Economic Impact of the Proposed Antrim 30 MW Wind Power Project in Antrim, New Hampshire

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1 Executive Summary

Antrim Wind Energy, LLC is proposing a 30 Megawatt (MW) wind power project ("Project") on private land located in Antrim, New Hampshire. The Project has an anticipated capital cost of $61 million, dependent upon market prices for turbines and other materials and services.

The U.S. wind energy industry is growing at an annual rate of 11.4% as of the 3rd quarter of 2011. New Hampshire has 24 MWs of wind power (the Lempster Wind Power Project installed in 2008) and has an additional 99 MWs of wind power under development in Coos County (Granite Reliable Power Windpark) and 48 MWs of wind power under development in Grafton County (Groton Wind Farm).

The economic benefits for Hillsborough County and the surrounding area of southern New Hampshire ("local area economy") from the Project are expected to be significant. The Project's development activities have already provided economic benefits to the local area economy. To date, Antrim Wind Energy, LLC has spent over $1.85 million on development activities with over 45% being spent in New Hampshire on services including professional services, lease payments, and surveying.

Table 1: Antrim Wind Power Project Estimated Summary Statistics

Total Investment (millions)	$61
Size (MW)	30
Total Economic Benefits -20 Year Period (millions)	$55.7
Total Economic Benefits – 20 Year Period – per MW (millions)	$1.85

The construction phase of the Project is the time period when there will be the greatest economic activity and benefits for Hillsborough County and the surrounding local area. The direct employment opportunities from wind construction are predominantly in manufacturing and construction. The wind turbines will not be manufactured in the local economy and therefore construction will be the major source of direct local area employment impact.

The Project is expected to contribute $12 million during construction to the local area (Cheshire, Hillsborough, Merrimack, Rockingham and Sullivan counties) economy. In the operation phase—after the construction phase—the economic and jobs impact of the Project are less but still significant. The Project is expected to contribute $2.3 million annually to the local area economy. Total benefits (including direct, indirect and induced) to the local economy from the Project are expected to be $55.7 million or $1.85 million per MW over a 20-year period.

Table 2: Antrim Wind Power Project Construction Phase Estimated Impacts

Total Local Area Economic Activity (millions)	$12.0
Direct Local Area Economic Activity (millions)	$2.1
Indirect Local Area Economic Activity (millions)	$7.7
Induced Local Area Economic Activity (millions)	$2.2
Total Local Area Jobs	86
Direct Local Area Jobs	23
Indirect Local Area Jobs	47
Induced Local Area Jobs	16

During the construction phase, the Project is expected to create a total of 86 full-time equivalent (FTE) jobs in the local area economy. This employment figure includes jobs directly filled by local labor and consists of construction employment and indirect and induced employment from project wages and local project expenditures (the so-called multiplier effect).

Of these 86 jobs, 23 FTE construction jobs are expected to be filled by NH resident workers. The Project in its on-going operations phase is expected to create an estimated 3 FTE jobs for workers employed by Antrim Wind, LLC and support an additional 10 jobs in the local area economy through the multiplier effect from the expenditures of the Project including: employee salaries, local supplies and services, land owner payments and local tax payments.

Table 3: Antrim Wind Power Project On-Going Operations Estimated Impacts

Total Local Area Economic Activity (millions)	**$2.3**
Direct Local Area Economic Activity (millions)	$0.2
Indirect Local Area Economic Activity (millions)	$1.5
Induced Local Area Economic Activity (millions)	$0.5
Total Local Area Jobs	**13**
Direct Local Area Jobs	3
Indirect Local Area Jobs	6
Induced Local Area Jobs	4

The jobs involved in the construction of the Project are expected to pay $54,222 in annual wages, 12% higher than the local area average annual wage of $46,685.

The impact of the Project on residential property values was considered through examining other studies and observing the impact on property values at the Lempster Wind Power Project in Lempster, NH (the project most similar to the proposed Antrim Project). Based on this analysis, there is no evidence to suggest that the Antrim Project will have a statistically- significant impact on residential property values.

2 Introduction

2.1 Overview

Antrim Wind Energy, LLC is proposing a 30 Megawatt (MW) wind power project in the Town of Antrim located in Hillsborough, New Hampshire. The Project will consist of 10 (3 MW) wind turbines situated along the ridge lines of Willard Mountain and Tuttle Hill in the northwestern area of Antrim. The Project is expected to involve a total investment of $61 million.[1]

Antrim Wind Energy, LLC contracted with Professor Ross Gittell from the University of New Hampshire's Whittemore School of Business and Economics to independently examine the potential impact of the Project on the local area economy in Hillsborough County and the surrounding counties in New Hampshire. The Project will be considered before the New Hampshire Site Evaluation Committee. This study is intended to help inform the members of the Committee as to the expected local area economic impacts of the Project. In conducting this economic analysis, emphasis was placed on providing conservative estimates of the economic impacts of the Project.

To evaluate the local area economic impacts of the Project, the research team drew on their previous research performed that focused on the economic impacts of wind power in New Hampshire including: 1) the New Hampshire Renewable Portfolio Standard legislation, 2) New Hampshire's participation in the Regional Greenhouse Gas Initiative (RGGI), 3) green industry employment in New Hampshire, and 4) the Granite Reliable Power Windpark in Coos County, and 5) the Groton Wind Farm in Grafton County.[2] The research team also considered current studies related to the economic costs and benefits of wind power project developments.

The research team considered the direct, indirect and induced economic impacts of the Project on Hillsborough County and the surrounding local area (Cheshire, Merrimack, Rockingham, and Sullivan) economies. This analysis included evaluation of the local area economic impacts during the construction phase and the on-going operations phase. Economic factors considered included employment, local capital expenditures, tax revenue, local material and supplies purchases, landowner payments and the broader "multiplier" impacts of the Project.

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[1] Spreadsheets and quotes containing expected capital expenditures and labor estimates for the Antrim Wind Project. Data was provided by Antrim Wind, LLC; Reed & Reed, Inc. of Woolwich, ME; and Acciona Windpower North America. Actual project cost will vary depend on market prices of wind turbines, labor and construction materials.

[2] The research team consisted of Ross Gittell and Matt Magnusson. A summary of their experience is provided at the end of the report.

2.2 Wind Energy and the Economy

2.2.1 U.S. & New England Wind Energy Industry

The U.S. wind energy supply expanded at an annual rate of 11.4% during the 3rd quarter of 2011 with the installation of 1,204 MWs of new generating capacity bringing total U.S. capacity to 43,461 MWs.[3]

New England has 396 MWs of wind energy facilities installed, far below the leading state, which is Texas at 10,223 MW. The region's wind power capacity also pales when compared to next door neighbor New York with 1,349 MWs of wind energy.[4]

However, Maine, Massachusetts, and New Hampshire are beginning to stand out in New England with significant recent additions of wind power generation. Maine currently has 326 MW of wind power installed; Massachusetts has 38 MW of wind power installed; and New Hampshire has 24 MWs of wind power installed as of 2008 (the Lempster Wind Farm) and has an additional 99 MWs of wind power under development in Coos County (Granite Reliable Power Windpark) and 48 MWs of wind power under development in Grafton County (Groton Wind Farm).

Table 4: New England Wind Power Statistics

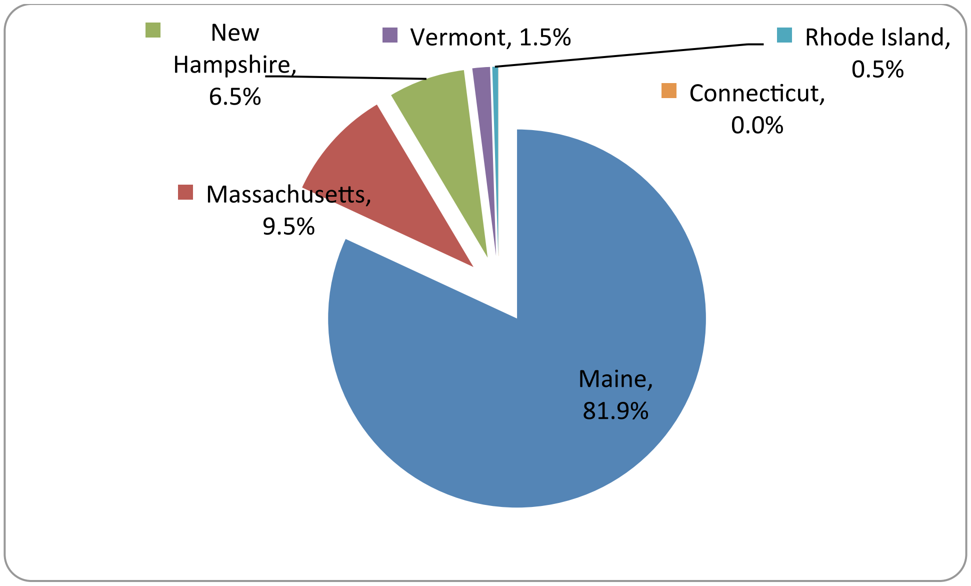
State	Installed Wind Capacity (MWs)
Connecticut	0
Maine	326
Massachusetts	38
New Hampshire	24
Rhode Island	2
Vermont	6

Source: American Wind Energy Association, December 2011

[3] "U.S. Wind Industry Third Quarter Market Report," American Wind Energy Association, October 2011, Available online at http://www.awea.org/learnabout/publications/reports/upload/3Q-2011-AWEA-Market-Report-for-Public-2.pdf

[4] See footnote 3

Figure 1: New England Installed Wind Power Capacity in 2012



Source: American Wind Energy Association, December 2011

The relatively modest amount of wind power development to-date in New England is not due to a lack of adequate wind resources. In New Hampshire, estimates of economically developable wind range from 500 – 2,200 MWs.[5] The potential is well above the current operating capacity of 24 MWs. The low level of wind development is unexpected given that New Hampshire and every other New England state has passed some form of Renewable Portfolio Standard (RPS). RPS legislation requires utilities to purchase a specific percentage of power from renewable sources and is a public policy supportive of renewable energy—including wind power—development.

There are several reasons that help to explain the low level of wind power development in New England when compared to the significantly higher level of activity seen in other areas of the country. One factor is the relatively high density of the New England population. The high density can make it harder to site projects, specifically due to potential opposition from vocal organizations.[6] Another factor is that wind resources are not uniformly distributed in New England and the most favorable sites—in terms of wind power generation potential—tend to be located along mountain ridges that presently have higher construction costs.[7]

[5] 500 MWs is the potential capacity provided by the American Wind Energy Association (AWEA) and 2,200 MWs is based on an economic study performed by the University of New Hampshire (UNH) assessing the economic potential of a Renewable Portfolio Standard in 2007. The AWEA estimate is available at http://www.awea.org/projects/Projects.aspx?s=New+Hampshire and the UNH study is available at http://www.renewableenergyworld.com/assets/documents/2007/unh_rps_report_final.pdf

[6] "The Offshore Wind Power Debate: Views from Cape Cod," Coastal Management, 2005, Available online at http://www.ceoe.udel.edu/Windpower/docs/KempEtAl-OffshoreWindDebate05.pdf

[7] "New England Wind Resources," New England Wind Forum, U.S. Department of Energy, Available online at http://www.windpoweringamerica.gov/ne_building_resource.asp

These factors tend to increase drive up costs and have steered development to other areas of the country with lower development costs. New England costs are typically at least 25% higher than those seen in similar installations in other regions of the country on a per MW basis. As a region, New England has the highest expected costs for on-shore wind installations in the U.S.[8]

Even though wind development can be more challenging in New England than in other areas of the country, there is considerable opportunity for New Hampshire and New England to develop significant new sources of wind power capacity. In fact, New England is starting to experience significant growth in wind power development; the majority of capacity has come on-line since 2007.

These new wind projects in New England are being built due to a combination of factors including: advances in turbine technology, relatively high regional wholesale electricity prices; federal policies (primarily the production tax credit); wider public acceptance of the need to address climate change and the use of fossil fuels; and increased state incentives (predominantly Renewable Portfolio Standard legislation).

2.2.2 Wind Power Economic Impacts

Wind power development offers significant economic benefits from the associated manufacturing, permitting, construction, and on-going operation activities. The economic benefits of wind for communities include the creation of local jobs, increased tax revenues, and generation of lease income for land owners.

A broader economic benefit is diversification of the power generation mix—wind power acts as a hedge against fossil fuel price volatility—which helps to provide households and businesses with more stable and potentially lower energy prices.[9] Additionally, wind power does not emit air pollution through the combustion of fossil fuels, so it can help reduce the total air pollution emitted by regional power generation, including greenhouse gas emissions which are associated with climate change.

The economic benefits provided by individual wind power projects from energy diversification and the reduction of pollution are very difficult to quantify for individual states or local areas. As part of this report's conservative approach and local economic impact focus, an assessment of the energy diversification and emission reductions benefits of the Project is not included.

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[8] "20 Percent Wind Energy Penetration in the United States: A Technical Analysis of the Energy Resource," Black & Veatch, October 2007

[9] "Renewable Energy as a Hedge Against Fuel Price Fluctuation: How to Capture the Benefits," Commission for Environmental Cooperation, May 2008, Available online at http://www.cec.org/files/PDF/ECONOMY/QA06.11-RE%20Hedge_en.pdf

It should be noted, however, that based on the analysis performed by Dr. Colin High from Research Systems Group related to this Project, the avoided emissions and water savings can be expected to have a generally positive economic impact on the region. This report shows expected CO_2 reductions of approximately 60,000 tons per year, and an additional 150 tons per year of SOx, NOx, methane, particulates and other toxic pollutants, as well as 17,500,000 gallons of fresh water saved each year. The economic benefit of these emissions reductions and resource savings in terms of human and environmental health, while not explicitly studied in this analysis, are expected to be material across New Hampshire and the region.

In this analysis, the impact of the Project on the local area economy is broken down into three distinct aspects.

1. **Direct Impacts -** Direct impacts are the employment and local capital expenditures necessary to manufacture and install the wind turbines and associated infrastructure of a wind power project. Direct construction activities include: land clearing, excavation, concrete and steel work, trucking, crane operation, engineering, and other professional services. There are significant direct economic impacts from the manufacturing of wind turbines and their associated components. However, the manufacturing facilities are often not located in the same locations as the wind power projects.

2. **Indirect Impacts -** Indirect impacts are the increased employment and economic activity brought on by the expenditures of firms during the wind power project that are directly involved in construction and manufacturing. For example, the construction of turbine foundations increases demand for gravel, sand, and cement, which in turn increases economic activity at quarries and cement factories. Indirect activity also includes local purchases of equipment, supplies, lodging of workers, parts and professional services.

3. **Induced Impacts -** Induced impacts are the increased employment and economic activity brought on through the expenditure of income and earnings in the broader local economy by individuals directly and indirectly employed by the project and increased expenditures by members of the local community as a result of the project. This can include expenditures in the local retail sector on goods and services including: food, clothes, utilities, transportation, recreation, medical care, and childcare.

3 Methodology & Assumptions

In this economic analysis, the following analytical tools were used: 1) the Job & Economic Development Impact (JEDI) Wind Energy model, 2) IMPLAN, and 3) spreadsheet modeling. The JEDI Wind Energy model (Wind Model rel. W1.10.03e) is provided by the National Renewable Energy Laboratory (NREL) and is a widely used and cited economic input-output model that is used to calculate regional economic impacts from wind power generation projects. IMPLAN 3.0 (2010 data) is a system of software and databases produced by the Minnesota IMPLAN Group (MIG) that is also widely used and accepted for regional input-output economic modeling; this model serves as a source of local economy employment and output multiplier inputs for the JEDI model. Additional spreadsheet modeling relied on project specific data, information gained from interviews with project managers and 2011 employment data available through the U.S. Bureau of Labor Statistics to supplement and expand on the model outputs from the JEDI and IMPLAN models.

The Project was evaluated in two phases: construction and on-going operations (post-construction). In determining the job impacts of the Project, the research team defined the "local area" economy to include Hillsborough County and bordering Cheshire, Merrimack, Rockingham, and Sullivan counties. In this analysis, the research team drew extensively on the experience they gained from modeling the Granite Reliable Power wind project in Coos County and Groton Wind project in Groton NH. Data was also obtained from Reed and Reed and Acciona—including project cost data and employment data—which helped guide the analysis.

The NREL JEDI Wind Energy model was used to calculate the direct, indirect and induced jobs associated with the construction phase of the project. The JEDI Wind Energy model calculates direct jobs as the sum of jobs associated with foundation preparation, turbine erection, electrical installation, management/supervision services, engineering professional services, and distribution line installation.

The JEDI model calculates direct jobs by dividing the total labor wages for any given job category (such as foundation) by a FTE Average Annual Wage (AAW) factor. This FTE AAW factor is FTE hours worked (2,080 hours) times the hourly labor wage for a job category increased by a payroll expense factor (government share & benefits). The JEDI default for payroll expense is 37.6%; this analysis assumed the same payroll expense. Total direct job creation from the JEDI model (with some slight exceptions) is a direct function of the total wages and the hourly wage assumed for different categories of employment.

Equation 1: JEDI Model Direct Jobs Calculation

$$Direct\ Jobs_{Jedi\ Model} = \frac{Total\ Wages}{2{,}080\ hours\ x\ Hourly\ Wage\ x\ (1 + \%\ Payroll\ Expense)}$$

The draft capital expenditure (CAPEX) budget for the Project provided by Antrim Wind Energy LLC and its partners did not exactly match up with expenditure categories in the JEDI model. This is because work is awarded to contractors in a quote process where they do not separate out labor and materials. For the purpose of this analysis, a percentage of overall capital expenditures was allocated to labor based on the information provided, researcher experience gained by working on other wind projects in New Hampshire, and default inputs from the JEDI Wind Energy model. None of the capital expenditures was allocated to local area labor for turbine component manufacturing. It was assumed that none of the major wind turbine components for the Project will be manufactured locally.

Hourly rates—based on the AAW of local area firms derived from the 2010 Bureau of Labor Statistics Quarterly Census of Employment and Wages, the research team's experience with past wind power projects in NH, and data submitted by Reed and Reed, Inc.—were calculated for each of the JEDI model job categories. The JEDI model adjusts employment to account for jobs originating from the region of analysis. For the major JEDI job categories, the percentage of labor coming from local sources was a conservative estimate based on information provided by Antrim Wind Energy, LLC, Reed and Reed, Inc., and JEDI model default inputs. The following table documents the percentage of local area labor assumed for each major JEDI job category.

Table 5: JEDI Job Category Model Inputs

JEDI Model Job Category	Hourly Rate (Including Benefits)	% from Local Labor*
Foundation	$23	30%
Erection	$25	30%
Electrical	$25	30%
Management/Supervision	$30	30%

*Local labor is defined as being from Cheshire, Hillsborough, Merrimack, Rockingham, and Sullivan counties in NH

The direct job calculations from the JEDI model for the Antrim Wind Project were compared on a per MW basis with other sources. New England based projects have tended to have an average of 2.0 to 4.0 FTE jobs per MW installed. This is higher than the national average range of 0.4 to 1.6 FTE jobs per MW installed.[10] The labor experience in New England is different from the overall country because the locations

[10] Pedden, M., "Analysis: Economic Impacts of Wind Applications in Rural Communities," National Renewable Energy Laboratory, January 2006, Available online at http://www.nrel.gov/docs/fy06osti/39099.pdf

typically selected for wind tower projects tend to require more labor during construction. This includes requiring additional personnel and equipment to construct roads, cut through rock and work in steep terrain.

A more appropriate FTE for direct construction jobs in New England is expected to be in the range of 2.0 to 2.5 jobs per MW installed.[11] This study estimated a total of 60 FTE (local and non-local) direct construction jobs. Of these 60 FTE direct construction jobs, 23 are expected to be filled by local labor.

The IMPLAN model considers 440 industry sectors in its economic analysis engine. The JEDI model aggregates the 440 industry sectors in IMPLAN down to 14 industry sectors. The JEDI model allocates inputs for capital expenditures to employment and economic activity in the 14 different industry sectors. Using a similar approach to that taken for labor (drawing on the Project CAPEX and JEDI Wind Energy model default inputs), different portions of the Project CAPEX were mapped to specific JEDI construction phase inputs.

Table 6: JEDI Model Aggregate IMPLAN Sectors

• Agriculture, • Mining, • Construction, • Manufacturing, • Fabricated Metals, • Machinery, • Electrical Equipment,	• Transportation Communication and Public Utilities (TCPU), • Wholesale Trade, • Retail Trade, • Finance, Insurance and Real Estate (FIRE), • Miscellaneous Services, • Professional Services, • Government

Demand from material expenditures in these different sectors combined with economic activity from direct construction employment was used by the JEDI Wind Energy model to calculate indirect and induced economic activity associated with the construction phase of the project. In calculating these impacts, economic and employment multipliers were obtained from the IMPLAN model for the specific New Hampshire counties of interest; the default JEDI multipliers were not used. The direct, indirect, and induced economic and employment multipliers are specific to the region of New Hampshire under study.

Determination of indirect and induced economic impacts have a degree of uncertainty as the lead contractor, subcontractors and material suppliers have yet to be determined by

[11] This range is based on three local projects. Unfortunately, there is not a great deal of documentation of labor or costs for New England wind power projects, both due to the limited number of projects to-date and project developer reluctance to share information about projects for confidentiality reasons. Iberdrola Renewables estimated approximately 60 FTE workers for 24 MW in Lempster, NH. The Granite Reliable Power Project economic impact study estimated 198 FTE construction jobs for 99 MW in Coos, County (available online at http://www.unh.edu/news/docs/windpowerreport.pdf). TransCanada estimated 300 jobs for the 132 MW Kibby wind power project (available online at http://www.transcanada.com/company/kibby.html).

Antrim Wind Energy, LLC. Therefore it is difficult to know the extent that materials will be obtained from local sources. In this analysis, conservative assumptions about the percentage of materials to be sourced locally were used.

Table 7 Percentage of Materials Assumed to be Sourced Locally

JEDI Model Material Category	% from Local Sources*
Construction (concrete, rebar, equip, roads and site prep)	40%
Transformer	0%
Electrical (drop cable, wire,)	30%

*Local is defined as being from Cheshire, Hillsborough, Merrimack, Rockingham, and Sullivan counties in NH

The JEDI model was used to calculate the direct, indirect and induced economic impacts of the on-going operations phase of the Project. The JEDI model took inputs of direct employment wages, local company expenditures, tax payments—including Payment In Lieu of Taxes (PILOT) payments, New Hampshire Utility Property Tax and Business Enterprise Tax (BET)— and land lease payments.

For on-going operations, it was estimated that there would be 3 permanent FTE jobs, or 0.10 FTE jobs per MW, employed by the Project.[12] This is consistent with national average ranges of 6-10 permanent operations and maintenance jobs per 100 MW, or 0.06 – 0.1 FTE jobs per MW[13].

Antrim Wind Energy, LLC and its partners provided the research team with itemized estimates of labor and operation costs (including percentage expected to be spent locally), taxes, and land lease payments for the on-going operations phases. For comparison with another major wind project by another company in New Hampshire, the aggregated categories of expenses provided by Antrim Wind were assessed relative to the aggregated expenses for the Granite Reliable Power Project in Coos County (a permitted 99 MW wind power project), Lempster Wind (24 MW project), and Groton Wind (a permitted 48 MW wind power project) . The Project expenditures appeared to be of similar magnitude relative to the different project sizes. None of the Project costs appeared to be extraordinary or unusual. Confidentiality provisions in proposals received by AWE for

[12] This estimate was based on hour and wage estimates submitted by potential contractors on the project. For smaller projects such as the Antrim Project, the national FTE average per MW figure is less applicable since there are a minimum number of personnel required to operate a wind project safely and efficiently. In the SEC Application, AWE expects to employ a minimum of 5 site personnel. The figure used in this study may be more conservative than actual employment from the Project.

[13] Flowers et al., "Wind Energy for Rural Economic Development," Power Point for Windpower 2005 Conference, National Renewable Energy Laboratory, May 18,2005, Available online at http://www.windpoweringamerica.gov/pdfs/wpa/flowers_windpower_2005.pdf

the Antrim Wind Project require that only aggregated economic impacts be presented and discussed in this report.

Separately the potential for Hillsborough County and the surrounding area to supply direct types of construction labor for the project was assessed. A list of industries directly involved in wind construction, based on the North American Industry Classification System (NAICS), was developed by the research team. This list of industries was used to determine local wages for the different types of direct construction employment expected to be seen in the Project. Employment and wage data for 2010 was obtained from the U.S. Bureau of Labor Statistics Quarterly Census of Employment and Wages for the counties considered in this analysis.

Table 8: NAICS Classifications for Direct Industries in Wind Power Construction

NAICS	Category Description
23713	Power and Communication Line and Related Structures Construction
23731	Highway, Street, and Bridge Construction
23811	Poured Concrete Foundation and Structure Contractors
23812	Structural Steel and Precast Concrete Contractors
23821	Electrical Contractors and Other Wiring Installation Contractors
23891	Site Preparation Contractors

For each industry a location quotient (LQ) was calculated. The LQ is a ratio of employment for a specific industry in the local economy compared to the employment for that same industry in the broader U.S. economy. This ratio is calculated for industries of interest to determine whether or not the local economy has a greater share of that industry than expected based on employment. If an industry has a LQ greater than 1 then that is indicative of a region having strength in that particular industry. If an industry has a LQ equal to 1, then that is indicative of a region being average in that particular industry. If an industry has a LQ less than 1, then that is indicative of a region being weak in that particular industry.

4 Analysis

4.1 Local Area Economic Impact

Antrim Wind's development activities have already brought investment and dollars into the local economy. Antrim Wind has spent over $1.85 million to-date on development activities with over 45% being spent in New Hampshire on services such as professional services, surveying, legal, and project impact analysis.

The construction phase is the period for which there will be the greatest economic activity and benefits for southern New Hampshire. The project is expected to contribute $12.0 million to the local New Hampshire economy during the construction phase. This would represent approximately 0.06% of total Hillsborough area economic activity.

The construction activity would help stimulate the local economy during a period of stagnant employment due to a weak overall U.S. economy. Although New Hampshire's unemployment rate was 5.2% in November 2011, the construction industry and employment is particularly weak and slow to recover from the sharp loss of jobs in the Great Recession of 2008-09.[14] During the construction phase, the impact on local area employment would be significant with 86 jobs and $5 million in wages and earnings. Longer term, the local employment impacts are lower, but still significant for Hillsborough County and the surrounding local area.

Table 9: Local Area Economic Activity during the Construction Phase of Antrim Wind

	Jobs	Earnings (Millions)	Economic Output (Millions)
Direct Construction	23	$1.7	$2.1
Indirect	47	$2.6	$7.7
Induced	16	$0.7	$2.2
Total Impacts	**86**	**$5.0**	**$12.0**

During the construction phase, 23 out of the total 60 FTE direct construction jobs created are expected to be local. The types of jobs created by this project are consistent with what are being termed "Green Jobs". Green jobs are jobs that involve, develop, or employ environmentally friendly practices or technologies; this includes the renewable energy sector. A recent report by the authors of this report on the green economy identified that green jobs can pay as high as 40% better than the national average[15]. This appears to be

[14] "Unemployment News Release," New Hampshire Economic and Labor Market Information Bureau, December 13, 2011, Available online at http://www.nh.gov/nhes/elmi/unempnr.htm

[15] Gittell et al., "New Hampshire's Green Economy and Industries: Current Employment and Future Opportunities," Whittemore School of Business & Economics, University of New Hampshire, January 2009

the case for the Antrim Wind Project as well with the construction jobs being well paying; the jobs involved in the construction of the Project are expected to pay $54,222 in annual wages, 12% higher than the local area average annual wage of $46,685.

In addition, to the direct employment benefits, there are indirect and induced local jobs created as a result of the Project during the construction phase. These jobs significantly magnify the employment impact of the Project on the local area economy. There would be expected to be 63 indirect and induced jobs created during the construction phase in the local area economy.

In the on-going operating phase (post construction), the economic and jobs impact of the wind power project are reduced but still significant. The project is expected to contribute $2.3 million annually to Hillsborough County and the surrounding local area economy. The project is expected to create an estimated 3 FTE new jobs for employees of Antrim Wind and support 10 indirect and induced jobs in the surrounding local area. This would bring an additional $2.0 million in wages and benefits into the local economy.

Table 10: Operations Economic Activity (Annual Basis)

	Jobs	Earnings (Millions)	Economic Output (Millions)
Direct (Antrim Wind)	3	$0.2	$0.2
Indirect	6	$0.3	$1.5
Induced	4	$0.2	$0.5
Total Impacts	**13**	**$0.7**	**$2.3**

Total benefits, including direct, indirect and induced, to the local economy from the Antrim Wind Project are expected to be $55.7 million or $1.85 million per MW over a 20-year period. This is consistent with other reports that are finding local economic benefits can be up to $1.6 million per MW over 20 year period from wind power project projects[16].

[16] Loomis, David, "Economic Benefits and Costs of Wind Farms," Power Point for the East Central Illinois Economic Development District , Illinois State University, January 30, 2009, Available online at http://www.econ.ilstu.edu/dloomis/236web/lectures/costbenefitwindfarms.pdf

4.2 Direct Wind Construction Employment Potential in Local Region

Hillsborough County and the surrounding counties were assessed to see if the local area has the types of industries and skilled labor force required to support the Antrim Wind Project. It appears that there is an adequate local labor force for general construction, electrical and site preparation. The region appears to be strong in site preparation but weak in power and related construction based on location quotients (LQ).

Based on the local area employment, the projected percentage of local employment for the Balance of Plant (BOP)—roads, foundations, operations and maintenance facilities—is 30%. Turbine erection work was assumed to be only 30% local, and electrical work is expected to be approximately 30% New Hampshire labor.

Table 11: Southern NH Wind Construction Labor Force

Industry	Employees	Total Wages (Millions)	Average Annual Wage	Location Quotient
Total Employment	372,351	$17,383.3	$46,685	
Power and Communication Line and Related Structures Construction	123	$9.7	$78,730	0.27
Highway, Street, and Bridge Construction	863	$55.0	$63,779	0.87
Poured Concrete Foundation and Structure Contractors	326	$12.6	$38,649	0.64
Structural Steel and Precast Concrete Contractors	131	$6.8	$52,052	0.58
Electrical Contractors and Other Wiring Installation Contractors	1,696	$82.3	$48,528	0.68
Site Preparation Contractors	1,162	$50.7	$43,594	1.26

Source: 2010 Bureau of Labor Statistics Quarterly Census of Employment & Wages for Belknap, Carroll, Coos, Grafton, Merrimack, and Sullivan Counties.

4.3 Fiscal Impact on the Town of Antrim

Antrim Wind has proposed an annual Payment In Lieu of Taxes (PILOT) to the Town of Antrim in the amount of $11,250 per MW for the first year, escalating at 2.25% per year during the 20 year operating term. The first year's payment would be $337,500 for a 30 MW project. This is in addition to payments prior to the commencement of the operating term and results in a total of $8,721,322 being paid to the Town of Antrim in PILOT payments during construction and the first 20 years of operations.

4.4 Property Value Impacts

Economic costs include potential property value effects and opportunity costs. While the impact of wind turbines on local residents can be a controversial topic, an objective way to assess the economic impacts of wind turbines on property values is to look for evidence that views of wind turbines, or proximity to wind turbines measurably affects real estate sales prices.

The research team undertook a detailed independent economic assessment of the Lempster Wind Project to evaluate if there was any evidence of changes in property values as a result of the project. A detailed discussion of the results is presented separately in "The Impact of Lempster Wind Power Project on Residential Property Values." The study did not find any statistically significant evidence that property values were impacted by the Lempster Wind Power Project.

4.5 Conservation

Antrim Wind Energy LLC reached an agreement with four private landowners in the area of the Antrim Wind Energy Project, by which, if the wind farm gains all necessary approvals and proceeds to construction, the landowners will conserve permanently approximately 685 acres of forestland. The Harris Center for Conservation Education will hold the easements. The remaining 60 acres, which encompass the footprint of the wind farm, will be permanently conserved upon the decommissioning of the wind farm. While this analysis did not analyze the economic impacts of the conservation project, it is expected to provide positive benefits for the community.

5 Conclusion

The 30 MW wind power project proposed in Antrim, NH is expected to have a positive economic impact on Hillsborough County and the surrounding local area with the highest impact experienced during the construction phase. During the construction phase, economic activity associated with the wind power project will add $12.0 million to the local area economy.

Given the weak state of the current economy, particularly in construction, the Antrim Wind Project – with its immediate and stimulative impacts – can be particularly valuable to the local area economy. The construction jobs and direct employees of Antrim Wind created by this wind power project are expected to be high quality, paying over 12% higher than the local average annual wage. The Project is expected to create 86 jobs in the local economy paying $5 million in wages and benefits during construction and an estimated 3 permanent FTE jobs for employees of Antrim Wind and supporting 10 jobs in the local area economy paying $700 thousand in wages upon project completion.

Long term, on-going benefits will be from an estimated 3 FTE on-site jobs, local purchases of goods and services by Antrim Wind (such as plow contracts, maintenance contracts, supplies), land owner lease payments, tax/tax equivalent payments to local and state government, resulting in an annual increase of $2.4 million in local area economic activity. An annual PILOT payment of $337,500 would have a significant impact on the revenue to the Town of Antrim and the Town would also experience positive impacts from conservation measures put in place as part of the Project.

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7 Research Team

Ross Gittell is the James R. Carter Professor at the University of New Hampshire's Whittemore School of Business and Economics. Professor Gittell's research has been funded by the National Science Foundation, the Rockefeller Foundation, and the Energy Foundation. Professor Gittell's applied research activities in the New England region include work for the states of New Hampshire and Massachusetts, the New Hampshire Business & Industry Association, the State of New Hampshire's, Department of Environmental Services, the New Hampshire Small Development Center, the Children's Alliance of New Hampshire and the Josiah Bartlett Center for Public Policy.

Professor Gittell is Vice President, forecast manager and on the board of the New England Economic Project. He is also on the board of the Exeter Trust Company, the Endowment for Health, and Exeter Health Services.

Matt Magnusson is a graduate of the University of New Hampshire's Whittemore School of Business and Economics with a Masters of Business Administration. He currently is earning his Ph.D. in Natural Resources and Environmental Studies at the University. He has worked with Professor Gittell to provide analysis on the economic impacts of several different public policy initiatives in the state of New Hampshire, including the Renewable Portfolio Standard (RPS) and the Regional Greenhouse Gas Initiative (RGGI) for the New Hampshire Department of Environment and Services (NH DES). Their analysis of these policies proposed by the NH DES has been influential in the passage of NH state laws implementing those policies.

Research performed in the last year includes "New Hampshire's Green Economy and Industries: Current Employment and Future Opportunities" performed for the Rockingham Economic Development Committee (REDC), "Economic Impact of Granite Reliable Power Wind Power Project in Coos County, New Hampshire" performed for Granite Reliable Power, LLC and the economic analysis of policies proposed in "The New Hampshire Climate Action Plan" performed for the NH Climate Change Task Force.

Impact of the Lempster Wind Power Project on Local Residential Property Values

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January 2012

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Executive Summary

With wind energy projects expanding throughout the United States—and New Hampshire—there is the need to provide local communities considering project development with good quality information on the potential environmental and economic impacts of wind project development. One area of concern is the impact that wind energy projects may have on residential property values. This is a valid concern given that studies have shown negative property value impacts near high voltage transmission lines and some forms of power generation facilities.

This study investigates residential property values around Iberdrola's 24-megawatt (12 turbine) wind power project located in the Town of Lempster in Sullivan County, NH. This is the first significant wind energy installation in New Hampshire which became operational in the 4th quarter of 2008. The Lempster project serves as a good case study to indicate the impact of wind energy development on property values in New Hampshire.

Since the completion of project construction, there have been 16 arms-length single family home property transactions in Lempster and 72 arms-length single family home property transactions in the bordering towns of Goshen, Marlow, Unity and Washington. This analysis also considered 2,065 property transactions throughout Sullivan County from January 2005 through November 2011 to compare Lempster area property values to the overall region.

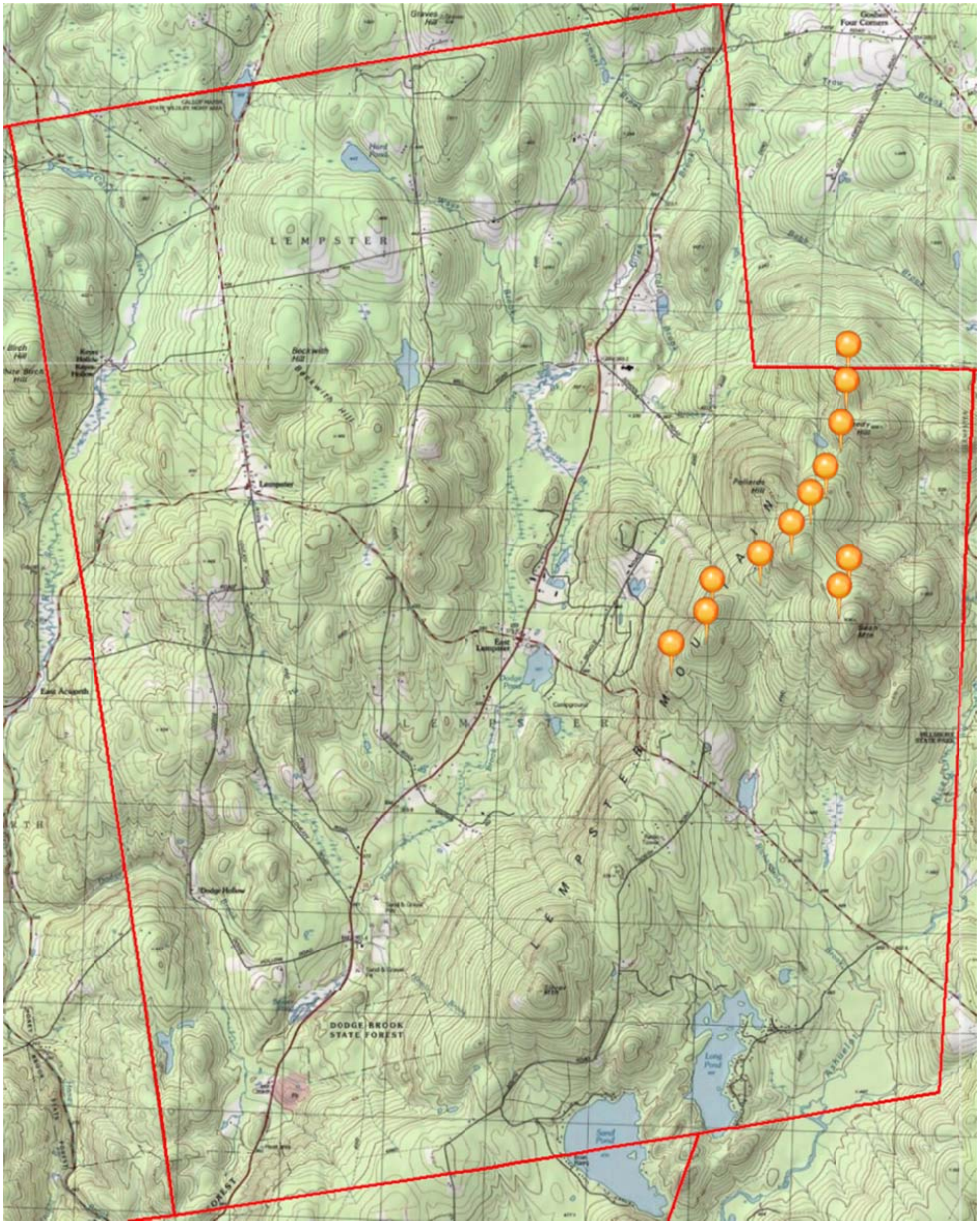
Table 1: Summary of Findings at the Lempster Wind Power Project

Scope			Statistically-significant Findings			
Location	Wind Farm Facilities	Property Transactions	Area Impact	View Impact	Nuisance Impact	Anticipation Impact
Local (1 State: NH)	1	2,593	None	None	None	n/a

All wind energy projects have their own unique characteristics including: the amount of residential and commercial development, terrain, and geographical features. An important feature of the Lempster Wind Power Project is that the area's hilly terrain and high level of forest cover obscure or block views of the turbines and limit clear visibility of the turbines to a relatively limited number of locations. Only 10% of the sales transactions that have occurred in the local area have had an obscure or clear view of one or more turbines.

While this study does not exclude the possibility of isolated cases of property value impacts attributable to the Lempster Wind Power Project, this study has found no evidence that the Project has had a consistent, statistically-significant impact on property values within the Lempster region. This is consistent with the near unanimous findings of other studies—based their analysis on arms-length property sales transactions—that have found no conclusive evidence of wide spread, statistically-significant changes in property values resulting from wind power projects.

Figure 1: Town of Lempster with Wind Turbine Locations



Source: ESRI, USGS

Introduction

The Town of Lempster is located in Sullivan County, New Hampshire. The town has a total area of 33 square miles and had a population of 1,150 in 2010. The region is rural, heavily forested, and features hilly terrain including Lempster Mountain and Bean Mountain whose summit is 2,326 feet above sea level. The town also has several bodies of water that account for 1.2% of the total area of the town and include: Dodge Pond, Long Pond and Sand Pond. There are two settlement areas in Lempster: the town center (Lempster village) and the village of East Lempster.

The major road routes in Lempster are: Route 10 (runs north to south through the center of Lempster), Second New Hampshire Turnpike (runs northwest to southeast up to the center of Lempster) and Mountain Road (runs northwest to southeast from the center of Lempster). Commercial establishments are primarily located along Route 10 and residential housing units are dispersed throughout Lempster. Lempster is bordered by the towns of Goshen and Unity to the North, the Town of Washington to the East and South, the Town of Marlow to the South and the Town of Acworth to the West.

The Lempster Wind Power Project is a 24-megawatt wind farm that began commercial operations in October 2008. The project is the first modern, commercial-scale wind farm in New Hampshire. The project is located in the eastern portion of Lempster on approximately 1,500 acres of privately owned land—with the project impacting only 5% of the land cover—and consists of 12 Gamesa G87 2 MW wind turbines stretching over several connected ridgelines on Lempster Mountain and Bean Mountain.

The northern-most wind turbine is just south of the Town of Goshen and nearby to the east is Pillsbury State Park in the Town of Washington. Pillsbury Park is heavily wooded and covers 8,135 acres which significantly limits the number of residential properties immediately east of the Project. Also noteworthy, two radio towers (not related to the Project) are located approximately one mile southwest of the Project with heights of about 350 feet.

The Gamesa G87 turbines stand 396 feet to the tip of blade and have a tower hub height of 256 feet and a blade length of 139 feet. Each of the turbines is located within 700 to 850 feet of another turbine and the turbines are accessible via 5 miles of gravel surfaced roads. The Project is interconnected to the Public Service of New Hampshire (PSNH) Newport substation by a 10.5-mile 34.5 kilovolt (kV) distribution line and features a 34.5 kV switchyard with pole mounted equipment and a 34.5 kV underground collector feeder system.[1]

Iberdrola Renewables, Inc. owns the Lempster Wind Power Project. Iberdrola Renewables is the second-largest wind operator in the U.S. and also operates more than 621 MW of gas-fired generation. Iberdrola Renewables is the U.S. division of parent company Iberdrola, S.A., Spain's largest energy group

[1] "Lempster Wind Power Project Fact Sheet," Iberdrola Renewables, Available online at http://www.iberdrolarenewables.us/cs_lempster.html

and the fourth largest utility company in the world by market capitalization. Iberdrola, S.A. features the largest renewable asset base of any company in the world.[2]

PSNH has a power purchase agreement with Iberdrola for 100% of the electricity generated from the Project. PSNH resells a portion of the power from the Project to the New Hampshire Electric Cooperative, a local electric service provider that includes the town of Lempster in its service territory.[3]

Figure 2: Lempster Turbines from Nichols Road (Approximately 0.6 Miles) – Dec. 2011

Study Sponsor

Antrim Wind Energy, LLC (AWE) contracted with Professor Ross Gittell and Matthew Magnusson from the University of New Hampshire's Whittemore School of Business and Economics to independently examine the impact of the Lempster Wind Power Project on local residential property values. This study is intended to inform the members of the New Hampshire Site Evaluation Committee around the question of the potential impacts on local property values from wind power facilities such as the proposed Antrim Wind Energy Project ("the Project"). .This study utilizes both a literature review and primary research on property transactions around the Lempster Wind Power Project in Lempster, New Hampshire to support its findings. In conducting this economic analysis, emphasis was placed on providing conservative analysis of the residential property impacts of the Lempster Wind Power Project.

Antrim Wind Energy, LLC ("AWE") is a Delaware limited liability company formed in 2009 as a special purpose entity to develop, build, own and operate the Antrim Wind Energy Project . AWE has two members – Eolian Antrim, LLC and Westerly Antrim, LLC who each own and control 50% of AWE. Both of these members are registered Delaware limited liability companies and are owned by Eolian

[2] "Business Overview," Iberdrola Renewables, Available online at http://www.iberdrolarenewables.us/business-overview.html

[3] "Twelve New Wind Turbines Nearing Completion at New Hampshire's First Wind Project," Iberdrola Renewables, October 7, 2008, Available online at http://www.iberdrolarenewables.us/rel_08.10.07.html

Renewable Energy, LLC ("Eolian") and Westerly Wind, LLC ("Westerly"), respectively. Westerly is a portfolio company of US Renewables Group ("USRG"). AWE operates from the offices of Eolian Renewable Energy, LLC at 155 Fleet Street, Portsmouth, NH 03801

Potential Residential Property Value Impacts of Wind

Areas of concern for host communities of wind power projects often include visual impacts and turbine noise.[4] Related to these concerns are that potential adverse impacts from a wind energy project will negatively impact property values. [5]

Residential properties can be thought of as a bundle of characteristics that have value (square footage, number of bedrooms and bathrooms, plot size, condition, etc.). Location and the characteristics of that location also have value. The view from a property is a location-based characteristic that has been shown to have positive value when it is perceived to be pleasant or desirable (such as waterfront property or mountain vista) and negative value when it is perceived to be unpleasant or undesirable (such as a waste landfill). Related to the electrical power sector, reductions in residential property values have been found for properties in relation to power transmission lines and conventional power generation facilities.[6]

The possible negative impacts of wind energy projects on residential property values can be divided into the following four categories listed in Table 2.

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[4] Devine-Wright, P., "Beyond NIMBYism: towards an Integrated Framework for Understanding Public Perceptions of Wind Energy", Wind Energy, 2005, 8:125-139.

[5] Firestone, J. and Kempton, W., "Public Opinion about Large Offshore Wind Power: Underlying Factors, Energy Policy, 2006, 35(3): 1584-1598. Available online at http://www.ceoe.udel.edu/windpower/docs/FireKemp07-PubOpinUnderly.pdf

[6] Simons, R. A. and Saginor, J. D., "A Meta-Analysis of the Effect of Environmental Contamination and Positive Amenities on Residential Real Estate Values," Journal of Real Estate Research. 2006, 28(1): 71-104. Available online at http://business.fullerton.edu/finance/journal/papers/pdf/past/vol28n01/05.71_104.pdf

Table 2: Wind Power Project Negative Impact Categories

Negative Impact	Description
Area	A general negative image of the wind energy project may adversely affect property values in the local community regardless of whether any specific property has a view of the wind turbines or not.
View	Property values with views of the turbines may be devalued because of the potential visual impact of the view that existed prior to turbine installation.
Nuisance	Property values in close proximity of the turbines may be devalued due to factors, such as turbine noise, and shadow flicker. Shadow flicker occurs when a specific set of conditions (location, wind direction, sun height) combine to cause the turbine blades to cast shadows.[7]
Anticipation	Property values in the local community may decline before, during, and immediately after construction of the wind project due to existing property owners' fear that the project will negatively impact the area. This impact would occur before the actual operating characteristics of the wind project are known.

The "bundled" value of all of the characteristics of a property is expected to be revealed when a buyer and a seller engage in a market-based transaction for that property. Therefore, the different potential impacts can be tested for objectively by looking at arms-length property transactions, as was the case in this study.

An area impact can be determined by comparing the sales of similar homes within the general area of a project with sales of similar homes in different nearby communities. If a wind project had an area impact then all homes in that community would be expected to have lower sales value relative to comparable homes in neighboring communities. Property transactions should also reveal if having a view of a wind project reduces the value of a property relative to other similar properties that do not have a view of a wind project in the region.

If close proximity (nuisance impact) to a wind project is a factor, than one should observe a reduced value for homes close to a wind turbine relative to other similar properties located further away from a wind turbine. Anticipation impacts would be expected to result in reduced sales prices that occur during the period of time in between when the community becomes aware of a wind project and construction completion of the project. Anticipation impact reflects the uncertainty property owners may have as to the actual impacts of a wind project. For example, prior to the completion of construction on a project, nearby property owners may wonder whether their view will actually change or whether potential impacts, such as shadow flicker or noise, from a nearby turbine will reduce a residential owner's enjoyment of their property.

[7] "Update of UK Shadow Flicker Evidence Base," Prepared by Parsons Brinckerhoff for the UK Department of Energy and Climate Change, March 2011, Available online at http://www.decc.gov.uk/assets/decc/what%20we%20do/uk%20energy%20supply/energy%20mix/renewable%20energy/ored/1416-update-uk-shadow-flicker-evidence-base.pdf

Review of Previous Studies

The impact of wind energy projects on residential properties has been explored in both the United States and in other countries. Different research techniques have been used including: homeowner surveys, expert surveys (such as surveys of real estate appraisers), and statistical analysis of property transactions. The body of research in this area has grown, increased in sophistication, and utilized larger data sets as more wind projects have been built.

Almost unanimously, statistical analysis of actual property transactions has not revealed a statistically-significant change in property values resulting after the construction of wind energy projects. Surveys of homeowners and experts have been more mixed as evidenced in some pre-project and post-project construction surveys. Some surveys have found statistically-significant expectations by survey respondents that property values will decline as a result of a wind power project.[8] While surveys can reveal homeowners' expectations of residential property value impacts from wind projects, the most reliable way to determine property value impact is not through surveys, but through analyzing actual market transactions. More in-depth discussions of previously performed studies can be found at Carter (2011), Hinman (2010), and Hoen et al. (2009).

In this study, a meta-analysis was conducted of six studies that collectively evaluated almost 50,000 property transactions in 11 different states. The studies reviewed are listed in Table 3. While the actual body of research in this area (the relationship between residential property values and wind energy projects) is much greater than six studies, these studies were chosen as they were believed to represent the best and most current research in the area of residential property values in relation to wind power projects.

The studies utilized actual arms-length property transactions in their analysis, tended to be more recent, utilized credible research methodologies, and typically had large transaction data sets. All but one of the reviewed studies found no statistically-significant difference in housing prices (as observed through actual market transactions) after wind energy projects were constructed. Heintzelman and Tuttle (2011) differed from the other five studies and reported a statistically-significant decline in property values (as witnessed through sales transactions) ranging from 8% to 18% due to the wind turbines in one geographic location in New York from the immediate time period preceding construction completion to immediately after project construction.

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[8] "Wind power sometimes hurts property values, Clarkson study says," Watertown Daily Times, July 20, 2011, Available online at http://www.watertowndailytimes.com/article/20110720/NEWS03/707209999

Table 3: Studies Reviewed of Residential Property Sales

Study Author	Date	Scope			Statistically-significant Findings			
		Location	Wind Facilities	Property Transactions	Area Impact	View Impact	Nuisance Impact	Anticipation Impact
Hinman[9]	May 2010	Local (1 State: IL)	2	3,851	None	n/a	None	Negative
Hintzelman & Tuttle[10]	March 2011	Local (1 State: NY)	6	11,369	n/a	n/a	Negative	n/a
Hoen[11]	Apr 2006	Local (State: NY)	1	280	None	None	None	n/a
Hoen et al.[12]	Dec 2009	National (9 States: IA, IL, NY, PA, OK, OR, TX, WA, WI)	24	7,459	None	None	None	n/a
Carter[13]	Spring 2011	Local (State: IL)	3	1,298	None	n/a	n/a	n/a
Sterzinger et al.[14]	May 2003	National (7 States: CA, IA, NY,PA, TX, VT, WI)	11	24,346	None	n/a	n/a	n/a

[9] Hinman, J., "Wind Farm Proximity And Property Values: A Pooled Hedonic Regression Analysis Of Property Values In Central Illinois," Illinois State University, May 2010, Available online at http://friendsofwind.ca/wp-content/uploads/2011/07/USA-2010-Hinman-Wind-Farm-Proximity-and-Property-Values.pdf

[10] Hintzelman, M. and Tuttle, C., "Values in the Wind: A Hedonic Analysis of Wind Power Facilities," Clarkson University, March 2011, Available online at http://docs.wind-watch.org/Values-in-the-Wind.pdf

[11] Hoen, B., "Impacts of Windfarm Visibility on Property Values in Madison County, New York," Bard College, April 2006, Available online at http://www.nhsec.nh.gov/2008-04/documents/app_appendix_30b.pdf

[12] Hoen et al., "The Impact of Wind Power Projects on Residential Property Values in the United States: A Multi-Site Hedonic Analysis," Ernest Orlando Lawerence Berkeley National Laboratory, December 2009, Available online at http://eetd.lbl.gov/ea/ems/reports/lbnl-2829e.pdf

[13] Carter, J., "The Effect of Wind Farms on Residential Property Values in Lee County, Illinois," Illinois State University, Spring 2011, Available online at http://renewableenergy.illinoisstate.edu/wind/publications/2011%20Wind%20Farms%20Effect%20on%20Property%20Values%20in%20Lee%20County.pdf

[14] Sterzinger, G., Beck, F. and Kostiuk, D., "The Effect of Wind Development on Local Property Values," Renewable Energy Policy Project, May, 2003, Available online at http://www.repp.org/articles/static/1/binaries/wind_online_final.pdf

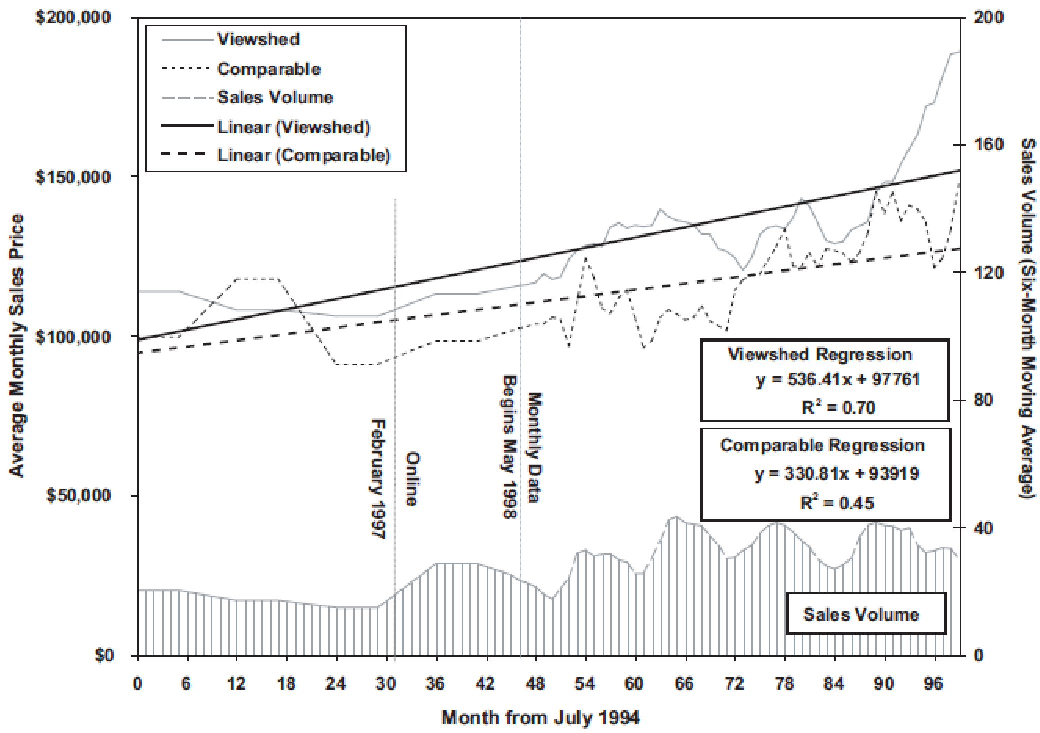
Hoen et al. (2009) is one of the most noteworthy studies and was prepared for the Office of Energy Efficiency and Renewable Energy in the U.S. Department of Energy. Their study analyzed almost 7,500 single family home sales within a 10 mile range of 24 existing wind projects in 9 U.S. states. Sales occurred between January 1996 and June 2007. The study used 8 different pricing models and the models consistently showed no evidence of widespread property value impacts in communities surrounding wind energy facilities. The models also found no evidence of change in property values related to distance to wind projects or views of wind projects. They concluded that while it was possible for individual or a small number of homes to have been negatively impacted by projects that the impact on property values was either too small or too infrequent to result in any statistically-significant, observable impact.

Sterzinger et al. (2003) analyzed the largest set of property transactions out of all of the studies considered and looked at properties transactions surrounding 11 wind projects in 7 different states over roughly a 6 year period for each area. The study used regression analysis to determine how property values changed over time in areas near wind projects and assessed them relative to a “comparable” community that was not located near a wind project. They found that there was no evidence to suggest that wind development harms property values.

Sterzinger et al. (2003) was also the only study out of the six studies evaluated to include an analysis of a New England wind facility. They considered the 6 MW Searsburg Wind Power Project in Searsburg, VT that was built in 1997. At the time, the Searsburg project was the largest wind power facility in the eastern part of the country. The facility consists of 11 turbines with a 131 foot hub height running along a mountain ridge line.

Sterzinger et al. (2003) analyzed 2,788 sales between 1994 and 2002 in the communities within a five-mile radius around the wind project which included the towns of Searsburg, Dover, Somerset, and Wilmington. Over the same time period, they analyzed 552 sales in the towns of Newfane and Whitingham, VT for comparison. They used three different regression models and found in all circumstances that the communities in the region around the Searsburg project had property value rates grow at a faster rate than the comparison communities, leading them to conclude that there was no evidence to suggest the Searsburg Wind Power Project has had a negative effect on residential property values in the local area. Also of note, Newfane Town Lister Doris Knechtel was reported to have stated that only 10% of homes in Searsburg, VT have a view of the Searsburg Wind Power Project. This is due to the hilly terrain and high level of forestation in the region.

Figure 3: Comparison of Searsburg Wind Power Local Area Property Sales with Comparable Community



Source: Sterzinger et al., ""The Effect of Wind Development on Local Property Values," 2003

Heintzelmen and Tuttle (2011) performed the only study that has had a finding of a statistically-significant decline in residential property values. Their analysis included 9,414 arms-length property transactions in Franklin and Clinton County, NY and considered 5 wind energy facilities consisting of 271 GE (1.5 MW) turbines that were constructed between 2008 and 2009. This analysis showed that for homes within 0.5 miles of a turbine the sales price decreased in the range of 11% to 18%. The average property in their sample sold for $106,864, which implies a loss of between $11,600 and $19,000. For properties, within 1 mile of a turbine the decline in value was 8% to 15%, implying a loss of $8,200 to $16,000.

Although, Heintzelman and Tuttle (2011) did identify some isolated negative impact in two counties in NY, their results were also mixed. They also looked at property values around the Maple Ridge Wind Farm located in Lewis County, NY, a wind project completed in 2006 which consists of 195 Vestas V82 (1.65 MW) turbines. They analyzed 1,955 total property transactions and found no significant impact due to the wind turbines and in fact, some instances, of a positive increase. [15]

Hinman (2010) found evidence that housing values in areas of close proximity to wind turbines can temporarily decline during the period between when a project is announced up until when the project is completed. Hinman analyzed 3,851 total property transactions from 2001 to 2009 in 25 townships in

[15] "Wind power sometimes hurts property values, Clarkson study says," Watertown Daily Times, July 20, 2011, Available online at http://www.watertowndailytimes.com/article/20110720/NEWS03/707209999

McLean and Ford Counties, Illinois around the Twin Groves Wind Farm— a 240 Vestas V82 (1.65 MW) MW project covering 22,000 acres that was constructed in 2007 and 2008. Hinman found up to an 18% decline in property values **between project announcement and project completion** for nearby properties. However, Hinman also found that during the operational stage of the wind farm project, as the actual visual and noise impacts of the wind turbines become known, property values rebounded higher in real terms than they were prior to wind farm approval.[16]

An explanation for the decline in property values that occurred around Twin Groves Wind Farm in Illinois could be anticipation, or that some homeowners expected (or were at least uncertain about) negative impacts from the wind farm and, as a result, property sales transacted at lower values than would otherwise be expected. Hinman's finding of wind farm anticipation may explain the difference between what has been shown in some past surveys where people expect a decrease in prices due to wind farm projects and the actual property transaction data for properties sold after the construction phase of the project. Hinman's study indicates that if there is a temporary decline in property values, it is also possible that they can rebound once the uncertainty surrounding how homeowners are affected by the development disappears.

Therefore it is possible that the decline in property values observed by Heintzelman and Tuttle in Franklin and Clinton County, NY is a temporary phenomenon related to homeowner anticipation of negative property value impacts similar to that observed at the Twin Groves Wind Farm in IL. The wind power projects in Clinton and Franklin County were completed in 2008 and 2009. Given that Heintzelman and Tuttle's analysis did not include sales in 2010 or 2011, it is plausible that the observed decrease in values was due to homeowners' uncertainty with potential impacts and would be expected to be temporary, with the market value of these nearby properties returning to the market values of the overall region as the actual impacts of those projects become known. Further supporting this line of reasoning is that the decrease in property values in Franklin and Clinton County, NY was similar to the 18% decline observed by Hinman at the Twin Groves Wind Farm. Before a definite conclusion is reached on the impact of property values in Franklin and Clinton County, NY and its applicability to all wind project installations, it would be important to include analysis of more post-project construction transactions for that region.

While it does appear that anticipation—uncertainty of impacts—can help to explain the property value declines observed in two of the studies reviewed, it is also important to note that not all studies have shown that property values decline at any phase of the wind power project life cycle. In fact, it seems that these occurrences may be more the exception than the general rule and could possibly be explained in how wind project developers, and local and state government manage the project approval process and communication with stakeholders. Actions taken by these entities to reduce uncertainty, such as providing visual and noise simulation, or providing the opportunity for local community members of proposed projects to view first-hand similar projects, combined with studies of impacts from other projects could help reduce uncertainty and prevent any "panic" selling that may occur due to that uncertainty.

Methodology

The research team obtained property sales and parcel records for all of the fifteen towns and cities in Sullivan County, NH— including the Town of Lempster. Real Data Corporation, located in Manchester, NH provided data for transactions occurring from January 2005 through November 2011. The research team only looked at warranty deed sales transactions of single-family homes as these arms-length transactions were deemed to be the best overall indicator of residential property market prices.

A total of 2,593 arms-length single family home sales transactions were statistically analyzed to observe if the Lempster Project had any broad impacts on residential property values in the local area. This analysis grouped sales into two categories for each town or city: 1) Pre-SEC decision, 2) and Post-SEC decision. Pre-SEC decision was for the time period from Jan 2005 up to July 2007 (when the NH Site Evaluation Committee issued a "Decision Issuing Certificate of Site and Facility with Conditions" for Docket No. 2006-01).

The time frame chosen for the PRE-SEC decision was based on expert judgment and believed to best reflect market values immediately leading up to the SEC decision on Lempster. Post-SEC Decision was for the time period from July 2007 through November 2011. The Post-SEC time frame was selected as it provided the maximum time period to observe any impacts of the project and also results in a weighted-average as sales transactions in 2010 and 2011 were weaker in the Sullivan County region overall.

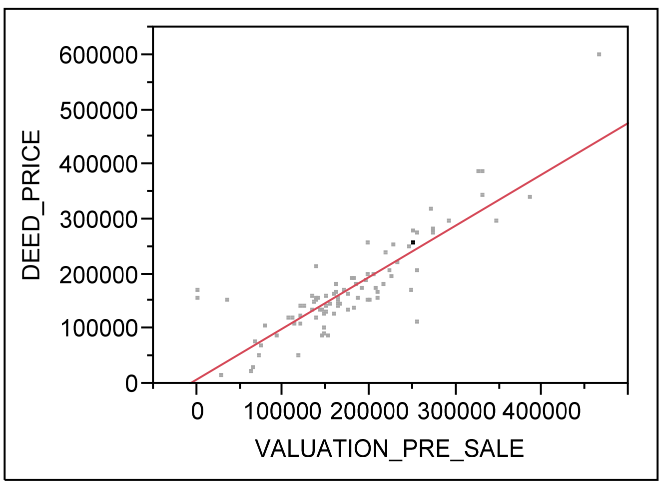
All fifteen towns and cities in Sullivan County were included in this portion of the analysis with the exception of Sunapee. Sunapee was excluded as its average property sales price was well above the regional average and not useful for comparison purposes. The percent difference between average property values was compared across each town to see how property values changed during the period of time before and after the SEC decision. Analysis of Means (ANOM) was a statistical test used to highlight the towns that had average property sales transactions that were statistically different from the overall region.

In addition, 88 property transactions occurred after the construction phase (the construction phase was defined in this study to have ended in September 2008) in the Town of Lempster and the bordering towns of Goshen, Marlow, Unity and Washington. Acworth was not included in this analysis as detailed parcel data was not available from Real Data Corporation for Acworth. These properties were mapped using Geographic Information Software (GIS) and with the assistance of Antrim Wind Energy, LLC, the research team developed a model showing the areas where the Lempster Wind turbines were likely to be visible. Mapped property locations were cross-referenced against the modeled turbine views to determine the properties that were expected to have a view of the turbines. All of these modeled locations were then "ground truthed" or visited by a member of the research team to ensure that they did have a view of the Lempster Wind Power Project. The views in those locations were categorized as either "none," "obscure," or "visible." An obscure view was one where the turbines were somewhat visible but were blocked by some object, typically tree cover.

View impact was tested using ANOVA statistical analysis to see if there was a statistically-significant difference between properties with no view, an obscured view, and a clear view of the turbines. Because of the small sample size, a hedonic analysis (one that uses characteristics of the property to develop an equation for sales price) was not used in this study. Previous studies have used either statistical analysis (as this study does) or a hedonic model.

Statistical analysis showed a strong correlation (0.73 R^2) between the deed price (price of sale) and the presale valuation. This means that, as would be expected, the presale valuation was a good indicator of what the actual deed price was. As such, the view analysis was carried out in two steps: 1) Test to see if the groups that had an obscure view or clear view of one or more turbines had a statistically-significant different presale valuation than groups with no view, and 2) Test to see if the average difference between the deed price and presale valuation for all three categories of view showed a statistically-significantly difference. If there was no statistical difference for both of these tests, than that would indicate that having a view of a turbine did not have a statistically-significant impact on property value. If either of these tests did show a significant difference than that conclusion could not be reached.

Figure 4: Deed Price by Presale Valuation



Nuisance was tested by looking at the correlation between a property's distance to the nearest turbine and the deed price. If distance was a significant factor, then some form of relationship would be expected to be observable.

Analysis

This study did not find any indications of the Lempster Wind Power Project having any statistically-significant, wide area impacts on local area residential properties. Furthermore, this study did not find any evidence to support that having a view of one or more turbines or that proximity to a turbine had any consistent, statistically-significant impacts in relation to residential property values in Lempster or the surrounding local area communities. This is consistent with the findings from other studies, including those reviewed in this analysis.

This analysis did not specifically test for an anticipation impact (a decrease in property values between project announcement and completion), however that does change any of the conclusions from this study as this "anticipation" time period was included in the overall time period analyzed for impacts. It is expected had there been a significant anticipation impact, that it would have been uncovered when comparing the average sales prices in communities around the Lempster Wind Project with the overall region. Table 4 summarizes the findings in this study.

Table 4: Study Findings

Study Author	Date	Scope			Statistically-significant Findings			
		Location	Wind Farm Facilities	Property Transactions	Area Impact	View Impact	Nuisance Impact	Anticipation Impact
Magnusson & Gittell	Jan 2012	Local (1 State: NH)	1	2,593	None	None	None	n/a

Area Impact

In Sullivan County (excluding Sunapee) the average value of a residential property (as witnessed through sales transactions) increased 3% from the 2.5 year period of time before the NH SEC decision on the Lempster Wind Power project to the 3.5 year period afterwards. Lempster and the three surrounding towns of Goshen, Unity and Washington, all showed increases in property value at or above the regional average for Sullivan County. For example, the Town of Lempster's average sales price increased 3% from $166,858 in the period of time before the SEC decision on Lempster to $171,530 in the period of time afterwards. The Town of Acworth was only slightly below the regional average with an increase of 2% in residential property value.

Table 5: Average Sales Price Before and After NH Site Evaluation Committee Decision

Communities	PRE-SEC Decision (JAN 2005 – JUL 2007)	POST-SEC Decision (JUL 2007 – NOV 2011)	Percent Change
ACWORTH*	$ 175,180	$ 178,778	2%
CHARLESTOWN	$ 158,368	$ 163,810	3%
CLAREMONT	$ 157,005	$ 152,361	-3%
CORNISH	$ 233,984	$ 262,030	12%
CROYDON	$ 192,731	$ 220,942	15%
GOSHEN*	$ 162,190	$ 178,020	10%
GRANTHAM	$ 300,068	$ 304,406	1%
LANGDON	$ 240,210	$ 209,875	-13%
LEMPSTER	$ 166,858	$ 171,530	3%
NEWPORT	$ 168,454	$ 154,418	-8%
PLAINFIELD	$ 214,216	$ 251,169	17%
SPRINGFIELD	$ 285,920	$ 262,399	-8%
UNITY*	$ 173,634	$ 207,636	20%
WASHINGTON*	$ 199,509	$ 209,022	5%
Sullivan County (except Sunapee)	**$ 201,214**	**$ 206,481**	**3%**

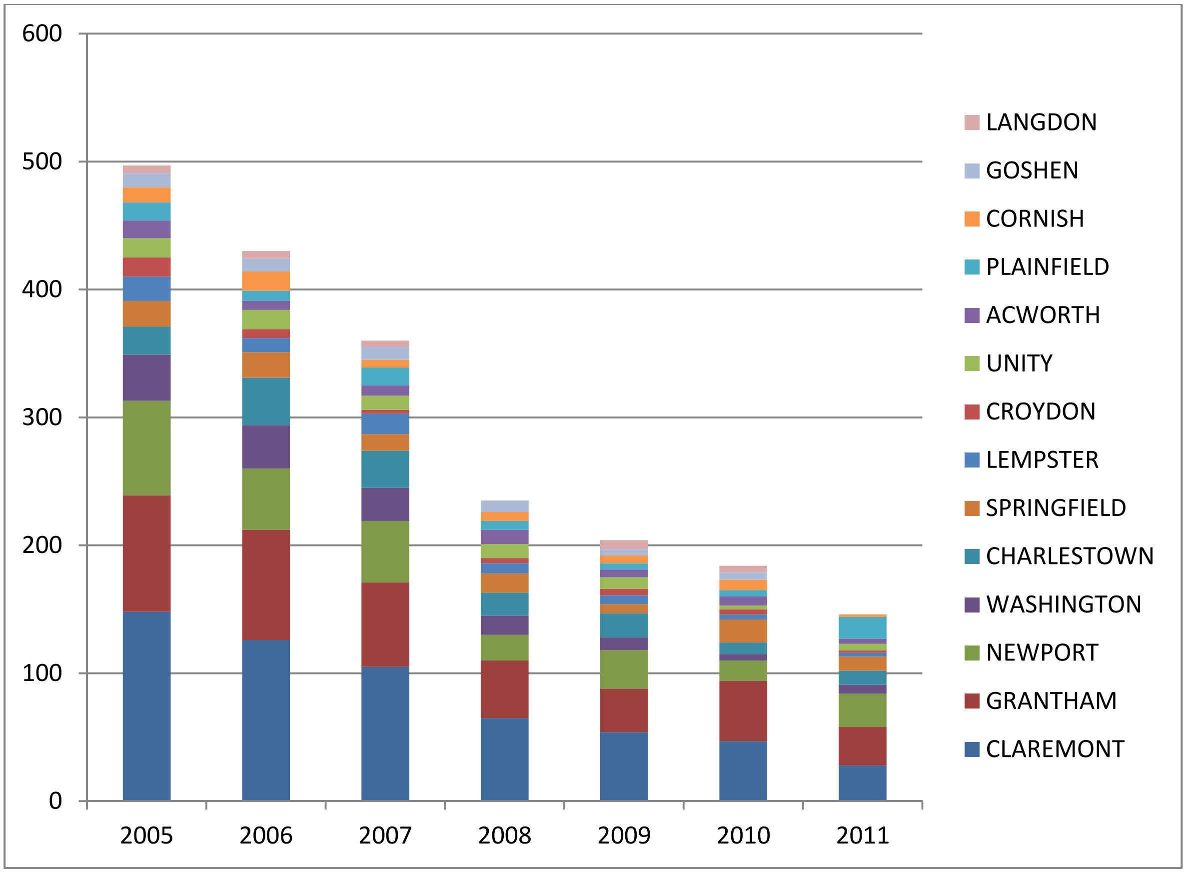
*Towns immediately bordering Lempster

Overall, the region has shown a decline in sales volume, with 2011 sales transactions for Sullivan County (excluding Sunapee) being 30% of 2005 levels. The towns of Acworth, Goshen, Lempster, Unity, and Washington had 19 sales transactions in 2011 (through November 2011) which was 20% of the transaction level observed (95 transactions) in 2005. This steep decline is not unique to Sullivan County or New Hampshire as the overall U.S. housing market has been in a state of decline for the past several years.

Table 6: Sullivan County (excluding Sunapee) Single Family Home Transactions from 2005 through 2011 (NOV)

Town	2005	2006	2007	2008	2009	2010	2011
ACWORTH	14	7	8	11	6	7	4
CHARLESTOWN	22	37	29	18	19	9	11
CLAREMONT	148	126	105	65	54	47	28
CORNISH	12	15	6	7	6	8	2
CROYDON	15	7	3	4	5	4	2
GOSHEN	11	10	10	9	5	6	
GRANTHAM	91	86	66	45	34	47	30
LANGDON	6	6	5		7	5	
LEMPSTER	19	11	16	8	7	4	3
NEWPORT	74	48	48	20	30	16	26
PLAINFIELD	14	8	14	7	5	5	17
SPRINGFIELD	20	20	13	15	7	18	11
UNITY	15	15	11	11	9	3	5
WASHINGTON	36	34	26	15	10	5	7
Total	497	430	360	235	204	184	146

Figure 5: Sullivan County (excluding Sunapee) Single Family Home Transactions from 2005 through 2011 (NOV)



An Analysis of Means (ANOM) statistical test was applied to the average sales price for each town and city in Sullivan County for the period of time before and after the NH SEC decision on the Lempster Wind Power Project. This test highlights any cities or towns that show a statistically-significant difference from the regional average. Figure 7 shows the ANOM test for towns and cities in Sullivan County before the NH SEC decision. A green colored point marking the average sales price indicates that there is not a statistically-significant difference for that community and a red color point indicates that there is a statistically-significant difference in the average sales price for that community.

Before the SEC decision, the City of Claremont and the towns of Charlestown and Newport had average sales prices that were below the regional average and were statistically-significant. The towns of Grantham, Plainfield, and Springfield had average sales prices that were above the regional average and were statistically-significant. While the towns of Acworth, Goshen, Lempster, Unity, and Washington all had average sales prices that were below the regional average, none of these differences were statistically-significant from the regional average.

Figure 6: Sales Transactions in Sullivan County in the Period of Time Preceding the NH SEC Decision (JAN 2005 – July 2007)

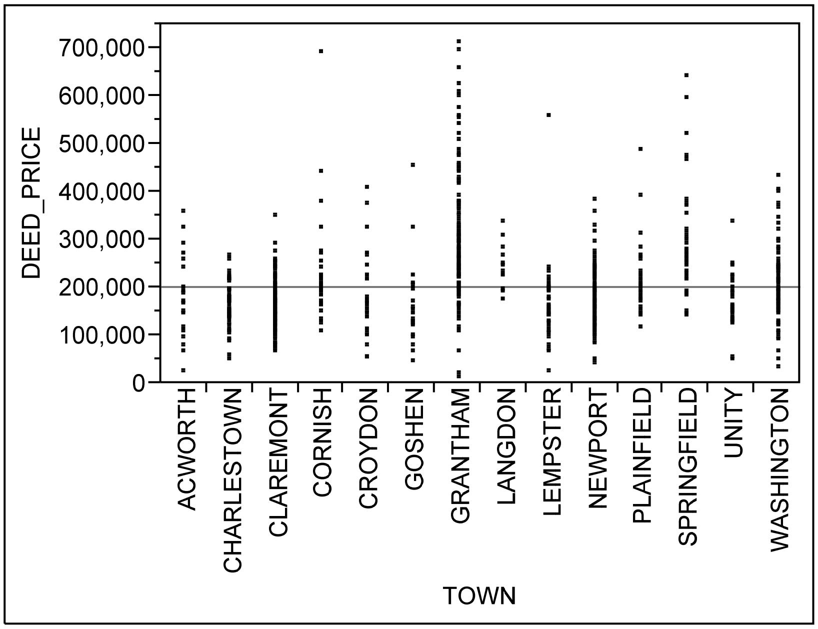


Figure 7: Analysis of Means in Sullivan County in the Period of Time Preceding the NH SEC Decision (JAN 2005 – July 2007)

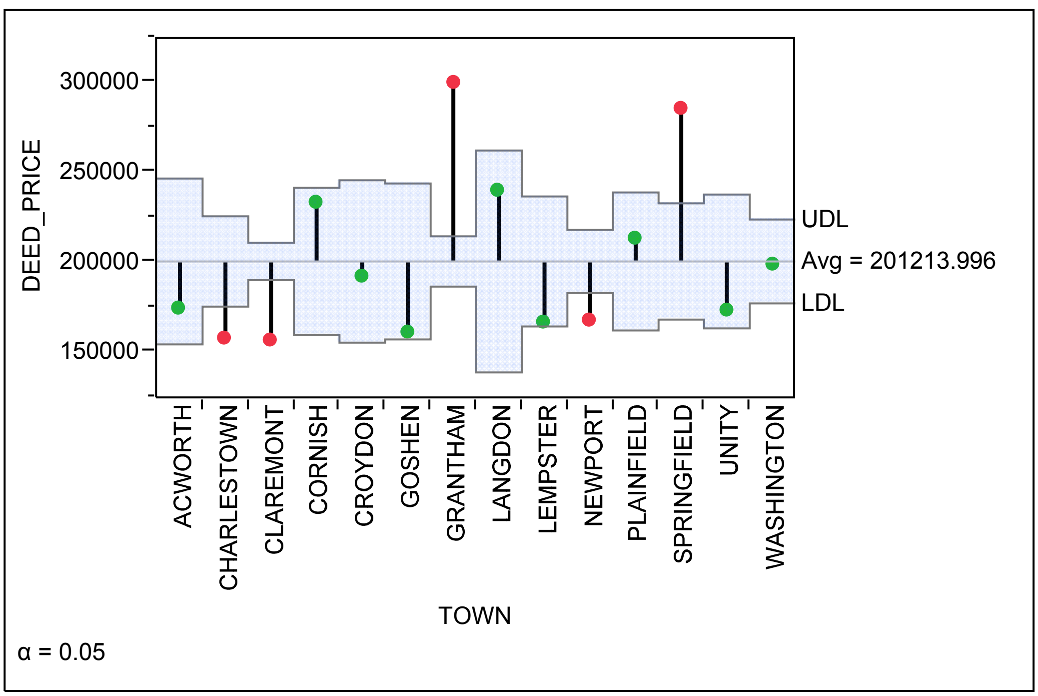


Figure 8: Sales Transactions by Town in the Period of Time After the NH SEC Decision (July 2007 – November 2011)

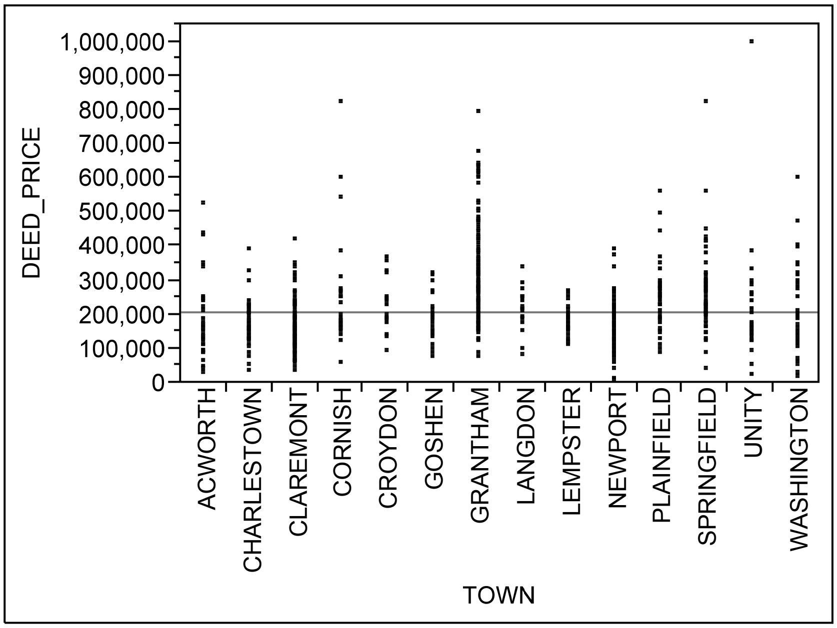
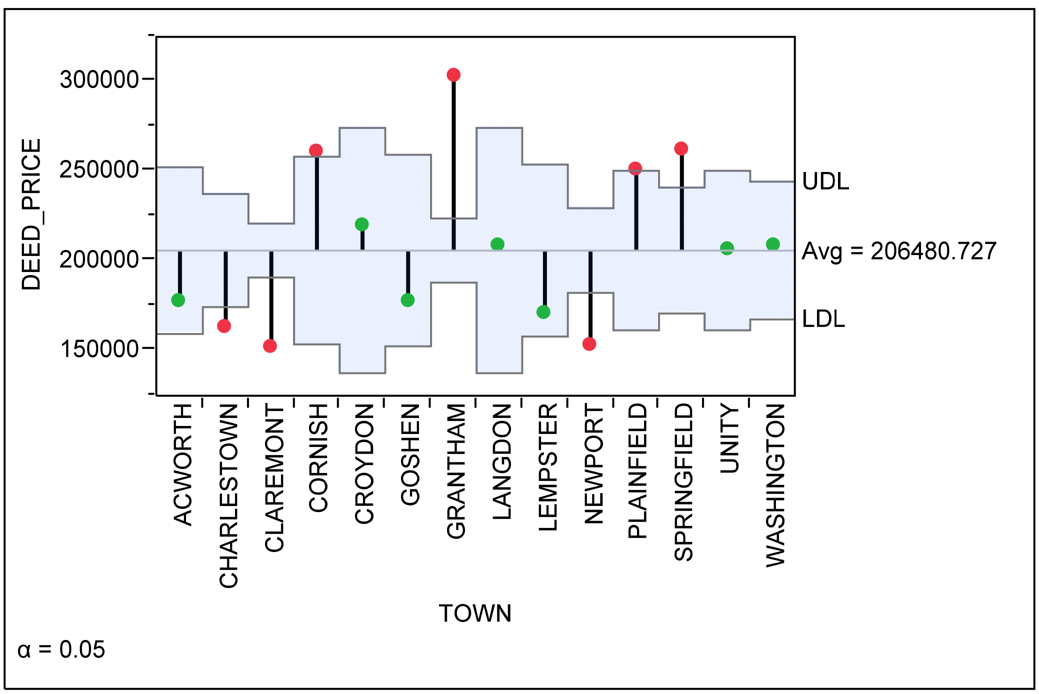


Figure 9: Analysis of Means by Town in the Period of Time After the NH SEC Decision (July 2007 – November 2011)



If the Lempster Wind Power Project had a consistent, observable, and statistically-significant impact on sales prices in Lempster and the surrounding communities, the ANOM test for the period of time after the NH SEC decision would be expected to show the average sales price for the Town of Lempster or other surrounding communities as statistically-significant and below the regional average sales price.

Figure 9 shows that while the towns of Acworth, Goshen, and Lempster all had average sales prices that were below the regional average after the NH SEC decision on Lempster, none of these differences were statistically-significant from the regional average. The Towns of Unity, and Washington had average sales prices that were slightly above the regional average, but the difference was not statistically-significant either. Therefore, there is no evidence to suggest that the Lempster Wind Power project had a consistent and statistically-significant impact on residential property values in Lempster or the nearby towns of Acworth, Goshen, and Washington.

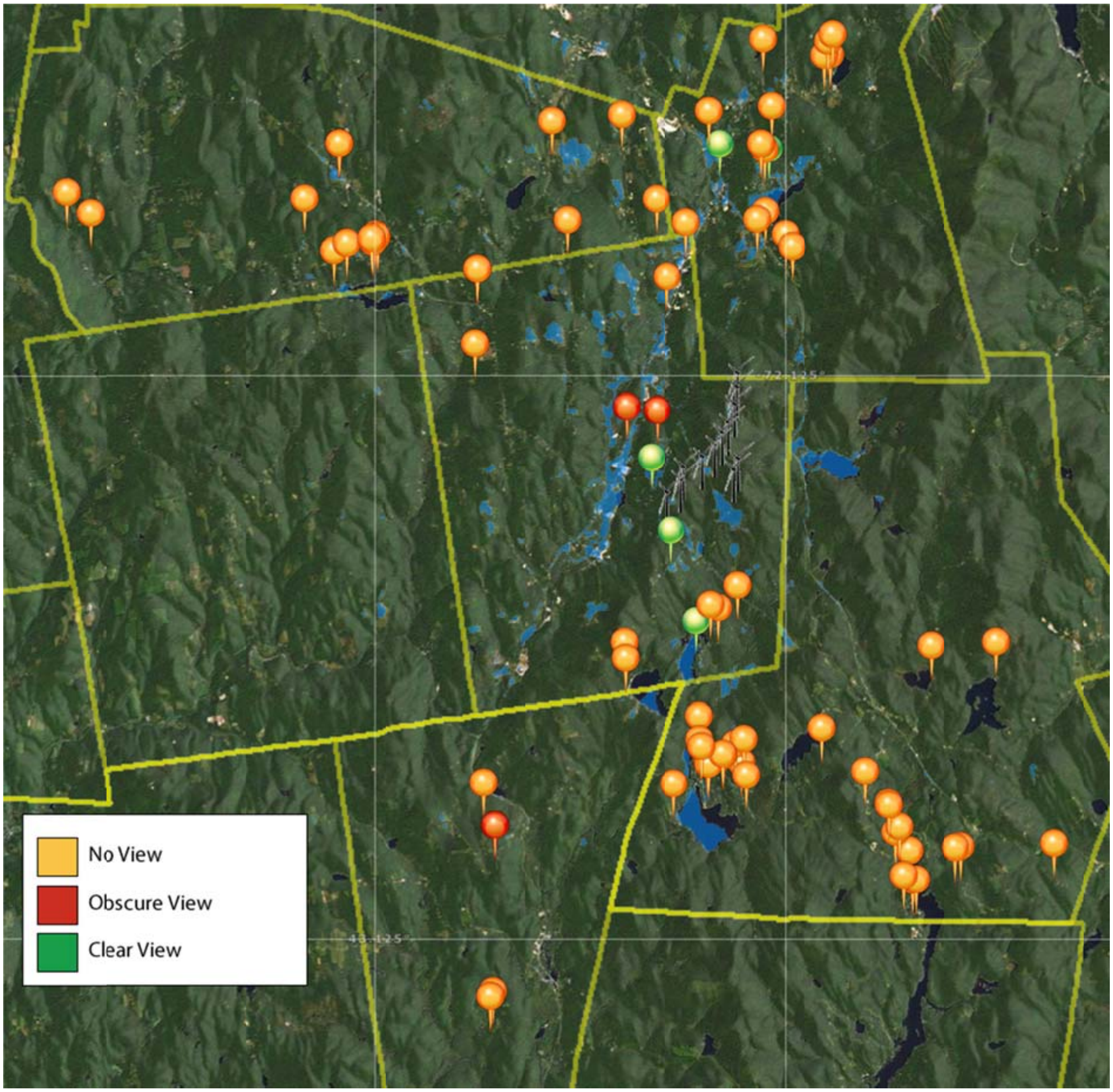
Post Construction Sales Analysis

Overall, 88 arms-length single family home sales transactions were recorded in Lempster and the bordering towns of Acworth, Goshen, Marlow, Unity, and Washington after the construction of the Lempster Wind Power project (September 2008 through November 2011). Three (3.4%) were within a 1-mile radius of the nearest turbine, 16 (18%) were within a 3-mile radius of the nearest turbine, and 52 (59%) were within a 5-mile radius of the nearest turbine. Forty of the property purchasers (45%) reported the purchase was for primary residence and 46 (52%) reported the purchase was not for a primary residence.

Table 7: Sales Transactions from Sep. 2008 to Nov. 2011 by Distance from Nearest Turbine

Distance Miles	Count	Percentage	Cumulative
0-1	3	3.4%	3.4%
1-2	5	5.7%	9.1%
2-3	8	9.1%	18.2%
3-4	11	12.5%	30.7%
4-5	25	28.4%	59.1%
5-6	8	9.1%	68.2%
6-7	14	15.9%	84.1%
7-8	6	6.8%	90.9%
8-9	3	3.4%	94.3%
9-10	1	1.1%	95.5%
10-11	3	3.4%	98.9%
11-12	0	0.0%	98.9%
12-13	1	1.1%	100.0%
Total	88		

Figure 10: Post-Construction Property Transactions & Vegetative View shed in Lempster & Surrounding Communities



Source: Antrim Wind Energy, LLC (Vegetated View Shed)

Figure 10 displays the overlay of the vegetated view shed model (models in tree cover) of the Lempster Wind Power Project developed by Antrim Wind Energy, LLC with post-construction single family home sales obtained from Real Data Corporation. The modeled views were "ground-truthed" by the research team and found to accurately map the actual view shed of the turbines. As the figure illustrates, due to the area's hilly topography and high level of forest cover, views of the turbines in the Project are restricted to a relatively specific range of locations. Modeled view locations are displayed as blue shaded areas in the map. Out of the post-construction property sales in the local region only 9 (10%) of the sales occurred for properties that had an obscure or clear view of one or more of the Lempster turbines.

Post-turbine construction, overall sales transaction volume and average sales price has decreased year over year in Lempster and the surrounding towns. This is not unique to this area as the overall NH and U.S. economy has been in a very weak housing marketing. In 2011, sales volume in NH increased only 1.8% and Sullivan County sales volume only increased 0.9%. The median sales price in NH decreased by 6.2% from 215,000 to 201,700. Sullivan County showed an overall decline of 10.3% with the median sales price decreasing from $155,500 to $139,500. [17]

Figure 11: Sales Transactions from Sep. 2008 to Nov. 2011 by Wind Project View

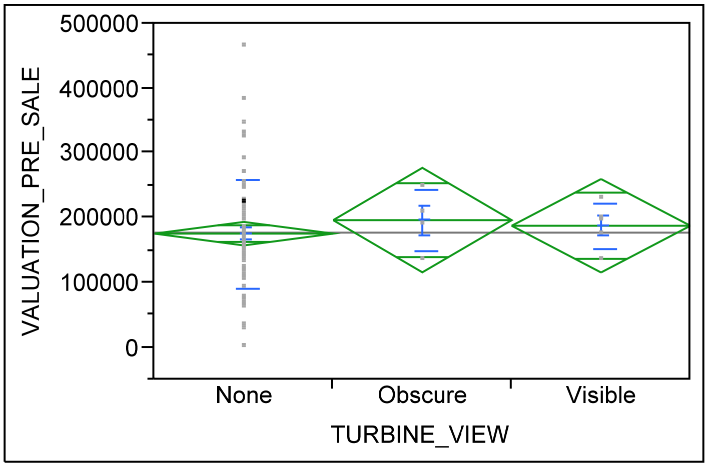
	2008 (Q4 only)		2009		2010		2011 (thru Nov.)		Total	
	Sales	Average Price	Sales	Average Price	Sales	Average Price	Sales	Average Price	Sales	Average Price
GOSHEN	5	$126,146	5	$153,200	6	$198,333			16	$161,625
None	4	$120,950	4	$154,000	6	$198,333			14	$163,143
Visible	1	$146,933	1	$150,000					2	$148,6.5
LEMPSTER	2	$167,500	7	$174,857	4	$171,300	3	$122,333	16	$163,625
None	1	$180,000	3	$158,333	4	$171,300	3	$122,333	11	$155,545
Obscure	1	$155,000	1	$164,533					2	$159,766
Visible			3	$194,667					3	$194,667
MARLOW	2	$223,500	4	$130,000	1	$255,000	2	$134,000	9	$165,556
None	1	$275,000	4	$130,000			2	$134,000	7	$151,143
Obscure	1	$172,000			1	$255,000			2	$213,500
UNITY	1	$139,933	9	$227,778	3	$165,333	5	$151,387	18	$191,667
None	1	$139,933	9	$227,778	3	$165,333	5	$151,387	18	$191,667
WASHINGTON	7	$251,000	10	$161,6.5	5	$142,3.2	7	$163,857	29	$180,207
None	7	$251,000	10	$161,6.5	5	$142,3.2	7	$163,857	29	$180,207
Total	17	$194,118	35	$176,714	19	$175,789	17	$149,941	88	$174,580

Visual Impact

Statistical testing did not show a statistically-significant difference between the average presale valuation price of properties with no view, an obscure view, or a clear view of one or more turbines. Furthermore, there was not a statistically-significant difference between the sales price and the presale valuation for any of these groups. While caution must be used due to the small sample size, there is no evidence to support that an obscure or clear view of a wind turbine reduced the selling price of a property below what it should have been. This finding is consistent with other studies reviewed.

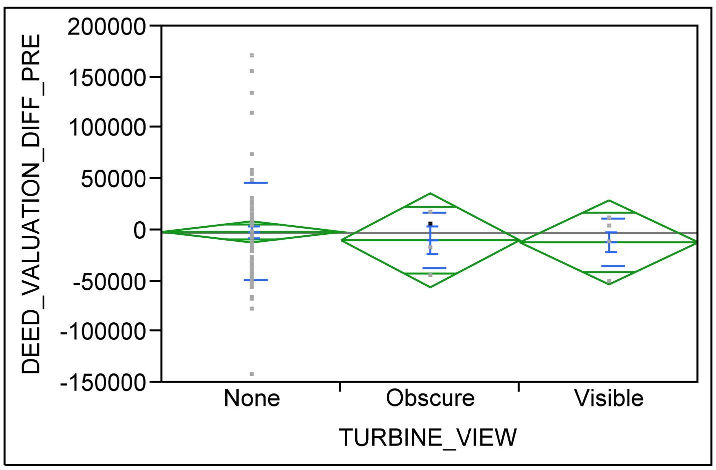
[17] "December 2011 Residential Sales: New Hampshire," New Hampshire Association of Realtors., Available online at http://www.nhar.org/filemanager/download/32461/

Figure 12: Analysis of Variance for Pre-sale Valuations of Post-Construction Property Sales



Source	DF	Sum of Squares	Mean Square	F Ratio	Prob > F
TURBINE_VIEW	2	2263024199	1.1315e+9	0.1714	0.8428

Figure 13: Analysis of Variance Between Sales Transaction Price and Pre-Sale Valuation

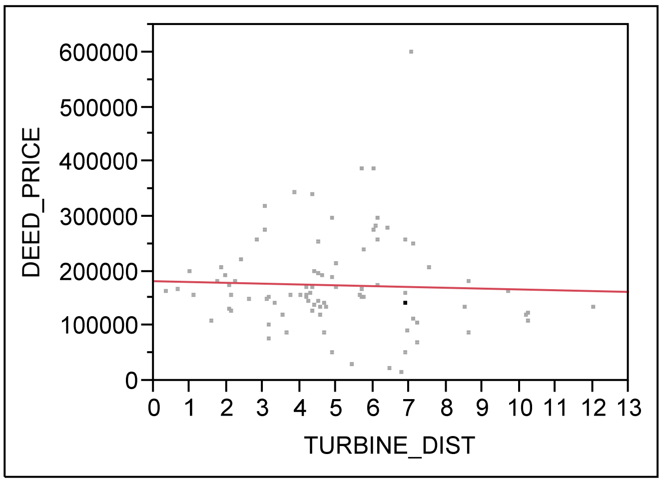


Source	DF	Sum of Squares	Mean Square	F Ratio	Prob > F
TURBINE_VIEW	2	712133056	356066528	0.1647	0.8484

Nuisance Impact

Nuisance impact would be observable by looking at a correlation between distance from the nearest turbine and sales price. There was no correlation between turbine distance and sales price (0.002 R^2). For comparison purposes, acreage and square footage were also tested for correlation. Interestingly, acreage has basically no correlation with sales price (0.02 R^2), presumably as Lempster is a rural area and acreage is generally not scarce. However, square footage (as would be expected) does have a correlation (0.27 R^2), meaning that larger homes tend to sell for more than smaller homes, all other factors being equal. This finding of no nuisance factor is consistent with most other studies; however the sample size for properties very close to a turbine is very small, so caution must be used, especially at short distances.

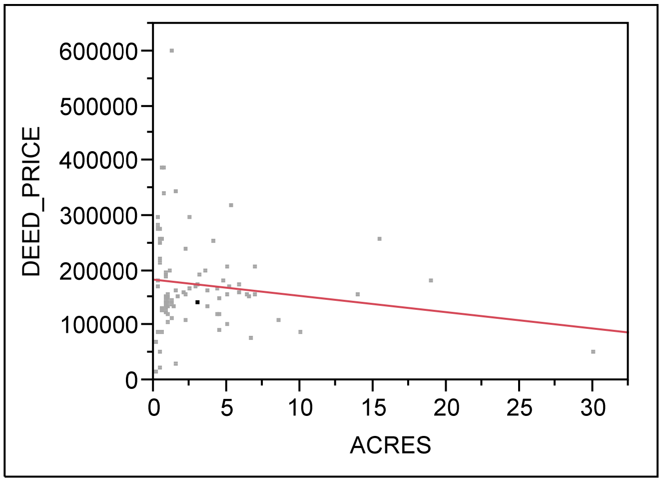
Figure 14: Correlation of Sales Price to Turbine Distance



Summary of Fit

RSquare	0.001568
RSquare Adj	-0.01004
Root Mean Square Error	88601.82
Mean of Response	174580.3
Observations (or Sum Wgts)	88

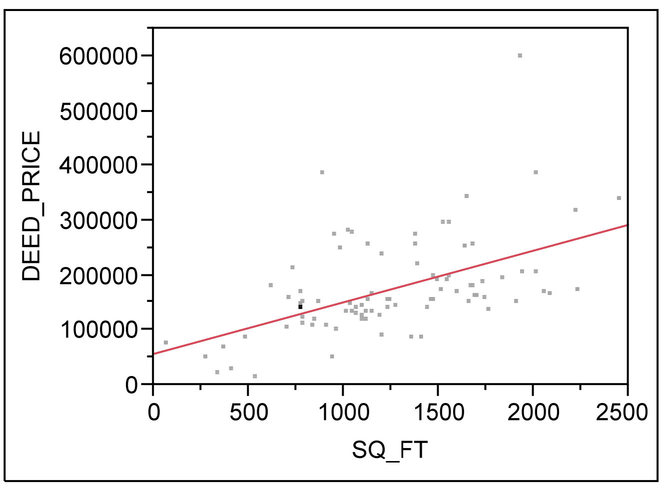
Figure 15: Correlation of Sales Price to Acreage



Summary of Fit

RSquare	0.022509
RSquare Adj	0.011143
Root Mean Square Error	87667.71
Mean of Response	174580.3
Observations (or Sum Wgts)	88

Figure 16: Correlation of Sales Price to Square Footage



Summary of Fit

RSquare	0.269353
RSquare Adj	0.260857
Root Mean Square Error	75794.42
Mean of Response	174580.3
Observations (or Sum Wgts)	88

Additional Discussion

Another indicator of impacts would be residential complaints or similar actions. Research identified four distinct "complaints". Iberdrola established a noise hotline after the Project was constructed, whose phone number is posted in the Lempster Town Hall. As of October 2009, Iberdrola had reported that two noise complaints had been received by the hotline.[18] In addition, the Town of Lempster has had two instances of tax abatement requests that were in part related to the wind project. The low number of complaints supports the overall finding of this study that while there is the possibility of isolated impacts that they are not expected to be consistent, wide spread, or statistically-significant.

Table 8: Iberdrola Hotline Noise Complaints through October 2009

Date	Complaint	Outcome
Aug-09	Resident located 1-mile from wind farm complained about noise from the wind farm.	Follow-up investigation found that there was a problem with the resident's hearing aid and that there was no noise audible from the Project.
Sep-09	Resident on Guildford Road (very close proximity to wind turbines) reported noise was noticeable at times.	A formal complaint was not filed.

Source: RSG, Inc.

Table 9: Lempster History of Abatement Requests

Assessment Date	Complaint	Outcome
May-09	Participating landowner stated "it's like living next to an airport" on abatement request, which also requested adjustment on other non-wind project related items.[19]	While the assessor noted, "it is not nearly the same (as living next to an airport)", the assessor did adjust several non-related items, but also recommended "Reduce view factor from 475 to 450…Add 10% economic depreciation for windmill close by" due to the Lempster Wind Project.
Jun-10	Resident on Guilford Road was concerned of over assessment due to proximity to one of the wind turbines.	Assessor adjusted several non-related items on property but did include an adjustment related to the wind project. Recommending "…the land lines be conditioned at 95 to reflect buyer resistance to the homes proximity to a wind mill."

Source: Town of Lempster Tax Records

[18] "Lempster Mountain Wind Farm: Post Construction Sound Survey," RSG, Inc., October 2009, Available online at http://www.nhsec.nh.gov/2006-01/documents/091104sound_report.pdf

[19] Note, landowner has a wind turbine installed less than 500 feet from the residence, which is much closer than is typical and is over 5 times as close as any turbine is to any participating or non-participating landowner in the Antrim Wind Project.

Conclusion

Given the significant investment that a residential property requires, it is not unreasonable to expect that homeowners would be concerned about the potential impacts of any significant infrastructure project nearby to that property, including wind power projects. This study analyzed property transactions from the end of construction of the Lempster Wind Power Project through November 2011. In that time period, 88 arms-length sales transactions for single family homes were conducted in the towns of Goshen, Lempster, Marlow, Unity, and Washington.

There were very few transactions within a very close distance to the turbines, and also very limited sales of properties with views of turbines, so some caution must be used in interpreting these results. Nevertheless, this analysis did not find any statistically-significant difference between the sales of homes within the view of one or more turbines and those with no view of a turbine. The analysis also did not find any evidence to indicate that distance to turbines (any indicator of nuisance) had any impact on sales price. Furthermore a review of over 2,500 property sales transactions in Sullivan County did not find any evidence to suggest that the property values in Lempster and neighboring communites were negatively impacted by the Lempster Wind Power Project relative to the overall region.

In some isolated cases (not observed in the case of the Lempster Wind Power Project), it appears that uncertainty about the impacts have resulted in a temporary decrease in value for properties located close to proposed wind power projects. It is expected that the process by which wind project developers and state and local government can help manage property owners' concerns will help reduce the potential for property values to sell for below their expected value during the phase between project announcement and completion.

All wind energy projects have their own unique characteristics and projects in New Hampshire tend to be located in hilly, highly forested regions. An important feature of the Lempster Wind Power Project, which is similar to the Antrim Wind Project, is that the area's hilly terrain and high level of forest cover obscure or block views of the turbines and limit clear visibility of the turbines to a relatively limited number of locations.

Another significant project in New England comparable to the Lempster Wind Power Project is the 11 turbine Searsburg Wind Power Project in Vermont. This project is located in topography similar to that of Lempster and has existed since 1997. Analysis of property transactions has not shown statistically-significant changes in property values in the Searsburg region as a result of that wind energy project.

Based on the analysis conducted in this study and taking into account other studies— based on arms-length sales property transactions—there is no evidence to suggest that the Lempster Wind Power Project has had any consistent, observable, statistically-significant impact on property values in Lempster or the communities surrounding the Project.

Energy Usage and Conservation

Antrim, like the rest of New Hampshire, is feeling the pinch when it comes to rising energy costs. Our appetite for more and more energy hits us in the pocketbook while damaging the environment.

There is no question that Antrim residents want to do something to reduce energy consumption not only to hold our costs down but to reduce the effects of global warming. Antrim was one of 164 towns in New Hampshire to adopt the New Hampshire Climate Change Resolution in 2007.

The resolution reads:

> ***"Whereas, The protection of our forests, air and water quality, fisheries and other natural resources are important to the health and quality of life of our citizens; and***
>
> ***"Whereas, There is evidence that climate change is already impacting New Hampshire's environment and natural resources, from increased intensity of storms, higher sea level, less snow cover, and more winter rain; and***
>
> ***"Whereas, New Hampshire state government has taken steps to lead by example by reducing energy use of state operations and committing to an overall state goal of using 25 percent renewable energy by 2025; and***
>
> ***"Whereas, The residents of many New Hampshire towns passed the New Hampshire Climate Change Resolution, calling for a national program to reduce U.S. greenhouse gas emissions while protecting the U.S. economy, to create a major national research initiative to foster rapid development of sustainable energy technologies, and encouraging towns to start local energy committees to seek ways to save energy, reduce emissions and save taxpayer dollars;***
>
> ***"Now, therefore, I John Lynch, Governor and the Executive Council of the State of New Hampshire, do hereby commend the New Hampshire Climate Change Resolution and local volunteers for bringing this issue to New Hampshire's town meetings and community leaders."***

Credit for Information That Follows

Before proceeding further, it should be noted that much of the information and data that follows was gathered from the Regional Planning Commission's master plan energy chapter for the Rockingham Planning Commission. It, in turn, relied heavily on the Intergovernmental Panel on Climate Change (IPCC) reports. The IPCC was formed in 1988 through the United Nations Environmental Programme and the World Meteorological Organization. The Regional Planning Commission says the IPCC's latest report, released in 2007, "is well regarded as the single most comprehensive and unbiased report on climate change." The Regional Planning Commission also said in its conclusion of the chapter, "…this chapter has been developed in a modular format to serve as a template for communities to amend and adopt into their master plan. It offered a background on the scientific data of global warming, depicted the baseline energy consumption trends of the region and summarized current programs. When this plan is combined with community energy information and community goals it could serve as an action plan to guide communities towards reduction of energy use and greenhouse gas emissions."

Impact of Global Warming on New Hampshire

Global warming is caused by the greenhouse effect. Just as a real greenhouse produces heat from the sun shining into it, the earth's atmosphere allows solar radiation to be absorbed by the earth's surface. When absorbed, the radiation is converted to heat and emitted as infrared radiation into the atmosphere. Some gases such as carbon dioxide, methane, chlorofluorocarbons, nitrous oxide, ozone, and water vapor absorb some of the infrared radiation which causes the earth's atmosphere to heat up.

Scientists have taken ice cores in Antarctica which show the correlation between carbon dioxide and temperature changes for the past 400,000 years. As carbon dioxide levels increase, so do atmospheric temperatures; when they fall, temperatures also fall. Scientists have found that historically, carbon dioxide levels have varied between 180 parts per million by volume (ppmv) to 300 ppmv. According to the National Oceanic and Atmospheric Association (NOAA), estimates of atmospheric carbon dioxide reached 386 ppmv in 2007.

How has this affected New Hampshire? According to C.P. Wake at the University of New Hampshire's Climate Change Research Center, in *Indicators of Climate Change in the Northeast*, 2005, there have been notable changes. The weather has become hotter, wetter, and more extreme.

- Average Northeast Temperature Change from 1899 to 2000: annual, up 1.8º; winter, up 2.8º; spring, up 1.9º; summer, up 1.7º; fall, up 0.7º.
- Total precipitation has increased 3.3 inches from 1899 to 2000 and the frequency of extreme precipitation events also has increased.
- Snowfall has decreased significantly in northern New England and northern New York from 1970 to 2000.
- Days with snow on the ground have decreased 16 days from 1970 to 2000.
- Ice-out of lakes occurs 9 days earlier in the northern/mountainous regions and 16 days earlier in the southern regions of New England from 1850 to 2000.
- Sea surface temperatures have increased 1.1º in the Gulf of Maine from 1880 to 2001.
- Relative sea level has increased 16 inches at New York City from 1856 to 2001.
- Growing season has increased by 8 days from 1899 to 2000.
- Lilac bloom dates are 4 days earlier and apple and grape bloom dates are 8 days earlier from 1965 to 2000.

How This Affects New Hampshire

Shorter, warmer winters mean fewer tourism dollars for skiing, snowmobiling, and ice fishing, according to Eric Steltzer, regional planner with the Rockingham Planning Commission. Its master plan says, "agricultural industry will be affected by a longer growing season and habitat changes which will affect crop output. Specifically, maple syrup production is shown to begin 10 days earlier, end 10 days later and the syrup runs for approximately 3 days shorter compared to 40 years ago. The seacoast areas will be affected by sea level rises and the increase in storm intensity, causing insurance companies to pull their coverage for coastal areas… The health industry will be affected by increased respiratory and heat related illnesses."

New Hampshire's Power Usage

Global warming is not our only problem. Our energy usage has increased at an alarming rate. In 1990, the total energy consumption in New Hampshire was 264.6 trillion British Thermal Units (BTUs).[1] At that time the state population was 1,109,117, which means each resident consumed 239 million BTUs. By 2004, the state's energy consumption had grown by 28.7% to 340.6 trillion BTUs, but the population grew by only 17.1%. The energy consumption per capita in 2004 rose to 262 million BTUs or a 9% increase from 1990 to 2004.

Breaking down energy usage by sectors, the commercial sector grew 73.8% from 1990 to 2004. Transportation grew 49.6% for the same period. The residential sector in 1994 consumed 29.8% of the state's energy making it the state's largest consumer sector. From 1994 to 2004, the residential consumer sector grew 26.4%. It was second only to the growth in transportation.

Petroleum products, including gasoline, propane, home heating oil, and diesel, are the primary fuel sources, providing 60% of the energy used between 1990 and 2004. The use of natural gas has increased dramatically over those 14 years. In 1990, the primary use for natural gas was for heating and accounted for only 5.5% of total energy consumption. By 2004 it had become the third largest fuel source, accounting for 18.9% of total energy consumed. In 1990 there were no natural gas power plants. By 2004 several natural gas plants came on line, producing 5.4 million megawatt hours, or 22.6% of all electricity generated in New Hampshire.

The Seabrook nuclear power plant is the largest in New England. It is the largest source of electricity in the state, producing 42.6% of the state's needs. However, because Seabrook accounts for a lot of electrical output, 34.2% of its generation is exported out of New Hampshire. Renewable energy provided only 4% of the state's energy needs in 2004. Coal usage in the U.S. as a whole accounts for 50% of the electricity generated. In New Hampshire, coal accounts for 17.1% of the generation.

Energy use patterns in New Hampshire are similar to the rest of New England. Per capita use for our state is 262 million BTUs, compared to 258 million BTUs for the rest of New England. However, New Hampshire fares better when compared to the rest of the U.S. which consumes 341 million BTUs per capita.

One of the key motivations in becoming more energy efficient is the rising price of fuel. Oil prices have risen drastically during the last quarter of 2007. The price of oil flirted with the $100

[1] A BTU is defined as the amount of energy required to raise the temperature of one pound of water 1 degree Fahrenheit. To put it into perspective, burning a cord of wood produces roughly 20 million BTUs.

per barrel range in the last quarter of 2007. The table below provides a perspective on the growth of energy prices since 1990.

Fuel	Price in 1990	Price
No. 2 Oil ($/gallon, excluding tax)	$1.25	$ 3.85, March 2008
Natural Gas ($/1000 cubic feet)	$7.80	$ 19.01, July 2008
Propane ($/gallon, excluding tax)	$1.25	$ 3.12, March 2008
Gasoline ($/gallon, excluding tax)	$0.95	$ 3.59, Sept. 2008
Electricity (cents/kilowatt hour)	10.05¢	15.75¢, May 2008

Source: Energy Information Administration

New Hampshire's Carbon Dioxide Emissions

Global warming is tightly bound with carbon dioxide emissions (other gases, such as methane also play a role). However, carbon dioxide emissions are pervasive in our society. Between 1990 and 2004, carbon dioxide emissions in New Hampshire have increased by 33%. Historically, the transportation sector has been the number one emitter of carbon dioxide. However, between 2002 and 2004 emissions from the electric power sector increased sharply. The table below shows the trend for each sector.

Carbon Dioxide Emissions in Million Metric Tons[2]

Sector	1990	2004	Percent Increase
Residential	2.4	3.4	41%
Commercial	1.3	1.8	38%
Industrial	0.9	1.2	33%
Transportation	5.1	7.7	50%
Electric Power	4.8	7.8	63%
Total	**14.6**	**21.8**	**49%**

New Hampshire Regulations

The problems associated with the drastic increase in energy usage and the accompanying increase in greenhouse gas emissions have not gone unnoticed by the state. New Hampshire has a number of regulations that support and encourage energy conservation and use of renewable energy sources.

- RSA 672:1 III-a states: "Proper regulations encourage energy efficient patterns of development, the use of solar energy, including adequate access to direct sunlight for solar energy uses, and the use of other renewable forms of energy, and energy conservation. Therefore, zoning ordinances should not unreasonably limit installation of solar, wind, or other renewable energy systems or the building of structures that facilitate the collection of renewable energy, except where necessary to protect the public health, safety, and welfare."

- RSA 21-I:19-d allows a municipality to contract with a pre-qualified energy service company to make energy efficient upgrades to be financed through the energy service company and to be paid off over time through the energy savings. There are no upfront capital costs for the municipality. A performance contract also protects the municipality by requiring the company to meet a certain reduction in energy use. If the goal is not met, the company pays the difference in the energy bill.

- RSA 72:61-72 allows municipalities to offer a property tax exemption on solar, wind and woodheating energy systems. The systems include solar hot water, solar photovoltaic, wind turbine or central wood heating systems (not including stovetops or wood stoves). As of 2006, Antrim does not offer property tax exemptions for these renewable energy resources.

- RSA 53-E allows residents, businesses and municipalities to form a Community Choice Aggregate (CCA) to combine their electrical demand in order to receive a reduction in price.

Be Innovative in Our Thinking and Implementation

Antrim should look at the obvious forms of energy conservation, but it shouldn't be afraid to encourage innovative solutions for some of the larger projects. Below are three examples of how other municipalities solved energy problems while saving money and increasing energy efficiencies at the same time. It should be noted here that while the Town of Antrim believes that energy conservation should be everyone's concern and responsibility, the following section should not be viewed as suggesting a mandate to non-residential users or potential businesses. We believe that commercial and manufacturing concerns will know best how to mitigate their energy needs and will take responsible steps in that direction as needed, steps that may be encouraged through reasonable and flexible regulations of the town.

Epping Energy Efficiency Article 22

In early 2007, the voters in Epping, New Hampshire, approved Article 22 which requires new non-residential buildings to implement energy efficiency and production, energy conservation, and sustainable design principles. A point system was established and non-residential buildings must earn a certain number of points based on their square footage. For example, a building 5,000 square feet or less must earn 5 points. A building of 50,001 square feet or larger must earn 25 points. Use of wind, photovoltaic panels, fuel cell based co-generation, use of biomass and bio-synthetic oil co-generation are among the ways designers can earn points.

Clay Mitchell, town planner, said TD Banknorth originally came forward with a design for a bank that met the 5 points necessary for approval. However, later it returned with a new design which achieved 15 points – the highest yet proposed for a building. Among the design changes was a system for using gray water to flush toilets and a solar power array for generating electricity.

Another business which supplies bricks, stones and masonry supplies constructed a new 4,000 square foot showroom. It features windows sealed with foam insulation which is better than fiberglass; four furnaces that eliminate trying to heat the showroom from a distance with the attendant heat loss. The company also recycles the water used in cutting and finishing counter tops to help reduce water consumption and keep from polluting streams.

Some Epping residents felt the innovative energy provision might put a damper on development. However, Mitchell said that businesses are using it as a selling tool in promoting their businesses.

Waste Water Treatment Plant

Up until 2003, the wastewater treatment plant in Essex Junction, Vermont, used only half of its waste methane gas produced by its anaerobic digester to fire the boiler that heated the digester. The remaining methane was flared because methane is 20 times more effective at trapping heat than carbon dioxide.

The facility officials had been considering installing a combined heat and power (CHP) system and power it with methane from the digester. However, they weren't sure that sufficient digester temperatures could be maintained. Also, it was not clear that it would meet the governing board's 7-year payback period. The system also would be required to emit no more pollutants than flaring methane.

Funding was found through various organizations and governmental agencies. Northern Power designed micro-turbines that can run either on methane or natural gas. Before the co-generation was installed, the treatment plant paid out $100,000 per year for electricity. After installation, electric costs dropped $37,000. At first it was assumed the micro-turbines would operate a total for both of 40 hours per day. However, both have run for a total of 48 hours per day, saving 80,000 kwh of electricity per year.

Other benefits of the project include preventing carbon dioxide emissions of 600,000 pounds per year, using nearly 100% of its waste methane, compared to 50% before, and demonstrating the viability of methane-fired cogeneration at a small facility (Essex Junction has a daily average flow of 2 million gallons per day).

Gas-To-Energy Project

In Antioch Village, Illinois, a closed 51-acre landfill was authorized by the U.S. Environmental Protection Agency to be used as a source of methane gas. The gas will be used to heat and power the Antioch Community High School only half a mile away.

The landfill holds about 2 million tons of waste. With the help of grants and bonding, the $1.9 million project will heat the 262,000 square foot school and generate 360 kw of power. The power and electricity will be generated by 12 Capstone MicroTurbines located on school property. Any additional electricity generated is to be sold back to the power company. Each microturbine produces 290,000 BTUs per hour at 550º F. The exhaust from the turbines is routed through a waste heat recovery system. By varying flow and inlet fluid temperature a wide variety of needs can be met for hot water.

When waste heat recovery is not required, the exhaust can automatically be diverted around the exchanger, permitting electrical output only. Also, during months when the school is not in use, all of the heat from the waste heat recovery system is diverted to other area businesses or industries. Starting in 2003, the annual savings to the school in energy costs was estimated to be over $100,000 annually.

Some of the other benefits of the project include:

- Low energy costs for the high school.
- Revenue from sale of electricity to the power company.
- Clean, complete combustion of waste methane gas.
- Waste heat for internal use in the high school.
- Reduced greenhouse gas emissions.

Biodiesel - An Alternative to Petroleum Diesel

Antrim should look into using biodiesel to power its diesel engines. Biodiesel is made from vegetable oils (commonly soy), animal fats or recycled waste grease. It can be used alone or it can be blended with petroleum diesel fuel. When used in its pure state it may cause damage to rubber parts. However when it is blended with petroleum fuel at a 20% rate of biodiesel to 80% regular diesel, no damage to engines will occur, according to the National Biodiesel Board.

The advantage of using a blend of biodiesel is that it will dramatically reduce emissions and lessen our dependency on foreign oil.

The table below shows the reduction of air pollution for pure biodiesel (B100) and a 20% blend of Biodiesel with 80% petroleum diesel (B20).

Average Biodiesel Emissions Compared to Conventional Diesel, According to EPA

Emission Type	B100	B20
Regulated		
Total Unburned Hydrocarbons	-67%	-20%
Carbon Monoxide	-48%	-12%
Particulate Matter	-47%	-12%
Nox (various nitrous oxides)	+10%	+2% to -2%
Non-Regulated		
Sulfates	-100%	-20%
PAH (Polycyclic Aromatic Hydrocarbons)	-80%	-13%
nPAH (nitrated PAH's)	-90%	-50%
Ozone potential of speciated HC	-50%	-10%

According to the biodiesel website (www.biodiesel.org), “sulfur emissions are essentially eliminated with pure biodiesel.” Sulfur emissions are major components of acid rain. Also, the smog forming potential of biodiesel is less than that for regular diesel fuel.

Antrim looked into using biodiesel previously, but there was concern over whether it would gel up during winter. According to the biodiesel.org website, “biodiesel will gel in very cold temperatures, just as the common #2 diesel does….typical blends of 20% biodiesel are managed with the same fuel management techniques as #2 diesel.” Minnesota has been running a biodiesel program for several years, apparently with no problems due to cold temperatures.

Tests have also shown that B20 provides similar engine performance as regular diesel fuel. It was consumed at a similar rate as #2 diesel with horsepower, torque, and haulage rates equivalent to those engines using conventional diesel fuel.

Other municipalities, organizations and the state are using biodiesel including the City of Keene, Keene State College, the University of New Hampshire and the New Hampshire Department of Transportation. In addition, Rymes Heating Oils, Inc. provides biodiesel fuel.

Antrim should take another look at biodiesel fuel.

Perform Public and Private Energy Audits

In late 2007 Antrim formed an energy committee to look at energy usage and to find ways to eliminate wasted energy and improve efficiencies. The first task of the committee was to audit the energy usage in the town’s public buildings and vehicles. The committee also sold energy saving compact fluorescent bulbs at little or no cost to residents. The program was well received and almost all the bulbs were sold. The committee likely will offer a similar program in the future.

For individuals there are many ways to cut energy usage. Public Service of New Hampshire (PSNH) points out that “if every American home replaced their five most frequently used lights or the bulbs in them with ones that have earned the ENERGY STAR, each home would save about $60 a year in energy costs, and together we’d save about $6.5 billion each year in energy costs and prevent greenhouse gases equivalent to the emissions from more than eight million cars.”

Also consider having a professional energy audit performed on your house. Go to www.psnh.com for more information about what is involved in an energy audit of your home.

PSNH offers a free lighting catalog which lists many energy efficient products that customers can use to cut their electricity bill and save power at the same time. PSNH’s website offers ideas and products under its efficiency programs including:

- Energy Star Homes
- Home Energy Solutions
- Home Energy Assistance
- Energy Star Lighting
- Energy Star Appliances

- HEATSMART
- Renewable Rate
- Tax Incentives
- Tools and Calculators

Antrim's Recent Conservation Measures

In 2003 and 2004, Antrim began looking seriously at ways to use electricity more efficiently. Working with Public Service of New Hampshire (PSNH), the town embarked on a street light replacement program to replace older inefficient lighting systems with newer more energy efficient systems. It also entered into another agreement with PSNH to determine what changes in power use could be made to make town buildings more efficient.

PSNH did a study of Antrim's street lighting. It suggested the town convert from the Municipal Outdoor Lighting *Rate OL* to the Energy Efficient Outdoor Lighting *Rate EOL*. To make the conversion Antrim would change over existing street lights to either high efficiency high pressure sodium or all-metal halide. The study indicated the following:

	Conversion Cost	Annual Savings	Simple Payback Period
High Pressure Sodium	$33,863	$5,168	6.6 Years
Metal Halide	$41,291	$3,581	11.5 Years

In the second program called Pay-As-You-Save (PAYS), PSNH pays all of the costs associated with the purchase and installation of approved measures such as lighting, including LED exit signs, occupancy sensors, programmable thermostats and hot water insulation wraps. A PAYS Purchase and Installation Charge, calculated to be less than the monthly savings, is added to the town's monthly electric bill until all costs are repaid.

The following chart shows how meaningful these savings are.

Facility	Project Cost	Antrim Cost-Share	Annual Savings (Conservative)	Payback (Years)
Sewer and Water Department	$3,064.94	$1,532.46	$449.98	3.41
James Tuttle Library	$2,005.20	$1,002.59	$349.15	2.87
Antrim Town Barn	$1,314.10	$657.04	$423.44	1.55
Antrim Grapevine	$702.21	$351.08	$265.14	1.32
North Branch Fire Station	$934.84	$467.42	$402.24	1.16
Antrim Fire Station	$3,277.20	$1,638.57	$649.40	2.52
Antrim Transfer Station	$875.63	$437.79	$195.94	2.23

TOTAL	**$12,174.12**	**$6,086.95**	**$2,735.29**	**2.23**

It is interesting to note that the town's electric costs have not increased since 2004 and that includes our share of the cost for the new lights, so the savings have been greater than originally anticipated above.

Cool Monadnock

Cool Monadnock is a three-year collaborative project for 36 southwest New Hampshire regional communities, including Antrim. Antioch New England Institute and Clean Air-Cool Planet will provide training, coordination and technical assistance to the region's towns and cities. Cool Monadnock's first goal is to "quickly accomplish a 10% reduction in GHG (greenhouse gases)."

Other goals are:

- "To achieve personal commitment and actions from a significant number of residents and businesses to reduce GHG emissions."
- "To stimulate 300 communities throughout New Hampshire and New England in implementing significant community engagement approaches to reducing GHG."
- "To create a model of regional collaboration that can be implemented in other regions in the northeast."

Businesses, local governments, residents and students will partner together to develop effective strategies and actions to reduce greenhouse gases, save on energy costs and support public health. Cool Monadnock also works with Southwest Regional Planning Commission and other agencies to deal with climate change.

Cool Monadnock says that community-level action is very important because there is virtually no federal leadership for this issue. Towns throughout the U.S., it says, can play a major role in reducing green house gas emissions.

Areas that can be targeted to reduce emissions include land-use planning, transportation planning and mass transit, reducing local government energy use, local forestry, power generation, residential energy and solid waste. Communities working collaboratively can institute multi-town efforts to reduce greenhouse gases.

The organization's task force "will prepare a regional climate action plan that identifies a range of actions to reduce GHG emissions that can be undertaken on both the regional and community levels." One reason a regional approach is a sound idea is that some green house gas emissions activities such as transportation are regional in scope. Also, the organization points out that a collaborative effort can help towns achieve economies of scale such as in fluorescent light bulb change-out programs.

The lead partners include Antioch New England Institute (ANEI), a consulting and community outreach department of Antioch University New England. Cool Monadnock says "ANEI promotes a vibrant and sustainable environment, economy, and society by encouraging informed civic engagement. It provides training, programs and resources (U.S. and international) in leadership development, place-based education, nonprofit management, environmental education and policy, smart growth and public administration." Clean Air-Cool Planet is another lead partner. It is dedicated to finding and promoting solutions to global warming. It partners with campuses, companies, communities and science centers in the Northeast to help reduce their carbon output. It helps partners, constituents and other regional leaders to understand global warming and find ways of dealing with the problem. Christa Koehler, a former city planner for Keene, is a project co-director along with James Gruber, the Antioch New England Institute co-founder.

Cool Monadnock's website has a wealth of information on its three-year project, including a calendar of events, using compact fluorescent bulbs, reaching out to students and social organizations to spread the word and get help with projects, etc. The website also has a page where everyone can see what the individual towns and cities in Cool Monadnock have done to date. See www.coolmonadnock.org.

Encourage Renewable Energy Resources

According to RSA 674:17(j), planning boards should "…encourage the installation and use of solar, wind, or other renewable energy systems." RSA 674:36(k) also encourages "the installation and use of solar, wind, or other renewable energy systems and protect access to energy sources by the regulation of orientation of streets, lots, and buildings…and encouragement of the use of solar skyspace easements under RSA 477."

Further information on ways to improve Antrim's energy efficiency and conservation can be found in *New Hampshire Handbook on Energy Efficiency and Climate Change* by Clay Mitchell, Julia Dundorf and Wes Golomb. See Appendix 5. Also see www.carboncoalition.org.

Antrim should also consider offering property tax exemptions to encourage the use of solar, wind and wood heating energy systems. These systems include solar hot water, solar photovoltaic, wind turbine or central wood heating systems (not stovetops or woodstoves). Presently 62 towns and cities in New Hampshire offer tax exemptions on one or more of these systems.

Constructing Green Buildings

The U.S. Green Building Council addresses what can be done to reduce energy use during construction and post construction. It has developed the Leadership in Environment and Energy Design (LEED) criteria which is the benchmark for design, construction, and operation of environmentally friendly buildings. Its criteria apply to new construction, existing buildings, homes and schools.

Its rating system considers sustainable site, water efficiency, energy and atmosphere, materials and resources, indoor environmental quality, and innovation and design process. The number of points a project receives determines the level of certification it receives. The ratings are: Certified (26-32 points); Silver (33-38 points); Gold (39-51 points); and Platinum (52-69 points).

Communities can adapt the system to encourage good practices and use of construction materials that are environmentally friendly. Note that this is similar to the Energy Efficiency program, Article 22, adopted by Epping. (See section above about being innovative). Tied to this point system, communities use incentives such as tax breaks, reduced fees, expedited reviews, density increases, etc. The system can be tied to municipal, residential, and non-residential construction from new buildings and houses to additions and home improvements.

New Hampshire State Energy Plan

In 2002, the state drafted a 10-year state energy plan. The plan says the single most cost effective means to address energy concerns is to improve energy efficiency. It also is a guide for municipalities to use in addressing energy concerns. For more information, see www.nh.gov/oep/programs/energy/StateEnergyPlan.htm.

Other Resources for Planning and Implementation

There is a great deal of information, grants, software, organizations and tools available from the state and non-profit groups that can be tapped by Antrim for assistance.

- ICLEI – Local Governments for Sustainability offers software that can be used to inventory current energy use, set reduction targets, and provide plans for evaluating a community's progress. It is called Clean Air and Climate Protection (CACP). It covers transportation, residential, commercial, and industrial energy use. The software can be downloaded from www.iclei.org.
- EPA Energy Star Program. The EPA provides Portfolio Manager software to perform energy audits. Communities are invited to join the campaign to reduce energy consumption by 10%. To date, the state, Dover, Rochester, Somersworth, and Nashua have signed on. See www.energystar.gov.
- RETSCREEN. It is similar to EPA's software but offers cost analysis for system improvements. RETSCREEN is produced in Canada. It is used to determine the viability of clean energy products. It is in use by 129,000 people across the world. It is downloadable from www.retscreen.net
- Sierra Club Cool Cities. The project provides guidance on what can be done to reduce greenhouse emissions. Municipalities which adopt the U.S. Mayors Climate Protection Agreement can become members of cool cities. See www.coolcities.us.
- U.S. Mayors Climate Protection Agreement. Since being created in 2005, over 680 mayors from three Canadian provinces and municipalities in all 50 states have joined to reduce global warming. In New Hampshire, Dover, Hanover, Keene, Manchester, Nashua, Portsmouth and Rochester have adopted the resolution. See www.usmayors.org/climateprotection.
- Clean Air-Cool Planet helps communities institute programs to reduce greenhouse gas emissions. Some programs include community-owned wind turbines, performance contracting experiences, LED streetlights, etc. Located in Portsmouth, the non-profit organization provides a wide range of projects

and assistance, including help in starting up an energy committee. See www.cleanair-coolplanet.org.

- Performance Contracting. RSA 21-I:19-d allows a municipality to contract with an energy service company (ESCO) to make energy efficient upgrades to be financed through the ESCO and paid off over time through the energy savings. There are no up-front capital costs to the town. If the agreed-upon level of savings is not achieved, the ESCO must pay the difference in the energy bill.
- Community Choice Aggregation. Under RSA 53-E, residents, businesses and municipalities “aggregate” their electric load together to form a Community Choice Aggregate (CCA). The CCA is formed by the community or region’s legislative body or bodies to competitively bid for electricity, among other benefits.
- NH Carbon Challenge provides information about how individuals can cut greenhouse gas emissions. Communities can use their materials to create a residential campaign. Go to http://carbonchallenge.sr.unh.edu/.
- Systems Benefit Charge (SBC) was begun in 2002 by the Public Utility Commission. It is a charge on electric bills which fund two energy efficiency programs run by the utilities. One program is the Low Income Assistance Program which subsidizes costs for eligible households. The second program is the Energy Efficiency Program for residential and commercial customers. Another program for municipalities is the Smart Start program. It allows municipalities to upgrade lighting to more efficient lighting and pay for the upgrades through the energy savings. See www.nhsaves.com.
- Database of State Incentives for Renewable Energy (DSIRE). This is a collection of financial incentives and rules applicable to renewable energy projects for all the states and the federal government. It lists many different programs available to New Hampshire through the state, utilities and the federal government. It also covers NH Renewable Portfolio Standard and the U.S. Department of Energy’s Alternative Fuels. Go to www.dsireusa.org.
- The U.S. Department of Agriculture offers grants between $75,000 and $5 million through its High Energy Cost Grant Program. It is open to individuals and municipalities. Go to www.usda.gov/rus/electric/hecgp/overview.htm.
- New England Grassroots Environmental Fund is a nonprofit organization which offers small grants to fund grassroots environmental projects. Past projects include maps for conservation lands, creation of urban gardens and municipal energy efficiency programs. The fund is encouraging energy committees to seek funding. Its website is: www.grassrootsfund.org.

Conclusion

There are a wide variety of programs, potential funding and assistance available to New Hampshire municipalities to help them reduce greenhouse gas emissions, conserve energy and make the towns as a whole more energy conscious. There is no question that the United States has, up to now, done very little to reduce our dependence on foreign oil, cut back harmful energy emissions, and make our society more aware of what the consequences are if we don't mend our ways.

Global warming is a real threat not only to the United States but to the world. Glaciers are melting away; the Arctic ice cap is shrinking which is threatening the polar bears' survival; oceans are rising; storms are becoming more intense. Scientists around the world are detecting a wide variety of changes. They are concerned that it could lead to large scale extinctions and changes to regions of the earth which can or cannot grow food. Coastlines will change as the ice caps melt and the oceans rise. There is even concern that continued warming ultimately could put an end to the Gulf Stream current which would have dire consequences for the world.

Antrim has created an energy committee – a positive first step in making our town more energy conscious and efficient. The committee alone is not enough. All Antrim residents, households, and businesses have to do their part. We should be driving more fuel efficient cars, replacing incandescent bulbs with energy-efficient bulbs and paying attention to Energy Star ratings when purchasing appliances and other products. All are important steps that residents can take to make Antrim more energy efficient while saving money in the process.

Recommendations

The Energy Committee has begun an energy audit for the public buildings in town to see where energy waste may be occurring and how to make them more efficient. Other steps the town can take include:

- Offer incentives in the form of property tax exemptions for residents or businesses who install renewable energy systems such as wind turbines and photovoltaic panels.
- Install the EPA Portfolio Manager software or the RETSCREEN software to manage the data from energy audits and to set goals for energy reduction over time.
- Thoroughly explore all the various programs listed in this document and any others that come to light so that the town can make intelligent choices about energy conservation and planning and take advantage of any grants or financial help that may be available.
- Conduct a feasibility study for creating a Community Choice Aggregate (CCA) to improve energy efficiency services, expand renewable energy and stabilize energy costs.
- Consider entering into a Performance Contract with an energy service company (ESCO).
- Establish point standards similar to those set up by the U.S. Green Building Council LEED certification to promote energy efficiency in future construction. Also, see the discussion above about Epping's modification of the point system to fit its own needs.

- Encourage smart growth principles such as mixed use, centralized development, higher density, and alternative transportation to reduce energy use.
- Reevaluate using biodiesel fuel for Antrim’s diesel engines.

The majority of workers in the Southwest Region, however, do not work in the export-oriented sectors of the Regional economy. In fact, an industry cluster analysis shows that most employment opportunities in the Southwest Region are lower-paying professional and customer service jobs and that high-technology jobs are relatively rare when compared to the high-growth centers of Hillsborough County located outside the Southwest Region.

In the Southwest Region, 10 of the 20 largest employers - those that employ at least 250 workers - are manufacturing companies and six are health service providers. The vast majority of businesses (81%), however, employs one to nine workers and generates 29% of all sales within the Region.

Tourism is an important industry sector in the Southwest Region. Travelers spent $241.7 million in FY 2004 while visiting the Region. Although not the largest tourism market area in the state, the occupancy rates for the Region's hotels, motels and inns are more consistent throughout the year than observed in other parts of New Hampshire. There are still opportunities for attracting larger numbers of tourists to the Region, thereby strengthening the Region's economic base.

3. Evaluation of Regional Issues

During recent decades, the Southwest Region has witnessed a growth in population and an increase in economic activity and income. Projections indicate that the Region's population will grow further over the next two decades. The challenge for the Region is to balance demographic pressures with demands for economic and community development, housing, transportation, infrastructure, and the protection of natural resources. In sum, the task that lies before the Southwest Region is to preserve the level of quality of life that the Region has enjoyed in recent years. The following section, by focusing on strengths, weaknesses, opportunities and threats (SWOT), addresses the Region's ability to cope with present and future demands.

A. Strengths and Opportunities

1) A skilled workforce is important for our regional economic strength.

The Region is fortunate to have a highly skilled workforce for most of its industry sectors. The workforce's education and skills, however, need to be improved to sustain current and future economic trends. The high quality of life throughout the Region attracts new workers to our municipalities. More housing construction would further guarantee the level of workforce quality and quantity currently enjoyed by the Region.

2) The Region has access to larger transportation networks.

The Region is well-connected to major urban areas through the federal highway system, in particular through I-91. East-west traffic, however, relies heavily on lower-classification highways. National and International airports are located within 100 miles. Direct access to the railroad network is not available.

3) Regional economic development is the focus of several organizations.

There are at least five organizations in our Region directly involved in regional economic development. The following agencies have developed numerous programs to this end: Monadnock Economic Development Corporation, Southwestern Community Services, Southern New Hampshire Services and Southwest Region Planning Commission. Many of their programs benefit businesses by giving planning assistance, financing advice, managerial and logistical support. Strengthening those programs will further develop opportunities for business retention and attraction.

4) A high level of public involvement in local governance and planning.

Volunteers are the backbone of local government throughout the Region. A strong sense of community is a major factor in inspiring residents to participate in local affairs. Efforts should be made to broaden the number of citizens involved in municipal government and to educate them about their responsibilities.

5) New Hampshire is a state of small government and low taxes.

Compared to other states, New Hampshire state and county governments are smaller in terms of the number of civil servants and have fewer rights to tax their citizens. The absence of sales and state income taxes is advantageous for consumers. This fact needs to be more publicized in other parts of the country to replenish our pool of qualified workers.

6) Tourism as a source of revenue has not been used to its fullest extent.

Our Region is blessed with an abundance of natural beauty and recreational opportunities. Nevertheless, tourism is often underestimated as a source of local income. This is in part due to the fact that our Region is in close proximity to high-volume tourism areas in New Hampshire and Vermont that seemingly possess more noticeable landmarks, such as the White Mountains or Green Mountains. We should consider overcoming this perception by marketing our Region from a tourism perspective.

B. Weaknesses and Threats

1) The Region is losing high-paying manufacturing jobs.

During the four years prior to the original drafting of this document, the Southwest Region lost at least 903 manufacturing jobs, or 8% of its manufacturing work force. Replacing those jobs with similar high-paying jobs has become a challenge. Moreover, because of a nation-wide decline in the manufacturing sector, the economic composition of the Region will most likely continue to change. The retention, extension and attraction of businesses providing higher-paying jobs in other sectors will help to diversify the Regional economy.

2) There is a loss of local business control.

In recent years, the number of locally owned businesses has declined. Many local businesses are now managed from offices outside the Region. Furthermore, many locally owned businesses are suppliers to larger, out-of-region companies.

3) Doing business has become more expensive and difficult.

In recent years, businesses benefited from relatively low costs for labor and land and low taxes. This may change once the amount of cheap and strategically located land decreases due to ongoing development. Because of rising public expenditures, property and corporate taxes may also increase. If not replenished, the pool of skilled local workers will dry up soon. Soaring utility costs will put additional pressure on local businesses.

4) There is a growing housing shortage.

When compared to Boston and other parts of eastern and southern New England, housing prices and rents are relatively low throughout the Region. The housing market, however, is very tight. This is due to a gradual increase in population and to insufficient home construction, which affects residents from all income groups. A reflection of this situation is the low vacancy rate for both owner-occupied and renter-occupied homes. This housing shortage might prevent the growth of the labor force needed to accommodate development demands.

5) Access to investment capital has become more difficult.

Because of mergers, financial institutions have lost their local character. As a consequence, the traditionally close relationship between local banks and businesses has weakened. Information about financing options has also become more difficult to obtain.

6) Land zoned for commercial and industrial use and reuse is often unsuitably located.

Although there are a sufficient number of parcels zoned for commercial and industrial uses in most towns, they are often located in areas without access to major transportation routes and isolated from each other in separate pockets.

7) Infrastructure in many towns needs to be improved.

The condition of infrastructure (roads, sewer and water) in many towns is unsatisfactory, due in part to public resistance to increased expenditures for maintenance and upgrades. This situation is not conducive for sustaining or expanding economic development activities. Investments in telecommunication infrastructure (e.g. broad-band internet access) should also be made to keep pace with other markets.

8) The lack of a research institution weakens economic development efforts.

Despite a number of colleges in the Region, the lack of a research institution is an obstacle to innovation and specialization. For example, the close relationship between Dartmouth-Hitchcock Medical Center and local companies has been crucial for establishing the Hanover-Lebanon area as an important bio-technology center. Geographic proximity of academic research and industrial activity is essential for accelerating economic development and successfully competing with other regions.

9) Local governance and planning is often unconcerned about regional needs.

Regional considerations frequently take a backseat to political and budgetary pressures at the local level. Consequently, many municipalities pursue goals that are not coordinated with neighboring communities.

Table 42: Summary of Regional Issues

Regional Issue		**Strength**	**Weakness**	**Opportunity**	**Threat**
Labor force	Education/ Skills	x	x	x	
	Availability	x			x
	Wages	x			
Transportation	Highways	x	x		
	Air	x			
	Rail		x		
Local infrastructure	Improvements & upgrades		x	x	
Housing	Availability		x	x	
	Prices	x			x
	Rents		x	x	
Educational system	Quality	x	x	x	
Economic base	Local control/ ownership		x	x	
	Business support/ retention	x	x	x	
	Financing sources		x	x	
	Diversification	x		x	
	Creative economy	x		x	
	Tourism potential		x	x	
Employment	Availability		x	x	
	Diversity		x	x	
	Income		x	x	
Tax structure	Sales and income	x	x	x	
	Property and corporate		x		x
Utilities	Costs		x		
Developable land	Suitability		x	x	
	Availability	x			x
	Zoning		x	x	
	Development fees		x		x
	Tax Increment Financing	x		x	
Quality of life		x			x
Research institution	Potential		x	x	
Regional perspective	Regional Organizations	x			
	Public awareness		x	x	
Local government	Volunteerism	x		x	x
	Resources		x	x	
Health services	Access	x			
	Capacity	x			

Source: CEDS Advisory Committee SWOT Analysis

C. Community Survey

A community survey was developed to better understand public attitudes with regard to economic development.[26] The survey used the issues of importance identified during the SWOT exercise as a starting point to develop questions and receive feedback from the public at large. Most respondents Quality of Life, the Educational System and Labor Force as the three most important issues, whereas Transportation, Tax Structure and Housing were on the bottom of the scale. A majority of respondents chose the Natural Environment, Historic/Rural Character and Cultural Activities as the main reasons to live in the Southwest Region of New Hampshire. When asked about the future, of highest concern were Transportation, Housing, and Tax Structure – issues also responsible for the majority of suggestions for improvements. When asked to identify critical issues affecting the Region on their own, most respondents listed Labor Force, Tax Structure, Smart Growth and Historic Preservation.

D. External Forces

The largest influence on the Southwest Region's economy is the larger U.S. economy. With the ongoing decline in manufacturing jobs, this Region's former pay-rate advantage is declining. Future concerns include the types of jobs being created and the rates of pay for these jobs.

Another issue impacting the Region is the high cost of energy, particularly electricity, gasoline and home heating oil. These costs place companies at a disadvantage in this Region because of high winter heating costs, generally long commute times of workers, and distance from more concentrated urban markets. Given the ongoing activities in the Middle East and the current lack of local, renewable energy alternatives, energy costs are likely to be of increasing concern in years to come.

A lack of housing puts this Region at a competitive disadvantage with other parts of New England by preventing the in-migration of well-trained and high-skilled workers. High housing costs in the economic centers of the Region also increase travel-to-work times for those in low-paying jobs and force them to pay more for gasoline. Once the Region starts to address the lack of housing, it will help address other, related problems.

E. Future Economic Development

According to New Hampshire Employment Security projections, the make-up of the labor force in much of the Southwest Region will change little by 2010.[27] The vast majority of new jobs in Cheshire County will be created in the personal service and retail sectors (Table 43). These employment

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26 The questionnaire contained four substantive questions and several questions on the background of the respondents. The questionnaire was available online at the SWRPC website for 16 weeks and received 67 responses. The majority of the respondents lived in Keene and Harrisville (68%), was between the ages of 46 and 85, had been living in the Region for more than 11 years and did not have children in school. While the responses give some insight to opinions in the Region, due to the rate of response the information should be used only as a supplement to other findings.

27 The author of this document views the findings for Cheshire County as an approximation to the economic situation in the entire Southwest Region, because the economic centers of Hillsborough County are located outside the Region. Incorporating the findings for Hillsborough County into an analysis for the Southwest Region will significantly distort this report.

AGREEMENT BETWEEN TOWN OF ANTRIM NEW HAMPSHIRE AND ANTRIM WIND ENERGY LLC, DEVELOPER/OWNER OF THE ANTRIM WIND POWER PROJECT DATED AS OF __-________________________, 2011 ("Effective Date")

1 Definitions

1.1 "Agreement" – This agreement between the Town of Antrim, New Hampshire and Antrim Wind Energy LLC, and its successors and assigns, which shall apply from the Effective Date until the End of Useful Life of the Wind Farm

1.2 "Ambient Sound Pressure" – The sound pressure level excluded from that contributed by the operation of the Wind Farm.

1.3 "Decommissioning Funding Assurance" – An assurance provided by the Owner as more fully described in Section 14.2 in a form reasonably acceptable to the Town that guarantees completion of decommissioning activities, as provided in this Agreement.

1.4 "Effective Date" – The date of this Agreement as set forth above.

1.5 "End of Useful Life" – The point in time at which the Wind Farm has not generated electricity for a continuous period of twenty-four months for reasons other than the wind regime, maintenance or repair, facility upgrade or repowering.

1.6 "Non-Participating Landowner" – Any landowner in the Town of Antrim, other than a Participating Landowner.

1.7 "Owner" – Antrim Wind Energy LLC, its successors and assigns.

1.8 "Occupied Building" – A permanent structure used as a year-round residence, school, hospital, church, public library or other building used for public gathering that is occupied or in use as of the Effective Date.

1.9 "Participating Landowner" – Any landowner having entered into an agreement with the Owner for lease of real property or the granting of easements for access, entry or conveyance of the other real property rights related to the Wind Farm.

1.10 "Project Site" – Property with rights as conveyed to Owner by lease, easement or other agreement with a Participating Landowner that includes all access roads, and other ancillary facilities required for construction and operation of the Wind Farm.

1.11 "Town" – Town of Antrim, New Hampshire

1.12 "Turbine Height" – The distance from the surface of the tower foundation to the tip of the uppermost blade when in a vertical position.

1.13 "Wind Turbine" – A wind energy conversion system that converts kinetic wind energy into electricity, comprised primarily of a tower, a nacelle housing the generator, and a 3-blade rotor.

1.14 "Wind Farm" – The wind powered project being developed in the Town of Antrim by Owner, including but not limited to up to 10 Wind Turbines, cable, accessory buildings and structures including substations, permanent and temporary meteorological towers, electric infrastructure, access roads, and cables and other appurtenant structures and facilities that comprise such wind power project.

2 General Provisions

2.1 Enforceability. This Agreement shall apply to and be binding and enforceable on all successors and assigns of the Owner.

2.2 Applicability to Owner. This Agreement shall apply to the Owner only to the extent of Owner's rights and responsibilities related to the Wind Farm and Project Site as conferred to Owner by Participating Landowner agreements.

2.3 Recording.

2.3.1 At the Town's request, the Owner shall submit to the Town evidence of all agreements between the Owner and Participating Landowner, which may take the form of memoranda recorded with the Hillsborough County Registry of Deeds.

2.3.2 This Agreement shall be recorded at the Hillsborough County Registry of Deeds.

2.4 Invalidity. The invalidity of any section, portion, or paragraph of this Agreement will not affect any other section, portion, or paragraph in this Agreement.

2.5 Limitation on Turbines. This Agreement relates to the installation and operation of the Wind Farm. The Wind Turbines used in the Wind Farm shall be consistent with the size and configuration as approved by the New Hampshire Site Evaluation Committee (NHSEC); provided, however, that in no event shall the overall Turbine Height of any Wind Turbine used in the Wind Farm exceed 500 feet. Communications or other equipment attached to the Wind Turbines shall be limited to that which is incidental or necessary for the safe and efficient construction, operation, maintenance, and interconnection of the Wind Farm.

2.6 On-Site Burning. The Owner will obtain a permit from the Town of Antrim, and comply with all state requirements before Owner or its agents perform any on-site burning.

2.7 Warnings.

2.7.1 A clearly visible warning sign concerning voltage must be placed on all of the Wind Farm's aboveground electrical collection facilities, switching or interconnection facilities, and substations.

2.7.2 Visible, reflective, colored objects, such as flags, reflectors, or tape shall be placed on the anchor points of the Wind Farm's guy wires, if any, and along the guy wires up to a height of ten feet from the ground.

2.7.3 A clearly visible warning sign concerning safety risks related to winter or storm conditions shall be placed on access roads to the Wind Farm no less than 500 feet from each Wind Turbine tower base.

2.8 Access. The Town shall have access to all gated entrances to the Project Site for the purpose of emergency response. The Owner shall provide to the Town any keys, combination codes, and/or remote control devices necessary to open such gates. Such keys or access devices may not be provided by the Town to anyone other than members of the Board of Selectman, Police Department, Fire Chief, EMS or Highway Department while engaged in official duties. The Owner shall provide access to the Project Site, Wind Turbines or other facilities upon reasonable request by the Town for the purpose of building or safety inspections under the Town ordinances. The Owner shall provide access for emergency response purposes pursuant to the protocols provided under Section 7 of this Agreement. The Owner shall coordinate agreements with responding town emergency services and ensure access for those responder departments.

2.9 Liability Insurance. The Owner shall maintain a current general liability policy covering body injury and property damage with limits of at least $5 million in the aggregate. Certificates verifying such insurance coverage shall be made available to the Town upon request.

2.10 Indemnification. The Owner specifically and expressly agrees to indemnify, defend, and hold harmless the Town and its officers, elected officials, employees and agents (hereinafter collectively "Indemnitees") against and from any and all claims, demands, suits, losses, costs and damages of every kind and description, including reasonable attorneys' fees and/or litigation expenses, brought or made against or incurred by any of the Indemnitees resulting from or arising out of any negligence or wrongful acts of the Owner, its employees, agents, representatives or subcontractors of any tier, their employees, agents or representatives in connection with the Wind Farm. The indemnity obligations under this Article shall include without limitation:

2.10.1 Loss of or damage to any property of the Indemnitees or, to the extent that loss of or damage to property of Owner, results in a third party claim against the Town, loss of or damage to any property of Owner;

2.10.2 Bodily or personal injury to, or death of any person(s), including without limitation employees of the Town, or of the Owner or its subcontractors of any tier.

2.10.3 The Owner's indemnity obligation under this Article shall not extend to any liability caused by the negligence or willful misconduct of any of the Indemnitees, or third parties outside the Owner's control.

2.11 Reopener Clause. Upon agreement of both parties to this agreement, this agreement or portions thereof may be revised or amended.

3 <u>Wind Turbine Equipment and Facilities</u>

3.1 Visual Appearance.

3.1.1 Wind Turbines shall be painted and lighted in accordance with Federal Aviation Administration (FAA) regulations. Wind Turbines shall not be artificially lighted, except to the extent required by the Federal Aviation Administration or any other applicable authority that regulates air safety. Lights shall be shielded to the greatest extent possible from viewers on the ground.

3.1.2 Wind Turbines shall not display advertising, except for reasonable identification of the turbine manufacturer and/or Owner.

3.2 Controls and Brakes. All Wind Turbines shall be equipped with a redundant braking system. This includes both aerodynamic over-speed controls (including variable pitch, tip, and other similar systems) and mechanical brakes. Mechanical brakes shall be operated in a fail-safe mode. Stall regulation shall not be considered a sufficient braking system for over-speed protection.

3.3 Electrical Components. All electrical components of the Wind Farm shall conform to relevant and applicable local, state, and national codes, and relevant and applicable international standards.

3.4 Power Lines. On-site distribution power lines between Wind Turbines shall, to the maximum extent practicable, be placed underground.

4 Project Site Security

4.1 Wind Turbines exteriors shall not be climbable up to fifteen (15) feet above ground surfaces.

4.2 All access doors to Wind Turbines and electrical equipment shall be locked, fenced, or both, as appropriate, to prevent entry by non-authorized persons.

4.3 Entrances to Project Site shall be gated, and locked during non-working hours. If the Owner identifies problems with unauthorized access, the Owner shall work to implement additional security measures.

5 Public Information, Communications and Complaints

5.1 Public Inquiries and Complaints. During construction and operation of the Wind Farm, and continuing through completion of decommissioning of the Wind Farm, the Owner shall identify an individual(s), including phone number, email address, and mailing address, posted at the Town Hall, who will be available for the public to contact with inquiries and complaints. The Owner shall make reasonable efforts to respond to and address the public's inquiries and complaints. This process shall not preclude the Town from acting on a complaint.

5.2 Signs. Signs shall be reasonably sized and limited to those necessary to identify the Wind Farm and provide warnings or liability information, construction information, or identification of private property. There will be no signs placed in the public right of way without the prior approval of the Town. After the completion of construction, signs visible from public roads shall be unlit and be no larger than twelve square feet, unless otherwise required by applicable permits or as otherwise approved by the Town.

6 Reports to the Town of Antrim

6.1 Incident Reports. The Owner shall provide the following to the Chairman of the Board of Selectmen or the Chairman's designee as soon as practicable, but not later than sixty days after an incident:

6.1.1 Copies of all reports of environmental incidents or industrial accidents that require a report to U.S. EPA, New Hampshire Department of Environmental Services, OSHA or another federal or state government agency.

6.2 Periodic Reports. The Owner shall submit, on an annual basis starting one year after the commencement of commercial operation of the Wind Farm, a report to the Board of Selectmen of the Town of Antrim, providing, at a minimum, the following information:

6.2.1 If applicable, status of any additional construction activities, including schedule for completion;

6.2.2 Details on any calls for emergency, police or fire assistance during the prior year;

6.2.3 Location of all on-site fire suppression equipment; and

6.2.4 Identity of hazardous materials, including volumes and locations, as reported to state or federal agencies.

6.2.5 Summary of any complaints received from Town of Antrim residents, and the current status or resolution of such complaints or issues.

7 <u>Emergency Response</u>

7.1 Upon request, the Owner shall cooperate with the Town's emergency services and any emergency services that may be called upon to deal with a fire or other emergency at the Wind Farm through a mutual aid agreement, to develop and coordinate implementation of an emergency response plan for the Wind Farm. The Owner shall provide and maintain protocols for direct notification of emergency response personnel designated by the Town, including provisions for access to the Project Site, Wind Turbines or other facilities within 30 minutes of an alarm or other request for emergency response, and provisions notifying the Town of contact information for personnel available at every hour of the day. The Owner shall coordinate with other jurisdictions as necessary on emergency response provisions.

7.2 The Owner shall cooperate with the Town's emergency services to determine the need for the purchase of any equipment required to provide an adequate response to an emergency at the Wind Farm that would not otherwise need to be purchased by the Town. If agreed between the Town and Owner, Owner shall purchase any specialized equipment for storage at the Project Site. The Town and Owner shall review together on an annual basis the equipment requirements for emergency response at the Wind Farm.

7.3 The Owner shall maintain fire alarm systems, sensor systems and fire suppression equipment customarily installed in all Wind Turbines and related facilities.

7.4 If an emergency response event related to the Wind Farm creates an extraordinary expense (i.e. expenses beyond what the Town would normally incur in responding to an emergency event for a business located in the Town) for the Town, Owner shall reimburse the Town for actual expenses incurred by the Town.

8 Roads

8.1 Public Roads. In the event that the Owner wishes to utilize Town of Antrim roads for construction or operation of the Wind Farm for oversize or overweight vehicles, and/or use during posted weight limit time periods, then the Owner shall:

8.1.1 Identify and notify the Town of Antrim of all local public roads to be used within the Town to transport equipment and parts for construction, operation or maintenance of the Wind Farm.

8.1.2 Hire a qualified professional engineer, as mutually agreed to with the Town, to document local road conditions prior to construction and as soon as possible after construction is completed (but no later than 30 days after such date) or as weather permits.

8.1.3 Promptly repair, at the Owner's expense, any local road damage caused directly by the Owner or its contractors at any time.

8.1.4 Reimburse the Town for reasonable costs associated with special police details, if required to direct or monitor traffic within the Town limits during construction of the Wind Farm.

8.2 Wind Farm Access Roads

8.2.1 The Owner shall construct and maintain roads at the Wind Farm that allows for year-round access to each Wind Turbine at a level that permits passage and turnaround of emergency response vehicles.

8.2.2 Any use of Town of Antrim public ways that is beyond what is necessary to service the Wind Farm or that is beyond the scope of Participating Landowner agreement(s) shall be subject to approvals under relevant Town ordinances or regulation, or state or federal laws.

9 Construction Period Requirements

9.1 Site Plan. Prior to the commencement of construction, the Owner shall provide the Town with a copy of the final Soil Erosion and Sediment Control site plans or New Hampshire Stormwater Pollution Prevention Plan, as approved by the New Hampshire Department of Environmental Services showing the construction layout of the Wind Farm.

9.2 Construction Schedule. Upon request of the Town, prior to the commencement of construction activities at the Wind Farm, the Owner shall provide the Town with a schedule for construction activities.

9.3 Disposal of Construction Debris. Tree stumps, slash, and brush will be disposed of onsite or removed consistent with state law. Construction debris and stumps shall not be disposed of at Town facilities.

9.4 Blasting. The handling, storage, sale, transportation, and use of explosive materials shall conform to all state and federal rules and regulations. In addition:

9.4.1 At least ten days before blasting commences, the Owner shall brief Town officials on the blasting plan. The briefing shall include the necessity for blasting and the safeguards that will be in place to ensure that building foundations, wells or other structures will not be damaged by the blasting.

9.4.2 In accordance with the rules of the State of New Hampshire, the Owner shall notify the Town police and fire chiefs before blasting commences. Any changes to the schedule for blasting will be reported immediately to the Town police and fire chiefs.

9.4.3 A copy of the appropriate Insurance Policy and Blasting License will be provided to the Town.

9.5 Storm Water Pollution Control. The Owner shall obtain a New Hampshire Site-Specific Permit and conform to all of its requirements including the Storm Water Pollution Prevention Plan and requirements for inspections as included or referenced therein. The Owner shall provide the Town with a copy of all state and federal stormwater, wetlands, and water quality permits.

9.6 Design Safety Certification. The design of the Wind Farm shall conform to applicable industry standards, including those of the American National Standards Institute. If requested by the Town, the Owner shall submit certificates of design compliance obtained by the equipment manufacturers from Underwriters Laboratories, Det Norske Veritas, Germanshcer Llloyd Wind Energies or other similar certifying organizations.

9.7 Construction Vehicles

9.7.1 Vehicles used for construction of the Wind Farm shall only use Town roads mutually agreed upon by the Owner and the Town. Staging or idling vehicles shall not be permitted on public roads. The Owner shall notify the Town at least 24 hours before any construction vehicle with a gross vehicle weight greater than 88,000 pounds is scheduled to use a

Town road. Acceptance by the Town of vehicles exceeding this weight is not a waiver of the Owner's obligation under Section 8.1.3 of this Agreement to repair all damage to Town roadways caused by the Owner or its contractors.

9.7.2 Construction vehicles will not travel on Town roads before 6:00 am or after 7:00 pm, Monday through Saturday, unless prior approval is obtained from the Town. Construction vehicles will not travel on Town roads on Sunday, unless prior approval is obtained from the Town.

9.7.3 Construction will only be conducted between 6:00 am and 7:00 pm, Monday through Friday, and between 7:00 am and 7:00 pm on Saturdays unless prior approval is obtained from the Town. Construction will not be conducted on Sundays, unless prior approval is obtained from the Town.

9.7.4 The start-up and idling of trucks and equipment will conform to all applicable Department of Transportation regulations. In addition, the start-up and idling of trucks and equipment will only be conducted between 5:30 am and 7:00 pm, Monday through Friday and between 6:30 am and 7:00 pm on Saturday.

9.7.5 Notwithstanding anything in this Agreement to the contrary, upon mutual agreement between the Town and Owner, over-sized vehicles delivering equipment and supplies may travel on Town roads between the hours of 7:00pm and 6:00am and on Sundays so that the timing of such over-sized deliveries will minimize potential disruptions to area roads.

10 <u>Operating Period Requirements</u>

10.1 Spill Protection. The Owner shall take reasonable and prudent steps to prevent spills of hazardous substances used during the construction and operation of the Wind Farm. This includes, without limitation, oil and oil-based products, gasoline, and other hazardous substances from construction related vehicles and machinery, permanently stored oil, and oil used for operation of permanent equipment. Owner shall provide the Town with a copy of the Spill Prevention, Control and Countermeasure (SPCC) for the Wind Farm as required by state or federal agencies.

10.2 Pesticides and Herbicides. The Owner shall not use herbicides or pesticides for maintaining clearances around the Wind Turbines or for any other maintenance at the Wind Farm.

11 Noise Restrictions

11.1 Residential Noise Restrictions. Sound from the Wind Farm during Operations at the exterior facades of homes shall not exceed 55 dBA or 5 dBA above ambient, whichever is greater during daytime and 45 dBA or 5 dBA above ambient, whichever is greater, at night.

11.2 Pre-Construction Sound Modeling. Upon request of the Town, the Owner shall provide a full noise study prepared by a qualified professional, which demonstrates that the Wind Farm will meet the requirements of this Agreement and any conditions imposed by the Site Evaluation Committee in a Certificate of Site and Facility.

11.3 Post-Construction Noise Measurements. Within one year of the commencement of commercial operations of the Wind Farm, the Owner shall retain an independent qualified acoustics engineer to take sound pressure level measurements in accordance with the most current version of ANSI S12.18. The measurements shall be taken at sensitive receptor locations as mutually identified by the Owner and Town. The periods of the noise measurements shall include, as a minimum, daytime, winter and summer seasons and nighttime. All sound pressure levels shall be measured with a sound meter that meets or exceeds the most current version of ANSI S1.4 specifications for a Type II sound meter. The Owner shall provide the final report of the acoustics engineer to the Town within thirty (30) days of its receipt by the Owner.

12 Setbacks

12.1 Setback From Occupied Buildings. The setback distance between a Wind Turbine and a Non-Participating Landowner’s existing Occupied Building shall be not less than three times the Turbine Height. The setback distance shall be measured in a straight line from the center of the Wind Turbine base to the nearest point on the foundation of the Occupied Building.

12.2 Setback From Property Lines. The setback distance between a Wind Turbine and Non-Participating Landowner’s property line shall be not less than 1.1 times the Turbine Height. The setback distance shall be measured in a straight line from the nearest point on the property line to the center of the Wind Turbine base.

12.3 Setback From Public Roads. All Wind Turbines shall be setback from the nearest public road a distance of not less than 1.5 times the Turbine Height as measured from the right-of-way line of the nearest public road to the center of the Wind Turbine base.

13 Waiver of Restrictions

13.1 Waiver of Noise Restrictions. A Participating Landowner or Non-Participating Landowner may waive the noise provisions of Section 11 of this Agreement by signing a waiver of their rights, or by signing an agreement that contains provisions providing for a waiver of their rights. The written waiver shall state that the consent is granted for the Wind Farm to not comply with the sound limits set forth in this Agreement.

13.2 Waiver of Setback Requirements. A Participating Landowner or Non-Participating Landowner may waive the setback provisions of Section 12 of this Agreement by signing a waiver of their rights, or by signing an agreement that contains provisions providing for a waiver of their rights. Such a waiver shall include a statement that consent is granted for the Owner to not be in compliance with the requirements set forth in this Agreement. Upon application, the Town may waive the setback requirement for public roads for good cause.

13.3 Recording. A memorandum summarizing a waiver or agreement containing a waiver pursuant to Section 13.1 or 13.2 of this Agreement shall be recorded in the Registry of Deeds for Hillsborough County, New Hampshire. The memorandum shall describe the properties benefited and burdened and advise all subsequent purchasers of the burdened property of the basic terms of the waiver or agreement, including time duration. A copy of any such recorded agreement shall be provided to the Town.

14 Decommissioning

14.1 Scope of Decommissioning Activities.

14.1.1 The Owner shall submit a detailed estimate of costs associated with site-specific decommissioning activities, net of estimated salvage value, to the Town before construction of the Wind Farm commences. This estimate shall be updated and submitted to the Town every five years thereafter. The plan and estimate shall include the cost of removing the foundations down to eighteen (18) inches below grade.

14.1.2 The Owner shall, at its expense, complete decommissioning of the Wind Farm or individual Wind Turbines, pursuant to Section 14.1.3 of this Agreement, within twenty-four (24) months after the End of Useful Life of the Wind Farm, as defined in Section 1.5.

14.1.3 The Owner shall provide a decommissioning plan to the Town no less than three months before decommissioning is to begin. The decommissioning plan shall provide a detailed description of all Wind Farm equipment, facilities or appurtenances proposed to be removed, the process for removal, and the post-removal site conditions. The Town will consider the remaining useful life of any improvement before requiring its removal as part of decommissioning. Approval of the Town, not to be unreasonably withheld, conditioned or delayed, must be received before decommissioning can begin.

14.2 Decommissioning Funding Assurance:

14.2.1 The Owner shall provide a Decommissioning Funding Assurance for the complete decommissioning of the Wind Farm in a form reasonably acceptable to the Town. The Wind Farm will be presumed to be at the End of Useful Life if no electricity is generated from the Wind Farm for a continuous period of twenty-four (24) months, and as defined in Section 1.5.

14.2.2 Before commencement of construction of the Wind Farm, the Owner shall provide Decommissioning Funding Assurance in an amount equal to the greater of the site-specific decommissioning estimate or $200,000. The Owner shall adjust the amount of Decommissioning Funding Assurance to reflect the updated decommissioning costs after each update of the decommissioning estimate, in accordance with Section 14.1.1.

14.2.3 Decommissioning Funding Assurance in the amount described in Section 14.2.2 shall be provided by posting a decommissioning bond, letter of credit, or other financial mechanism that provides for an irrevocable guarantee to cover the reasonably anticipated costs of complying with Owner's decommissioning obligations. Any decommissioning bond, letter of credit or other financial mechanism must be issued or made by an entity having and maintaining a minimum credit rating of "BBB" from Standard and Poor's, or "Ba" from Moody's, each as defined on the Effective Date, or their commercial equivalent.

14.2.4 Funds expended from the Decommissioning Funding Assurance shall only be used for expenses associated with the cost of decommissioning the Wind Farm.

14.2.5 If the Owner fails to complete decommissioning within the period prescribed by this Agreement, the Town may, at its sole discretion, require the expenditure of decommissioning funds from the Decommissioning Funding Assurance on such measures as reasonably necessary to complete decommissioning.

14.3 Transfer of Decommissioning Responsibility

14.3.1 Consistent with Section 2.1 of this Agreement, the provisions of Section 14 of this Agreement shall apply to and be binding and enforceable on all successors and assigns of the Owner.

14.3.2 The Owner shall ensure that any successors or assigns of the Wind Farm shall agree to be bound by this Agreement and shall provide the Town with written confirmation from any successors or assigns stating that they agree to be bound to this Agreement.

15 **Environmental Standards**

15.1 Wildlife Protection. Prior to commencing construction, Owner shall provide the Town with copies of all protocols and plans for post-construction monitoring and impact mitigation related to wildlife that are contained in any permit condition or as a condition of the Certificate of Site and Facility issued by the New Hampshire Site Evaluation Committee.

15.2 Environmentally Sensitive Areas. The Wind Farm shall be constructed and operated in such a manner as to comply with all applicable environmental permits and conditions associated with a Certificate of Site and Facility issued by the New Hampshire Site Evaluation Committee.

15.3 Erosion Control. The Wind Farm shall be designed constructed and maintained in accordance with accepted erosion and sediment control methods as required by the New Hampshire Department of Environmental Services (NHDES).

15.4 Hazardous Wastes. The Owner agrees to comply with all state and federal regulations applicable to the use and disposal of hazardous wastes involved in or generated by the Wind Farm during construction, operation, maintenance or decommissioning.

16 **Support for the Project**

16.1 The Town and Owner agree that they will propose to the New Hampshire Site Evaluation Committee that the terms and conditions of this Agreement be incorporated as conditions to any Certificate of Site and Facility issued by the SEC for the Project. The Town further agrees that it shall support the Project during the SEC process.

[*signatures appear on the following page]*

The parties agree the terms of this Agreement are effective as of the date first above written, regardless of the date of execution by either party.

TOWN OF ANTRIM	**ANTRIM WIND ENERGY LLC**
________________________ Chairman, Board of Selectmen	________________________ Print Name: Jack Kenworthy Title: Executive Officer
________________________ Selectman	________________________ Print Name: John Soininen Title: Executive Officer
________________________ Selectman	

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United States Department of the Interior

FISH AND WILDLIFE SERVICE

New England Field Office
70 Commercial Street, Suite 300
Concord, NH 03301-5087
http://www.fws.gov/newengland

October 13, 2011

Mr. Joshua Brown, Project Manager
TRC
10 Maxwell Drive, Suite 200
Clifton Park, NY 12065

Dear Mr. Brown:

This responds to your correspondence, dated May 23, 2011, which included study protocols for the Antrim Wind Energy Project, proposed by Eolian Renewable Energy. The project would consist of up to 10 wind turbines that would produce approximately 20 megawatts of electricity, an access road, a meteorological tower, collection lines, and an interconnection substation. The proposed project is sited on privately-owned land that is leased by Antrim Wind Energy. The ridgeline on which the project is proposed to be developed is a mostly contiguous ridgeline which runs east-northeast to west-southwest. The ridge is nearly parallel to NH Route 9, which is approximately three quarters of a mile to the north.

The proposed project is located on approximately 1,100 acres of land on Tuttle Hill and Willard Mountain in the Town of Antrim, Hillsborough Country, New Hampshire. This area is known to have an active bald eagle (*Haliaeetus leucocephalus*) nest, as well as an occupied bald eagle territory. Given the close proximity of the project to a known nest and other bald eagle activity, it is possible that these eagles may fly across the location of the proposed turbine strings to reach their primary foraging area.

We have reviewed your project study protocols, which included a *Breeding Bird Survey Protocol*, a *Rare, Threatened and Endangered Raptor Nest Survey Protocol,* an *Acoustic Bat and Radar Survey Protocol*, and a *Diurnal Raptor Migration Survey Protocol.* We are providing recommendations that we believe will enhance some of the currently proposed protocols. We are also providing information on some of the risks associated with wind power facilities to birds and bats. These comments are provided in accordance with the Endangered Species Act (87 Stat. 884, as amended; 16 U.S.C. 1531, *et seq.*), the Migratory Bird Treaty Act (MBTA) (16 U.S.C. 703-712), and the Bald and Golden Eagle Protection Act (BGEPA), 16 U.S.C. 668-668d, 54 Stat. 250, as amended.

General Comments

The U.S. Fish and Wildlife Service (Service) supports the development of wind power as an alternative energy source. However, wind facilities can have negative impacts on wildlife and their habitats if not sited and designed with potential wildlife and habitat impacts in mind. The Service's *2003 Interim Guidelines to Avoid and Minimize Wildlife Impacts from Wind Turbines* (Guidelines) are designed to be used by all utility- and community-scale land-based wind energy projects to reduce potential impacts to fish and wildlife, regardless of whether they are proposed on private or public lands. The Guidelines include recommendations on measures to avoid, minimize and compensate for effects to fish, wildlife and their habitats. The Guidelines are intended to promote compliance with relevant wildlife laws and statutes, including the Endangered Species Act, the Migratory Bird Treaty Act, and the Bald and Golden Eagle Protection Act. The Service encourages project proponents to use the process described in these Guidelines to address risks to fish and wildlife resources. The Guidelines may be found at http://www.fws.gov/habitatconservation/wind.pdf.

Siting of a wind energy project is an important element in avoiding and minimizing effects to species that may be impacted by wind development. The Service recommends that potential sites be investigated at the landscape as well as local scale to determine the risk of direct or indirect effects to species and their habitats. Alternative project locations and development configurations should be considered in order to avoid and minimize impacts to wildlife and their habitat.

Federally Listed Species

Based on information currently available to us, no federally listed or proposed, threatened or endangered species or critical habitat under the jurisdiction of the U.S. Fish and Wildlife Service are known to occur in the project area(s). Preparation of a Biological Assessment or further consultation with us under section 7 of the Endangered Species Act is not required. No further Endangered Species Act coordination of this type is necessary for a period of one year from the date of this letter, unless additional information on listed or proposed species becomes available.

Bats

It is now well known that large numbers of bats are being killed by wind turbines (Arnett *et al.* 2008; Jain *et al.* 2007; Kunz *et al.* 2007; Fiedler *et al.* 2007; Arnett 2005a,b; Kerns and Kerlinger 2004; Johnson 2003). Arnett *et al.* (2008) reported that bat fatalities have been recorded either anecdotally or quantitatively at every wind facility where post-construction surveys have been conducted. Worldwide, across a wide range of habitats, large numbers of migratory tree-roosting bats have been killed at commercial wind power facilities, especially at facilities along forested ridge tops in the eastern United States (Kunz 2006; Kunz *et al.* 2007).

Recent research has focused on describing the patterns and causes of bat fatalities. Results of a pilot study designed to investigate bat mortality associated with wind turbines in Sweden indicated that migratory and non-migratory aerially-hunting bats will forage on insects that concentrate near wind turbines (Ahlen 2003). This behavior was observed at facilities sited within flight corridors of migrating bats and/or foraging habitat of non-migrating bats. Ahlen (2003) also reported dead migratory and non-migratory species of bats near the turbine structures.

Bat activity at turbines is likely influenced by broad landscape or perhaps regional patterns dictated by weather, prey abundance and/or availability, and/or other factors. For example, Corten and Veldkamp (2001) reported that insects prefer to fly in conditions of low wind and temperatures above about 50°F (10°C). This suggests that bats may be out foraging during low wind speed nights and increase their risk of collision. More recently, Arnett *et al.* (2008) noted that bat fatalities appear to follow certain patterns, such as: 1) turbine collision fatalities seem to peak in mid-summer through fall; 2) fatalities are not concentrated at any particular turbine; 3) habitat variables may not influence fatalities; and 4) bat fatalities are highest during periods of low wind speed and related to weather events. Information from other operating wind power facilities indicates that bats may be attracted to wind turbines, and/or the cleared right-of-ways, increasing the risk of a bat colliding with a moving blade or being caught in the turbulence (Verboom and Spoelstra 1999; Durr and Bach 2004).

As previously noted, Arnett *et al.* (2008) reported that large bat fatalities have been recorded either anecdotally or quantitatively at every wind facility where post-construction surveys have been conducted, and that reported fatalities are highest at wind facilities located on ridges in eastern deciduous forests in the United States. Thus, the Service is concerned that wind power facilities will have direct impacts on individual migrating bats, as well as adverse cumulative impacts on unlisted bat populations.

Spring, summer and fall passive acoustic surveys, as well as nocturnal radar surveys, are being conducted at the proposed project site. Mistnetting studies are also being conducted at this site in coordination with the New Hampshire Fish and Game Department and this office. The results of these studies will be valuable in assessing the potential impacts of the proposed project, and provide a basis for measures to minimize or mitigate for these potential impacts.

Migratory Birds

Two types of local impacts to birds have been demonstrated at existing wind facilities: 1) direct mortality from collisions; and 2) indirect impacts from habitat disruption and displacement. Both migrating birds and resident birds collide with wind turbines. The majority of bird fatalities reported at wind farms are neotropical songbirds (Erickson *et al.* 2001).

Raptors also are susceptible to collisions with wind turbines. Fatalities were first observed at Altamont Pass in California in the late 1980s/early 1990s when an estimated several hundred raptors were killed each year due to turbine collisions, guy wire strikes, and electrocutions (Manville 2005). As part of a re-powering effort, the original smaller, faster-moving lattice-supported towers at Altamont Pass are being replaced with slower-moving tubular-supported turbines. These larger and slower moving turbines, however, still kill raptors, passerines, waterbirds, and other birds (Manville 2005). Low wind speed turbine technology requires much larger rotors, with blade tips often extending more than 420 feet above ground, and blade tip speed can reach in excess of 200 mph under windy conditions. When birds approach spinning blades, "motion smear"—the inability of the bird's retina to process high speed motion stimulation—occurs primarily at the tip of the blades, making the blades deceptively transparent at high velocities. This increases the likelihood that a bird will fly through the blade arc, be struck by a blade, and be killed (Manville 2005). Birds also may become disoriented in poor weather, and may be forced to fly at lower altitudes during migration due to overcast weather, increasing the number of birds potentially flying through wind turbine fields.

In addition, wind farms can also disturb and fragment habitats. Habitat fragmentation in particular is an issue for birds that use forest interiors. Habitat fragmentation can result from clearing forests for roads or corridors to accommodate vehicular access and transmission lines, and from site clearing to accommodate the wind turbines. These activities could cause a direct loss of forest interior habitat; an increase in edge habitat; increased nest parasitism and predation; a decrease in abundance and diversity of area-sensitive species with a concurrent increase in habitat suitability for edge and generalist species; and interruption of travel corridors, displacement, and other behavioral effects.

Studies being conducted at the proposed site include a *Breeding Bird Survey*, a *Rare, Threatened and Endangered Raptor Nest Survey*, *Diurnal Raptor Migration Surveys*, and a *Nocturnal Radar Survey*. The Diurnal Raptor Migration Survey Protocol Report (Report), prepared by TRC Engineers, states that raptor spring migration surveys will be conducted between March 21 and May 31 and fall migration surveys will occur between September 1 and October 15.

According to the Hawk Migration Association of North America (http://www.hmana.org/species/species.php), some raptors migrate later into the fall. For example, southbound migration for the red-tailed hawk (*Buteo jamaicensis*) peaks from late October through mid-November, the bald eagle in the eastern United States migrates mostly from mid-October into December, and the golden eagle (*Aquila chrysaetos*) migration is mostly from mid-October through mid-November. Therefore, we recommend that you extend the fall migration period through the end of November in order to capture the movements of late migrating raptors. Likewise, in the event that you conduct a second year of raptor migration surveys, we recommend that you conduct spring surveys beginning on March 1.

The Report states that assessments in each season will include between 10 and 20 days of surveying. That could mean that surveys may be undertaken as infrequently as one day per week. Having observations only one day per week may not generate an accurate representation of what is occurring at the site, because there is a greater likelihood of missing peak movements for some species. We recommend increasing the number of survey days to at least two per week.

The MBTA prohibits the taking, killing, collection, possession, and transportation (among other actions) of migratory birds, their eggs, parts, and nests, except when specifically permitted. While the MBTA has no provision for allowing unauthorized take, the Service realizes that some birds may be killed during wind energy operations even if all known reasonable and effective measures to protect migratory birds are used. The Service's Office of Law Enforcement carries out its mission to protect migratory birds through investigations and enforcement, as well as by fostering relationships with individuals, companies, and industries that have taken effective steps to avoid take of migratory birds, and by encouraging others to implement measures to avoid take of migratory birds. It is not possible to absolve individuals, companies, or agencies from liability even if they implement bird mortality avoidance or other similar protective measures. However, the Office of Law Enforcement focuses its resources on investigating and prosecuting individuals and companies that take migratory birds without identifying and implementing all reasonable, prudent and effective measures to avoid that take. Companies are encouraged to work closely with Service biologists to identify available protective measures when developing project plans and/or avian protection plans, and to implement those measures prior to/during construction or other similar activities.

Bald Eagles

The bald eagle is afforded special protection under the federal Bald and Golden Eagle Protection Act. The BGEPA prohibits the take of bald and golden eagles unless pursuant to regulations. The definition of take includes actions that kill, wound, or disturb eagles.

Based on yearly surveys performed by the New Hampshire Fish and Game Department, nesting bald eagles are known to be present within 10 miles of the proposed project on Lake Nubanusit. That nest produced three chicks in 2011 (personal communication, August 3, 2011, Chris Martin, New Hampshire Audubon Society). In addition, Powder Mill Pond, an impoundment of the Contoocook River in Hancock, which is approximately 5 miles from the proposed project, and has been identified as an occupied bald eagle territory. It is currently unknown whether bald eagles forage within, or fly over, the footprint of the project area. However, given the close proximity of the project to a known nest, it is possible that these eagles may fly across the location of the proposed turbine strings to reach their primary foraging area. Crossing the strings on a regular basis could increase the risk of collision, and thus mortality, of foraging bald eagles. Immature eagles may also have an increased risk of collision due to their lack of flying experience.

We recommend that you coordinate with Sarah Nystrom, the Service's Regional Bald and Golden Eagle Coordinator, at (413) 253-8592 to determine whether this project should develop an eagle conservation plan and whether a permit under the BGEPA may be appropriate. In addition, we recommend that you conduct at least one additional year of bald eagle and other raptor surveys to determine their use of the project area.

Thank you for your continued coordination on this project. For further information, please contact Maria Tur of this office at 603-223-2541. You may also visit the Wind Energy page on the New England Field Office's website for useful links, including guidance documents for avoiding and minimizing impacts to wildlife: (http://www.fws.gov/newengland).

Sincerely,

Thomas R. Chapman
Supervisor
New England Field Office