runoff/infiltration relationships;
5. Erosion and sediment control;
6. No unreasonable adverse effect on surface water quality;
7. No unreasonable adverse effect on ground water quality;
8. No unreasonable adverse effect on ground water quantity;
9. Buffer strips;
10. Control of noise;
11. Preservation of historic sites;
12. Preservation of unusual natural areas;
13. Access to direct sunlight;
14. No unreasonable effect on scenic character;
15. Protection of wildlife and fisheries.

"Unusual natural area" means any land or water area, usually only a few acres in size, which is undeveloped and which contains natural features of unusual geological, botanical, zoological, ecological, hydrological, other scientific, educational, scenic, or recreational significance. These may include: rare or exemplary plant communities; individual plant species of unusual interest because of size of population, species or other reasons; unusual or exemplary bogs; unusually important wildlife habitats, particularly those of rare or endangered species; unusual land forms; fossils and other deposits of importance to geologists; outstanding scenic areas; and others of similar character.

The wildlife and fisheries criterion requires maintaining travel corridors and avoiding disruption to wildlife life cycles, as well as "no unreasonable disturbance" to:

- High and moderate value deer wintering areas;
- Habitat of any species declared threatened or endangered, state or federal;
- Seabird nesting islands;
- Significant vernal pools;
- High and moderate value waterfowl and wading bird habitat; and
- Shorebird nesting, feeding, and staging areas.

[2] Site Location of Development and related provisions of PL 2007, c. 661, Part B, 38 M.R.S.A. §§ 481-490.

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These same categories make up "significant wildlife habitat" under NRPA (see below). The Maine Department of Inland Fisheries and Wildlife usually participates directly in the permitting process, and may advocate for project conditions or mitigation to protect the natural resources under its purview.

Maine NRPA

This permit is required for activity located in, on or over a protected natural resource or adjacent to wetlands or waterways. An "activity" is (a) dredging, bulldozing, removing or displacing soil, sand, vegetation or other materials; (b) draining or otherwise dewatering; (c) filling, including adding sand or other material to a sand dune; or (d) any construction, repair or alteration of any permanent structure. Some activities with limited impacts are covered by "permit by rule" and have set standards.[3] DEP will notify an applicant if an individual permit is required.

Protected natural resources include:

- coastal sand dune systems;
- coastal wetlands;
- significant wildlife habitat[4];
- fragile mountain areas [above 2700 ft];
- freshwater wetlands;
- community public water system primary protection areas;
- great ponds [natural 10 acres, reservoir 30 acres];
- rivers, streams or brooks.

Aside from wetland and habitat (described in the "Wetlands and Habitat Banking as Mitigation Models" section below), mitigation "offsets" under the NRPA are specifically mentioned for scenic impacts (e.g. correcting an existing visual problem in the same viewshed).

Evolving Policies Specific to Wind in Maine

Within New England, Maine has the most aggressive wind development goals, and hence is somewhat ahead of the other states in recognizing impacts and developing policies to address them. In 2004, the Maine Wind Energy Act directed the Public Utilities Commission to study the potential for wind development. In May, 2007 Governor Baldacci established a Task Force on Wind Power Development to assess permitting processes, identify barriers, recommend incentives, and develop siting guidance. The task force set state wind development goals at 2,000 MW by 2015 and 3,000 MW (300 offshore) by 2020. It also defined an expedited permitting area covering approximately two-thirds of the state, limited aesthetic criteria for projects in this area, and recommended adding tangible benefits criteria to permit review. These recommendations were enacted into law by the legislature in 2008.

Related to scenic impacts, a special standard applies within the expedited permitting area. Most developments must "fit harmoniously into the existing natural environment" but wind projects in the expedited area must meet a lower standard. However, the higher standard may still apply if the Department determines that the project "may result in unreasonable adverse effects due to the scope, scale, location or other characteristics of the associated facilities" and interested parties can submit evidence to that effect. Expedited wind projects assess effects on a restricted set of scenic resources at

[3] http://www.maine.gov/dep/land/nrpa/305-booklet.pdf

[4] This includes habitat for species appearing on the official state or federal list of endangered or threatened animal species; high and moderate value deer wintering areas and travel corridors; seabird nesting islands; critical spawning and nursery areas for Atlantic salmon; significant vernal pool habitat; high and moderate value waterfowl and wading bird habitat, including nesting and feeding areas; and shorebird nesting, feeding and staging areas.

a limited distance from the project (3 miles, or up to 8 miles at the discretion of DEP – in practice most projects use the 8 mile distance). Relevant scenic resources include: a. National Natural Landmarks and other outstanding natural and cultural features (e.g., Orono Bog, Meddybemps Heath); b. state or national Wildlife Refuges, Sanctuaries, or Preserves and State Game Refuges (e.g., Rachael Carson Salt Pond Preserve in Bristol, Petit Manan National Wildlife Refuge, the Wells National Estuarine Research Reserve); c. a State or federally designated trail (e.g., the Appalachian Trail, East Coast Greenway); d. a property on or eligible for inclusion in the National Register of Historic Places (e.g., the Rockland Breakwater Light, Fort Knox); e. National or State Parks (e.g., Acadia National Park, Sebago Lakes State Park); f. Public natural resources or public lands visited by the general public, in part for the use, observation, enjoyment and appreciation of natural or cultural visual qualities.(e.g., great ponds, the Atlantic Ocean).

In addition to the standard criteria and special scenic impact analysis, regulatory review for wind developments generally includes assessments of shadow flicker, noise, and adequacy of setbacks. Sound limits for grid-scale wind energy are established at the property line, with lower levels at protected locations and further night-time restrictions for living/sleeping spaces, including campgrounds. Along with residences and public buildings, protected locations subject to sound limits include "any location within a State Park, Baxter State Park, National Park, Historic Area, a nature preserve owned by the Maine or National Audubon Society or the Maine Chapter of the Nature Conservancy, The Appalachian Trail, the Moosehorn National Wildlife Refuge, federally-designated wilderness area, state wilderness area designated by statute (such as the Allagash Wilderness Waterway), or locally-designated passive recreation area; or any location within consolidated public reserve lands designated by rule by the Bureau of Public Lands as a protected location." In 2012 the legislature approved stricter night-time noise limits and defined a process for monitoring sound.

Maine's Office of Energy Independence and Security is responsible for annually assessing progress toward Maine's wind energy goals and recommending policy changes, with a full review due by the end of 2013. The assessment issued in March, 2012 offered a series of recommendations that included, among others:

- Convene a new transparent process for defining expedited permitting areas - allow for removal of areas from the expedited permitting area, including "those regions and view sheds that are most critical to the state's recreational and tourism economy and would be unacceptably degraded by any significant level of wind power development";
- Update the list of scenic resources of state and national significance and extend the assessment range from 3-8 miles to 8-15 miles;
- Provide more specific guidance for visual impact assessments, including cumulative impacts (a study commission has already reported its initial findings, which present several alternatives for limiting cumulative scenic impacts).

New Hampshire

NH Site Evaluation Committee

New Hampshire's Site Evaluation Committee (SEC) has oversight for significant energy developments likely to have landscape-scale impacts, which includes any proposals over 30MW plus smaller projects for which the SEC asserts jurisdiction (including the Lempster and Antrim wind projects). The SEC issues a "certificate of site and facility". The various required agency permits are incorporated in the umbrella certificate, and a certificate may not be issued without approval of all agencies that have jurisdiction.

Agency permits for wind projects usually include those issued by the Department of Environmental Services (DES) for wetlands, alteration of terrain, and water quality (delegated to the state under Section 401 of the federal Clean Water Act).

The SEC includes the heads (or designees) of multiple state agencies: Department of Environmental Services, DES Division of Water, DES Division of Air Resources, Department of Resources and Economic Development, DRED Division of Parks and Recreation, DRED Division of Forests and Lands, Fish and Game Department, Department of Health and Human Services, Department of Transportation, Office of Energy and Planning, Public Utilities Commission, PUC staff engineer, and Department of Cultural Resources. Within the SEC, a subcommittee of at least 7 considers the permit. Counsel for the Public, appointed by the state Attorney General's office, represents the public on issues of environmental protection and energy supply.

In order to issue a certificate, the SEC must find that:

- Applicant has adequate financial, technical, and managerial capability;
- Project will not unduly interfere with the orderly development of the region with due consideration having been given to the views of municipal and regional planning commissions and municipal governing bodies;
- Project will not have an unreasonable adverse effect on aesthetics, historic sites, air and water quality, the natural environment, and public health and safety;
- Project is consistent with state energy policy.

The Committee must also consider alternative means of meeting the needs addressed by the project, though a formal finding of need is no longer required.

The "unreasonable adverse effect" criterion is not clearly defined in regulations. Noise and scenic impacts are generally included in this assessment under aesthetics. Natural environment for wind projects approved to-date generally includes impacts to birds and bats, rare plants and exemplary natural communities, animal species of federal or state concern, and fragmentation of interior forest habitat.

Evolving Policies Specific to Wind in New Hampshire

An ad hoc working group met from October 2006 to May 2007 to develop detailed wind siting principles to guide both the SEC as it interprets statutory criteria and developers as they select sites and design projects in advance of permitting.[5] The group submitted its suggestions to the wind siting subcommittee of the NH Energy Policy Commission, which recommended adoption of the draft principles by the full commission, but no formal action was taken.

In addition to several social criteria which ensure that local community interests are fully considered, the working group developed the following specific environmental principles:

- Avoid or minimize disturbance of populations of or habitat for rare plant and animal species;
- Avoid areas that create a high risk of mortality to birds and bats;
- Avoid or minimize disturbance of uncommon or high-quality wildlife habitat;
- Avoid or minimize fragmentation of large blocks of natural habitat;
- Avoid or minimize disturbance of steep or fragile soils;
- Avoid or minimize disturbance of wetlands, streams and riparian areas;

[5] Wind Energy Facility Siting Guidelines Working Group. May 29, 2007. Proposed Wind power Siting Guidelines – forwarded to the NH Energy Policy Commission Wind Siting Subcommittee.

- Avoid or minimize disturbance of areas of high recreational use, especially use that is focused on the natural environment;
- Avoid or minimize degradation of scenic views, especially from areas of recognized high scenic value that depend on the undeveloped natural environment for their appeal;
- Have necessary infrastructure (access roads and transmission lines) on-site, in close proximity, or able to be constructed without undue impacts;
- Locate in areas that have been and continue to be altered by human use (e.g., developed or agricultural areas or lands under active timber management).

The working group also recommended appointment of a Wildlife Advisory Committee to review initial plans and relevant wildlife data, advise on the design of pre- and post-construction studies, make recommendations for project modifications to minimize impacts, and advise on mitigation proposals.

Vermont

Public Service Board - Section 248

Proposed energy facilities in Vermont must obtain a certificate of public good (CPG) from the Public Service Board (PSB), made up of three members appointed by the governor. Projects also require permits from the Agency of Natural Resources (including Department of Environmental Conservation and at least advisory input to the CPG from the Fish and Wildlife Department), and these may be incorporated as conditions of the CPG to be met before construction commences.

The VT PSB follows criteria defined in Section 248 of Title 30 of Vermont Statutes. A CPG requires the PSB to find that a proposed project:

- will not unduly interfere with the orderly development of the region with due consideration having been given to the recommendations of the municipal and regional planning commissions, the recommendations of the municipal legislative bodies, and the land conservation measures contained in the plan of any affected municipality;
- meets the 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;
- will not adversely affect system stability and reliability;
- will result in an economic benefit to the state and its residents;
- will not have an undue adverse effect on esthetics, historic sites, air and water purity, the natural environment and the public health and safety (this criterion incorporates by reference most of the criteria under Act 250, the state's development regulation law - (a)(1) through (8) and (9)(K));
- is consistent with a company's approved least cost integrated plan;
- complies with the electric energy plan approved by the Public Service Department;
- does not affect outstanding resource waters;
- is consistent with the state solid waste management plan (for a waste-to-energy facility); and
- can be served economically by existing or planned transmission.

For environmental criteria, the PSB may rule that the overall public good outweighs localized damage. In contrast, under Act 250 every criterion must be met in order to obtain a permit. The exception under Act 250 is the criterion protecting necessary wildlife habitat and endangered species, which includes several caveats that allow other benefits to over-ride habitat protection (i.e. economic, social, cultural, recreational, or other benefits outweigh habitat losses, developer has taken reasonable steps to minimize damage, and no alternative site is available on land owned by the developer).

Agency of Natural Resources

Permits issued by ANR for wind projects might include stormwater discharge, wetlands, stream alteration, water quality certification under Section 401 of the federal Clean Water Act (delegated to states), direct discharge, and endangered species taking. The Agency will often work with an applicant for up to several years pre-permitting to conduct the necessary resource assessments, and post-construction monitoring is often required as a permit condition.

The Agency also participates directly in the Section 248 process and may advocate for project conditions that extend beyond its narrow permitting authority. Vermont's ANR considers it their mandate under Section 248 to ensure no undue adverse impact to:

- air and water quality;
- headwaters, streams, shorelines, wetlands, etc.;
- historic sites;
- rare and irreplaceable natural areas;
- necessary wildlife habitat (defined under Act 250, the state's development regulation law, as "concentrated habitat which is identifiable and is demonstrated as being decisive to the survival of a species of wildlife at any period in its life including breeding and migratory periods" - includes deer yards, mast and wetlands used by bears, and may also include significant natural communities that are rare and of high quality);
- habitat fragmentation;
- rare, threatened and endangered species; and
- use, enjoyment or access to public lands, facilities or services, such as state recreation lands.

Evolving Policies Specific to Wind in Vermont

In 1993, the Vermont legislature asked the Department of Public Service to assess the potential for wind energy in the state. The report documented Vermont's pioneering role in wind energy, including a 1,250 kW turbine on Grandpa's Knob in 1941, four 200kW turbines on Mt. Equinox in the early 1980's - redeveloped temporarily by Green Mountain Power in 1989, and GMP's Searsburg facility then under development (installed 1996). The report concluded that "the ridgetops of the Green Mountains offer the best sites when only the wind resource is considered, but they also are ecologically fragile and aesthetically sensitive locations. The environmental sensitivity of the highest and windiest ridge lines excludes most of them from development... Of the total potential, all but 50-100 MW is considered undevelopable for environmental or economic reasons."

In 2001, VT DPS received a DOE grant to conduct a "Wind Siting Consensus Building Project" which convened key stakeholders to develop a joint understanding of the role of wind in Vermont.[6] After four workshops, the moderators concluded that "the number of issues and the quantity of information to be discussed and digested will make it difficult for the participants to reach consensus on many, if any, of the outstanding discussion points. The most valuable outcome of these workshops may be the

[6] An impressively broad list of participants included: 12 Regional Planning Commissions, Vermont Departments of Fish and Wildlife, Forests, Parks and Recreation/State Lands, and Public Service, VT Public Service Board, Vermont's US Senators and Congressman, Governor's Office, Northern Forest Alliance, Vermont Farm Bureau, Green Mountain Club, VT Institute of Natural Science, VT Land Trust, VNRC, Forest Watch, Appalachain Trail Conference, VT Audubon, Maine Natural Resources Council, The Nature Conservancy, Catamount Trail Association, National Park Service, Eastern Maine Development Council, Catamount Energy, VT Wind Energy Association, Endless Energy, NRG Systems, Vermont Environmental Research Associates, two Landscape Architects, Washington Electric Co-op, association of municipal utilities, and VT Ski Areas Association, all coordinated by Woodbury Dispute Resolution Center.

gathering of these participants, in one group, to begin the discussion of how wind power might be developed effectively in Vermont." Direct outcomes included a planning packet for towns and regional commissions,[7] and a scenic impacts assessment tool developed by Jean Vissering with stakeholder input.[8]

In 2003, a study of public land wind resources commissioned by the Department of Public Service[9] concluded that 3% of Vermont's land area had a wind resource Class 4 or better with about one-third of that area on public land (roughly half federal and half state). In 2004, Governor Jim Douglas established the Vermont Commission on Wind Energy Regulatory Policy.[10] The commission recommended some changes to the standard Section 248 process for wind projects, including advance notice to and consultation with surrounding towns and consideration of cumulative impacts of multiple projects within a region. Most of these recommendations appear not to have been implemented, with the exception of a citizens' guide to the 248 process issued by the Department of Public Service.[11] Governor Douglas subsequently established a moratorium on wind development on state lands.

In 2006, the Vermont Agency of Natural Resources issued Draft Guidelines for the Review and Evaluation of Potential Natural Resources Impacts from Utility-Scale Wind Energy Facilities in Vermont.[12] These apparently remain in draft form. Consistent with the department's overall mitigation approach, "the Department expects that during each phase of development of a utility-scale wind project – siting, construction and operation – applicants will take the necessary steps to ensure: 1) avoidance of impacts to necessary wildlife habitat to the maximum extent practicable; 2) on-site mitigation of impacts to necessary wildlife habitat that cannot reasonably be avoided; 3) off-site mitigation of the functions or values associated with unavoidable impacts to necessary wildlife habitat and when on-site mitigation is not possible…". In the project design phase for wind projects, Agency staff may recommend moving or eliminating some components to avoid habitat impacts, or request operational changes such as curtailment during critical periods, modified lighting, and vegetation management.

In 2012, six Vermont conservation organizations (Audubon Vermont, Green Mountain Club, The Nature Conservancy, Vermont Land Trust, Vermont League of Conservation Voters, and Vermont Natural Resources Council) requested that the governor appoint a commission to explore issues surrounding commercial wind generation. The group requested that the commission address five major topics:

- Map potential wind energy development locations (based on ANR resource mapping and considering conserved lands and sensitive natural and cultural resources);
- Consider cumulative impacts and define full build-out;
- Review the permitting process and consider whether it adequately protects mountain areas;
- Assess environmental impacts of wind and a consistent approach to monitoring and remediating;
- Provide opportunity for public involvement.

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[7] Wind Energy Planning Resources for Utility-Scale Systems in Vermont: A Product of the Wind Siting Consensus Building Project, October, 2002. Vermont DPS.

[8] A final version of this guide was issued by the Clean Energy States Alliance, http://www.cleanenergystates.org/assets/2011-Files/States-Advancing-Wind-2/CESA-Visual-Impacts-Methodology-May2011.pdf.

[9] Vermont Environmental Research Associates, Inc. December, 2003. Estimating the Hypothetical Wind Power Potential on Public Lands in Vermont. Prepared for The Vermont Department of Public Service, http://www.vtfpr.org/wind/windpwr.pdf.

[10] Background report at http://sitingcommission.vermont.gov/sites/cep/files/Siting_Commission/Publications/RegulatoryBackgroundReport.pdf. Final report with findings and recommendations no longer posted.

[11]

[12] April, 2006. http://www.anr.state.vt.us/site/html/plan/DraftWindGuidelines.pdf.

The governor's mandate to the resulting Vermont Energy Generation Siting Commission applies to all energy sources and focuses on permitting only.

Regional Coordination on Wind Siting Issues

In 2006, a small group of New England nonprofits developed joint principles on wind power development and natural heritage. Participants included: Appalachian Mountain Club, Appalachian Trail Conference, Conservation Law Foundation, Maine Audubon, Massachusetts Audubon, Natural Resources Council of Maine, The Nature Conservancy, and Union of Concerned Scientists. Resources highlighted as worthy of protection in wind siting included: critical ecological areas and communities, habitats of particular importance to individual species or groups of species, species of special concern, bird and bat migration areas, wilderness values, outdoor recreation resources that depend on, and support, a high quality natural environment, and scenic values and vistas. The group recommended that each state develop siting guidelines to minimize damage to these resources, through use of "landscape-level plans and design of landscape-level mitigation strategies".[13]

In January 2012, NH Audubon sponsored a New England Energy Brainstorming meeting where land protection and energy advocacy groups from throughout the region began a conversation about potential conflicts between renewable energy development and resource protection. Participants included: Appalachian Mountain Club, Audubon Vermont, Connecticut Audubon, Conservation Law Foundation, Environment Northeast, Forest Guild, Massachusetts Audubon, National Wildlife Federation, Natural Resources Council of Maine, New Hampshire Audubon, New Hampshire Audubon, NH Office of Consumer Affairs, Society for the Protection of NH Forests, Symbiotic Strategies, The Jordan Institute, The Wilderness Society, The Nature Conservancy Connecticut, and The Nature Conservancy New Hampshire. In a one-day meeting, there was limited opportunity to reach agreement on core issues, but the group listed some current energy realities and driving forces that will be helpful in guiding future conversations, and those related to wind siting are listed below.

Current Realities

- The region's public conservation lands, open space, and other natural and recreational resources are threatened both by climate change and by inappropriate energy infrastructure development.
- The environmental community is not adequately engaged in the processes that are planning for our energy future, including the ISO-NE and state utility and transmission planning.
- Lack of comprehensive energy planning in the Northeast reduces our choices in the future and will lead to less than optimal outcomes.
- The environmental community has no broad strategic view of energy markets.
- The environmental community needs to have a more informed dialogue about the trade-offs among energy choices in order to arrive at a consensus around an energy path.

Fundamental Driving Forces

- Unstable state and federal energy policies are driving poor decisions and lack of action.
- Externalities of energy use are not monetized.
- Engaging on these issues is extremely complex and resource-intensive.

[13] New England Conservation Community Perspectives on Wind Power: Defining Common Principles on Wind Power Development and the Protection of New England's Natural Heritage - A position paper for consideration by New England's conservation community. January 2006, http://www.maine.gov/doc/mfs/windpower/pubs/jody_jones/cons-wind-power-wpaper.pdf.

- Climate change has become highly politicized.
- Siting of new energy facilities is frequently pushed to unpopulated or economically disadvantaged areas.
- The environmental community has tended to segment interests and needs to have a more comprehensive view of the issue.

In the absence of landscape-level guidance for wind siting, location decisions are based on the choices of developers and reactions from various agencies and interested parties. For all three states, projects that make it to the permit application stage are very rarely denied a construction permit.[14] More commonly, permitting authorities impose conditions that reduce or offset the impacts so that those impacts will no longer be considered "undue" or "unreasonable" in comparison with the expected benefits of the project. It is up to permitting authorities to determine when mitigation is sufficient to bring impacts down to an acceptable level, resulting in uneven practice from project to project.

Mitigation practice is well-developed at both the federal and state levels for wetlands under the national "no net loss" policy. To a lesser degree, mitigation and habitat banking for wildlife habitat impacts has been developed at the federal level and in selected states, mostly under the endangered species act which allows incidental take of listed species for parties that implement a comprehensive habitat conservation plan. The next section reviews these mitigation models.

2. Wetlands and Habitat Banking as Mitigation Models

Before delving into the specifics of wetland and habitat mitigation, it's helpful to review mitigation principles that apply in all contexts. In general, mitigation for environmental damages should follow a hierarchy of preferred actions. Regulations issued by the Council of Environmental Quality for the National Environmental Policy Act define mitigation to include (in general order of preference):

- avoiding the impact altogether by not taking a certain action or parts of an action;
- minimizing impacts by limiting the degree or magnitude of the action and its implementation;
- rectifying the impact by repairing, rehabilitating, or restoring the affected environment;
- reducing or eliminating the impact over time by preservation and maintenance operations during the life of the action;
- compensating for the impact by replacing or providing substitute resources or environments.[15]

Compensatory mitigation can be carried out through four types of activity: *restoration* of a previously-existing site, *enhancement* of functions at a degraded site, *establishment* (i.e. creation) of a new site, or *preservation* of an existing site. Compensatory mitigation may be achieved through three alternative mechanisms: *permittee-responsible mitigation, mitigation banks* and *in-lieu fee programs.*[16] In general, practice is trending away from the first option because it leads to ineffective piecemeal projects that are not well monitored or maintained. Both banks and in lieu fee programs are managed by a dedicated entity that specializes in resource management and pools funds from multiple development projects to achieve more effective high-priority restoration or protection. Developers can purchase credits or pay a fee and leave the management to experts.

[14] To-date, Maine has denied three proposals (Redington/Black Nubble, Bowers Mountain, and Passadumkeag) with a fourth (Highland Wind) withdrawn in advance of an expected denial. Vermont has denied one proposal (East Haven.)
[15] CEQ, Regulation 1508, http://ceq.hss.doe.gov/nepa/regs/ceq/1508.htm.
[16] Section 404(b)(1) Guidelines for Specification of Disposal Sites for Dredged or Fill Material, http://water.epa.gov/lawsregs/rulesregs/cwa/upload/CWA_Section404b1_Guidelines_40CFR230_July2010.pdf.

Wetlands Mitigation

Wetlands regulations issued by EPA and the Army Corps of Engineers (ACE) in pursuit of "no net loss" wetland goals simplify the mitigation hierarchy to three mitigation options: avoid, minimize and compensate, in that order of preference. Under ACE wetland mitigation guidelines, preservation may be used for compensatory mitigation only under certain restricted conditions. The resources preserved must:

- provide important physical, chemical, or biological functions for the watershed;
- contribute significantly to the ecological sustainability of the watershed;
- be approved by the district engineer as appropriate and practicable;
- be threatened with destruction or adverse modifications; and
- be permanently protected (e.g. easement or title transfer to state resource agency or land trust).

In the New England Region ACE acknowledges that there are more opportunities to preserve existing wetlands than to restore or enhance wetlands, many of which have already been converted to other land uses. Since New England states have fairly stringent wetlands regulations, few existing wetlands are threatened with imminent destruction, so the ACE encourages off-site preservation to include uplands that enhance wetland functions. The replacement site must meet a set of conditions that guarantee its value and longevity, including:

- hydrological conditions, soil characteristics, and other physical and chemical characteristics;
- watershed-scale features, such as aquatic habitat diversity, habitat connectivity, and other landscape scale functions;
- size and location of the compensatory mitigation site relative to hydrologic sources (including the availability of water rights) and other ecological features;
- compatibility with adjacent land uses and watershed management plans;
- reasonably foreseeable effects the compensatory mitigation project will have on ecologically important aquatic or terrestrial resources (e.g., shallow sub-tidal habitat, mature forests), cultural sites, or habitat for federally- or state-listed threatened and endangered species; and
- other relevant factors including, but not limited to, development trends, anticipated land use changes, habitat status and trends, the relative locations of the impact and mitigation sites in the stream network, local or regional goals for the restoration or protection of particular habitat types or functions (e.g., re-establishment of habitat corridors or habitat for species of concern), water quality goals, floodplain management goals, and the relative potential for chemical contamination of the aquatic resources.[17]

The ACE mitigation ratios in the table below apply to direct permanent impacts (i.e. drainage or removal of material from or placement of fill in a wetland). The higher ratios for preservation options reflect the fact that protecting an existing wetland or its upland watershed does not fully compensate for permanent wetland destruction elsewhere.

[17] US Army Corps of Engineers, New England District. 7-20-2010. New England District Compensatory Mitigation Guidance, http://www.nae.usace.army.mil/reg/Mitigation/CompensatoryMitigationGuidance.pdf.

Compensatory Mitigation Ratios for Direct Permanent Impacts

Type of Wetland	Restoration	Creation	Enhancement	Preservation
Emergent Wetlands (acres)	2:1	2:1 to 3:1	3:1 to 10:1	15:1
Scrub-Shrub Wetlands (acres)	2:1	2:1 to 3:1	3:1 to 10:1	15:1
Forested Wetlands (acres)	2:1 to 3:1	3:1 to 4:1	5:1 to 10:1	15:1
Open Water (acres)	1:1	1:1	project specific	project specific
Submerged Aquatic Vegetation (acres)	5:1	project specific	project specific	N/A
Streams (linear ft)	2:1	N/A	3:1 to 5:1	10:1 to 15:1
Mudflat (acres)	2:1 to 3:1	2:1 to 3:1	project specific	project specific
Associated Upland (acres)	>10:1	N/A	project specific	15:1

State-level wetland mitigation programs in northern New England generally follow the ACE priorities and ratios, but differ in the options they offer developers for implementing mitigation activities.

Maine Wetlands Mitigation

Under Maine DEP's wetlands rules, compensatory mitigation may use any of the following methods:

- restoration (returning a damaged natural resource as closely as possible to its original condition prior to the damage);
- enhancement (making changes or improvements to natural resources to replace the functions or values performed by the resources lost or damaged);
- preservation (protecting a natural resource in an adjacent area that are equivalent to the area damaged and that might otherwise be subject to an unregulated activity);
- creation (converting a non-resource area into a resource with all of the physical and biological characteristics to replace the area lost or damaged).[18]

For mitigation of wetland impacts, Maine's NRPA requires compensation to occur on-site if wetland function is localized (e.g. regulating water flow to reduce flooding). Otherwise, off-site mitigation is acceptable. Options include restoration or enhancement of degraded wetlands, preservation of existing wetlands or adjacent uplands threatened by unregulated activity, or creation of a new wetland. Mitigation ratios are specified in Chapter 310 of Maine's Land Rules. Standard compensatory mitigation ratios are 1:1 for restoration, enhancement or creation if damaged wetlands are not of special significance; 2:1 for restoration, enhancement or creation for wetlands of special significance; and 8:1 for preservation, including adjacent upland areas.[19]

Four options are described for achieving compensatory mitigation:

- permittee-responsible on-site compensation: Enhance, restore or preserve resources within project boundaries. These are particularly encouraged when they directly benefit affected resources and when they border already protected lands.

[18] Maine DEP. June, 2008. Natural Resource Compensation: Methods for Restoring Lost Functions and Values, http://www.maine.gov/dep/land/nrpa/fs-nrcomp.html.
[19] http://www.maine.gov/dep/land/rules/index.html.

- permittee-responsible off-site compensation: Enhance, restore, or preserve resources outside the boundaries of the project but within the same watershed. Target areas should be threatened by development and preferably be near already protected lands.
- purchase of credits from a mitigation bank: Maine has a state-affiliated wetland mitigation bank for transportation projects.
- payment of a fee in lieu of a compensation project.

Maine's In Lieu Fee (ILF) program, managed in conjunction with The Nature Conservancy, charges a fee that reflects project impacts and uses the fee to manage resource enhancement and protection projects that offset those impacts. Within the ILF program, seven project service areas defined by biophysical regions ensure that mitigation occurs sufficiently near development activity. Theoretically, the program can be used for all resources under NRPA jurisdiction, but the initial focus has been on wetlands. Fee formulas are provided for wetlands, vernal pools, inland wading bird and waterfowl habitat, and shorebird habitat, based on (land value + restoration cost) x multiplier of 2 for highly significant resources.

New Hampshire Wetlands Mitigation

New Hampshire wetlands mitigation regulations, like most states, follow the model established by EPA and the ACE. Mitigation is generally required when more than 10,000 square feet of wetland or open water/stream are affected. Mitigation ratios are defined for bogs, tidal wetlands, forested wetlands, and tidal buffer zones, and these generally conform to the ratios from ACE/EPA guidance. Four options for mitigation are: wetland restoration, wetland creation, land preservation (mostly uplands), and an in lieu fee program.[20]

New Hampshire's in lieu fee option, known as the Aquatic Resource Mitigation (ARM) Fund, is administered by New Hampshire's Department of Environmental Services. "The program has been built on protecting high value aquatic resources and buffers to reduce cumulative impacts and ensure that the resources will remain intact for the long term. Protection of upland habitat adjacent to aquatic resources is essential for the protection of the functions and values of these resources. Funding projects that promote habitat diversity is key to the overall health of New Hampshire resources and key to a successful mitigation strategy. For preservation parcels, a review of whether the site is under threat from development or is in close proximity to other protected lands is essential to maintaining and protecting habitat connectivity."[21]

Nine major river basins based on modified HUC 8 watersheds define the service areas. Sites are selected by a state-wide committee with representatives from NH Department of Environmental Services, NH Assoc. of Conservation Commissions, NH Fish & Game Department, NH Office of Energy and Planning, NH Department of Resource and Economic Development Natural Heritage Bureau, NH Assoc. of Natural Resource Scientists, Society for the Protection of NH Forests, and The Nature Conservancy. Site Selection Priorities are laid out in detail, and include state wildlife action plan priorities and an emphasis on permanent protection. The chart below shows acres of wetland altered and acres improved or protected through mitigation – both created/restored/enhanced wetlands and easements.

[20] New Hampshire Department of Environmental Services. 2009. Environmental Fact Sheet: Aquatic Resource Mitigation, http://des.nh.gov/organization/commissioner/pip/factsheets/wet/documents/wb-17.pdf.

[21] New Hampshire Department of Environmental Services. May, 2012. New Hampshire Aquatic Resource Mitigation Fund Final In-Lieu Fee Program Instrument, http://www.nae.usace.army.mil/Regulatory/Mitigation/In-Lieu/NHinstrument051812.pdf.

Acreage of Wetland Loss, Restoration and Upland Preservation, 2006-2010

[22]

In 2011, the Trust for Public Land was awarded $89,000 in ARM funding to purchase 935 acres surrounding Greenough Ponds in Errol. This land will be donated to the state.

Vermont Wetlands Mitigation

Vermont wetland permits are required for all activities within a wetland that are not defined as an allowed use. As for most wetland protection programs, Vermont regulations prioritize avoidance (locating an activity outside the sensitive resource or on-site design to avoid sensitive areas), then minimization (reducing impacts on wetland functions and restoring after activity is finished), then compensation. Compensation includes establishing or enlarging wetlands or payments to an in lieu fee program or wetland bank. Further requirements of a compensation plan are:

- no net loss of the protected functions or acreage of significant (Class I) wetlands;
- fully implemented prior to, or concurrently with, the proposed activity;
- monitored and managed for a period necessary to insure full replacement of the protected functions, no less than five years;
- self-sustaining following the period for which monitoring or management is required;
- financial surety; and
- permanently preserved by a conservation easement or deed restriction.[23]

Like Maine and New Hampshire, Vermont has an In Lieu Fee program, in this case operated by Ducks Unlimited, but the program has not been widely utilized. The program defines four service areas by 6-digit HUC watershed. Fees are based on the costs of land acquisition, project planning and design, construction, plant materials, labor, legal fees, monitoring, remediation or adaptive management measures, program implementation, contingency costs over the life of the project, establishment of a long-term management and protection fund, financial assurances to ensure successful completion, an administrative fee, and other factors as deemed appropriate by DU.[24]

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[22] New Hampshire Department of Environmental Services. May, 2012. New Hampshire Aquatic Resource Mitigation Fund Final In-Lieu Fee Program Instrument, http://www.nae.usace.army.mil/Regulatory/Mitigation/In-Lieu/NHinstrument051812.pdf.

[23] Vermont Wetland Rules. Vt. Code R. 12 004 056 (Amendments adopted July 16, 2010, Effective August 1, 2010), http://www.nrb.state.vt.us/wrp/publications/VWR%207-16-10.pdf.

[24] Ducks Unlimited, Inc. 12-7-2010. Vermont In-lieu Fee Program, http://www.nae.usace.army.mil/reg/Mitigation/In-Lieu/VT.pdf.

Wildlife Habitat Mitigation

US Fish and Wildlife Service (USFWS) mitigation guidance issued in 1981 and revised 1986 adopts the CEQ definition of mitigation as avoiding (omitting action), minimizing (limiting action), rectifying (restoration), reducing over time (operations), or compensating for (substitutes) impacts. The guidance defines how the Service will use mitigation to protect habitats that fall under four defined categories:[25]

I. High value, unique and irreplaceable nationally or in ecoregion - No losses;
II. High value, scarce - No net loss of in-kind habitat (minimize, rectify, compensate with same habitat type);
III. High to medium, relatively abundant nationally - No net loss of overall habitat value, minimize loss of in-kind habitat (minimize, rectify, compensate with any habitat of similar value, includes out-of-kind);
IV. Medium to low value - Minimize loss of overall habitat value.

The assessment of impacts to be mitigated includes not only direct (e.g. habitat destruction or degradation) but also indirect (e.g. changes to animal behavior beyond the disturbed property) and cumulative (e.g. habitat fragmentation and loss of core forest).

The guidance restricts compensatory mitigation practices in several ways: discourages fee purchase unless it costs less than or is more effective than alternatives, encourages multiple compatible uses on mitigation lands (although recreation values may not substitute for habitat value), and prioritizes lands nearest to the area of impact over remote lands.

Mitigation may be part of the strategy for protecting endangered species. When the USFWS issues an incidental take permit for a listed species under the Endangered Species Act, it requires a habitat conservation plan (HCP) that specifies how the expected harm will be offset by improving conditions for that species. These actions may include off-site mitigation, including purchase of credits from an established habitat bank.

As for wetland banking and in lieu programs, the USFWS recognizes that there may be an advantage to pooling mitigation funding and effort. In 2003, the Service issued guidance on habitat banking,[26] which built on previous experience with wetland banking. Ideally, banking makes conservation efforts more effective by concentrating effort on larger reserves with better connectivity. As for wetlands, a bank could protect existing habitat via fee or easement, restore or enhance degraded habitat, create new habitat, or dictate management practices with no change in ownership. Unlike wetlands which have significant location-specific values, conservation banks concern survival of a species as a whole and are more focused on areas of ideal conditions for a species, or a location that is part of a well-designed conservation network, rather than proximity to the development being permitted.

Just as wetland banks and in lieu programs have progressed from early assumptions that wetland functions could be measured in acres alone to advance various measures of functional value, habitat banks are struggling with how to measure habitat credits to ensure adequate compensation for impacts. In addition to area, habitat quality, nesting sites, and food sources may be part of a credit formula. Also similar to wetlands, mitigation ratios may differ depending on the degree of damage from a project and the quality of the habitat damaged, though harm to a species from a given disturbance is seldom as certain or directly measurable as draining or filling an acre of wetland.

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[25] Federal Register January 2, 1981. Vol. 46 No. 15 pp. 7656-7663 Federal Register Vol 46 No 15, http://www.fws.gov/habitatconservation/FWS%20Mitigation%20Policy.pdf.

[26] USFWS Conservation Banking Guidance, 2003. http://www.fws.gov/endangered/esa-library/pdf/Conservation_Banking_Guidance.pdf.

Off-site compensatory mitigation is often controversial because it seems so easy to declare damages offset with little assurance that the envisioned benefits actually materialize. Agencies often use mitigation to reduce project impacts enough to reach a Finding of No Significant Impact (FONSI), which means that an Environmental Assessment can be used rather than a full Environmental Impact Statement. However, there is not always follow-through to ensure that mitigation actions work to protect the species at risk. In 2011, CEQ issued guidance that tightened up the practice of using mitigation to reach a FONSI.[27] The guidance might be equally appropriate to state regulators using mitigation to conclude that net impacts from a wind project fall below the "undue" or "unreasonable" threshold. The guidance recommends relying on compensatory mitigation only if there are both authority and resources to implement, monitor, and track effectiveness. The guidance also stresses public transparency about how impacts and offsets are measured and monitored.

Another mitigation model that might inform regional wind siting efforts to minimize cumulative impacts is a multi-state HCP now under development for wind power projects in 8 states of the upper Midwest. The Conservation Fund and these states received a $3.3 million HCP Planning Assistance Grant in 2010 to address incidental take of multiple species by wind farms (http://www.fws.gov/midwest/endangered/permits/hcp/r3wind/index.html). Species that may be included in the final plan include: gray bat, Indiana bat, Kirtland's warbler, piping plover Great Lakes population, least tern interior population, plus several other species of bats that may soon be listed due to white nose syndrome.

The USFWS also introduces mitigation principles in its recently-issued Land-Based Wind Energy Guidelines.[28] These guidelines are intended to help wind developers and regulators minimize impacts to "species of concern", which include not only federally listed or candidate species, but also those subject to the Migratory Bird Treaty Act or Bald and Golden Eagle Protection Act, as well as species formally designated as in need of protection and/or management by a "relevant agency or other authority" or those shown to be "significantly adversely affected by wind energy development". The guidance also introduces a new category – "species of habitat fragmentation concern"— those for which a government agency finds that smaller habitat blocks decrease the likelihood of the species thriving. This very broad definition of affected species leaves considerable scope for using mitigation conditions to reduce wildlife impacts from wind projects. The guidance also confirms that compensatory mitigation may be required by the USFWS or by state resource agencies, tribes, localities, and federal or state land management agencies. An appropriate role suggested for non-profit organizations is to help "developers and agencies design and implement mitigation or offset strategies."

Another example of a mitigation model that might be adapted to northeastern wind mitigation is the approach proposed for Solar Energy Zones (SEZs) on Bureau of Land Management lands in the western U.S. SEZs are low-conflict areas where BLM encourages energy development. Impact fees would be pooled for all projects in a zone and priority mitigation investments would be pre-defined.[29] A pilot regional mitigation plan is being developed for the Dry Lake SEZ in Nevada.[30]

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[27] Council on Environmental Quality. January 2011. Guidance: Appropriate Use of Mitigation and Monitoring and Clarifying the Appropriate Use of Mitigated Findings of No Significant Impact.

[28] USFWS Land-Based Wind Energy Guidelines, March 23, 2012, Chapter 8 Mitigation, http://www.fws.gov/windenergy/docs/WEG_final.pdf.

[29] Bureau of Land Management and U.S. Department of Energy. July 2012. Final Programmatic Environmental Impact Statement (PEIS) for Solar Energy Development in Six Southwestern States, Volume 6, Part 1, Appendix A.2.5 Draft Framework for Developing 1 Regional Mitigation Plans for the BLM's Solar Energy Program, pp. A-112 to A-120.

[30] http://www.blm.gov/nv/st/en/fo/lvfo/blm_programs/energy/dry_lake_solar_energy.html

Habitat Mitigation at the State Level

In general, state-level mitigation standards for wildlife habitat are less well-developed that wetland standards. Maine's NRPA regulations offer two compensation options to offset impacts to wildlife habitat:

- restoration, enhancement or preservation of in-kind significant wildlife habitat or uplands or wetlands adjacent to such habitat. The site of the compensation project must provide significant wildlife habitat functions that might otherwise be degraded by unregulated activity, be located within or near the affected habitat, and the site must be preserved.
- payment of a compensation fee into the "Natural Resources Mitigation Fund", an in lieu fee program (see details in wetlands section).

Mitigation ratios are specified in Chapter 335 of Maine's Land Rules.[31] Standard compensation ratios for significant wildlife habitat are 2:1 for restoration, enhancement, or creation; and 8:1 for preservation, including adjacent upland or wetland habitat, but the department may require some other ratio depending on specific project characteristics.

New Hampshire's Wildlife Action Plan, completed in 2005, notes that "NHDES currently regulates wetlands and requires mitigation for wetland impacts, but there is not an equivalent process for terrestrial habitats, some of which are considered globally rare (e.g., pitch-pine barrens)".[32]

VT ANR has specific mitigation guidelines for deer wintering areas (1999) and black bear habitat (2006).[33] These guidelines define direct and indirect impacts and outline common mitigation strategies for various types of projects. The department uses the US Fish and Wildlife Service resource categories (see Wildlife Habitat Mitigation below) to determine its approach to habitat loss and acceptable mitigation, and defines RC2 (high quality and unique) and RC3 (high quality and scarce) for deer and bear habitat. Theoretically, no encroachment is allowed on RC2 habitats. Mitigation ratios for protected habitat (via conservation easement or deed restriction) are defined for deer wintering areas at 2:1 on-site and 4:1 off-site and for bear habitat at 4:1 for beech/oak stands and 10:1 for wetlands. Aside from deer and bear, the Department has a policy of no net loss for Bicknell's thrush habitat.

3. Compensatory Mitigation for Wind Projects

Given this general background on mitigation, we turn now to mitigation practice in northern New England as applied specifically to wind projects. We first summarize mitigation practice to-date, then discuss the possibility of an expanded in lieu model to better address landscape-scale wind development impacts.

Compensatory Mitigation in Wind Projects To-Date

As of early December, 2012, 13 wind projects have been permitted in Maine, 4 in Vermont, and 3 in New Hampshire. The following tables list all projects by state, date, permitting authority, primary resource concerns, parties involved in mitigation negotiations, and compensatory mitigation measures.

[31] http://www.maine.gov/dep/land/rules/index.html.

[32] New Hampshire Fish and Game Department. October 1, 2005. New Hampshire's Wildlife Action Plan. http://www.wildlifeactionplan.org/pdfs/action_plans/nh_action_plan.pdf

[33] Bear guidelines entered as exhibit in Lowell Mountain PSB proceeding (not posted online); deer guidelines at http://www.vtfishandwildlife.com/library/Reports_and_Documents/Fish_and_Wildlife/Guidelines_for_the_Review_and_Mitigation_of%20Impacts_to_White-Tailed_Deer_Winter_Habitat.pdf

Maine

Project	Permit	Date	Resource concerns	Parties involved in mitigation	Compensatory mitigation elements
Mars Hill 50MW	ME DEP	2006	Wetlands, birds	MDIFW, Maine Audubon	• None
Stetson I 57MW	ME LURC	2008	Wetlands, birds/bats	NRCM, CLF, Maine Audubon intervenors but not opposed	• None
Kibby 132MW	ME LURC	2008	High elevation, Bicknell's thrush, wetlands, rare plants	NRCM, Maine Audubon, TPL, AMC	• $500,000 toward Stowe Mountain in Mahoosucs; • Forego wind development on 1,100+ acres neighboring ridgeline; • Not in formal permit conditions
Stetson II 25.5MW	ME LURC	2009	Wetlands, birds/bats, yellow lampmussel, scenic	No public hearing	• $25,000 to Stetson Mountain Fund (FSM) for recreational access - may be used for land acquisition (not a formal permit condition)
Beaver Ridge 4.5MW	ME DEP	2009	Forested wetland clearing (permitted after-the-fact)	No public hearing	• None
Rollins 60MW	ME DEP	2009	Wetlands, riparian, vernal pools, inland waterfowl and wading bird habitat, deer wintering area, scenic lakes, bald eagles, bats	MDIFW	• $140,140 to In Lieu Fee mitigation fund for IWWBH (formal permit condition); • MDIFW reserves right to request compensatory mitigation depending on bird/bat monitoring
Fox Islands 4.5MW	ME DEP	2009	Vernal pool	DEP	• Preserve 14.2 acres within 500ft of vernal pool
Record Hill 50.6MW	ME DEP	2009	Wetlands, vernal pools, birds/bats	MDIFW	• MDIFW reserves right to request compensatory mitigation depending on bird/bat monitoring
Spruce Mountain 20MW	ME DEP	2010	Wetlands, vernal pools, northern spring salamander, habitat fragmentation, scenic, peregrine, golden eagles, other birds/bats	MDIFW, local interested parties	• $80,000 to Woodstock for land conservation (not a formal permit condition); • protect 1,000 acres on project property; • 250 ft stream buffer for salamander; • MDIFW reserves right to request compensatory mitigation depending on bird/bat monitoring (specifically mentions habitat protection offsite)

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Maine (cont.)

Project	Permit	Date	Resource concerns	Parties involved in mitigation	Compensatory mitigation elements
Kibby Expansion 33MW	ME LURC	2011	Fir heart-leaved birch subalpine forest, Bicknell's thrush, roaring brook mayfly, spring salamander, northern bog lemming, raptors, scenic chain-of-ponds	MDIFW; Friends of the Boundary Mountains (FBM) [opposed]; Appalachian Mountain Club (AMC) [opposed in part]; Maine Audubon Society (MAS) [opposed in part]; Natural Resources Council of Maine (NRCM) [opposed in part];	• High Peaks Alliance $110,000 for land conservation and trail corridor acquisition in Franklin County (not a formal permit condition)
Saddleback Ridge 33MW	ME DEP	2011	Multiple scenic resources; peregrine, bald eagle, bats	MDIFW	• $60,000 to BPL for land acquisition near Mt Blue (formal permit condition); • MDIFW reserves right to request compensatory mitigation depending on bird/bat monitoring
Bull Hill 34.2MW	ME LURC	2011	Salmon, scenic lakes and BPL unit summits	Local interested parties	• $25,000 to Downeast Salmon Federation Narraguagus River watershed and vicinity conservation projects + annual payments to DSF of $20,000 for water quality projects and public access (not a formal permit condition)
Oakfield 150MW	ME DEP	2012 (amended)	Wetlands, IWWBH, deer yards, mussels, wetland plants, wood turtle, blue spotted salamander, multiple birds of special concern, 2 exemplary natural communities, scenic lakes	MDIFW	• Purchase 2,100 acres 8 miles away within a Habitat Focus Area near Mattawamkeag River WMA with multiple values (formal permit condition)

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New Hampshire

Project	Permit	Date	Resource concerns	Parties involved in mitigation	Compensatory mitigation elements
Lempster 24MW	SEC	2007	Wetlands, birds/bats	Public advocate	Donate Earl's Lane parcel to town of Lempster
Granite Reliable 99MW	SEC	2009	High elevation habitat (Bicknell's thrush, marten), wetlands	NH F&G and AMC for high elevation; DES for wetlands	• Fee purchase 1,735 acres above 2700' – no motorized access • 620 acres conservation easements for wetlands (Columbia, Erving's Loc.); • 8 constructed vernal pools totaling 3,600 sq.ft.; • $750,000 to NHF&G to purchase comparable habitat; • $200,000 to NHF&G to monitor Bicknell's and marten
Groton 24MW	SEC	2011	Wetlands	NH DES	• $150,000 in lieu payment to DES ARM to improve 9 stream crossings plus technical assistance to SPNHF (wetlands permit conditions)

Vermont

Project	Permit	Date	Resource concerns	Parties involved in mitigation	Compensatory mitigation elements
Searsburg	PSB	1996	Bear, scenic	VT ANR	None
Deerfield – 30MW	PSB	2009/12	Bear, wetlands	VT ANR	144 acres protected bear habitat (4:1 ratio) (Iberdrola requests USFS to provide this?)
Sheffield – 40MW	PSB	2007/09	Bear, wetlands	VT ANR	2,700 acre temporary easement (for duration of project), subject to reduction if monitoring shows no effect on bears
Georgia Mountain – 10MW	PSB	2010	Rare natural communities, habitat fragmentation	VT ANR	108 acres permanent easement on project site, close summit ATV trails
Kingdom Community (Lowell) – 63MW	PSB	2011	Habitat fragmentation, bear, rare high-elevation natural communities, wetlands	VT ANR	• Bear habitat - on-site easements: 292 acres temporary (until 25 acres after decommissioning) + 288 permanent • Wetlands – on-site already included in above • Fragmentation – on-site parcel 4- 324 acre ridgeline easement to prevent secondary development (starts post-project then permanent, allows further energy development), 1,662 acres off-site permanent "connectivity" easements • 172 acres additional permanent no-logging easement after landowner cleared mitigation parcels • 110 acre Long Trail property (already owned by GMC)

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Compensatory mitigation has been incorporated in 8 of the 13 permitted wind projects in Maine, all 3 permitted in New Hampshire, and 4 of the 5 permitted in Vermont.

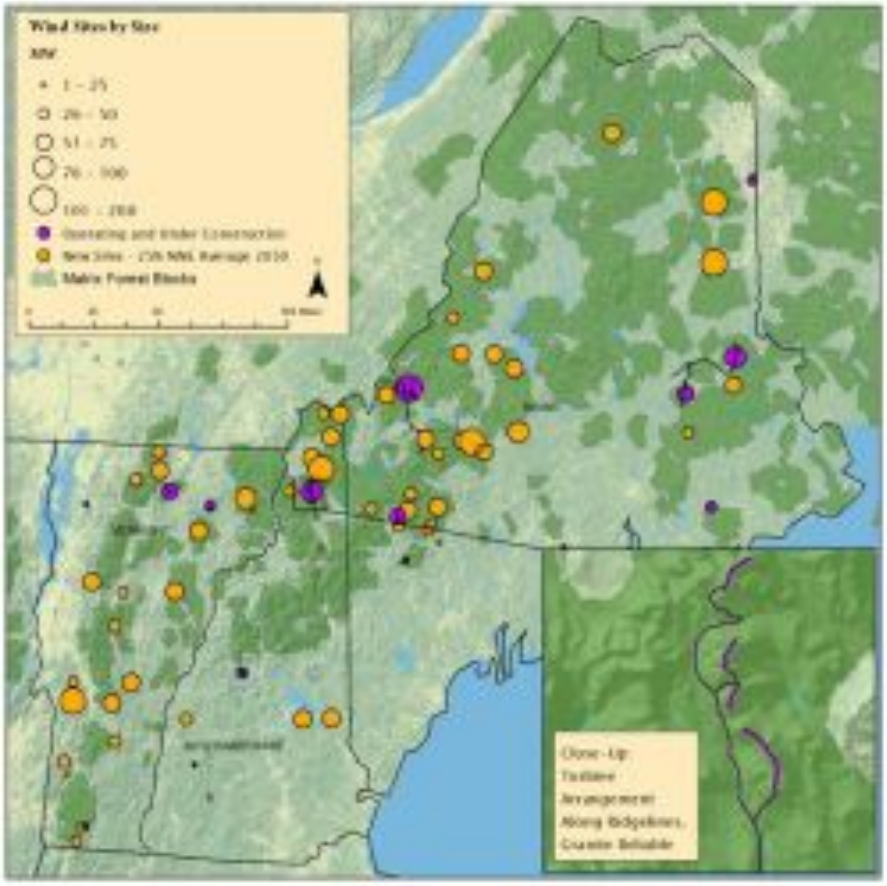
- On-site land protection through temporary or permanent easements on project property is commonly required. Examples include:
  - Kibby I - temporary restriction on 1,100 high-elevation acres originally leased for wind development),
  - Fox Islands - permanent protection of vernal pool buffer),
  - Spruce Mountain - 1,000 acres plus stream buffer),
  - Lempster - Earl's Lane parcel),
  - Sheffield - 2,700 acres for project duration),
  - Georgia Mountain - 108 acres permanent),
  - Lowell - 460 acres permanent, 292 acres temporary during project, ~300 acres delayed post-project permanent).
- Direct purchase of land or easements off-site may be required, with land usually donated to the state or a nonprofit:
  - Oakfield - purchase and donation to the state of 2,100 acres,
  - Granite Reliable - purchase and donation to the state of 1,735 high-elevation acres and easement protection for 620 acres of wetlands,
  - Deerfield - protect 144 acres bear habitat (it appears that Iberdrola expects the Forest Service to provide that protection on National Forest land),
  - Lowell - 1,662 of connectivity easements.
- Payments are frequently made to a town, state agency, or nonprofit for specific or unspecified future conservation:
  - Kibby I - $500,000 to Trust for Public Land for Stowe Mountain project,
  - Stetson II - $25,000 to Forest Society of Maine for recreational access,
  - Spruce Mountain - $80,000 to Woodstock for local land conservation,
  - Kibby Expansion - $110,000 to High Peaks Alliance for recreation access (under appeal),
  - Saddleback Ridge - $60,000 to ME BPL for land near Mt. Blue,
  - Bull Hill - $25,000 plus $20,000/year to Downeast Salmon Federation for conservation and fishing access,
  - Granite Reliable - $750,000 to NH Fish & Game for land purchase.
- In two cases payments were made to established state in lieu fee programs:
  - Rollins - $140,140 inland wading bird and waterfowl habitat,
  - Groton - $150,000 for stream crossings.

Mitigation as a Tool for Limiting Cumulative Impacts from Wind Development

In northern New England, areas with the best wind resource also tend to be those with the most intact habitat and lowest human population density. The map below shows approximate locations of 63 wind sites[34] required to provide 25% of northern New England's projected energy needs (including conversion to 50% electric vehicles and 25% geothermal heat) by 2050. Wind sites are displayed with matrix forest blocks delineated by The Nature Conservancy. Sites in northern New Hampshire and western Maine would require major new transmission capacity, which would further fragment the landscape.

[34] Sites with highest capacity factor from the Eastern Wind Integrations and Transmission Study (EWITS). EnerNex Corporation. February 2011 (revised). Prepared for National Renewable Energy Laboratory. Note that many sites are larger than 100MW, whereas most projects to-date have been considerably smaller, so a larger number of smaller sites might be more realistic.

Wind Sites to Provide 25% of Northern New England Electricity in 2050



Map by TWS

The pattern of development depicted on this map is not necessarily the one that maximizes overall net social and environmental benefit, because critical information is often left out of the site selection process. Regulatory and/or incentive structures that account for the full costs of development can help guide projects to appropriate places. Systematic mitigation funding could provide both carrots (funding for core wildland protection) and sticks (higher mitigation fees for projects that locate in sensitive areas). If every constructed project yielded substantial permanent habitat protection via compensatory mitigation funding, and those funds were targeted to protect the highest priority habitat, the cumulative landscape impacts of wind development could be reduced well below those resulting from the current free-for-all approach.

Uniform regional mitigation standards would add further predictability to the permitting process. Since wind developers, the electricity grid, and wildlife habitat networks are all shared across this region, it makes sense to coordinate policies and land use priorities to avoid playing off one state against another. Standardized mitigation programs would require intensive study, broad agreement on wind energy zones and protection zones, and management of funding to distribute both costs and benefits equitably. Maine may already be poised to fine-tune its initial very broad expedited permitting area; habitat mapping for New Hampshire's wildlife action plan provides a good basis for such a discussion in that state; and Vermont ANR's BioFinder resource map might provide guidance regarding appropriate development and protection areas.

From: Willem Post [redacted]
Sent: Saturday, January 12, 2013 8:53 AM
[redacted]
Subject: IWT Capacity Factors Less Than Estimated

All,

Below is a new article on THE ENERGY COLLECTIVE. It had almost 600 views in one day.

Willem

http://theenergycollective.com/willem-post/169521/wind-turbine-energy-capacity-less-estimated

From: Annette Smith
Sent: Saturday, January 12, 2013 10:31 AM

Subject: Poland And Czech Republic Ban Germany's Green Energy | The Global Warming Policy Foundation (GWPF)

Dear Siting Commission,

I appreciated the historical information that Rep. Cheney provided to the commission in her presentation on Friday, but was a bit disturbed by the incomplete information provided about Germany. I understand she had a very productive trip to Germany, but there is more to the story based on news stories. I admit to being challenged by the language barriers in understanding the details of what is happening in the highly lauded renewables efforts of Denmark and Germany, but there is enough information available in English (der Spiegel has been doing a good job covering the issues) to know that there are real problems in both Germany and Denmark with the deployment of renewables. I am also aware that there is a lot of spin involved in the reporting on these issues, but there does seem to be enough information to suggest there are serious issues to consider beyond what was presented to the commission.

In this email I am going to paste in one complete article at the beginning and one complete article at the end, and summaries of articles that include links from der Spiegel International so you can review them as you wish. The issues as I understand them have to do with destabilizing the grid in neighboring countries such that other countries are blocking Germany's green energy, rapidly increasing costs, disparity of users sharing the burden of the high costs, the shutting down of conventional plants, the need for conventional plants to back up green energy, and a lot of opposition to wind turbines. I have heard that Germany is building 23 or so new coal plants and just did a search and found this opinion piece http://www.forbes.com/sites/jamesconca/2012/08/31/germany-insane-or-just-plain-stupid/ and this news story http://www.nytimes.com/2012/11/01/business/energy-environment/01iht-green01.html?_r=0

I also included one story about biogas resulting in a land grab. There are lots of issues to consider with renewables deployment, and we can learn from Germany in many ways, not just with what seems to be working but also where the problems are arising.

Annette

http://www.thegwpf.org/poland-czech-republic-ban-germanys-green-energy/

POLAND AND CZECH REPUBLIC BAN GERMANY'S GREEN ENERGY

- Date: 29/12/12
-
- Daniel Wetzel, Die Welt

In order to boost Germany's 'ecological wonder' and its green energy transition, the Federal Republic has used power grids of neighbouring countries – without asking for permission. For this short-sighted policy, the German government is now being punished.

Germany considers itself the environmental conscience of the world: with its nuclear phase-out and its green energy transition, the federal government wanted to give the world a model to follow. However, blinded by its own halo Germany overlooked that others have to pay for this green image boost and are suffering as a result. For example, Germany's 'eco-miracle' simply used the power grids of neighboring countries not only without asking for permission but also without paying for it. Now Poland and the Czech Republic have pulled the plug and are building a huge switch-off at their borders to block the uninvited import of green energy from Germany which is destabalising their grids and is thus risking blackouts.

Foto: Infografik Die Welt : Wie das Wasser, so sucht sich auch der Strom den besten Weg

More forced shutdowns of wind farms

Germany's neighbours act in self-defense, no one can blame them. The blocking of energy at their borders, however, are fragmenting the single European market for electricity. They also turning Germany into an electrical island within the European energy network, with unknown consequences for the security of supply. And they cause even more forced shutdowns of wind farms in Germany, which means additional costs of at least one hundred millions Euros.

Germany's federal government took the nuclear phase-out decision without any consultation with their European partnerns and irrespective of any implications for neighbouring countries. The green decision was rushed through without regard of transport capacity. For their short-sighted, self-centered and actionistic energy policy the German government is now paying the price.

Die Welt, 28 December 2012

From: Rob Pforzheimer
Sent: Sunday, January 13, 2013 11:30 AM

Subject: Tourist sector is paying the price for misguided promotion of wind farms

SATURDAY 12 JANUARY 2013 http://www.heraldscotland.com/comment/letters/tourist-sector-is-paying-the-price-for-misguided-promotion-of-wind-farms.19889290

Tourist sector is paying the price for misguided promotion of wind farms

OFFICIAL figures have revealed a catastrophic decline in Scottish tourism last year with tourist spending down by £50m ("Olympics put a dampener on Scots tourism industry", The Herald, January 11.

VisitScotland chairman Mike Cantlay has blamed the poor weather. Since when do tourists come to Scotland for the weather?

This is the same tourism chief who claimed a few weeks ago that giant industrial wind turbines which now scar some of our most beautiful hills and glens are not a deterrent to tourists. He said there was even anecdotal evidence that wind turbines might attract visitors to Scotland. Well, now we have the answer.

Scotland's unique selling points are its world-renowned landscapes and seascapes, which the SNP Government is determined to industrialise. Already, more than 1700 giant industrial wind turbines have been erected across 142 operational wind farms in Scotland. With 37 more wind farms currently under construction, 123 consented and a massive 165 further developments submitted for planning, thousands more will be built to meet Alex Salmond's ludicrous target of the equivalent of 100% of our electricity from renewables by 2020.

Wind turbines are costly, useless and force us to rely on back-up supplies of coal and gas. They don't make any significant impact on CO2 emissions, but they do make a massive impact on energy bills. Already more than one-third of all households in Scotland have been driven into fuel poverty, faced each winter with the awful decision on whether to spend their money on food or fuel.

Now Scotland's tourist sector is paying the price for this misguided and ruinous energy policy and the best VisitScotland can come up with is to blame the weather.

Struan Stevenson,
MEP (Conservative),
The European Parliament,
Rue Wiertz, Brussels.

From: Rob Pforzheimer
Sent: Sunday, January 13, 2013 12:06 PM
Subject: Wind turbine causing headaches, nausea, Scituate family says

Wind turbine causing headaches, nausea, Scituate family says
Produced January 12, 2013 (Posted January 12, 2013) by WCVB TV 5 Boston
Description:
Massachusetts WCVB TV Boston visited Scituate, MA to report on the impacts of noise and flicker on the home life of people living near the turbine.
Duration: 2 minutes 30 seconds
SCITUATE, Mass. —Mark and Lauren McKeever Friday asked a Plymouth Superior Court for a temporary restraining order against Scituate to halt operations of a giant wind turbine 640 feet from their house.

With three blades each 150 feet long, the turbine runs intermittently throughout the day and night.
"We can't sleep, my children wake up in the middle of the night because of the noise and humming, and then they go to school where they can't concentrate because they are sleep deprived," said Mark McKeever.
He said his family is suffering from sleep disturbances, headaches, nausea, dizziness, extreme fatigue, anxiety, tinnitus and difficulty concentrating since the turbine was erected over their house last March.
On sunny afternoons, light flickers throughout their house and makes it impossible to stay in the house or even to do any yard work.

Mark McKeever said his family had two good weeks of sleep in recent months -- when they went to New Hampshire for vacation.

"What they are doing is wrong," said Mark McKeever, who has pleaded with the town's board of health to at least shut the turbine down at night.

But town officials have been told by operators of the turbine that one-third of the wind generated is produced at night.

Town officials have said there is no proof that the turbine is causing the McKeevers' health problems.
Mark McKeever said he has invited every official to come to his house and see for themselves, but none have shown up to date. He is suing the members of the Board of Health for their refusal to act on his request for relief.

From: Annette Smith
Sent: Saturday, January 12, 2013 4:53 PM

Subject: Intervenor Funding and Risk, Elevations about 2500 feet, Protecting Class A1 Waters

Dear Siting Commission,

I am writing to offer comment on two subjects that came up during your deliberations on Friday, Jan. 11, 2013, and also Sen. Benning's suggestion that the siting commission support a moratorium.

1. Intervenor Funding -- It was suggested by Michael Dworkin that a consideration of Intervenor Funding should include requiring Intervenors to assume some level of risk, and that IF be conditioned on success. Given the current decision-making process at the Public Service Board, requiring success in order to receive IF is a significant bar to participation. You have heard from citizen and town Intervenors that they participated fully and with qualified lawyers and credible experts and lost every argument they presented. For example, the Towns of Albany and Craftsbury hired an attorney whose work was first rate and who never won a single argument. He recently was offered a prestigious teaching position that has taken him out of Vermont and his experience with the PSB is one that will probably make him think twice before returning to Vermont to participate in such a futile legal process. Please understand, this is not sour grapes about losing, which is something I have heard Chairman Volz suggest in his comments to the media. I followed the Lowell case closely, reading many of the legal arguments, and many issues arose that deserved more thorough consideration, and much excellent testimony was completely ignored by the Board. It would be impossible to show any successful outcome as a result of participation by the Towns or the Lowell Mountains Group, who were the primary intervenors going up against Green Mountain Power.
There seems to be a lack of understanding of just what a full-time job it is to participate in a PSB 248 hearing process. For no benefit, we are asking Vermonters to give up every moment of free time and more for more than a year to fully engage in an extraordinarily complex legal process, while also raising money. Chairman Volz's lack of support for Intervenor Funding is indicative of the public's sense that this Board does not respect the public or their issues and concerns.

2. Development on lands above 2500 feet in elevation -- I've attached some photos and maps about the Lowell and Deerfield Wind projects. Lowell is constructed. Deerfield has been permitted by the PSB and the USFS and VCE is appealing the USFS special use permit in federal court. http://vermontersforacleanenvironment.wordpress.com/2012/09/28/vce-files-for-summary-judgment-in-deerfield-wind-case/. If we were not appealing, the project would likely be under construction or planned for construction soon. ANR is actively reviewing the water permits with the developers' expert. The public and their experts have no access to ANR and are in no way involved in these pre-permitting processes.

The attached three photos of the Lowell ridgeline just came to my attention yesterday. They were taken by Steve Wright in August and provide excellent evidence that it is not an exaggeration to say the the tops of the mountains have been leveled or blown off. More than a million pounds of explosives was likely used on this one project. ANR has traditionally not gotten involved in blasting and has let Act 250 handle it. But that has changed with the passage of the Groundwater Protection law, where a public trust analysis is now required. To my knowledge, there was never any evaluation of the implications to groundwater from blasting on these highest elevations of the Lowell Mountains. These photos show three different pads on the Lowell Mountains. These are the highest elevations, and are above 2500 feet. See the attached map which shows that a significant area on top of the Lowell mountains is above 2500 feet.

During ANR's permitting of the Lowell mountain stormwater construction and operations permits, Energize Vermont and the Towns of Albany and Craftsbury hired highly qualified water experts who raised serious concerns about the designs for managing stormwater runoff. Watershed Consulting focused on the Curve Number (CN) used for modeling the turbine pads and roads. VHB modeled them at a number equivalent to

them draining like a cemetery lawn. Watershed Consulting submitted comments to ANR that the CN suggested by VHB and being considered by ANR would result in underestimating the volume and velocity of stormwater runoff by 20 to 30%. Princeton Hydro focused on the use of experimental level spreaders that are not recommended for slopes greater than 15% (most of the slopes on the Lowell Mountain wind project were 25% to 50%), degradation of water quality, especially Class A1 waters above 2500 feet, and filling headwater streams. In their comments to ANR, Princeton Hydro noted that 9 headwater streams would be filled. In its response to public comment, ANR ignored virtually all public comments, and among other things said that they disagreed that headwater streams would be filled.

The stormwater plans clearly showed that hundreds of feet of one stream would be filled, and certain areas of other streams would be filled. One of the EPSC (Erosion Prevention Sediment Control) reports contained the attached photo with the note that the stream was being "taken" for the project. Prior to the issuance of the permits, 10 of us went to EPA in Boston and met with their permitting staff expressing our concerns, including 4 water experts, 3 attorneys, and 3 representatives of towns and citizens, and at EPA's recommendation we also went to the US Army Corps's regional office for a meeting. We learned there was tremendous political pressure to issue permits, coming from the highest levels. Within weeks of our visits, nobody at either federal agency ever got back to us and all the water quality permits were issued.

During construction, public records from EPA show that groundwater was being surfaced, something that was not anticipated in the permits. The groundwater was dealt with by dedicating a piece of equipment to digging trenches to guide the water into surface water, meaning that even more water will come off the mountain more rapidly in intense rain events than the permits considered. One of those events happened in May 2012, just as the water experts hired by citizens and towns predicted.

I was fortunate to be able to see those highest elevations before the area was blasted. I have included one photo of a wetland between two turbine pads. It was not directly impacted, but a road was built by blasting through the peak of the mountain not far from it. I have been astonished to see areas that I thought were sacred (as a policy of the state of Vermont) turned into rock quarries.

The attached two maps are of the already-permitted Deerfield Wind proposal. The number of turbines has been reduced from what is shown on the map, but the two ridgelines that are permitted are both above 2500 feet, with one as high as 3000 feet. This project was opposed by ANR because it is some of the best bear habitat in the state, and in testimony Forrest Hammond said building the project threatens a genetically distinct population of bears.

Moratorium. There seems to be a lot of misimpression about the need for a moratorium, or rather that there is no need because there are no projects coming along. I have witnessed three mountains completely developed in two years. There is nothing standing in the way of building the Deerfield Wind project on those habitat-rich, high elevation remote mountains less than two miles from the George D. Aiken Wilderness except VCE's litigation. Should Iberdrola succeed, you can expect those two ridgelines to see the same fate as Lowell, Georgia Mountain and Sheffield.

As Jan Eastman said on Friday, we have never had the conservation about throwing out our policy to protect lands above 2500 feet. The only thing that is going to give us that time to have that conversation is a moratorium. The Grandpa's Knob developer has leases, he has had met tower data for 5 years, he has done his wildlife assessments, and he has said he is going to proceed even in light of ANR telling him the project contains insurmountable obstacles. The Seneca Mountain Wind developer, whose project is far from transmission and in the most biologically sensitive area of the state, has access to years' worth of met tower data from met towers that were up on several of the sites he is currently seeking new met towers, and his experts have been in meetings with ANR for two years. Iberdrola has said they only need 6 months of met tower data for the Grafton/Windham project (recently updated to a year, but I have heard no explanation why they changed it, and it could be to support the idea that nothing is in the works so nobody will put on the brakes). For the

communities that are facing these wind projects, the threat is far too real. Met towers have been up in Bolton and Eden for several years gathering data. One thing I have been amazed by is how fast these projects go from a concept to completion. We cannot afford to let this marketplace run wild without taking the time to address all the issues that are developing. On a daily basis now I am receiving noise complaints from neighbors who cannot sleep, are getting headaches, ringing in the ears, nausea, and all the health symptoms that the PSB was told by qualified experts can happen.

For all the above reasons, I sincerely hope you will discuss your role in this process, and talk about the moratorium in your deliberations. The governor and leadership in the legislature have said in public that there is no moratorium needed because the energy siting commission should be allowed to do its work. At some point soon I hope your understanding of the issues will lead you to act with urgency to protect public health and the environment. We need to evaluate this technology before more is constructed or permitted in more fragile environments in communities that do not want them.

Annette

P.S. The Nelson farm is seen below. They were up last night unable to sleep, measuring 49 dBA out their window and 39 dBA inside with the window closed. Hundreds of Vermonters are now being exposed to unhealthy levels of noise, and we have not come up with a plan to address what is happening to them.

Two ridgelines have been permitted for 15 wind turbines (8 on one, 7 on the other) in Searsburg and Readsboro Vermont, to be constructed by Spanish utility Iberdrola, which has a major lawsuit against it because of noise being generated at its Hardscrabble NY wind project.

Annette Smith
Executive Director
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Danby, VT 05739

http://www.vce.org/
vce@vce.org

From: Donald Cummings
Sent: Sunday, January 13, 2013 2:27 PM

Subject: Testimony for the Siting Commision

I have been unable to attend one of your hearings and so I am submitting my testimony via email.

Vermonters love their state and want it to remain as beautiful as we have always known it. We have marvelous lakes, beautiful farms, wonderful mountains and quaint towns and we feel we must do our best to protect them. However, progress often presents us with some difficult choices. We want our children to stay in Vermont but how do we find places for them to live and work without upsetting the balance we all love? Shall we exchange productive farm land for new homes where people can live or stores where they buy their groceries?
Town planners and zoning administrators deal with this tug of war nearly every day. The question is almost always how to balance one person's plan for change against the rest of the community's desire to protect what we have and love.

Some of the most contentious of these recent issues are over Solar and Wind electricity generation. There are those that believe renewable energy is necessary to protect Vermont from the dramatic impacts of Climate Change and others who do not want the change that is often required for these projects.

The fact that Vermont's current electricity portfolio produces very little CO2 is a point of pride for most of us. However, our "green" electricity portfolio is due to dramatic changes to someone somewhere else. One third of GMP's power comes from Hydro Quebec which is at the expense of hundreds of thousands of acres of northern Quebec, land the native peoples wanted to protect. Another part comes from Seabrook Nuclear plant – a power plant that caused dramatic change to the coast of New Hampshire and to the people who live near it. Most of us have been fortunate not to have a big power plant next to us. We have had all the benefit and none of the pain. Others have paid for progress in other ways; by living near a busy highway, a big shopping center, a power transmission line or a growing airport.

Ironically, both sides, in their own way, are fighting change. Less visible but ultimately more profound are the changes that renewable advocates are worrying about. The changes in store for Vermont's lakes and forests and as a result our culture could be dramatic. What will our country and world will be like when droughts and storms become worse and sea levels rise to displace millions worldwide. How will our children and our grandchildren prosper in this world?

The first way to minimize these major disruptions is by saving energy by every means possible: saving electricity through efficiency and conservation, reducing dependence on natural gas and fuel oil by weatherizing our homes & businesses and by using alternate forms of transportation and more efficient vehicles.
Even with conservation measures we will need new sources of electrical generation. Distributed renewable generation means a little discomfort for many. Yes, that means we will have to look at wind turbines and solar panels. The future of all Vermonters depends on our doing our absolute best to reduce our dependence on energy sources that that are causing global climate change.

I support community sized and large scale renewable energy production in Vermont when it is done with all of the appropriate care. The faster we and our country can develop these projects the less difficultly we will have later in adapting to the changes Climate Change will bring.
Thank you.

Don Cummings

From: Kim
Sent: Sunday, January 13, 2013 3:18 PM

Subject: Siting Commission Meeting 1/11/13

Dear Chairperson and members of the Vermont Generation Siting Commission,

I would like to thank you for conducting another very interesting and beneficial public Commission meeting on January 11, 2013. I found the afternoon deliberations session especially informative and would like to follow up on one of the many subjects that came up during this part of your hearing. The issue I would like to speak to is the future changes and improvements for the PSB process.

When any changes are suggested for this process there are always the warnings of "it's going to take more time and money". To me this response is a warning in itself; the suggestion that the present system only needs "tweaking" is inadequate. If the process only needed slight modifications a Siting Commission wouldn't be necessary. When the issue of money is discussed it's almost always in relation to the developer's investment. What about the small towns being heavily burdened by legal expenses? What about the thousands of volunteer hours invested by Vermonters trying to be heard? What about the expense of dividing communities? Yes, democracy and fairness take more time and money, but that is what has made Vermont unique. Our Towns,Town Plans, Town meetings are part of our culture. If critical decisions involving our wildlife, the environment, our ridge lines and health are to be only made in the fastest possible way and in the most cost effective way we are truly in trouble as a state. This is not how Vermont approached our environment in the past (Act 250 for example). I heard in the meeting several times "the easiest way doesn't mean the best way". It was "best" practices that resulted in the Vermont we love not the "easiest" or "fastest". I think we can all agree on that.

We have learned (or should have) "measure twice, cut once". Planning and community involvement result in "cutting once". Doing things the quickest way, with looming "dead lines" always referred to as a critical issue is wrong when we develop industrial wind generation facilities on our ridge lines. We don't get a second chance after these projects have started. We need to do what ever is necessary to avoid the "no time to do it right the first time but plenty of time to rework and get it right the second time around" syndrome. There is no second chances with ridge line industrial wind development.

The idea of having, and participating, in a collaborative approach for siting and developing large generation projects sounds so right and attractive. Working together for common goals is the Vermont approach I've always known.

A moratorium on high impact, high elevation industrial wind projects might be the only choice we have to allow Vermont to develop and implement a truly Vermont approach to these challenges.

Thank you again.
Sincerely,
Kim Fried

From: jennifer [redacted]
Sent: Monday, January 14, 2013 10:55 AM
To: Hughes, Michelle
Subject: My 1/11/2013 comments

Hi Michelle,

In case you want to post the notes of my oral testimony.....although still a draft.....for your website.

Thanks,
Jennifer Ely
Burlington resident

1/11/2012 Oral Testimony: Governor's Commission on Energy Generation Siting Policy

My remarks focus on wildlife.....the bobcat, fisher, bear....who are the best indicators of the ecological health of Vermont's landscapes.

I am a biologist and have a masters degree in natural resources. Today I am retired however for 30 years I worked in acquiring, designing and managing public natural areas in Vermont, trying to strike a balance of respect for park visitors and resident wildlife....so that both groups could peacefully coexist with one another. I've attended 4 of the commission's meetings. This is my 5th.

I would like to offer my perspective on two design restrictions to be placed on future ridgeline turbine projects as a condition of a proposal being considered. Please understand that any development of Vermont's ridges is a fundamental loss to critical wildlife habitat. I'd rather our state focus on energy conservation and increased efficiency and revisiting our frugal roots which is part of Vermont's culture to tackle global climate change, however if society is determined to develop its ridges for energy generation then I offer these two restrictions. They are very specific and my hope is they become a recommendation in the Commission's final report. Another avenue for action would be for people here in this audience to ask for them during the permitting process for new turbine proposals that appear destined to happen.

1. Demand that project designers look seriously at ways to reduce the footprint of impact on the ridgeline and its environs. Certainly only allow single-width roads. Helicopter in heavier equipment if feasible so the road base on the ridge needs not be so fortified, steep-sided, and wide. Minimize the footprint of turbine pads too. (Handout Exhibit A, photo of turbine pad in Spain.) In other words, specify that proposers must demonstrate how they have looked seriously at using technologies more common out west for remote areas, where drill rigs and heavy equipment are helicoptered in, rather than accepting as a given massive road building on Vermont's ridges.

2. Demand that the developer restrict motorized public access to the ridge, not only during construction but forever after. I am not talking about curbing existing uses. It's the new levels and new uses by people. The roads they build should not become public thoroughfares. It won't be possible to keep everyone away but less traffic...the occasional hikers, snowshoers...will probably be tolerated by wildlife....hopefully.

Before human settlement, bobcat, fisher and bear roamed Vermont's valleys more freely. Today the presence of people has pushed these species to higher, less developable, more remote areas, especially the higher elevations of its mountains and ridges. These have become the bobcat, fisher and bear's main travel corridors and will no doubt become increasing important to these species in a warming world. Wind turbine farms access roads cut across and into this remaining habitat of our largest mammals. This impact can be minimized by reducing the footprint of disturbance to a minimum...so that craggy features so important to bobcat are left intact, the ridgeline still undulates forever less susceptible to erosion, and diverse forest remains intact as much

as possible, helping us to fight global warming. We can't stop there though. Demand that those servicing the turbines also keep them and the ridges upon which they sit remote from people. Only then can we realistically hope that new ridgeline wind turbine projects can peacefully coexist with our wildlife.

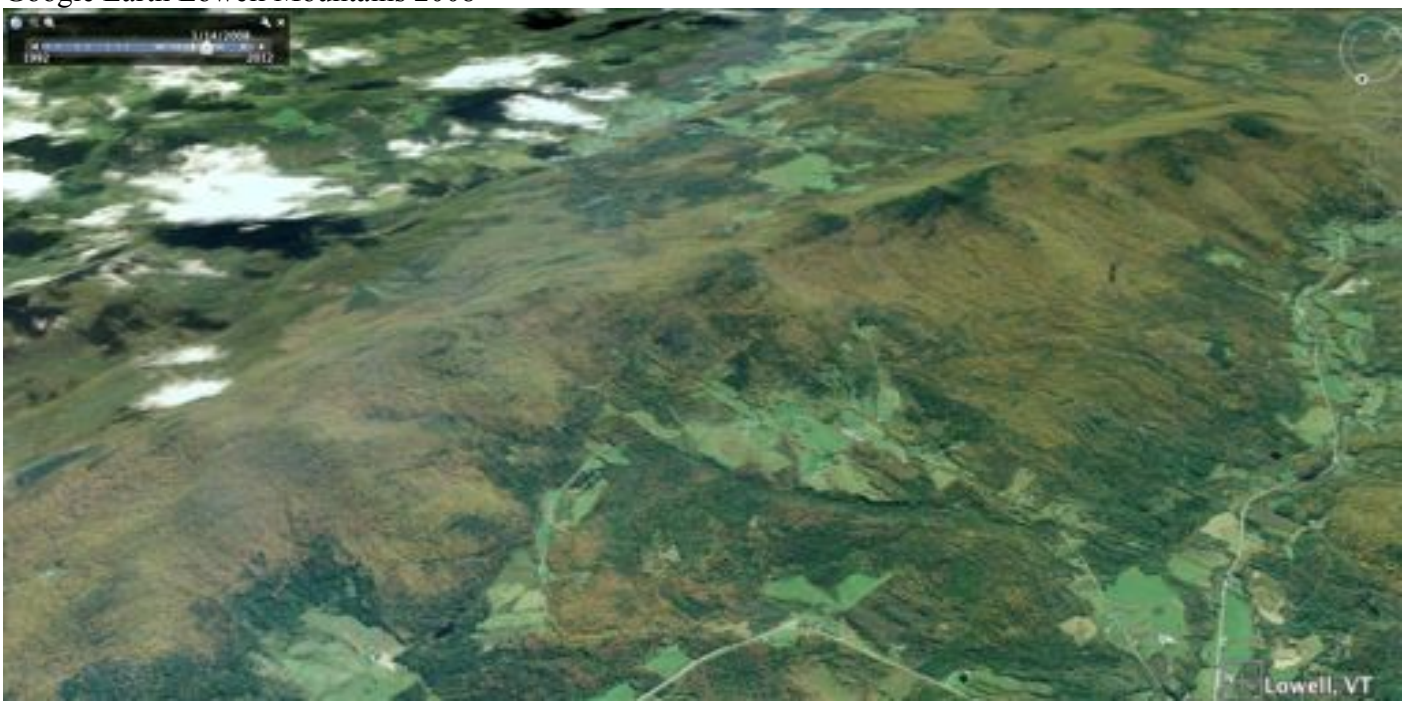
Thank you.

From: Annette Smith
Sent: Sunday, January 13, 2013 7:34 PM
To: Margolis, Anne
Subject: Roads for Wind Projects #1

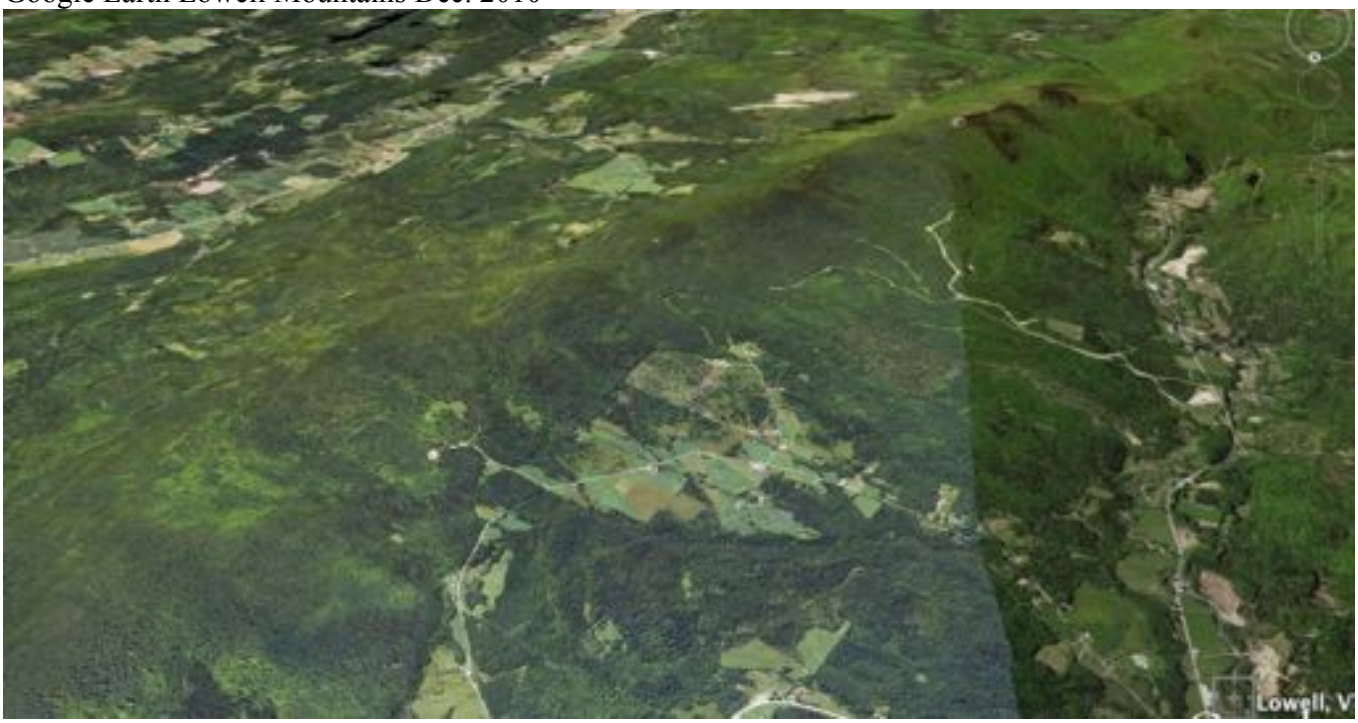
Some statements have been made during the presentations to the commission about using existing logging roads, indicating that the environmental impact is minimized. This email provides photographic evidence of the status of the mountain prior to wind development and the changes that have occurred in the last 4 years on the Lowell Mountains.

Part 1 of this subject is this email, which shows the mountain's condition in 2008, with no road up to the ridgeline or along the ridgeline. In 2010, landowner Trip Wileman began building roads up the mountain, but not up to the ridgeline or along the ridgeline. In the summer of 2011, the Lowell ridgeline was still essentially in tact. A year later, in August 2012, there was a road and transmission network up to the mountain approximately 2.5 miles long, and a 3.2 mile long road network more than 100 feet long, in places wide enough for two large trucks to pass each other safely. Part 2 will show the conditions of the woods on the ground along the access road and the ridgeline road.

Google Earth Lowell Mountains 2008

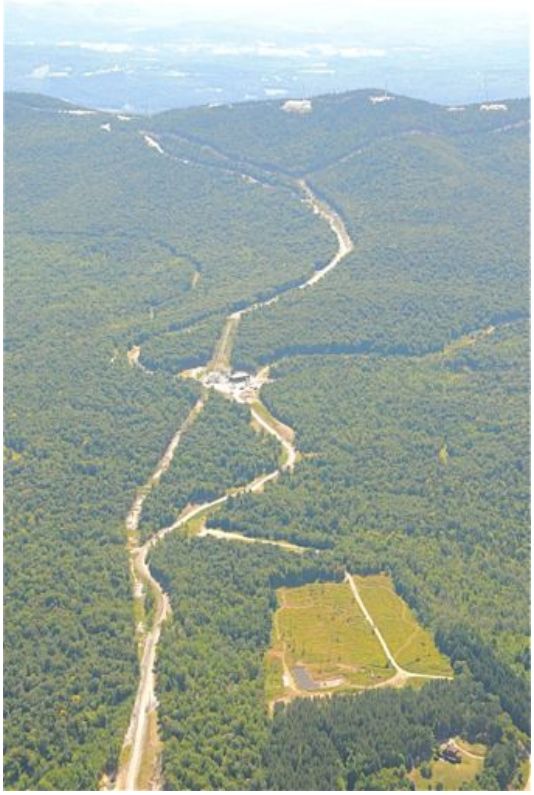


Google Earth Lowell Mountains Dec. 2010



Lowell Mountains 2011

Lowell Mountains August 8, 2012



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From: Annette Smith
Sent: Sunday, January 13, 2013 7:57 PM
Subject: Roads for Wind Projects Part 2

The Lowell Wind Project Access Road prior to construction can be seen here https://picasaweb.google.com/114098560210816181304/July312011?authkey=Gv1sRgCO_UobHlieGT0AE# The photos are in order from the area near the substation up to the ridgeline. The last photos are on the ridgeline.

The two photos below show the Lowell ridgeline road prior to construction. This series of photos was taken by GMP's expert in August 2011 and made available through public records: https://picasaweb.google.com/114098560210816181304/August142011?authkey=Gv1sRgCN79j9vd79jOGA They were taken with a GPS camera and you can view them on Google Maps or Google Earth from the site above.

The final attached photo shows the ridgeline road from T-6 looking north on the ridgeline, during construction showing the road wide enough for two trucks to pass.

More photos of the ridgeline, May 2011, pre-construction can be seen here: https://picasaweb.google.com/112246232055800335101/May2011Lowell?authkey=Gv1sRgCKXT1_uTjZeEUw

There is no comparison between the prior road network on the Lowell Mountains and what has been done to the mountain by blasting and compacting the rock into impervious surfaces. Any suggestion that the roads for wind projects are similar to logging roads is disingenuous. There is also no comparison between the damage to the ecosystem from ski are development to wind development. More than a million pounds of explosives were used on the Lowell Mountains. Ski areas rarely use explosives, and do not change the hydrology of the mountain. Ski areas will grow back. Mountain wind developments will not. As serious as ski area developments are, especially with the growth in housing development, their impacts to the ecosystem are much less serious than wind development according to many Vermont scientists.

From: Justin Turco
Sent: Thursday, January 10, 2013 9:38 PM

Subject: My letter to the paper.

Ponder the ramifications of this if you will. I'm going to start a power company in Ira. I will source a year's worth of the projected power required from a dam set up on a currently DRY drainage that comes down off of Herrick Mountain. I am quite sure that we will get one good storm this year which will create a torrent that when harnessed for a day will meet our power needs for the year. We will keep track of the power produced and in essence pay forward the cost of power that we require from the grid for the rest of the year. You might question if the torrent of power that we produce on that day will actually get used. Nope. Our grid manager wasn't completely sure this power was coming and thus didn't scale back the big baseload producers of energy.

This doesn't matter to me, my power company will take the credit for this unused energy and use that credit to keep Ira's lights on for the rest of the year. Who pays for energy we used over the rest of the year? Not Ira. We have a credit.

You know who pays... Everybody else. Did you know that common sense and legal precedent doesn't allow other generators to get away with this type of operation. Hydro Quebec couldn't. Vermont Yankee couldn't. They have to be available 24/7/365 to sell their power into the market. They are required to be reliable, forcastable and stable.

Then there is industrial wind which works just like my sham of a dam up on Herrick. Wildly unstable, variable and inefficient, but for some ratepayer ripoff of a reason, irregardless of the time of day or the need for energy, always first to sell power that won't get used into the market. If you can't trust a wind turbine enough to shut down the other generators you are NOT using the wind. Crazy? You bet, but we're destroying mountains and neighbor's lives for this debacle.

Four wind projects are already shamming the Vermont rate payer (Sheffield, Lowell, Georgia Mtn., Searsburg), Windham/Grafton, Deerfield, Grandpa's Knob, Brighton/Newark/Ferdinand are in the works.

Don't leave this to someone else. Call your reps. and tell them it is time to support the moratorium on industrial wind in Vermont.

Justin Turco
Ira, Vermont

From: Rob Pforzheimer
Sent: Friday, January 11, 2013 9:15 AM
Subject: Montana-New PSC chair Gallagher raps wind power

Note that the 5 PSC members are elected rather than appointed. Something worth considering for VT.
http://www.windaction.org/news/36997

New PSC chair Gallagher raps wind power
In a clear reference to wind power, Gallagher said all five of the PSC's Republican members "campaigned against the concept of using the utility bill to force Montana's families and employers to be unwilling investors in high-cost, low-output, intermittent generation and other programs that at present can exist only through government mandates and substantial tax and ratepayer subsidies."
January 7, 2013 by Mike Dennison in Billings Gazette
HELENA - Montana's Public Service Commission, with its newly minted 5-0 Republican majority, chose Commissioner Bill Gallagher as its new chairman Monday.

And Gallagher, a Helena attorney, wasted no time in spelling out what he sees as the panel's central idea: That it opposes using subsidies or mandates to promote any type of power, particularly wind power.

In a clear reference to wind power, Gallagher said all five of the PSC's Republican members "campaigned against the concept of using the utility bill to force Montana's families and employers to be unwilling investors in high-cost, low-output, intermittent... *[continue via Web link]*

Web link: http://billingsgazette.com/news/state-and-regional...

From:
Sent: Tuesday, January 15, 2013 10:25 AM

Subject: Solar siting

To whom it may concern

I am an energy engineer, board member of Building Performance Professionals Association of VT, and former member of the S Burlington energy committee. I am impressed with the writings submitted to the siting commission with regards to siting of solar by energy committee members, Don Cummings and Sam Swanson. I am not as eloquent as they are but will be concise with my comments.

Sam and Don well stated the big picture of energy and importance of solar of which I agree 100%. However I believe that before we populate our open spaces, we should exhaust placement of solar on built on spaces to including land that is landscaped (aka lawns). There are many opportunities to place solar on roof tops of commercial spaces and land that is mowed multiple times a year.

Energy self reliance is critical and may require use of Vermont's open spaces but lets first use land that is already 'tamed' by humans. You should include an evaluation factor of reduced photosynthesis caused by shade from solar panels

Allan Bullis CEM, LEED AP

Common Sense Energy | Sensible Energy Solutions |
CSEnergyVT.com

From: Rob Pforzheimer
Sent: Wednesday, January 16, 2013 10:01 AM
Subject: Wind Turbines Not Operating Effectively Around The World

"These studies are based on actual research data rather than computer modelling for their conclusions. The study from The Netherlands concluded that "the wind projects do not fulfill 'sustainable' objectives. They cost more fuel than they save and they cause no CO2 saving, in the contrary they increase our environmental 'foot print'".

http://www.themeafordindependent.ca/letters/47-letters/2209-reader-wind-turbines-not-operating-effectively-around-the-world

Reader: wind Turbines Not Operating Effectively Around The World
Tuesday, 03 April 2012 07:19 Letter to the EditorLetters - Letters

Dear Editor
I read with interest the article posted today in The Meaford Independent entitled "Waste to Energy Proposal in Limbo".

I like to think that I give fair time to all sides of any discussion and that I can listen, consider and evaluate fairly. But I do like to base my opinions on firm data. Mayor Richardson is quoted as having stated that "we've got these wind turbines and waste to energy plants operating effectively all over the world". I am not seeing that in the research I have reviewed, at least not for wind. For example: In Germany, Dr Christoph Schmidt et al of the Rheinisch-Westfälisches Institut für Wirtschaft sforschung in a study entitled Economic impacts from the promotion of renewable energies: The German experience Final report concluded that "Although Germany's promotion of renewable energies is commonly portrayed in the media as setting a "shining example in providing a harvest for the world" (The Guardian 2007), we would instead regard the country's experience as a cautionary tale of massively expensive environmental and energy policy that is devoid of economic and environmental benefits." and "Germany's principal mechanism of supporting renewable technologies through feed-in tariffs imposes high costs without any of the alleged positive impacts on emissions reductions, employment, energy security, or technological innovation."

(http://www.instituteforenergyresearch.org/germany/Germany_Study_-_FINAL.pdf)

· In Denmark, initially, wind was considered a success (prior to 2000) but over 600 complaints to the Environmental Complaints Board about wind turbines were submitted between 1998 and August 2000. (http://wilfriedheck.tripod.com/danish.htm) In the Sept 1, 2010 online edition of the Copenhagen Post it was reported that "State-owned energy firm Dong Energy has given up building more wind turbines on Danish land, following protests from residents complaining about the noise the turbines make." The article quotes then-CEO Anders Eldrup, as saying "It is very difficult to get the public's acceptance if the turbines are built close to residential buildings, and therefore we are now looking at maritime options."

(http://www.cphpost.dk/news/national/88-national/49869-dong-gives-up-on-land-based-turbines.html)

· As a result of citizen protest, the opinions and advice of physicians and nurses, and a Senate Committee investigation, the Australian state of Victoria has now implemented a 2-km setback for industrial wind turbines.

(http://www.abc.net.au/news/2011-06-27/wind-farm-setbacks-policy-to-remain/2772716)

· In the United Kingdom, the cost in other sectors is 3.7 jobs for every job created in the green sector. The study concludes: "the policy to promote the renewable electricity sector in both Scotland and the UK is economically damaging." (Richard Marsh & Tom Miers (March 2011) Worth the Candle? The Economic Impact of Renewable Energy Policy in Scotland and the UK)

· Green programs in Spain destroyed 2.2 jobs for every green job created, while the capital needed for one green job in Italy could create almost five jobs in the general economy. (Kenneth P. Green, D.Env. and Ben Eisen, M.P.P. (April 2011) Green Jobs: The European Experience)

· Janet Warren, who raised sheep on her property near Makara, New Zealand, until a wind project was built near her home. Noise from the turbines caused "loss of concentration, irritability, and short-term memory effects" that forced her and her husband, Mike, to leave their property in early 2010.

http://online.wsj.com/article/SB10001424052748704240004575085631551312608.html

· Two studies from the Netherlands and Ireland challenge the ability of Industrial Wind Turbines to reduce the level of CO2 in the environment. These studies are based on actual research data rather than computer modelling for their conclusions. The study from The Netherlands concluded that "the wind projects do not fulfill 'sustainable' objectives. They cost more fuel than they save and they cause no CO2 saving, in the contrary they increase our environmental 'foot print'". (C. le Pair. Electricity in The Netherlands: Wind turbines increase fossil fuel consumption & CO2 emission. http://www.clepair.net/windSchiphol.html) The Irish study concluded that "the introduction of wind energy without buffer storage leads to increased fossil fuel use and CO2 emissions and is a non-sustainable practice." (Fred Udo. Wind energy in the Irish power system.http://www.clepair.net/IerlandUdo.html)

· The July 2011 ERT decision for an IWT project in Ontario confirmed IWTs can harm humans:
"While the Appellants were not successful in their appeals, the Tribunal notes that their involvement and that of the Respondents, has served to advance the state of the debate about wind turbines and human health. This case has successfully shown that the debate should not be simplified to one about whether wind turbines can cause harm to humans. The evidence presented to the Tribunal demonstrates that they can, if facilities are placed too close to residents. The debate has now evolved to one of degree." (p. 207)
In December 2011, Ontario Government released the "Howe Report" (Low Frequency Noise and Infrasound Associated with Wind Turbine Generator Systems) conducted by HGC Engineering, a member of CanWEA. Its conclusion (pg 39) states: "The audible sound from wind turbines, at the levels experienced at typical receptor distances in Ontario, is nonetheless expected to result in a non-trivial percentage of persons being highly annoyed. As with sounds from many sources, research has shown that annoyance associated with sound from wind turbines can be expected to contribute to stress related health impacts in some persons."http://www.ene.gov.on.ca/environment/en/resources/STDPROD_092087 An interesting admission from the Wind Lobby Group.

· The European Platform Against Windfarms has 524 signatory organizations from 23 European countries including France, Switzerland, Finland, Poland, Germany, Denmark, UK and others. (http://www.epaw.org/about_us.php?lang=en). This number of opposing organizations, by itself, would indicate that turbines are not 'operating effectively all over the world'

Now, Mr Richardson, it is your turn. In my opinion industrial wind turbines are not operating effectively all over the world. But I am willing to give you equal time to try to persuade me. Please send me some research reports and articles – but not written by the wind turbine companies and their paid lobbyists – that support your statement that "wind turbines and waste to energy plants are operating effectively all over the world". I would be happy to look at them and consider their credibility.
Frances Coe, Municipality of Meaford

From: Rob Pforzheimer
Sent: Wednesday, January 16, 2013 9:45 AM
Subject: FW: Developers and the Green Agenda from the WSJ

- BUSINESS WORLD
- January 15, 2013, 6:46 p.m. ET

Green Energy's Baptists and Bootleggers
If Warren Buffett likes solar, it's not because the technology is cutting-edge.
· **By HOLMAN W. JENKINS, JR.**

President Obama was right: Solar is back. Exchange-traded indexes of solar shares are up 60% since Election Day. One big solar company, SunPower, saw its share price surge 41% in a single day this month.

Of course, it might be more accurate to say President Obama is back, and solar is riding his coattails. The fiscal-cliff deal extended an accelerated write-off for "renewable" energy investments and protects (at least for now) the Treasury's "1603" program, in which taxpayers hand green developers 30% of their project costs in cash. Mr. Obama's new Treasury chief will be Jack Lew, once a K Street lawyer for alternative energy interests.

Obama supporter Warren Buffett, meanwhile, has suddenly emerged as America's second biggest solar operator. If the Sage of Omaha is buying, you should too, right?

Not really. What was true a year ago is true now. As solar analyst Michael Horwitz explained to the Financial Times when the Sage first began nosing around: "Let's be clear, this is not Warren Buffett taking a bet on solar technology. This is Warren Buffett investing in a power plant that is guaranteed to yield large cash flows for at least 20 to 25 years."

California utilities are under legislative mandate to get 33% of their electricity from renewable sources by 2020. The state's own watchdog, the Division of Ratepayer Advocates, issued a report complaining that utilities have been rushing to sign overpriced contracts that have already locked-in $6 billion in above-market costs for California electricity users.

According to the watchdog, 59% of contracts feature a price at least half-again higher than available conventional energy. Which utility has been most lavish? Pacific Gas & Electric, which Mr. Buffett will be selling to.

Reuters
President Obama visits a solar plant in Boulder City, Nev., March 21, 2012.

Twenty-nine states now have such mandates, and a recent defeat signals no topping out in this most enduring source of subsidies for solar entrepreneurs. In November, activists largely funded by a San Francisco green-energy promoter failed to amend Michigan's state constitution to up the state's existing mandate to 25% from 10%.

Yes, amend the state constitution: Most greenies now agree the campaign failed by overreaching and should have settled for seeking a legislated increase.

Political scholars use the term "baptists-and-bootleggers" to describe the coalitions of do-gooders and mercenaries that gather around such agendas. The pitch wouldn't be complete without claims about how, with enough transmission (after all, the sun is always shining and the wind always blowing somewhere), renewables are a real answer to America's energy needs, not just a costly indulgence.

Yet funny how the bootleggers' interests are the only ones that end up being served. Notice, for instance, that though shale gas has done more than wind or solar to reduce America's CO_2 output by displacing coal, the green lobby has had to attack shale because it accentuates the high cost of wind and solar.
Notice, too, the absence of any meaningful baptist-and-bootlegger counterweight to citizen opposition to new power lines, which would mean more competition and lower prices for renewables. Notice that many states actually prohibit or discourage shopping out-of-state to meet green-energy mandates, which would also mean lower prices for renewables.

A parody of baptist-bootlegging is the case of AEP Ohio. The local utility has been losing customers to cheaper power, so it has been lobbying regulators to approve a costly new solar plant and make its competitors' customers help pay for it.

It may be pleasant still to assume that President Obama's motives are pure; that his green agenda may require corrupt bargains with private interests, but the sparks fly upward.
After all, even allowing for corruption, inefficiency and high costs, aren't solar and wind being encouraged to make the technological leaps that will make them viable someday? Don't be so sure. The political networks here consist of owners who aren't in business to risk capital on technological advances, but to extract cash from political favoritism.

But isn't it important somehow to encourage alternative energy, and aren't we constantly told that the most efficient, least corrupting approach—a carbon tax—would never fly with voters?

That may not be quite right either. Baptist-bootlegger campaigns have no trouble promoting higher costs for voters, but notice that the bootleggers don't reach into their ample pockets to promote a carbon tax. They aren't interested in wide-open, competitive approaches to reducing carbon emissions. They're interested in the guaranteed, uncompetitive cashflows that Mr. Buffett will enjoy from his California solar projects.

James Buchanan, the economist who won a Nobel Prize for his cold-eyed analysis of political behavior, died last week. We'll have to rely on our own instincts, then, to suggest it doesn't matter what politicians believe about their own motives. The result is a green political machine that exists to extract high prices from electricity users for the machine's own benefit.

A version of this article appeared January 16, 2013, on page A11 in the U.S. edition of The Wall Street Journal, with the headline: Green Energy's Baptists and Bootleggers.

From: Rob Pforzheimer
Sent: Thursday, January 17, 2013 3:03 PM
Subject: Wind energy lobby ignoring real concerns of families, children

"People around the world and in Wisconsin are suffering from industrial wind turbines that are too close to their homes."

Wind energy lobby ignoring real concerns of families, children
The wind energy lobby doesn't care about families and children currently being harmed or about future families that will be harmed by 500- foot industrial wind turbines. They are not listening, they are either uninformed or are deliberately misrepresenting the facts; it appears they don't care.
January 17, 2013 by State Sen. Frank Lasee in Manitowoc Herald Times Reporter
Yet again, supporters of wind energy claim that families moving from their homes need to "learn the facts and separate actual risks from unfounded fears."

This is a response to the opinion piece written by John Anderson and Joe Sullivan, erroneously titled "Science Proves that Wind Energy is Safe for Wisconsin."

They claim that the "detractors" of wind energy are simply publicizing their concerns that "sounds emitted from wind turbines cause adverse health effects." The use of the word "sound" suggests audible noise. This is another example of the pro-wind lobby ignoring the real concerns of families and children. These families are not claiming harm from audible sound, but from low-frequency "infrasound."

The wind energy lobby doesn't care about families and children currently being harmed or about future families that will be harmed by 500- foot industrial wind turbines. They are not listening, they are either uninformed or are deliberately misrepresenting the facts; it appears they don't care.

They cite the Massachusetts Health Study as a source to support their erroneous claim. This study says that wind turbines have the ability to harm people's health. Yet, they claim just the opposite.

The "impartial panel" used several articles by the same authors of studies I provided to the Public Service Commission that say harmful health effects caused by wind towers are likely. Here is a small sample of those sources available on my legislative website that say there are likely negative effects caused by 500-foot wind turbines:

• The Bruce McPherson Infrasound and Low Frequency Noise Study: Adverse Health Effects Produced By Large Industrial Wind Turbines Confirmed.

• "Low-frequency noise from large wind turbines," Journal of the Acoustical Society of America.

• "Responses of the ear to low frequency sounds, infrasound and wind turbines."

Scientists have repeatedly said inner ear issues caused by infrasound can cause loss of balance, unsteadiness, nausea, vertigo, anxiety, headaches and panic attacks especially in people who get motion sickness.
People around the world and in Wisconsin are suffering from industrial wind turbines that are too close to their homes. In my Senate District, several families with children have moved out of their homes because of the 500-foot industrial wind towers near their homes. These families had to take out second mortgages to pay for a place to live to stop their suffering. Imagine that you had to do this for your family. It's against common sense to claim these families' symptoms are "make-believe."

The editorial attempts to discredit the results of the Shirley Wind Farm study in Glenmore, Wis., are the result

of those making money from taxpayers and electric ratepayers. They don't want their gravy train to end.

The Shirley Wind Farm study and peer-reviewed studies show how important it is for the PSC to immediately create new set-back rules that protect the health and safety of families and children who, through no fault of their own, are forced to live too close to these 500-foot wind turbines. I renew my request of the PSC to protect the men, women and children of our state.

Frank Lasee is a State Senator representing the First Senate District.
Web link: http://www.htrnews.com/article/20130117/MAN07/3011...

From: Rob Pforzheimer
Sent: Thursday, January 17, 2013 8:50 PM
Subject: CBC Documentary: WIND RUSH-A Look at the Wind Turbine Controversy-Feb 7

CBC Documentary: WIND RUSH- A Look at the Wind Turbine Controversy
Posted on 01/17/2013by OWR

WIND RUSH A Look at the Wind Turbine Controversy on CBC TV's Doc Zone
Date: Thursday, February 7
Time: 9:00PM

Driving by a wind farm, looking at the rural houses, it's easy to be skeptical about the talk of wind turbines making people sick. We're told that wind turbines are good and green. So how could those people living by them have an issue? But there is a problem—and it's there because some governments and wind companies didn't do their homework before installing megawatt after megawatt of huge industrial machines. And as a result there are people living among the turbines who are suffering.

In the new documentary film **WIND RUSH**, produced for **CBC Doc Zone by Toronto's 90th Parallel Productions**, the battleground for the pro and anti wind forces is southern Ontario. The government there pledged to wean the province off coal fired generation plants and replace them with green wind energy. **WIND RUSH** will be broadcast on **Thursday, February 7 at 9PM (9:30PM NT).**

But as soon as the turbines went up in places like Wolf Island, Amaranth and Bruce County, people realized they could hear them. Sometimes it was like a whisper, but other times it sounded more like a jet taking off. And then it got worse.

New turbines started coming in at two and three times the size of the old ones. And they were even louder. It led to chronic sleeplessness for many people living close by—and that can lead to diabetes, depression and heart disease. Others were affected in their inner ears by low-level sounds that set off their equilibrium. Doctors

started seeing patient after patient complaining of the same sets of symptoms. And then people started to realize that no one had done any significant human health studies before giving the green light to the turbine farms. **WIND RUSH** takes viewers to southwestern Alberta, where wind has been an energy staple for more than twenty years. There is plenty of room for humans and windmills to coexist—a stark contrast to Ontario, where the same prairie technology was installed in a dramatically different landscape. The film then moves to Denmark, a country long considered the poster-child for the wind energy movement. But as **WIND RUSH** reveals, the relationship between the Danes and turbines has soured.

WIND RUSH talks to people on either side of the turbine divide, and then turns to scientists to try and determine what has gone wrong. In the next several years the turbines will double in size again—bigger, louder and more powerful. But without sufficient research have the people who live among the wind farms been forgotten?

WIND RUSH is produced by 90th Parallel Productions of Toronto. Gordon Henderson is Executive Producer. **WIND RUSH** is produced, written and directed by Andrew Gregg.

For further information, etc. please contact:
David McCaughna,
Publicist, **WIND RUSH**

From: Rob Pforzheimer
Sent: Thursday, January 17, 2013 8:42 PM

Subject: USFWS's eagle mortality models are dramatically higher than one eagle every-other-year as predicted by New Era's consultant

Bald Eagle Annual Deaths As High As 14
http://www.windaction.org/news/37047
United States Fish and Wildlife Service predicts that between 8 and 14 American bald eagles could be killed annually if New Era Wind Farm is built as currently designed. The outcome of USFWS's eagle mortality models are dramatically higher than one eagle every-other-year as predicted by New Era's consultant Westwood Professional Services.

January 16, 2013 by Kristi Rosenquist

United States Fish and Wildlife Service predicts that between 8 and 14 American bald eagles could be killed annually if New Era Wind Farm is built as currently designed. The outcome of USFWS's eagle mortality models are dramatically higher than one eagle every-other-year as predicted by New Era's consultant Westwood Professional Services.

In November 2012, New Era was the first wind facility in the nation to apply to the USFWS for an "Incidental Take Permit" to be allowed to kill bald eagles with their wind turbines without the danger of federal prosecution. Bald eagles are protected under the federal Bald and Golden Eagle Protection Act. Without an ITP, killing an eagle is against federal law. The ITP process for New Era is not yet completed.

The eagle mortality rates were one part of extensive analysis and comments that USFWS provided in response to New Era's updated Avian and Bat Protection Plan (ABPP) required by the State of Minnesota. Overall, the USFWS found a number of problems with the ABPP methodology and conclusions. This included a warning about killing golden eagles, which also fly through the area. The Service made it clear that there is no possibility of obtaining an ITP for golden eagles in this area of the country, so that killing one would be a federally prosecutable offense.

The Minnesota Department of Natural Resources provided comments on the same ABPP. The DNR raised concerns about Northern Harriers, Henslow Sparrow, bats and other wildlife potentially impacted by the project and the lack of data provided by New Era. Northern Harriers are listed as a bird of national concern by the USFWS and a Species of Greatest Conservation Need by DNR.

Goodhue County is located within the broad corridor of the Mississippi River Flyway. This is the largest migration route in North America. Millions of birds pass through and stop over this area on their annual spring and fall travels. The New Era ABPP shows a failure to perform avian migration field studies despite the project's advanced stage in the State permitting process. Bats are also high on the list of concerns expressed by USFWS and the MN DNR. Bats are a keystone species known to die in large numbers at wind facilities
Few wildlife impact studies have been done before, or after, the construction of industrial wind facilities in the United States. However, the studies that have been done suggest high mortality of birds and bats. Raptors, such a eagles, are known to be at high risk of being struck and killed by wind turbine blades. A study in SW Minnesota showed a 47% reduction in raptor numbers after construction of wind turbines. It is not clear how many died, and how many abandoned the area as no-longer-suitable habitat. Bats die both from blade strikes and barotrauma.

New Era Wind Farm is a 78 MW industrial facility proposed for central Goodhue County in southeastern Minnesota. The project became nationally infamous under its previous owner, Texas billionaire T. Boone Pickens. During Pickens' ownership the project was called AWA Goodhue and was wholely owned by his

Dallas based Mesa Power. The lack of local public support and the high number of educated and concerned citizens has made this the most controversial wind project in Minnesota history.

The previous ABPP for this project was rejected by the Minnesota Public Utilities Commission at a hearing on February 23, 2012. It is unclear when the MPUC may hold a hearing on the updated ABPP. Due to Minnesota State laws promoting industrial wind, this project is not required to produce an Environmental Impact Statement (EIS) as required of other industries.

The Coalition for Sensible Siting is proud of the extensive and important feedback citizens provided on the ABPP. The USFWS and the MN DNR provided excellent and thorough review and comment on the ABPP. Many concerns raised by citizens (below) where confirmed by USFWS and MN DNR.

Links to the updated New Era Wind Farm Avian and Bat Protection Plan (4 parts) and citizen comments can be found by clicking here.
Web link: http://baldeaglesitings.blogspot.com/2013/01/bald-...

From: Rob Pforzheimer
Sent: Friday, January 18, 2013 4:59 PM
Subject: Speaker connects 'dirty electricity' to wind power

http://www.agrinewsinteractive.com/article_print/article_print.htm?ArticleID=12872&ShowSection=News

January 2013, Vol. 37, No. 1
AgriNews Interactive **www.agrinewsinteractive.com**

Speaker connects 'dirty electricity' to wind power
By **Nelson Zandbergen**SOUTH MOUNTAIN - Dairy farmers are familiar with the negative health effects of wayward electrical energy: Stray voltage can be the bane of keeping milk cows as productive and healthy as possible.

Armed with this understanding, a retired dairy farmer now working as a stray-voltage dairy consultant - who once leased some of his own land to a wind-power developer several years ago - is drawing attention to another kind of unwanted electrical interference he attributes to the "cheap" DC-to-AC power inverters employed by wind- and solar-farm installations.

David Colling maintains that developers' reliance on such equipment to process their final output of alternating current (AC) feeds a problematic high frequency into the power grid and the internal wiring of nearby homes and buildings.

This "dirty electricity" can sicken people and disturb animals, he suggested in a late-November address to local wind-power opponents gathered at South Mountain's agricultural hall. Instead of the smooth-sided "sine wave" expected of a clean AC source, the contaminated current shows a jaggedness when measured on an oscilloscope, according to Colling, who says he turned against the wind industry after a developer in his Ripley, Ontario, area, briefly hired him to measure the phenomenon, then refused to acknowledge a problem when he became an advocate for five affected families.

"It is imperative that both wind turbines and solar installations generate as close to a pure 60Hz sine wave as possible to minimize adverse effects of transient harmonics to both equipment and human health," said the guest speaker, citing research by an associate professor of Environmental & Resource Studies at Trent University, Dr. Magna Havas.

Carried into buildings through the neutral wire, the unwanted frequency then radiates from the wiring inside the structure, according to Colling. He relayed anecdotes about several families in his area whose health symptoms - including migraines and ear aches - suddenly disappeared after the wind company disconnected them from the grid and supplied power with on-site generators. "They tried to prove me wrong, and it backfired."

The company finally bought out the homeowners, he said, assuring the audience that no other Ontario wind developer would ever follow that precedent again.

The Township of North Dundas has seen an anti-wind movement spring up in response to proposed turbine projects that have yet to be built. The local debate has tended to revolve around the usual alleged health effects of low-frequency noise and light flicker, as well as concerns about esthetics and impact on property values.

Colling's late-November visit- spearheaded by wind-power opponents led by Chesterville's Theresa Bergeron - was the first local event to highlight the dirty-electricity angle from a health perspective.

He told the group about finding a direct link between the spinning of turbine blades and the frequency level on the wiring of several homes in his area where individuals reported feeling sick because of nearby windmills.

The telltale jagged "inverter waveform" appeared whenever the turbines were running, he said, showing a PowerPoint slide. "It's very clear."
He used a provincial website to confirm when local turbines were putting power into the grid. "It directly correlates. So when they tell you, 'Oh we don't cause any stray voltage,' they're lying," he said of project proponents. "You must understand the people you're dealing with are just PR people...."

According to Colling, there's only one type of expensive inverter, made by Siemens, that ought to be used to create the AC outputted by wind and solar farms. But project developers choose less costly options, he said.

One family in his area spent the summer sleeping in a fifth-wheel trailer beside their house because they couldn't rest inside the building. Colling helped them install a system to filter the incoming hydro supply, but they still "have to kill the power at the house at night. It's the only way they can sleep." The family sold the place in September to an Amish buyer who took down the incoming hydro lines entirely.

"I've got another family up there, the only way they can sleep at night is to cut the power into the bedroom," he said.

He argued that dairy cattle receive better health care on this issue than do humans, as health authorities discount people's complaints as unproven by default.

He claimed to have spoken with insiders at Ontario Hydro, and the Ministry of the Environment, and even the wind industry itself, who applaud the message he has delivered in over 30 talks across the province.

Dirty electricity has also captured the attention of the Ontario Federation of Agriculture, which held a well-attended seminar on that subject and stray voltage last month in Listowel.
Advice to farmers Colling also acknowledged that yearly per-turbine lease payments have now risen into the $50,000 range for participating landowners. But he contrasted that with the $500,000 he said the turbine owners annually net on their 20-year power contracts. And he warned farmers of the pitfalls of signing on the dotted line, starting with the construction process.

"I can tell you horror stories about how they cut drainage tiles and never hooked them up again. Because often, in some of the areas I come from, it's absentee ownership. And no one cares, right? And the subcontractor's in there just to bury [power] lines," said Colling, who has since sold his land that was involved in a turbine land lease.

"So I tell people - any construction they do on that farm, make sure somebody's standing with them there all the time. I don't care if you have to hire somebody because if you don't, and you try to fix that tile after, good luck."

His 2004 land lease was only four pages long, he said, adding that newer documents run into the dozens of pages. The leases now explicitly state that the landowner knows the potential for nuisance from turbines hosted on their property and waives their right to complain about it, he added.

A member of the audience piped up to argue this could expose farmers to lawsuits, and Colling - who isn't a lawyer - replied he wouldn't be surprised if that became more common. Anyone looking at leasing land to a renewable energy developer should hire a specialized corporate lawyer to go over the agreement, he cautioned

From: Pam Arborio
Sent: Saturday, January 19, 2013 9:41 PM
Subject: Re: Siting lottery

Thanks Anne, you're right, a ticket is in order!

I have a question. If there are pending sites ie. SMW permit currently before the PSB for a project in Brighton, Ferdinand and Newark why isn't the Siting Commission visiting sites of this nature to see if they're appropriate? I see the need for a Lowell/Sheffield visit due to the health and water runoff issues but it seems a look across Island Pond at the ridge lines or at Bud Santos' home in Newark where his home will literally be surrounded by 492' turbines would be excellent places for the Commission to view what is under consideration.
Thanks,
Pam

Sent from my iPad

From: paul lefebvre
Sent: Thursday, January 17, 2013 1:58 PM

Subject: site visits

To members of the commission:

I want to convey in the strongest possible terms my objection to excluding the press on the wind sites visits planned for February 12 at Lowell and Sheffield. In light of the Department of Public Service's role as the governor's advocate in implementing an energy policy, the press has become the public's watchdog in this debate. It's a debate that is going to heat up as the wind moratorium goes in front of the Legislature, and it's a debate on a subject that the press should understand from every possible angle.

To say that the press can't go because there is not enough Snowcats is really irresponsible. And given how badly GMP's image has been tarnished by its role in prosecuting publisher Chris Brathwaite's trespassing case, it makes absolutely no sense. Utilities and developers alike should provide whatever means is necessary to allow journalists to accompany members of the commission, which, after all, has been charged to make recommendation of how these kind of projects should be sited.

Thank you.
Paul Lefebvre
Chronicle staff writer
Barton, VT

From: Rob Pforzheimer
Sent: Wednesday, January 16, 2013 10:09 AM

Subject: turbine pad construction

What you won't see on your site visit to Sheffield and Lowell.

From: Kathleen Iselin [redacted]
Sent: Wednesday, January 16, 2013 10:34 AM
[redacted]
Subject: Fw: turbine pad construction

And this is what developers want to do to VT's ridgelines?

Please let Gov. Shumlin and the PSB know, that the Siting Commision fully supports a 3-year moratotium on IW (industrial wind).

Thank you,

Kathleen Iselin

Kathleen Iselin, CST, LMT
[redacted]
Your Source for Leading Edge Wellness Services, Products, and Education

From: Annette Smith
Sent: Wednesday, January 16, 2013 4:10 PM
Subject: Washington Electric Co-op opposes wind moratorium legislation; bill introduced that would prohibit turbines on state lands

The article is cut off at the end
<http://vtdigger.org/2013/01/16/washington-electric-co-op-opposes-wind-moratorium-legislation-bill-introduced-that-would-prohibit-turbines-on-state-lands/>

Annette Smith
Executive Director
Vermonters for a Clean Environment, Inc.
789 Baker Brook Rd.
Danby, VT 05739
http://www.vce.org/
vce@vce.org

From: Gabrielle Strufo
Sent: Sunday, January 27, 2013 9:34 AM
Subject: Do NOT Support the development of renewable energy

Dear Commissioners

Industrialized wind saves no oil consumption. Stripping our mountains is sinfull and looks bad. Any policy should look ahead 7 generations with real not accepted science.

Gabrielle Strufo

From: Rob Pforzheimer
Sent: Friday, January 25, 2013 9:16 PM

Subject: FW: [New post] 1987 MNR bald eagle quote – those were the days…

The Ontario Ministry of Natural Resources (MNR) just granted NextEra a permit to cut down a hundred year old cottonwood tree with an active eagle's nest recently built by a breeding pair, to build a road for a wind project.

Hypocrite MNR doesn't follow their own guidelines any more. Kind of like the VT ANR and USFWS, that used to protect endangered species, head water wetlands and streams, and enforce the MBTA.

.way back in June 1987

BALD EAGLE HABITAT MANAGEMENT GUIDELINES- Ontario Min. of Natural Resources

{Excerpt} "Human attitudes toward eagles in the area. Much human-eagle interaction depends on the predominant attitude of human residents of each area. Residents and visitors of some areas are very favourably disposed toward the birds, if not proud and quite protective. They may be careful not to disturb the eagle and may help prevent disturbance or destruction by other persons. Such attitudes should be encouraged through education and law enforcement."

.

OWR posted: "....way back in June 1987 BALD EAGLE HABITAT MANAGEMENT GUIDELINES- Ontario Min. of Natural Resources {Excerpt} "Human attitudes toward eagles in the area. Much human-eagle interaction depends on the predominant attitude of human residents of each are"

Respond to this post by replying above this line

New post on Ontario Wind Resistance

1987 MNR bald eagle quote – those were the days…

by OWR

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Read more of this post

OWR | 01/25/2013 at 20:02 | Categories: Bats and Birds, Environmental, Ethics, Ministry of Natural Resources | URL: http://wp.me/pmgPI-dAO

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Comment See all comments

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Trouble clicking? Copy and paste this URL into your browser:
http://ontario-wind-resistance.org/2013/01/25/1987-mnr-bald-eagle-quote-those-were-the-days/

From: Rob Pforzheimer
Sent: Thursday, January 24, 2013 2:33 PM
Subject: WindAction Editorial

WindAction Editorial
Important stories Windaction is following...
(Posted January 23, 2013)

New Hampshire's RPS draining the State's economy
This week the New Hampshire Public Utilities Commission opened a docket to consider possible changes to the State's renewable portfolio standard (RPS), the law which mandates increasing percentages of the State's electricity demand be met with renewable energy. The program peaks at 25% renewables by 2025.
The NH-PUC acted after it learned a whopping $19.1 million in penalties under the mandate were paid by utilities in 2011 -- *penalties that were passed on to NH customers*. Penalties are exacted when in-state utilities are unable to deliver sufficient renewable energy (measured in megawatt hours) to meet their yearly, and escalating renewables obligation.

The $19.1 million was deposited into a government administered "renewable energy fund" to support pet thermal and electrical renewable energy initiatives. This was in addition to the $6.3 million pilfered from consumers in the same year through the sale of carbon allowances under RGGI.

Most NH residents are unaware how much of their energy dollars are pouring into State coffers to pay for projects they will never benefit from. But even worse, most NH State legislators have no idea how the New England RPS market works or why NH's RPS policy, in the context of the larger regional market, is likely to fall short of its goals each year while costing consumers far more than forecasted when it was first adopted in 2007.

The ISO-New England is reporting that wholesale electricity prices fell nearly 23% in 2012 to their lowest levels since 2003, yet New Hampshire's electricity consumers are paying some of the highest prices in the country thanks, in part, to poorly defined renewables policies that benefit a select few. The NH PUC has the authority to amend the annual renewable percentages to lessen the economic burden on consumers. Under this docket, it's time for consumers to stand up and be heard.

The pain of living with wind turbines
Cary Shineldecker and his wife, Karen, are caught in the middle of a wind farm development in Michigan. Consumers Energy's Lake Winds Energy facility in Mason County which consists of fifty-six 1.8 MW Vestas V100 turbines was put into service on Thanksgiving day in 2012. The turbines stand 476-feet tall with property setbacks of just 952 feet (2x turbine height). There are 5 turbines within a ½ mile of Cary's home, 13 within 1 mile and 26 turbines within 1.5 miles.

Symptoms reported by Cary include continual headaches, pressure in head and ear, turbine sound outside and inside his home, sleep disturbance almost nightly, thumping, rumpling, pulsing felt in the head and chest, the need to sleep in the basement on gusty nights. Wind Wise Radio spoke with Cary this week to understand the impact of the turbines on the community and on his quality of life. Listen to Cary's own words and ask yourself when you last heard of a power plant in the United States, that under normal operating conditions, was driving entire neighborhoods from their homes.

Wisconsin Towns Association calls for moratorium

The Wisconsin Towns Association voted this week to adopt a resolution calling on the state of Wisconsin and the Public Service Commission (PSC) to place a moratorium on the construction of industrial wind turbines "until further studies are done, solutions are found and the state's wind siting rule is modified."

In its resolution, the Association cited a December 28, 2012 report filed with the State's PSC which examined the low-frequency noise and infrasound emanating from large-scale wind turbines at the Shirley Wind Farm in Denmark, Wisconsin. The homes of three families were tested, each located a different distance from the turbines. All three families reported adverse health effects since the wind facility commenced operation and three have been forced out of their homes after experiencing symptoms of the type associated with wind turbine syndrome.

First Circuit Court of Appeals rules that offshore wind is no match for reliable generation
This month, the U.S. Court of Appeals for the First Circuit affirmed the decision by the Nuclear Regulatory Commission (NRC) rejecting a challenge to the Seabrook nuclear power plant's relicensing posed by environmental groups in New Hampshire.

At issue was whether offshore wind energy can serve as an alternative to reliable electricity generation.
The NRC ruled that offshore wind is NOT a reasonable alternative for baseload generation produced by nuclear power plants. The NRC further concluded that the intermittent nature of wind power means that it cannot be considered baseload without effective energy storage mechanisms, and that storage technology is not sufficiently demonstrated at this time. FERC Chairman Jon Wellinghoff could take a lesson from the NRC.

From: Keith Epstein
Sent: Sunday, January 27, 2013 9:47 PM

Subject: Renewable Energy Siting

Dear Commissioners

We have a lot of work to do to get to the worthwhile Vermont State goal of 90% renewable energy by 2050. I think the statewide renewable energy permitting process has helped Vermont become a leader in getting projects built quickly and cost-effectively, while making sure the projects don't ruin our cherished natural resources. Please do everything you can to keep permitting costs low and delays minimal. Local rules against a renewable energy project should be validated against the statewide goals that are in the best interest of all residents. Thank you for your work in ensuring we have the best renewable energy permitting process in the USA.

Keith Epstein

From: Austin Sumner
Sent: Sunday, January 27, 2013 11:04 PM
Subject: I Support Wind Turbines

Dear Commissioners

I am writing to voice my support for wind turbines. I work in Georgia Vermont within half a mile of the wind turbines on the Georgia Mountain. I never hear them and I think they are beautiful. I enjoy watching them slowly turn as I drive North on Interstate 89 every day as I go to work. I challenge you to compare on a clear day the image of the Georgia Wind Turbines to that of the Burlington Power Plant which sends a cloud vapor into the sky that can be seen for miles.

No mining, no drilling, no burning, no green house gases and it never ends doesn't wind sound good.

Please support wind. Wind needs to contribute to achieving the State's goal of 90% renewable energy by 2050 goal.

Thank you and kind regards,

Austin Sumner

Austin Sumner

From: Rob Pforzheimer
Sent: Thursday, January 24, 2013 9:59 AM
Subject: Blaming the victims of Big Wind

"Wind turbines cannot eliminate our dependency on fossil fuels. They will not reduce the emissions of greenhouse gases, nor save us from climate change. Wind turbines are not safe, they are not clean, and they have proven to be economically unsustainable-time and time again."

Blaming the victims of Big Wind
Just as we blame the poor for their poverty, we seem compelled to blame the victims of Big Wind for their own illness. Apostles of the wind industry, like Dr. Dora Mills, Dr. Robert McCunney and Australia's Professor Simon Chapman, are only too happy to furnish the tacit explanations needed to justify blaming these victims for their own plight. These typically include psychosomatic causes, hypochondria, delusions, and other forms of mental illness.

January 23, 2013 by Curt Devlin in Wind Turbine Syndrome

During my years at Boston College, I had the good fortune to study with Dr. William Ryan, then Professor of Social Psychology, and the author of a the acclaimed book, "Blaming the Victim." At the time of its writing, Dr. Ryan focused attention on pressing social issues of the day, such as poverty and racism.

He contended, for example, that we blame the poor for poverty; and that we blame minorities for their own disfranchisement; we fault victims for somehow inviting the social inequities they endure. In effect, we hide behind an ideological façade rather than face our responsibilities to redress such injustices.

Lately, I have been struck by how Dr. Ryan's description of this phenomenon applies to the victims of Big Wind-to those who have become ill or were forced to flee their homes to escape the toxic effects of industrial wind turbines sited in close proximity to them.

Just as we blame the poor for their poverty, we seem compelled to blame the victims of Big Wind for their own illness. Apostles of the wind industry, like Dr. Dora Mills, Dr. Robert McCunney and Australia's Professor Simon Chapman, are only too happy to furnish the tacit explanations needed to justify blaming these victims for their own plight. These typically include psychosomatic causes, hypochondria, delusions, and other forms of mental illness. Interestingly, these "diagnoses" are always arrived at without benefit of examining a single patient, conducting an independent study, or even speaking with those suffering from adverse health effects. It is guilt is by reason of insanity. In this inverted logic, the victims are to blame, not the turbines.

In some cases, we are told the illness associated with these toxic monsters is actually caused merely by the negative perceptions created when someone is ill-disposed to renewable energy-as though anyone could be against such an idea in principle. This is the always-handy nocebo effect.

This justification for blame is particularly absurd and reprehensible because it flies in the face of a simple fact. Most of the people who become ill were actually in favor of wind energy; that is, until they had firsthand experience of turbines spinning near their homes.

Why are so many ready to blame the victims of wind? Why so willing to receive these explanations without skepticism, without demanding the same scientific rigor demanded of wind critics? Dr. Ryan's work is especially useful on this question. The answer is simple; it is a convenient form of social denial. People prefer blaming the victim to taking responsibility for confronting the real issue. It is much easier, for example, to blame someone in poverty for laziness, than to accept responsibility to find the true causes of economic inequities, much less take action to correct them.

This pitfall is easier to fall into than one might think. It is easy to believe that if we feed the hungry, we risk rewarding them for being hungry. It's much harder to make sure they can find ways to help them feed themselves. Accepting personal or social responsibility requires change, action, or personal sacrifice to effect positive change or prevent harm. It forces people to confront the contradictions and absurdities in their ideological dogmas and replace them with facts, to reject social delusions and face inconvenient truths.
In short, it is much, much easier to blame the victims-than ourselves.
The overwhelming body of medical and scientific evidence demonstrates that infrasound, low frequency noise, and vibration of the kind produced by industrial wind turbines cause serious adverse health effects. The evidence has grown steadily for more than 30 years. It shows compellingly that the symptoms and illnesses called Wind Turbine Syndrome and Vibro-Acoustic Disease are caused by exposure to this toxic form of sound energy. Despite the vocal denials of the wind industry, there are no independent studies of merit to contradict this finding. There are only the groundless, though profuse, assertions and rhetoric of the windy industry to assure us that their denial of the real dangers is well founded.

There is also incontrovertible evidence that industrial wind turbines produce excessive quantities of this dangerous form of sound and vibration. Recently, the wind industry itself is being forced to gradually admit this fact. But even if the underlying causal connection were a complete mystery, the simple empirical evidence that many, many people become ill when they are near turbines is undeniable to anyone with eyes, ears, or one iota of common sense. Of equal importance, the same people who become ill near turbines, feel better when they get away from them. This simple form of evidence, referred to as case-crossover data by epidemiologists, matches common sense. It furnishes irrefutable proof that, in fact, the turbines are to blame, not the victims.

Wind turbines cannot eliminate our dependency on fossil fuels. They will not reduce the emissions of greenhouse gases, nor save us from climate change. Wind turbines are not safe, they are not clean, and they have proven to be economically unsustainable-time and time again. Wind power will not prevent irreparable harms to people as well as the environment caused by our own insatiable appetite for energy. Wind cannot alleviate our obligation to one another to use energy wisely and conservatively.

There is virtually no benefit to justify the harm caused to victims. Even if such benefits existed, they could hardly outweigh the harm being done to people. If we continue to blame the victims and deny this truth, we will soon become victims of our own devices. This ironic little reversal of fate is what Hegel referred to as dialectic and it is inevitable. We will become the victims of our own blindness and we will be blamed for it-though perhaps only by history.

This last thought is cold comfort to those who must face the steady erosion of their health, their families' and financial reserves, and the destruction of their very livelihoods that is created by living too close to turbines. The victims of Big Wind are like so many canaries in the mine shaft, who flee or fall in the face of this industrial toxin. Those who blame them are like unwitting miners who stand staring dumbfounded at the obvious, wondering what these canaries have done to bring this catastrophe upon themselves-and then continue along their merry way down the mine shaft, oblivious to the clear and present danger as though they are immune to it. Until it is too late.

Mr. Devlin is a resident of Fairhaven, Massachsetts

Web link: http://www.windturbinesyndrome.com/2013/blaming-th...

From: Rob Pforzheimer
Sent: Wednesday, January 23, 2013 12:56 PM

Subject: The Great Renewable Energy Scam: Is There A Change In The Wind?

http://www.forbes.com/sites/patrickmichaels/2012/01/19/the-great-renewable-energy-scam-is-there-a-change-in-the-wind/

OP/ED
|

1/19/2012 @ 2:10PM |
The Great Renewable Energy Scam: Is There A Change In The Wind?
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Image via Wikipedia
People don't like being forced to purchase things they may not want, which is why over half of us are hoping that the Supreme Court throws out the individual insurance mandate in President Barack Obama's health care plan.

There's also a worldwide rebellion brewing against being forced to purchase expensive electricity produced by so-called "renewable" sources, now being exacerbated by the availability of very cheap natural gas from shale formations.

But, here in the U.S. there are some 30 different statewide "renewable portfolio standards" (RPSs) that also mandate pricey power, usually under the guise of fighting dreaded global warming.

RPSs command that a certain percentage of electricity has to come from wind, solar, geothermal, or biomass. Given that this power generally costs a lot more than what comes from a modern coal or gas plant, your local utility passes the cost on in the form of higher bills, which the various state utility commissions are only too happy to approve in the name of saving the planet.

RPSs generally do not include hydroelectric power, which produces no carbon dioxide. It's also much more predictable than solar or wind, and costs about the same as the average for gas and coal combined. It's not in the portfolio standards because dams are soooo 20th century, and it isn't a darling of the green lobby, like solar, wind and biomass. But hydro can deliver more juice than solar is ever likely to.

Nor do RPSs allow for natural gas. There are massive quantities in shale formations around the country, and new horizontal drilling techniques are releasing so much of it that it is now the cheapest source of electrical power. If our environmentalist friends were at all serious about climate change, they would enthuse over it because it produces significantly less carbon dioxide than an equivalent quantity of coal when used for power generation. Instead, they are horrified that cheap gas will destroy solar and wind.
Their worries are quite well-founded. In November, NextEra Energy, the country's largest wind-energy producer, said it would develop no new wind projects this year, as utilities sell cheaper gas power.

When are governments going to learn that they ought to butt out of the energy business? RPSs that specify certain technologies are essentially picking winners and losers based more upon political pull than market logic. One needs to look no further than ethanol as a motor fuel, mandated by the feds. Sold as "renewable" and reducing pernicious carbon dioxide emissions, it actually produces more in its life cycle than simply burning an equivalent amount of gasoline. It also—unconscionably—consumes 40% of U.S. corn production, and we are the by far the world's largest producer of this important basic food.

The popular revulsion against ethanol has succeeded in cutting its massive federal subsidy, of $0.54 per gallon, which ran out on Dec. 31. But that doesn't stop the federal mandate. Last year it was for roughly 14 billion gallons from corn and it will be nearly 15 billion in 2012. By 2022, up to 20 billion gallons will be required — all from corn — unless there is a breakthrough in so-called "cellulosic" ethanol, which, no matter how much money the government throws at it, hasn't happened. Indeed, the largest cellulosic plant, Range Fuels, in Camilla, Ga., just went bankrupt. The loss to American taxpayers appears to be about $120 million, or about 25% of a Solyndra.

Don't expect Congress to zero the ethanol mandate anytime soon. Farm country tends to be conservative on pretty much everything except propping up corn prices, which is what ethanol mandates do.

Having seen the ethanol debacle, will the states put solar and wind in their rightful (small) niches by repealing the RPSs? Increasing utility bills with renewable mandates is politically dangerous, and there is less and less political will to subsidize and otherwise prop up energy sources and technologies that cost too much.

Look for a movement in the many state legislatures that approved the outrageous RPSs without asking people how they liked being forced to buy something they don't want. Or will cheaper natural gas and hydro be allowed in the standards in the place of wind and solar? There is likely to be some legislation introduced this year and a lot more in the future, as the U.S. catches on to the great renewable energy scam.

From: Rob Pforzheimer
Sent: Wednesday, January 23, 2013 11:50 AM
Subject: Big Wind Energy Subsidies: A Hurricane of Carnage, Cronyism and Corruption

http://greencorruption.blogspot.com/2013/01/big-wind-energy-subsidies-hurricane-of.html?m=1

GREEN CORRUPTION
President Obama's Clean-Energy Dirt — Green Corruption is the largest, most expensive and deceptive case of crony capitalism in American history. Stay tuned...
Tuesday, January 22, 2013

Big Wind Energy Subsidies: A Hurricane of Carnage, Cronyism and Corruption
Despite Harm to the Environment and the Economy, Fiscal Cliff Deal Fuels Continuing Corporate Welfare

First Wind is mentioned in this article:
First Wind's projects have received over $452 million in grants through the Stimulus' 1603 Program.

#3) Kahuku Wind Power, LLC, a project of First Wind in Kahuku Oahu, HI, was granted a $117 million loan in July 2010, estimated to create a whopping 200 jobs. And then on February 3, 2012 this same project received a 1603 grant for over $35 million [docket #2594 –- $35,148,839].

Sadly, in August 2012 a fire that destroyed First Wind's battery storage facility and sent toxic fumes into the air, left ratepayers in the dark over costs and safety. We should keep an eye on that one, however, there is more corruption to expose...

The First Wind plan was to secure taxpayer money and then go public. Now they achieved their first objective from the Bank of Obama — since he took office (and as of 7/18/12), First Wind's projects have received over $452 million in grants through the Stimulus' 1603 Program.

- First Wind's Stetson Wind Farm in Maine — $40,441,471
- Cohocton Wind Farm in New York, $52,352,334
- Dutch Hill Wind Farm In New York, $22,296,494
- Milford Wind Corridor Phase I In Utah; $120,147,809
- Milford Wind Corridor Phase II In Utah, $80,436,803
- Rollins Wind Farm In Maine; $53,246,347
- Sheffield Wind Farm In Vermont, $35,914,864
- Kahuku Wind Farm In Hawaii, $35,148,839
- Steel Winds II Wind Farm In New York, $12,778,75

However, in November 2010, *Bloomberg* announced, "First Wind Holdings Inc., the operator of wind-energy projects backed by D.E. Shaw & Co. and Madison Dearborn Partners LLC, said it withdrew its initial public offering because of unfavorable market conditions" that's code for "weak demand."

Speaking of IPO's...

Within the House Oversight leaked emails that were unleashed late October 2012, you'll discover that these correspondences basically prove that the White House, Secretary Chu, and certain DOE Officials lied about how they handled the green energy loans on various fronts — a story I have emphasized in many of my recent green corruption posts.

In the 350+ page Appendix II, I discovered a series of intriguing **emails dated in May 2010, where the DOE staff was discussing the Kahuku loan**, just months prior to the final approval in July 2010. It seems that on May 12, 2012, LPO Credit Advisor James McCrea was concerned about the Loan Guarantee Program Office's "credit policies and procedures" — so much so that he *intensely* clarified the importance of order, "...everyone needs to understand is all that has to go in order to put the transaction into the Federal accounting system which requires collaborating among OMB, Treasury, and parts of DOE with which you do not normally interact. To be clear, one of the reasons this is so carefully handled is that there are several penalties for a violation of the Ant-deficiency Act including jail time..." Later McCrea writes, "I know the processing is frustrating for First Wind. The deal will close when it is time."

Five days later, McCrea writes, "To fill Brian in, we have a pretty good mess on First Wind and it is looking like it is going to get a lot worse and quickly at that. Someone is pressing Jonathan [Jonathan Silver is the former Executive Director of the Loan Program Office] who is now pressing hard on the everyone as the sponsor has an IPO in the works. I have told Jonathan that the deal has huge issues and the sponsor's overriding is not helping at all and that further, the sponsor's pending IPO is irrelevant."

While there's no mention of where *that pressure* came from, the first-rate, high-powered political ties to First Wind are vast, starting with D.E. Shaw & Co, a New York-based investment firm — "a $39 Billion Hedge Fund Giant" (also a First Solar investor), which so happens to be one of the three top contributors to Democrats — is a backer of First Wind Holdings Inc. The founder David Shaw, is a two-time Obama bundler, who employed Larry Summers, and before heading to the Obama White House, as the top economic advisor, "Lawrence Summers received about $5.2 million over the past year in compensation from hedge fund D.E. Shaw," as revealed by the *Wall Street Journal*, noting his "frequent appearances before Wall Street firms including J.P. Morgan, Citigroup, Goldman Sachs and Lehman Brothers." Towards the end of 2011, Summers left the Obama administration and rejoined the firm as a consultant.

As revealed by Peter Schweizer, "another 42 percent of First Wind is owned by Madison Dearborn Partners, an investment firm with close ties [and friend of] to then-White House Chief of Staff Rahm Emanual. The founder of the firm, David Canning, had been a bundler for George W. Bush. But he switched sides in 2008 and gave heavily to Obama. Madison Dearborn gave more to Emanual's congressional campaigns than did any other business."

While the GOP found that "Julia Bovey, First Wind's Director of External Affairs, was formerly Director of External Affairs for Obama's Federal Energy Regulatory Commission (June 2009 to June 2010)," there is much bigger fish here. All government backed green comes with a slew of lobbyists, and First Wind is no different — enter in Larry Rasky's Lobbying Firm with *ties to the top*.

Larry Rasky, "a longtime confidant and campaign strategist" of Vice President Joe Biden, was also a 2012 Obama bundler, and since Obama took office, "Rasky has visited the White House at least 21 Times," half of which were during the course of the DOE loan review process (Data.gov, Accessed 7/18/12). Moreover, we know that in 2009, about the time the 2009-Recovery Act passed, First Windretained lobbyists Rasky Baerlein Strategic Communications as well as Brownstein, Hyatt et al, who isprimarily a Democrat donor, with some Republicans in the mix — and as of 2012, maintains the work of Rasky. .

From: Rob Pforzheimer
Sent: Wednesday, January 23, 2013 10:37 AM

Subject: Sting operations reveal Mafia involvement in renewable energy

Sting operations reveal Mafia involvement in renewable energy
http://www.washingtonpost.com/world/europe/sting-operations-reveal-mafia-involvement-in-renewable-energy/2013/01/22/67388504-5f39-11e2-9dc9-bca76dd777b8_story.html

When reading this Washington Post article please keep in mind that:

First Wind, formerly UPC, formerly IVPC, in their prefiled testimony in VT PSB docket 7156, boasts of their Italian roots as IVPC in Sicily and Sardinia, Italy. Their former partners have been arrested for fraud, corruption, money laundering and mafia connections.

Prefiled Direct Testimony February 21, 2006 http://www.sheffieldwind.com/UserFiles/File/regulatory_sheffield/Cowan-Rowland-Vavrik%20-%20Direct%20Testimony.pdf p.8/70
Quoting UPC's own testimony:

"UPC Group is a group of related companies that have developed large scale wind farms in Europe. To date, **UPC Group has developed, financed, constructed, owned and operated over 635 MW of large-scale wind turbine generators in southern Italy and the islands of Sicily and Sardinia through a company called Italian Vento Power Company ("IVPC")** (www.ivpc.com). Certain principals of the UPC Group recently sold their ownership interests in holding companies that own the IVPC companies. In conjunction with this sale, a new European subsidiary of UPC Group has been established and is pursuing several hundred megawatts of wind energy projects in Europe and North Africa, including additional projects in Italy".

From: Hope Lindsay
Sent: Sunday, January 27, 2013 3:31 PM
Subject: Support the development of renewable energy

Dear Commissioners

Dear Commissioners: Local clean energy projects are a necessary public good and should be given a preference over non-renewable energy sources.
When we see that countries like Germany and Denmark are more than half way to energy independence with solar and wind energy, it seems like we are falling behind and have a desire to return to the Dark Ages. (Literally) I do not understand the resistance from those who fail to see the harm of continued reliance on fossil fuel and nuclear power. The Clean energy alternatives are available, successful and healthy.

Hope Lindsay

From: Helen Huyffer
Sent: Sunday, January 27, 2013 12:49 PM
Subject: Support the development of renewable energy

Dear Commissioners

Energy Generation Siting Policy Commission,

Use the State's Comprehensive Energy Plan and existing legislation as a roadmap for reviewing proposed projects—In order to reach the state's goal of meeting 90% of our energy needs with renewable power by 2050, it will be necessary to substantially increase the development of local, clean energy projects such as wind, solar and small hydro facilities. Local clean energy projects are a necessary public good and should be given a preference over non-renewable energy sources.

Thank you.

Helen

Helen Huyffer

From: Margaret Brault
Sent: Sunday, January 27, 2013 1:16 PM
Subject: Support the development of renewable energy

Dear Commissioners

I believe it's important to support the responsible development of local, renewable energy sources, using a siting process that promotes strong public participation, mitigates environmental harm, and adheres to the established clean energy goals of the state.

Margaret Brault

From: Cindy Provost
Sent: Sunday, January 27, 2013 12:54 PM
Subject: Support the development of renewable energy

Dear Commissioners

Dear Commission,

I cannot make the talk on January 30th.
I fully support renewable energy sources.

We all need to realize that there has to be sacrifices to create a model and infrastructure for renewable energy.

Thank you,

Cindy Provost

From: Barbara Wanner
Sent: Sunday, January 27, 2013 12:40 PM
Subject: Support the development of renewable energy

Dear Commissioners

I feel it is vitally important to reach the state's goal of meeting 90% of our energy needs with renewable power by 2050 !

Barbara Wanner

From: Josiah Klingler
Sent: Sunday, January 27, 2013 11:15 AM
Subject: Support the development of renewable energy

Dear Commissioners

Clean green renewable energy is good for Vermont. Stay on track for 90% renewable power by 2050. Local Vermont businesses benefit from this commitment (Northern Power, NRG and Draker Labs to name a few).

Close Vermont Yankee, I am not opposed to utilizing new cleaner nuclear power (as many who oppose Yankee are). Foster growth of new technology and innovation, propping up these aged train wrecks is untenable.

Thanks for your consideration,

Josiah Klingler

From:
Sent: Sunday, January 27, 2013 11:14 AM

Subject: Support the development of renewable energy

Dear Commissioners

Dear Sir or Madam,

Wind and other renewable energy sources are a vital part of Vermont's energy future, freeing us from polluting energy sources. A wind moratorium is a poorly disguised effort to pass off our energy problems to other states and regions, while inevitably increasing our dependence on fossil fuels, helping further accelerate climate change. I strongly support all efforts to accelerate the development of in-state renewable energy, with wind energy representing the most cost effective current solution.

Best regards, Matt Wormser

From: Karen Thompson |
Sent: Sunday, January 27, 2013 10:15 AM

Subject: Support the development of renewable energy

Dear Commissioners

I think it is a crime to put industrial wind turbines on our ridge lines- ESP in the northeast kingdom where communities are financially unable to prevent them. I am certain that VPIRG supports clean energy as long as it's not on the ridge lines of Stowe, Shelburne or the shores of Lake Champlain where all of the multi million dollar property owners live.
Sorry but. I do not support VPIRG.
Karen Thompson
Milton VT

Karen Thompson

From: Richard Faesy
Sent: Sunday, January 27, 2013 9:26 AM
Subject: Support the development of renewable energy

Dear Commissioners -

I am troubled by the anti-wind forces in Vermont. We need clean local renewable power sources (after maximizing our investment in energy efficiency first) and wind should provide a signifant piece of that. At the same time, we need to ensure the environmental protections Vermont is known for. I am sure that we can do both.

We can no longer continue to rely on distant and unreliable sources for our electricity, but need to balance strong envinmental protections with renewable energy development here in Vermont to meet our needs and achieve our 90% renewable energy goals. Protecting the climate through clean wind should be a top priority.

We need to realize that no energy source is without downsides. We need to take responsiblity for our own generation of electricity rather than relying on others elsewhere to do so for us. Let's do it "the Vermont way" and balance smart wind development with strict environmental practices to ensure we achieve our renewable energy goals while protecting our environment and way of life.

Thanks, Richard Faesy, Starksboro

Richard Faesy

From: charles parent
Sent: Sunday, January 27, 2013 4:44 PM
Subject: Support the development of renewable energy

Dear Commissioners

[Copy and paste suggestions from above, or craft your own comments here. Just be sure to delete this message before you submit your comment to the commissioners!]

charles parent

From: Andrea Rogers
Sent: Sunday, January 27, 2013 5:18 PM
Subject: Support the development of renewable energy

Dear Commissioners

[Copy and paste suggestions from above, or craft your own I just want to say that I think a moratorium on wind energy is the wrong thing. Reviewing how the permitting process should happen, and respecting town plans and local comments is important for wind and solar. And to my mind it is a matter of planning to acquire and identify the right sites, not simply incentivizing private developers to take sites they may control. The other issue is scale. Again, we need to develop ways to integrate renewable energy into working sites at a scale that supports those developments and adds to the common capacity.

I hope this helps.

Andrea Rogers

From: Gerard Adams
Sent: Sunday, January 27, 2013 6:27 PM
Subject: Support the development of renewable energy

Dear Commissioners

3. Provide additional support for public participation without silencing the majority— The State should encourage and facilitate meaningful public participation in the energy siting process. Technical or financial support for qualifying interveners is one way to facilitate that participation. While encouraging more local input, the State must also consider the best interests of all state residents. Host communities alone must not have the exclusive power to approve or deny projects. Local voices need to be considered and balanced with the interests of all residents of the state.
Gerard Adams

Gerard Adams

From: Timothy Hoopes
Sent: Sunday, January 27, 2013 10:57 PM

Subject: Support the development of renewable energy

Dear Commissioners

Hello,

I would like to make sure my voice is heard, so I am writing to let you know that I support both Wind and Solar development in Vermont. I believe climate change is a real issue, and that real measures need to taken as soon as possible to deal with it. Also, I am tired of powerful industries like the fossil fuel industry and the nuclear industry steamrolling the will of the Vermont citizenry. We may need more energy but we don't need more air pollution, more water pollution, more relased carbon, and more fat cat businessmen getting rich off huge projects. Instead, we need more projects that are smaller in size, spread out around the state and done as community scale efforts that result in sustainable solutions. Now...let's get to work....together.

Thanks,
Tim H

Timothy Hoopes

From: Gail Ernevad |
Sent: Monday, January 28, 2013 8:26 AM

Subject: Support the development of renewable energy

Dear Commissioners

I support the responsibile development of renewable energy sources for our state our country and our world.

Gail Ernevad

From: Jerry Williams
Sent: Monday, January 28, 2013 9:14 AM

Subject: Support the development of renewable energy

Dear Commissioners

The Vt state population as a whole should be heard re. renewal project siting, and balanced with local voices.

Jerry Williams

From: fred kosnitsky
Sent: Sunday, January 27, 2013 1:50 PM
Subject: Support the development of renewable energy

Dear Commissioners

In 1989 I wrote a booklet entitled "Global Warming Strategies for Vermont" which was distributed to the appropriate agencies of the Kunin administration, all legislators, and the public at large. One of the five key recommendations was (no surprise) a rapid transition to environmentally friendly renewable energy sources.

Now, 23 years later, we in Vermont as well as elsewhere have just begun to scratch the surface of renewable energy development, But starting a vigorous plan to switch to renewables now is even more critical than it was a generation ago - time is running out to avoid global climate catastrophe.

I urge the Commission to develop siting policies that require high environmental standards and allow for public input (both local and statewide); that don't allow vocal opponents a veto power on projects that meet standards and would greatly serve the public good; and that provide a model for other states to encourage the energy transition that we must encourage for the sake of future generations.

Respectfully submitted,
Fred Kosnitsky

fred kosnitsky

From: Jane ALee Heyerdahl
Sent: Monday, January 28, 2013 5:33 AM
To: [illegible]
Subject: Support the development of renewable energy

Dear Commissioners

1. Use the State's Comprehensive Energy Plan and existing legislation as a roadmap for reviewing proposed projects—In order to reach the state's goal of meeting 90% of our energy needs with renewable power by 2050, it will be necessary to substantially increase the development of local, clean energy projects such as wind, solar and small hydro facilities. Local clean energy projects are a necessary public good and should be given a preference over non-renewable energy sources.

2. Use Climate Change as a framework for determining which projects should be sited— The potential climate impact of an energy project should be considered when determining whether the project qualifies for a Certificate of Public Good.

3. Provide additional support for public participation without silencing the majority— The State should encourage and facilitate meaningful public participation in the energy siting process. Technical or financial support for qualifying interveners is one way to facilitate that participation. While encouraging more local input, the State must also consider the best interests of all state residents. Host communities alone must not have the exclusive power to approve or deny projects. Local voices need to be considered and balanced with the interests of all residents of the state.

Jane ALee Heyerdahl

From: Martha Dinnan
Sent: Monday, January 28, 2013 8:30 PM

Subject: Support the development of renewable energy

Dear Commissioners

I am absolutely convinced that the promotion of green energy solutions (solar, wind, hydro) is critical to Vermont's future. We have a wonderful opportunity to create jobs, to enhance our environmental leadership, and to take responsibility for generating at least some of the energy we consume. We should produce clean energy in our own backyards rather than expecting other communities to suffer the consequences of our energy appetite. We have accepted ski areas on our mountaintops as suitable economic endeavors for our state, and its time we recognize that wind and solar make just as much sense and result in acceptable environmental and visual impacts. Lets get going!

Martha Dinnan

From: Teal Scott
Sent: Thursday, January 31, 2013 6:30 PM
Subject: Support the development of renewable energy

Dear Commissioners

Please protect the development of clean energy, especially wind. Wind power is a wonderful resource for us. Please prevent a few anti-wind extremists from trapping us in a moratorium on creating wind power.

Thank you.

Teal Scott

From: Merianne O'Grady
Sent: Wednesday, January 30, 2013 10:50 AM
Subject: Support the development of renewable energy

Dear Commissioners

As a household in rural VT, we strongly support the move in VT to KEEP our state as the leader of seriously dealing with climate change and STAT implementation of renewable energy and phasing out of our dependence on fossil fuels. Our state's Comprehensive Energy Plan is a good start, and we support expanding this plan, including ALL VT citizens, in asking US to do our part TODAY!

THANK YOU!

From: allan bullis
Sent: Monday, January 28, 2013 12:25 PM
Subject: Support the development of energy efficiency

Dear Commissioners

Please make a strong effort to implement the reccomendations of the thermal energy task force with a strong push for efficiency especially for non regulated fuels by means of phasing out the suspended tax on fuel oil and LP which was suspended in the 70's to pay for these efforts.

allan bullis

From: Carolyn DeFrancesco
Sent: Sunday, January 27, 2013 10:53 AM
Subject: I support the development of renewable energy

Dear Commissioners

I strongly recommend the following:

1. Use the State's Comprehensive Energy Plan and existing legislation as a roadmap for reviewing proposed projects—In order to reach the state's goal of meeting 90% of our energy needs with renewable power by 2050, it will be necessary to substantially increase the development of local, clean energy projects such as wind, solar and small hydro facilities. Local clean energy projects are a necessary public good and should be given a preference over non-renewable energy sources.

2. Use Climate Change as a framework for determining which projects should be sited— The potential climate impact of an energy project should be considered when determining whether the project qualifies for a Certificate of Public Good.

3. Provide additional support for public participation without silencing the majority— The State should encourage and facilitate meaningful public participation in the energy siting process. Technical or financial support for qualifying interveners is one way to facilitate that participation. While encouraging more local input, the State must also consider the best interests of all state residents. Host communities alone must not have the exclusive power to approve or deny projects. Local voices need to be considered and balanced with the interests of all residents of the state.

Carolyn S. DeFrancesco

From: Willem Post
Sent: Monday, January 28, 2013 6:22 PM

Subject: Sanders in Favor of Destroying Ridge lines.

All,

Sanders' news conference in favor of destroying Vermont's cherished, pristine ridge lines with environmentally-damaging, health-damaging, property-value-lowering, visually-offensive, noise-making, bird-killing IWT projects, that produce expensive, variable, intermittent energy, i.e., junk energy, that could not be used on the grid, unless it is balanced by quick-ramping gas turbines operating in inefficient part-load-ramping mode. The inefficiencies use extra fuel/kWh and emit extra CO2/kWh, that offset much of what wind energy was meant to reduce.

This is not about CO2 emissions reduction, but about schlepping federal subsidies to Vermont to benefit the wealthy few at the expense of the many. World CO2 emissions in 2011 = 33,990 million metric ton, Vermont's CO2 emissions in 2011 = 8.1 million metric ton; only 4% of that from generating energy. How much difference can Vermont make?
Answer: NOTHING.

Kilian feels : "I feel that the Public Service Board in particular …
(has) done an excellent job of including public input through public hearings and through broad public participation."

The VT-PSB has shamefully bent over backwards to use bogus vendor-provided data to make IWT ridge line energy costs appear much less/kWh than if REAL WORLD values were used.

IWT vendors continuing to claim CFs = 0.32 or better on ridge lines is a misrepresentation.
IWT vendors continuing the claim IWT lives of 25 years is a misrepresentation.

Here we have an example of people such as Klein, Smith, Cheney, Sanders, Welch, Leahy, Kilian, Hooper, Lyons, Shumlin, Dostes, Schnure, Patt, Blittersdorf, the PSB, VT-DPS, and subsidy-chasing IWT developers, IWT vendors, etc., all holding hands, sticking to their mantra of RE talking points, singing the praises of IWTs on ridge lines. Completely irrational behavior, if one looks at ACTUAL "facts on the ground".
http://vtdigger.org/2013/01/28/sanders/#comment-47435

LOWELL MOUNTAIN WIND ENERGY COST RE-ESTIMATED

Gaz-Metro/GMP used a "vendor-predicted" CF of 0.33 and a "vendor-predicted" 25-year life to obtain bank financing, federal and state subsidies and "Certificate of Public Good" approvals for its ridge line Lowell Mountain IWT project, a.k.a. "Kingdom Community Wind".

GMP calculated the levelized cost of Lowell heavily subsidized energy at 10 c/kWh. It would be 15 c/kWh, unsubsidized, per EIA/US-DOE.

But ACTUAL ridge line CFs are 0.25 or less, and ACTUAL lives are 15 -20 years.

The ACTUAL energy cost would be 10 c/kWh x CF ratio 0.33/0.25 x Life ratio 25/17 = 19.4 c/kWh

This compares with Hydro-Quebec and Vermont Yankee nuclear energy at about 5-6c/kWh, inflation or grid price adjusted, and grid energy at about 5.5 c/kWh.

GMP is buying 60 MW of Seabrook nuclear energy for 23 years at 4.66 c/kWh, inflation adjusted.

SHEFFIELD MOUNTAIN CF

Sheffield Mountain 2012 CF = 0.23 vs 0.32 claimed by promoters to get VT-PSB approvals. This CF is about equal to weighted average (0.234) of the below 6 Maine ridge line sites.

MAINE RIDGE LINE CFs

Here are some numbers regarding the much less than expected results of the Maine ridge line IWTs for the past 12 months.
http://www.coalitionforenergysolutions.org/maine_wind_thru_3q2012m1.pdf

Mars Hill, 42 MW, CF = 0.353; uniquely favorable winds due to topography.
Stetson I, 57 MW, CF = 0.254
Stetson II, 26 MW, CF = 0.227
Kibby Mtn 132 MW, CF = 0.238
Rollins, 60 MW, CF = 0.238
Record Hill, 50.5 MW, CF = 0.197

The Maine weighted average CF = (42 x 0.353 + 57 x 0.254 + 26 x 0.227 +132 x 0.238 + 60 x 0.238 + 50.5 x 0.197)/(42 + 57 + 26 + 132 + 60 +50.5) = 0.247; excluding Mars Hill, the CF would be 0.234.

Note: CF reduction due to aging is not yet a major factor, as all these IWTs were installed in the past 5 years.

BOLTON VALLEY SKI RESORT CF

A recent check of the Bolton Valley website in January 2013

Actual power production after 39 months (3.25 yrs) was 509,447 kWh from October 2009 to-date.

Actual capacity factor for 39 months = 509,447 kWh/(3.25 yr x 100 kW x 8,760 hr/yr) = 0.179; a shortfall of 47.4% of the 0.34 promised.

Value of power produced = (509,447 kWh x $0.125/kWh)/3.25 yr = $19,594/yr; if O&M and financing costs amortized over 15 - 20 years are subtracted, this value will likely be negative. STILL A VERY BAD INVESTMENT.

http://theenergycollective.com/willem-post/169521/wind-turbine-energy-capacity-less-estimated

From: Willem Post
Sent: Tuesday, January 29, 2013 4:26 PM

Subject: Sanders in Favor of IWTs That Destroy Ridge Lines.

All,

Sanders is in favor of destroying Vermont's cherished, pristine ridge lines with environmentally-damaging, health-damaging, property-value-lowering, visually-offensive, noise-making, bird-killing IWT projects, that produce expensive, variable, intermittent energy, i.e., junk energy, that could not be used on the grid, unless it is balanced by quick-ramping gas turbines operating in inefficient part-load-ramping mode. The generator inefficiencies use extra fuel/kWh and emit extra CO2/kWh, that offset much of what wind energy was meant to reduce.
http://theenergycollective.com/willem-post/89476/wind-energy-co2-emissions-are-overstated

IWTs on ridge lines is not about CO2 emissions reduction, but about schlepping federal subsidies to Vermont to benefit the top 1%, at the expense of the people. World CO2 emissions in 2011 = 33,990 million metric ton, Vermont's CO2 emissions in 2011 = 8.1 million metric ton; only 4% of that from generating energy. How much difference can Vermont make? Answer: NOTHING. Destroy ridge lines for NOTHING? There are better ways to reduce CO2 emissions than IWTs on ridge lines.

Klein, Smith, Cheney, Sanders, Welch, Leahy, Kilian, Hooper, Lyons, Shumlin, Dostes, Schnure, Patt, Blittersdorf, the PSB, VT-DPS, and subsidy-chasing IWT developers, IWT vendors, etc., all holding hands, sticking to their mantra of RE talking points, singing the praises of IWTs on ridge lines. Completely irrational behavior, if one looks at ACTUAL "facts on the ground".
http://vtdigger.org/2013/01/28/sanders/#comment-47435

Mr. Kilian during Sanders' news conference : "I feel that the Public Service Board in particular … (has) done an excellent job of including public input through public hearings and through broad public participation." I think otherwise, based on facts that are also available to Mr. Kilian. See below.

The VT-PSB has shamefully bent over backwards by using bogus vendor-provided data to make IWT ridge line energy costs appear much less/kWh than if REAL WORLD values were used.

IWT vendors' claim CFs = 0.32 or better on ridge lines is a misrepresentation.
IWT vendors' claim IWT lives of 25 years is a misrepresentation.
http://theenergycollective.com/willem-post/169521/wind-turbine-energy-capacity-less-estimated

BOLTON VALLEY SKI RESORT:

Since October 2009, the Bolton Valley Ski Resort has had a Vermont-made, 100 kW "community" wind turbine, project capital cost
$800,000 (includes a $250,000 gift from the Clean Energy Development Fund, a.k.a. RE slush fund); vendor-predicted energy production 300,000 kWh/yr, for a CF = 0.34; vendor-predicted estimated useful service life 20 years.

A recent check of the Bolton Valley website in January 2013 indicates actual energy production from October 2009 to-date (39 months or 3.25
yrs) was 509,447 kWh, for an actual CF = 509,447 kWh/(3.25 yr x 100 kW x 8,760 hr/yr) = 0.179, 47.4% less than the vendor-predicted CF of 0.34 to obtain VT-PSB approval. Like selling a car and telling the new owner it will do 34 mpg, whereas it actually does only 18 mpg. Also, an early indication of poor CFs on Vermont ridge

lines, as I predicted some years ago.

Value of energy produced = (509,447 kWh x $0.125/kWh)/3.25 yr = $19,594/yr; if annual O&M and financing costs, amortized over 15 - 20 years, are subtracted, this value will likely be negative, i.e., a CEDF-subsidized money loser.

SHEFFIELD MOUNTAIN:

Vermont Electric Cooperative, VEC, purchased energy from the Sheffield Wind LLC project (16 IWTs, each 2.5 MW = 40 MW) since it came on line in October 2011. Under two Power Purchase Agreements, PPAs, VEC purchased 2 x 20,124 MWh in 2012, for a VEC-calculated CF = 0.23, less than the vendor-predicted CF of 0.32 or better, to obtain VT-PSB approval.

VEC paid 10 c/kWh for the energy and received 5.5 c/kWh by selling Renewable Energy Credits, RECs, to out-of-state entities that should have reduced their CO2 emissions, but likely did not want IWTs on their ridge lines.

LOWLL MOUNTAIN

Gaz-Metro/GMP used a "vendor-predicted" CF of 0.33 and a "vendor-predicted" 25-year life to obtain bank financing, federal and state subsidies and "Certificate of Public Good" approvals for its ridge line Lowell Mountain IWT project, a.k.a. “Kingdom Community Wind”. It is not yet on line, because a $10 million dynamic-reactive system need to be installed to prevent grid instabilities in the NEK, according to ISO-NE.

Using the “vendor predictions”, GMP calculated the levelized cost of Lowell Mountain heavily-subsidized energy at 10 c/kWh. It would be 15 c/kWh, unsubsidized, per US-DOE.

The energy cost, based on REAL WORLD values, would be 10 c/kWh x CF ratio 0.33/0.25 x Life ratio 25/17 = 19.4 c/kWh, subsidized; 29 c/kWh, unsubsidized. http://theenergycollective.com/willem-post/61309/lowell-mountain-wind-turbine-facility-vermont

This compares with Hydro-Quebec and Vermont Yankee nuclear energy at about 5 - 6c/kWh, inflation or grid price adjusted, and grid energy at about 5.5 c/kWh. GMP is buying 60 MW of Seabrook nuclear energy for 23 years @ 4.66 c/kWh, inflation adjusted.

Whereas Lowell Mountain may have significantly greater levelized energy costs than the above 10c/kWh, this would not affect GMP's bottom line, as it would roll all its costs regarding Lowell Mountain into its household and business rate schedules, subject to PSB approval after pro forma hearings. Because the business records of this heavily-subsidized project are "proprietary", it is likely, the lay public will never learn what the real costs were.

VT-PSB AND LACK OF DUE DILIGENCE:

The VT-PSB, VT-DPS, etc., likely knew CFs on Vermont ridge lines would be less than the vendor-predicted values (the evidence was on the FERC website, and it is on my email distribution list), but approved the above 3 projects anyway, after pro forma hearings.

It should be obvious to the VT-PSB (which is supposed to serve/protect the public) and other government entities, whereas IWT project developers make claims of IWTs having:

- CFs of 0.32 or greater, this claim should be discounted to at most 0.25, based on actual ridge line results in Maine and in Vermont.

- Useful service lives of 25 years, this claim should be discounted to at most 17 years, based on actual useful service life results in Denmark and the UK.

The spreadsheet levelized energy cost analyses prepared by IWT project developers, currently based on their dubious claims, should be revised to better reflect the real world, rather than an "Alice in Wonderland" world.

Failure to base approval decisions on real-world, spreadsheet-based analyses is, as a minimum, a lack of due diligence, or, if facts were known to the VT-DPS, as is the case with the Lowell Mountain and Sheffield Mountain approvals, a malfeasance of a public trust; both have legal consequences.

From: Pam Arborio
Sent: Thursday, January 31, 2013 11:51 AM

Subject: VPR News: Grid Constraints Mean Less Power Output From Wind Projects

http://www.vpr.net/news_detail/97331/grid-constraints-mean-less-power-output-from-wind/

From: Rob Pforzheimer
Sent: Wednesday, January 30, 2013 9:36 PM

Subject: FW: Check out "SELECTMEN OF THE TOWN OF FALMOUTH ,MASS, HAVE VOTED TONIGHT TO TAKE THE TURBINES DOWN" on Citizens' Task Force on Wind Power - Maine

SELECTMEN OF THE TOWN OF FALMOUTH ,MASS, HAVE VOTED TONIGHT TO TAKE THE TURBINES DOWN

Citizens' Task Force on Wind Power - Maine

Check out the blog post 'SELECTMEN OF THE TOWN OF FALMOUTH ,MASS, HAVE VOTED TONIGHT TO TAKE THE TURBINES DOWN'

Blog post added by monique aniel:

http://www.falmouthmass.us/deppage.php?number=426 AT THEIR MEETING TONIGHT ,THE SELECTMEN OF THE TOWN OF FALMOUTH MASS VOTED TO TAKE...
Blog post link:
SELECTMEN OF THE TOWN OF FALMOUTH ,MASS, HAVE VOTED TONIGHT TO TAKE THE TURBINES DOWN
About Citizens' Task Force on Wind Power - Maine
A coalition of citizens advocating responsible, science based, economically and environmentally sound approaches to Maine's energy policy.

540 members
522 photos
103 videos
46 discussions
1325 blog posts

To control which emails you receive on Citizens' Task Force on Wind Power - Maine, click here

From: JAMES DYLAN RIVIS
Sent: Wednesday, January 30, 2013 3:29 PM

Subject: EFFECTS OF WIND TURBINES

http://www.windturbinesyndrome.com/category/what-effects-do-wind-turbines-have-on-domestic-animals-wildlife/

From: Jim Morey
Sent: Wednesday, January 30, 2013 1:23 PM
Subject: Comment with attachments for Siting Commission
Importance: High

Anne,
Can you please advise me on how to submit comments with attachments as I have several to submit in the next few days? BTW, I made a comment on real estate value impact by wind towers at the Brattleboro public meeting last week, along with my wife Leslie.
I am sending you this request, as I was not able to attach information to a comment on the standard web site. Please pass it along to the Commission.
Thank you.

The following is a request after five hours of research and phone calls with the Attorney General's Office of New York. In line with the charge of the Commission to advise the legislature on alternate dispute resolution, I respectfully submit there must be transparency before there can be understanding. I want to call attention to the NY Attorney Generals Code of Conduct for Wind Energy, which required disclosure of any *financial interests between wind developers and municipal officers*. I quote the AG "“New York must be equally committed to clean energy and clean government. The companies that have signed our Wind Industry Ethics Code are echoing that commitment - and I commend them for that,” said Attorney General Cuomo. “Wind power has enormous environmental and economic potential for New York and it is critical that this industry continues to grow without the suspicion or shadow of public corruption or anything else outside the law.”
I have attached a copy of that code signed by Iberdrola, the largest developer operating in VT. I apologize for the clarity of the copy. In conversation with Judith Malkin at the NY AG office (315 448 4848), this was the clearest copy readily available. It is available online at
http://www.iberdrolarenewables.us/pdf/Executed-AG-Code.pdf
An overview of the minimum level of money offered in one year to town officers and/or relatives by Horizon Wind includes: Clinton, NY $2,060,000. Ellenberg, NY $3,335,000 and Harrisburg, NY $5,060,000. As amounts were reported in ranges such as $500,000 to 1,000,000, the actual totals in each town could be double the amount listed. The complete disclosure tables for Horizon and Iberdrola, who co-own NY developments, are available at http://horizonwindfarms.com/northeast-region/documents/NY_Code_Disclosures_05042010.pdf
http://www.iberdrolarenewables.us/pdf/NY-AG-Code-Historical-Disclosure-092010.pdf
In light of recent developments where select boards in Windham County are blocking citizen's discussion in town meetings of proposed developments by Iberdrola, I request the commission review this information and highly recommend similar state codes. In my research, I was unable to find corresponding protection for Vermont citizens in our laws. Thank you.
Without disclosure, there can only be distrust.

Jim Morey

Submitted on Saturday, January 12, 2013 - 12:20 Submitted by anonymous user: [64.222.122.126]
Submitted values are:

Name: Kathy Leonard
Town: Randolph

2) Energy Sources and/or Facilities: Please check the type of energy generation you wish to comment upon: Wind

3) Comment :

Hello,

At the Commission's sixth meeting yesterday, Rep. Cheney didn't include any of the problems Germany is facing with their wind energy. The linked stories below from Bloomberg News and Reuters present information I had not heard before, and the third linked article speaks to Louise McCarren's question of costs. There are always two sides to any subject, and both needed to be included to present a fair picture of Germany's wind success. (I'm sure her hosts were careful to steer her to the positives).

I've much enjoyed attending four of your commission meetings and have learned much. Thank you,
Kathy Leonard
Randolph Center

Windmills Overload East Europe's Grid Risking Blackout http://www.bloomberg.com/news/2012-10-25/windmills-overload-east-europe-s-grid-risking-blackout-energy.html

German wind power irks neighbouring grids:
http://www.reuters.com/article/2012/12/20/column-wynn-german-wind-idUSL5E8NJ3GV20121220

Germans Grow Wary of Switch to Renewables http://www.spiegel.de/international/germany/consumers-bear-brunt-of-german-switch-to-renewable-energies-a-861415.html

The results of this submission may be viewed at:
http://sitingcommission.vermont.gov/node/7/submission/747

Submitted on Wednesday, January 16, 2013 - 09:38 Submitted by anonymous user: [71.192.148.187]
Submitted values are:

Name: Ronald R Palmer
Town: Milton

Organization: none
Title: homeowner

2) Energy Sources and/or Facilities: Please check the type of energy generation you wish to comment upon: Wind

3) Comment : I am very pleased to see VT making advances in clean energy production, especially in the area of Wind Turbines. I live 1-2 miles from Georgia Mountain and can see the 4 new turbines from my front lawn. Their amazing technology and geraceful form stands out above the mountain, and are pleasing for me to watch as they crank out power effortlessly. It's comforting to know that BED will be coughing out considerably less pollution thaks to the turbines. Please do not slow the advancement of these gentle giants as they clean our environment. Thank You

The results of this submission may be viewed at:
http://sitingcommission.vermont.gov/node/7/submission/751

Submitted on Wednesday, January 16, 2013 - 15:36 Submitted by anonymous user: [173.13.79.169]
Submitted values are:

Name: Doug Goldsmith
Town: Burlington

2) Energy Sources and/or Facilities: Please check the type of energy generation you wish to comment upon:
- Biomass
- Geothermal
- Hydroelectric
- Solar
- Wind

3) Comment :
I am a strong supporter of Renewable Energy. While I believe our climate change issues are significant, I'm more concerned about the long term economic advantage VT will lose if we don't make investments in wind and solar now. I'm concerned that the general public isn't as aware as necessary on energy issues to understand why we need to make hard choices and investments - and even make sacrifices - so we can maintain a quality of life. It would be very unfortunate if we slow down the progress of implementing wind and solar - the longer we wait, the more expensive it becomes not only to build but also to keep buying traditional energy as prices go up.

Please recognize the 'Greater Good' that renewable energy provides and please don't slow the progress by suggesting changes that don't provide equal balance to the good these projects provide with any negatives that is inevitable with development.

The results of this submission may be viewed at:
http://sitingcommission.vermont.gov/node/7/submission/752

Submitted on Friday, January 18, 2013 - 10:36 Submitted by anonymous user: [173.13.79.169] Submitted values are:

Name: Christie Hutchins
Town: North Hero

2) Energy Sources and/or Facilities: Please check the type of energy generation you wish to comment upon:
- Solar
- Wind

3) Comment : I feel it is imperative for our future generations to enhance and improve upon Renewable Energy in Vermont. This includes Wind and Solar power. We do not have any more time to sit on this extremely important issue of global warming. I am asking this council to support all legislation that enhances renewable energy in Vermont.

Submitted on Monday, January 21, 2013 - 12:53 Submitted by anonymous user: [96.61.75.108] Submitted values are:

Name: Jeremy Turner
Town: Windham
Organization: Meadowsend Timberlands Ltd
Title: Managing Forester

2) Energy Sources and/or Facilities: Please check the type of energy generation you wish to comment upon:
- Biomass
- Wind

3) Comment : Biomass and Wind are powerful links to maintaining Vermonts working lands and bridging long-term land conservation. With these two options of renewable energy, private working lands in VT will maintain a healthier chance at poviding all of the multi-use and multi-ecofuntions that the public is dependant on for gererations ahead. Without these management options the private landowner will be greatly impacted at maintaining land as working forests- a great risk of lose for the public.

The results of this submission may be viewed at:
http://sitingcommission.vermont.gov/node/7/submission/759

Submitted on Monday, January 21, 2013 - 13:18 Submitted by anonymous user: [96.61.75.108] Submitted values are:

Name: Ryan Kilborn
Town: Bradford
Organization: Meadowsend Timberland
Title: Northern Regional Forester

2) Energy Sources and/or Facilities: Please check the type of energy generation you wish to comment upon:
- Biomass
- Solar
- Wind

3) Comment : I am writing to support renewable energy as a whole to help vermont & our country scale back on its dependency of fossil fuels. We also need to make sure that we are diversified in our portfolio and well educated on all of these sources of renewables so that they are being done right and located in the appropriate locations within the state. Although no situation will have support by all, the state does need to at least address the issues and concerns generated from all parties.

The results of this submission may be viewed at:
http://sitingcommission.vermont.gov/node/7/submission/760

Submitted on Tuesday, January 22, 2013 - 11:39 Submitted by anonymous user: [96.61.75.108] Submitted values are:

Name: Beverly Dunning
Town: Barnard

2) Energy Sources and/or Facilities: Please check the type of energy generation you wish to comment upon: Wind

3) Comment : I love our mountains and ridgelines as they are BUT I would much rather see a graceful windfarm than not be able to see the mountain tops because of fossil fuel smog or continue to lose trees due to acid rain coming from refineries further west.

The results of this submission may be viewed at:
http://sitingcommission.vermont.gov/node/7/submission/762

Submitted on Thursday, January 24, 2013 - 17:32 Submitted by anonymous user: [71.169.180.21]
Submitted values are:

Name: Gina Faro
Town: Brattleboro

2) Energy Sources and/or Facilities: Please check the type of energy generation you wish to comment upon: Wind

3) Comment :
I attended the first public hearing at BUHS on 23 Jan 2013 and, as always, was impressed by the citizen involvement, concern and understanding and research into the general issue and their personal take. Good points made:
smaller footprint of windmill pad, look to European designs, set up system w/out blasting,& destroying wildlife corridors and fauna (PA).

We DO NOT have 20 years to figure it out! We are in a crisis, we MUST reduce radically our usage & use alt. resources that are sustainable & respectful to Earth & people. Nothing having to do w/ mining (no nuclear) or emitting dangerous waste products. All other issues are moot (property values) if we have no planet. Climate change, a.k.a. global warming is THE NUMBER ONE ISSUE. Wind power is a great idea, it does not have to destroy ridgelines - it's a new aesthetic. Mills can be smaller & installed kindly.
Thank you for listening. Gina Faro

The results of this submission may be viewed at:
http://sitingcommission.vermont.gov/node/7/submission/769

Submitted on Monday, January 28, 2013 - 08:24 Submitted by anonymous user: [70.192.5.142] Submitted values are:

Name: Linda Gray
Town: Norwich
Organization: Norwich Energy Committee

2) Energy Sources and/or Facilities: Please check the type of energy generation you wish to comment upon: Wind

3) Comment :
a link to the most recent study about the impact of wind projects on property values:
http://seagrant.gso.uri.edu/resp/pdfs/resp_propertyvalue_presentation.pdf

The results of this submission may be viewed at:
http://sitingcommission.vermont.gov/node/7/submission/775

Submitted on Monday, January 28, 2013 - 08:29 Submitted by anonymous user: [70.192.5.142] Submitted values are:

Name: Linda Gray
Town: Norwich
Organization: Norwich Energy Committee

2) Energy Sources and/or Facilities: Please check the type of energy generation you wish to comment upon: Wind

3) Comment : a wind integration study of particular interest, since it was prepared for ISO-NE: http://www.uwig.org/newis_es.pdf

The results of this submission may be viewed at:
http://sitingcommission.vermont.gov/node/7/submission/776

Submitted on Wednesday, January 23, 2013 - 23:13 Submitted by anonymous user: [24.91.67.191]
Submitted values are:

Name: Michael Bosworth
Town: Brattleboro

2) Energy Sources and/or Facilities: Please check the type of energy generation you wish to comment upon: Wind

3) Comment :
Remarks for Energy Siting Hearing
January 23, 2013

My name is Michael Bosworth and I live in Brattleboro. My remarks are primarily about siting wind power facilities, and primarily from a recreation impact perspective.
I come to this discussion with a background in 2 areas:

1. I have been and intend to continue to be personally involved with siting renewable energy facilities, including a rooftop solar array that has been installed and a community-scale, wood-fueled cogeneration system that has not yet happened.

2. I have spent a fair amount of time in the out of doors in my life, including some time backpacking and a lot of time hiking and cross-country skiing. I am a member of the Appalachian Mountain Club, the Green Mountain Club and the Catamount Trail Association.
I believe the following:

A. Having renewable energy facilities in Vermont is highly desirable, most particularly in light of climate change but also for more local control of our energy resources.

B. Vermont needs to do its fair share of siting renewable energy facilities and should want to be a leader in siting such facilities.

C. Wind power in particular can cause conflicts with landscape level issues, such as the recreation experience and, yes, even Vermont's landscape "brand"
that is so important to its tourist economy.

D. Both the scale and location of wind power are important. One wind turbine at a ski area where there is already developed infrastructure is much different than a whole set of turbines on a heretofore undeveloped ridgeline.

E. The state should prioritizelocations where wind power makes the most sense and locations where it does not make sense. I assume this commission is already aware of the Wind Energy Facility Development policy of the Green Mountain Club and the even more detailed Conceptual Wind Power Siting Guidelines put together by the Appalachian Mountain Club and Audubon Society of New Hampshire. Neither of those documents state that there should be no new wind power facilities. Rather, they set frameworks for evaluating the suitability of wind power proposals.

F. From a recreational point of view, the Appalachian Trail corridor, the Long Trail corridor and the Catamount Trail corridor should receive special consideration. Also, public lands and wilderness areas should receive special consideration. Wind power proposals in those areas should receive a higher level of review. Particularly for the hiking trails, the view sheds from the ridgeline portions of those trails should be an important factor given consideration.

G. The Green Mountain Club has brought up the issue of "cumulative impact."
That is, multiple wind power developments in one area have the potential of overwhelming the recreation experience. I agree with that sentiment.

H. While I realize that individual communities, right down to the individual household level, can sometimes be the most impacted by particular wind power proposals, I do not think either those communities or the regions they lie within should have veto power over such proposals. Yes, they should have the opportunity to argue for or against a proposal. I believe, however, given the adverse impacts that climate change is already bringing to us, that decisions on renewable energy facilities are important enough to be made at the state level.

Finally, as an example of how I would put my own thoughts into practice in a real world situation, the wind power development off Rte. 8 in the Searsburg/Readsboro/Woodford area comes to mind. I like the existing turbines. I like knowing that they're generating power renewably. I think
they look cool, even when I see them from miles away while I'm hiking. When I first heard of the proposal to put more turbines up, I thought that would be a good thing. Now, even though the new turbines will be generating a fair amount more power, I no longer think the project is a good one. The new turbines will be several times taller than the existing turbines, and there will be more of them, and they'll impact the experience from Woodford State Park as well as the Aiken Wilderness. If the size of the turbines were smaller, or the number of turbines were lesser, or if the location were different, or some combination of those factors, I would be in favor. As it has played out, I am no longer in favor.

I hope these remarks are helpful. Thank you for the chance to comment.

The results of this submission may be viewed at:
http://sitingcommission.vermont.gov/node/7/submission/767

Submitted on Wednesday, January 23, 2013 - 22:13 Submitted by anonymous user: [209.198.90.181]
Submitted values are:

Name: Tad Montgomery
Town: Brattleboro
Organization: Home Energy Advocates
Title: Principal

2) Energy Sources and/or Facilities: Please check the type of energy generation you wish to comment upon: Wind

3) Comment :

I have two suggestions regarding the permitting of wind facilities.

I) COMMUNITY OWNED WIND I believe that wind energy developments would be facilitated if there were a mechanism by which individual communities could develop these facilities with a majority ownership stake. To this end I suggest that the State of Vermont establish a commission to develop protocols and templates for community wind energy development. The next step would be for this commission to solicit proposals from towns to initiate such wind power development projects and walk a number of those projects through to completion. The process would be documented and publicized to facilitate future communities in following suit.

II) WIND PROJECT DECOMMISSIONING FUNDS I suggest that it would be beneficial to the siting and permitting process if part of each wind power development project included a clause for 'decommissioning.' This clause would stipulate something to the effect that a fund would be established and paid for through revenues collected from the wind power project once it becomes operational. This fund would be used for the exclusive purpose of restoring a wind power site to its previous undeveloped state, or as close a proximity as possible, when the facility is permanently closed and has stopped producing power. "Undeveloped state" shall include removal of any and all roads, structures, 'improvements,' reforest the area with appropriate indigenous flora and restore any altered hydrological features to their state before development began.

The results of this submission may be viewed at:
http://sitingcommission.vermont.gov/node/7/submission/766

Submitted on Wednesday, January 23, 2013 - 13:15 Submitted by anonymous user: [75.67.82.197]
Submitted values are:

Name: Ken Alberti
Town: Londonderry
Organization: Blue Gentian Lodge
Title: Owner

2) Energy Sources and/or Facilities: Please check the type of energy generation you wish to comment upon:
- Geothermal
- Solar
- Wind

3) Comment : I am in support of the development of all forms of renewable energy in Vermont. I feel the state should assist in the approval of wind projects given the cooperation of developers with existing environmental laws. Private ski area should be encouraged to develop their own wind energy installations.

The results of this submission may be viewed at:
http://sitingcommission.vermont.gov/node/7/submission/765

Submitted on Tuesday, January 29, 2013 - 14:03 Submitted by anonymous user: [64.131.155.147]
Submitted values are:

Name: Deborah Krasner
Town: Westminster

2) Energy Sources and/or Facilities: Please check the type of energy generation you wish to comment upon:
- Solar
- Other Energy Sources, Facilities or General Comment

3) Comment : As I said at the public meeting in Brattleboro, I suggest that the Commission do three things: Create an international public contest, asking for innovative, small-scale/small footprint solar and wind proposals; create a business climate which favors Vermont-owned companies to install and maintain such facilities; consider siting a ribbon of solar panels along the medians of I-91 and I-89 to power the state with solar-generated electricity, creating a State Electric Coop to distribute this energy to Vermonters. I would like to volunteer to be a part of creating the contest. Thank you.

The results of this submission may be viewed at:
http://sitingcommission.vermont.gov/node/7/submission/779

Submitted on Thursday, January 31, 2013 - 13:25 Submitted by anonymous user: [64.222.87.108]
Submitted values are:

Name: Daniel Ingold
Town: Springfield
Organization: North Springfield Sustainable Energy Project
Title: Senior Technical Director

2) Energy Sources and/or Facilities: Please check the type of energy generation you wish to comment upon:
- Biomass
- Solar
- Wind
- Other Energy Sources, Facilities or General Comment

3) Comment : Relative to #7 on developing generic siting guidelines. As a power project developer who has worked with both landfill gas and wood chip fueled power plants in Vermont I strongly would encourage that generic siting guidelines be developed for projects by technology. This not only helps determine the viability of the project at an early stage, but also reduces risk to the developer. In addition by having set guidelines for certain siting issues- it will take them "off the table" if they are met, and therefore provide a more defined and reduced framework of issues for the developer and the potential opposition groups to focus on and try to resolve or mitigate.

The results of this submission may be viewed at:
http://sitingcommission.vermont.gov/node/7/submission/787

Submitted on Wednesday, January 30, 2013 - 13:08 Submitted by anonymous user: [72.92.134.76]
Submitted values are:

Name: Maurice James Morey
Town: Windham
Organization: Planning Commission, Windham Co NRCD
Title: Wildlife Biology Consultant

2) Energy Sources and/or Facilities: Please check the type of energy generation you wish to comment upon: Wind

3) Comment :
The following is a request after five hours of research and phone calls with the Attorney General's Office of New York. In line with the charge of the Commission to advise the legislature on alternate dispute resolution, I respectfully submit there must be transparency before there can be understanding. I want to call attention to the NY Attorney Generals Code of Conduct for Wind Energy which required disclosure of any financial interests between wind developers and municipal officers. I quote the AG "“New York must be equally committed to clean energy and clean government. The companies that have signed our Wind Industry Ethics Code are echoing that commitment - and I commend them for that,” said Attorney General Cuomo. “Wind power has enormous environmental and economic potential for New York and it is critical that this industry continues to grow without the suspicion or shadow of public corruption or anything else outside the law.”

I have attempted to attached a copy of that code signed by Iberdrola, the largest developer operating in VT. I apologize for the clarity of the copy. In conversation with Judith Malkin at the NY AG office (315 448 4848), this was the clearest copy readily available. It is available online at http://www.iberdrolarenewables.us/pdf/Executed-AG-Code.pdf

An overview of the minimum level of money offered in one year to town officers and/or relatives by Horizon Wind includes: Clinton, NY $2,060,000.

Ellenberg, NY $3,335,000 and Harrisburg, NY $5,060,000. As amounts were reported in ranges such as $500,000 to 1,000,000, the actual totals in each town could be double the amount listed. The complete disclosure tables for Horizon and Iberdrola, who co-own NY developments, are available at
http://horizonwindfarms.com/northeast-region/documents/NY_Code_Disclosures_05042010.pdf
http://www.iberdrolarenewables.us/pdf/NY-AG-Code-Historical-Disclosure-092010.pdf

In light of recent developments where select boards in Windham County are blocking citizen's discussion in town meetings of proposed developments by Iberdrola, I request the commission review this information and highly recommend similar state codes. In my research I was unable to find corresponding protection for Vermont citizens in our laws. Thank you.
Without disclosure there can only be distrust.

The results of this submission may be viewed at:
http://sitingcommission.vermont.gov/node/7/submission/785