Local Ordinances to Regulate Wind Energy Projects

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The following report reviews the options available to local governments in the Shenandoah Valley to regulate wind energy systems. It revises and updates a similar review prepared in 2008. It includes a review of proposed wind projects, zoning options adopted by some localities, and a model ordinance to address the siting and scale of diverse wind energy systems.

Substantial wind resources have been identified in the Shenandoah Valley, although they pale in comparison to wind power off Virginia's coasts. The strongest wind resources in the Valley are located on the ridge lines of the Blue Ridge. These resources have attracted the attention of large scale wind investors since 2001 and have raised concerns about impacts of industrial wind development on forests, water quality, wildlife, historic resources, and scenic vistas.

There also is enough wind power at lower elevations in the Valley to support the development of small wind projects to power individual homes, businesses, and farms. These more modest wind resources provide opportunities for private landowners, farms, businesses, and other energy users. Most smaller scale projects on open lands have not generated the impacts or opposition of larger wind power projects.

"Wind power accounted for nearly 30 percent of all new electricity generating capacity added nationally in 2007, up from less than 1 percent in 2002," according to the American Wind Energy Association.[1] As the technologies that harness wind power become more efficient and the cost of other sources of energy rise, localities in the Valley are likely to be presented with increasing numbers of proposals for wind energy systems in the future.

Proposed Wind Projects in Virginia

Counties in the Shenandoah Valley and southwest Virginia have been subject to proposals from wind farm developers since at least 2001, when an unidentified company expressed interest in placing a wind farm on mountain land in Pulaski.[2]

Highland New Wind Development LLC proposed in 2004 to construct and operate a wind energy power generating system in Highland County near the West Virginia border on Allegheny Mountain. The project will use utility scale wind turbines to produce approximately 39 megawatts (MW) of electricity. It will consist of up to 20 turbines of 2.0 MW nominal

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[1] American Wind Energy Association. 2008. "Wind Power: Carving Out Market Share." Wind Power Outlook 2008. http://www.awea.org/pubs/documents/Outlook_2008.pdf.

[2] Raboteau, Albert. 2006. "Wind power comes blowing into Dublin: Volvo, New River Community College are interested in wind-generated power." *Roanoke Times*, www.roanoke.com/news/nrv/cram/feature/wb/86460. October 11. Cited hereafter as Raboteau.

capacity each. A conditional use permit was issued for the project pursuant to the Highland County Zoning Ordinance's provisions for electric generation and substations in 2005.[3]

In 2006, 20 turbines were proposed on leased private mountain land in Patrick County.[4] About the same time, Roanoke County was the subject of preliminary studies by Chicago-based Invenergy Wind LLC. The proposal was for a project to generate up to 81 megawatts of electricity, requiring more than 50 turbines stretched along mountain ridges for several miles.[5]

In 2007, Western EcoSystems Technology Inc. (WEST Inc.) asked the US Fish and Wildlife Service's West Virginia Field Office to comment on a proposed wind farm site on Shenandoah Mountain in Rockingham, Pendleton, and Hardy counties. The exact location of this proposed project has not been made public.[6]

In March 2008, Freedom Works LLC asked the Federal Aviation Administration (FAA) to study the impact of installing 130 wind turbines, each 440-feet tall, along the western ridgelines of Shenandoah and Rockingham counties in the George Washington National Forest.[7]

Landowners on Shenandoah Mountain in the Fulks Run area of Rockingham County were approached by representatives wind energy developers on numerous occasions during the spring and summer of 2008. At least one landowner signed a letter of intent expressing interest in participating in a wind development project.[8] In December, the Woburn, Massachusetts-based firm Solaya, Inc. was granted a special use permit to erect a temporary meteorological tower to gather data in the area.[9]

Most recently, Dominion and BP Wind Energy North America Inc. announced in January that they are evaluating wind energy projects in Tazewell and Wise counties in southwest Virginia. The two companies have entered into an agreement to jointly own, operate, and develop wind energy projects in Virginia. The exact size of each project has not been determined. In 2008, they purchased about 2,560 acres of mountain land in Tazewell.[10]

Other localities that have received inquiries about wind farm development include Amherst, Bath, Bland, Caroline, Clarke, Giles, and Halifax counties, the Town of Rocky Mount, and the City of Suffolk.[11]

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[3] Supreme Court of Virginia. 2007. *Miller v. Highland County* Va. Record Nos. 062111, 062489. September 14. Cited hereafter as Miller.

[4] Adams, Mason. 2006. Wind may be asset in Patrick County: A company is looking at possible sites to erect wind turbines to generate electricity." *The Roanoke Times*. www.roanoke.com/news/roanoke/wb/xp-60907. April 14.

[5] Cramer, John. 2006. "Wind farm company eyes Roanoke Valley: A Chicago company is looking into building a wind farm on Bent and Poor mountains." *Roanoke Times*, www.roanoke.com/news/roanoke/wb/xp-63903. May 06.

[6] Ashley, Joan. *2008.* "Company Considering Wind Farm on Shenandoah Mountain in Pendleton and Hardy Counties." *The Elkins Inter-Mountain.* http://theintermountain.com, January 15.

[7] Federal Aviation Administration. 2008. Form 7460-1 for ASN: 2008-AEA-1462-OE. https://oeaaa.faa.gov/oeaaa/external/searchAction.jsp?action=displayOECase&oeCaseID=566897, March 18.

[8] Bolgiano, Chris. 2008. Email to Shenandoah Valley Network, August 6.

[9] Rockingham County. 2008. *Minutes of the Regular Meeting of the Rockingham County Board of Supervisors*. Harrisonburg, Virginia: 2008. December 10.

[10] Dominion. 2009. *Dominion, BP Announce Plans To Evaluate Potential Wind Farms In Tazewell County, Wise County, Va*. http://www.dom.com/news/elec2009/pr0122.jsp, January 22.

[11] Bowman. Rex. 2008. "Regulations crafted for wind-power turbines: Localities are developing land-use rules to control where, or if, they're built." *Richmond Times-Dispatch*. March 9.

Local Response to Wind Projects in Virginia

A number of Virginia localities have amended their zoning ordinances to accommodate wind energy development after receiving proposals from developers. Beginning in 2004, local response has ranged from an ordinance enacted to prohibit all but the smallest of wind projects in Patrick County to zoning ordinance changes in Highland that opened the way for the only large scale wind project to date to receive approval from local government and the State Corporation Commission.

Pulaski County

In 2004Pulaski began its regulation of wind energy by allowing "windmills," defined as "a mill or machine installed at a height of no greater than 60 feet operated by the wind" in all of its zoning districts under a special use permit.

Two years later Pulaski updated its ordinance to permit "small wind energy systems" in its industrial zoning district under a special use permit. A small wind energy system is defined as a " wind energy conversion system consisting of a wind turbine, a tower and associated control or conversion electronics, which will be used primarily to reduce on-site consumption of utility power." Pulaski places no height limitation on these small wind systems.[12] Subsequently, the county issued a special use permit to Volvo Trucks North America to erect a single 80-foot-high turbine at its Dublin plant.[13]

Rockingham County

Rockingham County also amended its zoning ordinance to deal with small wind energy in 2004. The ordinance regulates "small wind energy systems" using the same definition as did Pulaski.

However, where Pulaski only restricts the height of windmills, Rockingham also restricts the height of small wind energy systems. The ordinance stipulates any wind turbines up to 65 feet tall are permitted as a special use on parcels of an acre or more. Turbines up to 80 feet high are permitted as a special use on properties of five acres or more in the Conservation (C-1) and General Agriculture (A-2) zoning districts. Towers over 80 feet high are not permitted, effectively banning commercial wind farms.[14]

Caroline, Clarke, Halifax, and Rockbridge counties have passed similar ordinances permitting small wind energy systems but none of these ordinances permit or regulate larger (taller) systems thereby prohibiting utility scale projects.

[12] Pulaski County, Virginia. *Zoning Ordinance*. www.pulaskicounty.org/Zoning/zoning_ordinance.pdf.
[13] Raboteau.
[14] Rockingham County. *Zoning Ordinance*. www.municode.com/resources/gateway.asp?pid=12196&sid=46.

Highland County

In 2005, in response to Highland New Wind's proposed development, Highland County officials amended the zoning ordinance to authorize the Board of Supervisors to issue conditional use permits allowing structures that exceed the maximum heights (ranging from 35 to 60 feet) allowed by right in the underlying zoning district.

The board then granted Highland New Wind a conditional use permit to construct its project, defined as an "electric generation substation" after determining that the proposed use "is compatible with surrounding uses, is consistent with the intent of this ordinance and of the Land Use Element of the Comprehensive Plan, is in the public interest, and will comply with all other provisions of law and ordinances of Highland County or the Town of Monterey."[15]

Patrick County

Faced in 2006 with a proposal to place 20 wind turbines on leased private mountain land, Patrick County took an approach opposite from that of Highland. While Patrick does not have a zoning ordinance, it passed an amendment to the county code effectively prohibiting all commercial wind facilities everywhere in the county, as follows.

> "No structure shall be permitted to be constructed anywhere in Patrick County which exceeds one hundred (100) feed in height, excepting structures that are to be erected and used exclusively for the purposes of telecommunications and also excepting towers, spires or, steeples to be constructed exclusively for places of religious worship. This prohibition shall be without any other exception and there shall be no variances, nor conditional, nor special use permits granted from this ordinance."[16]

City of Suffolk

The City of Suffolk enacted zoning regulations for wind energy systems in November 2008. The regulations allow small wind energy systems, those that produce 25 kilowatts (kW) or less, as a by-right use in some zoning districts. Larger systems require a conditional use permit. The use regulations and application submission requirements are nearly identical to those adopted by Rockingham and Pulaski counties.

However, Suffolk adopted a three-tiered approach to the permitting process that is similar to many ordinances adopted in regions of the country where wind projects are much more prevalent than in Virginia.[17]

Restrictions, including lot size, set backs, and height, are based on the amount of energy a system might produce. (Please see the table below.)

Small wind facilities (not more than 25 kW) are permitted by right in the agricultural, rural residential, rural estates, general commercial, commerce park, and industrial zoning districts.

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[15] Miller.
[16] Patrick County, Virginia. 2007. *Minutes of the Board of Supervisors of the County of Patrick*. 12 February.
[17] City of Suffolk. 2008. *UDO Amendment – Wind Energy*. November 5.

Large wind (less than 1 megawatt (MW)) and utility scale wind (1 MW or greater), facilities are conditional uses in distinct zoning districts. Large wind systems are conditional uses in the same zoning districts where small wind systems are permitted. Utility-scale systems are conditional uses in the industrial and agricultural districts.[18]

Wind Energy System Dimensional Requirements, City of Suffolk, Virginia

		Minimum Setback Requirements [1]					
	Min.	Occupied Buildings					Max.
System Type	Lot Size (acres)	Subject Property [2]	Adjacent Property [2, 3]	Property Lines [2]	Right of Way [2]	Major Highways [2]	Height (feet)
Small (≤ 25 kW)	1	0.0	1.5	1.0	1.5	2.5	120
Large (<1 MW)	5	1.0	2.0	1.0	1.5	2.5	250
Utility (>/+ 1 MW)	25	1.5	2.5	1.5	1.5	2.5	500

Notes:

1. Measured from the center of the wind turbine base to the property line, right-of-way, or nearest point on the foundation of an occupied building.
2. Calculated by multiplying the required setback number by the wind turbine height.
3. This setback proposes to reduce noise and shadow flicker impacts to any existing occupied buildings on adjacent properties. Setbacks are expressed as a factor of the total turbine height.

[18] Taylor, Cynthia S. 2008. City of Suffolk Planning Department. Email communication with SVN. August 6.

Planning and Zoning for Wind Projects in Virginia

Localities can review and allow for wind energy facilities in appropriate locations in various ways, including:

- Through the comprehensive plan which can be used to identify a locality's objectives for wind power and areas where it is an appropriate use.
- As a permitted use that is allowed "by right," usually with a building permit.
- As an accessory use that is allowed "by right" if it is accessory to a permitted use. For instance a locality might allow wind energy systems in agricultural areas if they are part of a farm operation, usually with a building permit.
- As a special or conditional use that is allowed on a specific property only after a special or conditional permit is approved by the governing body.
- Through the creation of an overlay zoning district that overlies and encompasses one or more underlying districts and that imposes additional requirements above that required by the underlying district. An overlay district would require a greater level of scrutiny by the planning commission and governing body because it would entail amendment of the zoning ordinance and map.[19]

Scale of Wind Energy Systems

Across the country, many localities that use zoning to regulate wind energy systems apply different regulatory schemes to wind projects depending on the size of the project, usually based upon the amount of energy produced. As described above, such an approach was recently adopted by the City of Suffolk. Rules that are appropriate for a small system that generates all or part of the energy needed by a home may not be appropriate for a larger system that powers an intensive farming operation or other industry or a school or office building. Likewise a utility scale project that uses multiple turbines to produce and sell energy off site requires greater scrutiny than a larger on-site system.

Scale of Wind Energy Systems.

Category	Capacity	Description
Small	≤ 10 kW residential ≤ 100 kW other on-site uses	Small systems are used primarily to generate energy for on-site use. Small systems are appropriate "by-right" uses in most areas where setbacks can be met, subject to a building permit.
Large	> 100 kW < 1 MW	Large systems are used primarily to generate energy for on-site use and are limited to a single tower and turbine. Because of the size of system, large systems are appropriate special uses in most areas where setbacks can be met.
Utility	≥ 1 MW	Utility scale systems will usually be used to generate energy for sale to off-site users and require more than one tower and turbine. Because of the higher likelihood of significant impacts, they should require a zoning amendment into an overlay zoning district specifically for wind facilities.

[19] Minnesota Association of County Planning and Zoning Administrators. 2005. *Wind Energy Conversion System Model Ordinance*. Saint Paul, Minnesota, June 14. http://www.mncounties3.org/macpza/OrdinanceLinks/Dist%20D%20modelwindordinancefinal.pdf.

The scale above has been adapted from the Virginia Renewables Siting Scoring System under development by James Madison University for the Commonwealth of Virginia and from model wind ordinances and local laws reviewed for this project.[20]

The table below shows the total height and power rating of various wind energy systems for illustrative purposes. While the heights and ratings are of actual systems, the height at which a given system will yield a specific amount of energy varies because winds blow harder at greater heights.

Power Rating and Height of some Wind Energy Systems

Rating (kilowatts)	Total Height (feet) (feet)
10	111.5
50	127.92
100	148.5
225	179
250	212
500	164
660	200
750	213
1,650	328
3,000	394
3,600	492
5,000	807

Sources:

Windflow Technology Ltd. 2008. Wind turbines height comparison." Christ Church, New Zealand. http://www.windflow.co.nz/products/wind-turbines-height-comparison.

Loeser, Mark. 2008. "New Jersey's Clean Energy Program Municipal Technical Training Wind and Biopower Resource Assessment." Trenton, New Jersey: New Jersey Office of Public Utilities, June 11. http://www.njcleanenergy.com/files/file/Renewable_Programs/MunicipalTraining/MuniTrainingWindBiopowerAssess.pdf.

Papadakis, Maria. 2008. Virginia Renewables Siting Scoring System (VRS3) Workshop. Harrisonburg, Virginia: James Madison University, June 18. http://vwec.cisat.jmu.edu/conf/ presentations/VRS3%20VWEC%20Symposium%20June%2008.pdf.

Power Usage

The amount of energy produced by a wind energy system is usually expressed in kilowatts (kW) or megawatts (MW). The following comparisons between kWs, MWs, and usage are provided to give the reader a sense of scale.[21]

- A 10 kW wind turbine can generate about 10,000 kW hours annually at a site with wind speeds averaging 12 miles per hour, or about enough to power a typical household.

[20] Papadakis, Maria. 2008. *Virginia Renewables Siting Scoring System (VRS3) Workshop*. Harrisonburg, Virginia: James Madison University, June 18. http://vwec.cisat.jmu.edu/conf/ presentations/VRS3%20VWEC%20Symposium%20June%2008.pdf.

[21] American Wind Energy Association. 2008. *Wind Energy Basics*. http://www.awea.org/faq/wwt_basics.html#How%20many%20homes%20can%20one%20megawatt%20of%20wind%20energy%20supply.

- A 250 kW turbine installed at a 53,000-square-foot elementary school provides more energy than is used by the school. Excess electricity is sold into the local utility system earning the school $25,000 over five years of operation.
- One MW of wind generates enough electricity to supply 225 to 300 households.
- A 5 MW turbine can produce enough energy to power more than 1,400 households.

The Comprehensive Plan

Like other good planning practices, planning for wind energy development should be rooted in a locality's comprehensive plan.[22] This can be done by adding wind to the many resources that are considered in the plan just like agriculture, historic sites, transportation facilities, and other natural and man made resources are considered in most plans today. Comprehensive planning for wind can include the following steps.[23]

Inventory: If a locality considers wind to be a potentially valuable resource, it should conduct an inventory of that resource and map where wind is able to support various uses (i.e. commercial or utility scale wind, large wind, or small wind). Geographic information system (GIS) layers for mapping wind in Virginia may be obtained from the Virginia Department of Mines, Minerals, and Energy.

Context: Before identifying areas that are appropriate for various wind uses, a locality should analyze the context in which its wind resources are located. Strong wind resources may exist in locations where utility scale development would conflict with other resources that the community values.

For instance, the strongest winds may coincide with scenic vistas of mountain ridges such as the Shenandoah National Park or historic resources such as a Civil War battlefield. Some localities do not consider utility scale wind to be compatible with residential development. In some areas, impacts on wildlife might be too high.

On the other hand, utility scale wind can compliment agricultural uses since most utility scale operations lease wind rights, providing a substantial source of income to farm landowners. On-site wind projects can also provide substantial cost savings to farm operators and other intensive electricity users such as dairy and poultry farms, schools and small industry.

James Madison University is under contract to develop a scoring system for the siting of wind development projects, a project mandated by the General Assembly and known as the Virginia Renewables Siting Scoring System. The system will be available to Virginia localities. A description of the system may be found at http://vwec.cisat.jmu.edu/conf/presentations/VRS3%20VWEC%20Symposium%20June%2008.pdf.

[22] Lindabury, Shawn, and Todd M. Schmit, Rod Howe, and Tania Schusler. 2007. *Municipal Approaches to Energy Conservation and Renewable Energy Production: A Resource for Community Energy Initiatives*. Cornell Community and Rural Development Institute. CaRDI Reports ISSUE NUMBER 3/NOVEMBER 2007. http://devsoc.cals.cornell.edu/cals/devsoc/outreach/cardi/publications/upload/11-2007-Reports.pdf.

[23] Daniels, Katherine. 2005. *Wind Energy Development and the Comprehensive Plan*. NYS Energy Research & Development Authority. October. http://www.powernaturally.org/Programs/Wind/toolkit/1_windenergydevplan.pdf.

Goals and Strategy: The plan should include the community's goals regarding wind energy development, a map showing areas that are and are not appropriate for such development, and strategies for achieving the stated goals. Goals might include "fostering wind energy development on appropriate sites" or "fostering distributed generation including on-site wind facilities to help meet the electricity needs of farmers, businessmen and residents" while strategies might include "enactment of a wind energy system zoning ordinance."

Model Wind Energy Zoning Ordinance

There are many considerations that may be raised when permitting a wind energy system depending on its scale, location, and impact. The following model ordinance is intended to assist localities in the Shenandoah Valley in designing wind energy zoning ordinances that meet the particular needs and circumstances of the community.

The options listed were drawn from a wide range of sources from around the country, including model ordinances, existing ordinances, and other documents, all of which are listed in the bibliography.

Sample language for a model ordinance follows.

Purpose and Intent

The purpose of this ordinance is to provide for the construction and operation of wind energy systems and to provide standards for the placement, design, construction, monitoring, modification, and removal of wind facilities; address public safety, minimize impacts on scenic, natural, and historic resources of LOCALITY; and provide adequate financial assurance for decommissioning. The provisions set forth in this section shall take precedence over all other sections when considering applications related to the construction, operation, and/or repair of wind energy systems.

Applicability

This section applies to all wind energy systems, proposed to be constructed after the effective date of this section including micro wind systems, and physical modifications to existing wind facilities that materially alter the type, configuration, or size of such facilities or other equipment.

Definitions

Fall Zone: The area, defined as the furthest distance from the tower base, in which a guyed tower will collapse in the event of a structural failure. This area is less than the total height of the structure.

Micro Wind System: A building-mounted wind system that has a manufacture's rating of 10 kW or less and projects no more than fifteen (15) feet above the highest point of the roof and shall not be considered a small wind energy system in terms of area and setback requirements.

Net Energy Metering: Measuring the difference between:

1. electricity supplied to an eligible customer-generator from the electric grid and

2. the electricity generated and fed back to the electric grid by the eligible customer-generator.

If electricity generated by an eligible customer-generator exceeds the electricity consumed by the customer-generator, the customer-generator shall be compensated for the excess electricity.

"Eligible customer-generators" include customers that own and operate an electrical generating facility that:

1. has a capacity of not more than 10 kilowatts for residential customers and 500 kilowatts for nonresidential customers;

2. uses as its total source of fuel renewable energy,

3. is located on the customer's premises and is connected to the customer's wiring on the customer's side of its interconnection with the distributor;

4. is interconnected and operated in parallel with an electric company's transmission and distribution facilities; and

5. is intended primarily to offset all or part of the customer's own electricity requirements.

Overlay Zoning District: A district that encompasses one or more underlying districts and that imposes additional requirements above that required by the underlying district.

Rated Nameplate Capacity: The maximum rated output of electric power production equipment. This output is typically specified by the manufacturer with a "nameplate" on the equipment.

Rotor diameter: The diameter of the circle described by the moving rotor blades.

Sensitive Receptor: Structures that have occupants on a routine basis and whose occupants could be negatively affected by noise, vibration, shadow, or flicker, including those structures intended for four season human habitation (whether inhabited or not), public parks, state designated wildlife areas, the manicured areas of private recreational establishments such as golf courses or the campsites in a state approved campground, schools, daycare centers, elderly care facilities, hospitals, places of seated assemblage, businesses. Any parcel of land having a valid building or sanitary permit on file on the date of the issue of the Wind Energy Facility Permit shall be treated the same as any existing sensitive receptor.

Shadow Flicker: The visible flicker effect when rotating turbine blades cast shadows on the ground and nearby structures causing the repeating pattern of light and shadow.

Substation: Any electrical system designed to convert electricity produced by wind turbines to a voltage greater than 35,000 (35,000 KV) for interconnection with high voltage transmission lines.

Temporary Meteorological Towers (Met Towers): For the purposes of this ordinance, meteorological towers are those temporary towers which are erected primarily to measure wind speed and directions plus other data relevant to siting wind energy systems, used to determine how much wind power a site can be expected to generate.

Total height: The highest point, above ground level, reached by a rotor tip or any other part of the wind energy system.

Tower: Towers include vertical structures that support the electrical generator, rotor blades, or meteorological equipment.

Tower height: The total height of the wind energy system exclusive of the rotor blades.

Transmission Line: Those electrical power lines that carry voltages of at least 69,000 volts (69 KV) and are primarily used to carry electric energy over medium to long distances rather than directly interconnecting and supplying electric energy to retail customers.

Wind Energy System: All equipment, machinery, and structures utilized in connection with the conversion of wind to electricity. This includes, but is not limited to, transmission, storage, collection, and supply equipment, substations, transformers, service, and access roads, and one or more wind turbines.

Wind Energy System, Building Integrated: A wind energy system shall be considered to be building integrated if it is designed to be permanently mounted on a building or other inhabitable structure. This definition applies to wind turbines of any capacity that are designed to be operated in direct contact with a building. This definition also covers, for the purposes of this zoning provision, other wind energy facilities primarily used for land-based applications which may be permanently mounted and operated on a building.

Wind Energy System, Large: A wind energy system with a rated output of electrical power production equipment of greater than 100kW but less than 1 MW.

The minimum lot size for a large wind energy system shall be five (5) acres.

Large wind turbines shall be no higher than two hundred and fifty (250) feet above the current grade of the land, as measured at the uppermost point of the rotor's swept area. A large wind turbine may exceed two hundred and fifty (250) feet only if it meets the requirements provided below under the section General Requirements for all Wind Energy Systems, 7. Turbine Height.

Wind Energy System On-site: A wind energy system that will generate electricity on-site primarily for use on-site and /or through net metering.

Wind Energy System, Small: A wind energy system with a rated output of electrical power production equipment of not more than 10kW for residential uses and not more than 100kW for other uses.

Small wind turbines shall be no higher than 65 feet on a parcel of less than 5 acres, or 120 feet on a parcel of five (5) acres or more. A small wind turbine may exceed these height restrictions only if it meets the requirements provided below under the section General Requirements for all Wind Energy Systems, 7. Turbine Height.

Wind Energy System, Utility-scale: A wind energy system with a rated output of electrical power production equipment of 1 MW or greater.

The minimum lot size for a utility-scale wind energy system shall be five (5) acres per turbine if installed in a line or twenty five (25) acres per turbine if installed in a grid pattern.

Utility-scale wind turbines shall be no higher than five hundred (500) feet above the current grade of the land, as measured at the uppermost point of the rotor's swept area. A utility-scale wind turbine may exceed five hundred (500) feet only if it meets the

requirements provided below under the section General Requirements for all Wind Energy Systems, 7. Turbine Height.

Wind turbine: A device that converts kinetic wind energy into rotational energy that drives an electrical generator. A wind turbine typically consists of a tower, nacelle body, and a rotor with two or more blades.

General Requirements for all Wind Energy Systems

The following requirements are common to all wind energy facilities.

1. *Application*: Any owner or operator of a wind energy system proposed to be constructed after the effective date of this ordinance, including building integrated wind systems and physical modifications to existing wind energy systems that materially alter the type, configuration, or size of such systems or other equipment, must apply to the zoning administrator for a wind energy system permit.

(a) *Permitted uses*: A small wind energy system as defined herein shall be a permitted use and when it is in accordance with other regulations herein, the use shall be permitted by the zoning administrator without a public hearing. A micro wind system shall be considered a small wind system for the purposes of this ordinance.

A permit shall be granted unless the zoning administrator finds in writing that there is substantial evidence that:

(i) development of a wind energy facility at the specific site is contrary to specific provisions of the comprehensive plan;

(ii) there is expected to be any serious hazard from the use;

(iii) a nuisance is expected to be created by the use; and

(iv) adequate and appropriate facilities will not be provided for the proper operation and maintenance of the use.

(b) *Special uses*: A large wind energy system as defined herein shall be a special use. It may be allowed when the board of supervisors, after review of the application and hearing thereon, finds as a fact that the proposed use or uses are consistent with the comprehensive plan and the policies of the county, the regulations of this chapter, and are in the public interest. A special use permit will be issued by the zoning administrator after such special use has been approved by the board of supervisors.

(c) *Met Towers*: Met towers shall be permitted under the same standards as a large wind system, except that the requirements apply to a temporary structure. A permit for a temporary met tower shall be valid for a maximum of three (3) years after which an extension may be granted. Small anemometers installed directly on buildings shall not require a building or special permit.

(d) *Wind Energy Overlay Zoning District*: A utility-scale wind energy system is not specifically permitted or by special use. However when an application is made by a property owner to the zoning administrator for a utility-scale wind energy system, the administrator shall refer the application to the planning commission for consideration of an amendment to the zoning ordinance to create a wind energy system overlay zoning

district. Such an application shall follow the stipulations for zoning chapter and map amendments found elsewhere in this ordinance. The zoning administrator shall issue a wind energy system permit for the utility scale system only after the applicable wind energy system overlay zoning district is created and all other requirements of this ordinance are met.

2. *Site Plan*: The application will include a site plan that will show the locations and dimensions of turbines on a site, the locations of above and below ground utility lines, rights of way, electrical substations, access and service roads, excavation and fill areas, sediment and erosion control structures,, and property lot lines.

4. *Siting Requirements*: The requirements for siting and construction of all wind energy systems shall include the following.

(a) Wind energy towers shall maintain a galvanized steel finish, unless Federal Aviation Administration (FAA) standards require otherwise, or if the owner is attempting to conform the tower to the surrounding environment and architecture, in which case it may be painted to reduce visual obtrusiveness.

(b) Wind energy systems shall not be artificially lighted unless required by the FAA or appropriate authority.

(c) No tower should have any sign, writing, or picture that may be construed as advertising.

(d) Noise from a wind energy system shall not exceed sixty (60) decibels, as measured at or beyond the closest property line.

(f) The applicant shall provide evidence that the proposed height of the wind energy system tower does not exceed the height recommended by the manufacturer or distributor of the system.

(e) The minimum distance between the ground and any protruding blades utilized on a wind energy system shall be fifteen (15) feet, as measured at the lowest point of the arc of the blades. The lowest point of the arc of the blade shall also be ten (10) feet above the height of any structure within one hundred fifty (150) feet of the base. The supporting tower shall also be enclosed with a six-foot tall fence or the base of the tower shall not be climbable for a distance of twelve (12) feet.

(f) Any on site transmission or power lines shall, to the maximum extent possible, be placed underground.

5. *Federal and state requirements*:

(a) *Compliance with Uniform Statewide Building Code*: Building permit applications for wind energy systems shall be accompanied by standard drawings of the wind turbine structure, including the tower, base, and footings. An engineering analysis of the tower showing compliance with the Uniform Statewide Building Code and certified by a licensed professional engineer shall also be submitted.

(b) *Compliance with FAA Regulations*: Wind energy systems must comply with applicable FAA regulations, including any necessary approvals for installations close to airports.

(c) *Compliance with National Electric Code*: Building permit applications for wind energy systems shall be accompanied by a line drawing of the electrical components in sufficient detail to allow for a determination that the manner of installation conforms to the National Electrical Code.

(d) *Compliance with regulations governing energy net metering*: Wind energy systems connected to the utility grid must comply with the Virginia Administrative Code 20 VAC 5-315: Regulations Governing Energy Net Metering.

(e) *Environmental and cultural permits*. The applicant shall demonstrate that they have received all require state and federal permits for the protection of wildlife and other natural resources and cultural resources.

6. *Building Permit*: No wind energy system shall be erected, constructed, installed or modified as provided in this section without first obtaining a building permit. All such wind energy systems shall be constructed and operated in a manner that minimizes adverse visual, safety, and environmental impacts.

7. *Turbine Height*: Turbine height restrictions are provided below for three classes of wind energy systems: small, large, and utility scale. A wind energy system may have turbines higher than the height restrictions provided for its class only if:

(a) the applicant demonstrates by substantial evidence that such height reflects industry standards for a similarly sited wind system;

(b) such excess height is necessary to prevent financial hardship to the applicant; and

(c) the system satisfies all other criteria of this section.

8. *Setbacks***:** Setback requirements are provided below for three classes of wind energy systems: small, large, and utility scale. These setbacks may be reduced only if

(a) the owner of the property on which the requested wind energy system is to be erected and the adjacent landowner whose property line or dwelling falls within the specified distance provide notarized consent that they approve of the reduced setbacks and

(b) such adjacent landowner executes a deed of easement for the benefit of the property on which the wind energy system is to be erected prohibiting construction of any new structure on such adjacent property within the specified easement.

Wind energy systems shall meet all setback requirements for the zoning district in which the wind energy system is located in addition to the requirements set forth above.

9. *Fish, Wildlife, and Native Plant Protection*: The proposed wind energy system must be designed, constructed, and operated without significant adverse impact to fish, wildlife, or native plant resources, including fish and wildlife habitat, migratory routes, and state or federally-listed threatened or endangered fish, wildlife, or plant species. The applicant agrees to implement operational monitoring and mitigation actions that the planning commission determines appropriate to demonstrate compliance with this provision after consultation with the Virginia Department of Conservation and Recreation – Division of Natural Heritage and the Virginia Department of Game and Inland Fisheries.

Small Wind Energy System Requirements

In addition to the requirements applying to all wind energy systems stated in the section above, small wind energy systems shall meet the following requirements.

1. *Energy Capacity*: No small wind energy system shall have a rated output of electrical power production equipment of more than 10kW for residential uses and more than 100kW for other uses.

2. *Lot or Parcel size*: No small wind energy system shall be located on a lot or parcel smaller than one (1) acre in size.

3. *Turbine Height*: No small wind energy system shall have turbines higher than sixty-five (65) feet on a parcel of less than five (5) acres or one hundred twenty (120) feet on a parcel of five (5) acres or more. A small wind turbine may exceed these height restrictions only if it meets the requirements provided above under the section General Requirements for all Wind Energy Systems, 7. Turbine Height.

4. *Setbacks***:** Small wind energy systems shall be set back a distance at least equal to one hundred and ten (110) percent of its total height from all adjacent property lines and a distance equal at least to one hundred and fifty (150) percent of its total height from sensitive receptor on neighboring property.

A small wind turbine may exceed these setback requirements only if it meets the requirements provided above under the section General Requirements for all Wind Energy Systems, 8. Setbacks.

Large Wind Energy System Requirements

In addition to the requirements applying to all wind energy systems and to small wind energy systems stated in the sections above, large wind energy systems shall meet the following requirements.

1. *Energy Capacity*: A large wind energy system shall have a rated output of electrical power production equipment of greater than 100kW but less than 1 MW.

2. *Lot or Parcel size*: No large wind energy system shall be located on a lot or parcel smaller than five (5) acres in size.

3. *Turbine Height*: No large wind energy system shall have turbines higher than two hundred and fifty (250) feet above the current grade of the land, as measured at the uppermost point of the rotor's swept area. A large wind turbine may exceed two hundred and fifty (250) feet only if it meets the requirements provided above under the section General Requirements for all Wind Energy Systems, 7. Turbine Height.

4. *Setbacks***:** Large wind energy systems shall be set back a distance at least equal to one hundred and ten (110) percent of its total height from all adjacent property lines and a distance equal at least to one hundred and fifty (150) percent of its total height from any sensitive receptor on neighboring property.

A large wind turbine may exceed these setback requirements only if it meets the requirements provided above under the section General Requirements for all Wind Energy Systems, 8. Setbacks.

5. *Flicker or Shadow Flicker*: The owner of a wind energy system must take steps as are necessary to prevent, mitigate, or eliminate shadow flicker. There can be a maximum of ninety (90) seconds per day, or ten (10) hours per year of shadow/flicker effects within a one hundred (100) foot radius of a sensitive receptor. Turbines must be shut down at certain times of day or times of the year if shadow/flicker is a problem with any sensitive receptor.

6. *Required Application Documents*: The wind energy system permit application for large wind systems shall be accompanied by deliverables including the following.

(a) A site plan showing:

(i) property lines and physical dimensions of the subject property;

(ii) location, dimensions, and types of existing major structures on the property;

(iii) location of the proposed wind system towers, foundations, guy anchors, and associated equipment; above and below ground utility lines, electrical substations, access and service roads, rights of way, excavation and fill areas, and sediment and erosion control structures,

(iv) the right-of-way of any public road that is contiguous with the property; and

(v) location and approximate height of tree cover.

(b) Wind system specifications, including manufacturer and model, rotor diameter, tower height, tower type (freestanding or guyed).

(c) One or three line electrical diagram detailing wind turbine, associated components, and electrical interconnection methods, with all National Electric Code (NEC) compliant disconnect and overcurrent devices.

(d) Foundations for towers greater then one hundred and sixty (160) feet must have blueprints or drawings signed by a professional engineer.

(e) A plan for maintenance of the wind energy system.

(f) Environmental inventory and impact statement: the inventory and impact statement shall cover the area of proposed wind energy system and areas within five hundred (500) feet of the nearest boundary of the proposed wind energy system. Included in the inventory and impact statement shall be the following:

(i) Inventory: Existing characteristics and conditions of the natural and cultural environment shall be addressed in the statement, including, but not limited to, the topics listed below.

a. The applicant shall be responsible for contacting the agencies or resources where listed for each topic and provide written documentation to the Planning Commission of the existence (or lack) of these characteristics and conditions.

i. Endangered and Avian Species or Habitats: Virginia Department of Conservation and Recreation – Division of Natural Heritage (DNH): A site map shall be provided to DNH in order that it may compare the location to existing data regarding threatened or endangered species or habitat.

ii. Avian and Bat Species: Virginia Department of Game and Inland Fisheries: Provide an inventory of avian and bat species that includes an indication of the type and number of birds and bats that are known or suspected to use the project site and the area surrounding that site.

iii. Historic/Archeological Resources: Virginia Department of Historic Resources: Identification of archaeological and historic resources more than 50 years old, including resources on, or determined eligible for, the Virginia Landmarks Register and/or the National Register of Historic Places.

iv. Conservation Easements: Virginia Outdoors Foundation, Virginia Department of Historic Resources, Shenandoah Valley Battlefields Foundation, Valley Conservation Council, The Nature Conservancy. Potomac Conservancy. Easements held by the above referenced entities and other public or private conservation agencies shall be identified.

b. On-site research shall identify and locate the following features

i. Sinkholes and Water features including springs, intermittent streams, perennial streams, sinkholes, wetlands, and ponds.

ii. Ridgelines: Prominent ridgelines (watershed divides or slopes exceeding 15 percent over 800 feet elevation) shall be identified.

iii. Slopes: Slopes (in categories of 15 percent up to 25 percent and 25 percent and greater) shall be identified.

iv. Pollution Sources: Known pollution sources (including without limitation dump sites, drain fields, buried fuel tanks, solid and liquid disposal sites, etc.) shall be identified.

v. Man Made Facilities and Activities: Structures, transportation network including movement and access, utility networks, waste disposal, barriers, corridors.

(ii) Impact: Applicant shall show how the proposed wind energy system will impact any items identified in (i) Inventory above and how any negative impacts will be remediated so as to reduce or eliminate the impact.

(g) A shadow flicker model to include a description of the zones where shadow flicker will likely be present within the project boundary and a one-half mile radius beyond the project boundary, the expected durations of the flicker at these locations and the calculation of the total number of hours per year of flicker at all locations.

(h) Design / Engineering Plan: The application will include a design and engineering plan that will show drawings of the various structural components of the turbine construction, a mapped location and description of any proposed maintenance and storage facilities, and the manufacturer's dimensional drawings and installation/operation guidelines. The Design / Engineering Plan should be certified by a registered professional engineer to show that the design meets all applicable building codes.

7. Failure to show how the negative impacts from a wind energy system on any of the items identified in section (f) (i) Inventory above will be reduced or eliminated will be grounds for the denial of the application for a permit for that wind energy system.

8. After a permit for a wind energy system is granted, failure to continue to mitigate the negative impacts from the wind energy system on any of the items identified in section (f) (i) Inventory above will be grounds for revocation of the permit for that wind energy system.

9. *Abandonment, Decommissioning, and Expiration*:

(a) *Removal Requirements*: Any wind energy system which has reached the end of its useful life or has been abandoned shall be removed. When the wind energy system is scheduled to be decommissioned, the applicant shall notify the **LOCALITY** by certified mail of the proposed date of discontinued operations and plans for removal. The owner/operator shall physically remove the wind system no more than one hundred and fifty (150) days after the date of discontinued operations. At the time of removal, the wind system site shall be restored to the state it was in before the system was constructed or any other legally authorized use. More specifically, decommissioning shall consist of:

(i) physical removal of all wind turbines, turbine foundations, structures, equipment, security barriers, , electrical components, roads, cabling, transmission lines, and any other associated facilities from the site down to 36 inches below grade..

(ii) disposal of all solid and hazardous waste in accordance with local and state waste disposal regulations.

(iii) stabilization or re-vegetation of the site as necessary to minimize erosion.

(b) *Abandonment*: Absent notice of a proposed date of decommissioning, the system shall be considered abandoned when the system fails to operate for more than one year without the written consent of the zoning administrator. The **LOCALITY** shall determine in its decision what proportion of the system is inoperable for the system to be considered abandoned. If the applicant fails to remove the wind energy system in accordance with the requirements of this section within one hundred and fifty (150) days of abandonment or the proposed date of decommissioning, the **LOCALITY** shall have the authority to enter the property and physically remove the system.

(c) The zoning official shall require the applicant for a wind energy system to provide a form of surety, either through escrow account, bond, or otherwise, to cover the cost of removal in the event the **LOCALITY** must remove the system, of an amount and form determined to be reasonable by the zoning official, but in no event to exceed more than 125 percent of the cost of removal and compliance with the additional requirements set forth herein, as determined by the applicant. The applicant shall submit a fully inclusive estimate of the costs associated with removal, prepared by a qualified engineer. The amount shall include a mechanism for Cost of Living Adjustment.

(d) *Expiration*: A permit issued pursuant to this ordinance shall expire if:

(i) the wind energy system is not installed and functioning within forty eight (48) months from the date the permit is issued; or,

(ii) the wind energy system is abandoned.

Utility scale Wind Energy System Requirements

In addition to all of the requirements stated in the sections above, utility scale wind energy systems shall meet the following requirements.

1. *Energy Capacity*: Utility scale wind energy system shall include all such systems that have a rated output of electrical power production equipment of 1 MW or greater.

2. *Lot or Parcel size*: The minimum lot size for a utility scale wind energy system shall be five (5) acres per turbine if installed in a line or twenty five (25) acres per turbine if installed in a grid pattern.

3. *Turbine Height*: No utility scale wind energy system shall have turbines higher than five hundred (500) feet above the current grade of the land, as measured at the uppermost point of the rotor's swept area. A large wind turbine may exceed five hundred (500) feet only if it meets the requirements provided above under the section General Requirements for all Wind Energy Systems, 7. Turbine Height.

4. *Setbacks***:** Utility scale wind energy systems shall be set back a distance at least equal to one hundred and fifty (150) percent of its total height from all adjacent property lines and a distance equal at least to two hundred (200) percent of its total height from any sensitive receptor on neighboring property.

A utility scale wind turbine may exceed these setback requirements only if it meets the requirements provided above under the section General Requirements for all Wind Energy Systems, 8. Setbacks.

5. *Required Application Documents*: The wind energy system permit application for utility-scale wind systems shall be accompanied by deliverables including the following.

(a) *Location Map*: The applicant shall submit to the zoning administrator a copy of a portion of the most recent USGS Quadrangle Map, at a scale of 1:25,000, showing the proposed system site, including turbine sites, and the area within at least two miles from the system. Zoning district designation for the subject parcel should be included; however a copy of a zoning map with the parcel identified is suitable.

(b) *Site Plan*: A one inch equals two hundred (200) feet plan of the proposed wind system site, with contour intervals of no more than ten (10) feet, showing the following:

(i) Property lines for the site parcel and adjacent parcels within three hundred (300) feet.

(ii) Outline of all existing buildings, including purpose (e.g. residence, garage, etc.) on site parcel and all adjacent parcels within the setback distance of two hundred (200) percent of the total height of any component of the wind energy system. Include distances from the wind system to each building shown.

(iii) Location of all roads, public and private on the site parcel and adjacent parcels within the setback distance of two hundred (200) percent of the total height of any component of the wind energy system.

(iv) Existing areas of tree cover, including average height of trees, on the site parcel and adjacent parcels within the setback distance of one hundred (120) percent the total height of any component of the wind energy system.

(v) Proposed location and design of the wind energy system, including all turbines, ground equipment, appurtenant structures, transmission infrastructure, access, fencing, exterior lighting, etc.

(vi) Location of viewpoints referenced below in visualization paragraph of this section.

(b) *Visualizations*: The zoning administrator may select up to four (4) sight lines, including from the nearest building with a view of the wind system, for pre- and post-construction view representations. Sites for the view representations shall be selected from populated areas or public ways within a two (2)-mile radius of the proposed wind energy system. View representations shall have the following characteristics:

(i) View representations shall be in color and shall include actual pre-construction photographs and accurate post-construction simulations of the height and breadth of the wind system (e.g. superimpositions of the wind system onto photographs of existing views).

(ii) All view representations will include existing, or proposed, buildings or tree coverage.

(iii) Include description of the technical procedures followed in producing the visualization (distances, angles, lens, etc.).

(c) *Landscape Plan*: A plan indicating all proposed changes to the landscape of the site, including temporary or permanent roads or driveways, grading, vegetation clearing and planting, exterior lighting, other than FAA lights, screening vegetation, or structures. Lighting shall be designed to minimize glare on abutting properties and except as required by the FAA be directed downward with full cut-off fixtures to reduce light pollution.

(d) *Independent Consultants*: Upon submission of an application for a zoning amendment, the **LOCALITY** will be authorized to hire outside consultants. The applicant will be required to pay all of the consultant's costs.

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