



Wind Study Report

August 21, 2014

(As prepared by the NVDA Wind Study Committee)

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Executive Summary

Policy Statement (from the NVDA Regional Plan) – “This region has a responsibility to plan for adequate supply of energy to meet local energy demand. Planning activities may include the production, storage, siting, and distribution of energy. Individuals, businesses, organizations, and communities are encouraged to explore emerging energy supply, efficiency, and net-metering opportunities that meet accepted environmental standards in order to satisfy their power demand.

New industrial/utility energy development shall meet the highest standards required by law. Permitting authorities shall first consider current and historical land use and the culture of the region, community opinion, economic benefit, as well as the land owner’s rights. Any development shall to the extent possible be done so as to mitigate adverse impacts to the region. Any utility-scale energy generation project deemed acceptable by the Public Service Board shall include a plan for distributing benefits to the towns in the region proportional to the adverse effects experienced by that town. Long term maintenance, safety issues, decommissioning, and land reclamation procedures required at the end of the energy project’s life must also be included in the project plan.

The plan aims to balance environmental quality and important natural resources with energy production. Significant local and regional support and clearly demonstrated benefits should exist in any energy proposal.”

Wind as a Renewable Generation Resource - Wind energy has recently been on the forefront of the renewable energy movement. The U.S. Department of Energy has announced a goal of obtaining 5% of U.S. electricity from wind by 2020, a goal consistent with the current rate of growth of wind energy nationwide. Vermont is currently ranked 34th out of the lower 48 states for wind energy potential.

At this time, our region harnesses wind energy through small-scale individual systems and two utility-scale wind farms: 1) First Wind (formerly UPC), located in Sheffield, VT, consists of 16 turbines over 400’ tall; 2) GMP/Kingdom Community Wind, located in Lowell, is the region’s second utility –scale wind farm (and VT’s largest wind facility), utilizing 3 miles of ridgeline with 21 turbines over 400’ tall. There are other utility-scale wind projects in the works at various stages of planning and development in Vermont, most notably the proposed Seneca Mountain Wind project proposed for Essex County.

Status/Recent History of Industrial Wind Development in the NEK - Projects that have been constructed or proposed in the Northeast Kingdom include: UPC/First Wind Project (constructed in Sheffield); GMP/Kingdom Community Wind (constructed in Lowell); Eolian/Seneca Mountain Wind (initially proposed for Ferdinand, Newark, & Brighton, but scaled down to only include Ferdinand); East Mountain – 4-turbine demonstration project (proposal for East Haven); Grandview Farm 1-turbine (Derby); and Smugglers Hill Farm 1-turbine (Holland). [pp. 21-22 of NVDA Energy Plan]

The First Wind facility, located in Sheffield, Vermont came online in September 2010 and contributed another 25,948 MWhs to regional generation. The wind farm was only operating for a portion of 2010, but was projected to contribute a total 112,000 MWhs annually. Another utility-scale wind farm in the region, Kingdom Community Wind (Lowell, Vermont), received a Certificate of Public Good and began generating electricity in November 2012. The Kingdom Community Wind Project was projected to contribute another 180,000 MWhs annually.

Public Issues and Concerns over Industrial-scale Wind Development - The siting of wind turbines has raised public concerns about aesthetic impacts, erosion, water quality impacts, noise, land scarring, and effects on wildlife, property values, public health, and impacts on local economic drivers, such as tourism. Concern has also been expressed by residents within the Northeast Kingdom that our region has been targeted for industrial-scale wind development due to the region's rural nature, low population densities, and lower overall socio-economic status. When one considers the number of projects proposed for this (the NEK) region in comparison to the rest of VT, perceptions may seem valid. To address these many unknown impacts and for other reasons, including the state's permitting process for energy generation facilities, the NVDA Board of Directors, at its July 2012 meeting, overwhelmingly passed a resolution recommending a suspension of industrial-scale wind in the Northeast Kingdom for a three-year period for further study. Later, broad public concerns at a statewide level over the siting of energy generation facilities and complaints around the state's permitting process for these facilities resulted in Governor Shumlin appointing an official Siting Commission to examine the VT Public Service Board's permitting process and to come up with recommendations for improvement.

Purpose

Board Resolution for Industrial-Scale Wind Study – As recommended by NVDA Board of Directors Resolution of July 2012, the NVDA formed a committee to conduct “a thorough evaluation of the impact of wind towers on the Northeast Kingdom” to include:

- The cost versus the benefit of industrial size wind turbines in the Northeast Kingdom
- What does objective data and science show concerning measurable health impacts? What does national and international research show?
- Are transmission requirements being adequately addressed with these projects?
- Do statutes, regulations and the review process provide ample environmental protections for the development of higher elevation ridge-lines?
- What is the impact of industrial wind turbines on property values and tourism in the Northeast Kingdom?
- What impact do industrial wind turbines have on greenhouse gas emissions in the Northeast Kingdom?

Methodology - The NVDA Executive Board approved a Study Committee of volunteer members from the NVDA Board of Directors. Members of the study committee are local and regional stakeholders representing different backgrounds with differing areas of expertise. Some of the appointed committee

members were just completing a 2013 comprehensive update of the Energy Section of the NVDA Regional Plan*, and others members were recruited based on their ability to address areas of study proposed by the NVDA Board resolution. The Study Committee began its work in January 2013. *Note – The Energy section of the 2013 NVDA Regional Plan received a grade of ‘A’ for its content related to the requirements of 24 V.S.A., Chapter 117 following a review of the entire plan by an independent consultant selected by the Agency of Commerce & Community Development and the Vermont Association of Planning & Development Agencies.

Study Committee members included: James Greenwood, Chair (retired NVDA Economic Development Specialist, VT Dept. of Labor official, State Senator, Citizens Utilities), Farley Brown (NVDA Board of Directors, Sterling College, Town of Craftsbury Planning Commission and Conservation Commission), Robert Croteau (NVDA Executive Board, Town of Barton Selectboard, Business Owner), Mark Whitworth (NVDA Executive Board, Town of Newark Planning Commission, Energize Vermont), and David Snedeker (NVDA Executive Director, Town of Barton Planning Commission). Other NVDA Board members that participated in committee meetings over the study period include: Peter Rodin (UTG Planning Commissioner and retired VT Electric Cooperative employee), Steve Amos (Town of Wheelock Selectboard), Martha Feltus (State Representative, Town of Lyndon Selectboard), and John Morley (President, NVDA Board of Directors, Orleans Village Supervisor, former Director VPPSA).

Following upon the study recommendations of the NVDA Board’s resolution, the Study Committee developed a format of inviting guest speakers with experience and/or expertise in specified topical areas. The selected guest speakers were chosen based on their perceived knowledge of the subject area the committee was interested in learning. As the study evolved and additional information was desired, other guest speakers were invited to participate. Guest speakers appearing before the study committee were:

- April 3, 2013: David Hallquist, VT Electric Cooperative (speaking on generation, transmission, and distribution)
- April 24, 2013: Billy Coster, ANR (speaking on ANR’s role and responsibilities in the PSB process)
- May 8, 2013: Ann Margolis and Aaron Kisicki, PSD (speaking on PSD’s roles and responsibilities in PSB process)
- May 29, 2013: John Soinenen and Travis Bullare, Eolian Renewable Energy (speaking on climate change, wind industry, and role as a renewable energy developer)
- August 14, 2013: Kerrick Johnson, VT Electric Transmission Company (VELCO), (speaking on VT’s Electric Transmission Company and its role and responsibilities, transmission system in northern VT, interconnecting wind resources, etc.)
- September 4, 2013: Kevin Jones, VT Law School (speaking on VT’s renewable energy policy and its impacts on Vermont)
- September 4, 2013: Steve Therrien, adjoining property owner to First Wind (speaking complaining of health impacts and impacts to property value based on inability to resell.

- September 26, 2013: Robert Dostis, Green Mountain Power (speaking on the Kingdom Community Wind Project in Lowell)
- September 26, 2013: Jason Shafter, Professor of Atmospheric Sciences at LSC (speaking on climatology, wind resources, and local data)
- November 6, 2013: Dr. David Grass, VT Dept. of Health (speaking on health impacts and studies related to industrial-scale wind)
- January 6, 2014: Gloria Bruce, Northeast Kingdom Travel and Tourism Association (teleconference speaking on impacts to businesses in the travel and tourism industry)
- January 29, 2014: Dr. Ben Luce, Lyndon State College (speaking on renewable energy options for VT and the NEK region)

Study Committee meetings notices were posted on the NVDA website, along with meeting minutes and materials www.nvda.net. Local newspaper reporter(s) were invited to each of the committee meetings, as well. Over the months of March – June 2014, the study committee held 5-6 working meetings to assess and discuss information that had been covered over preceding months and develop recommendations (proposition statements) for the committee's report.

The proposition statements are presented in no specific order and must be understood within the context in which they were developed. For a complete understanding, it is important that they should be read along with the full report, minutes from each meeting, and supplementary materials that were presented (and reviewed) by each of the invited presenters and/or study committee members.

General assertions regarding industrial wind development in Vermont and the Northeast Kingdom:

1. The State of Vermont, through its adopted Comprehensive Energy Plan, has set progressive and ambitious renewable energy generation goals to achieve by the year 2050. 20% by 2017 up to 90% by 2050.
2. The development of industrial-scale wind generation facilities is contributing to meeting the State's renewable energy generation goals. There are two projects in the NEK region – Sheffield and Lowell. Other projects have been proposed, but not developed – East Haven, Seneca Mountain (Ferdinand), and Derby.
3. The siting and development of industrial-scale wind facilities in the NEK region has not been without controversy, whether in towns where projects have been constructed or in towns where projects have been developed, proposed, tabled, or withdrawn from consideration.
4. Industrial-scale wind turbines have created significant local, regional, and state land use planning issues.

Health Impact Propositions

The NVDA Wind Study Committee concludes*:

- We are concerned that our neighbors have health complaints that they attribute to turbine operations.
- The relationship between turbine operation and health is not well understood.
- There may well be a direct link from turbines to ill health that has yet to be discovered.
- If turbine noise will disturb sleep only if it exceeds noise guidelines, then assuring the health of neighbors may require continuous noise monitoring and rigorous enforcement of noise standards.
- DoH should actively investigate the health claims made by turbine neighbors in Vermont.
- There is not enough known about: the potential health impacts (direct or indirect) of turbines; the distances over which those impacts might be felt; or, the effectiveness of possible mitigation measures to allow the NVDA to recommend further turbine development in the Northeast Kingdom.

As developed by the Study Committee based upon the testimony and evidence presented. For a full assessment of findings, see **Attachment A: Propositions on Health 5.0*

Transmission Propositions:

The NVDA Wind Study Committee concludes*:

- We acknowledge that VELCO, through its long-range plan and presentation, has identified most of the NEK region as a constrained zone due to transmission grid congestion. This limits the system's ability to accept additional generation resources.
- We acknowledge the VT Electric Cooperative's recommendation for a moratorium on implementing renewable mandates because of transmission constraints and grid integration issues associated with renewable generation resources.
- Accepting VELCO's assertions that new generation added over the last five years now makes our region an exporter of power to other regions of VT and New England; our regional constraint issues; and, that the forecasted annual load growth for VT is less than 1% (and decreasing) going forward, there seems to be little need for new large-scale generation facilities in the NEK region.
- Improving transmission reliability within the existing system is preferable to adding new generation and transmission facilities that may exacerbate curtailment issues or destabilize the existing transmission grid.

As developed by the Study Committee based upon the testimony and evidence presented. For a full assessment of findings, see **Attachment B: Propositions on Transmission 4.*

Wildlife and Water Resource Propositions:

The NVDA Study Committee concludes*:

- Regional environmental impacts of industrial wind development are not well understood, such as high elevation stormwater runoff, bird and bat fatalities, wildlife habitat destruction, and loss of connectivity across the Northeast Kingdom landscape. Studies are ongoing and further research should be conducted.
- Alternative stormwater technologies, such as level spreaders, need to be proven for their effectiveness.
- Because there is limited data on the impacts of wind projects in the Northeast Kingdom on birds and bats, it is recommended that GMP continue to monitor bat fatalities beyond the one year post construction survey and follow methods used in the Sheffield Bird and Bat Post-Construction Study.
- The Sheffield Bird and Bat Post-Construction Study Final Report is due in December 2014 and the Vermont Department of Fish and Wildlife determination of future methods of mitigation based on this information will need to be followed.
- Agency of Natural Resources wind development guidelines from 2006 need to be updated. This is consistent with the Energy Generation Siting Policy Commission Recommendations 2013: ANR shall provide detailed guidelines on assessment and “undue” impact.

As developed by the Study Committee based upon the evidence presented. For a full assessment of findings, see **Attachment C: Wildlife and Water Resources Propositions (8/5/14)*

Property Value Impact Propositions:

The NVDA Wind Study Committee concludes*:

- Establishing property values is a subjective as well as an objective exercise.
- Perceptions (negative and positive) drive the decision making and valuation process.
- While the property value impact studies that were presented to the Committee showed mixed conclusions, the Committee gives greater consideration to the studies from the professional appraisal consultants given their experience in establishing values, including an accounting for subjectivity.
- The nearer a residential property is to an industrial wind project, the greater the likelihood of negatively impacting its value.
- With a number of existing industrial wind facilities in the region and Vermont, the Public Service Department, working with the VT Tax Department, should consider tracking property values and sales within a defined range of distances (e.g. 1/2-mile, 1-mile, 2-miles, etc.) to aid in determining the impacts of turbines on property values.

As developed by the Study Committee based upon the testimony and evidence presented. For a full assessment of findings, see **Attachment D: Property Value Propositions4 (6/17/14)*

Green House Gas Propositions:

The NVDA Wind Study Committee concludes*:

- Focusing on the generation of electricity is not the most effective way of reducing the state's GHG emissions
- It is unclear if industrial wind turbines in Vermont can bring about reductions in the region's GHG emissions.
- If the reduction of GHG emissions is a goal, it is clear that significant reductions may be achievable by addressing the state's larger contributors: transportation and heating.
- The impacts of Vermont turbine operations upon GHG emissions are dependent upon: The GHG lifecycle costs and benefits of the turbine project under consideration; and, the energy policies of Vermont and neighboring states
- The analysis of these lifecycle and policy effects is beyond the scope of this report.

As developed by the Study Committee based upon the testimony and evidence presented. For a full assessment of findings, see **Attachment E: Greenhouse Gas Propositions 2.0*

Propositions on Aesthetics:

The NVDA Wind Study Committee concludes*:

- 1.1.1. Due to their enormous size, industrial wind turbines have an impact on aesthetics.
- 1.1.2. The municipal plans excerpted here constitute clear, written community standards intended to preserve the aesthetics or scenic, natural beauty of the area.
- 1.1.3. Industrial wind turbines violate the clear, written community standards established in the excerpted municipal plans.
- 1.1.4. Since industrial wind turbines violate these clear, written community standards, under Vermont law they would constitute an undue adverse impact to these communities.
- 1.1.5. The clear, written community standards expressed in the region's municipal plans reflect a high level of education and experience relating to industrial wind turbines.

As developed by the Study Committee based upon the testimony and evidence presented. For a full assessment of findings, see **Attachment F: Aesthetics Propositions 3.0*

This report will be reviewed first by the NVDA Executive Committee and then the full Board of Directors. Changes may be made subsequent to the reviews, and final recommendations may be used to inform changes to the NVDA Regional Plan.

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A Regional Profile

The Northeast Kingdom is a rural, sparsely populated region in the northeastern corner of Vermont, comprised of Caledonia, Essex, and Orleans counties. Its name is attributed to the late George D. Aiken—former Governor of Vermont and US Senator—who quipped in a 1949 speech, “you know, this is such beautiful country up here, it should be called the Northeast Kingdom.” The region is a year-round travel and recreation destination, known for its skiing, mountain biking, fall foliage viewing, covered bridges, and maple syrup production. The Northeast Kingdom’s land area covers about one-fifth of the state of Vermont and is bounded by the Connecticut River to the east, which also corresponds to the border with New Hampshire; the Province of Quebec to the north; the Vermont counties of Franklin, Lamoille, and Washington to the west, and the Vermont county of Orange to the south.

The Northeast Kingdom encompasses 55 towns and gores and numerous small villages, with the largest population centers being St. Johnsbury, Lyndon, Derby, Newport, and Hardwick.

Demographics – The 2,014 square mile Northeast Kingdom hosts a 2010 population of 64,764 which amounts to a population density of approximately 32 people per square mile. In comparison, Vermont has a population density of approximately 68 people per square mile; and the United States a density of 87 people per square mile.

While each of the three counties has approximately the same amount of land area, their respective regional population shares differ. As of April 1, 2010 Caledonia County held the largest share with 48.2 percent of NEK’s regional population residing there, which corresponds to 31,227 people (Figure 2). Orleans County was not far behind with a share of 42.0 percent (or a population level of 27,231). Essex County with a population of 6,306, accounts for only 9.4 percent of the total regional population.

The 2010 populations of Sheffield (703), Lowell (879), Newark (581), Brighton (1,222), and Ferdinand (32) are notable as these are small communities where large-scale industrial wind projects have been developed, or were being considered.

Public Lands and Ownership – Land ownership has broad implications for economic developments within any region; including potential and existing land uses and collection of property-related taxes. Over many years, significant public investments have been made to purchase and reserve large tracts of land for wildlife, conservation, recreational, and other purposes. About one-tenth of the Northeast Kingdom’s land area is under public ownership, with 146 square miles in public state forest lands and parks (including the Brighton, Darling, Groton, Kingdom, and Willoughby State Forests); 43 square miles of public federal lands (mostly the Nulhegan Basin of the Silvio O. Conte National Fish and Wildlife Refuge, Essex county); and 9 square miles of public town park or forest lands.

Special Designations - Special designations are pursued by communities or regions for many different reasons, including recognition of locally important and unique resources, as well as to attract visitors and tourism dollars.

In 2006, the National Geographic Center for Sustainable Destinations identified the Northeast Kingdom region of Vermont as a Geotourism Destination. This was after partnering with the 'local' community to identify the assets and attractions that make the NEK region a special place). A Geotourism program was then launched. At the time, the Northeast Kingdom was one of only a handful of destinations selected by National Geographic to participate in a Geotourism program.

Geo•tourism (n): Tourism that sustains or enhances the geographical character of a place – its environment, culture, aesthetics, heritage, and the well-being of its residents.

Geotourism values, practices, and offerings include many of the best aspects of a variety of types of tourism including ecotourism, heritage tourism, agritourism and culinary tourism to name a few. It encompasses a set of elements that incorporate the concept of sustainable tourism - a commitment to enhance local economies while minimizing the negative impacts on the environment and local culture.

(Northeast Kingdom Travel & Tourism Association, www.travelthekingdom.com.)

There are also two designated scenic byways in the Northeast Kingdom – the nationally designated Connecticut River Scenic Byway that includes all Vermont towns along the Connecticut River, and the newer state designated Northeast Kingdom Byway that extends from St. Johnsbury to Derby Line and passes through Lyndon, Burke, Westmore, Charleston, and Newport.

Other noteworthy designations: Willoughby Lake (Westmore) and the Barton River Marsh (Coventry) are designated National Natural Landmarks (<http://www.nature.nps.gov/nnl/index.cfm>). National Historic Districts exist in the following communities: Brownington, Crystal Lake Falls (Barton), Newport City, Guildhall, Island Pond (Brighton), Maidstone State Park, Barnet Center, Hardwick, St. Johnsbury, New Discovery State Park, Peacham, Ricker Pond and Stillwater State Parks (Groton), West View Farm (Waterford), and Wheelock. (<http://www.nationalregisterofhistoricplaces.com/vt/districts.html>)

Economic Challenges – The Northeast Kingdom region has long been the most economically challenged region of Vermont, with high rates of unemployment, lower wages/incomes, and fewer employment opportunities than in other regions of Vermont. This was officially recognized when the 3-county region was designated as a Rural Economic Area Partnership (REAP) Zone in 2000. The REAP Initiative, administered by USDA Rural Development, was established to address critical issues related to constraints in economic activity and growth, low density settlement patterns, stagnant or declining employment, and isolation that has led to disconnection from markets, suppliers, and centers of information and finance. The region's REAP designation was recently extended through September 30, 2018.

In recent years, unemployment rates across the United States spiked during the Great Recession. Vermont and the Northeast Kingdom reached 20-year annual average unemployment rate highs in 2009 with annual unemployment rates of 6.9 percent and 7.2 percent, respectively.

The per capita income in the Northeast Kingdom was \$31,795 in 2009. This was \$7,840 below that of the nation and \$7,410 below the statewide average. While Vermont's per capita income remained slightly below the national average between 1990 and 2009, Northeast Kingdom's per capita income remained well below the state and national averages.

Recent (2009) income statistics from the U.S. Census Bureau indicate that residents in the Northeast Kingdom are substantially less affluent than residents of the state as a whole. For households in Caledonia, Essex, and Orleans Counties, the 2009 median income was substantially below (between \$8,000 - \$16,800) that of the statewide median of \$51,219.

The number of persons below the poverty line has increased significantly in the last decade. Since 2002 for the United States, and 2004 for the Northeast Kingdom region, the number of persons below the poverty line has been steadily increasing. The high poverty levels seen in recent years are due to the recent recession, during which no geographic region or industries were spared. The United States and the Northeast Kingdom have experienced higher levels of poverty over the past decade than the rest of Vermont. As of 2009, 14.3% of the people in the United States were below the poverty line, which is an increase of 3.0 percentage points since 2000. The Northeast Kingdom had 14.1% of its population living below the poverty level, which was an increase of 1.4 percentage points since 2000. Vermont did not reach the same levels of poverty that were experienced by the United States and the Northeast Kingdom, but still had elevated levels, with 11.5% of the population living in poverty in 2009. Given the lag in income growth and the persistent income gap in the Northeast Kingdom, it is not surprising to see poverty rates remain persistently high during the 2000-2009 time periods. With the exception of Orleans County, where rates slightly decreased from 13.9 percent in 2000 to 13.5 percent in 2009; the Northeast Kingdom experienced an uptick in poverty rates over the 9-year period.

Economic Opportunities - In 2010-11, with a *Regional Innovation Grant* from the VT Dept. of Labor, NVDA was able to conduct a strategic analysis of the key industries in the Northeast Kingdom. Key industries are those with a high number of establishments and significant levels of employment. This study was needed to help us better understand what our growth sectors were, as well as identify strategies for focusing our limited resources. From the 2011 *NVDA - Strategic Industries of the Northeast Kingdom* analysis (conducted by Economic & Policy Resources, Inc.), the following sectors were identified as "the leading industries for the region to focus on for future growth and job creation":

Agribusiness, food processing & technology cluster. One of the "stars" of the Northeast Kingdom, this cluster is made up of twelve production, processing and distribution segments. With a 2009 critical mass of 75 establishments, employing 654 workers with average wages of \$33,270; this cluster has exhibited strong growth over the business cycle period of 2001-2009.

Biomedical/biotechnical (life sciences) cluster. One of the emerging “opportunity” clusters in the NEK region, this cluster is made up of biomedical-oriented manufacturing sectors, equipment and supplies wholesalers, health and personal care stores, and ambulatory health care services. Overall, this cluster experienced modest employment growth with some erosion of export orientation during the last recession.

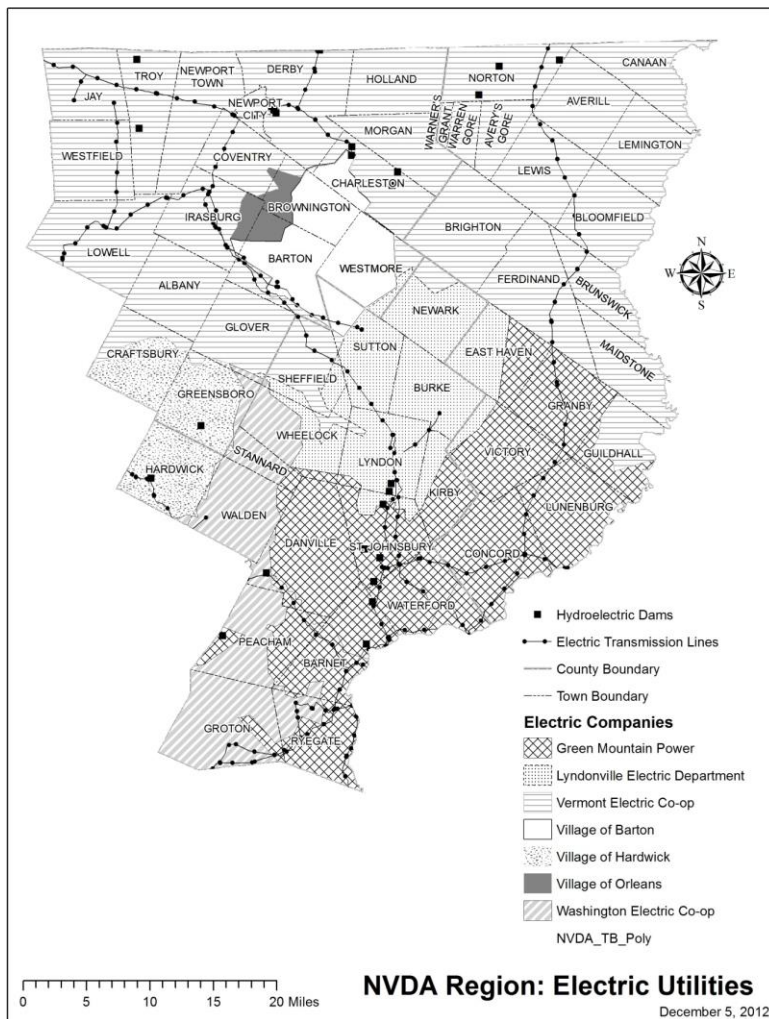
Fabricated metals and machinery manufacturing cluster. A “mature” cluster, fabricated metals and machinery manufacturing is diversified. The combined industry is in the midst of a recovery after the debilitating great recession. Several fabricated metals segments were hollowed out by the recession. Given the significant orientation toward national and international markets, many firms within this cluster are once again showing signs of life and beginning to hire-back laid off workers and expanding production.

Forest and wood products cluster. Overall, a cluster composed of several “mature” sectors including wood products manufacturing, paper manufacturing, and furniture products manufacturing. Though showing a significant decline from 2001-2009 (employment base of 2,500 workers in 2001 to 1,450 workers in 2009), the churning has spawned a number of developments in niche markets. As in the agribusiness and food processing cluster, forest and wood products is part of the traditional economic base of the Northeast Kingdom and as such have many opportunities for convergence and intersection with other economic activities, including visitor and tourism.

Visitor and tourism cluster. Another “star” cluster for the Northeast Kingdom with solid growth during the study period of 2001-2009. Significant investments being made right now in Jay, Burke, Newport, and Craftsbury will help make the region a year-round travel destination and bring money into local economies.

Electricity Supply, Demand, and Transmission

REGIONAL UTILITIES - The Northeast Kingdom is served by eight electric utilities. The map below depicts the coverage areas of the region's utilities and the major transmission lines. Vermont Electric Co-op serves the largest area, covering over 19 towns in Northern Essex and Orleans Counties. Green Mountain Power also covers a large area in Caledonia and Southern Essex Counties, with the remainder of the region served by Washington Electric, and four municipally-owned electric companies. The region's municipal electric utilities include Barton Electric, Orleans Electric, Lyndonville Electric, and Hardwick Electric. Together the municipal utilities provide service to over 19 different towns and villages.



Lyndonville Electric, Hardwick Electric, and Barton Electric's power supply portfolios are made up of a mixture of generation resources, long-term contracts, and short-term contracts. Orleans Electric's portfolio also includes long-term and short-term contracts; however it is without generation resources of its own.

According to the 2011 Resource Reports provided by VPPSA (VT Public Power Supply Authority), the municipal utilities receive generated power from hydro, wood, fuel-oil, natural gas, and nuclear facilities located throughout New England. Table 2.7 below outlines the actual power loads of the municipal utilities from 2006 through 2010 and their forecasted loads for 2011 through 2015.

Utility	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015
Orleans Electric	14,327	14,194	14,147	12,185	13,768	12,926	13,247	14,328	14,693	14,662
Barton Electric	17,197	17,353	17,371	17,370	17,080	17,194	17,253	17,173	17,167	17,168
Lyndonville Electric	78,246	79,050	78,017	75,957	76,462	75,520	75,890	77,342	77,817	77,776
Hardwick Electric	37,637	38,130	37,897	33,113	34,706	34,896	34,896	34,896	34,896	34,896
Total	147,407	148,727	147,432	138,625	142,016	140,536	141,285	143,739	144,573	144,501
Source: VPPSA 2011 Resource Reports										

According to the chart above all of the region's municipal utilities except Barton Electric, with its large residential base, saw a significant drop in load obligations that corresponds with the economic recession. These same utilities have forecasted that they will just begin to return to pre-recession load obligations between 2013 and 2015. This is not surprising since much of the consumption lost were from commercial/industrial operations that are hard to replace.

DEMAND - According to the *2005 Vermont Electric Plan*, energy consumption will increase in coordination with economic growth and population growth. According to the 2000 and 2010 Census, the region has grown by roughly 3.7% in the last decade, down from a 4.2% population growth between 1990 and 2000. If the region continues this slower than average growth rate, as it is expected, the Kingdom will see 0.3 – 0.4% population increase each year for the next decade.

The projected future growth in energy demand for the Northeast Kingdom is between 0.5 – 0.7% a year for the next eight years. This is very similar to the compound annual growth rate of between 0.4 - 0.7% (forecast to 2030) predicted for the Vermont as a whole by the Department of Public Service.

Using a conservative projection (0.5% per year), the Northeast Kingdom's electricity consumption will reach approximately 462,886 MWH by 2020, which is still below the regional consumption peak of 466,353 in 2006 (Table 2.10). This is certainly a possibility, since 2006 peak demand was reached prior to the implementation of extensive conservation and efficiency programs. The more realistic projection is 0.7% per year in electric consumption growth, as it reflects the 2015 rebound amount of 457,812 MWH, nearly matching the pre-recession consumption figures of 2007 that account for conservation and

efficiency measures. Following the more realistic figure, the NVDA Energy Committee projected that the Northeast Kingdom will consume an additional 40,000 MWh of power by 2020.

With respect to simply how much electricity is generated here relative to what is consumed, the Northeast Kingdom became a net exporter of electricity once the Kingdom Community Wind Project began generating electricity. This is a major shift from a few years ago, when the region relied heavily on Canada, New Hampshire and the rest of Vermont to meet its electricity demand. In 2004, the total electric usage for the region was 433,019 MWhs (Table 2.10). Between 2004 and 2005 the region saw a significant increase in consumption (5.34%), even 2006 saw another 1.93% in growth, but by 2008 consumption had returned closer to 2004 levels. Again, this reduction in electric consumption is associated with the onset of the Great Recession, rising fuel costs, and improved efficiency measures. If consumption figures (2009-2011) were available at the county level it is expected they would follow the trend reflected in the municipal utilities' load obligation data, essentially showing a continued decline in 2009-2010 with a recovery to pre-recession consumption levels by 2015. With the recent addition of significant generation assets, including the Kingdom Community Wind Farm, the Northeast Kingdom will produce approximately 580,000 MWhs of electricity, which is approximately 150,000 MWhs more than it consumes.

County	2004	2005	2006	2007	2008
Caledonia	213,437	223,313	216,580	219,845	211,269
Essex	41,312	53,333	60,552	51,447	41,173
Orleans	178,270	180,802	189,221	187,054	183,553
Total	433,019	457,448	466,353	458,346	435,995
(VT Dept. of Public Service & Renewable Energy Atlas of Vermont)					

SUPPLY - The Northeast Kingdom has a very large share of generation resources when compared to other regions of the state. While slightly out of date, Table 2.8 provides a list of the region's generation sources. The year 2005 saw the first major jump in regional generation growth with the development of the Coventry Landfill methane generator, which provided 25,000 MWhs. In 2009, regional generation made another major jump when Coventry Landfill's generation output was doubled. Altogether, the Northeast Kingdom's 2009 electric generation capacity grew to 284,614 MWhs.

While not reflected in the chart below, the region saw more generation growth in 2010 with the addition of the First Wind facility. The First Wind facility, located in Sheffield, Vermont came online in September 2010 and contributed another 25,948 MWhs to regional generation. The wind-farm was only operating for a portion of 2010, but was expected to contribute a total 112,000 MWhs annually. Another utility-scale wind farm in the region, Kingdom Community Wind in Lowell, VT came on line in November 2012. The Kingdom Community Wind Project was projected to contribute another 185,570 MWhs annually. If producing at expected capacity*, both wind farms will bring the region's electric generation capacity to approximately 580,000 MWhs. * Expected production capacity figures are provided

by the Public Service Department and include discounts from actual total production capacity based on the frequency of wind generation (i.e. intermittency).

Table 2.8 Generation Facilities in Caledonia, Essex, and Orleans Counties				
Owner/Operator - Facility Name	Facility Type	2005 MWH Produced	2009 MWH Produced*	Location
Great Bay Hydro Corp. (IPP) - Newport Units 1,2,3	Hydro	15,678.22	undisclosed	Newport
Great Bay Hydro Corp. (IPP) - Newport 4-10	Diesel	0	-	Newport
Great Bay Hydro Corp. (IPP) - West Charleston	Hydro	undisclosed	2,070.00	Charleston
CVPS - Emerson Falls	Hydro	undisclosed	700.00	St. Johnsbury
CVPS - Arnold Falls	Hydro	1,510.70	1,965.00	St. Johnsbury
CVPS - Gage	Hydro	2,968.00	3,582.00	St. Johnsbury
CVPS - Passumpsic	Hydro	2,158.70	2,060.00	Barnet
CVPS - East Barnet	Hydro	9,855.70	7,320.00	Barnet
Barnet (IPP)	Hydro	1,767.38	1,814.00	Barnet
Village of Barton - Diesels	Diesel	3.83	4.00	Barton
Village of Barton	Hydro	3,678.92	5,101.00	Barton
Great Bay Hydro Corp. (IPP) - North Troy	Hydro	0	-	Troy
Chaput Family Farms	Methane	0	2,490.00	Troy
Maplehurst Farm	Methane	0	723.00	Greensboro
Norton Hydro	Hydro	0	-	Norton
Lyndonville Electric - Vail & Great Falls	Hydro	4,455.91	6,205.00	Lyndonville
CVPS - Pierce Mills	Hydro	1,411.40	1,464.00	St. Johnsbury
Amperand Gilman Hydro (IPP)	Hydro	undisclosed	undisclosed	Lunenburg
GMP - Joe's Pond	Hydro	11,122.50	2,759.00	Danville
Dodge Falls (IPP)	Hydro	23,500.00	21,734.00	Ryegate
Ryegate Power Station (IPP)	Wood Chip	167,627.41	172,367.00	Ryegate
Maxwell's Neighborhood Energy, LLC (IPP)	Methane	0	1,750.00	Coventry
WEC - Coventry Landfill	Methane	25,000.00	50,506.00	Coventry
Total		224,509.00	284,614.00	
*figures are a mixture of actual & projected		(Source: VT Dept. of Public Service & IPPs)		

There are also three very large generation assets located on the border of the region that are not included in the Table above. The Comerford Dam, McIndoe Falls Dam, and the Moore Dam are all located on the Connecticut River, which is owned by New Hampshire. According to the Department of Public Service, they are not considered Vermont generation assets, but their mere proximity to the region may provide future benefit to our region. Also not included are large (@ 2.0 MW) solar projects in Coventry and Barton, although they have received their CPGs.

Other wind projects that have been proposed for Vermont are outlined in Table 2.13, some of which are within the Northeast Kingdom.

Table 2.13 Proposed Commercial Wind Projects in Vermont			
Project Name	Size (MW)	Location	Status
Deerfield Wind	30 (15 towers)	Reedsboro (Searsburg Expansion)	Certificate of Public Good Permitted (Lawsuit pending)
Georgia Mountain	7.5-12 (3-5 towers)	Milton	Certificate of Public Good Permitted (operational Nov. 2012)
Grandpa's Knob	50 (20 towers)	W. Rutland, Castleton, Hubbardton, Pittsford	Permit Application expected in 2012
Seneca Mountain Wind	91.5* (12-25 towers)	Ferdinand, Newark, Brighton	Planning stage (measurement towers application submitted Apr. 2012)
Grandview Farm	2-2.3 (1 tower)	Derby	Certificate of Public Good Permit Application submitted Dec. 2011
Smugglers Hill Farm	2-2.3 (1 tower)	Holland	Certificate of Public Good Permit Application submitted Dec. 2011
*based on NEEPOOL Interconnection application		(Source: VT. Department of Public Service, www.aweo.org)	

Note: Table 2.13 is from the Energy Section of the NVDA Regional Plan. The Deerfield, Georgia Mountain, and Grandpa's Knob projects are not in the Northeast Kingdom. The Seneca Mountain Wind project proposed for Ferdinand, VT has been withdrawn. The Grandview and Smugglers Hill Farm projects have been tabled or withdrawn.

TRANSMISSION - A majority of Vermont's electric transmission system is operated by the Vermont Electric Power Company (VELCO). VELCO is responsible for bulk transmission lines with a voltage rating of 115kV and above. Lines with a rating of 34.5kV, 44kV, and 69kV are considered sub-transmission lines. The Northeast Kingdom has roughly 325 miles of transmission and sub-transmission lines (Map 4) and serves as an important gateway for electricity coming from both Canada and New Hampshire.

At this time, Vermont is considered a constrained zone due to transmission grid congestion. Constrained states have a limited transmission network and transport electricity over long distances, creating congestion on the lines and restricting the ability to receive additional electricity from outside the state during increasing demand. The majority of the constraint was caused by the considerable growth in the Northwest region of the state. The increasing demand congested the Northeast Kingdom's transmission network – limiting the capacity to receive additional electricity from out of state when needed. Constraint issues usually result in increased electricity costs. Because of transmission line congestion in-state facilities must be brought online (started up) in order to meet the new demand, even though less expensive generation facilities might be available out of state.

Northern Vermont constraint issues were further identified in VELCO's Long Range Plan. The transmission utility's Northern Loop Project alleviated much of the congestion of the Northern transmission grid. In our region, the project installed new lines between Irasburg and Newport; upgraded the St. Johnsbury substation; upgraded the Irasburg substation; and reconfigured the Hydro Quebec interconnection at Highgate – resulting in a significant amount of new transmission capacity on existing lines. An upgrade of the Hill Street substation in Lyndonville provided a secondary connection between Lyndonville Electric's grid and the larger VELCO transmission lines. The project was expected to ensure adequate future demand is met and improve overall reliability in Caledonia and Essex Counties. Other similar upgrades are being made throughout the region.

While the Northern Loop Project increased the reliability issues in Northern Vermont, the VELCO Long-range plan indicates (by map and text) that generation in much of the Northeast Kingdom “reached transmission capacity as of 2012” and that the transmission system in other areas of Vermont would benefit from new generation resources in those areas – northwest and central Vermont, primarily.

Study Methodology

The Study Committee opted to seek information that directly responded to the NVDA Board of Directors Resolution of July 2012 and conduct a “thorough evaluation of the impact of wind towers on the Northeast Kingdom” that would include the following:

- The cost versus the benefit of industrial size wind turbines in the Northeast Kingdom?
- What does objective data and science show concerning measurable health impacts? What does national and international research show?
- Are transmission requirements being adequately addressed with these projects?
- Do statutes, regulations and the review process provide ample environmental protections for the development of higher elevation ridge-lines?
- What is the impact of industrial wind turbines on property values and tourism in the Northeast Kingdom?
- What impact do industrial wind turbines have on greenhouse gas emissions in the Northeast Kingdom?

The Study Committee developed a format of inviting guest speakers with experience and/or expertise in specified topical areas. The selected guest speakers were chosen based on their perceived knowledge of the subject area the committee was interested in. As the study evolved and additional information was desired, other guest speakers were invited to participate. In fact, many of the invited speakers participated in the Governor’s Siting Commission effort. Guest speakers appearing before the study committee were:

- April 3, 2013: David Hallquist, VT Electric Cooperative (speaking on generation, transmission, and distribution)
- April 24, 2013: Billy Coster, ANR (speaking on ANR’s role and responsibilities in the PSB process)
- May 8, 2013: Ann Margolis and Aaron Kisicki, PSD (speaking on PSD’s roles and responsibilities in PSB process)
- May 29, 2013: John Soinenen and Travis Bullare, Eolian Renewable Energy (speaking on climate change, wind industry, and role as a renewable energy developer)
- August 14, 2013: Kerrick Johnson, VT Electric Transmission Company (VELCO), (speaking on VT’s Electric Transmission Company and its role and responsibilities, transmission system in northern VT, interconnecting wind resources, etc.)

- September 4, 2013: Kevin Jones, VT Law School (speaking on VT's renewable energy policy and its impacts on Vermont)
- September 4, 2013: Steve Therrien, adjoining property owner complaining of health impacts and impacts to property value based on inability to resell.
- September 26, 2013: Robert Dostis, Green Mountain Power (speaking on the Kingdom Community Wind Project in Lowell)
- September 26, 2013: Jason Shafter, Professor of Atmospheric Sciences at LSC (speaking on climatology, wind resources, and local data)
- November 6, 2013: Dr. David Grass, VT Dept. of Health (speaking on health impacts and studies related to industrial-scale wind)
- January 6, 2014: Gloria Bruce, Northeast Kingdom Travel and Tourism Association (teleconference speaking on impacts to businesses in the travel and tourism industry)
- January 29, 2014: Dr. Ben Luce, Lyndon State College (speaking on renewable energy options for VT and the NEK region)

Study Committee meetings notices were posted on the NVDA website, along with meeting minutes and materials presented to the committee. www.nvda.net. Local newspaper reporter(s) were invited to each of the committee meetings, as well. Over the months between March – June 2014, the study committee held 5-6 working meetings to assess information had been covered over preceding months and discuss information and recommendations that would be included in the committee's report.

○ **General assertions regarding industrial wind development in Vermont and the Northeast Kingdom:**

1. The State of Vermont, through its adopted Comprehensive Energy Plan, has set progressive and ambitious renewable energy generation goals to achieve by the year 2050. 20% by 2017 up to 90% by 2050.
 - 1.1 Renewable energy generation goals can be achieved through the development of small and large scale wind, solar, hydro-electric, and biomass resources.
 - 1.2 Renewable energy generation goals can be achieved by the use of both in-state and out-of-state renewable resources.
2. The development of industrial-scale wind generation facilities is contributing to meeting the State's renewable energy generation goals. There are two projects operating in the NEK region – Sheffield and Lowell. Other projects have been proposed, but not developed – East Haven, Seneca Mountain (Ferdinand), and Derby.

- 2.1 The facilities in Sheffield and Lowell were projected to generate approximately 112,000MWh and 185,570MWh of electricity annually, respectively (from the NVDA 2013 Regional Plan).
- 2.2 The facilities in Sheffield and Lowell have not generated the amount of electricity that each project presented during the PSB's CPG process. This is due in part to curtailment issues, but it may include available wind resources in the region.
- 2.3 Wind is an intermittent generation resource and can only generate electricity when the wind is blowing. A spinning reserve of base load power is required for intermittent generation resources.
3. The siting and development of industrial-scale wind facilities in the NEK region has not been without controversy, whether in towns where projects have been constructed or in towns where proposed projects have been tabled or withdrawn from consideration.
 - 3.1 The UPC/First Wind project was originally proposed for the Towns of Sutton and Sheffield. The vote in the Town of Sheffield in support of the project was 120 to 93. The Town of Sutton's opposition to the development was reflected in its Town Plan. A public vote in Sutton was 120 opposed and 23 in favor of the project. The PSB decision required the developer to remove turbines in the Town of Sutton.
 - 3.2 The proposed Seneca Mountain Wind project was originally proposed for the Towns of Newark, Brighton, and Ferdinand. After public votes against the project in Brighton (544-320) and Newark (169-59), along with amendments to each Town Plan, the project was scaled back for only the Town of Ferdinand. A subsequent public vote by landowners in Ferdinand, part of the UTG, against the project (171-107) has halted the project to date.
 - 3.3 Single turbine projects in the Towns of Holland (Smugglers Hill Farm) and Derby (Grandview Farm) were withdrawn / tabled in part due to local public opposition.
 - 3.4 The Kingdom Community Wind project in the Town of Lowell was supported by a public vote of 342 to 114.
 - 3.5 The Governor's Energy Siting Commission was appointed to examine energy siting in VT and the Public Service Board's decision making process. This was in part due to concerns about a lack of community and public input into the energy siting process. The Siting Commission completed its work in April 2013. Legislation proposed in the subsequent legislative session that would have implemented some of the Siting Commission recommendations did not/has not passed.
4. Industrial-scale wind turbines have created local, regional, and state land use planning issues.
 - 4.1 Northeast Kingdom towns with expired land use plans or towns that never had adopted land use plans have developed plans opposing or limiting industrial-scale wind development because of associated issues or location of suitable wind resources (Charleston, Holland, Morgan, and Barton - drafting).
 - 4.2 Northeast Kingdom towns with adopted plans in effect amended their land use plans to in ways that would oppose or limit opportunities for industrial-scale wind turbines (Brighton, Newark, Sutton, Westmore, Newport Town, and the UTG - drafting).

- 4.3 Except for the Lowell town plan, no Northeast Kingdom towns have language within their plans with clear encouragement or support for the development of industrial-scale wind facilities. Sheffield's plan acknowledges the favorable vote for the project in their community, but is otherwise silent. Support for smaller-scale wind turbines (and other forms of renewable energy) is common in many local plans, however.
- 4.4 The NVDA Board of Directors passed its resolution recommending a 3-year suspension of industrial-scale wind turbines for further study.
- 4.5 The Governor's Energy Siting Commission was appointed to examine energy siting in VT and the PSB's decision making process. This was in part due to concerns about a lack of community and public input into the energy siting process.

○ **What does objective data and science show concerning measurable health impacts? What does national and international research show?**

Testimony / Evidence Presented:

The committee heard from Dr. David Grass from the VT Dept. of Health on this topic. Dr. Grass spoke to the committee on November 6, 2013. He provided health reviewed literature and testing reports to the committee following his presentation.

The committee also heard from Steve Therrien, an adjoining property owner to the First Wind site in Sheffield. Mr. Therrien, who has publicly discussed his and his family's personal health issues, spoke to the committee on September 4, 2013.

The committee received a literature review of health effects and wind turbines document from Robert Dostis of Green Mountain Power. Mr. Dostis spoke to the committee on September 26, 2013.

John Soininen's presentation to the committee on May 29, 2013 also spoke to wind and health impacts.

Minutes from the meetings with each of these individuals are included at the end of this document, as are any materials presented to the committee. They can also be found at the bottom of the NVDA homepage www.nvda.net.

Health Impact propositions developed by the Study Committee based upon the testimony and evidence presented:

1. Turbine neighbors report negative health impacts that they attribute to turbine operations.

2. The health impacts that Vermonters report are similar to those reported by turbine neighbors in other states and countries.
3. It is the position of Vermont's Department of Health (DoH) that:
 - 3.1. If installed and operated within noise level guidelines, wind turbines would not be expected to directly impact human health. Despite this, I suspect that there may be effects on health related to anxiety, disturbed sleep and stress. These effects are real to the individuals but not specifically related to wind turbines but rather more generally to annoyance from an unpleasant situation.¹
 - 3.2. No evidence has been found of a direct link between turbine noise and ill health.²
 - 3.3. There is a direct link from turbine noise to sleep disturbance.³
 - 3.4. Turbine noise can annoy some people.⁴
 - 3.5. Sleep disturbance and annoyance are known to cause ill health.⁵
 - 3.6. If turbines operate within the Department of Health's noise guidelines, then their noise will not disturb sleep.⁶
 - 3.7. Turbines produce infrasound at such low levels that it cannot affect health.⁷
 - 3.8. It is important to evaluate every home where there are complaints of wind turbine effects.⁸
4. DoH acknowledges that:
 - 4.1. The studies that it has used to develop its position are flawed and insufficient in number.⁹
 - 4.2. There are turbine effects (including flicker) that have not been investigated.¹⁰
 - 4.3. Turbine noise is qualitatively different from other common noise (like traffic or wind).¹¹
 - 4.4. No DoH employee has evaluated a home where there have been complaints of turbine-related health effects.¹²
5. The NVDA Wind Study Committee takes the following positions:
 - 5.1. We are concerned that our neighbors have health complaints that they attribute to turbine operations.
 - 5.2. The relationship between turbine operation and health is not well understood.
 - 5.3. There may well be a direct link from turbines to ill health that has yet to be discovered.

¹ Harry Chen (Commissioner, Vermont Department of Health), 25 March 2014, email to Mark Whitworth,.

² William Bress, William Irwin, and Austin Sumner, *Potential Impact on the Public's Health from Sound Associated with Wind Turbine Facilities*, Vermont Department of Health, 15 October, 2010, http://healthvermont.gov/pubs/ph_assessments/wind_turbine_sound_10152010.pdf (accessed 1 December 2013), 2.

³ Bress, *Potential Impact*, 5.

⁴ William Irwin (Vermont Department of Health), Legislative Hearing, Vermont State House, 16 April 2013, Testimony before the Vermont House Committee on Natural Resources and Energy.

⁵ Bress, *Potential Impact*, 2 & 4.

⁶ David Grass (Vermont Department of Health), Telephone conversation with Mark Whitworth, 26 March 2014.

⁷ David Grass (Vermont Department of Health), NVDA Wind Study Committee Meeting, Barton Town Offices, 7 November 2013, Question and Answer Session.

⁸ Irwin, House Committee Testimony.

⁹ Grass, NVDA Wind Meeting.

¹⁰ Grass, NVDA Wind Meeting.

¹¹ Grass, NVDA Wind Meeting.

¹² Grass, NVDA Wind Meeting.

- 5.4. If turbine noise will disturb sleep only if it exceeds noise guidelines, then assuring the health of neighbors may require continuous noise monitoring and rigorous enforcement of noise standards.
- 5.5. DoH should actively investigate the health claims made by turbine neighbors in Vermont.
- 5.6. There is not enough known about:
 - the potential health impacts (direct or indirect) of turbines,
 - the distances over which those impacts might be felt, or
 - the effectiveness of possible mitigation measuresto allow the NVDA to recommend further turbine development in the Northeast Kingdom.

○ **Are transmission requirements being adequately addressed with these projects?**

Testimony / Evidence Presented:

The committee heard from David Hallquist, CEO of Vermont Electric Cooperative, on this topic. Mr. Hallquist spoke to the committee on April 3, 2013.

The committee also heard from Kerrick Johnson, CEO of VELCO (VT's transmission utility). Mr. Johnson spoke to the committee on August 14, 2013. He also provided the group with information on system reliability and inter-connecting wind generation.

The committee also heard from project developers John Soininen of Eolian Renewable Energy on May 29, 2013, and from Robert Dostis of Green Mountain Power on September 26, 2013. Neither speaker addressed transmission to any significant degree. Mr. Dostis acknowledged that GMP had to build transmission to move the power onto the grid. While Mr. Soininen's presentation touched on many of the issues surrounding wind development.

Minutes from the meetings with each of these individuals are included at the end of this document, as are any materials presented to the committee. They can also be found at the bottom of the NVDA homepage www.nvda.net.

Transmission Impact propositions developed by the Study Committee based upon the testimony and evidence presented:

1. A majority of Vermont's electric transmission system is operated by the Vermont Electric Power Company (VELCO). VELCO is responsible for bulk transmission lines with a voltage rating of 115kV and above. The Northeast Kingdom serves as an important gateway for electricity coming from both Canada and New Hampshire.ⁱ
 - 1.1 Within the 2012 VELCO Long Range Transmission Plan, most of the NEK region is identified as a constrained zone due to transmission grid congestion. Constrained states have a limited transmission network and transport electricity over long distances, creating congestion on the

lines and restricting the ability to receive additional electricity from outside the state during increasing demand.

- 1.2 The increasing demand has congested the Northeast Kingdom's transmission network – limiting the capacity to receive additional electricity from out of state when needed. Constraint issues usually result in increased electricity costs.
2. VT Electric Cooperative has recommended a moratorium on implementing renewable mandates until the problems in the existing transmission system have been figured out. Grid integration issues exist. ⁱⁱ
 - 2.1 The Grid was designed for “spinning generation”. Most generation technologies provide “ride-through” (akin to inertia), but solar and wind provide no ride-through. In our section of the Grid, we're at about 20% renewables and we're experiencing problems. There is a growing realization that we don't know everything we need to know about grid-integration of renewable generation resources.
3. VELCO is statewide transmission-only company. Owned by distribution utilities, VELCO connects smaller systems and brings power to VT. ⁱⁱⁱ
 - 3.1 Energy Switching is occurring with movement toward renewable generation resources.
 - 3.2 Forecasted load growth for VT of <1% going forward and trend is decreasing.
 - 3.3 Costs to connect to grid are increasing, while costs to exit grid are decreasing.
 - 3.4 Transmission costs are increasing. VELCO is taking projects off the table as they assess whether they really need to build all that they wanted to build.
 - 3.5 Transmission and generation are being used for economic development. This differs from reliability projects.
4. Utilities pay for reliability projects. Developers would pay transmission costs for non-reliability projects. ^{iv}
 - 4.1 No reliability projects are proposed for NEK region of VT.
 - 4.2 VELCO Long-range Transmission Plan map indicates where new generation should be sited. Adding new generation strains transmission in some areas, including most of the NEK region. Adding/upgrading transmission adds to project costs.
 - 4.3 *Interconnecting Wind Generation in Northern Vermont* document provided by K. Johnson (p.5): Northern VT system still reliable, but with 140+ MW of new generation in last five years, power is now exported to other parts of VT and New England. To preserve reliability, generators in VT have been curtailed.
 - 4.4 *Interconnecting Wind Generation in Northern Vermont* document regarding Potential Impact of Additional Generation in Northern Vermont (p.6): If export capacity does not increase and more generation is added, additional curtailment of all generation in northern VT is likely. Potential exists for significant adverse financial impact for existing and new generators in northern VT. Recommended that long term solution is to site generation in more advantageous locations in VT.
5. *A System Reliability: Renewable Generation as a Non-Transmission Solution* document provided to the committee by K. Johnson, VELCO indicates that VELCO has a responsibility to provide early information to allow sufficient time to plan and implement more cost-effective, non-transmission alternatives to meet reliability needs wherever feasible.
 - 5.1 *2012 VELCO Long Range Transmission Plan* map indicates that generation in the northern VT region has reached transmission capacity as of 2012.

6. The “New England Wind Integration Study”, published in December 2010, analyzed wind penetrations at 2.5%, 9%, 14%, 20% and 24%. The study found that New England’s regional electric generation system, which is dominated by natural gas-fired generators, is very flexible and compatible with wind generation.^v
 - 6.1 The New England Wind Integration Study looked at New England as a large region and this study does not account for local or sub-regional transmission issues or constraints.^{vi}
7. Costs of solar and ridgeline wind are now roughly in the same ballpark, assuming transmission costs for wind are minimal. If transmission costs for a large build-out of wind are included, it is difficult to see how wind could be competitive with solar.^{vii}
8. The NVDA Wind Study Committee takes the following positions:
 - 8.1 We acknowledge that VELCO, through its long-range plan and presentation, has identified most of the NEK region as a constrained zone due to transmission grid congestion. This limits the system’s ability to accept additional generation resources.
 - 8.2 We acknowledge the VT Electric Cooperative’s recommendation for a moratorium on implementing renewable mandates because of transmission constraints and grid integration issues associated with renewable generation resources.
 - 8.3 Accepting VELCO’s assertions that new generation added over the last five years now makes our region an exporter of power to other regions of VT and New England; our regional constraint issues; and, that the forecasted annual load growth for VT is less than 1% (and decreasing) going forward, there seems to be little need for new large-scale generation facilities in the NEK region.
 - 8.4 Improving transmission reliability within the existing system is preferable to adding new generation and transmission facilities that may exacerbate curtailment issues or destabilize the existing transmission grid.

- I. NVDA Regional Plan adopted March 28, 2013.
- II. David Hallquist, VEC, April 3, 2013 presentation to Committee.
- III. Kerrick Johnson, VELCO, August 14, 2013 presentation to Committee.
- IV. K. Johnson, VELCO, August 14, 2013.
- V. John Soininen, Eolian, May 29, 2013 presentation to Committee.
- VI. D. Snedeker, NVDA.
- VII. Dr. Ben Luce, LSC, January 29, 2014.

- **Do statutes, regulations and the review process provide ample environmental protections for the development of higher elevation ridgelines?**

Testimony / Evidence Presented:

The committee heard from Billy Coster of the VT Agency of Natural Resources on April 24, 2013. Mr. Coster spoke at length with the committee on ANR’s role in the Section 248 process and the agency’s experience to date with industrial wind projects.

John Soininen's (Eolian Renewable Energy) presentation to the committee on May 29, 2013 also spoke on impacts to wildlife, natural communities, and water quality.

The committee heard from Robert Dostis of Green Mountain Power on September 26, 2013. His *KCW Fact Sheet* provided information on wildlife and water quality impacts.

On January 29, 2014, the committee heard from Dr. Ben Luce, of Lyndon State College. Dr. Luce's presentation touched upon wind development impacts to the natural environment

Importantly, the study committee also believed that some of this work fell within the scope of the Governor's Energy Generation Siting Policy Commission. Governor Shumlin created the "Siting Commission" through Executive Order No. 10-12. The charge of the Commission was to survey best practices for siting approval of electric generation projects (all facilities except for net- and group-net-metered facilities) and for public participation and representation in the siting process, and to report to the Governor and the Legislature on their findings by April 30, 2013. The Commission was also to look at alternative dispute resolution processes for project siting, permit coordination opportunities, how cumulative project impact is considered, and whether generic siting guidelines should be developed.

The Governor's Siting Commission's recommendations fell within five broad themes (in no particular order):

1. Increase emphasis on planning at state, regional, and municipal levels, such that siting decisions will be consistent with Regional Planning Commission (RPC) plans.
2. Adopt a simplified tiered approach to siting to achieve a quicker, more efficient review of a greater number of small or less-controversial projects while focusing the bulk of PSB time and effort on the evaluation of larger or more complex projects.
3. Increase the opportunities for public participation.
4. Implement procedural changes to increase transparency, efficiency, and predictability in the siting process.
5. Update environmental, health, and other protection guidelines (on a technology basis, where necessary).

The Siting Commissions' full report can be found at:

http://sitingcommission.vermont.gov/sites/cep/files/Siting_Commission/Publications/FinalReport/Final%20Report%20-%20Energy%20Generation%20Siting%20Policy%20Commission%2004-30-13.pdf

Wildlife and Water Resource Impact propositions developed by the Study Committee based upon the evidence presented:

1. Billy Coster, Vt Agency of Natural Resources (ANR), reports that the agency developed draft guidelines for review of energy generation projects in 2006 and new guidelines will be developed.¹³
 - 1.1. ANR has been a strong advocate for the protection of wildlife, natural communities, and water quality, from the impacts of high elevation industrial wind energy development. The Public Service Board does not always agree with the agency's positions.

¹³ Billy Coster, Vermont Agency of Natural Resources, NVDA Wind Study Committee Meeting April 24, 2013.

- 1.2. The bar of “undue adverse impact” can be difficult to demonstrate. If ANR believes a project poses an undue adverse impact to the natural environment that cannot be mitigated, it will recommend the PSB find against the petition on those grounds.¹⁴
2. ANR natural resource requirements for a CPG and recommendations in the PSB decisions and mitigation measures include pre and post studies. ANR personnel work closely with developers’ consultants to set up studies, develop methodologies, etc.¹⁵ Example studies in the Kingdom Community Wind Project and First Wind Project include,
- Potential impacts of First Wind Project on wildlife resources, including impacts to migrating birds, as well as small and large mammals (except bats) and their respective habitats (2006)
 - Evaluating Bird and Bat Post – Construction Impacts at the Sheffield Wind Facility, Vermont, Bat Conservation International and First Wind (2013)
 - Bird and Bat Pre-Construction Surveys for Kingdom Community Wind Project in Lowell, VT – Stantec Consulting, Inc. for Green Mountain Power (2010)
 - Potential impacts of KCW project on significant natural communities and the large, relatively unfragmented habitat on the Lowell Mts. (2010)
 - Impacts of Sheffield project related to stormwater and other environmental criterion (2006)
 - Impacts of Sheffield project to wetlands (2006)
 - ANR Aquatic Biological Sampling Results for Sheffield (2006 – 2012)
3. Billy Coster of ANR states that some agency personnel were surprised at the unexpected landscape change from the wind projects regarding the amount of earth and site work, specifically at Lowell. The amount of blasting and clearing for the Lowell wind project was significantly more than the Sheffield project.¹⁶ There are dust control and blasting plans for both projects.
4. ANR Stormwater Construction and Operational Permits
- 4.1. Post-construction stormwater permit issued for a wind project requires an Annual Inspection be completed by the permittee, which covers inspection and maintenance of the Best Management Practices on site (stormwater pond, level spreaders, vegetative buffer, etc) as needed and identify any issues. Every three years the permittee is also required to provide a Designer’s Restatement of Compliance, which is a higher level review of the system by a qualified designer. First Wind is required to undergo a Designer’s Restatement of Compliance summer of 2014.¹⁷
- 4.2. GMP/Kingdom Community Wind stormwater permit is an individual permit (vs. general permit as Sheffield) because they implemented an *alternative stormwater treatment practice design*, utilizing some conventional Best Management Practices such as stormwater ponds. They installed a site specific design, utilizing a number of level spreaders combined with established vegetated areas for stormwater dispersal. The alternative design requires that they implement a stormwater monitoring plan of the alternative system, which will go into effect in 2014. They are also subject to additional water quality/biomonitoring of the streams as required by their 401 Water Quality Certification. GMP is also subject to the recertification and annual inspection requirements, but not likely for a couple years.¹⁸

¹⁴ Overview of Section 248 Process, pdf.

¹⁵ Billy Coster, April 24, 2013.

¹⁶ Coster, April 24, 2013.

¹⁷ Email with Kevin Burke, Vermont Agency of Natural Resources, Watershed Management Division

¹⁸ *ibid*

- 4.3. GMP/KCW project had a violation during construction October 2011- a stormwater discharge due to failure to control sediment after a major rain event. Though the First Wind/Sheffield project did not violate the stormwater permit, private professionals found evidence of stormwater discharge during construction. Individuals appealed the stormwater permits issued to both projects and in both cases, the permits were upheld (Sheffield in the Environmental Court and Lowell in the Vermont Supreme Court).
5. ANR Water Quality Permit
 - 5.1. First Wind Project = ANR Bio-monitoring and Aquatic Studies Program. Results in 2011 and 2012 tests show that the project has not had an adverse impact to water quality and aquatic life of near-by cold-water streams.¹⁹
 - 5.2. KCW = As required by Section 401 Water Quality Certification, fish population monitoring was conducted by Bear Creek Environmental, Inc.²⁰
6. Bird and Bat Fatality Monitoring.
 - 6.1. A special Endangered and Threatened Species Takings Permit was issued by Vermont Secretary of ANR to each wind project for incidental take of listed bat species (no more than four bats per annum.)²¹ The permits were issued because the both First Wind and GMP demonstrated “an economic hardship” if they were required to curtail turbine operation during specific times when bats were present (one half hour before sunset and sunrise, wind speed below 6.0 m/s, and temperatures above 49 degrees Fahrenheit.) Economic hardship is one of six reasons for granting a takings permit.
 - 6.2. First Wind project is conducting a 2 year project, Evaluating Bird and Bat Post-Construction Impacts at the Sheffield Wind Facility, Vermont. The findings of the study will help to inform the Vermont Department of Fish and Wildlife in determining future methods of mitigation to reduce the impacts of wind energy on bats and birds in Vermont.²² The study started in 2012 and the area was resurveyed in 2013; a final report is due out in December 2014.
 - 6.3. Results of the 2012 First Wind bat study: three different bat species were found (all migratory tree-roosting bats) and carcasses were collected at all 16 turbines. The total bat fatality estimated for the project site was 235 with an estimate of 14.65 bats killed per turbine.²³
 - 6.4. The research methods included curtailment of several turbines at specific times to determine if operational mitigation would have an impact on bat fatality. Researchers found that operational mitigation had an estimated 60% reduction in bat fatality on site and they reported this as a “statistically significant effect” (average of 1.0 bats/turbine following operational mitigation compared to 2.7 bats/turbine following full operation.)²⁴ Operational mitigation was curtailment ½ hour before sunset and sunrise, when winds are less than 6.0 meters/second (13.42 mph), and temperature greater than 49 degrees Fahrenheit.
 - 6.5. Results of the 2012 First Wind bird study: twelve different bird species were found and carcasses were collected at 13 of 16 turbines. The total bird fatality estimate for the project site was 211 with an estimate of 13.17 bird fatality per turbine.²⁵

¹⁹ Vermont Agency of Natural Resources Biomonitoring and Aquatic Studies Program (2013)

²⁰ Bear Creek Environmental, <http://www.bearcreekenvironmental.com/projects/biological-investigation>

²¹ 10 V.S.A. § 5408

²² Colleen Martin, Evaluating Bird and Bat Post-Construction Impacts at the Sheffield Wind Facility, 2012.

²³ *ibid*

²⁴ *ibid*

²⁵ *ibid*

- 6.6. A memorandum between GMP and ANR was accepted by the PSB in which a one year post construction bat survey and a three year bird survey be conducted by GMP for review by ANR.²⁶ GMP is making payment of \$18,438 annually to support Vermont's bat colony conservation efforts as a form of mitigation for the lost of bats at the wind project.²⁷ Bird and bat fatalities were found in first year study of the GMP project.
7. Land Conservation and Habitat Mitigation.
- 7.1. Both projects include habitat mitigation efforts which intent to offset impacts. Conservation easements have been procured (GMP 2,800 acres; Sheffield 2,700 acres).
- 7.2. There are concerns about unknown wildlife impacts. Vermont Department of Fish and Wildlife biologists Cedric Alexander and John Austin are interested in our work to investigate broader effects of the Lowell wind project. "It's an issue that is of interest to the Department as well." (email from John Austin, January 10, 2014). They have shared big game harvest numbers from 2013 and 2012 and further studies should be done to better understand potential impacts on wildlife and wildlife habitat.
- 7.3. Other studies:
- UHS and RPInc – William Kilpatrick – First Wind project impacts on wildlife but not limited to birds, bats, bear and deer. Concerns about fragmentation of remote wildlife habitat (2006)
 - UHS and RPInc. – Marc Lapin – natural resource values of the site proposed wind-power development with specific regard to natural communities, wetlands, and rare plants. (2006)
 - Black Bear Use Response to a Wind Energy Project in Southern Vermont David Tidhar¹, Cecily Costello¹, Forrest Hammond and Trent McDonald *Western EcoSystems Technology, Inc.1; Vermont Fish and Wildlife Department*² (2006)
 - Population Ecology of American Marten in New Hampshire: Impact of Wind Farm Development in High Elevation Habitat - Alexejpeder Kelly Siren (2013)
8. The NVDA Study Committee takes the following positions:
- 8.1 Regional environmental impacts of industrial wind development are not well understood, such as high elevation stormwater runoff, bird and bat fatalities, wildlife habitat destruction, and loss of connectivity across the Northeast Kingdom landscape. Further research should be conducted.
- 8.2 Alternative stormwater technologies, such as level spreaders, need to be proven for their effectiveness.
- 8.3 Because there is limited data on the impacts of wind projects in the Northeast Kingdom on birds and bats, it is recommended that GMP continue to monitor bat fatalities beyond the one year post construction survey and follow methods used in the Sheffield Bird and Bat Post-Construction Study.
- 8.4 The Sheffield Bird and Bat Post-Construction Study Final Report is due in December 2014 and the Vermont Department of Fish and Wildlife determination of future methods of mitigation based on this information will need to be followed.
- 8.5 Agency of Natural Resources wind development guidelines (2006) need to be updated. This is consistent with the Energy Generation Siting Policy Commission Recommendations 2013: ANR shall provide detailed guidelines on assessment and "undue" impact.

²⁶ GMP and ANR Memorandum of Understanding, PSB Docket #7628, October 22, 2010

²⁷ Lowell GMP, ANR reach deal on bats death, Caledonia Record, September 20, 2013

Additionally, given the basic question as to whether there are ample environmental protections in place, the fifth recommendation developed by the Siting Commission essentially indicates that more work is needed.

“As a broader range of electric generation technologies are deployed at an increasing rate and related siting issues evolve, the Commission recognizes the central role of providing clear and accessible guidance wherever possible to ensure that all parties in the siting process are adequately informed. The Commission recommends that specific guidelines and checklists be developed by the relevant agencies - Agency of Natural Resources (ANR), Public Service Department (PSD), Department of Health (DOH), and Agency of Agriculture, Food and Markets (VAAFM) - to reflect the changing electric generation landscape. These guidelines must be made publicly available, in clear layperson terminology on an improved PSB siting website, and based on peer-reviewed scientific literature.” (from the Siting Commission report).

- **What is the impact of industrial wind turbines on property values and tourism in the Northeast Kingdom?**

Testimony / Evidence Presented:

Conclusions from a presentation entitled *Wind Turbines & Property Value* based upon a 2009 Wind Turbine Impact Study, conducted by Appraisal Group One (Kurt Kielisch, President/Senior Appraiser)

From <http://fairwindenergy.org/propertyvalues.html>, Michael McCann, an independent expert who presented at the 3/26/2013 Boone Co. IL, ZBA Public Hearing reported that his studies in IL

Relationship between Wind Turbines and Residential Property Values in Massachusetts – Joint Report of the U. of Connecticut and the Lawrence Berkeley National Laboratory, Jan. 9, 2014.

A Spatial Hedonic Analysis of the Effects of Wind Energy Facilities on Surrounding Property Values in the United States - Prepared for the Office of Energy Efficiency and Renewable Energy Wind and Water Power Technologies Office, U.S. Department of Energy. Principal Authors: Ben Hoen, Ryan Wiser, Peter Cappers, Lawrence Berkeley National Laboratory, August 2013

Local property valuation decisions in Georgia, VT (not in the NEK) and Barton VT (adjoiner to Sheffield's First Wind project).

NVDA October 2013 telephone conversation with Douglas Lay, VT Tax Department, Division of Property Valuation and Review.

Property Value Impact propositions developed by the Study Committee based upon the testimony and evidence presented:

1. Studies that have examined the impacts of industrial-scale wind turbines on property values have had mixed conclusions.

1.1 Conclusions from a presentation entitled *Wind Turbines & Property Value* based upon a 2009 *Wind Turbine Impact Study*, conducted by Appraisal Group One (Kurt Kielisch, President/Senior Appraiser) indicate:

- Media has reported on negative value issues influencing a negative perception.
- Realtor survey in WI indicated that perceptions are real in the market.
- Impact studies in WI suggest values are substantially negatively impacted in the range of -12% to -40%.
- The further away a property is from a project, the less the impact.

1.2 From <http://fairwindenergy.org/propertyvalues.html>, Michael McCann, an independent expert who presented at the 3/26/2013 Boone Co. IL, ZBA Public Hearing reported that his studies in IL showed negative impacts on property values:

Study # 1: The first study he did in 2009 on the sales of properties in the Mendota Hills Wind Project. The average Value Diminution within 2 miles of wind turbines was 25%.

Study # 2: The second study he did was a “Paired Sales Analysis” in 2012 on the sales of properties in the Lee/DeKalb Wind Project. He studied the sales of properties that were approximately 2,618 ft. from a turbine with comparable sales that were 10 miles away from a turbine.

In Lee County there was on average a 23% loss in property value. In DeKalb County (where the turbines were even closer to the houses) there was on average a 33% loss in property value. He also found that it took an extra year to sell the properties in both Lee and DeKalb Counties.

1.3 *Relationship between Wind Turbines and Residential Property Values in Massachusetts* – Joint Report of the U. of Connecticut and the Lawrence Berkeley National Laboratory, Jan. 9, 2014:

The results of this study do not support the claim that wind turbines affect nearby home prices. Although the study found the effects on home prices from a variety of negative features (such as electricity transmission lines, landfills, prisons and major roads) and positive features (such as open space and beaches) that accorded with previous studies, the study found no net effects due to the arrival of turbines in the sample’s communities. Weak evidence suggests that the announcement of the wind facilities had an adverse impact on home prices, but those effects were no longer apparent after turbine construction and eventual operation commenced. The analysis also showed no unique impact on the rate of home sales near wind turbines.

1.4 *A Spatial Hedonic Analysis of the Effects of Wind Energy Facilities on Surrounding Property Values in the United States* - Prepared for the Office of Energy Efficiency and Renewable Energy Wind and Water Power Technologies Office, U.S. Department of Energy. Principal Authors: Ben Hoen, Ryan Wiser, Peter Cappers, Lawrence Berkeley National Laboratory, August 2013:

Across all model specifications, the study found no statistical evidence that home prices near wind turbines were affected in either the post-construction or post-announcement/preconstruction periods. Therefore, if effects do exist, either the average impacts are relatively small (within the margin of error in the models) and/or sporadic (impacting only a small subset of homes).

2. Property valuation adjustments have been made in Vermont and New Hampshire as a result of industrial-scale wind facilities:
 - 2.1 Downward adjustments in site value were made for properties in view of the Sheffield wind project in the Town of Barton's reappraisal. A +25% adjustment to the site value for views of Crystal lake and -10% adjustment for view of the wind towers (in Sheffield). We did this for a constant lake view factor of 25% with the minus 10% for homes with substantial wind tower views." – 8/2/13 email to D. Snedeker from Bill Krajewski of Patriot Properties, Inc. The appraisal consultant was involved in the mass reappraisal for the Town of Barton.
 - 2.2 The Board of Civil Authority for the Town of Georgia, VT reduced the value (by 12% and 8%) of two properties near the Georgia Mountain wind project in an appeals process. – Burlington Free Press article dated 10/27/13 and BCA decision dated 9/25/13.
3. The VT Tax Department does not track data in a manner that would be helpful to determining a wind project's impact on property values. It is unlikely that there would be enough sales, or decreases in valuations, to draw any conclusions on impacts to value. – D. Snedeker telephone conversation with Doug Lay, VT Tax Dept., Property Valuation and Review. October 2013.
4. The NVDA Wind Study Committee takes the following positions:
 - 4.1 Establishing property values is a subjective as well as an objective exercise.
 - 4.2 Perceptions (negative and positive) drive the decision making and valuation process.
 - 4.3 While the property value impact studies that were presented to the Committee showed mixed conclusions, the Committee gives greater consideration to the studies from the professional appraisal consultants given their experience in establishing values, including an accounting for subjectivity.
 - 4.4 The nearer a residential property is to an industrial wind project, the greater the likelihood of negatively impacting its value.
 - 4.5 With a number of existing industrial wind facilities in the region and Vermont, the Public Service Department, working with the VT Tax Department, should consider tracking property values and sales within a defined range of distances (e.g. 1/2-mile, 1-mile, 2-miles, etc.) to aid in determining the impacts of turbines on property values.

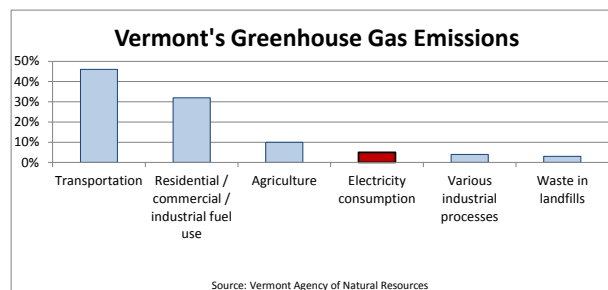
○ **What impact do industrial wind turbines have on greenhouse gas emissions in the Northeast Kingdom?**

Testimony / Evidence Presented:

The committee heard from David Hallquist, CEO of Vermont Electric Cooperative. Mr. Hallquist spoke to the committee on April 3, 2013.

The committee heard from Ann Margolis and Aaron Kisicki of the Vermont Department of Public Service on May 8, 2013. They spoke mainly on the goals of the Vermont Energy Plan and implementation.

The committee heard from John Soininen, Eolian Renewable Energy, on May 29, 2013. His slide presentation *The Case for Wind Energy in Vermont and the Northeast Kingdom* touched upon climate change and renewable energy resource potential to lessen climate impacts. Mr. Soininen also submitted information for a January 29, 2014 meeting with Dr. Ben Luce entitled *Antrim Wind Avoided Emissions Report*.



The committee heard from Kevin Jones, Vermont Law School, on September 4, 2013. Mr. Jones spoke at length on Vermont's SPEED program and Renewable Energy Credits.

The committee heard from Robert Dostis of Green Mountain Power and Jason Shafer, Professor of Meteorology at Lyndon State College, on September 26, 2013. Mr. Dostis presented a 'fact sheet' on the Kingdom Community Wind project in Lowell, and Mr. Shafer spoke a bit on climate change and wind resources in Vermont.

The committee heard from Dr. Ben Luce, Lyndon State College, on January 29, 2014. Much of the presentation was a comparison of renewable energy options with a goal of reducing CO2 emissions.

Minutes from the meetings with each of these individuals are included at the end of this document, as are any materials presented to the committee. They can also be found at the bottom of the NVDA homepage www.nvda.net.

Greenhouse Gas Impact propositions developed by the Study Committee based upon the testimony and evidence presented:

1. Consumption of electricity accounts for only 5% of Vermont's greenhouse gas (GHG) emissions.²⁸
2. **It is the position of the NVDA Wind Study Committee that:**
 - 2.1. Focusing on the generation of electricity is not the most effective way of reducing the state's GHG emissions
 - 2.2. It is unclear if industrial wind turbines in Vermont can bring about reductions in the region's GHG emissions.
 - 2.3. If the reduction of GHG emissions is a goal, it is clear that significant reductions may be achievable by addressing the state's larger contributors: transportation and heating.
 - 2.4. The impacts of Vermont turbine operations upon GHG emissions are dependent upon:
 - 2.4.1. The GHG lifecycle costs and benefits of the turbine project under consideration
 - 2.4.2. The energy policies of Vermont and neighboring states
 - 2.5. The analysis of these lifecycle and policy effects is beyond the scope of this report.

²⁸ Vermont Agency of Natural Resources Climate Change Team, http://www.anr.state.vt.us/anr/climatechange/Vermont_Emissions.htm (accessed 16 April 2014).

3. **Calculating the lifecycle GHG costs or benefits of an industrial wind project is beyond the scope of this report.** Such a calculation would require consideration of at least the following:
 - 3.1. The GHG investment in the turbine equipment
 - 3.2. The site-specific GHG emissions associated with transporting the equipment, preparing the site, erecting the equipment, maintaining the equipment, upgrading the transmission infrastructure, and decommissioning the project at the end of its life
 - 3.3. The loss of the eco services of the land that has been disturbed by the project
 - 3.4. The amount of electricity that the project places on the grid over its lifetime
 - 3.5. The GHG characteristics of the electricity that the wind energy displaces
 - 3.6. The GHG characteristics of the generation plants that provide backup and spinning reserve to the wind project
 - 3.6.1. ISO-NE (the regional grid operator) requires a spinning reserve of 8% of wind turbine capacity and is considering increasing the requirement to 12%.²⁹
 - 3.6.2. In New England, spinning reserve is generally provided by gas plants.³⁰
 - 3.6.3. When spinning reserve is unavailable, ISO-NE orders wind turbines to shut down.³¹
4. **Determining the GHG effects of Vermont energy policies and their interaction with those of other states is beyond the scope of this report.**
 - 4.1. "A renewable portfolio standard (RPS) is a regulatory mandate to increase production of energy from renewable sources such as wind, solar, biomass and other alternatives to fossil and nuclear electric generation."³²
 - 4.2. Vermont is "the only New England state which does not have a mandatory Renewable Portfolio Standard. Instead, Vermont's Sustainably Priced Energy Enterprise Development ("SPEED") program creates renewable energy development goals..."³³
 - 4.3. All Vermont's new utility-scale wind projects (including Sheffield and Lowell) are SPEED projects.³⁴
 - 4.4. "The goal of the SPEED program is to promote the development of in-state energy sources which use renewable fuels (SPEED resources) to ensure that to the greatest extent possible the economic benefits of these new energy sources flow to the Vermont economy in general and to the rate paying citizens of the state in particular."³⁵
 - 4.5. The SPEED program requires Vermont utilities to obtain electricity from SPEED projects and sell it to their customers: 20% of total statewide electric retail sales during year commencing

²⁹ David Hallquist (Vermont Electric Cooperative), NVDA Wind Study Committee Meeting, Barton Town Offices, 3 April 2013, Question and Answer Session.

³⁰ David Hallquist.

³¹ David Hallquist.

³² http://www.nrel.gov/tech_deployment/state_local_activities/basics_portfolio_standards.html (Accessed 27 April 2014).

³³ Andrew Bobenski (NEPOOL counsel), *Potential Inclusion of Vermont Load in the Definition of 'GIS Load'*, Memorandum to NEPOOL Budget and Finance Subcommittee, 12 February 2013, http://www.iso-ne.com/committees/comm_wkgrps/prtcpnts_comm/budgfin_comm/budgfin/mtrls/2013/mar272013/4b_vt_gis_load.pdf.

³⁴ <http://vermontspeed.com/project-status> (accessed 22 April 2014).

³⁵ <http://vermontspeed.com> (accessed 22 April 2014).

January 1, 2017 must be generated by SPEED resources that constitute new renewable energy.³⁶

4.6. The treatment of renewable energy credits (RECs) under the SPEED program is controversial:

4.6.1. Vermont utilities can count their purchases of electricity from SPEED projects toward Vermont's renewable energy goals.³⁷

4.6.2. At the same time, SPEED project operators can sell the renewable energy credits (RECs) generated by their projects to out-of-state utilities to meet out-of-state renewable energy goals.³⁸

4.6.3. "Vermont's current activities where it claims SPEED resources are renewable for purposes of counting them in Vermont, while at the same time selling the RECs out of state, run afoul of the FTC requirements and leave Vermont's programs vulnerable to a costly and embarrassing challenge."³⁹

4.6.4. Vermont's Public Service Board defines "renewable energy" to be "energy produced using a renewable technology and has all of the RECs attached."⁴⁰

4.6.5. Since Vermont turbine operators sell their RECs, the PSB cannot consider their electricity "renewable" and the operation of SPEED turbines, therefore, cannot reduce Vermont's GHG emissions.

4.7. According to Kevin Jones of the Vermont Law School, the lack of a mandatory RPS, which allows the practice of out-of-state REC sales, has three undesirable effects:⁴¹

4.7.1. Because utilities in other New England states can meet their renewable energy goals by buying Vermont RECs, it replaces their need to develop their own renewable electricity projects, resulting in no net increase in renewables in the region.

4.7.2. While REC sales are credited against utility rates, rates remain higher than they would have been without the SPEED project costs.

4.7.3. It increases Vermont's carbon footprint, since Vermont utilities purchase brown power (fossil fueled energy) not renewable energy.

4.8. It is the position of Green Mountain Power that the practice of selling RECs does not provide a disincentive for the development of renewable electricity in other states.⁴²

³⁶ <http://vermontspeed.com> (accessed 22 April 2014).

³⁷ Bobenski.

³⁸ Bobenski.

³⁹ Sandra Levine, Senior Attorney for the Conservation Law Foundation, Letter to the Vermont Public Service Board, 20 December 2012.

⁴⁰ Vermont Public Service Board, *Further Analysis and Report on Renewable Energy Requirements*, 15 January 2013.

⁴¹ Kevin Jones (Vermont Law School), NVDA Wind Study Committee Meeting, Barton Town Offices, 4 September 2013, Question and Answer Session.

⁴² Robert Dostis (Green Mountain Power), NVDA Wind Study Committee Meeting, Barton Town Offices, 26 September 2013, Question and Answer Session.

○ **What are the costs versus the benefits of industrial size wind turbines in the Northeast Kingdom?**

Given its limited resources to complete this study, the study committee was unable to conduct a “true” cost-benefit analysis. A review of what is entailed in a cost-benefit analysis yielded several very similar definitions:

“Cost-benefit analysis (CBA) is a tool used to determine the worth of a project, program or policy. It is used to assist in making judgments and appraising available options. CBA is a quantitative analytical tool to aid decision-makers in the efficient allocation of resources. It identifies and attempts to quantify the costs and benefits of a program or activity and converts available data into manageable information. The strength of the method is that it provides a framework for analyzing data in a logical and consistent way. CBA helps decision makers answer questions such as:

- Does the proposal provide a net benefit to the community as a whole?
- Should the proposed project, program or policy be undertaken?
- Should the project or program be continued?
- Which of various alternative projects or programs should be undertaken?

A CBA adds rigor to a program evaluation because, among other things, it makes explicit the links between inputs and outcomes, clarifies the underlying assumptions, and points to gaps in information. By endeavoring to express outcomes (benefits) and inputs (costs) in dollar terms, it facilitates comparisons across different types of programs as well as options within a particular program.”

(http://www.finance.gov.au/finframework/docs/Intro_to_CB_analysis.pdf)

As indicated above, a cost-benefit analysis can reveal gaps in information and the committee, through its work, found that more information is needed in a number of areas. The major hurdle the committee would have faced was quantifying benefits and costs in dollar terms. This is difficult for anyone, especially when trying to quantify environmental, health, and societal impacts.

However, the U.S. Department of Energy’s Office of Energy Efficiency and Renewable Energy does provide information on the advantages and challenges of wind power and these are presented below, along with excerpts from some of the information provided to the study committee by invited presenters. From <http://energy.gov/eere/wind/advantages-and-challenges-wind-energy>

Advantages of Wind Power:

It's a clean fuel source. Wind energy doesn't pollute the air like power plants that rely on combustion of fossil fuels, such as coal or natural gas. Wind turbines don't produce atmospheric emissions that cause acid rain or greenhouse gasses.

Wind energy is a domestic source of energy. The nation's wind supply is abundant: over the past 10 years, cumulative wind power capacity in the United States increased an average of 30% per year, outpacing the 28% growth rate in worldwide capacity.

It's sustainable. Wind is actually a form of solar energy; winds are caused by the heating of the atmosphere by the sun, the rotation of the earth, and the earth's surface irregularities. For as long as the sun shines and the wind blows, the energy produced can be harnessed to send power across the grid.

Wind power is cost effective. It is one of the lowest-priced renewable energy technologies available today, costing between four and six cents per kilowatt-hour, depending upon the wind resource and project financing of the particular project.

Wind turbines can be built on existing farms or ranches. This greatly benefits the economy in rural areas, where most of the best wind sites are found. Farmers and ranchers can continue to work the land because the wind turbines use only a fraction of the land. Wind power plant owners make rent payments to the farmer or rancher for the use of the land providing landowners with additional income.

Excerpts from John Soininen, Eolian Renewable Energy (5.29.13 presentation to committee and public)

Developing wind power is an important part of our energy transition. We must acknowledge there is a real cost to doing nothing to change the status quo and consider that:

- Wind can be a local asset and part of a working landscape
- Well-designed systems can have small impacts
- Landowners have rights and development alternatives
- Wind is economic development with tax revenue and jobs
- There are limited areas with the appropriate criteria for wind energy development in VT

Excerpts from Robert Dostis, Green Mountain Power (9.26.2013 presentation to the committee)

- Kingdom Community Wind developers were out and providing information in the community 16 months before the application was filed for a CPG. The Lowell community voted in favor of the project. There were no other formal votes in surrounding communities.
- Lowell receives municipal tax revenue from the KCW facility. KCW doesn't pay state education tax in manner of residential property owner, but they are required to contribute to the state education fund. KCW also created a mechanism whereby surrounding towns receive payment based upon land mass within 5 miles of the project's center. Community payments are based upon output and will continue for 10 years. There were no objections of methodology from local Selectboards.
- VEC is sold power generated at cost. KCW has upgraded transmission lines to help move power out.

Excerpts from John Soininen, Eolian Renewable Energy (5.29.13 presentation to committee and public)

Relative Cost and Price Stability:

- New wind generation is the least expensive form of new renewable generation to build in Vermont today.
- High permitting and construction costs have a major impact on the total costs.
- However, operating costs are relatively low. This leads to stable pricing for the life of the project.
- For new facilities, the Energy Information Administration Annual Energy outlook for 2011 projected that by 2016, the total cost of electric generation will be 10 cents per kWh for inland wind, compared to 7 cents for combined cycle natural gas and 24 cents for offshore wind.

Excerpts from Jason Shafer, Lyndon State College (9.26.13 presentation to the committee "Wind Energy in Vermont: A Meteorologist's Perspective")

- Industrial wind in the NEK region is not an appropriate resource anywhere below an elevation of 2,000 ft.
- Class 2–3 resources (11.5–14.5 mph) makes industrial-scale wind generation feasible.
- A minimum of one year's worth of data is necessary for siting a wind generation facility. (R. Dostis noted that GMP had five years' worth of data.)
- Wind direction is important for siting.

- 2012 data from airports in Island Pond, Lyndonville, Newport, and Burlington indicate that Burlington has wind speeds greater than or equal to 11.4 mph for the greatest percentage of time (29.3 % of the time. Newport was second at 17.4%). In Chittenden County, there are good wind resources (Class 2, 11.5 mph) in much of the Shelburne and Charlotte areas.

Challenges of Wind Power:

Wind power must still compete with conventional generation sources on a cost basis. Depending on how energetic a wind site is, the wind farm may or may not be cost competitive. Even though the cost of wind power has decreased dramatically in the past 10 years, the technology requires a higher initial investment than fossil-fueled generators.

Good wind sites are often located in remote locations, far from cities where the electricity is needed. Transmission lines must be built to bring the electricity from the wind farm to the city.

Wind resource development may not be the most profitable use of the land. Land suitable for wind turbine installation must compete with alternative uses for the land, which may be more highly valued than electricity generation.

Turbines may cause noise and aesthetic pollution. Although wind power plants have relatively little impact on the environment compared to other conventional power plants, there is some concern over the noise produced by the rotor blades, aesthetic (visual) impacts.

The turbine blades may damage local wildlife. Sometimes birds have been killed by flying into the rotors. Most of these problems have been resolved or greatly reduced through technological development or by properly siting wind plants.

Excerpts from David Hallquist, VT Electric Cooperative (4.3.2013 presentation to committee)

Grid integration issues:

- a. Grid was designed for “spinning generation”
- b. Most generation technologies provide “ride-through” (akin to inertia)
- c. Solar and wind provide no ride-through
- d. In our section of the grid, we’re at about 20% renewable generation and we’re experiencing problems

Capacity factor:

- a. actual production / nameplate capacity (has not been what was promised)
- b. Lowell promised 33%; last reporting period 17%
- c. Sheffield promised 32%; 2012 production was 23%

Excerpts from Kerrick Johnson, VELCO (8.14.2013 presentation to committee)

- Distributed generation is up to 2MW. Energy Switching is occurring.
- Forecast load growth of <1% going forward and trend is decreasing.
- Costs to connect to grid are increasing, while costs to exit grid are decreasing.
- Transmission costs are increasing. VELCO is taking projects off the table as they assess whether they really need to build all that they wanted to build.
- Transmission is being used for economic development. This differs from reliability projects.

Excerpts from Dr. Ben Luce, Lyndon State College (1.29.14 presentation to committee)

Economics of Wind and Solar:

- Costs of wind and solar are now roughly equivalent, assuming transmission costs for wind are minimal.
- If transmission costs for large build-out of wind are included, wind will be less competitive than solar.
- Solar technology is potentially more susceptible to price reduction through innovation and manufacturing scale-up.
- No justification from either a resource or economic point of view to install ridgeline wind projects for the sake of mitigating climate change.
- Continued large investment in NE ridgeline wind will hinder near term investment in, and long-term success, of more viable solutions.

Excerpts from Dr. David Grass, VT Dept. of Health (11.6.2013 presentation to committee)

- The only complaints that VDOH was investigating were those where the department had been contacted by physicians. Direct complaints to the department from the individuals complaining of health effects from industrial wind turbines have not been investigated. Doctors have visited existing wind turbine project sites, but not the homes of any complainants.
- For the studies that he reviewed, Dr. Grass noted that noise exposures were estimated through modeling (difficult to obtain actual exposure). The health effects in the studies are also self-reported, which is problematic. The studies did not include objective, individual health measures for those who self-reported. The generation capacity of the turbines in the reviewed studies was not available.
- The 2013 Canadian health study will be the largest and most objective study of the effects of wind turbines on health when it is completed. Although the study may be completed by the end of 2014, the information will not have been peer-reviewed until sometime in 2015 at the earliest.

This report will be reviewed first by the NVDA Executive Committee and then the full Board of Directors. Changes may be made subsequent to the reviews, and final recommendations may be used to inform changes to the NVDA Regional Plan.