Report on the Feasibility of a Wind Power Project on the Berlin Pass

Collins Canada

Lindi von Mutius

Sarah Wu

Vivian Schoung

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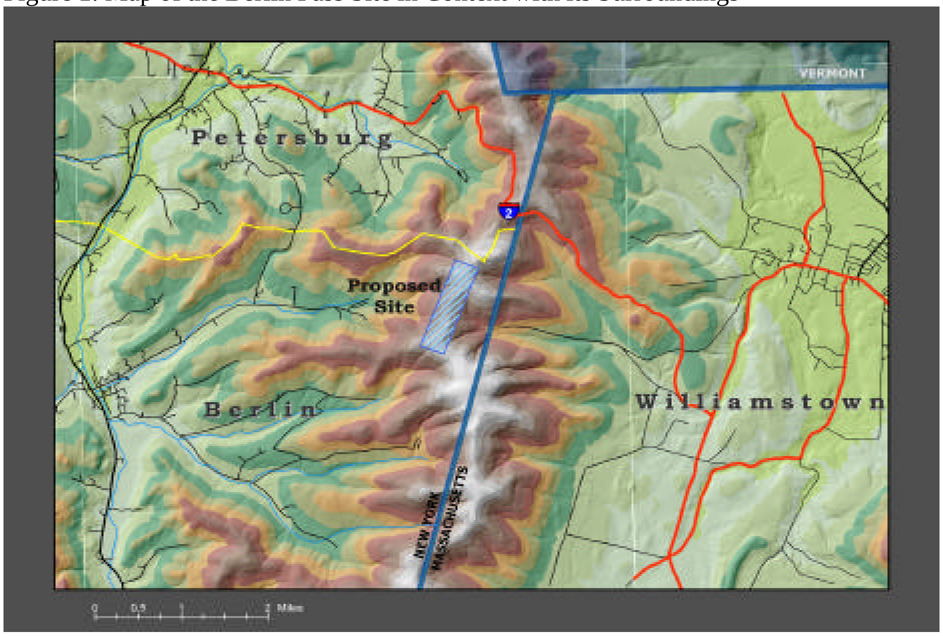
Abstract

This report is the result of a feasibility study on a potential wind development project on Berlin Pass. This project has a long history, but unfortunately has never received serious attention by the Williams College community. We investigated whether legal, logistical, and public opinion issues would be obstacles to the feasibility of this project. This report shows that this wind project is indeed feasible, and desired by the communities it would affect. There is strong support for this project in Berlin, New York; Petersburg, New York; and Williamstown, Massachusetts; and other surrounding communities. In addition, the legal, ecological, and siting issues are not impediments to this project, allowing Williams College to proceed without being liable for dangerous situations, or conflicts with surrounding communities. This project also presents the college with an ideal opportunity to be an environmental leader, and make a positive impact in surrounding communities. The College must now consider whether this project is worth their time and money. As demonstrated not only by our group, but by previous students, a wind farm development on Berlin Pass is feasible.

Project Background

Williams College currently owns a 400-acre parcel of land that straddles the New York and Massachusetts border west of Williamstown, Massachusetts, east of Berlin, New York, and south of Petersburg, New York. (Figure 1).

Figure 1: Map of the Berlin Pass Site in Context with its Surroundings



Source: Nicholas Hiza

In the 1950's and 60's the Williams College Ski team practiced at the *Ralph J. Townsend Ski Area* located on this property. The ski area had 30- and 40- meter natural jumps for Nordic combined, and a giant slalom run for the Alpine team's use. The area was named after the team's coach of 22 years, Ralph Townsend, who led the team to Division I status shortly after his arrival to Williams and forged his place in Williams history with his positive leadership of the skiing program.[1] In the late 1970's, the ski time discontinued its use of the area, moving its practices and races to nearby Jiminy Peak, leaving the site unused. Currently, Williams College would like to put the land to use again, and some options include donating the Massachusetts portion to the Williamstown Rural Lands Foundation and selling the New York portion to the State of New York, so that these two entities can manage the land for increased recreation opportunities. Another option the College is considering, and the topic of this paper, is developing the site as a wind farm.

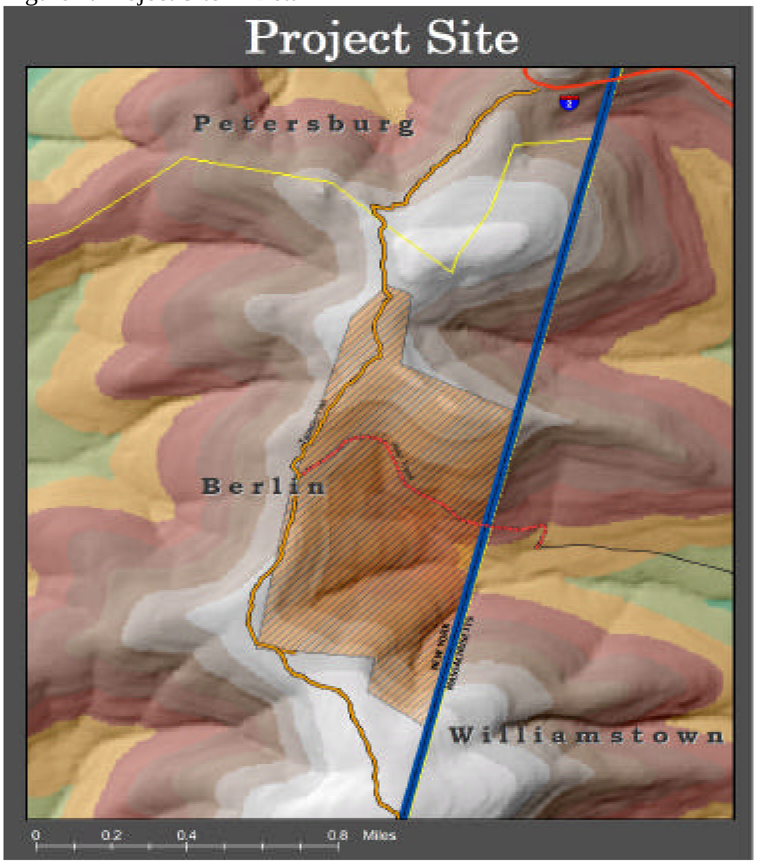
[1] *Skiing*. http://www.williams.edu/Athletics/all_ski/index.shtml Accessed 18 Nov 2002.

Introduction to Site

This particular parcel of land combines two important attributes favorable to wind power generation, namely, its saddle-shaped depression in the Taconic range and its location at the end of Green Hollow, which both serve to channel wind into the pass. The site already includes numerous human developments, including charcoal kilns, wells, and a radio tower. Also, Williams College constructed an access road at the base of the site for the old ski area. Connecting the end of this road to the top of the mountain is a 1.4 km (0.9 mi) rocky double track trail, which could provide the base for an improved road. On the site's Western boundary is the Taconic Crest Trail, which snakes along 1.8 km (1.1 mi) of the New York Massachusetts border ridgeline running North-South. In addition, power lines that connect to the grid stop only 1 km (0.6 mi) from the base of Berlin Pass. At the base of the valley and peak of the ridge, the elevation measures approximately 472 m (1550 ft) and 700 m (2300 ft), respectively, and can be seen in Figure 2 below. In between lies a series of steep climbs and sharp descents, riddled with rocks and ditches. Berlin Mountain, the highest point in the vicinity, towers at 856 m (2800 ft).[2]

[2] *Berlin Wind Site Information.* http://www.berlinwind.org/site.html Accessed 27 Oct 2002.

Figure 2: Project Site in Detail



Source: Nicholas Hiza

The vegetation on this site, and in this region, is dominated by northern hardwood species, such as sugar maple (*Acer saccharum*), yellow birch (*Betula allegheniensis*), and American beech (*Fagus grandifolia*). Low shrubs, herbs, and spring ephemerals are characteristic of these forests. The site also includes pockets of spruce-fir forests.[3] The property also serves as a wildlife corridor by connecting protected habitat from Petersburg Pass through Berlin Mountain and beyond. According to the New York State Department of Environmental Conservation (NYSDEC), approximately 46 species of mammals, 74 species of birds, and 31 species of reptiles and amphibians inhabit the Taconic Crest near Petersburg Pass. None of these plant or animal species is endangered, and along the ridge within the site there are no wetland communities or conservation

[3] Ibid.

easements. The abutting state-owned land in New York is designated as the Petersburg Pass State Forest and Scenic Area managed by NYSDEC. In Massachusetts, land closest to the site is protected in an upland conservation zone.[4] Figures 3-6 illustrate features of the site.

Figure 3: Parking Lot at Base of Site

Figure 4: Trail Used for Access to the Site

Figure 5: Vegetation on the Site

Figure 6: Property and Restriction Signs

Project History

In 1979, a Williams College student, Reed Zars, wrote *The Proposed Wind Energy System for Williams College* as his senior thesis. Zars identified Berlin Pass as

[4] *Petersburg Pass Scenic Area Unit Management Plan* http://www.williams.edu/CES/studentpapers/taconic.html#Site; NYSDEC 1992, p. 16. Accessed 15 Dec 2002.

the most feasible site for a wind farm because Williams College already owned the land and because, "it just so happens that it is one of the best sites in Berkshire County."[5] Zars researched the power availability of wind on Berlin Pass, the available technology, the access, appearance, and stability of the site, the forecasted cost of the project, and economic feasibility of wind systems. Building on Zars' project, Williams College senior, Thomas Black wrote *A Comprehensive Technical and Economic Feasibility Study of Large-Scale Generation of Electricity by Wind Power at Berlin Pass* as his 1981 Environmental Studies senior thesis. Black centered his thesis on a study of the site, an anemometer study of wind speeds on the site, the power produced by wind, and the cost of constructing and maintaining wind farms. Based on his economic and scientific analysis, Black concluded that a wind farm would be viable on Berlin Pass.[6] Currently, recent graduates Nicholas Hiza, Chris Warshaw, Fred Hines, and Stefan Kaczmarek are working on furthering the feasibility study that Black initiated in 1981. The current project proposal under consideration is to install seven 1.5 megawatt turbines on the site, which, using Black's 1981 incomplete anemometer data, would produce approximately 140 percent of Williams College's power demands.

Current Project Clients and Goals

As Environmental Studies 302 students, we are currently working for both Nicholas Hiza and the Williams College administration, represented by Vice President for Administration and Treasurer, Helen Ouellette. Mr. Hiza asked us to conduct a public opinion survey, and research anticipated problems with legal, political, historical, and Taconic Crest Trail location issues. Mrs. Ouellette and the College asked us to research

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[5] Zars, Reed. *The Proposed Wind Energy System for Williams College*. Williams College: 1979. p 3.
[6] Black, Thomas C. *A Comprehensive Technical and Economic Feasibility Study of Large-Scale Generation of Electricity by Wind Power at Berlin Pass*. Williams College: 1981.

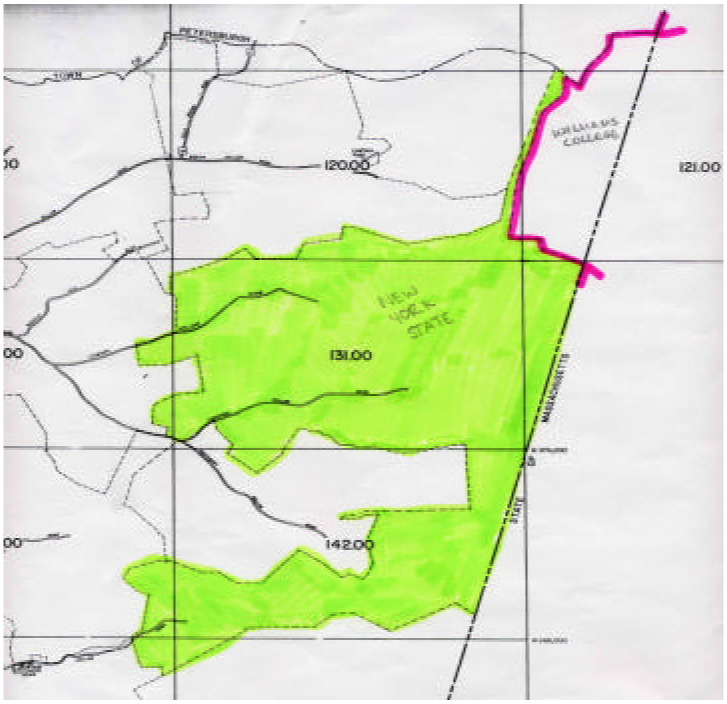
project logistics and offer feasibility advice. To these ends, we researched anticipated problems, and concerns gleaned from the public opinion survey and recommended approaches to each issue. We therefore present the solutions in aggregate to both Mr. Hiza and Williams College, and suggest that the proposed project is feasible.

Historical Significance Considerations

To ensure that construction on the property would not disturb a historically significant site, we consulted deeds of the land and surrounding parcels from the 1830's to the present. According to deeds of the New York State Forest land and the Williams College ski area, these sections were not conglomerate land parcels until the 1970's, but many smaller parcels with various owners. The oldest pertinent deed dates back to 1841, and describes the land that stretches from southern Berlin to the northeastern corner of the town. The land commonly stayed in families, and was deeded over from one widow to the next generation's married couple. Most of the early owners were from Berlin, Petersburg, or neighboring towns in Rensselaer County. The value of the land increased from its original price of $700 to $1000.

The land stayed as one parcel property for another 50 years until its first division into two parcels: Krug's Rolling Green Park, and the Hayner property. The fragmented nature of the land also explains why so little development actually took place on these parcels. In addition to being rougher terrain, most parcels stayed only in a particular family for ten to twenty years. Perhaps reflecting the economic decline of the area and the increase of seasonal wealthy vacationers, the land was increasingly bought by people who no longer lived in Petersburg or Berlin.

Figure 7: Land Ownership Map



In 1984, Myles Fischer and Jack Stringfield, residents of Pensacola, FL merged the parcels, buying extensive tracts of land in Berlin, NY and extending into Petersburg, NY. They paid $139,000 for the property in 1984, and three years later in 1987 sold it to Peter Borelli and the State of New York as three parcels for $266,000.[7] The Borelli property boundaries define land that land that is presently state-owned reforestation land. The property which would later be owned by Williams College was bought and sold several times until John Armstrong, John Jay, and Dickran Sarkisian bought the land in conjunction with the President and Trustees of Williams College for $10. The present total value of the land is $66, 200.[8] As one can see, the current Williams College property is a conglomerate of many properties with various histories. Construction of a wind farm at this site would not disrupt any historically significant lands.

[7] Deed Book 1478, page 302. County Clerk's Office, Rensselaer County
[8] Deed Book 1244, page 898. County Clerk's Office, Rensselaer County and Rensselaer County Real Property Special Cross Reference, page 45.

Ecological Disturbances

One of wind power's great advantages is that, as a local, renewable, and non-polluting power source, it helps to mitigate some of the negative environmental impacts of power produced by fossil fuels. If ecological disturbance caused by the construction of this project would negate wind power's positive environmental effects, the project would become undesirable. As discussed in the Introduction to the Site section, the site is a typical hardwood forest with no endangered species or sensitive habitats. The site's most important biological function is as a habitat corridor for wildlife movement. Also, recall that the site includes existing human development such as the ski area parking lot on the Massachusetts side of Berlin Pass and the access road connecting this to the ridge.

The actual ground area occupied by each turbine of the proposed size would be less than 14 square meters (150 square feet).[9] As the site includes less than one mile of ridgeline, a conservative estimate of the access road length on the ridge is one mile. Typically, wind farms require 5 m (16 ft) wide access roads.[10] The total area occupied by seven turbines and 1.6 km (1 mi) of 5 meter (16 ft) wide access road is 7950 square meters (85,530 square feet), or 0.5% of the parcel. If the calculations of land impacted include the approximately 1.6 km (1 mi) long access road from the parking lot to the ridge, which is already an impacted jeep track, the area occupied by infrastructure increases to 15,800 square meters (170,010 square feet), or 1% of the parcel. These percentages make an insignificant overall impact, and, further, the impact would be spread among seven disconnected areas. Based on these findings, we conclude that the wind farm will not prevent wildlife movement through the site. Also, the wind farm's

[9] Conservative estimates based on blueprint of wind turbines and typical access requirements from ENRON WIND, provided by Nicholas Hiza.
[10] Ibid.

dirt access road could possibly coincide with some of the wider, more impacted areas of the Taconic Crest Trail. Based on these preliminary estimates, the total newly disturbed area occupied by infrastructure would be minimal, which in turn suggests minimal ecological disturbance. Developers should, however, remain vigilant about fragmenting the habitat as little as possible.

Bird Fatality Concerns

Again, one of wind power's major goals is to provide environmentally friendly energy. Recently, some environmentalists have questioned whether avian fatalities caused by wind turbines contradict the technology's environmental friendliness.[11] The misconception that wind turbines kill birds results largely from negative publicity regarding one specific site in Altamont Pass, California. This 5,400 turbine site is situated in grassland with exceptionally high raptor densities and has caused a significant number of raptor fatalities. Studies suggest that the poor siting of this project and its use of older, first generation turbines with lattice supports, where birds like to nest, are the two largest factors causing undesirable levels of avian deaths.[12] Because poor siting may be to blame for high bird fatalities, most wind bylaws now require a study of bird densities and migration patterns at potential wind farm sites. Scientists have conducted many studies of bird fatalities at wind farms throughout the United States and Canada, comparing siting, use of old lattice support versus newer technology, and number of turbines with frequency of bird fatalities (Table 1).

Table 1. Wind Power and Bird Studies

SITE LOCATION	**SITE DESCRIPTION**	**FINDINGS** bird fatalities
Princeton, MA	8 older turbines, forested	Zero

[11] *Wind Power and Bird Studies* http://www.currykerlinger.com/studies.htm Accessed 15 Dec 2002.
[12] Ibid.

Madison, NY	7 modern turbines, farmland	Four 2001-2002
Copenhagen, NY	2 modern turbines, farmland, 30 mi from Lake Ontario	Zero
Somerset County, PA	8 modern turbines, farmland	Zero
Algona, IA	3 modern turbines, farmland	Zero
St. Mary's, KA	2 modern turbines, grassland prairie	Zero
Buffalo Ridge, MN	200+ turbines, farmland near Lake Benton	53 over 5 years one raptor, no endangered species
Door County, WI	31 modern turbines, farmland on peninsula	21 1999-2000, mostly songbirds
Altamont, CA	5,400 older turbines, grassland	Significant raptor mortalities 1989-2002, few other species involved
Montezuma Hills, CA	237 older, 11 modern turbines, grassland near river	10 raptor, 2 songbird, 1 duck over 2 years
San Gorgonio Pass, CA	2,700 older and modern turbines, desert	Very few
Tehachapi Pass, CA	3,700 older and modern turbines, arid grassland/rangeland	Low to moderate, small number raptor fatalities
Ponnequin, CO	29 modern turbines, rangeland	16 over 4 years, one raptor, no endangered species
Vansycle, OR	38 modern turbines, wheat and grazing land	8 songbird, 4 game bird, zero raptor and endangered species in 1999
Arlington, WY	105 modern turbines, rangeland	75 over 2 years, 3 raptors
Le Nordais, Quebec	133 modern turbines, forest	Zero

Source: http://www.currykerlinger.com/studies.htm

The findings for sites most similar to the proposed Berlin Pass site show very low avian fatality rates. We suggest a study of bird density and migration on Berlin Pass before installation of any turbines. Based on findings at similar wind farms, we anticipate that bird fatalities will be negligible and not present an obstacle to the completion of the proposed project. In conclusion, the development of wind turbines on this site will not significantly damage the already existing flora and fauna.

Noise Concerns

In our research and survey results, we found that noise generated by turbines makes many people feel negatively about wind energy. However, research conducted, not only by wind farm developers, but also by private citizens' groups, shows that noise emitted by wind turbines is minimal, and that new noise technologies reduce outputs of "mechanical and aerodynamic" noise. [13] The only negative study we found was written by a group of residents in the United Kingdom, who were unfortunately the victims of poor siting of a wind farm. Poor siting causes them to hear a constant "whomp, whomp, whomp" noise from the turbines.[14] Research on wind turbine noise shows that the most important factors that reduce noise are good siting and quiet machines. Most negative perceptions of wind turbine noise were based on old wind turbine technologies and rumor. In reality wind turbines are very quiet compared to other industrial sites, and the "background" noise of the wind blowing tends to mask the noise that the turbines create. Additionally industry representatives state, "noise used to be a very serious problem for the wind energy industry. Some early, primitive types of turbines built in the early 1980s were extremely noisy, to the point that it was annoying to hear them from as much as a mile away."[15] However, experts also claim, "the industry quickly realized that this problem needed to be dealt with."[16] We thoroughly researched noise generated by turbines to allay public fears.

The first step in our research was to see how the sound generated by the wind turbines translated to decibels, and how we could realistically and clearly compare this to

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[13] *American Wind Energy Association*. http://www.awea.org Accessed 14 Dec 2002.
[14] *Noise*. http://www.windfarm.fsnet.co.uk/noise.htm Accessed 14 Dec 2002.
[15] *American Wind Energy Association*. http://www.awea.org Accessed 14 Dec 2002.
[16] Ibid.

other noises generated by natural and human activity. In basic terms, the wind turbines from a distance of 350 m (1150 ft) would make less noise than one hears when using an electric toothbrush. To put this in context, more decibel levels are shown below:[17]

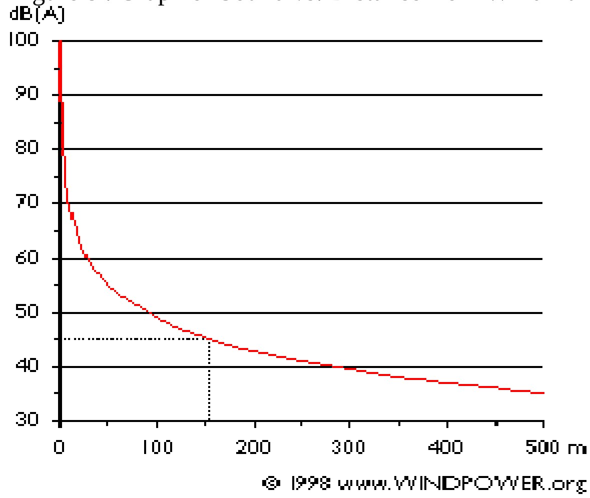
Threshold of Hearing:	0 dB
Soft Whisper:	30dB
Rural Night-time Background:	20-40dB
Wind Farm from 350m away:	35-45dB
Electric Toothbrush:	55dB
Dishwasher:	55-70dB
Normal Conversation:	60dB
Telephone Ringing:	80dB
Wind Turbine at close range:	100dB
Thunder	120dB

The turbines would spin at a varying rate, based on wind speed, and therefore produce varying levels of noise. However, at increased wind speeds, the sound of the wind itself is likely to drown out the sound of the turbines spinning. The noise of the turbines at close range does not drown out conversation, because the noise generated by the turbines is the sound of "swooshing" wind.

The next step of our research examined how far noise generated at the site would travel, and if it would affect any residences in Berlin, Petersburg, or Williamstown. First we analyzed the pattern of noise from a turbine. As can be seen in Figure 8, below, decrease in noise level has a semi-log relationship with increased distance from the turbine.

[17] *Noise Levels in Our Environment Fact Sheet.* http://www.lhh.org/noise/decibel.htm Accessed 2 Dec 2002.

Figure 8 : Graph of Sound vs. Distance from Wind Turbines



Within 200 m (655 ft) of the site, the rotation of the turbines is audible, but at a level softer than the sound of a normal conversation. At 500 m (1640 ft) away from the site, the audible noise of the turbines is the level of a whisper.

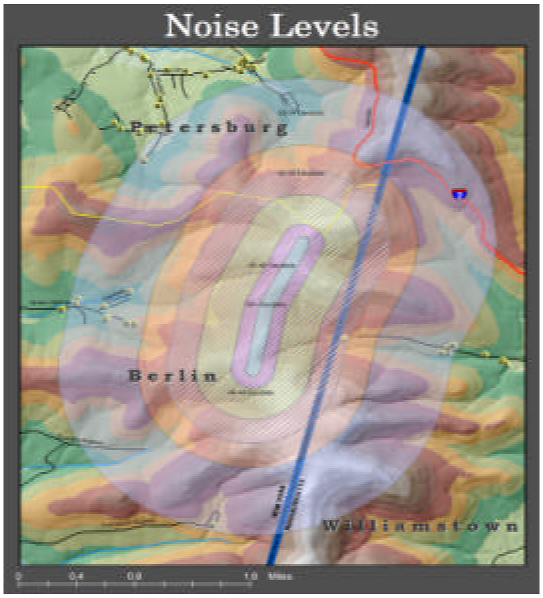
According to the graph, which unfortunately is copyrighted to the Danish Wind Power Association, and cannot be used in this paper, but can be found at: http://www.windpower.dk/tour/env/db/dbcalc.htm[18], our site would generate audible noise up to 1120 m (3675 ft), and then noise would blend into the surrounding environment. The nearest house in Berlin is 1613 m (5300 ft) away from the site, and the nearest house in Petersburg is 2419 m (7940 ft) from the northern portion of the site. Therefore, none of the houses in Berlin or Petersburg would be affected by noise generated by the turbines, and at most would hear the sound of a whisper.

To illustrate this clearly, we made a map of potential residences affected at different decibel levels, based on distance from turbines. Figure 9 below illustrates that, based on conservative worst-case-scenario estimates, the closest residents would hear a "swooshing" noise at a whisper level. Within the shaded zone, people could hear

[18] We used values of 7 turbines, 80m rotor diameter, acceptable residential noise level at 36dB, and unit size of 32.

anywhere from the full 100dB sound at the source, to 40dB, which is comparable to noises generated in a rural setting.

Figure 9: Noise Level Map (note houses are in yellow)
Source: Nicholas Hiza



Based on this research, we concluded that none of the houses will hear any noises above a whisper, and that they are in fact outside of the zone of audible noise based on calculations using the Danish Wind Power model. In support of these findings, we estimated that the worst-case-scenario presented in the sound map above, may be altered by a westerly blowing wind. Since the wind carries sound, the westerly winds might shift the left border of the whisper zone to the right. Four houses in Williamstown may be affected by the whisper zone, but are 2580 m (8465 ft) away from the site, and will be even less affected by noise than residents in Berlin or Petersburg. No residences in the area will hear more than a whisper.

Ice Throw Concerns

During New England winters, moist air could condense on the turbines at night, forming small chunks of ice, from up to 150 mm[19] (6 in) to 0.5 mm[20] (1/50 in) thick, and can cause wind turbines to stop spinning because the blade balance is uneven. On

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[19] From an address about his wind energy research by Dr. Otfried Wolfrum in Frankfurt, Germany. Found at: http://www.sfv.de/briefe/brief97_4/sob97408.htm

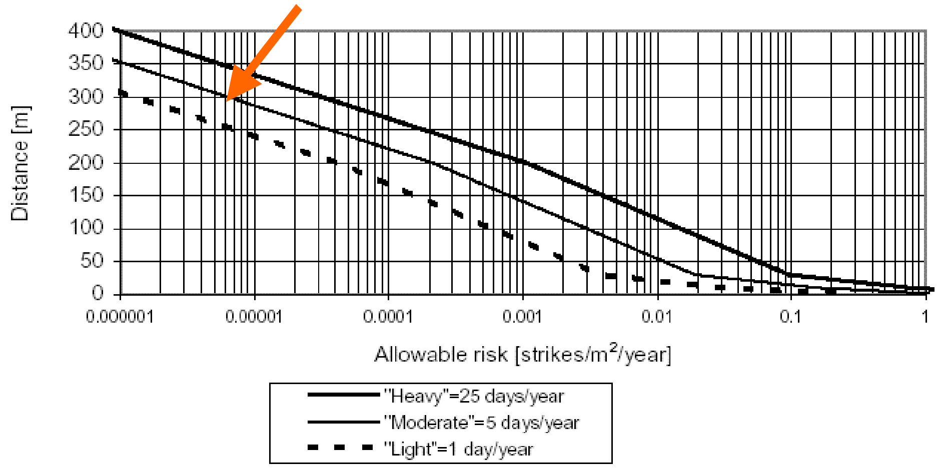
[20] Morgan/Seifert, et. al. "Assessment of Safety Risks Arising from Wind Turbine Icing". Prepared by the Deutsches Windenergie-Institut and Garrad Hassa and Partners, Ltd.

mornings following icing, these chunks begin to melt, and a turbine operator has to manually reset the turbines so that they start spinning again. This has the potential to reduce slightly the productivity of the turbines, however, most studies show that, in climates similar to Berlin Pass, icing occurs only 3-5 days a year. Restarting turbines shortly after ice melts would limit the loss of productivity. Another drawback of icing, is that as the turbines start spinning again, they may fling off pieces of melting ice. The research performed on such ice throws is very inconclusive and scattered. Some studies show that ice can be flung as far as 500 m[21] (1640 ft), and others show that the risk may only be 127 m[22] (415 ft). Our concerns therefore include ice throws affecting Taconic Crest Trail users, as the College could face considerable liability should someone get hurt.

Figure 10, below, shows that at a site with moderate icing, such as ours, the risk of being hit by falling ice from a turbine with a 50 m (165 ft) blade diameter at a distance of 300 m (985 ft) away is .00001, which is a relatively acceptable risk factor. Although our turbines would have blade diameters of 80 m (260 ft), ice throw danger from ice throws from any turbine with blade diameters over 40 m (130 ft) is the same.[23]

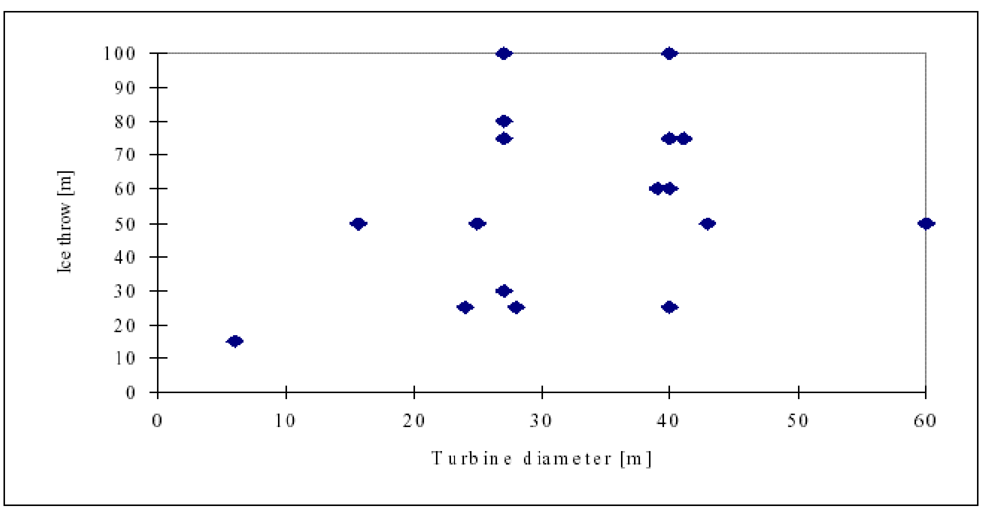
[21] From Notes on the BOREA V Conference on Wind Energy Production in Cold Climates, Levi, Finland.
[22] Crescent Ridge Wind Power Project in Bureau Country, IL. Found at: http://www.crescentridgewind.com/faq.htm Accessed 22 Nov 2002.
[23] Schaffner, Beat. "Wind Energy Site Assessment in Harsh Climatic Conditions: Long Term Experience in the Swiss Alps". Bern, Switzerland.

Figure 10: Graph of Allowable Risk from Ice Throws vs. Distance



In a study on wind turbine operators, none reported ice being thrown more than 100 m (330 ft) from turbines of 10 – 60 m (33 – 200 ft) blade diameter. Figure 11, shown below, illustrates the results of this study. Again, these blade diameters are shorter than the proposed turbines for Berlin Pass. Therefore, we suggest a safety zone of 300 m (985 ft) to ensure the safety of hikers and site users, as well as operators.

Figure 11: Data Collected By Operators on Distance of Ice Throws



Issues Regarding the Taconic Crest Trail

One complication for the proposed project is the presence of the Taconic Crest Trail. Marked by white blazes, the trail runs for 56 km (35 mi) along the Taconic Mountain Range. An approximately 1.6 km (1 mi) section of this trail runs through Williams College property and the proposed site for the wind farm.

The trail currently supports a variety of recreational uses; it is enjoyed by hikers, mountain bikers, skiers, hunters, and—though unauthorized in their use of the trail—all terrain vehicle (ATV) and snowmobile enthusiasts. Organizations with vested interest in the trail include the Taconic Hiking Club, the Taconic Trails Council, the Williamstown Rural Lands Foundation, and the Rensselaer-Taconic Land Conservancy. The trail is accessible from Williamstown via Hopkins Forest, Shepherd's Well Trail, Birch Brook Trail, Bee Hill Road, and Oblong Road. The trail itself is quite wide, and in some places in poor condition for hiking enjoyment. The ruts and large puddles in the trail are most likely caused by ATVs. Perhaps construction of the wind project could include restoration of the trail to be more hiker-friendly and to discourage damaging vehicular traffic.

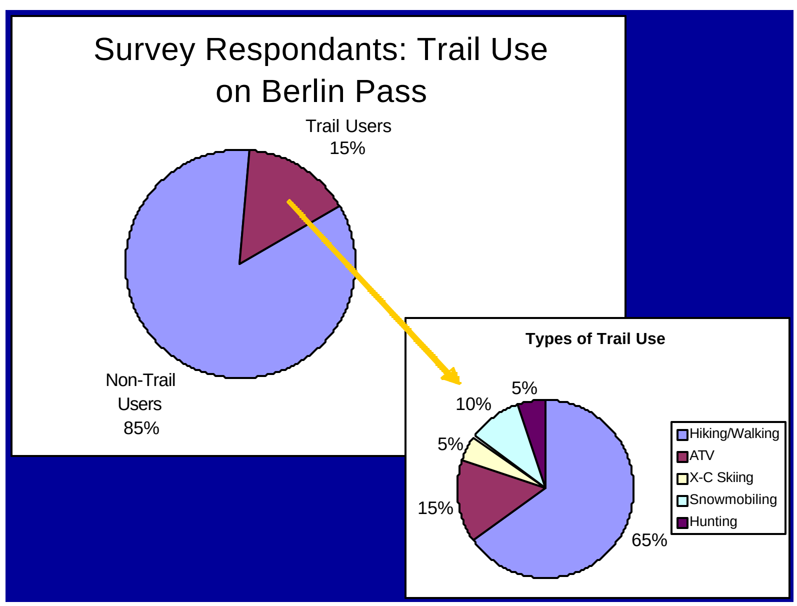
The addition of a wind farm to the Taconic Crest could potentially have both positive and negative effects for trail-users. It may detract from the wilderness experience of hiking, but it may also attract other hikers and lead to restoration and further protection of the Taconic Crest Trail. Because of its location on the ridge, the trail offers expansive views of New York and Massachusetts. If the wind turbines are to be built, we were concerned that hikers might resent the obstruction of this aesthetic feature of the trail.

Considering the compatibility of wind turbines and trail-users is a major component in our evaluation of the wind farm project. Though having foot traffic right next to the turbine during the summer presents little danger, ice flying from the blades in winter months may be problematic. As part of the project, constructing an alternate route around the wind farm site will be necessary to insure the safety of individuals using the trail. The important components for evaluating the feasibility for constructing an alternate trail are public opinion, construction requirements, and cost.

Trail Use and Public Opinion

The Taconic Crest Trail supports a wide variety of recreational activities. Based on responses to surveys—one conducted by a Williams student in 2000 regarding use of the entire trail, and one administered as part of this project regarding use at Berlin Pass—we found that there are both winter and summer uses of the trail. Only fifteen percent of the 2002 respondents reported using the trail for recreation. These respondents marked hiking as the most frequent activity. Camping, ATV use, mountain biking, and hunting were other common summer uses. In the winter the use of the trail is much lighter and the primary uses are cross-country skiing and snowmobiling. According to a survey

Figure 12: Graph of Trail Use



conducted in 2000, only 0.7% of respondents used snowmobiles on the trail and 38% skied on the trail, but only 15% reported skiing frequently on the trail.[24] Because of issues of ice on the turbines, these responses are important because they indicate that there is enough use of the trail in the winter to justify providing an alternate route around the site.

For safety and liability reasons, providing an option to pass around the turbines on heavy icing days is necessary. Besides the logistical necessity of building a new trail, there are additional benefits to constructing an alternate route. The current trail, because of the variety of activity that it supports, is heavily impacted and degraded for hiking use in many areas. Trail officials referred to the trail as "semi-urban."[25] The new trail would be restricted to non-vehicular uses, and would therefore provide a more pristine and enjoyable trail for hikers and skiers, the most frequent groups recreating on the Taconic Crest Trail at Berlin Pass.

Because of the long history of the trail, we were concerned that siting of the wind turbines and the construction of an alternate trail could face some opposition from individuals using the trail for recreation. Hikers are the most frequent users of the trail, and to gage their opinion of an alternate route we contacted the Taconic Hiking Club (THC). The THC was founded by Edward T. Herald in 1932. The club "began to develop the continuous Taconic Crest Trail in 1948."[26] The club is still active today and has a broad membership.[27] Katherine Wolfe is the current director of the THC. The Hiking Club sponsors organized hiking and cross-country skiing outings and serves

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[24] Ibid.
[25] Wolfe, Katherine. Peronsal Telephone Interview. 13 November 2002.
[26] http://www.williams.edu/CES/studentpapers/taconic.html Accessed 15 Dec 2002.
[27] http://www.williams.edu/CES/studentpapers/taconic.html#Site Accessed 15 2002.

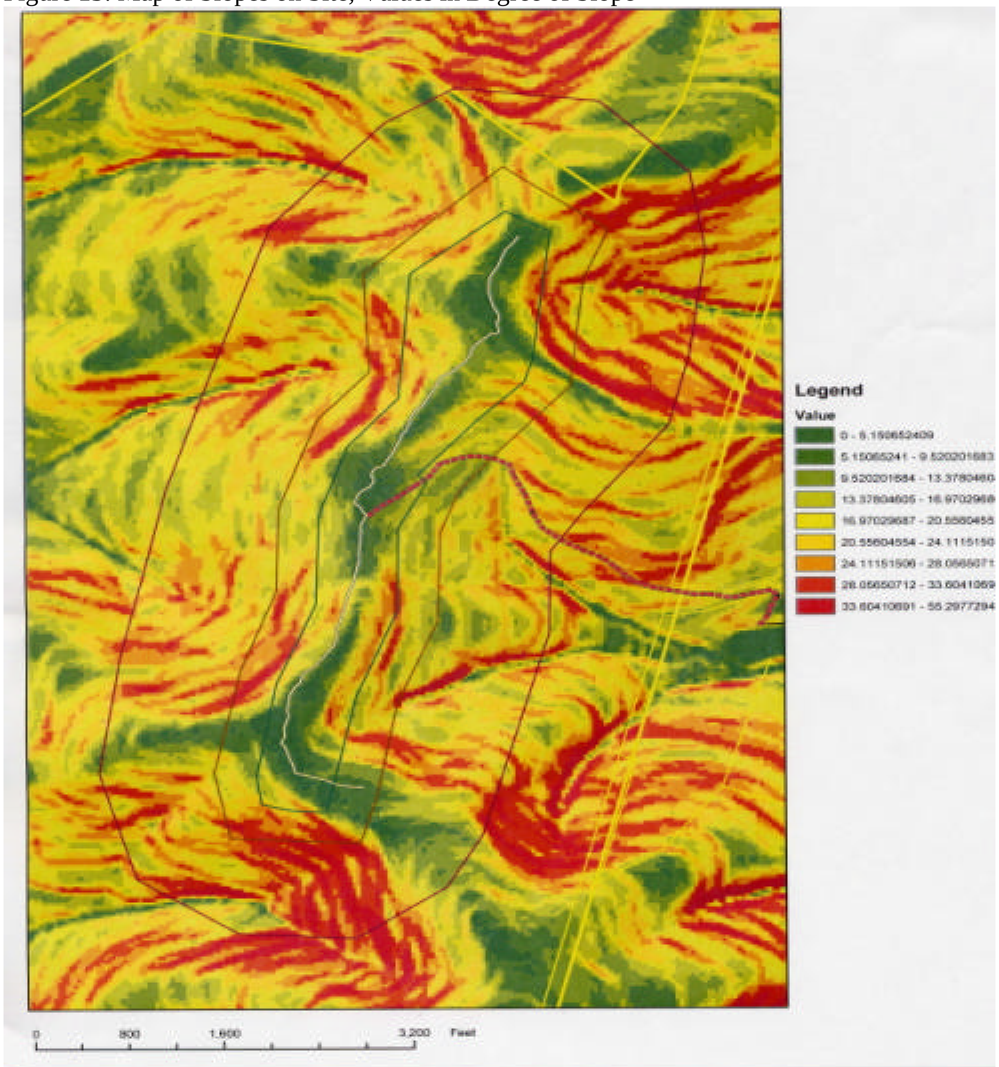
members in New York State and Massachusetts. The club maintains much of the trail. It is also part of the New England Trail Conference and the New York-New Jersey Trail Conference.[28] A phone discussion with Ms. Wolfe about the proposed project touched on the pressing issues that directly affect the Taconic Crest Trail: trail easement, ice throws, public safety, and alternate trail construction. Ms. Wolfe expressed her adamant support of wind energy stating, "We all will have to bite the bullet about wind turbines. They are coming."[29] She stressed that she could speak for the members of the club as well. Ms. Wolfe assured us that the Hiking Club would support the construction of an alternate trail if Williams College provided the funding for its construction and for some of its maintenance. Though other users of the trail will have to be considered, the largest contingent of people that recreate frequently on the Taconic Crest Trail support both the wind project and the construction of an alternate trail.

Trail Construction Requirements

The topography on either side of the Taconic Crest is very steep. Because of this terrain, a new trail would have to be heavily engineered as a three-quarter bench or full bench trail to prevent erosion.[30] The trail also needs to be wide enough to accommodate skiers in the winter. Though the exact siting of the trail will have to be surveyed by the contractor building the trail, construction of an alternate route is possible.

[28] The Taconic Crest Trail Guide
[29] Wolfe, Katherine. Personal Telephone Interview. 13 November 2002.
[30] Jones, Drew. Personal Interview. 2 December 2002.

Figure 13: Map of Slopes on Site, Values in Degree of Slope



Source: Nicholas Hiza

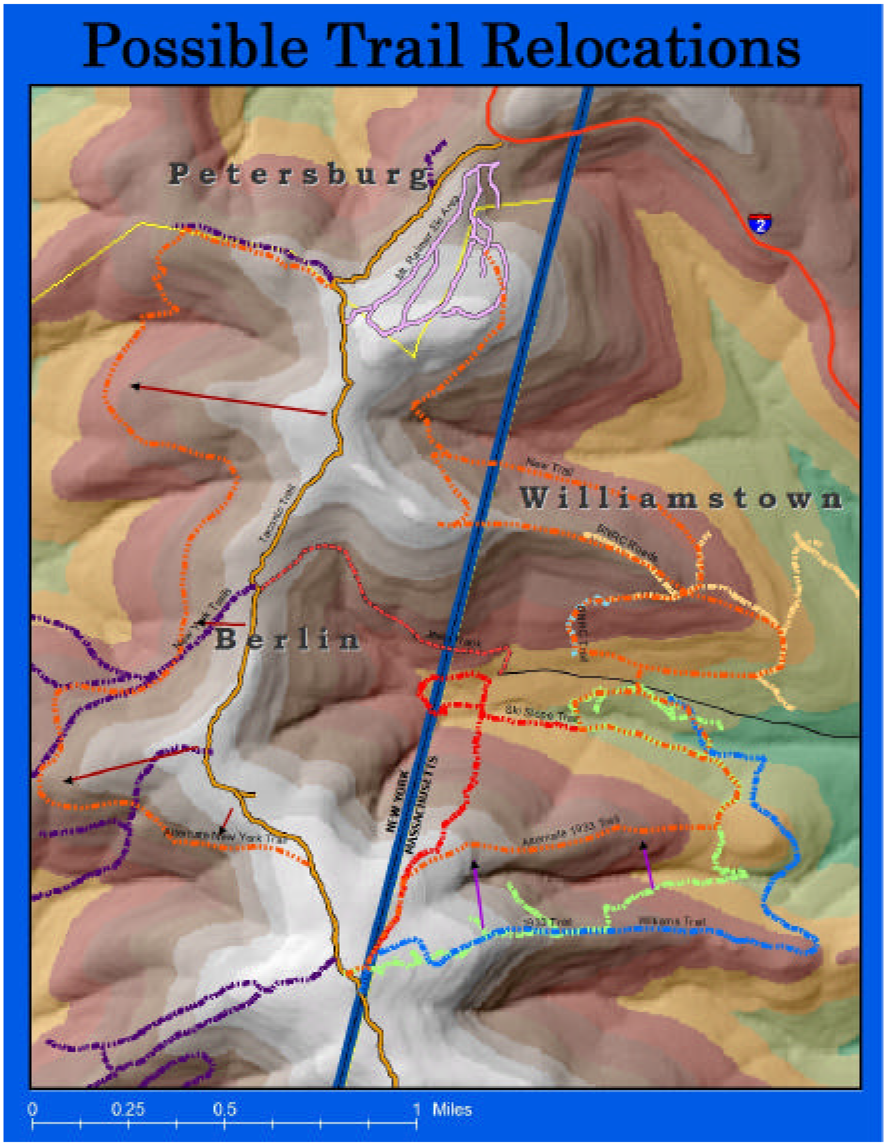


Figure 14:
Alternative Trails

Source: Nicholas Hiza

Proposed sites for new trail locations exist on both the New York and sides would be well outside of the 300 m (985 ft) range of predicted ice throws, and would therefore be safe for winter recreation. The New York alternative would be constructing in State Reforestation Land. Trail construction is allowed under the New York Environmental Conservation Law which allows use of the land for recreation and kindred purposes. A new trail certainly falls within this category. On the Massachusetts side the land is owned in parcels by Williamstown, Williams College, Williamstown Rural Lands

Foundation (WRLF), and the Berkshire Natural Resource Council (BNRC). Both the WRLF and the BNRC are currently considering their own trail construction projects in this area. WRLF is considering relocating the existing 1933 Trail onto a neighboring ridge to the north. BNRC is considering extending the roads existing on its property into trails to Mt. Raimer and other points along the Taconic Ridge. If an alternative were to be constructed in the Massachusetts side, combining efforts in the construction of a greater trail network would be possible. Our research regarding the terrain and property ownership shows that it would be possible to construct an alternate trail on this site. The land use regulations pertaining to trail construction, however, also affect the feasibility of building a new trail.

New York State Land Use Regulations

To the west of the Williams College property is a narrow parcel of New York State Reforestation Area. Directly to the west of this strip is land on which the State of New York holds a conservation easement. The legal restrictions on this land could be more or less cumbersome than on the land that the state owns outright, and Williams College should keep this in mind when seeking legal council.

If the alternate trail were to be constructed in New York, one set of regulations pertinent to trail relocation is the NYSDEC, Division of Lands and Forests, Bureau of Public Land's land use regulations. The land directly abutting Williams College's property is New York State Forest, which the NYSDEC is managing as a Reforestation Area. New York's Environmental Conservation Law (ECL) section 9-0501 defines the purpose of a Reforestation Area to adapt land "for reforestation and the establishment and maintenance thereon of forests for watershed protection, the production of timber and other forest products, and for recreation and kindred purposes."[31] The Taconic Crest Trail certainly falls within "recreation and kindred purposes," and the NYSDEC would likely permit a trail crossing easement.

Trail Construction Cost

The cost of constructing an alternate trail is the final consideration to its feasibility. According to the New York State division of Parks and Recreation, which construction many trails, a rough estimate for the construction of an engineered trail is between $1,800 and $2,000 per mile,[32] (or $2,800-$3,200 per kilometer), 3.3 miles (5.3 km) would have to be constructed on the NY side costing $6,600 dollars. On the MA side, 3.19 miles (5.1 km) of new trail would be constructed, but when added to the existing and proposed trail network it would total 5.8 miles (9.3 km). The cost of this project would be $6,380. When considering the cost of the wind farm project this is a very small amount and is manageable.

Fencing

An alternate trail is needed to prevent injury to individuals recreating on Berlin Pass and limit the liability risk for Williams College. In addition to providing an alternative route, we also had to look into fencing the entire site. When speaking to the Williams College administration, they informed us that a fence would not be necessary. They suggested that a chain across the trail during heavy icing days and a sign posting the dangers of ice and advising users of exercise caution and their own discretion would be sufficient to reduce the liability risk for the College. We suggest, despite this information, however that the College inquire into the insurance requirements and

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[31] http://www.dec.state.ny.us/website/dlf/publands/landclass.html Accessed 15 Dec 2002.
[32] Messenger, Robert. Personal Email Correspondence. 5 December 2002.

liability risks associated with other wind farms. If a fence in fact needed to be erected, the land regulations of the adjoining property will be an issue. The turbines will be on Williams' property. A fence, however, would have to be located in the adjoining New York land.

Because it is Reforestation Land, the New York Conservation Rules and Regulations might prevent the installment of fencing at the edge of the 300 m (985 ft) safety zone, which, as mentioned earlier, may or may not be problematic to the proposed project. The New York Conservation Rules and Regulations, Title 6, Chapter II, Part 190 establishes acceptable uses of state owned land. Section 190.8 states "The use of State forest preserve land or any improvements thereon for private revenue or commercial purposes is prohibited."[33] The fences would most certainly serve Williams College's commercial purposes. Unless the site developers receive special permission, constructing a fence on the New York side of the site will be impossible. We suggest that the College put up a chain to close the trail on days when there is a risk for injury, and post clear signs advising trail users about the turbines and ice and directing them to the alternate trail.

Trails Recommendation

An alternate route is needed to circumvent the site. Based on our research, it is both supported and feasible. We recommend constructing the alternate trail on the Massachusetts side, because the cost is lower, and if combined with other existing trail construction proposals it would result in a wonderful new trails network.

[33] http://www.dec.state.ny.us/website/regs/190.htm#top Accessed 15 Dec 2002.

Economic Analysis

This project cannot move forward unless the economics of installing and maintaining a wind farm are viable. How much investment will a project of this proportion require? Is this project an economically sound investment for the College or is it cost-prohibitive? Based on preliminary figures, the total investment for site infrastructure and seven turbines is about ten million dollars. Equipment and installation will cost $1,200,000 per 1.5 megawatt General Electric wind turbine. Infrastructure and siting, including road construction, interconnect to the existing electricity grid, and substation construction will cost $1,600,000 total. The payoff period, which is the period of time required to earn back the original capital investment not accounting for inflation or other market changes, is relatively fast. A conservative estimate is around eight years and an optimistic estimate is four years. Business investors generally consider a project with a payoff period shorter than ten years a solid investment.

Survey Results

Since the college expressed that it would not go forward with a wind project unless there was adequate town support for it, public opinion was one of the most determining factors in our feasibility study. For this reason, one of our major goals was to assess public opinion among the people who would be most affected by a wind project on the proposed site, namely the citizens of the Towns of Berlin, Petersburg, and Williamstown. Conducting a public survey not only indicated how much local support the project had, but it also informed us of the aspects of wind energy about which the people were most enthusiastic or pessimistic, as well as the common misperceptions about wind generated energy. As a starting point, we used the *Public Acceptance Study* *of the Searsburg Wind Power Project: Year One Post-Construction* as a local model for our survey.[34] While we could not duplicate the scale of the Searsburg survey nor its 58-page analysis, it contributed greatly to our survey composition. In addition, issues such as noise, bird fatality, ecological disturbance, were considered when formulating the questions. A copy of the survey is included in Appendix I.

Due to limited time and resources we used a convenience sampling method. That is, we surveyed available groups of individuals at popular gathering points such as Stewart's Shops in Berlin, the post office, public library and town hall in Petersburg, and Williams College campus, the post office and other shops on Spring Street in Williamstown. The major drawback to this non-probability sampling style is that it makes our data susceptible to selection biases. We were cognizant of this, and especially in Williamstown, we tried not to taint our sample pool by using Williams College professors and students as the predominant respondents. In total, we administered ninety-one face-to-face surveys. Twenty-four of those respondents lived in Berlin, twenty-seven in Petersburg, twenty in Williamstown, and the remaining twenty-one were residents of other local regional towns, illustrated in the graph below.[35] Also, the graph of the age distribution of our respondent population echoed the US census data[36], in that, the largest age group was between thirty to thirty-nine years old, indicating that we obtained a relatively representative cross-section of the target population. Generally, the respondent demographics spanned a broad age range from the teens to seventy plus year olds.

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[34] Vermont Environmental Research Associates, Inc.
[35] Other towns included Bennington, VT., Grafton, Troy, Hoosick, NY., and Adams, MA.
[36] www.census.gov Accessed 15 Dec 2002.

Figure 15:

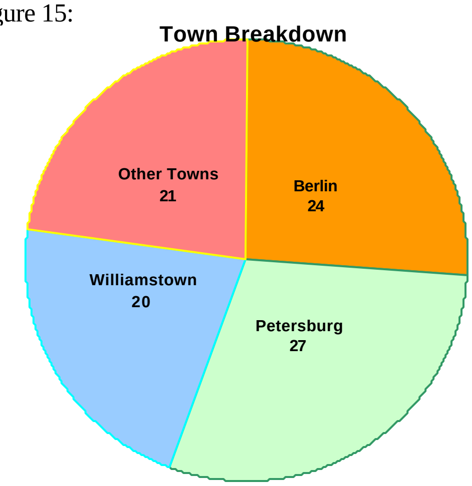
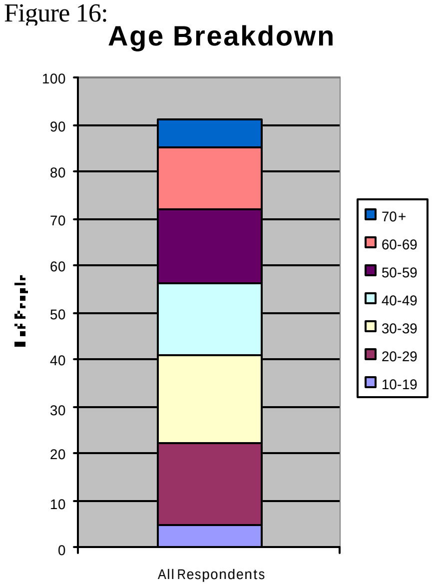


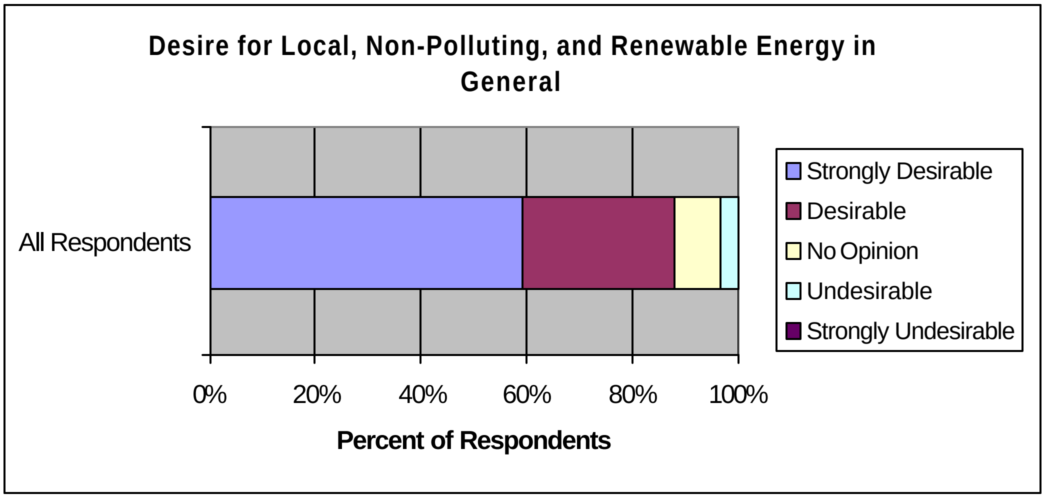
Figure 16:



Support for Wind Power

When formulating the survey we realized that the questions had to be simple, and the survey quick, otherwise, people would not take the time to complete it. Therefore, we divided the survey into three sections titled “Your Opinion,” “Taconic Range Windmill Proposal,” and “Information about You”. In the first set of questions, we gauged the general opinion about wind energy in the context of energy use. We showed respondents graphs of how they currently received their energy, specific by state, and then asked them whether or not they, “would like to get my energy from a local, non-polluting and renewable source.” Almost 60% responded that they “strongly desired” such energy. That number rose to about 90% when considering the people who “strongly desire” and those who simply “desire” clean, renewable sources of energy. Please see graph below for an illustration of this data.

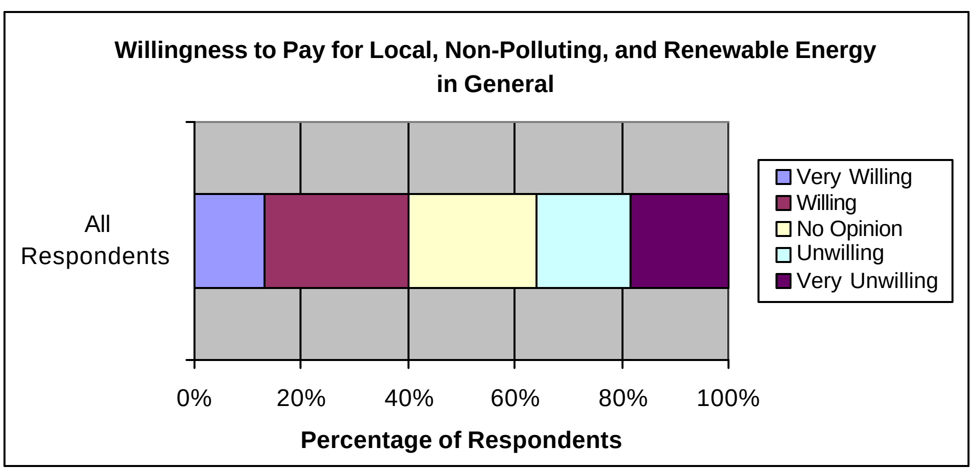
Figure 17:



The fact that at least 90% of the respondents desired or strongly desired cleaner energy shows an interesting trend in support for renewable energies, which we did not expect.

Next, we asked if they were willing to pay more for that energy. As predicted, the number of people who were very willing to pay more for clean, renewable energy dropped to 15% as compared to the 60% who strongly desired this energy. Roughly 40% were "willing" or "very willing" to pay more, as can be seen on the graph below.

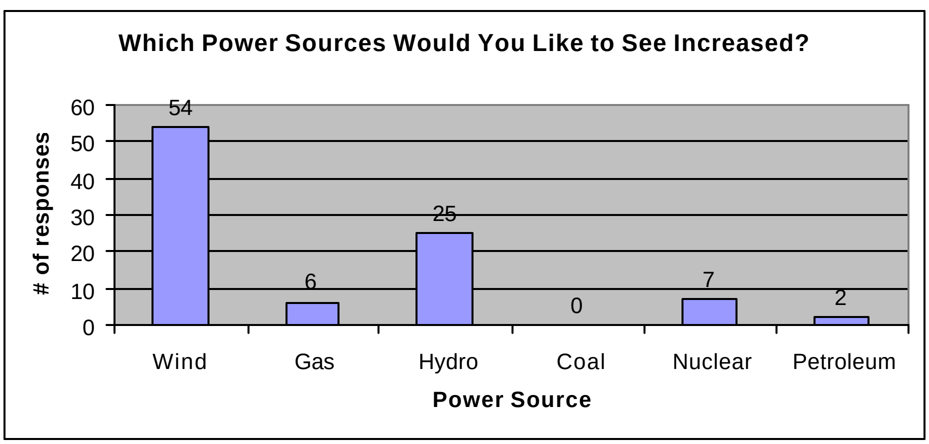
Figure 18:



While this precipitous drop from desire to willingness to pay reflects a more complicated socioeconomic phenomenon, it did indicate that the respondents were honest enough to tell us that they were not willing to pay more. Thus, our survey results are not biased towards or favor wind energy and the authenticity of the answers did legitimize this more strongly.

The next survey question asked respondents which of the power sources presented to them in the graphs of their current energy supply at the beginning of the survey, they wanted to see increased or decreased. According to our calculations, 57% of the respondents specifically wanted to see wind technologies as a power source increased. Interestingly, many respondents also favored hydro-electric power as a source of clean energy. However, the number of people who supported wind-generated energy exceeded the number which supported hydro-electric power by two times. Lagging far behind clean energy, dirty sources of power, such as nuclear, gas, petroleum and coal, together appealed to only 15% of the respondents. It is not surprising that towns which have seen industry, such as a plastics company, reject the increase of coal powered plants. The compilation of data from this survey question can be seen in Figure 19.

Figure 19:



We then asked the survey respondents if they liked windmills for any reason, and if so, why. 70% responded that yes, they do like windmills. More importantly, 31% of this 70% cited the renewable, non-polluting nature of wind energy as the primary reason.

Figure 20:

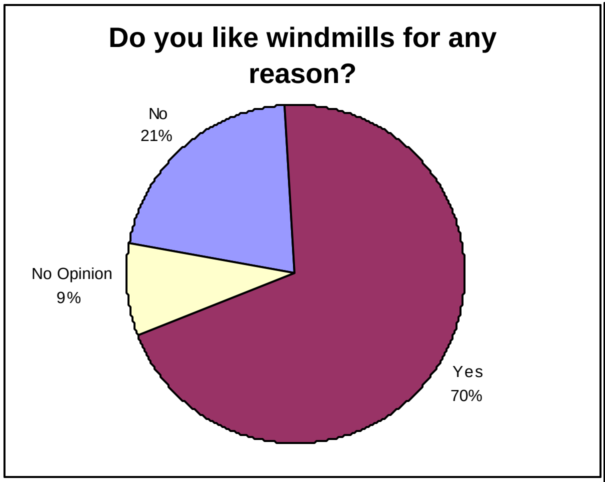
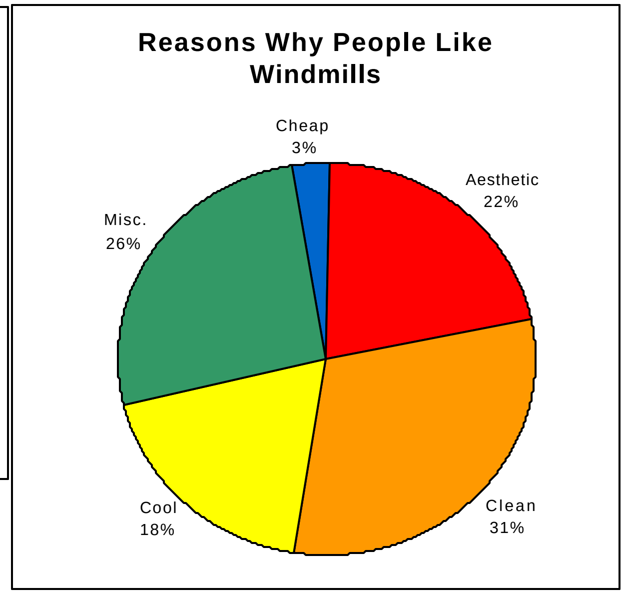


Figure 21:



Following the environmental reason, the aesthetics of windmills appealed to 22% of respondents. In addition, 18% of respondents expressed a strong but unspecific positive association with windmills, saying that windmills were "cool," "cute," or "great". 3% of respondents liked windmills because they provide cheap energy. The remaining 26% of respondents who like windmills are clumped into a miscellaneous category because their answers were too vague. Overall, the surprisingly positive response we received from individual people encouraged us that this support in the community might help Williams College to realize that wind was not a lost cause.

Conversely, we asked the opposite question, "Do you dislike windmills for any reason?" At 82%, a clear majority of our respondents do not dislike windmills for any reason, which considering that this response is a double negative, means that they could find not reason to dislike windmills. The reasons for their aversion to windmills were named by the 18% of respondents who said they dislike windmills are summarized in four categories. The main reason people gave was aesthetics (50%). 33% disliked windmills because of the noise generated by them. 11% felt that poor siting of the windmills would create problems, and, finally, 6% listed reasons that were too elusive for form a substantial category.

Figure 22:

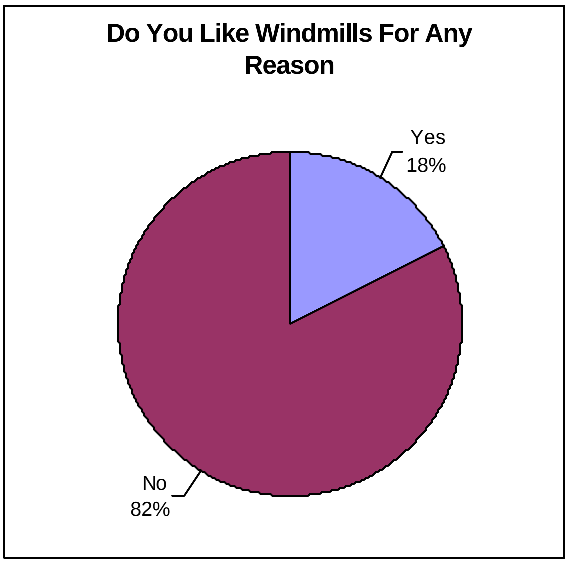
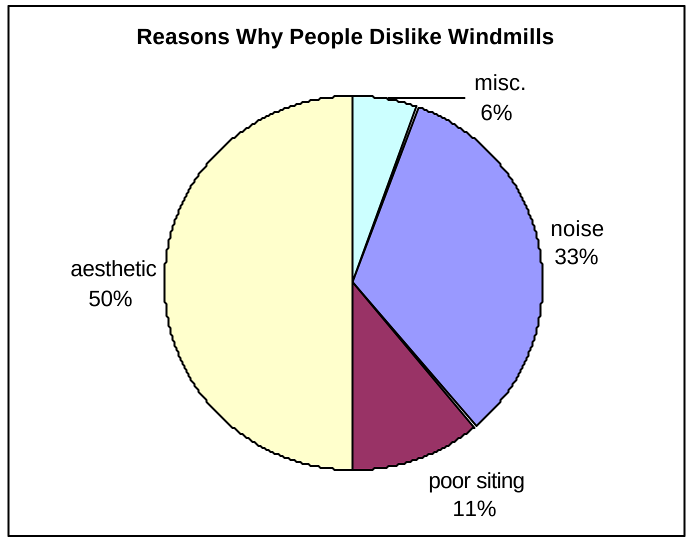


Figure 23:

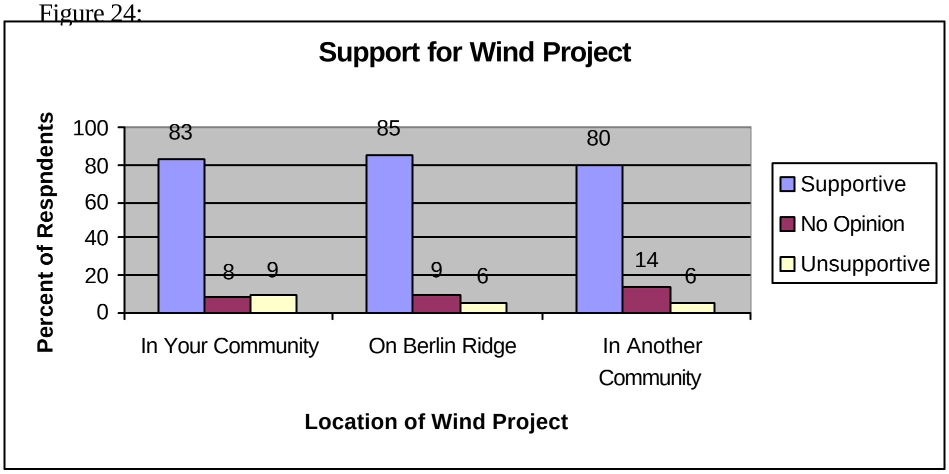


These results were not surprising as we predicted prior to conducting the survey that the most formidable public concerns with the project would be the aesthetic degradation of the ridgeline and the noise pollution generated by the turbines. We decided to further explore the aesthetics issue by questioning the respondents on the attractiveness of the ridge with and without the turbines. These results will be covered later in the section dedicated to aesthetics. Our research on noise showed that the perception of noise issues are exaggerated, and based on mainly of stereotypes of other wind projects. As pointed out earlier in this report, noise is a minor issue for this project, given the distance of the turbines from residential homes, and that the turbine noise will be masked by other factors, such as wind in the trees, traffic and other 'natural' sounds. We feel confident that once the public is informed of the latest improvements in wind turbine technology, the benefits of wind-generated energy will outweigh these drawbacks.

Support for Berlin Pass Wind Project

In the last section of the survey, respondents were asked if they would support a wind project in their community, on Berlin Pass, and in another community. The results indicate whether public support depends on where the turbines were built. The percentage of respondents who supported a wind project was high across the board at 80% or more and there was little variance by location. This shows that the "not in my backyard" (NIMBY) sentiments do not obstruct citizens from embracing wind energy.

Figure 24:

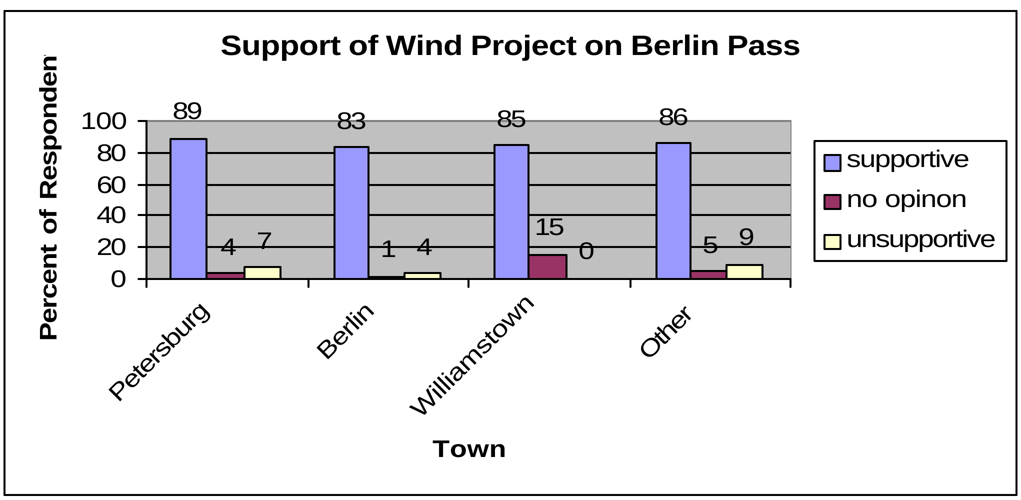


In short, Berkshire and New York neighbors agree that wind is a good technology, and, for the most part, are not hesitant to build them in their backyard. When asked if they would support a wind project specifically on Berlin Pass, the numbers were again very positive at 83% or more respondents expressing support.

By analyzing the results by town, we saw that the varying effects of place of residence related to the level of support were not substantial, showing us that wind energy not only has local community support in Berlin, but on some level, also has broader regional support in the surrounding towns.

Our findings of public opinion were generally reassuring and encouraging. Public support was overwhelmingly higher than we anticipated. As we expected, concerns about the aesthetics of the wind farm and fears about noise generated by turbines were the biggest public concerns. However, we feel that our research may put these issues to rest. Once again, we looked to the wind project at Searsburg, Vermont, where two public opinion surveys have been conducted – one before turbine installation and one after – for ideas of what changes in public opinion we might expect. Looking at their results, we found that the public usually anticipates the effects of wind turbines to be worse that they actually are. Moreover, it appears that people actually become more accepting of wind turbines once the structures are built and the rotors are spinning. Given that the future of wind on Berlin Pass depends heavily on public support, our survey results indicate that

Figure 25:



the majority of people are supportive, and that Williams could expect them to be somewhat more supportive after construction and installation is completed.

Aesthetic Concerns

When we asked respondents who disliked windmills to state their reasons, 50% responded that they do not like the way that the wind turbines look. However, of all the respondents, this 50% accounted for 9% of the total pool – about 8 respondents. Therefore, contrary to expectations, while aesthetics are a concern for some respondents, and warrant examination, they do not present a large problem. When we asked them about aesthetics we got a wide variety of responses, such as, "I like windmills 'cause they're cute", "I think that turbines are really artistic in a modern industrial sort of way", and "I think they are God awful. I couldn't stand to look at those things every day".

To analyze more specifically the public's aesthetic concerns, we showed respondents photographs of views from three different locations in the surrounding communities and from the site itself. First we placed the photographs in context by showing respondents an area map with the four views marked. The four views include: a photograph of the site itself during the early spring, a photograph of Green Hollow as seen from the east, a view of the ridge from the junction of Routes 2 and 22, and, the last view which we showed only the Williamstown residents, a photograph of the ridge taken from Blair Road. For each of the four views we showed respondents current pictures of the site and pictures with the proposed turbines digitally imposed into the original photographs (see Figures 26-33).

Figure 26. Berlin Pass without Turbines

Source: Nicholas Hiza

Figure 27. Berlin Pass with Turbines

Source: Nicholas Hiza

Figure 28. Green Hollow without Turbines

Source: Nicholas Hiza

Figure 29. Green Hollow with Turbines

Source: Nicholas Hiza

Figure 30. Green Hollow Junction without Turbines

Source: Nicholas Hiza

Figure 31. Green Hollow Junction with Turbines

Source: Nicholas Hiza

Figure 32. Blair Road without Turbines

Source: Nicholas Hiza

Figure 33. Blair Road with Turbines

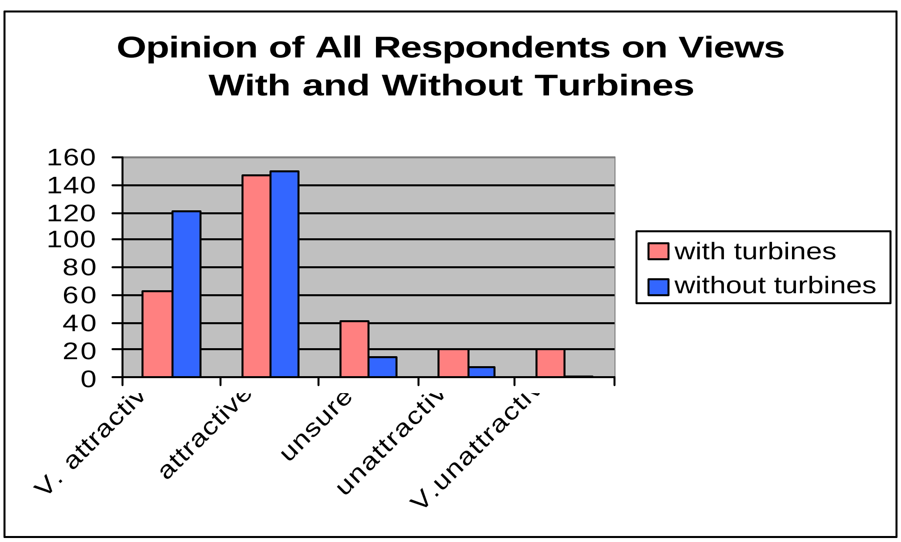
Source: Nicholas Hiza

In administering the aesthetics section of the survey, we asked respondents to rate whether they thought the photographs with and without turbines were "very attractive", "attractive", "unattractive", or "very unattractive", or whether they felt "unsure" how to rate them. Each change in opinion was measured as a positive or negative impact value, based on what degree of intensity the respondent changed their opinion. For example, if a respondent thought the photograph of the site on the Berlin Pass was very attractive without turbines, and then changed his opinion to simply attractive, that picture would receive a score of -1. Similarly, if a respondent said that she thought the photograph of Green Hollow was unattractive without turbines, but rated it attractive with turbines, the picture earned a score of 2. Finally, if a respondent thought both views were attractive, the photograph got a score of 0 because the respondent did not change her opinion. This analysis allowed us to quantify the visual impact of turbines by comparing increase or decrease in affinity.

Surprisingly, the opinions of the respondents were supportive, echoing the result that only 9% found aesthetics to be a problem. Interestingly, the percentage of people who thought that the turbines were a negative aesthetic feature decreased after the respondents had actually looked at the photos. One respondent even considered them "very attractive" after looking at the pictures. The average drop in attractiveness for respondents who expressed aesthetic concerns was -1.4, and although this is greater than the average value, translates to the respondent dropping between one and two levels of attractiveness. These statistics show that the residents of these four towns do not consider aesthetics to be a large problem – if they consider them a problem at all.

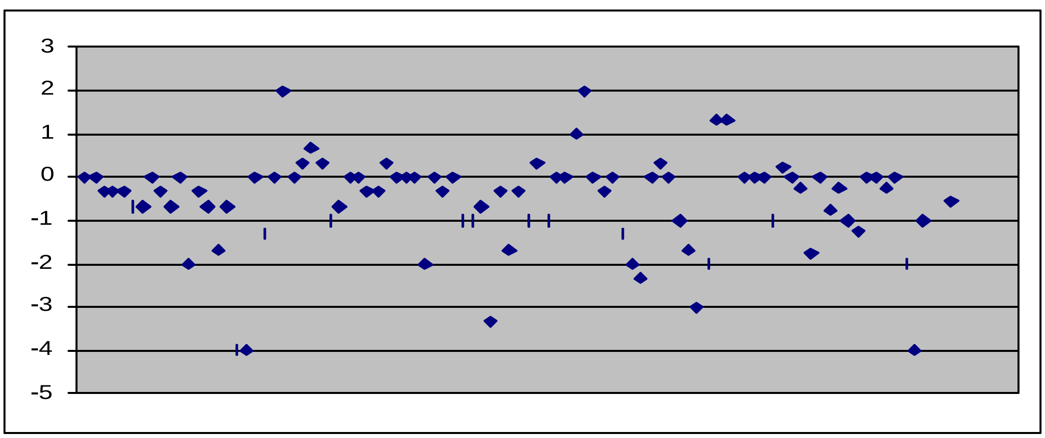
The opinions of all respondents on all views, with and without turbines, are shown in Figure 26 below. The skew to the left of the data indicates that not many people thought that views with turbines were unattractive or very unattractive.

Figure 34:



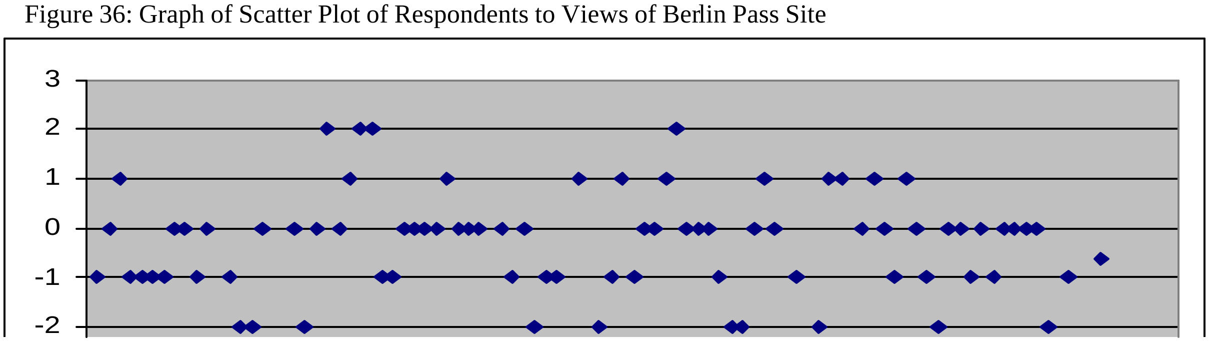
The following graph shows a scatter plot of the incremental drop or increase in attractiveness rating of the respondents. In this type of scatter plot clusters in the data are significant because they show trends in responses. While Figure 27 does not seem to have obvious clusters, there is a strong correlation of either zero or -1 impact values. The average value of all respondents is -.56, which illustrates that most respondents did not consider the visual impact of the turbines to merit a full change in attractiveness.

Figure 35: Graph of Scatter Plot of All Respondents to All Views



When we showed respondents the two pictures of the site on the Berlin Pass, we got slightly more negative responses, the average impact value being -.59.

Figure 36: Graph of Scatter Plot of Respondents to Views of Berlin Pass Site



We account for this .03 impact value drop by an increase in the number of people who gave impact values of -2 or -3. This could be because they were looking at them from a close view. However, there is also a clear cluster of respondents who felt that the turbines had no impact on the attractiveness of the site. Many respondents also thought that considering the rough terrain of the site, the turbines did not really make an aesthetic difference. As Figure 29 and 30 show, the majority of respondents still had an impact value of zero, and the percent of respondents who thought the photograph with the turbines was unattractive was 28% -- or 25 respondents.

Figure 37: Number of Respondents at Each Impact Value

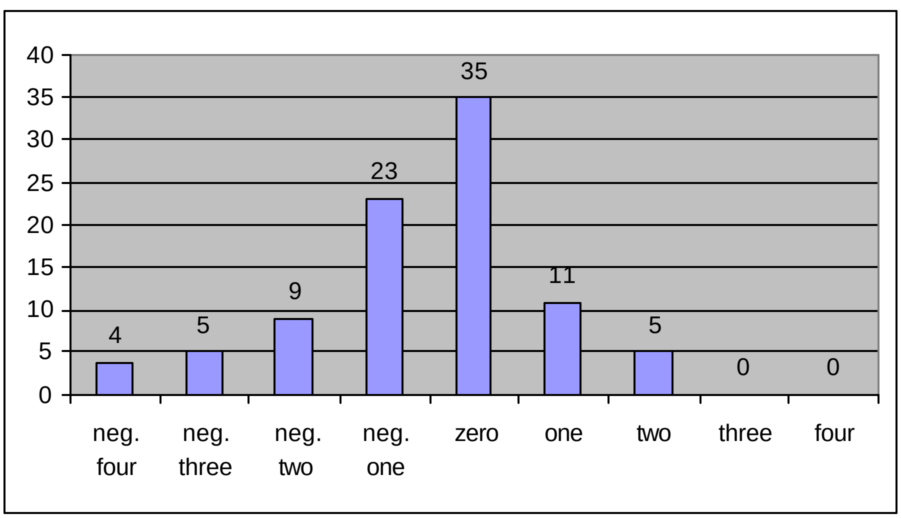
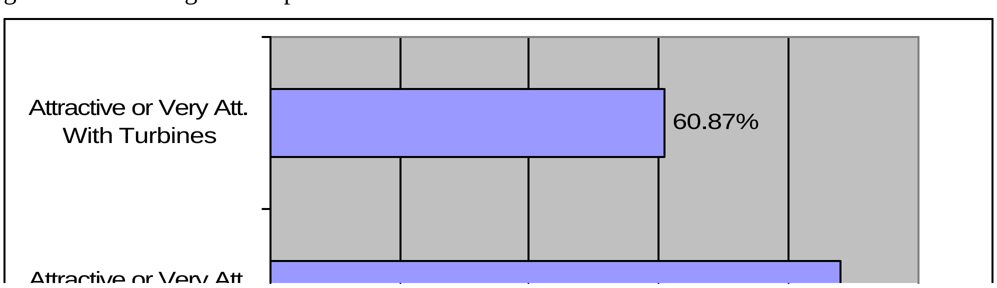


Figure 38: Percentage of Respondents who Rated The View of Berlin Pass Attractive



The next view that we showed the survey respondents, was the photograph of Green Hollow from the east. As can be seen on the scatter plot in Figure 31, this view scored the worst of all the views that residents of Berlin and Petersburg saw. This could be because of a strong affinity for the landscape, and the presence of the turbines at the center of the ridgeline. The average impact value is -.63, but again, there is a large cluster at zero, which can be clearly seen on Figure 32.

Figure 39: Graph of Scatter Plot of Respondents to Views of Green Hollow

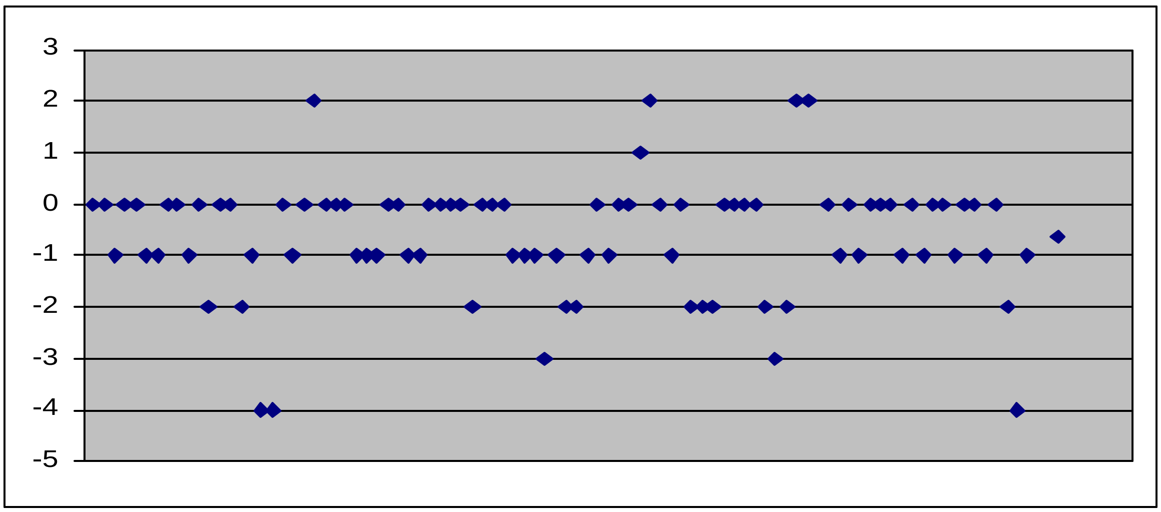
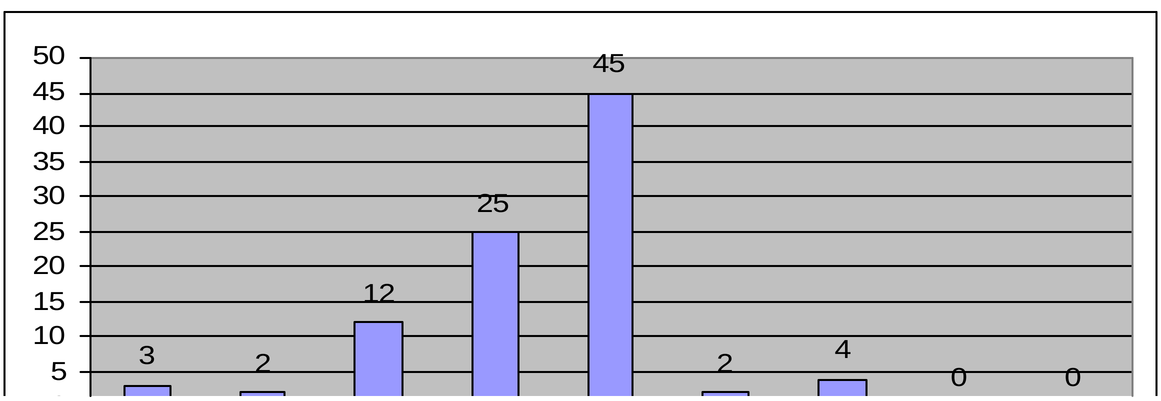
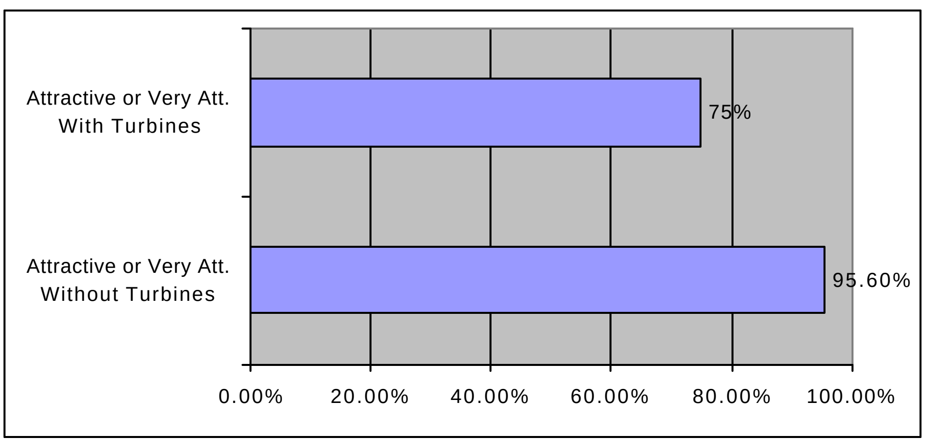


Figure 40: Number of Respondents at Each Impact Value



Finally, the percent of respondents who thought that this view was unattractive was 25%, less than the previous view, and corresponding to 23 respondents.

Figure 41: Percentage of Respondents who Rated The View of Green Hollow Attractive



The third set of pictures shown to the survey respondents were of Green Hollow Junction with and without the turbines. Surprisingly, many respondents did not like this picture without the turbines because they thought that the house was ugly. Although we reminded respondents that they would see the turbines more clearly in the winter months when the trees lost their leaves, many still felt that the trees would mask the impact of the turbines in the landscape. However, this did not seem to affect the impact value. As Figure 34 illustrates, the scatter plot of responses shows a strong correlation at zero impact. The average impact value on this set of pictures was -.44, better than the overall average, suggesting that most respondents were had the greatest affinity for this view with turbines. Indeed, with all of the other elements of this view – the house, street signs, cars, and the road itself – the visual impact of the turbines is negligible.

Figure 42: Graph of Scatter Plot of Respondents to Views of Green Hollow Junction

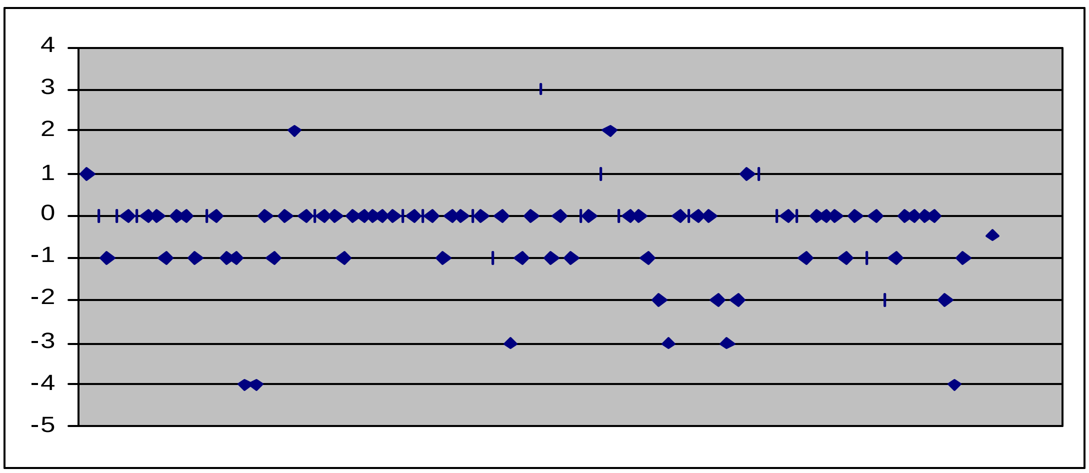
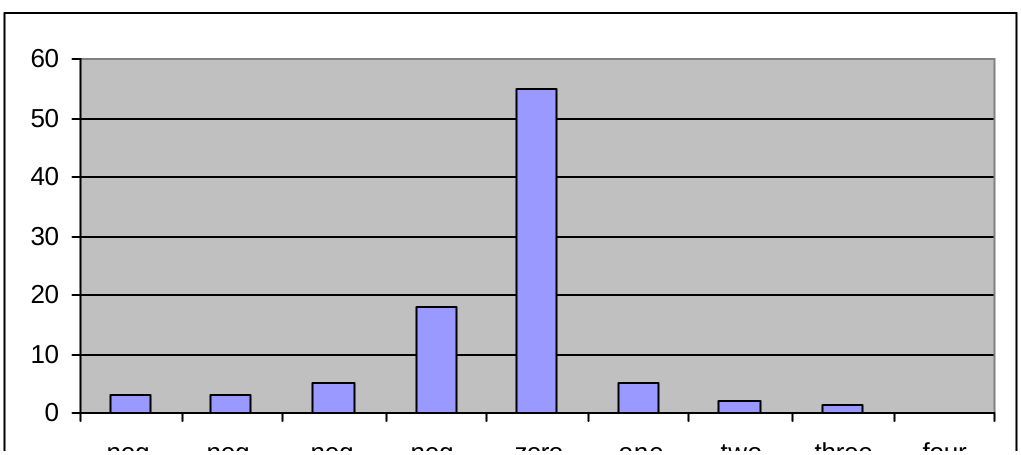
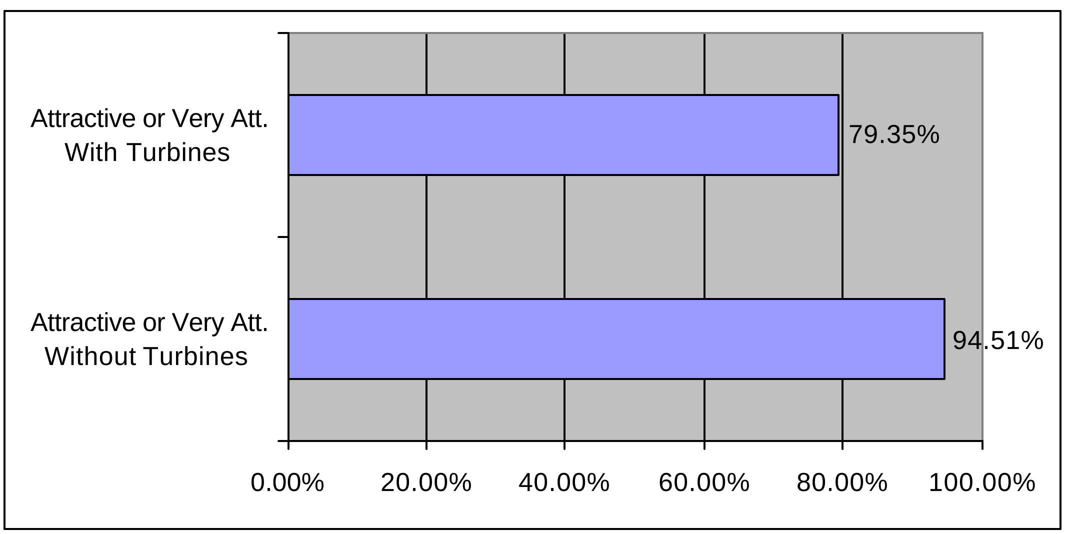


Figure 43: Number of Respondents at Each Impact Value



In addition, the percent of respondents who considered this view unattractive was roughly 15%, or 14 of the respondents.

Figure 44: Percentage of Respondents who Rated The View of Green Hollow Attractive



The fourth set of views, shown only to Williamstown residents, was the least encouraging of all. This could be because we surveyed a smaller number of people for the aesthetics of this photograph, or because residents of Williamstown were the most negative respondents. This is interesting, since they will be least affected by the turbines visually. However, it points to the trend that when the turbines are the most prominent feature on the landscape, such as in the Green Hollow and Blair Road views, people responded more negatively. When the turbines are just one additional man-made feature in the landscape, as in the Green Hollow Junction view, they trouble people less.

As can be seen on the three following graphs, there is no clear cluster of responses among the Williamstown residents. All had negative or zero impact values, and the average is -.9, the lowest score in the survey. However, as Figure 38 shows, the overwhelming majority of residents thought that the turbines had no impact. Figure 39 reinforces these findings because only 3 Williamstown residents found the views with the turbines unattractive.

Figure 45: Graph of Scatter Plot of Respondents to Views of Blair Road

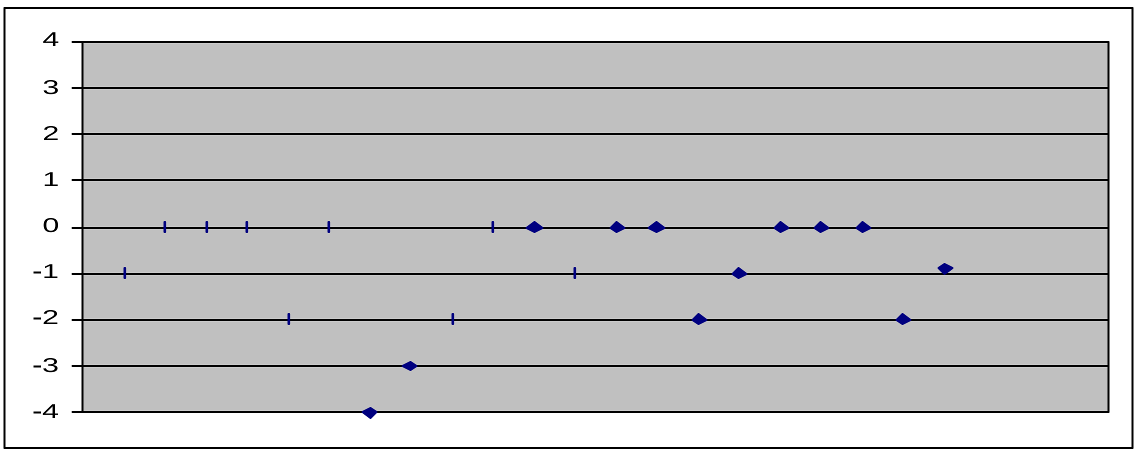


Figure 46: Number of Respondents at Each Impact Value

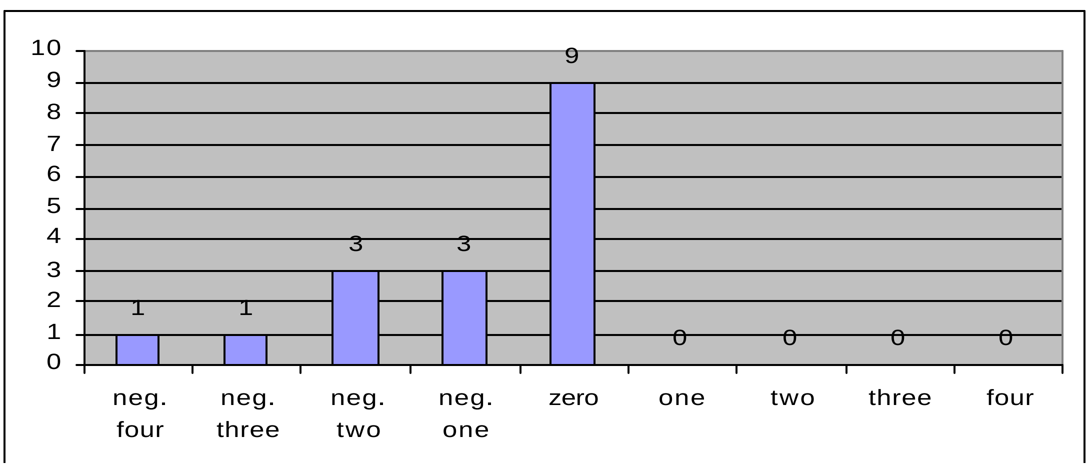
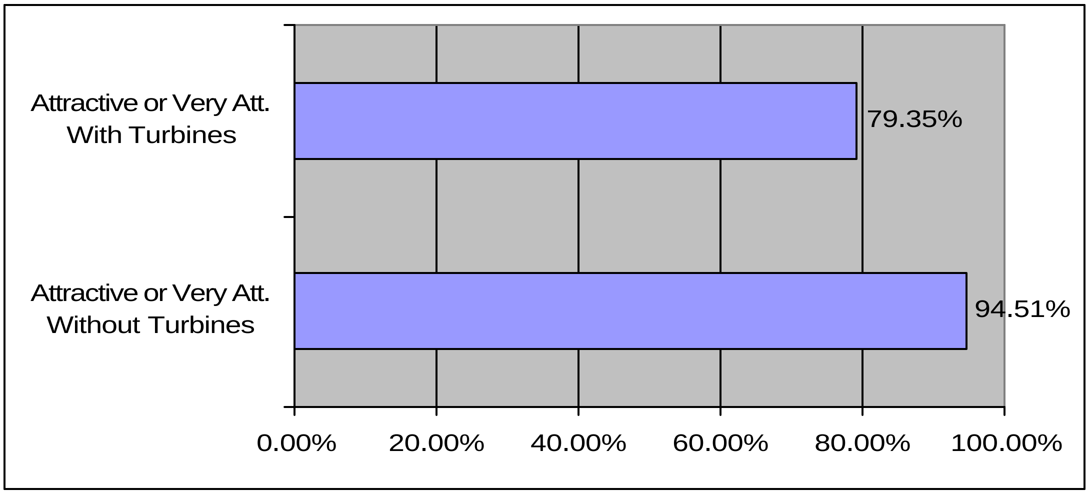


Figure 47: Percentage of Respondents who Rated The View of Green Hollow Attractive



this specific project in the communities of Berlin, Petersburg, and surrounding towns. Even the slightly less enthusiastic residents of Williamstown are positive and give the views an average impact value of less than -1. Furthermore, very few of the respondents actually thought that the turbines were unattractive. This shows that Williams College should not be wary of public opinion in the affected towns. Our data shows that there is support, and that this support is across the board, which is very encouraging. The mere fact that only 9% of the respondents thought that aesthetic concerns were a problem, shows that this issue should not be a hindrance to this project.

Legal Logistics

The proposed site is located within the town boundaries of Berlin, New York. Because Berlin does not currently have a bylaw regulating wind power, the most pertinent regulation on the parcel is zoning. The Williams College parcel is zoned as a Rural Use District. Uses permitted by right in this district are one-family dwellings, residential cluster developments, forestry, golf courses and country clubs, and roadside stands. To develop a commercial enterprise on the site, Williams College would need to apply for a special permit from the Town of Berlin Zoning Board of Appeals (ZBA). The ZBA could exercise much discretion in this decision. One of the general standards for a special permit reads "the character and appearance of the proposed use, buildings, structures, and /or outdoor signs shall be in general harmony with the character and appearance of the surrounding neighborhood."[37] This codifies the ZBA's right to reject the project based on aesthetic objections.

Article VIII of Berlin's land use regulations outline the required process to obtain a special permit. First, an applicant must have a sketch plan conference with the ZBA, presenting a property tax map and a topographic map of the proposed project area. The board will either ask for more information or decide whether or not the project requires full review. The applicant then must submit an application for site plan approval including a detailed site plan. At this point the applicant must also pay the appropriate application fee. The plan can then be subject to a public hearing if the majority of the ZBA deems it desirable. Then within sixty days of receipt of the application or within forty-five days of the public hearing the ZBA has to act on the application. The board can approve, disapprove, or approve with modifications the site plan application.

The two issues most likely to influence the Zoning Board's decision are aesthetic concerns and taxes. The citizen concerns about visual degradation of Berlin's surrounding mountains are less severe than anticipated as discussed in the previous section on the survey results. One important issue that could potentially increase the

[37] Berlin Town Board, *Land Use Regulations*. Berlin Land Use Committee [1988]. p 16.

Zoning Board's support of a wind proposal for Berlin Pass is taxes. Currently the undeveloped parcel is assessed at $66,200. With commercial development, the assessed taxable value of the land would increase by approximately $750,000 per turbine installed.[38] This would increase the assessed value of the property to about $5,250,000 (7 * $750,000). According to the year 2000 annual report on real property tax rates for municipalities by The New York State Comptroller's Office, the 2000 property tax range in Berlin was $24.39 to $25.38 per $1000 of assessed value.[39] Based on these figures, the possible taxes on the hypothetically developed site could range from $128,047.50 to $133,245.00 per year, as opposed to the current $1609.74 to $1675.08 per year. Therefore, the least increase in tax revenue that the town of Berlin would receive would be $126,372.42 per year.

Berlin does not currently have a bylaw regarding wind energy, but in the past the town has reacted vehemently against proposed projects that the public did not support. When wireless companies wanted to erect structures in the town, the Zoning Board placed a moratorium on new construction until they could pass a bylaw. Two sections of the *Proposed Town Law pertaining to Wireless Telecommunications Towers / Facilities within the Town of Berlin, Rensselaer County, New York,* that might indicate the town's reception of wind turbines are requirement for a visual impact assessment and the recertification requirement. The proposed law would require cell tower applicants to present a zone of visibility map, pictorial representations of before and after views, and

[38] ECONorthwest, "Economic Impacts of Wind Power in Kittitas County." A Report for the Phoenix Economic Development Group, October 2002. p 11-12.
[39] http://www.cdrpc.org/PropTax.html#2000 15 Dec 2002.

an assessment of visual impact.[40] This could help Williams College to anticipate the process through which the Board might assess visual impact. This proposed bylaw also requires that cell towers apply for recertification at the five-year anniversary of granting of the special permit.[41] If Berlin imposed such a restriction for a wind power site, this might be prohibitive, as five years might not be long enough for a developer to break even.

Based on this information, the college should continue to cooperate with Berlin's Zoning Board of Appeals. First, we should share our survey results with them to assuage fears of public backlash. Also, we should highlight the tax benefit that the project will provide the town. Ultimately, we should encourage Berlin to pass a wind bylaw. The process of writing the bylaw would compel the town to begin thinking critically about the criteria they would like a wind project in their municipality to meet.

Conclusion

Constructing a wind farm on Berlin Pass involves environmental, public opinion, legal, economic, and safety issues. The research for this study shows that none of these concerns will impede the development of wind energy on the proposed site. The communities affected by this project support its development, and they would benefit from its economic and educational value. Wind energy is clean, renewable, and local. Our research proves that a Berlin Pass wind farm is feasible, and we encourage Williams College to invest in its development. This project presents Williams with an ideal

[40] Berlin Town Board. *Proposed Town Law pertaining to Wireless Telecommunications Towers / Facillites within the Town of Berlin, Rensselaer County, New York*. p 7.
[41] Ibid. p 15.

opportunity to be an environmental leader and to educate its students about the importance and value of renewable energy.

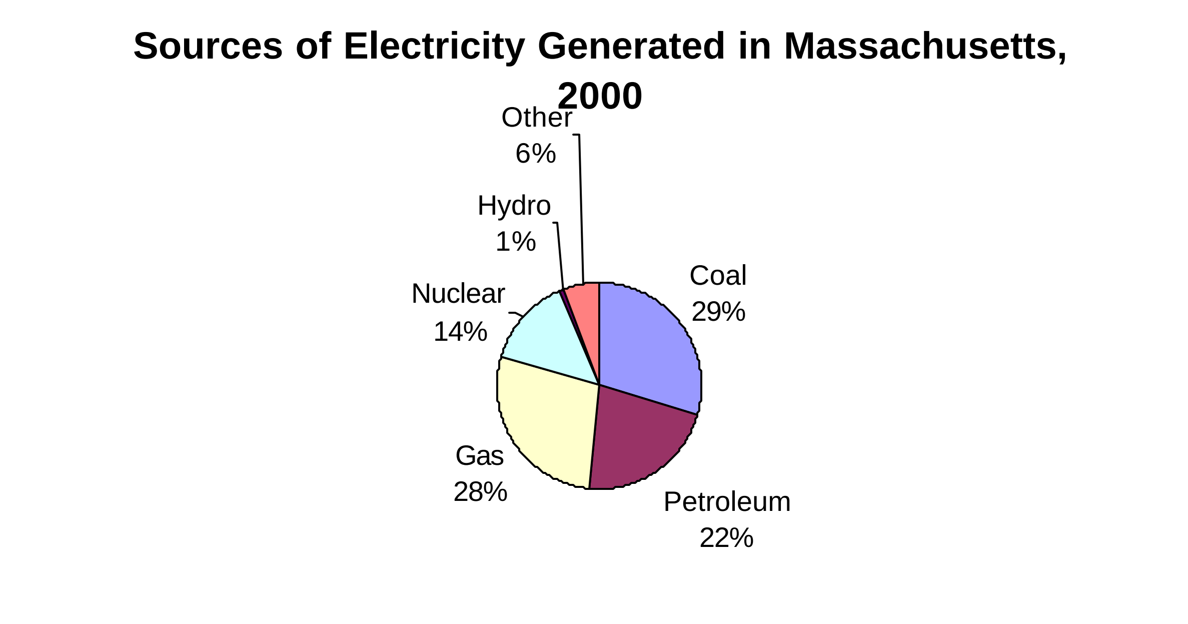
Appendix I:

Survey

WIND ENERGY SURVEY: RAW DATA

Raw Data in Red

Your Opinion:



1. Please rate 1-5: 1 = strongly agree 3 = no opinion 5 = strongly disagree

	1	2	3	4	5
I would like to get my energy from a local, non-polluting, and renewable source # of Respondents	53	27	9	3	0
I am willing to pay more for my energy to get my energy from a local, non-polluting, and renewable source # of Respondents	12	25	22	14	19

2. Which power sources, if any would you like to see increased?

____

decreased?____

3. Do you like windmills for any reason? ______________________________

If so, why? ____

4. Do you dislike windmills for any reason? ___________________________

If so, why? ____

Taconic Range Windmill Proposal:

5. Please rate your level of support 1-5: 1=very supportive 3=no opinion 5= unsupportive

	1	2	3	4	5
Would you support a wind project in or near your community? # of Respondents	45	31	8	5	3
Would you support a wind project on Berlin Pass? # of Respondents	50	29	8	2	3
Would you support a wind project in or near a community other than your own? # of Respondents	41	33	11	2	3

6. Please rate how you feel about the following views:

View	Very Attractive	Attractive	Unsure	Unattractive	Very Unattractive
Berlin Ridge, no turbines	29	52	7	3	1
Berlin Ridge, with turbines	17	39	18	13	5
Green Hollow, no turbines	48	39	1	3	0
Green Hollow, with turbines	18	51	13	7	3
Green Hollow Junction, no turbines	34	52	3	2	0
Green Hollow Junction, with turbines	20	53	11	3	5
Blair Road, no turbines	12	8	0	0	0
Blair Road, with turbines	7	6	4	2	1

7. If this project were completed, how often would you see the turbines?
Daily [29] Weekly [33] Monthly [24] Less Frequently [6]

8. Where would you see them from? ____

Information about You:

9.Age: 10-19[5] 20- 29[18] 30-39[22] 40- 49[11] 50- 59[16] 60 -69[13] 70+[6]

10. What town do you live in? ___________________________
11. How long have you lived there? _______________________________

12. How often do you participate in the following activities?

	Frequently	Occasionally	Never	On the Berlin Pass
Hiking/Walking	47	35	9	13
Horseback Riding	3	16	70	0
Off-road Vehicles or ATV's	18	16	51	3
Cross country skiing	9	7	74	1
Hunting	16	19	52	1
Snowmobiling	14	13	61	2
Camping	26	26	35	0
Other: no additional Berlin	Pass uses			

13. Where have you gotten information about wind energy?

TV [25] Newspaper [31] Radio [11] Magazine/Book [18] Internet [8]

Town Meeting [3] Friends or relatives [16] Other source [16]