

Wind Energy and Vermont's Scenic Landscape

A Discussion Based on the Woodbury Stakeholder Workshops

By
Jean Vissering, Landscape Architect

Background

This paper addresses aesthetic considerations in the siting and design of wind energy projects in Vermont. It attempts to fairly reflect the variety of opinions that emerged during the Workshop's two mornings of discussions on the topic.

The design of wind turbines has improved dramatically in the past decade or so. They are now generally much quieter and more visually attractive. A good deal has also been learned about designing wind projects to minimize their visual impacts. The more difficult question in Vermont is where should wind turbines be sited in the landscape in order to optimize power production and minimize visual impacts. Developers at the workshop were very aware of this issue.

They want to avoid investing time and money on sites that are unlikely to be permitted due to aesthetic impacts, and want to be sure that expectations are reasonable. Town, regional and state planners want to be able to protect the most scenically valuable or sensitive areas but also to encourage wind development. Developers, planners, and regulators would like guidance that is clear and fair as to what areas would be appropriate for wind projects.



Opinions about the siting of wind turbines in Vermont varied widely among participants in the workshops, but there were some common themes which provide useful directions for proceeding with the introduction of wind technology in the Vermont landscape. There was general agreement that wind energy production is a good thing for Vermont, and that there are sites that are visually unsuited to wind energy development. Perhaps the greatest concern about wind development was expressed by representatives of the Green Mountain Club and the Appalachian Trail Conference. The spine of the Green Mountains offers the best wind resources, but is also an area that is highly valued by hikers and others for its wildness and scenic views.

In a recent book¹, Paul Gipe, a leading authority on wind technology, describes a “paradox of power”. Wind power is one of the most environmentally friendly methods for producing electricity, but it is highly visible. Many dirtier forms of power production are often easier to screen from public view (except, of course, for smog). The visual issues are especially challenging in Vermont whose landscape is highly prized for its scenic attributes. In addition, few people have actually seen modern wind turbines, and are unsure of what to expect.

General Siting and Design Requirements of Commercial Scale Wind Energy Projects

Ridgelines provide the best location for wind generation facilities in Vermont, and elevations between 2000 and 3500 feet above sea level are ideal for maximum power production. Above this elevation, icing of blades is problematic. Below this elevation, wind velocity and constancy drop off dramatically. Clearly the Green Mountain range offers ideal sites. The Taconics, and numerous other smaller mountain ranges and ridgelines offer good potential as well.

The turbines in a commercial-scale wind project are likely to range in height from 135 to 250 feet tall. While there are many designs for turbines, the most common involve a white or gray tower that is large enough for a person to climb inside to service the turbine. At the top is a turbine which consists of a nacelle and usually two or three blades. Wind projects in Vermont are likely to be clustered with up to 40 turbines. Vermont’s only existing wind energy project in Searsburg consists of 11 turbines, each approximately 135 feet tall (not including blades). The blades are black to reduce icing in winter and have a rotor diameter of 132 feet.

Lighting is required on turbines over 200 feet tall, but specific Federal Aeronautics Administration (FAA) standards for wind turbines are not yet in place. The wind industry is exploring techniques for reducing lighting impacts.

A wind energy project also requires power lines, a substation, and access roads. These are discussed in more detail later in the report.

How the Public Service Board Evaluates Aesthetic Impacts

In assessing projects for a Certificate of Public Good (CPG), the Public Service Board weighs the impacts of a proposed project against the benefits it provides to the citizens of Vermont. The Board by statute uses most of the criteria of Act 250². Criterion 8 includes the following statement which is used as the basis for evaluating aesthetic impacts:

Will not have an undue adverse effect on the scenic or natural beauty of the area, aesthetics, historic sites or rare and irreplaceable natural areas.

¹ *Wind Power in View: Energy Landscapes in a Crowded World*, Edited by Martin J. Pasqualetti, Paul Gipe, and Robert W. Righter (Academic Press, 2001) is a collection of papers written on the topic of dealing with public reactions to the visual impacts of wind technology.

² Electrical generation and transmission facilities are reviewed by the Public Service Board, and do not require an Act 250 permit.

In order to make this determination, the Board uses an evaluation process known as the Quechee Analysis. The process begins by defining the existing aesthetic resources and characteristics of the area affected. A series of questions is posed in order to first determine if the impacts will be adverse. These questions are as follows:

1) *What is the nature of the project's surroundings? Is the project to be located in an urban, suburban, village, rural or recreational resort area? What land uses presently exist? What is the topography like? What structures exist in the area? What vegetation is prevalent? Does the area have particular scenic values?*

2) *Is the project's design compatible with its surroundings? Is the architectural style of the buildings compatible with other buildings in the area? Is the scale of the project appropriate to its surroundings? Is the mass of the structures proposed for the site consistent with land use and density patterns in the vicinity?*

3) *Are the colors and materials selected for the project suitable for the context within which the project will be located?*

4) *Where can the project be seen from? Will the project be in the viewer's foreground, middleground or background? Is the viewer likely to be stationary so that the view is of long duration, or will the viewer be moving quickly by the site so that the length of the view is short?*

5) *What is the project's impact on open space in the area? Will it maintain existing open space, or will it contribute to a loss of open space?*

The Quechee Analysis also notes that certain landscapes are particularly sensitive to aesthetic impacts "because these landforms tend to be visible from a wide area or they are seen by large numbers of people." These include ridgelines, steep slopes, shorelines, and floodplains. Other features are sensitive "because they are aesthetically unique: examples may include historic structures, wetlands and natural areas."

The assessment described above is used to determine if a project's impacts are "adverse" because it is out of context with its surroundings. However, the project will be considered acceptable unless it can be demonstrated that it will have undue adverse impacts using the following criteria. A project may be found to have undue adverse aesthetic impacts if any one of the following conditions exists:

1) *The project violates a clear written community standard intended to preserve the aesthetics or scenic, natural beauty of the area. Such standards may for example, be set forth in the local or regional plan, or be adopted in the creation of an historic design district, or be incorporated into a municipal or State scenic road designation.³*

³ A clear written community standard is one which addresses a particular area (e.g. a part of a town, or a stretch of road), and which clearly identifies the resources to be protected. General statements about the value of rural character do not constitute a clear written community standard.

2) The project offends the sensibilities of the average person. It is not enough that the Board may prefer to see a different design or style, or a different type of land use, but that the project, when viewed as a whole, is offensive or shocking, because it is out of character with its surroundings, or significantly diminishes the scenic qualities of the area.

3) The applicant has failed to take generally available mitigating steps which a reasonable person would take to improve the harmony of the proposed project with its surroundings. Such steps may include selection of less obtrusive colors and building materials, implementation of a landscaping plan, selection of a less obtrusive building site with the project area, or reduction of the mass or density of a project. If there are reasonable alternatives available to the applicant that would mitigate the adverse impact of the project, failure to take advantage of those alternatives may, in some circumstances, render undue an otherwise acceptable project.

In making a final decision as to whether or not a project's impacts are undue, the Public Service Board will consider the public benefits of the proposed project, i.e. the amount of renewable energy provided.

Local Evaluation of Wind Farms

Although review by the Vermont Public Service Board preempts local permits, the role of towns in planning for the location of wind facilities in their communities is extremely important. As noted above, clear written community standards can be a critical evaluative tool for determining the appropriateness of a proposed wind facility under Board review. The discussion below should be helpful to town planners in articulating why some ridgelines are better able to absorb wind facility development with few impacts while others may be less appropriate for this use.

Benefits and Issues associated with Wind Turbines

Locating wind turbines on Vermont's ridgelines will be aesthetically challenging, but there was general agreement among Workshop participants that the environmental benefits of wind energy are likely to make them more visually acceptable to many people. Post-construction studies of the Searsburg project showed that public acceptance of the project increased after the project was in place. Many people find wind turbines attractive. But even the most beautiful human-made objects can be inappropriate in certain settings.

Ridgelines are difficult places for development for a number of reasons. Most obvious is their high visibility. Changes on ridgelines tend to be highly noticeable because they are the dividing line between earth and sky (horizon line), and because historically in Vermont, development has been focused in the valleys. Most of our hillsides and ridgelines are undeveloped. On the other hand, we have a tendency to find things to be more aesthetically appealing when they are located in logical or meaningful places. We expect agricultural fields to be located on flatter land. We expect important civic buildings to be in the center of town. And we logically expect wind turbines to be located in the

windiest locations. The fact that we can actually see the wind being turned into power with the rotating blades gives wind turbines a visual appeal that is not true of stationary communication towers like cell towers.

When looking at the potential visual impacts of wind projects, it will be necessary to look at 1) the visual characteristics of the area in which the turbines will occur, and 2) the visual characteristics of the areas from which the turbines will be seen. Mountain peaks and ridgelines that are scenic focal points in the landscape will be difficult locations for wind turbines. By contrast, more linear and undifferentiated ridgelines are usually less noticeable, and, therefore, less likely to be scenic focal points than sharply varied ridgelines. In fact, the visibility or elevation of a ridgeline is probably less important than its shape. Camel's Hump and Mt. Mansfield are examples of peaks with distinct and memorable profiles; many other mountains and ridges are less prominent.

Impacts may also be significant, if the turbines appear as prominent elements from areas where there is a high expectation of experiencing a predominantly natural or historically intact landscape. Sensitive viewpoints include hiking trails, particularly the nationally recognized scenic Long Trail and Appalachian Trails which follow the high ridgelines of the Green Mountains. Designated natural areas, wilderness areas and a few historic sites may also be sensitive viewpoints. This does not mean that wind facilities should not be developed anywhere near these uses. Rather it means that careful siting will be required in these areas so that turbines do not appear as overly prominent elements within a scenic view (see below), or compete visually with an important scenic focal point.

Visualizing Proposed Wind Energy Facilities

It is fairly easy to determine where wind turbines will be seen from and how they will look. Computer generated viewshed analyses illustrate potential viewing areas, which can then be field verified. Simulated images of turbines on photographs give a fairly accurate portrayal of how turbines will look. A weather balloon flown on a windless day (usually difficult on a good site for wind turbines), or a tall crane can provide the public with a sense of the height of the turbines in the landscape.

Up to a half-mile away, details of the turbines will be visible. This is a foreground view. From ½ mile up to 3-5 miles is considered to be middleground. With increasing distance the turbines will appear to be a smaller and smaller part of the overall view. Beyond about 7 miles, turbines are likely seem so small as to be insignificant in the view.

Evaluating Aesthetic Impacts

There are two parts to evaluating aesthetic impacts.

- Determine whether there are landscape characteristics which make either the project site or specific viewing points particularly sensitive to aesthetic impacts (see below).
- Determine if the project's siting or design characteristics seriously degrade an aesthetically sensitive site or viewpoint.

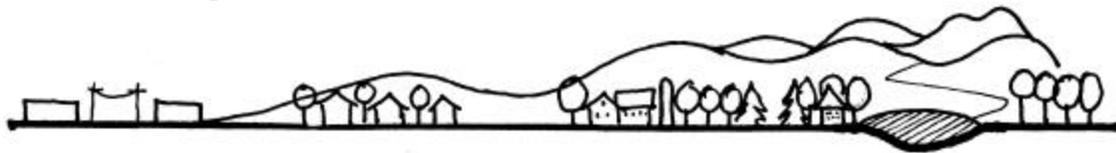
Areas which are particularly sensitive to aesthetic impacts include areas of exceptional scenic quality, areas which have some distinct or unique visual or cultural attributes, areas of recognized natural value where cultural elements are out of place, or areas where a particular historic period has been preserved. When these areas have been legally designated through a systematic inventory and planning process, they are more likely to be recognized in the Public Service Board's review procedures.

Identifying areas of high scenic value is not as difficult as it might seem. A number of well-established methodologies for evaluating scenic quality have been developed⁴ based upon extensive research about how we perceive landscapes. Often these techniques are combined with public surveys to prioritize scenic resources that deserve special protection.

Some basic concepts used in determining scenic quality and evaluating impacts are described below, along with their relevance in siting wind turbines.

Diversity

In general, the greater the vegetative and topographic diversity of a landscape, the higher its scenic quality. Landscapes that are highly scenic often contain dramatic contrasts such as flat open meadows in combination with steep mountains. Water features (lakes, ponds, rivers) or dramatic rock cliffs or ledge often further enhance scenic quality. For siting wind turbines, a more undifferentiated or horizontal ridgeline, will be preferable over one with a distinct or varied profile.



Increasing Scenic Quality ----->

Order

Natural landscapes tend to be highly varied but with an underlying natural order. The most attractive built landscapes also tend to have an inherent sense of logic or order to them. Often this is expressed in patterns such as the distinction between village and countryside, or the patterns of development concentrated in valley bottoms. Despite their strong contrast with traditional patterns of growth in Vermont, wind turbines are logically associated with hilltops and ridges. In wind project design, the clean and simple repetition of one type of turbine seems to have much greater appeal to people than combining many types or combining turbines with other elements like cell towers.

⁴ The U.S. Forest Service uses a methodology for evaluating all its land holdings and for determining appropriate management practices (*National Forest Service Landscape Management, Volumes 1 and 2*). The methodology is the basis for all federal environmental impact assessments. It has been adapted for ranking scenic quality along highways, coastlines, and for evaluating entire states by physiographic regions.

Focal Points

Some landscape features are focal points because they contrast with what is around them in form, color, or texture. Camels Hump is a good example. It rises above surrounding mountains, has a memorable and easily identified profile, and a rocky summit. The Statehouse in Montpelier with its round golden dome is an example of a cultural focal point. Wind turbines on ridgelines will become focal points due to their strong physical contrast with their surroundings. This will be a problem primarily when they compete visually with another scenically important natural or cultural focal point.

Camel's Hump rises above surrounding mountains and has a distinct profile, making it a strong focal point in the landscape.



Prominence/Dominance

Prominence has to do with both distance and position in the view. Wind turbines diminish in prominence quickly with distance. Within a quarter mile they can be both seen and heard, and will be very noticeable. Within a half mile away they are considered to be part of the foreground view (assuming they can be seen). As distance increases, the turbines will become a much smaller portion of the overall view, and therefore, less dominant. At five miles, turbines will be visible, but much less prominent.

Prominence also increases when an object is seen in the center of a view. This is especially problematic if turbines are seen in the context of an important visual focal point, where it will compete for our attention. Ideally, turbines should be located so they are at the periphery of a scenic view, or sufficiently far away to appear as a small part of the overall scene.



Searsburg's turbines viewed from 1/2 mile away and from 4 miles away. Note that the profile of the ridgeline is generally horizontal and undistinguished in visual character.

Scale

In California's Tehachapi Pass there is a wind farm with over 1000 turbines. This is a landscape on a much grander scale than Vermont, but even there, the size of the project is controversial. Vermont's landscape is very different from the American west and projects need to be scaled appropriately. Searsburg's 11 turbines fit reasonably comfortably into the landscape. More could probably be accommodated there without significant impacts. Projects involving up to 40 turbines are likely to be a starting point in Vermont, but an appropriate size or scale of project will depend on the characteristics of an individual landscape. It may be necessary to start small and expand as wind turbines become more accepted elements in the landscape. One of the reasons wind energy projects have been so successful in Denmark and Germany is that most projects consist of single turbines or small clusters rather than large arrays.⁵

Visibility/Viewer Sensitivity

Wind turbines on ridgelines will be highly visible, but certain viewpoints will be more visually sensitive than others. Sensitivity is a factor of the expectations of the viewer. The most sensitive viewpoints are those from which viewers are likely to expect a predominantly natural or highly scenic landscape. These landscapes would include hiking trails of State or National significance such as the Long Trail and Appalachian Trail, designated scenic roads, designated natural areas, and water bodies limited to non-motorized uses. Certain historic sites in which an atmosphere of a particular historic era is important to the experience may also be sensitive viewpoints. Visibility of wind turbines from these sites is possible provided they are not prominent elements in the view.

Wind turbines are more likely to be visible to a larger number of people in landscapes where there are many open meadows. Open meadows not only increase our ability to see the larger landscape around us, but they enhance scenic quality by increasing diversity. Steep and complex forested terrain with narrow valleys will make objects on any one ridge much harder to see, than in an open landscape of gently sloping hillsides. Numbers of viewers, however, is not necessarily the most important factor in determining visual impacts. The scenic quality of the turbine site and the sensitivity of the viewing points may be more important.

View duration (the length of time a viewer spends looking at the turbines or other site features) may be a relevant factor. In general, if the turbines are seen as a quick glimpse while driving along, the impact is less than for someone who will see the turbines from their home or an outdoor sitting area on a daily basis. The severity in this case would depend on the placement and prominence in the view.

⁵ Gipe, Paul, "Design as if People Matter: Aesthetic Guidelines for a Wind Power Future" in *Wind Power in View: Energy Landscapes in a Crowded World* (see footnote 1).

Land Uses and Wind Energy Facilities

There was considerable discussion in the Workshops about the types of areas where wind turbines would be appropriate. A number of people felt that wind energy projects may be best close to population centers rather than in remote or wild areas. Since these projects need to be located close to existing transmission lines, this makes sense from a practical standpoint as well. However, it was generally agreed that it would be too limiting at this time to suggest that certain land use types are better for wind projects than others, but the following land uses do present some particular problems and opportunities:

State Land

The State of Vermont does not yet have a policy regarding wind energy on State lands. At the present time, the State will encourage wind development on private land. Ski areas are regarded as areas with good potential since they involve already developed ridgelines. State land near ski areas will be considered only if there is no suitable private land. The State plans a public review process to determine whether commercial wind generating facilities would be appropriate on state lands in certain situations. .

Hiking Trails

Some of the greatest potential conflicts between wind energy development and scenic resources may involve hiking trails such as the Long and Appalachian Trails. Many hiking trails in Vermont ascend to high elevation ridges. Scenic views and a remote, natural landscape are among the expectations of hikers. These ridges also offer excellent potential for wind project development. There was general agreement that the two uses are not mutually exclusive in every location, but that careful siting to avoid the most sensitive sites and views would be critical. Areas where development already occurs along ridge tops, or areas where wind project development will not be visible from trails may be possible locations. The Appalachian Mountain Club has policies which suggest where wind turbines should be and under what conditions they would support a wind energy projects.

Scenic Roads

At present, only two roads in Vermont are officially designated as scenic State highways: a portion of Route 108 through Smuggler's Notch, and Route 125 from East Middlebury to Ripton. Both are dramatic natural landscapes, and views of turbines from these locations would not be appropriate. Questions were raised in the Workshops about how wind turbines should be evaluated from major state highways such as I-89 and Route 100 which have been historically recognized as scenic corridors. The State has adopted numerous laws and policies designed to protect and enhance these corridors, including recent policies to limit development around interstate interchanges. In addition, some towns have identified locally scenic roads. Development of wind energy projects should not significantly degrade the views from these roadways.

Wild and Remote Areas

There was general concern that wild and remote areas are rare in Vermont, and that it would be preferable to focus wind development close to areas where development already occurs.

Ski Areas

Ski areas offer potential for wind development for two reasons. The associated ridgelines are already developed and they are close to areas of heavy electrical demand. On the other hand, some of Vermont's most scenic ridgelines are in or near ski areas. Siting wind projects on ridges that are less memorable or distinct in profile will help to reduce impacts. As noted in the report, this has less to do with the elevation or visibility of a ridgeline, and more to do with its particular topographic profile.

Other Land Use Areas

Lakes and ponds, and historic landscapes are two other landscape types which were not specifically discussed in the Workshops. However, there are potential aesthetic issues which could arise if turbines are located within the viewsheds of these areas.

Co-location

The concept of co-location has been much discussed with regard to telecommunications projects. The idea of co-locating wind turbines and telecommunications equipment was briefly discussed in the workshop. Research has shown that visual clutter is one of the chief reasons that some wind projects are considered eyesores. The projects receiving the greatest public acceptance have been those with uniform turbines in small groupings. Combining wind turbines with telecommunications equipment must be handled carefully to avoid visual clutter, but could provide the benefit of avoiding the development of a pristine site

Site and Turbine Design

The focus of this report has been on the siting of wind turbines on ridgelines. Once a suitable site is found, the design of the entire facility becomes an important issue. Perhaps most important is minimal disturbance of the site. Unnecessary site clearing and visible roadways can have greater impacts than the turbines themselves. Several site design techniques which are likely to reduce the visual impacts of a project are described below.



Turbines

Since these elements will clearly be impossible to screen from view, it is best to design them to be clean, simple, and functional. Some modern wind turbine designs, especially the well-proportioned, white columnar wind turbines such as those used at Searsburg, have been found to be aesthetically appealing. Gray lattice type towers are often regarded as less appealing, perhaps because of their industrial associations. Of great importance is

that all turbines in a project be of the same design, and that all be functioning (blades turning). Mismatched and non-functional turbines create a chaotic and disturbing visual image. Whether blades are black or white is a minor detail as long as they are all the same. Further studies of how people perceive various designs would be useful. Some basic recommendations are:

- Choose designs that are simple and functional, yet engineered for aesthetic appeal and good proportions.
- Avoid distracting or bright colors or graphics.
- Use non-reflective surfaces
- Be sure all turbines are of the same design, and that blades are turning in the same direction.
- Avoid off-site visibility of concrete pads and transformers.

Organizing the Turbines on the Site

Since turbines in Vermont are most likely to be located on ridgelines rather than on flat farmland, site topography will likely dictate their arrangement. Research has shown that turbines organized into smaller groupings are often more acceptable than large arrays. Projects in Vermont are likely to be relatively small, and this may not be necessary.

Access Roads and Site Clearing

Seeing sleek white turbines emerging from a forested ridgeline can be a dramatic, even aesthetically appealing sight. On the other hand visible roadways with cut and fill slopes, and overly large clearings around the turbines can create greater visual impacts than the

turbines themselves. Minimizing site clearing and avoiding steep slopes is the best way to minimize impacts.

On-Site Power Lines

Power line swaths can result in some of the most significant impacts on hillsides. This usually results from removing vegetation in a straight line down a hillside. Instead, power lines should be located along carefully planned roads, or in flexible above-ground tubing, that can be threaded through the forest.

Substations

Substations are often the most unsightly elements of a power project. If possible they should be located so that they are naturally screened with existing vegetation. If planting is needed to screen the substation, the species selected and their arrangement on the site should be appropriate to the context. In natural settings, indigenous vegetation should be used and organized in groupings rather than straight rows. In cultural settings, plantings that are characteristic of the area will be appropriate.

Off-Site Transmission Lines

Developing new transmission lines to connect into the existing power grid can create significant impacts. Locating wind generation facilities close to existing power lines is one way to mitigate impacts. Using existing power line rights-of-way is another. Where new rights-of-way (row) need to be cleared, a number of techniques can be used to avoid significant impacts. Clearing can be set back and buffered from existing rural or scenic roads. Clearing can be minimized, with plantings to screen the row from road crossings or other viewpoints. Curved or angled alignments can minimize the view down a long straight swath. Orienting the row along the grade and avoiding alignments down steep slopes will minimize visibility.

Lighting

Turbines over 200 feet tall will have to be lighted, though the specific requirements for lighting are as yet unclear. The impacts of lighting are likely to be a significant aesthetic issue. Eliminating the need for lighting, or finding techniques to minimize the visibility of lights will be extremely important. Shielding lights from below, minimizing the number of turbines which need to be lighted, and minimizing the intensity of lighting need to be explored. Flashing patterns and colors may also be required to minimize injury to birds, but may exacerbate visual impacts. It is unclear yet as to whether the options currently available will significantly reduce the impacts on the night sky. Lighted turbines in or near urban areas may have less of an impact than those in remote or rural areas.

Noise

Modern wind turbines are becoming increasingly quiet as they gain efficiency. But the sound can be heard up to a half mile from the site under certain environmental conditions, and may have an impact on residents within this radius. The sound from turbines is of a low pitch, and is not a highly annoying sound. However, it will be important to select turbines which can be documented to have minimal sound impacts.

Site Maintenance

Seeing the movement of rotating turbine blades seems to contribute to their visual appeal. On the other hand, studies have shown that one of the worst impacts of wind facilities is turbines that are not functioning, or worse, have the top nacelle and blades removed while the tower remains standing (these are known as headless horseman). Key maintenance issues are as follows:

- Repair or remove any non-functioning turbines without delay.
- Repair erosion which could result in injury to vegetation.
- Maintain any planted vegetation, and replace if dying.

Summary

Following is a summary of some of the most important points:

- Developing wind energy in Vermont is important; so is protecting the scenic quality of Vermont's landscape.
- When well designed and sited, public surveys show that most people find them to be acceptable; visitors to wind sites often find them attractive and interesting.
- Ridgelines will be the focus of wind development in Vermont; this will result in some conflicts between wind resources and scenic resources. A balance must be found.
- In assessing the appropriateness of a wind project, it is necessary to look at both the visual character of the project site, and of the viewpoints from which the project will be seen.
- Ridgelines with unusual or distinctive topographic form, or dramatic cliffs may become visual focal points and may be difficult locations for wind farms.
- Horizontal or gently rolling ridgelines may not stand out as much and therefore be better able to absorb development of wind turbines.
- Viewpoints from designated scenic or natural areas and corridors are most critical.
- Wind projects can be visible from scenic areas provided they are not overly prominent, or distracting.
- Wind turbines will appear most prominent if they are seen at close range (within a half-mile), in the center of an important view, and/or in close visual association with an important natural or cultural focal point.
- The collateral development associated with wind turbines includes roads, power lines, and substations. These must be carefully designed and sited to minimize off-site visibility.