Final Technical Report

Project Title: Overcoming Barriers to Wind Development in Appalachian Coal Country

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A. EXECUTIVE SUMMARY

1. Project Purpose

The project “Overcoming Barriers to Wind Development in Appalachian Coal Country” was designed to identify the barriers to wind energy development in a five-state region that traditionally has had had a legacy of fossil fuel extraction (Pennsylvania, Maryland, West Virginia, Virginia, and Kentucky), and to suggest approaches that could minimize or overcome those barriers.

2. Project Scope

Using a comparative approach, the project team synthesized existing data on energy production and consumption, policy frameworks, regulatory statutes, and social and economic factors for each of the target states. It examined variations within each state (coal is not sourced uniformly across the geography in any of the study states), and it also compared the five “coal country” states to states in other regions. Finally, the current status of wind development was nested in the context of changing national and international energy markets, energy prices, and trends in energy production.

From these data, the project team was able to generate a series of recommendations regarding changes in current approaches to wind development that could facilitate more rapid deployment of wind energy facilities. Such changes range from fairly simple adjustments of policies, to more fundamental shifts in wind development that are less likely from a political or economic perspective. Additionally, the project identified characteristics of the region that hinder the development of wind in ways that may not be resolvable given current technologies.

The project team included a non-profit organization (The Mountain Institute) and its principal partner (and project lead), an environmental consulting firm (Downstream Strategies). An independent legal consultant and an environmental attorney were contracted for policy reviews. A rural non-profit organization also was contracted to contribute to the team’s understanding of community wind power.

The significance of coal in the regional economy has been suggested as a barrier to the development of new energy economies, and the project addressed the central question of whether the dominant coal economy constrains wind development. The answer to this initial assessment was “yes and no”: While there are certainly policies that favor coal production, as well as supporting or affiliated industries, infrastructure, politics, and culture which perpetuate its extraction, coal is not the sole, or even the dominant, limiting factor in the wind development. Indeed, there are sites where wind and coal can co-exist, where wind development may follow in coal’s path once mineable seams have been exhausted.

With this “coal vs. wind” assumption muted, the team continued its comparison with trends in wind production in other states and regions in the US.. These comparisons allowed region-specific barriers to be revealed, while highlighting common challenges that wind development faces across the nation.

The principal final product of the project is an extensive report detailing the team’s findings (“A Windfall for Coal Country? Exploring the Barriers to Wind Development in Appalachia”). The report was designed to allow easy access to state-specific information, since it was recognized that the audience for the report would be primarily state-level individuals. A secondary product, a handbook on community-scale wind projects, was launched, but modified to become a resource list for community members from the region when other “community toolkit” products were published which made this sub-product unnecessary. It was produced as “A Resource List for Community Wind in Appalachia.”

3. Results, Conclusions, and Recommendations

a: *Barriers to wind development in Appalachia are related to geography, environmental impacts, policy, and economics.* Barriers of geography (topography) and environmental impacts (birds, bats) have market impacts, and are more intractable; but higher resolution wind studies could improve site selection, and promoting wind development on formerly mined sites should be explored. Policy and economic barriers are more malleable, though the political will to provide state government support to spur wind and/or renewable energy development has been highly variable among the five study states.

b: *Coal influences state energy policies, which impact the rate of wind development.* The coal industry is a beneficiary of almost all policies in energy-producing states, including “alternative portfolio standards” that favor alternative uses of coal (at the expense of promoting renewables), and policies that minimize the role of renewables in the states’ energy futures, tax schedules, and incentives programs. Policies specifically targeting renewables would likely accelerate the development of wind power.

c: *The region’s strongest wind resources—and the region’s existing and proposed wind farms—are often not found in the counties that produce the most coal.* Wind development could represent a new energy opportunity for some of these regions. However, policies that favor coal have statewide impacts.

d: *Many opportunities exist for wind development in coal-producing counties*. Post-mine land use and more precise assessments of wind resources may favor wind energy development; former strip mines should be considered more often for their wind energy potential.

e: *States within Appalachian coal country are developing wind at different rates.* Although the study states share topography, their wind resources and political climates differ markedly. Policies that have widely differing structures (and therefore impacts) include net metering, green pricing, and renewable portfolio standards. Regional cooperation to examine opportunities to develop wind power, to share “success stories”, and to promote regional economic efficiencies should be pursued.

f: *Compared with other regions, the geography of Appalachia presents barriers to wind development.* Wind development costs increase in mountainous areas with poor infrastructure, compared to more states with flatter terrain.

g: *Barriers related to environmental impacts have common themes—birds and bats, noise, lighting, and viewsheds and esthetics—and often increase project cost by slowing down permit approvals; however, these barriers usually do not result in permit denials.* Increasing economic benefits at the local level, and promotion of wind power development at scales that are not so industrial, may lessen public opposition to wind projects. Restrictions on turbine operation during peak times of bird migration and bat mating can reduce collisions.

h: *Factors related to policy have a strong influence on wind energy development.* Wind power develops faster when state-level incentives are in place to encourage its deployment, and when these policies focus specifically on either wind or the cohort of renewables. Improved net metering and renewable portfolio standards are two of the most powerful policy tools that could enhance wind power development in the study region.

i: *Factors related to economics have a strong influence on wind energy development.* States with limited power production are quicker to embrace new technologies, due to need; and wind develops partially in response to market forces for other sources of power production (price of coal, or gas). Investment in manufacturing of wind power turbines and components could accelerate wind development. Tax exemptions or subsidies to reduce capital costs, and “small wind” (or community wind) incentives to reduce local opposition to large-scale projects, could improve prospects for wind energy. Feed-in laws or tariffs requiring utilities to purchase electricity from renewable sources, and green pricing programs region-wide for consumers, should be considered.

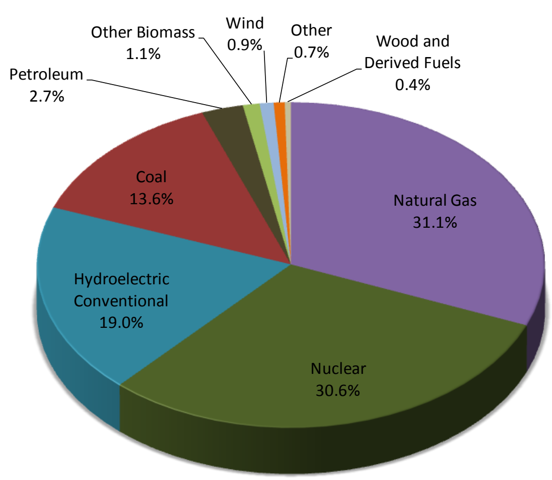
j: *Local opposition is the most cumulative barrier*. Industrial-scale development funded by out-of-state corporations, which offer limited local benefits, constrain local support for wind development, and motivate opposition. Policies that specifically favor wind power may have more opposition than broader policies that favor renewables in general. Special incentives for non-absentee landowners could reduce local opposition.

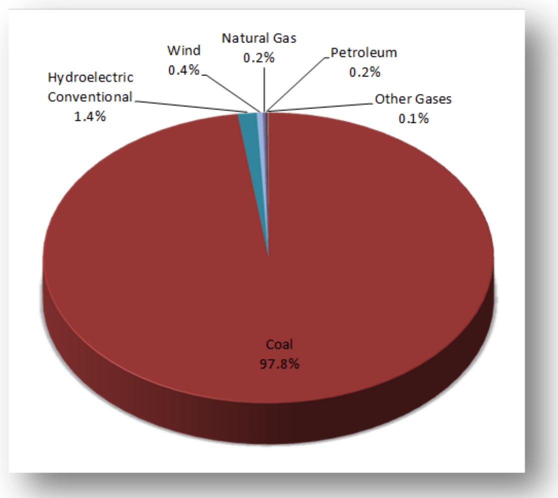
B. OBJECTIVE and TASK DISCUSSION

1. Analyze solutions for overcoming wind development market barriers from other states and regions, and develop strategies to apply these solutions to central Appalachia.

The project team, with early input from its advisory committee (Task 1), compiled information on electricity production and consumption in the study region (Task 2a), as well as data on the extent of wind energy development in each state's current energy profile (Task 2b). It also selected states where energy production's status quo represents alternative (and more advanced) scenarios to the five states in the study region, and examined their approaches to policy formation that could inform changes in the study region's states (Tasks 2c,d). In absolute terms, wind energy remains a small source of electricity generation in most states. But in relative terms, wind's growth is notable. For example, Wyoming – a large coal producer – has encouraged the growth of its wind industry, which has accounted for 20% of the increase in the state's generation since 2004, illustrating that wind and coal can co-exist. Colorado's total (12%) generation increase since 2004 was comprised of almost 70% growth in renewables, thanks to an aggressive Renewable Portfolio Standard. Minnesota has special incentives that promote community-based energy development, and its lessons could be applied in Appalachian states to mute the powerful barrier of local opposition to wind development. New York's diverse mix of energy sources (it is not a coal producer, but a consumer for its power), especially its growth in renewables, is largely owed to a state agency that has supported renewable resource development and consumer-driven market demands for renewables and local incentives. These efforts buffer changes in pricing in specific fuel sources, and positions the state to take advantage of new technologies and government incentives for energy production.

The project's primary final report ("A Windfall for Coal Country? Exploring Barriers to Wind Development in Appalachia") provides graphics that provide the basis for comparisons among study states. Two examples that depict sources of energy generation and diversification are below:

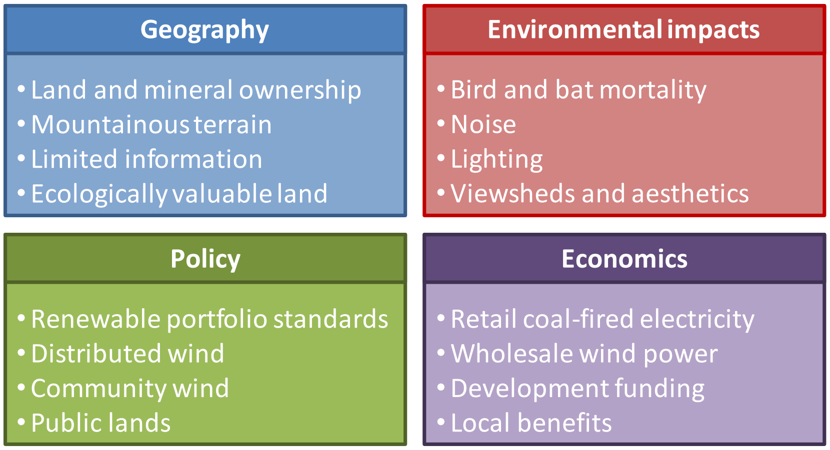




New York State (out of study region) West Virginia (central Appalachia)

Source: Energy Information Administration, 2010

Additionally, the comparisons with other states' energy profiles and policy environments allowed the project team to clarify the types of barriers that are most germane to Appalachia. Generally speaking, central Appalachia's barriers fall into four categories, which are represented in the final report with the following graphic:



Types of barriers to wind energy development in Appalachia (Figure 4, page 6 of final report)

Raising public awareness about success stories and effective policies from other regions to Appalachia is a key element in promoting change in the region's energy policy. Thus bringing these lessons "home" through comparisons serves as an entry point for discussion of alternatives by the states' decision-makers and opinion leaders (Task 2d). The report and a news release were distributed to major media outlets in the study region (radio, television, newspaper), and shared with non-profit development organizations in the target states, who were asked to present it to legislative representatives on key committees (Task 6). Our advisory group, comprised of an energy researcher, an environmental attorney, a law school faculty member, and a representative from the National Renewable Energy Laboratory, was helpful in shaping the project, editing the final products, and distributing within their networks as well. The reports appear on the web sites of both The Mountain Institute (TMI) (http://www.mountain.org/map/water-and-energy) and Downstream Strategies (http://downstreamstrategies.com/projects.html). The main project report was subsequently posted to the website of the WV Highlands Conservancy (http://wvhighlands.org/wv_voice/?p=5193) and the project was referenced in Maryland's Bay Journal (http://www.bayjournal.com/article/clean_may_not_always_be_green_where_wind_power_is_concerned), as well as the Charleston Gazette's online "Coal Tattoo" blog:
http://blogs.wvgazette.com/coaltattoo/2012/07/03/tuesday-roundup-july-3-2012/.

Follow-up from the project is ongoing. Project team members have given presentations, briefings, or interviews to:
West Virginia Wind Working Group (Canaan Valley, WV);
West Virginia Highlands Conservancy (Blackwater Falls State Park);
Community Wind Across America conference (Penn State);
Kentucky Public Radio;
WV legislative representatives;
"Living Green" lecture series, Oglebay Park, Wheeling, WV.

Perhaps more importantly, the project cast a wide net by establishing contacts with non-profit organizations, legislators, government agencies, and the media. TMI and Downstream Strategies thus have become part of the energy "networks" that exist in the states (but primarily in West Virginia). Becoming part of these networks puts TMI and this project's results at the table, contributing to dialogue about energy development. Participating in this ongoing dialogue is the key strategy to having an influence on future policy changes that can favor wind energy development.

2. Identify options for diversifying wind production models in Appalachia to include not just industrial wind, but also community wind and distributed wind approaches.

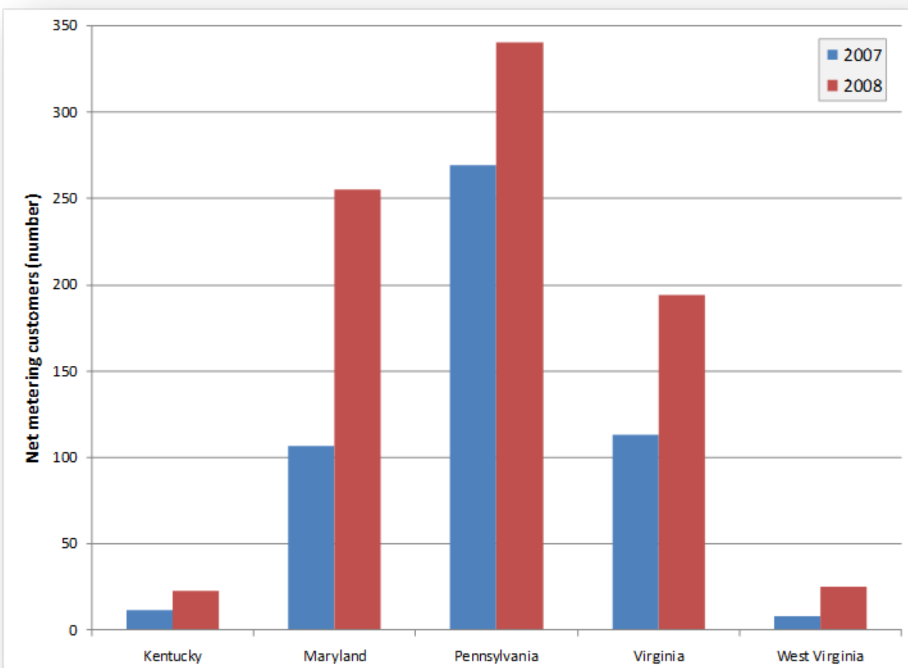
The project produced a publication, "A Resource List for Community Wind in Appalachia," which distilled much of the larger report's information into a more manageable source for parties interested in exploring non-industrial wind power generation (Task 2e). It provides basic energy production information for each of the five study states, and references excellent community wind toolkits that have been developed by other organizations.

Community wind is defined as a locally-owned, commercial-scale wind project that optimizes local benefits. Locally-owned means that a significant direct financial stake and decision-making authority in the development of the project (other than through land lease payments, tax revenue, or payments in lieu of taxes) is held by one or more local individuals or entities. Commercial-scale means projects that are designed for bulk power generation and sale to a retail electric utility company distributing electricity locally, or for distribution to a non-residential electricity user.

Community wind projects tend to benefit the local community by using local labor and materials during project development and operations, providing dividends to local shareholders, and patronizing local banks for construction, financing, and operating loans. For these reasons, "several studies have investigated the difference between local- and absentee owned wind turbines and all have found substantial increases in net economic benefits when turbines are locally owned, both in jobs and in total economic output" (Farrell and Morris, 2008, p. 22). Even more notably, "in all but one of the studies, the economic impact of community wind projects more than tripled that of an absentee owned wind farm" (Farrell and Morris, 2008, p. 22).

Renewable portfolio standards (RPSs) and net metering are two principal policy tools that can promote community-based and small (distributed) wind production, as well as other renewable energy sources. RPSs, set by state law, require a percentage of an electric provider's energy sales (measured in megawatt-hours, or MWh) or installed capacity (measured in MW) to come from renewable energy resources. RPSs in Pennsylvania and West Virginia include alternative fossil fuel–based energy sources in addition to renewables.

While all five states in Appalachia allow net metering, the capacity limits across the states vary considerably (see table, below). The aggregate limits vary as well. Pennsylvania is most flexible because it does not contain an aggregate limit. Maryland's aggregate limit is fixed: 1,500 MW. In West Virginia, Virginia, and Kentucky, aggregate limits are based on peak loads in the previous year.



Net metering customers from 2007-2008, by state. (Figure 25, page 44 of final report)

3. Through an advisory committee, bring together diverse stakeholders to help shape the research and disseminate results to their respective geographical areas and sectors.

Four key individuals remained involved with the project through its various phases, and contributed to shaping the research, reviewing findings, participating in mid-term conference calls, editing final reports, and distributing products to their networks (Tasks 1,3,5). Several individuals started as advisors to the project, but at various midpoints withdrew due to job changes, lack of interest, or other factors. But the project relied on key contributions from myriad individuals who offered fact checking, insight, connections to other contacts, etc.

The four key advisory committee members were:
Christine Risch (Director, Center for Business and Economic Research, Marshall University, Huntington, WV)
Buzz Belleville (Professor, Appalachian School of Law, Grundy, VA)
Brad Stephens (Attorney with litigation experience in WV and Maryland, Morgantown, WV)
Larry Flowers (Project Leader, National Renewable Energy Laboratory, Golden, CO).

The larger list of individuals who contributed in significant ways at various points during the project includes:

Bobby Baloski (Cambria County Conservation District, Cambria County, Pennsylvania);
Dan Boone (Independent Environmental Consultant);
Lowrey Brown (Senior Policy Analyst, Western Resource Advocates);
Elizabeth Byers (Project Ecologist, West Virginia Natural Heritage Program, West Virginia Division of Natural Resources);
Kerry Campbell (Manager, Division of Energy Policy and Technology Deployment, Pennsylvania Department of Environmental Protection);
Chris Caffyn (Senior Energy Developer, Community Energy, Inc.);
Lisa Daniels (Executive Director, Windustry);
Josh Framel (Project Manager, Gamesa Energy);
Andrew Gohn (Clean Energy Program Manager, Maryland Energy Administration);
Sue Jones (President, Community Energy Partners);
Neil Joshipura (Division of Energy Regulation, Virginia State Corporation Commission);
Pam Kasey (Reporter, The State Journal, Charleston, WV);
Ken Landgraf (Forest Planner, Jefferson National Forest and George Washington National Forest, VA);
Earl Melton (West Virginia Public Service Commission);
Jessica Morey (Project Director, Clean Energy Group);
John Moskal (New England Region Energy Team, United States Environmental Protection Agency);
Kelly Ostertag (Member Relations, PJM Interconnection, LLC);
Hugh Rogers (President, West Virginia Highland Conservancy);
Kate Shanks (Director of Renewable Energy, Kentucky Energy & Environment Cabinet);
Dirk Shulund (Project Manager, Transmission Tariff Coordinator, Western Area Power Administration Upper Great Plains Region);
John Shupp (Division of Engineering, Electric Branch, Kentucky Public Service Commission);
Charlie Smith (President, Utility Wind Integration Group, National Renewable Energy Laboratory);
Matthew Stoltz (Manager Transmission Services, Basin Electric Power Cooperative);
Eric Supey (Environmental Program Manager, Northeast Regional Office, Pennsylvania Department of Environmental Protection);
Kim Van Fleet (Important Bird Area Coordinator, Audubon Pennsylvania); and
Erick Walker (Acting Manchester District Ranger, Green Mountain National Forest).

4. Develop recommendations and disseminate results that are tailored specifically to policy makers, landowners with significant wind resources, community groups, and others.

Following an introductory chapter with an overview of the region's status as a wind development zone, Chapter 2 provides state-level information that describes each state's present energy sector, in terms of its generation capacity and fulfillment of wind potential. The following four chapters address the four principal categories of barriers, illustrated above (Geography, Environmental Impacts, Policy, and Economics). In the three barrier categories that were comprised of significantly differing factors among the study states, a state-by-state breakdown was developed. Each category section concludes with a set of recommendations (Task 4).

This structure makes information readily available on a state-by-state basis, making for easier searching for the varied audiences. Indeed, the variations among states in wind energy development indicate little cohesiveness of the five-state study area as a region. The project team realized early in the research process that the report would be most viewed for its state-specific information.

Geography represents the single barrier category that is fairly uniform within the region. Mountainous terrain and limited road infrastructure makes wind development expensive. Broad-scale wind resource assessments often lack the necessary resolution to pinpoint high-wind areas most suitable for wind projects. Ridgelines are often the most ecologically valuable natural sites, hosting the headwaters of streams that ultimately flow into drinking water supplies, and hosting species that are not found at lower elevations (this overlaps with Environmental barriers). The region's land ownership patterns generally trend toward small parcels, increasing transaction costs for developers who must negotiate with many individual landowners.

Recommendations regarding barriers of geography (important for wind developers), page 31:

1. Establish guidelines for rigorous site selection criteria.
2. Establish publicly available, finer-resolution wind resource datasets.
3. Provide funding for Wind Energy Testbeds.
4. Expand anemometer loan programs.
5. Strengthen collaboration among regional wind working groups.
6. Establish collaboratives among land owners.

Recommendations regarding barriers of the environment (of strong interest to communities), page 37 (Task 2f):

1. Continue pre- and post-construction monitoring of birds and bats, and adjust permitting decisions based on the results.
2. Carefully monitor and integrate information regarding white-nose syndrome in bats.
3. Take necessary steps to protect birds and bats.
4. Consult early with municipal officials and prospective neighbors.
5. Relocate turbines when necessary.
6. Consider items from Pennsylvania's model local ordinance.

Recommendations regarding barriers of policy (tailored for state legislators), page 49 (Task 2c):

1. Strengthen the existing RPSs in the region.
2. Create an RPS in Kentucky.
3. Strengthen existing net metering policies in the region.
4. Create policies supportive of community wind.
5. Institute a REC multiplier for community and distributed wind.
6. Incentivize the further development of green pricing.

Recommendations regarding barriers of economics (targeting agency personnel), page 62 (Task 2c):

1. Establish feed-in laws or tariffs. Invest in the expansion of domestic manufacturing of wind turbines and components.
2. Establish subsidies to reduce capital costs on the front end of wind projects.
3. Develop a stable market for RECs.
4. Offer wind-specific funding mechanisms.
5. Revise current tax-based wind energy incentives so that benefits are primarily available to non-absentee land-owners.
6. Establish incentive programs specifically targeted at small wind.

Additionally, a "Resources List for Community Wind in Appalachia" was developed to guide local-level interest in developing non-industrial-scale projects (Task 2e).

5. Guide a transition toward wind energy in coal-producing counties of Appalachia, leveraging the most localized economic benefits that are feasible.

A transition requires a shift in behavior or motivation, and in rural states with a strong history of fossil fuel dependence, change is a long-term process. This project represents a first and important step in suggesting a way forward for wind development, by compiling, synthesizing, and interpreting an extensive body of works into one document. The principal final report defines the present status of wind development in the region, identifies barriers that constrain the wind sector's penetration into the region's energy portfolio, and suggests ways to eliminate or reduce those barriers with policy instruments, economic incentives, and alternative approaches to wind development. It also points out barriers that are relatively intractable, which are important considerations endemic to the region of which wind energy developers should be aware.

Tackling this project required the team to engage with a broad spectrum of players in the energy sector, which included government agencies, private enterprises, elected officials, non-profit organizations, academics, and community activists. These interactions created an informal network of colleagues and contacts who collectively participate in promoting (or resisting) change in the energy sector in the study region. Within this large group, a smaller cluster of allied players in the renewable energy sector (including solar, geothermal, and wind) comprises a "pressure group" that is active with state policy makers, essentially playing the role of an informal coalition to work on the transition to new energy sources in the region.

One dominant characteristic of current wind development in the region is its industrial scale, promoted by energy corporations that are from out of state and whose entry into rural communities often generates opposition. Little effort and few policies have focused on smaller-scale wind projects, community ownership, or distributed wind development. This gap in the wind energy portfolio in the study states led the project team to develop a "Resource List for Community Wind Projects." The publication describes basic wind information, and points readers (targeting an audience from the rural areas of the region) to existing "toolkit" publications that provide guidance on developing non-industrial-scale wind projects (Task 2e).

C. CONCLUSIONS AND ACCOMPLISHMENTS

The project "Overcoming Barriers to Wind Development in Appalachian Coal Country" revealed a striking variety of approaches and rates of wind power development in a study area of five contiguous states. Although the region is termed "Central Appalachia," the commonalities of the states are defined primarily by topography, culture, environmental concerns, and a legacy of fossil fuel extraction (coal, gas, and oil). Contemporary influences of state-level politics and economics play a large role in fragmenting the region's approaches to energy development. Few cross-border initiatives exist which could support uniformity of approaches to development of wind power.

With the US Department of Energy goal of "20% Wind by 2030" in mind, the project concluded with a consideration of what future scenarios would be if the region were to meet that goal (Task 2g).While conceptually feasible, it is nevertheless a tall order: Current and expected projects across the region provide only 12% of the total capacity (2039 MW) that would be required to meet the wind energy goals. West Virginia and Pennsylvania have attained 30% and 31%, respectively, of their "20% by 2030" goals, but Maryland, Virginia, and Kentucky each produce less than 10% of the wind energy that would be required to meet the same goal. Maryland and Virginia could experience rapid growth if they were to focus on offshore projects, but to rely on a land base would be more difficult. For the region overall, meeting the 20% goal would require the additional installation of more than 6,000 2MW turbines. Many of the "low hanging fruits" among likely turbine sites have already been picked, with less accessible sites likely to be more expensive to develop, or those closer to communities likely to face vigorous opposition.

The project was challenged by the fluidity and rapidly changing nature of the energy sector. State legislatures in the study regions meet at different times, and monitoring legislative changes and regulatory updates for the 5-state area was daunting. It also risked that baseline information in the report could be outdated quite rapidly. The accelerated pace of gas drilling into the Marcellus Shale in West Virginia and Pennsylvania also began to have an impact on energy markets, with abundant gas supplies making some coal production undesirable, even displacing coal as the energy source of choice for some electricity-generating utilities. This shifting of the markets away from coal and toward natural gas also affected the "status quo" snapshots of energy production in the region.

An additional environmental impact also began to appear as the project team was drawing its work to a close. Researchers in Pennsylvania, Maryland, West Virginia, and Virginia were in the process of publishing peer-reviewed studies of golden eagle migration and wintering habitat sites along ridgelines of the Appalachians, which are prime sites for wind development. The discovery that a significant portion of eastern North America's golden eagle population uses these four states' highest elevations poses a potential barrier for wind development that was beyond the scope of this report at the time of its production.

Environmental advocates are of varied opinions about wind power's desirability, and the project team's lead organization (TMI) received criticism from some of the organization's supporters for what was presumed to be an endorsement of wind power in the region. The project was reviewed by TMI's Board of Directors to ensure that its approach was neither to endorse nor to oppose wind development, but to provide a more nuanced and detailed view of wind power potential in the region.

Partly as a result of this project, The Mountain Institute's Appalachia Program expanded its energy focus to a broader focus on "Sustainable Energy" projects, and is now networked with many of the organizations and agencies that assisted in the acquisition of information for this report on wind. That project, with a current emphasis on solar power, is supported by private foundations, as well as lawsuit settlement funds from coal company violations of the Clean Water Act.

Within this network of collaborators and contacts are the following:

Energy Efficient West Virginia (WV): www.eewv.org
Coal River Mountain Watch (WV): www.crmw.net
Mountain Association for Community Economic Development (KY): www.maced.org
Ohio Valley Environmental Coalition (WV): www.ohvec.org
United Electrical Workers/Public Workers Union, WV: http://www.ue-easternregion.org/
Kentucky Sustainable Energy Alliance (KY): www.kysea.org
Power In My Back Yard (WV): www.getpimby.net
Student Environmental Action Coalition: www.seac.org
Clean Energy States Alliance: http://www.cleanenergystates.org/
Energy Action Coalition: http://www.energyactioncoalition.org/
Affiliated Construction Trades: http://www.actwv.org/
West Virginia Wind Working Group: http://www.wvcommerce.org/energy/renewable_energy/wind.aspx
Southern Alliance for Clean Energy: http://www.cleanenergy.org/
Windustry: www.windustry.org
American Wind Energy Association: www.awea.org
Pennsylvania Wind Working Group: http://www.pawindenergynow.org/pa/farms.html
Virginia Wind Energy Collaborative: http://wind.jmu.edu/vwec/
Penn State U--Pennsylvania Wind for Schools (PA): http://www.wind.psu.edu/wfs/
PennFuture (PA):

Appendix A: “A Windfall for Coal Country? Exploring the Barriers to Wind Development in Appalachia”

A Windfall for Coal Country? Exploring the Barriers to Wind Development in Appalachia

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building capacity for sustainability

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Brent Bailey, Ph.D., Director, Appalachia Program, The Mountain Institute. Dr. Bailey directs the Appalachia Program at The Mountain Institute. He has more than 20 years' experience in forestry, natural resource management, environmental education, and local community development on three continents.

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Holly Groschner, J.D., New Mountain Wind. Ms. Groschner has made her career at the interface of development and regulation in the utility sector, working to find common ground among publicly traded companies; local landowners; and federal, state, and municipal governments. Ms. Groschner received her J.D. from Vermont Law School, served as a law clerk for the Honorable Louis J. Peck at the Vermont Supreme Court, practiced law as a partner at Vermont's largest law firm, and served as senior vice president at a publicly traded company in Pittsburgh. She works from Pittsburgh and Corinth, Vermont.

Rory McIlmoil, M.A., Project Manager, Energy Program, Downstream Strategies. Mr. McIlmoil has a background in environmental science and policy with a focus on the analysis and presentation of scientific and economic data relevant to environmental policy and energy development. He has three years of experience working on energy and economic policy issues relevant to Appalachia.

Laura Hartz, M.S., Project Manager, Land Program, Downstream Strategies. Ms. Hartz researches science and policy related to energy, agriculture, and the environment. She brings a strong background in federal policy analysis, technology and sustainability, and natural resource and environmental economics.

Jen Shaver, J.D. Ms. Shaver received a Master of Studies in Environmental Law (M.S.E.L.) from Vermont Law School and a J.D. from the Appalachian School of Law. She served as law clerk for the Honorable Patrick R. Johnson, Circuit Court Judge of the 29th Judicial Circuit of Virginia and was an Assistant Commonwealth's Attorney in the Russell County Commonwealth's Attorney's Office. She now works for the Virginia Gas Owners Litigation Group.

Anne Hereford, M.S., Project Environmental Scientist, Downstream Strategies. Ms. Hereford has a background in environmental science, with diverse experience in GIS development, watershed planning, permit research, aqueous geochemical modeling, data analysis, water monitoring, and science education.

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DISCLAIMER

This report is accurate as of November 2011, when it was finalized. Even though wind development has continued since then, the authors believe that the fundamental conclusions and recommendations stand as written.

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ABBREVIATIONS

AEP	American Electric Power
AEPS	alternative energy portfolio standard
AFA	Allegheny Front Alliance
C-BED	Community-Based Energy Development
CPCN	Certificate of Public Convenience and Necessity
CRWP	Citizens for Responsible Wind Power
EIA	Energy Information Administration
ESA	Endangered Species Act
EWG	exempt wholesale generator
FAA	Federal Aviation Administration
FAF	Friends of the Allegheny Front
FERC	Federal Energy Regulatory Commission
FGC	Friends of Greenbrier County
FOBPC	Friends of Beautiful Pendleton County
GWh	gigawatt-hour
HB	House Bill
HCP	Habitat Conservation Plan
IOU	investor-owned utility
ITP	Incidental Take Permit
kV	kilovolt
kW	kilowatt
kWh	kilowatt hour
LMPA	Laurel Mountain Preservation Association
m	meter
MCRE	Mountain Communities for Responsible Energy
MPSC	Maryland Public Service Commission
MSHA	Mine Safety and Health Administration
MW	megawatt
MWh	megawatt-hour
NEG	net excess generation
NPDES	National Pollutant Discharge Elimination System
NREL	National Renewable Energy Laboratory
NYSERDA	New York State Energy Research and Development Authority
PDCNR	Pennsylvania Department of Conservation and Natural Resources
PDEP	Pennsylvania Department of Environmental Protection
PFBC	Pennsylvania Fish and Boat Commission
PGC	Pennsylvania Game Commission
PNDI	Pennsylvania Natural Diversity Inventory
PPA	power purchase agreement
PPUC	Pennsylvania Public Utility Commission
PSC	public service commission
PUC	public utility commission
PV	photovoltaic
REC	renewable energy credit
RPS	renewable portfolio standard

SODAR	sonic detection and ranging
US	United States
USACE	United States Army Corps of Engineers
USDOE	United States Department of Energy
USFS	United States Forest Service
USFWS	United States Fish and Wildlife Service
VDEQ	Virginia Department of Environmental Quality
VSCC	Virginia State Corporation Commission
WVDNR	West Virginia Division of Natural Resources
WVHC	West Virginia Highlands Conservancy
WVPSC	West Virginia Public Service Commission

EXECUTIVE SUMMARY AND KEY FINDINGS

Introduction

Wind is a rapidly growing renewable energy resource in the United States; in 2009 and for the fifth consecutive year, growth in wind power generating capacity exceeded that of new coal plants and was only behind that of new natural gas plants. By 2009, the United States had more than 35,000 megawatts (MW) of installed wind capacity, more than anywhere else in the world, and only trailing China in annual wind capacity additions. In 2010, United States wind capacity continued to expand, but at half the annual rate of the previous year due to fluctuations in the economy.

The United States Department of Energy has outlined a variety of goals related to the penetration of distributed wind, cost effectiveness of wind-based electricity generation, improvement of renewable energy interconnection, and enhancement of public acceptance of wind technology. In 2008, it commissioned a study to consider the scenario where wind generation would provide 20% of total US electricity needs by 2030. This concept—20% by 2030—provides a substantial portion of the theoretical context for this report.

Despite the recent growth, the country has only barely tapped its wind energy resource. As shown in the national map in Figure ES-1, most Appalachian states have areas at Class 3 or above. In Appalachia—which for the purposes of this report includes Pennsylvania, West Virginia, Maryland, Kentucky, and Virginia—the best wind resources are generally found along mountain ridges and offshore. These five states are all coal-producing states; the intent of our analysis was to elucidate market barriers that, among other things, related to the existence of wind resources in Appalachian coal country.

Wind turbines have the potential to generate considerably more electricity than they currently generate. This sharp disparity between potential and existing wind energy generation begs the question: What, if anything, is delaying the deployment of wind energy in the United States? This research team set out to identify the market barriers to wind energy development in Appalachian coal country.

Currently, the five Appalachian states considered in this report are home to 29 current and expected wind projects, ranging in size from 3 to 264 MW (Table ES-1). This table details the wind farms that are under construction, partially in service, or in service as of May 2, 2011. If built as planned, a total of 2,039 MW of wind turbines would be installed across the region.

According to the United States Department of Energy, in order to meet the 20% by 2030 scenario for the country, different states would be required to generate different percentages of wind; the five Appalachian states considered in this report would need between 8,100 and 26,000 MW of installed wind capacity, including off-shore wind. According to federal estimates of land-based wind resource potential, the five states considered here could install approximately 16,872 MW of capacity, meeting twice as much as the minimum requirement if every resource were fully developed. Current projects, however, comprise just 12% of the region's potential.

Some states within the region have succeeded at utilizing more of their wind resource than others. West Virginia, for example, has utilized almost 33% of its resource, whereas Pennsylvania, with a comparable amount of installed wind capacity, has only utilized 13% of its total resource (see Figure ES-2).

Figure ES-1: Wind resources in the United States and Appalachian coal country

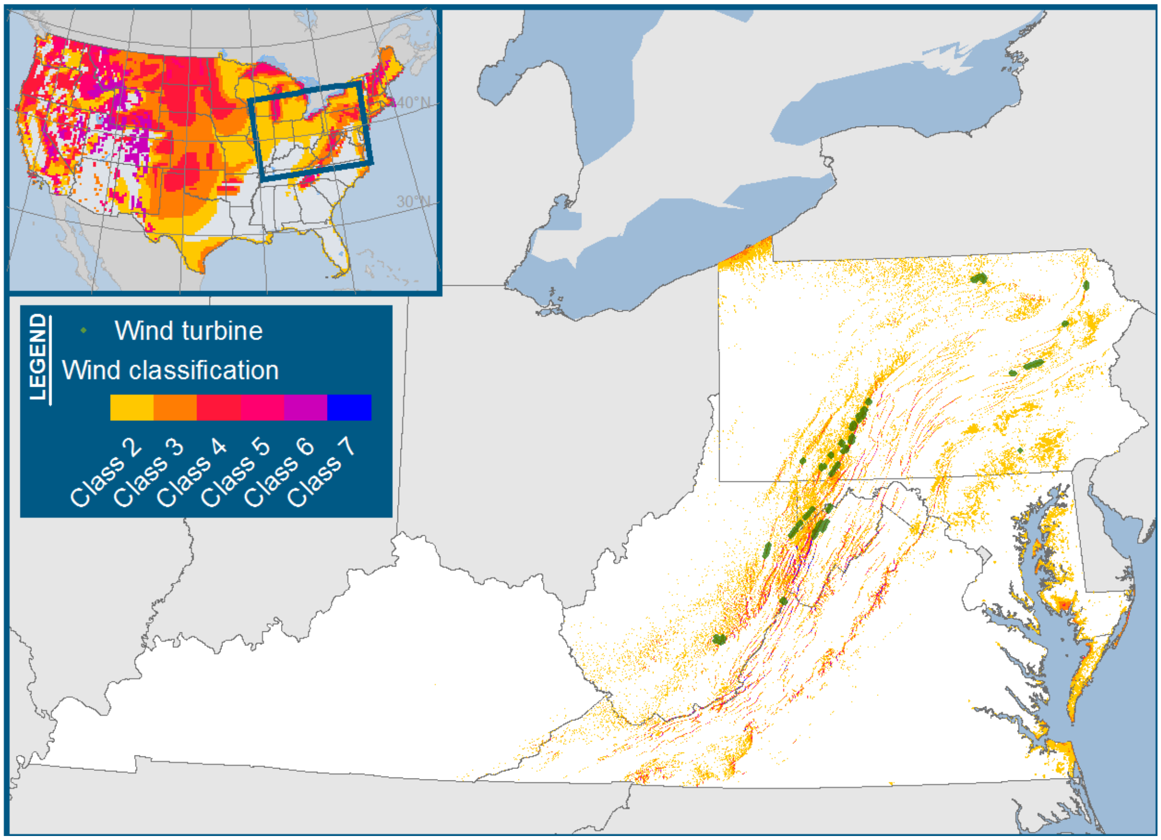
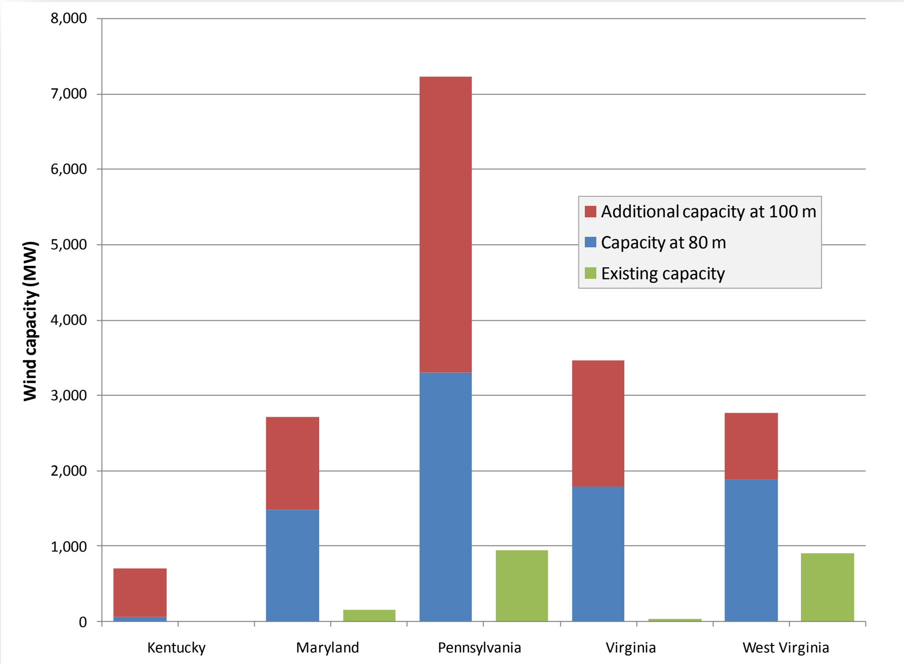


Table ES-1: Current and expected wind projects in Appalachia

Project name	County	Status	Year	Capacity (MW)
Pennsylvania				
Somerset Wind Farm	Somerset	In service	2001	9
Mill Run Wind Farm	Fayette	In service	2001	15
Meyersdale Wind Farm	Somerset	In service	2003	48
Waymart Wind Farm	Wayne	In service	2003	70
Bear Creek Wind Project	Luzerne	In service	2006	26
Locust Ridge Wind Farm	Schuylkill	In service	2006	27
Forward Wind Farm	Somerset	In service	2008	29
Casselman Windpower Project	Somerset	In service	2008	40
Lookout Wind Project	Somerset	In service	2008	38
Highland Wind Project	Cambria	In service	2008	65
Locust Ridge II Wind Farm	Schuylkill	In service	2009	100
Stonycreek Wind Farm	Somerset	In service	2009	53
North Allegheny Wind Farm	Blair/Cambria	In service	2009	132
Allegheny Wind Farm	Blair/Cambria	In service	2009	20
Armenia Mountain	Bradford/Tioga	In service	2009	101
Turkey Hill Dairy	Lancaster	In service	2011	3
Chestnut Flats Wind Farm	Blair	Partially in service	2011	38
Project near Gans substation	Fayette	Under construction	2011	50
Mahanoy Mountain	Northumberland	Under construction	2012	18
Shaffer Mountain	Bedford/Somerset	Under construction	2012	60
Total, Pennsylvania	**12 counties**			**941**
West Virginia				
Mountaineer Wind Energy Center (Backbone)	Tucker/Preston	In service	2003	90
Mount Storm Phase I, II, III	Grant	In service	2007	264
Beech Ridge Wind Farm	Greenbrier	Partially in service	2010	186
Green Mountain	Mineral	Under construction	2011	85
Laurel Mountain	Barbour	Under construction	2011	125
New Creek	Grant/Mineral	Under construction	2012	160
Total, West Virginia	**6 counties**			**910**
Maryland				
Kelso Gap Wind Project	Garrett	Partially in service	2010	100
Roth Rock Wind Facility	Garrett	In service	2011	50
Total, Maryland	**1 county**			**150**
Virginia				
Highland New Wind	Highland	Under construction	Unknown	38
Total, Virginia	**1 county**			**38**
Kentucky				
None	N/A	N/A	N/A	0
Total				**2,039**

Figure ES-2: Wind energy potential versus capacity in current and expected wind projects



In completing this report, the research team conducted economic, policy, and geospatial analyses and interviewed wind developers, environmental advocates, electricity professionals, legal counsel, and state regulators. In addition to five Appalachian states, we researched Colorado, Wyoming, and New York as comparison states. We distilled a wealth of information related to wind resources, policy, social norms, energy production, and Appalachia down to a broad list of key findings. Each key finding is related to one or more barriers to wind energy development. These barriers prohibit the development of actual projects, delay the expansion of wind energy across the region, and delay the achievement of the 20% by 2030 scenario.

Different barriers are more of less easily overcome. For example, policy barriers can be overcome if state governments adjust their laws. It is open for debate, however, whether such changes are easy or difficult. Other barriers, such as the potential for white-nose syndrome to slow the development of wind projects in Appalachia, may be less solvable. In this case, solutions will require scientific advances before it will be known whether wind turbines can be permitted in the future—and if so, with what protections.

Finding 1: Barriers to wind development in Appalachia are related to geography, environmental impacts, policy, and economics.

Although the five states considered in this report share many characteristics, they do not neatly cluster as a region. Each state has taken a different approach to wind development, and no single mechanism will alter the circumstances enough to immediately expand wind energy development. Still, wind projects in Appalachian coal country are influenced by a similar set of barriers. Certain barriers, however, have more influence than others.

The geography of Appalachia, for example, raises barriers because of land and mineral ownership patterns, mountainous terrain that makes it more expensive to build wind farms and harder to predict wind resources, and an abundance of wind resources on ecologically valuable land.

Environmental impacts from wind projects—bird and bat mortality and migration, noise, lighting, and viewsheds and esthetics—are raised frequently by opponents to wind farms.

While numerous policies impact the pace of wind development, the structure of renewable portfolio standards is particularly important. For example, in West Virginia and Pennsylvania, renewable portfolio standards do little to incentivize wind development because of their inclusion of fossil fuel technologies as "alternative" energy. Progressive policies in Appalachian coal country related to distributed and community wind—two types of wind development that show promise for overcoming opposition to large-scale, corporate wind farms—are lacking. In addition, because so much of Appalachia's wind resources are found on public land, policies that protect public land from the development of wind resources play a significant role in limiting the penetration of wind farms.

Finally, economic barriers are also important. In several Appalachian states, coal-fired electricity in the retail market has kept electricity prices low. Wholesale wind prices also influence the rate of wind energy development. Despite the existence of federal incentives, few state funding sources are available to support wind projects in Appalachia. Finally, a lack of sufficient local benefits is a factor that helps galvanize opposition to wind projects.

Finding 2: Coal influences state energy policies, which impact the rate of wind development.

All five states considered in this report—Pennsylvania, West Virginia, Maryland, Virginia, and Kentucky—produce coal; West Virginia and Kentucky are among the country's largest producers. The political and social influence of the coal industry extends beyond the borders of coal-producing counties. This influence impacts perceptions and, ultimately, policies that guide each state's energy future.

For example, West Virginia's Alternative and Renewable Energy Portfolio Standard encompasses a wide range of coal and fossil fuel-based "alternative energy" sources, including advanced coal technologies, coal bed methane, natural gas, fuel produced by coal gasification or liquefaction facilities, synthetic gas, integrated gasification combined cycle technologies, waste coal, and tire-derived fuel. It should come as no surprise, then, that Allegheny Power needs no new generation to satisfy this standard for 15 years and will instead rely on its existing, qualifying hydro and coal facilities. American Electric Power, the state's other major utility, also needs no new generation to satisfy this standard.

Finding 3: The region's strongest wind resources—and the region's existing and proposed wind farms—are often not found in the counties that produce the most coal.

West Virginia's most concentrated wind resources generally do not occur in the most important coal-producing counties. Wind farms in this state, so far, also tend to be built in counties with little or no coal production.

Pennsylvania shows a somewhat different pattern. Of the five counties with the most land at Class 3 and higher, two counties produced no coal in 2008-9 and one produced an insignificant amount. The other two counties were the third- and seventh-highest coal-producing counties in the state.

In Maryland, two wind farms have been built in the county with the state's largest wind resource, which is also the state's second-largest coal-producing county. Three of the other four counties with the largest wind resources do not produce coal.

No wind farms are operational in Virginia, although one is under construction in a non-coal-producing county. In Kentucky, which has by far the lowest wind resources of the five states, no wind farms are proposed yet.

Finding 4: Many opportunities exist for wind development in coal-producing counties.

Many wind farms in Appalachia have actually been built on former surface mines, and coal-producing counties hold numerous opportunities for wind development, even if they are not the windiest counties in the region. As the best wind resources are developed, it would be natural to expect wind developers to seek out additional sites for wind development, including those in coal counties that are not the prime sites with known high wind classes. Also, as wind resource maps are improved and as site-specific studies are conducted, developers can find localized wind resources that do not necessarily show up in state-level wind resource maps.

Finding 5: States within Appalachian coal country are developing wind at different rates.

Pennsylvania has a substantial total wind resource capacity and a significant amount of capacity installed. The state has 7,222 MW of wind potential at hub heights up to 100 meters, the most of any state in our region and more than that of Kentucky, Maryland, and Virginia combined. Pennsylvania already has 941 MW of wind under construction, partially in service, or in service, barely behind West Virginia. However, this amount is only 13% of its total capacity, making the state's proportion of wind resource developed comparable to Maryland, which only has 150 MW under construction, partially in service, or in service.

Of all of the states in our region, West Virginia has the most capacity under construction, partially in service, or in service in absolute and comparative terms. As of 2011, the state had 910 MW of capacity, 33% of its total wind resource, which is equal to 2,773 MW at hub heights up to 100 meters. A significant amount of wind developed, however, does not necessarily mean that the state has been progressively favoring wind development.

West Virginia, Virginia, and Maryland show similar available capacities but disparate proportions of fulfilled capacities. The total wind resource in each of these three states falls between 2,700 and 3,500 MW at hub heights up to 100 meters. Current projects in West Virginia will fulfill 33% of its capacity, whereas current projects in Maryland and Virginia only will fulfill 6% and 1%, respectively, of these states' capacities.

Kentucky has little wind and few wind-related incentives. According to the National Renewable Energy Laboratory, there are only 699 MW available at hub heights up to 100 meters. This ranks Kentucky last of the states in our analysis and 43rd out of the 48 contiguous states in the nation. Furthermore, Kentucky state policy does not incentivize development of the wind resources that the state does have. The state does not currently have a renewable portfolio standard or any public financing available for wind energy projects. The state does offer net metering and a tax credit, but neither of these policies is specific to wind.

Finding 6: Compared with other regions, the geography of Appalachia presents barriers to wind development.

Geography and ownership of mineral rights in Appalachia present barriers to wind energy development. Paradoxically, both small and large land parcels can delay wind projects. Small land parcels increase transaction costs and may limit the size of a wind project. Large parcel owners may be unwilling or unable to allow wind development due to existing coal leases, for example.

In Appalachia, the best onshore wind resources are generally found on ridge tops; wind farms along ridge tops can sometimes extend over many miles. The region's mountainous terrain, however, makes it more expensive to build wind farms. Moreover, there are technological constraints that impede the availability of accurate and precise wind resource information. In addition, much of the region's wind resource is located on ecologically valuable land.

Finding 7: Barriers related to environmental impacts have common themes—birds and bats, noise, lighting, and viewsheds and esthetics—and often increase project cost and slow down permit approvals; however, these barriers usually do not result in permit denials.

Environmental impacts may increase development costs, but they have not generally prohibited wind energy development. Of the projects proposed in the states considered in this report, none have been denied permits due to environmental impacts. In one case, approval was denied for turbines near a wilderness area, but these turbines were relocated.

Environmental concerns involving endangered species have been influential because endangered species may require an Incidental Take Permit in addition to monitoring and mitigation efforts. The United States Fish and Wildlife Service recommends bird and bat mortality monitoring for three years post-construction; these recommendations and any requisite mitigation strategies are usually adopted into permit conditions. In our study area, the Virginia big-eared bat and the Indiana bat have required these measures. Local groups in West Virginia, Maryland, and Virginia have sought enforcement of the Endangered Species Act due to impacts on the these bat populations in the area. Construction on the Highland New Wind Project in Highland County, Virginia, was paused by a federal court because of a "take" of a bat population. In at least one instance, endangered species concerns led to a restriction on the number of turbines built.

White-nose syndrome, which has decimated bat populations in Appalachia, presents a significant wild card as to how environmental concerns might grow in importance for wind farms near bat habitat.

Finding 8: Factors related to policy have a strong influence on wind energy development.

In Appalachia, few policies explicitly encourage wind energy development. While a range of policies impact wind development, the presence, absence, and characteristics of each state's renewable portfolio standard—targets that require utilities to source electricity from an array of energy sources—play a significant role. Neither Kentucky nor Virginia have mandated renewable portfolio standards; neither state has wind farms in operation. Pennsylvania and West Virginia include fossil fuels in the mix as "alternative" fuels, and West Virginia's standard can be met without the development of any renewables such as wind.

Distributed wind has the potential to help overcome certain barriers to wind in Appalachia, such as local opposition and environmental concerns. All five states mandate that net metering and interconnection—policies that favor distributed wind—be made available to on-site energy producers, including those that qualify as distributed. The four states other than Kentucky have additional regulations in place that enable distributed wind. Additionally, some states give further preference to distributed wind through granting reduced environmental review (Maryland and Virginia), renewable portfolio standard credit multipliers (Virginia and West Virginia), some state funding in the form of rebates or grants (Maryland, Virginia, and West Virginia), and some tax deductions or credits (Pennsylvania, Virginia, and West Virginia).

Community wind can benefit from supportive policies such as those in Maine and Minnesota, and can help overcome certain barriers, such as those related to local opposition, environmental concerns, and economics. No states in our region have policies that favor community wind. West Virginia and Pennsylvania have some programming that is beneficial to wind, including tax incentives, direct loan programs, and technical assistance; however, most of these benefits do not cater to community-wind initiatives. State policies help determine the profitability of a project.

A significant amount of wind is available on public lands in Appalachia. While public outcry may deter development, the absence of favorable federal policies impedes wind energy development on public land.

Finding 9: Factors related to economics have a strong influence on wind energy development.

In some cases, government incentives can increase the profitability of wind energy development; however, there is no guarantee that incentives will necessarily allow projects to overcome low electricity prices in some states considered in this report.

The volatility of the retail and wholesale electricity markets can impede wind energy development. Retail energy pricing is influenced by the availability of other energy sources. The historic and prolonged presence of cheap coal-fired electricity does not favor wind energy development. High wind development costs may be overcome if the retail price of electricity is high enough. Development costs are largely determined by the character of the terrain and the availability of a strong wind resource. Mountainous terrain and historic land ownership patterns also influence the overall development costs.

In-state funding programs can influence the volatility and enhance the price competiveness and profitability of wind energy projects. Public financing or tax credits for both commercial-scale and distributed wind projects promote wind development. When available, these policy instruments increase the odds that wind energy will be developed, and when unavailable, decrease the odds that wind energy will be developed. For example, neither Kentucky nor Virginia offers public financing to wind projects; neither state has wind farms completed. All of the states in our region except Kentucky make tax credits or deductions available to distributed wind developers.

Insufficient local benefits are a barrier to wind development in Appalachia. Increased distribution of economic benefits at the local level may positively impact communities' receptivity to wind projects.

Finding 10: Local opposition is the most cumulative barrier.

Unifying all of these concerns—geography, environmental impacts, policy, and economics—is one last issue: local opposition. Ultimately, individuals who live or recreate near wind projects experience the most pointed effects. This last concern is the most cumulative of all of the others presented in this report. A landowner can choose to oppose or solicit wind energy projects in his region based on environmental impacts, pertinent state and local policies, and individually-experienced economic gains or losses.

The less that wind developers are able to overcome local opposition, the slower the pace of wind development in Appalachian coal country. Potential avenues for overcoming local opposition include, for example, ensuring sufficient local benefits, allowing the purchase of electricity generated by local wind farms, and systematically addressing environmental issues. In addition, wind developers can seriously consider community wind structures so that local people are invested in the wind project and, at least over the long-term, share in the financial rewards.

1. INTRODUCTION

Wind is a rapidly growing renewable energy resource in the United States (US); in 2009 and for the fifth consecutive year, growth in wind power generating capacity exceeded that of new coal plants and was only behind that of new natural gas plants (USDOE, 2009). By 2009, the US had more than 35,000 megawatts (MW) of installed wind capacity,[1] more than anywhere else in the world, and only trailing China in annual wind capacity additions (USDOE, 2009). In 2010, US wind capacity continued to expand, but at half the rate of the previous year due to fluctuations in the economy (American Wind Energy Association, 2011).

The US Department of Energy (USDOE) has a variety of goals related to the penetration of wind, cost effectiveness of wind-based electricity generation, improvement of renewable energy interconnection, and enhancement of public acceptance of wind technology (USDOE, 2010a). In 2008, it commissioned a study to consider the scenario where wind generation would provide 20% of total US electricity needs by 2030 (USDOE, 2008). This concept—20% by 2030—provides a substantial portion of the theoretical context for this report.[2]

Despite the recent growth of wind capacity, the US has only barely tapped its wind energy resource. As shown in the national map in Figure 1, most Appalachian states have areas at Class 3 or above.[3] In Appalachia—which for the purposes of this report includes Pennsylvania, West Virginia, Maryland, Kentucky, and Virginia—the best wind resources are generally found along mountain ridges and offshore.[4] These five states are all coal-producing states; the intent of our analysis was to elucidate market barriers that, among other things, related to the existence of wind resources in Appalachian coal country.

According to the National Renewable Energy Laboratory (NREL), wind turbines have the potential to generate 37 million gigawatt-hours (GWh) per year in the lower 48 states (USDOE, 2010b). This is more than nine times the total amount of electricity generated in the US in 2009 (USDOE, 2010b). Yet, during that year, wind generation only accounted for less than 2% of total electricity generation (EIA, 2010a).

This sharp disparity between potential and existing wind energy generation begs the question: What, if anything, is delaying the deployment of wind energy in the US? This research team set out to identify the market barriers to wind energy development in Appalachian coal country.

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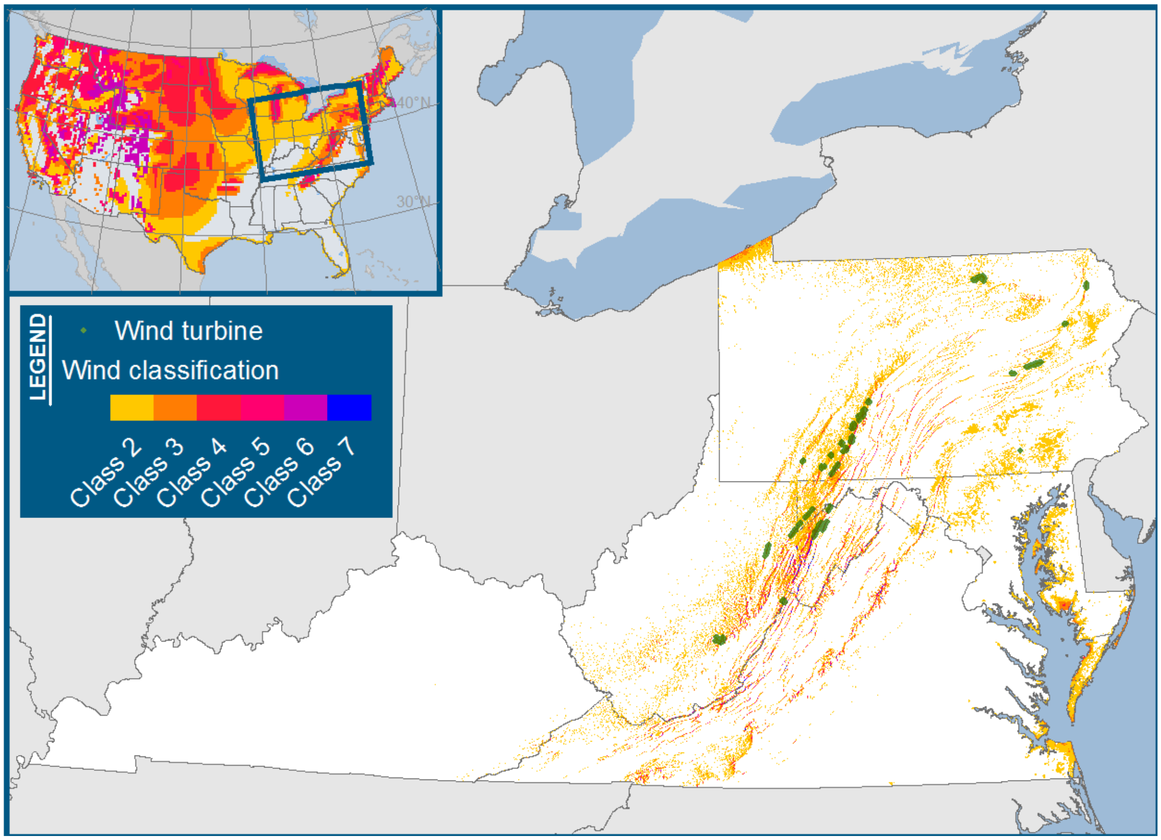
[1] Here and in the rest of the report, the word "capacity" refers to nameplate capacity, or the maximum power generated by a wind turbine should the wind blow at the optimal speed. In reality, winds are variable and turbines' true generating capacities are considerably less than their installed capacity. For example, the average capacity factor of wind farms operating in Pennsylvania and West Virginia in 2009 was 27.5% (EIA, 2009 and 2011). Also, PJM assumes an average summer capacity factor of 13% for new wind projects (PJM, 2010).

[2] While the growth of wind generation has been impressive in recent years, questions remain about whether it will ever provide baseload capacity and whether it will be able to follow loads. The 27.5% average capacity factor in Pennsylvania and West Virginia in 2009 and the 13% capacity factor assumed by PJM for new projects indicate that wind projects do not have capacity factors as high as those for baseload generation facilities. Solutions to these and other technical questions will, to some extent, determine what percentage of electricity can practicably be generated from wind. This report, however, focuses on market barriers and excludes technical barriers from consideration.

[3] Wind classes are based on wind speeds; the higher the class, the greater the average annual wind speed. Generally, wind projects are located on sites at Class 3 and above.

[4] We do not consider offshore wind potential in this report.

Figure 1: Wind resources in the United States and Appalachian coal country



Sources: Wind resources in Pennsylvania, West Virginia, Maryland, and Virginia: AWS Truewind (2003a). In Kentucky: AWS Truewind (2008). In inset: NREL (1986). Note: Wind resources are at 50-meter hub heights. The five Appalachian states are at 200-meter resolution, and the inset is at 30-kilometer resolution. The map does not depict unnamed "Project near Gans substation" in Fayette County, Pennsylvania. Note: turbine locations are shown as green dots.

Currently, the five Appalachian states considered in this report are home to 29 wind projects, ranging in size from 3 to 264 MW (Figure 1). Table 1 details the wind farms that are under construction, partially in service, or in service according to the PJM Active Generation Queue list as of May 2, 2011 (PJM, 2011).[5] If built as planned, a total of 2,039 MW of wind turbines would be installed across the region.

Pennsylvania has the most total current and expected capacity, followed by West Virginia, Maryland, and Virginia. Kentucky has no current or expected wind projects to date. Pennsylvania has the longest history with wind energy and contains the first farm in the region, which was completed in 2001. As depicted in Figure 2, the largest wind farms have been built in West Virginia and Pennsylvania over the last several years.

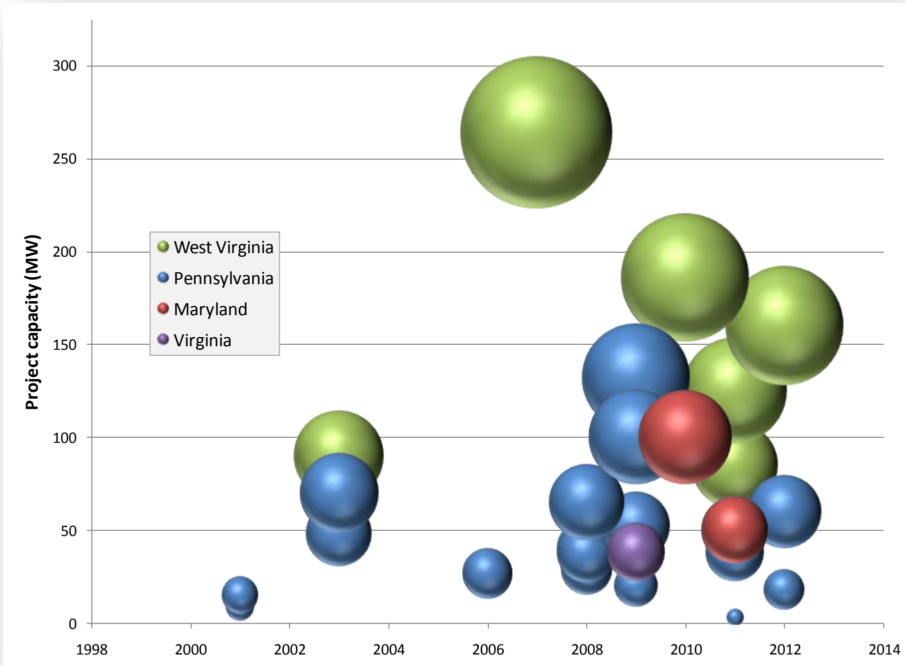
[5] In this report, we aggregate PJM's under construction, partially in service, and in service categories to represent existing wind capacity.

Table 1: Current and expected wind projects in Appalachia

Project name	County	Status	Year	Capacity (MW)
Pennsylvania				
Somerset Wind Farm	Somerset	In service	2001	9
Mill Run Wind Farm	Fayette	In service	2001	15
Meyersdale Wind Farm	Somerset	In service	2003	48
Waymart Wind Farm	Wayne	In service	2003	70
Bear Creek Wind Project	Luzerne	In service	2006	26
Locust Ridge Wind Farm	Schuylkill	In service	2006	27
Forward Wind Farm	Somerset	In service	2008	29
Casselman Windpower Project	Somerset	In service	2008	40
Lookout Wind Project	Somerset	In service	2008	38
Highland Wind Project	Cambria	In service	2008	65
Locust Ridge II Wind Farm	Schuylkill	In service	2009	100
Stonycreek Wind Farm	Somerset	In service	2009	53
North Allegheny Wind Farm	Blair/Cambria	In service	2009	132
Allegheny Wind Farm	Blair/Cambria	In service	2009	20
Armenia Mountain	Bradford/Tioga	In service	2009	101
Turkey Hill Dairy	Lancaster	In service	2011	3
Chestnut Flats Wind Farm	Blair	Partially in service	2011	38
Project near Gans substation	Fayette	Under construction	2011	50
Mahanoy Mountain	Northumberland	Under construction	2012	18
Shaffer Mountain	Bedford/Somerset	Under construction	2012	60
Total, Pennsylvania	**12 counties**			**941**
West Virginia				
Mountaineer Wind Energy Center (Backbone)	Tucker/Preston	In service	2003	90
Mount Storm Phase I, II, III	Grant	In service	2007	264
Beech Ridge Wind Farm	Greenbrier	Partially in service	2010	186
Green Mountain	Mineral	Under construction	2011	85
Laurel Mountain	Barbour	Under construction	2011	125
New Creek	Grant/Mineral	Under construction	2012	160
Total, West Virginia	**6 counties**			**910**
Maryland				
Kelso Gap Wind Project	Garrett	Partially in service	2010	100
Roth Rock Wind Facility	Garrett	In service	2011	50
Total, Maryland	**1 county**			**150**
Virginia				
Highland New Wind	Highland	Under construction	Unknown	38
Total, Virginia	**1 county**			**38**
Kentucky				
None	N/A	N/A	N/A	0
Total				**2,039**

Source: Data and information from the PJM"s online listing of active projects in the generation queues as of May 2, 2011 (PJM, 2011). Note: Project name, location, and capacity were verified via Web searches and phone calls to developers. Only those projects listed as "under construction," "partially in service," or "in service" are listed here. We excluded those projects listed as "under study" and "suspended." Inconsistencies within the PJM listings were resolved on a case-by-case basis. For example, in Somerset County, Pennsylvania, it is assumed that the Casselman Windpower Project subsumed Green Mountain Wind Farm (in service in 2000, 10.4 MW), so Green Mountain Wind Farm has been deleted from the project list.

Figure 2: Current and expected wind projects in Appalachia

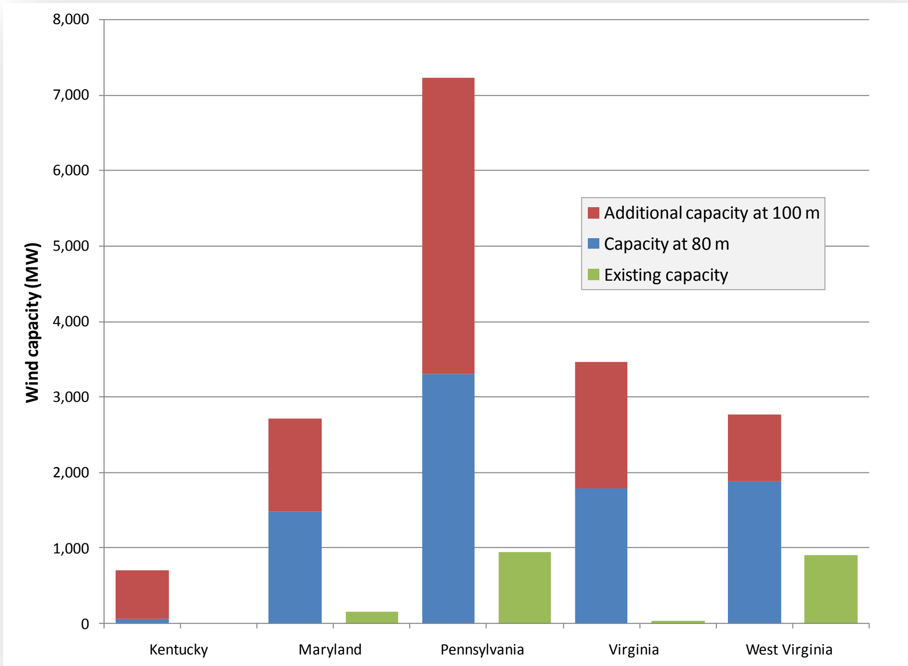


Source: PJM (2011). Note: Each bubble represents one wind project, which may be composed of multiple wind turbines. The middle of the bubble corresponds to coordinates on the x and y axes.

Despite the rapid expansion of wind projects between 2007 and 2010, current and expected wind projects in our region only comprise 2,039 MW. According to USDOE, in order to meet the 20% by 2030 scenario for the country, different states would be required to generate different percentages of wind; the five Appalachian states considered in this report would need between 8,100 and 26,000 MW of installed wind capacity, including off-shore wind (USDOE, 2008). According to NREL estimates of land-based wind resource potential at hub heights up to 100 meters (m), the five states considered here could install approximately 16,872 MW of capacity (NREL, 2010a), meeting twice as much as the minimum requirement if every resource were fully developed. Current projects, however, comprise just 12% of the region's potential.

Furthermore, some states within the region have succeeded at utilizing more of their wind resource than others. West Virginia, for example, has utilized almost 33% of its 100-m resource, whereas Pennsylvania, with a comparable amount of installed wind capacity, has only utilized 13% of its total resource (see Figure 3).

Figure 3: Potential and existing wind capacity



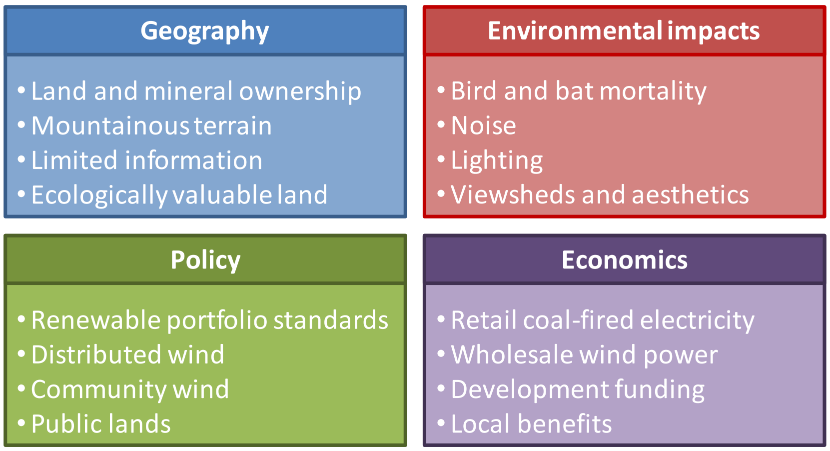
Sources: 80-m and 100-m capacity from NREL (2010a); existing capacity from PJM (2011).

This research was originally conceived to investigate the unique factors related to the market acceptance of wind in Appalachian coal country. The five states in our region rely on coal for between 43% and 98% of their electricity generation. Likewise, all of the states in our region are coal producers, ranging between 18th and 2nd in the nation for most coal produced. Three of the states currently derive some electricity from wind, but coal still dominates over other fuel sources.

This report explores wind energy because USDOE has posited that, across the nation, wind could provide much more electricity than it currently does, yet this premise has not been thoroughly vetted for Appalachia. In completing this report, the research team conducted economic, policy, and geospatial analyses and interviewed wind developers, environmental advocates, electricity professionals, legal counsel, and state regulators. In addition to the five Appalachian states, we researched Colorado, Wyoming, and New York as comparison states. We distilled a wealth of information related to wind resources, policy, social norms, energy production, and Appalachia down to a broad list of key findings. Each key finding is related to one or more barriers to wind energy development. These barriers prohibit the development of actual projects, delay the expansion of wind energy across the region, and delay the achievement of USDOE's 20% by 2030 scenario.

Figure 4 depicts the major barriers to wind energy development in Appalachia: geography, environmental impacts, policy, and economics.[6] Identifying discrete barriers to wind energy in Appalachia is complex. Many barriers are directly related to other barriers, and all are composed of a variety of factors. While some barriers—such as state policy—can be changed, others like Appalachia's mountainous terrain cannot. While any one barrier in and of itself may not prevent the development of wind energy in Appalachia, a cluster of barriers is more likely to do so.

Figure 4: Types of barriers to wind energy development in Appalachia



[6] Even though they are important, we do not consider barriers related to technology in this report. Technological barriers such as those related to electricity transmission are considered in other USDOE studies.

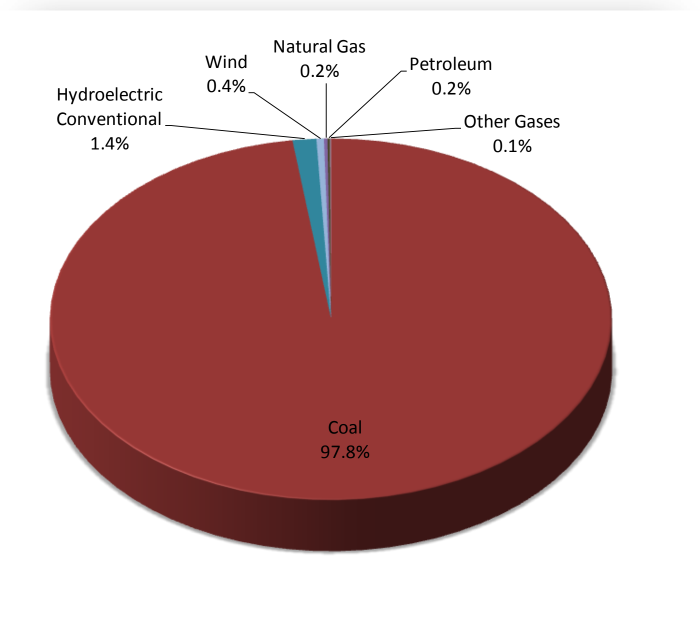
2. ELECTRICITY, WIND, AND COAL IN APPALACHIAN COAL COUNTRY

We first consider key information about each of the five states related to the wind resource, electricity generation, and coal production. These facts help define what we mean by “Appalachian coal country” and help explain several of the barriers that are discussed in the subsequent chapters.

2.1 West Virginia

In 2008, West Virginia generated a net total of approximately 91.1 million MWh of electricity (EIA, 2010a); of this, coal accounted for 98% of net generation, while wind power accounted for approximately 0.4% (Figure 5). Renewable energy sources—consisting of wind and hydroelectric—accounted for approximately 1.8% of net electricity generation in 2008, with fossil fuels accounting for the balance. West Virginia exported 62% of its total electricity generation in 2008, amounting to 56.9 million MWh (EIA, 2010a and 2010b).

Figure 5: Net generation by fuel and energy source for West Virginia, 2008



Source: EIA (2010a).

During 2000-2008, electricity generation in West Virginia fell by 2%. This corresponded to an average annual decrease of 0.2%. Since 2000, wind generation grew while total generation fell, with the growth in wind generation amounting to 22% of the loss in total net generation, as shown in Table 2.

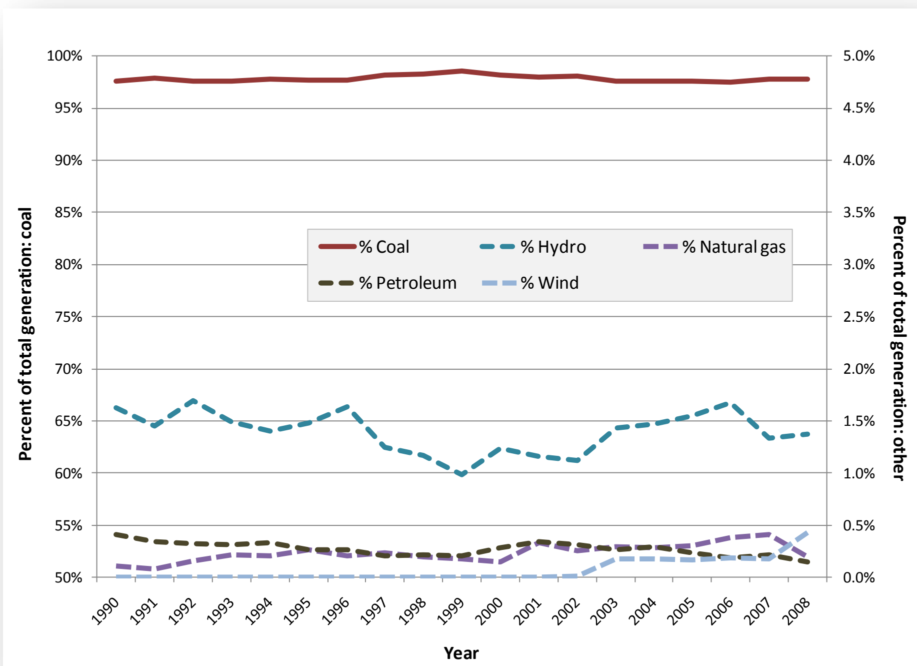
Table 2: Change in electricity generation by energy source in West Virginia, 2000-2008

Source	MWh net growth	Percent of net growth
Coal	-2,088,829	-120%
Natural gas	40,892	2%
Petroleum	-125,554	-7%
Nuclear	0	0%
Wind	391,909	22%
Hydro	97,134	6%
Total biomass	-14,822	-1%
Total electricity generation	**-1,742,078**	**-100%**
Total fossil fuels and nuclear	-2,216,299	-127%
Total renewables	474,221	27%

Source: EIA (2010a).

Coal's share of electricity generation in West Virginia has remained stable since 1990, hovering between 97.6% and 98.6% of net generation (see Figure 6). As shown in Figure 6, wind projects in operation in West Virginia as of 2008 generated approximately 0.4% of the state's total electricity generation, amounting to 391,000 MWh of generation (EIA, 2010a).

Figure 6: Percent of total electricity generation by energy source for West Virginia, 1990-2008



Source: EIA (2010a).

West Virginia ranks 32nd among the 48 continental states for wind potential at an 80 m hub height, with potential installed capacity of 1,883 MW at hub heights up to 80 m and 2,772 MW at hub heights up to 100 m (NREL, 2010a).[7] This potential is within the range of West Virginia's installed wind capacity in USDOE's 20% by 2030 scenario: 1,000 to 5,000 MW (USDOE, 2008).

Six wind projects in six counties are under construction, partially in service, or in service, with a current or expected capacity of 910 MW (Table 1 and Figure 7). If built as planned, these projects would fulfill 33% of the state's wind resource potential at hub heights up to 100 m (Figure 3). Since the year West Virginia's first wind farm began operating, wind generation grew at an average of 55,987 MWh per year (EIA, 2010a).

NREL estimates that full development of the 80 m wind resource would annually produce approximately 5.8 million MWh of electricity.[8] This would equate to approximately 6.4% of the state's total net generation in 2008. The development of the full 100 m wind resource could provide approximately 9.5% of 2008 net generation (NREL, 2010a and EIA, 2010a).

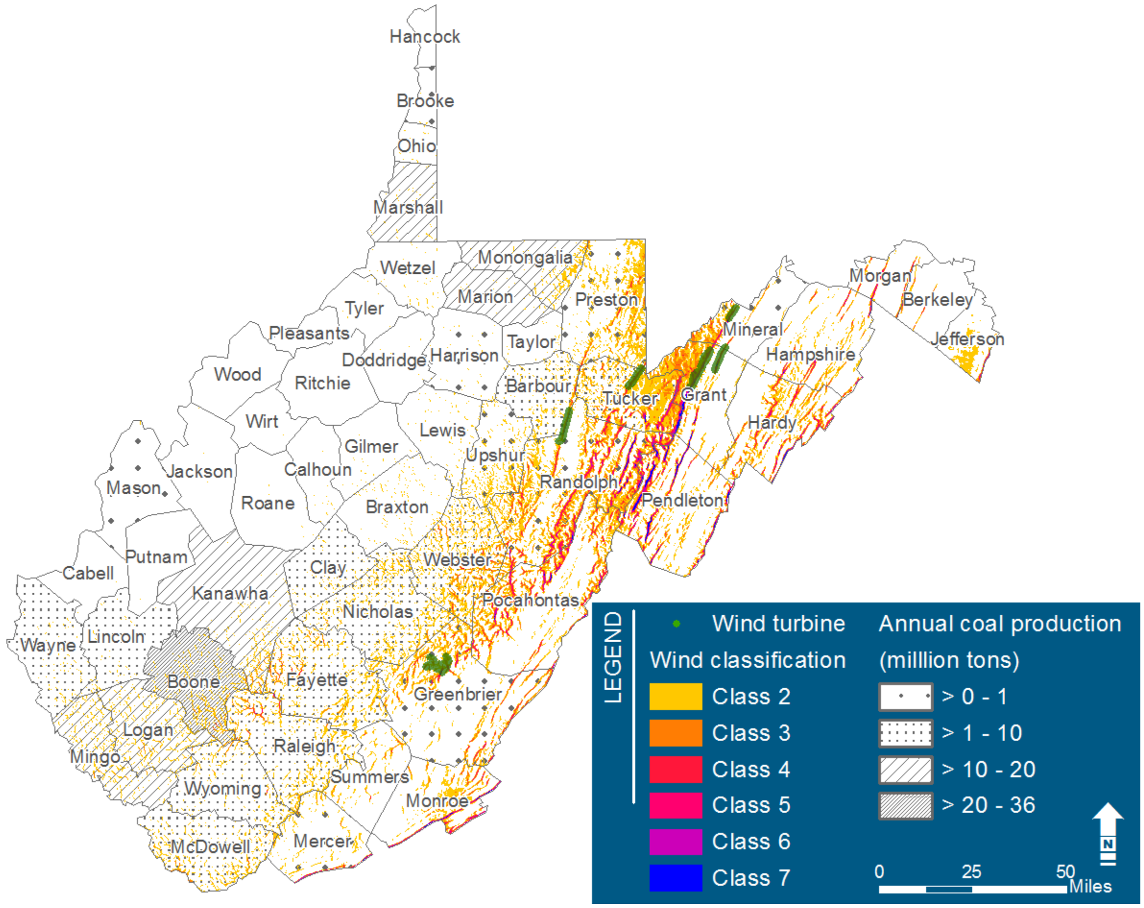
As shown in Figure 7, West Virginia's wind resource is concentrated in the eastern half of the state, with the highest wind classes along its mountain ridges. Randolph, Tucker, Grant, Pendleton, and Pocahontas counties have the most land area with Class 3 and above wind resources. These areas range from 72 to 189 square miles (AWS Truewind, 2003a). Of these counties, only Tucker and Randolph counties produced coal in 2008-2009, and their coal production was relatively low: 2.4 and 0.4 million tons on average in 2008-2009.

In contrast, the seven highest coal-producing counties—Boone, Kanawha, Logan, Mingo, Marion, Monongalia, and Marshall—have 1% or less of land area with wind resources at Class 3 and above. This county-level comparison shows that West Virginia's most concentrated wind resources generally do not occur in the most important coal counties. Despite this general lack of overlap, there are some locations within coal-producing counties—such as the area where Kanawha, Fayette, Raleigh, and Boone counties meet—with significant wind resources.

Table 1 lists, and Figure 7 maps as green dots, the current and expected wind turbines. Of the six counties with current and expected wind turbines, one produced no coal in 2008-9 (Grant), and the rest ranged from 0.4 million tons in Randolph County to 2.4 million tons in Tucker County. For perspective, West Virginia's top coal-producing county, Boone, produced 28.4 million tons annually, on average in 2008-2009. In short, wind development in West Virginia, so far, has tended to occur in counties with little or no coal production.

[7] The hub height is the distance from the ground to the center of the blades. Generally, the wind resource increases with hub height.
[8] The 80 m and 100 m NREL estimates only include areas that would generate wind electricity with a 30% or greater capacity factor.

Figure 7: Wind resource, wind turbines, and 2008-2009 coal production in West Virginia counties



Sources: AWS Truewind (2003a) and MSHA (2010).

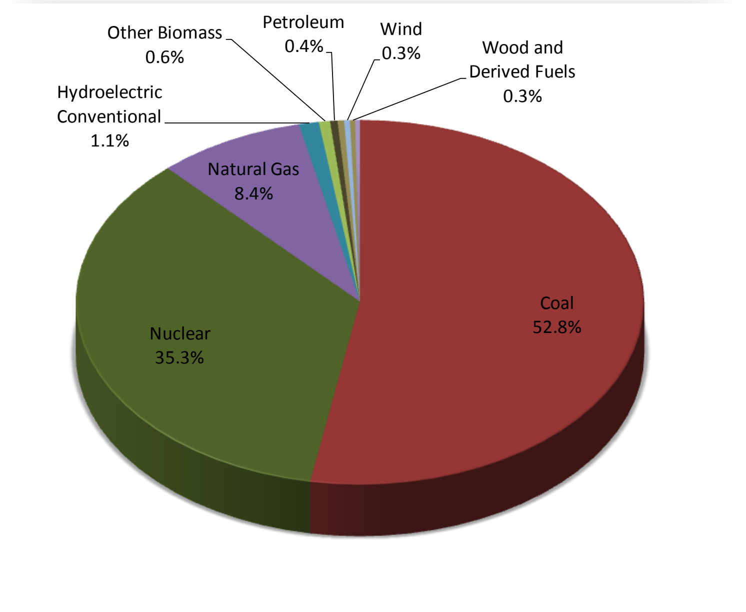
West Virginia is the nation's 2nd largest coal-producing state, producing approximately 158 million tons in 2008, which accounted for over 13% of all coal production in the US (EIA,2010c). Twenty-six of West Virginia's 55 counties produced coal in 2008. Production in only seven of those counties accounted for 65% of total state production.[9] These included Boone (19%), Logan (11%), Mingo (8%), Kanawha (7%), Monongalia (7%), Marion (7%), and Marshall (7%) counties (MSHA, 2010). Of all coal produced, West Virginia exported 76 million tons domestically for electricity generation (48%), and another 26.4 million tons to other countries, while importing 14 million tons, including approximately 2.5 million tons total from Wyoming and Montana (EIA, 2010d).

2.2 Pennsylvania

Like West Virginia, Pennsylvania is heavily reliant on coal for electricity production, and is also a significant coal-producing state. In 2008, Pennsylvania generated a net total of 222.4 million MWh of electricity (EIA, 2010a). Of this, coal accounted for 53% of net generation, while wind power accounted for approximately 0.3% (see Figure 8). In total, renewable energy sources—consisting of wind, hydroelectric, and biomass—accounted for approximately 2.3% of net electricity generation in 2008, with fossil fuels and nuclear accounting for the remainder.

[9] Production in only ten counties accounted for nearly 80% of all state coal production.

Figure 8: Net generation by fuel and energy source for Pennsylvania, 2008



Source: EIA (2010a).

Since 2000, electricity generation in Pennsylvania has grown by 10%, at an average rate of 1.3% per year. Wind power accounted for 3% of net growth between 2000 and 2008, as shown in Table 3. The amount of electricity generated from wind power grew by 138% over the same time period. By comparison, coal-fired generation accounted for 7% of net growth in total electricity generation, while the amount of electricity generated from coal grew by only 0.3% (EIA, 2010a). Pennsylvania exported 32% of its total electricity generation in 2008, amounting to 72 million MWh (EIA, 2010a and 2010b).

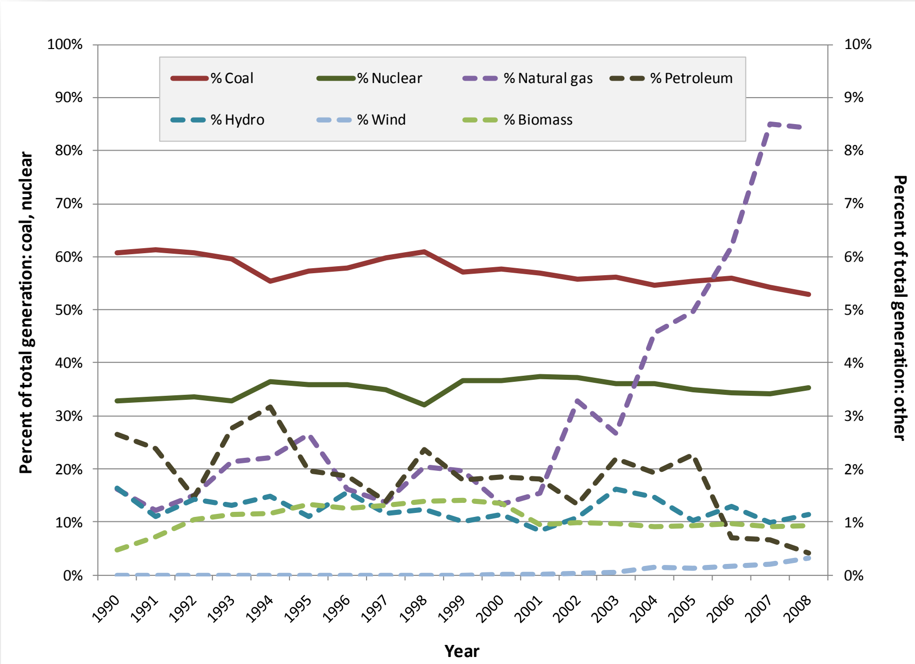
Table 3: Change in electricity generation by energy source in Pennsylvania, 2000-2008

Source	MWh net growth	Percent of net growth
Coal	1,370,851	7%
Natural gas	16,031,534	78%
Petroleum	-2,810,231	-14%
Nuclear	4,886,746	24%
Wind	719,612	3%
Hydro	258,626	1%
Total biomass	-646,473	-3%
Total electricity generation	**20,662,945**	**100%**
Total fossil fuels and nuclear	20,331,180	98%
Total renewables	331,765	2%

Source: EIA (2010a).

Coal's share of electricity generation in Pennsylvania has declined since 1990, falling from 61% of total generation to 53% as of 2008 (See Figure 9), even though coal-fired generation has grown in absolute terms. Wind power has grown from 0% in 1999 to 0.3% of total generation by 2008. Natural gas has risen significantly since 2004, accounting for most of the growth in electricity generation in Pennsylvania.

Figure 9: Percent of total electricity generation by energy source for Pennsylvania, 1990-2008



Source: EIA (2010a).

Pennsylvania ranks 29th among the 48 continental states for wind potential at an 80 m hub height, with potential for 3,307 MW at hub heights up to 80 m and 7,222 MW at hub heights up to 100 m (NREL, 2010a). This potential exceeds the top of the range of Pennsylvania's installed wind capacity in USDOE's 20% by 2030 scenario: 1,000 to 5,000 MW (USDOE, 2008).

A total of 941 MW of capacity would be installed by the 20 current wind projects in12 Pennsylvania counties, should they all be built (Table 1 and Figure 10). These projects, if fully built, would fulfill 13% of the state's wind resource potential at hub heights up to 100 m (Figure 3). Since the year before Pennsylvania's first wind farm began operating, wind generation has grown at an average of 81,047 MWh per year, a rate similar to that of Wyoming (EIA, 2010a).

Wind projects in operation in Pennsylvania as of 2008 generated approximately 0.3% of the state's total electricity, amounting to approximately 729,400 MWh (EIA, 2010a). NREL estimates that full development of the 80 m wind resource would annually produce approximately 9.7 million MWh of electricity, approximately 4.4% of the state's total net generation in 2008. The development of the full 100 m wind resource could provide approximately 9.5% of 2008 net generation (NREL, 2010a and EIA, 2010a).

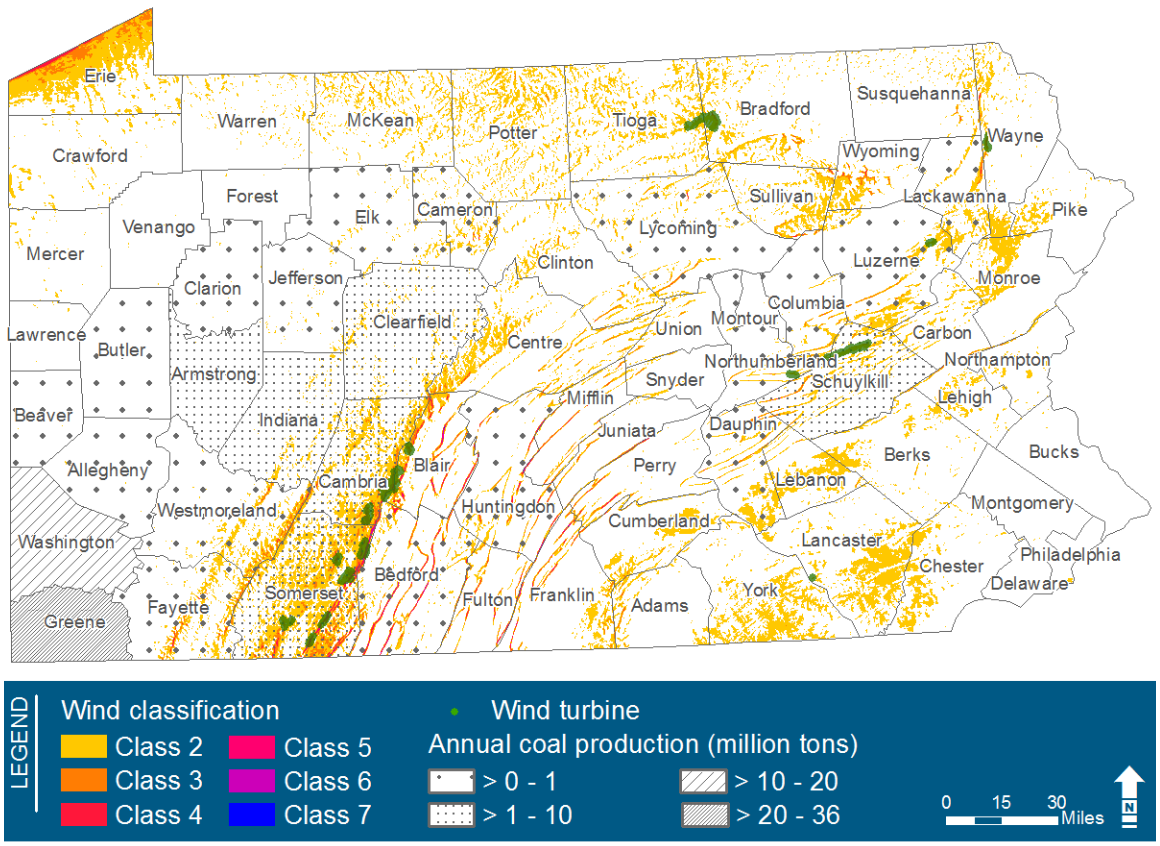
As shown in Figure 10, Pennsylvania's wind resource is strong in Erie County along the bank of Lake Erie, as well as along the mountain ridges that generally run northeast from the state's southern border with Maryland. Erie, Somerset, Blair, Bedford, and Cambria counties have the most land area at Class 3 and above, ranging from 35 to 114 square miles (AWS Truewind, 2003a).

Of these five counties, Blair and Erie counties produced no coal in 2008-9, and Bedford County produced virtually no coal (15,560 tons). Somerset County, which produced 4.2 million tons in 2008-9, was the third-highest coal producer in the state. Cambria Country, which produced 1.4 million tons, was the state's seventh-highest producer.

The top two coal-producing counties—Greene County (24.1 million tons) and Washington County (12.7 million tons) in the state's southwest corner—have no wind resources of Class 3 and above. Like West Virginia, Pennsylvania is an important coal-producing state; however, its most concentrated wind resources do not overlap with the counties that produce the most coal. These concentrated wind resources do, however, overlap with Cambria and Somerset counties, which have produce significant amounts of coal.

Figure 10 also displays current and expected wind turbines as green dots.[10] Of the 12 counties with current and expected wind turbines, four produced no coal in 2008-9 and five produced less than 1 million tons. Only Schuylkill County (1.2 million tons), Cambria County (1.3 million tons), and Somerset County (4.2 million tons) produced more than 1 million tons annually, on average in 2008-9. Therefore, while some overlap is apparent, many of Pennsylvania's wind projects are in counties with little or no coal production.

Figure 10: Wind resource, wind turbines, and 2008-2009 coal production in Pennsylvania counties



Source: AWS Truewind (2003a) and MSHA (2010).

Pennsylvania is the nation's fourth-largest producer of coal, producing nearly 60 million tons in 2008, which accounted for 5% of all coal production in the US (EIA, 2010c). Twenty-seven of Pennsylvania's 67 counties produced coal in 2008. Production in only five of those counties accounted for 85% of total state production. These included Greene (41%), Washington (22%), Somerset (8%), Clearfield (7%), and Armstrong (6%) counties (MSHA, 2010).

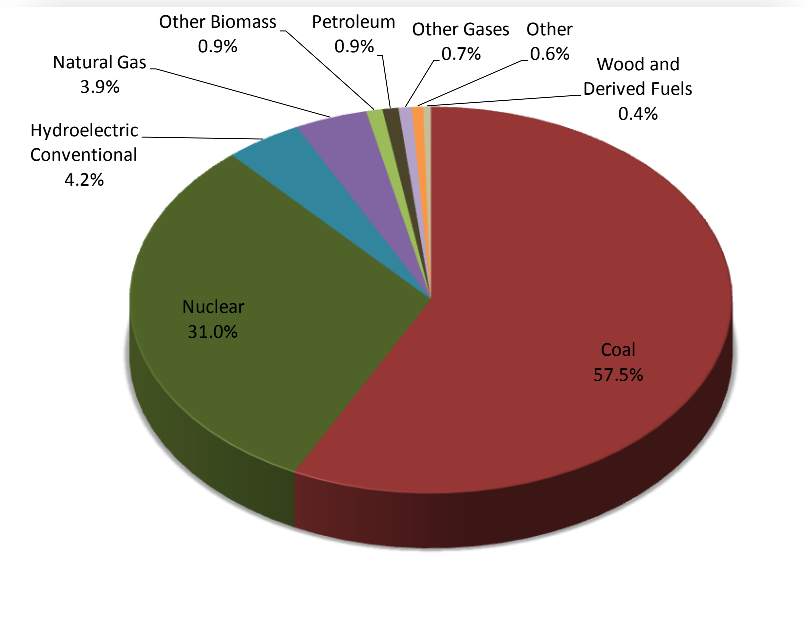
[10] The project labeled "Project near Gans substation" in Fayette County on the PJM active queue (PJM, 2011) does not have a confirmed project name, and is therefore not mapped.

2.3 Maryland

Like West Virginia and Pennsylvania, Maryland is dependent on coal for much of its electricity generation. Maryland produces coal, but less than West Virginia and Pennsylvania, ranking 18th in the nation. Unlike West Virginia and Pennsylvania, however, Maryland has only two wind projects that are partially or fully in service.

In 2008, Maryland generated a net total of approximately 47.4 million MWh of electricity (EIA, 2010a). Of this, coal accounted for 58% of net generation, while wind had not yet been developed in Maryland (see Figure 11). In total, renewable energy sources—consisting of hydroelectric and biomass—accounted for approximately 5.5% of net electricity generation in 2008, with fossil fuels and nuclear accounting for the remainder.

Figure 11: Net generation by fuel and energy source for Maryland, 2008



Source: EIA (2010a).

Between 2000 and 2008, total electricity generation fell by 7% overall. This corresponds to an average annual loss of 0.9% (EIA, 2010a). The changes in electricity generation from 2000 to 2008 are depicted in Table 4. No wind farms are currently in operation in Maryland; therefore, in-state wind has not played a role in meeting the state's electricity needs.

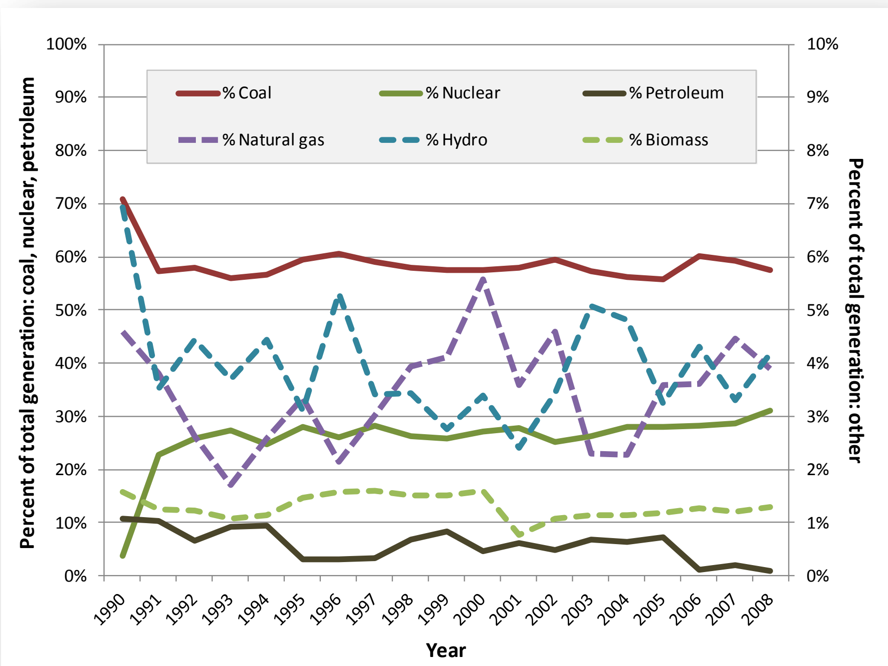
Table 4: Change in electricity generation by energy source in Maryland, 2000-2008

Source	MWh net growth	Percent of net growth
Coal	-2,232,826	-59%
Natural gas	-1,004,728	-27%
Petroleum	-1,982,756	-52%
Nuclear	851,452	22%
Wind	0	0%
Hydro	241,459	6%
Total biomass	-205,925	-5%
Total electricity generation	**-3,784,427**	**-100%**
Total fossil fuels and nuclear	-3,819,961	-101%
Total renewables	35,534	1%

Source: EIA (2010a).

Coal's share of electricity generation in Maryland has fallen from 71% of net generation in 1990 to under 58% in 2008 (see Figure 12). The decrease in coal-fired electricity has been mediated by an increase in petroleum and hydropower.

Figure 12: Percent of total electricity generation by energy source for Maryland, 1990-2008



Source: EIA (2010a).

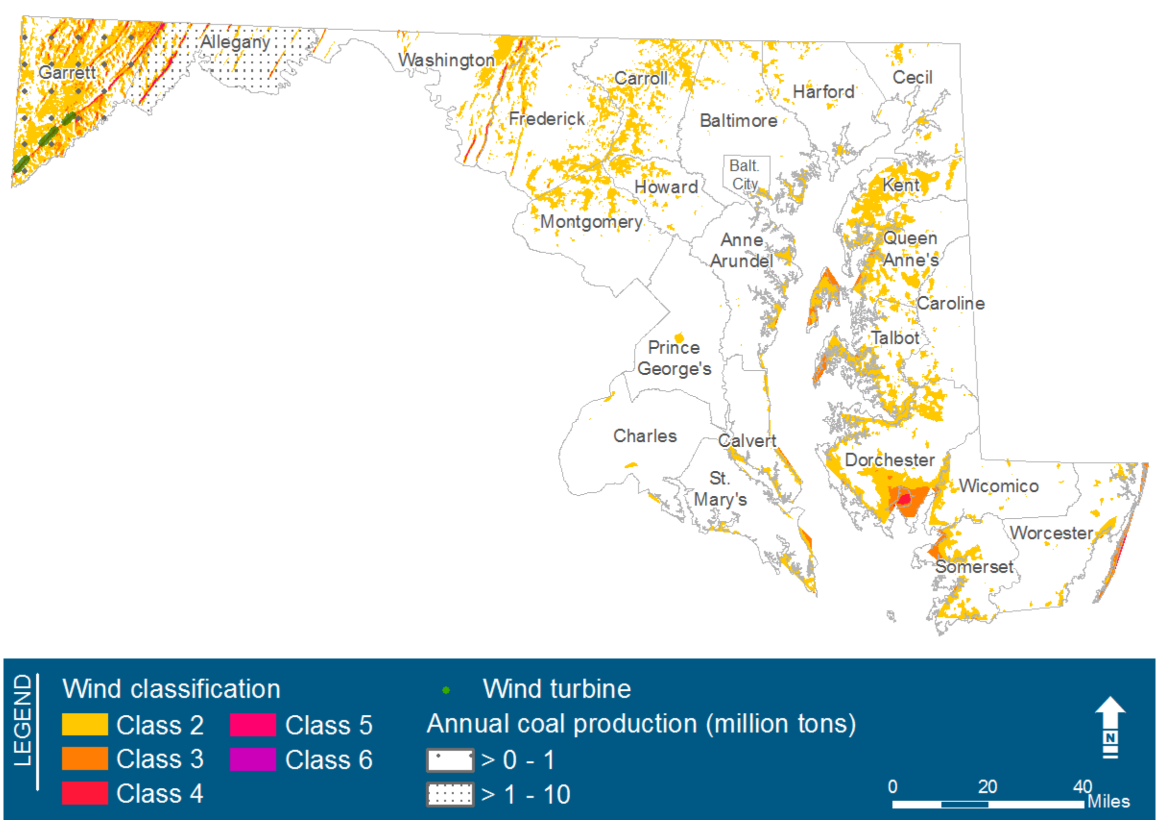
Maryland ranks 34th among the 48 continental states for wind potential at an 80 m hub height. Maryland's potential installed capacity is 1,483 MW at hub heights up to 80 m and 2,713 MW at hub heights up to 100 m (NREL, 2010a), nearly double the resource at 80 m. This potential is within the range of Maryland's land-based and off-shore projected wind capacity in USDOE's 20% by 2030 scenario: 1,000 to 5,000 MW.

Two wind projects are partially or fully in service, totaling 150 MW (Table 1 and Figure 13). These projects would fulfill 6% of the state's on-shore wind resource potential at hub heights up to 100 m (Figure 3).

NREL estimates that full development of the 80 m wind resource would annually produce approximately 4.3 million MWh of electricity. This would equate to approximately 9% of the state's total net generation in 2008. The development of the full 100 m wind resource, on the other hand, could provide approximately 8.0 million MWh, or 16.8% of 2008 net generation. Therefore, there is enough land-based wind potential in Maryland to achieve nearly 17% of the state's net generation at 2008 levels (NREL, 2010a and EIA, 2010a). Additional off-shore wind development could significantly increase that contribution.

As shown in Figure 13, the greatest land areas with Class 3 or higher wind resources are found in Garrett, Dorchester, Somerset, Worcester, and Allegany counties, and range from 18 to 75 square miles (AWS Truewind, 2003a). Three of these counties produced no coal in 2008-9 (Dorchester, Somerset, and Worcester). In fact, only two Maryland counties produced coal in 2008-9: Garrett and Allegany counties. Garrett County has the most Class 3-and-above wind resources (75 square miles), and Allegany County has the state's fourth-best resource (18 square miles) (AWS Truewind, 2003a). Still, most of the counties with the strongest wind resources are not coal counties, and Garrett and Allegany counties only produced 0.8 and 1.8 million tons annually, on average in 2008-9. Both existing Maryland wind farms are in Garrett County.

Figure 13: Wind resource, wind turbines, and 2008-2009 coal production in Maryland counties



Sources: AWS Truewind (2003a) and MSHA (2010).

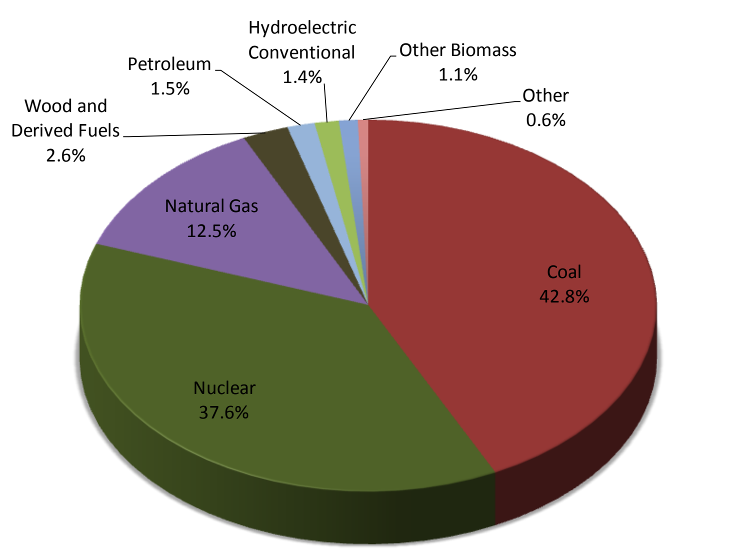
Maryland is the nation's 18th largest producer of coal, producing approximately 2.9 million tons in 2008, which accounted for approximately 0.2% of all coal production in the US (EIA, 2010c). Only two of Maryland's 24 counties and county-equivalents produced coal in 2008—Garrett County and Allegany County, each located in western Maryland (MSHA, 2010).

2.4 Virginia

Virginia relies on coal for a smaller percentage of its electricity than Maryland. Virginia does not have any wind farms currently in operation, although one project is under construction.

In 2008, Virginia generated a net total of approximately 72.7 million MWh of electricity (EIA, 2010a). Of this, coal accounted for 43% of net generation, while wind power did not yet exist in Virginia (see Figure 14). In total, renewable energy sources—consisting of hydroelectric and biomass—accounted for approximately 5.1% of net electricity generation in 2008, with nuclear and fossil fuels accounting for the remainder. Virginia imports both coal and electricity. Virginia imported 34% of the electricity it consumed in 2008, amounting to 37.4 million MWh.

Figure 14: Net generation by fuel and energy source for Virginia, 2008



Source: EIA (2010a).

During 2000-2008, electricity generation in Virginia fell by 6%, with the majority of that loss occurring since 2004. This corresponded to an average annual loss rate of 0.7% over 2000-2008. The changes in electricity generation from 2000 to 2008 are depicted in Table 5. No wind farms are currently in operation in Virginia.

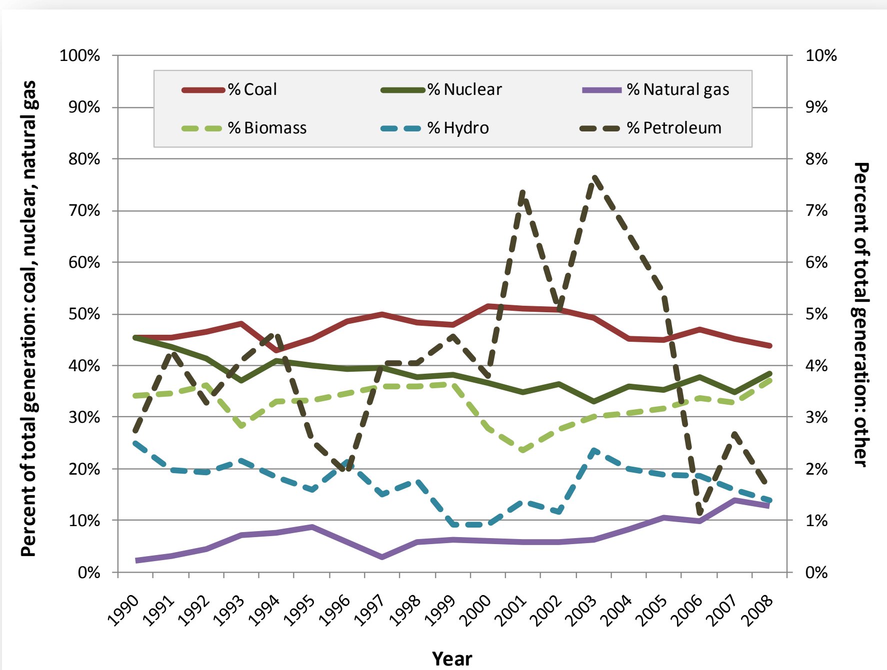
Table 5: Change in electricity generation by energy source in Virginia, 2000-2008

Source	MWh net growth	Percent of net growth
Coal	-7,984,961	-177%
Natural gas	4,661,756	103%
Petroleum	-1,788,184	-40%
Nuclear	-390,327	-9%
Wind	0	0%
Hydro	299,009	7%
Total biomass	554,360	12%
Total electricity generation	**-4,510,840**	**-100%**
Total fossil fuels and nuclear	-5,364,209	-119%
Total renewables	853,369	19%

Source: EIA (2010a).

Coal's share of electricity generation has fallen somewhat since 1990, although coal accounted for about the same share of generation in 2007 as it did in 1990 (see Figure 15). In absolute terms, net generation from coal has risen by 7.9 million MWh since 1990, although approximately all of that growth occurred between 1990 and coal's peak generation level in 2000. Since then, there has been a steady decline in electricity generation from coal in Virginia. As noted, wind power has yet to impact electricity generation in Virginia.

Figure 15: Percent of total electricity generation by energy source for Virginia, 1990-2008



Source: EIA (2010a).

Virginia ranks 33rd among the 48 continental states for wind potential at an 80 m hub height, with potential installed capacity of 1,793 MW at hub heights up to 80 m and 3,466 MW at hub heights up to 100 m (NREL, 2010a), nearly double the resource at 80 m. This potential is below the range of Virginia's land-based and off-shore projected wind capacity in USDOE's 20% by 2030 scenario: 5,000 to 10,000 MW (USDOE, 2008).

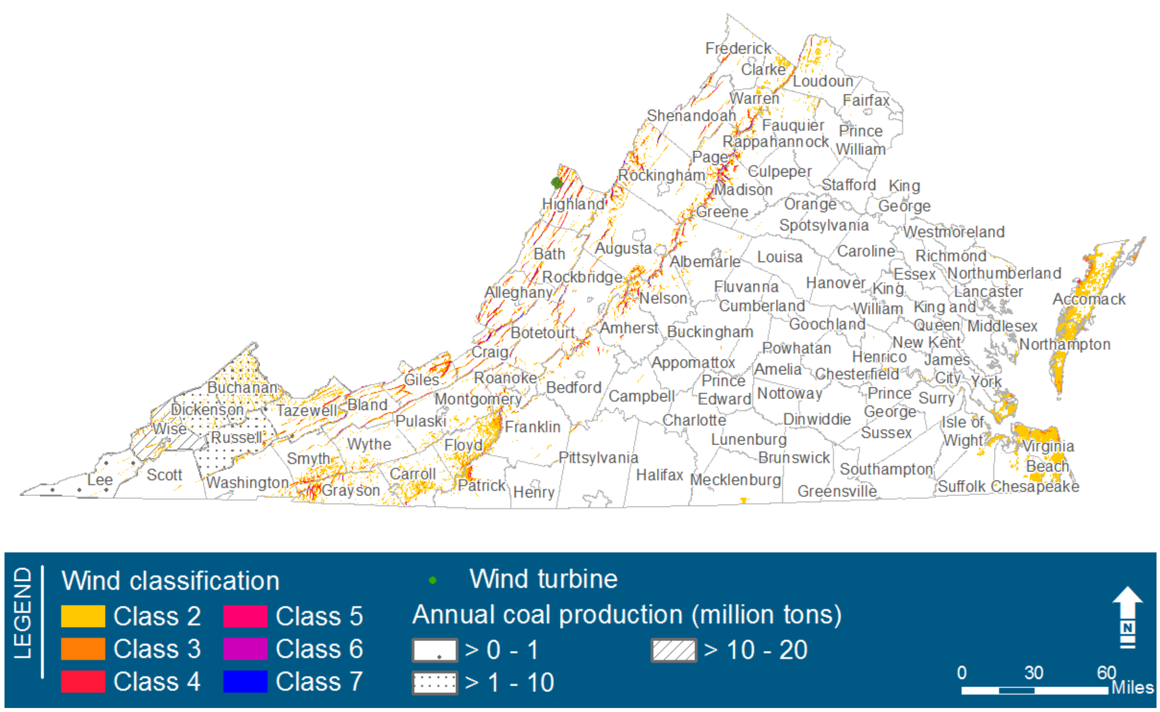
No wind farms have been completed yet in Virginia, although a 38 MW project is under construction in Highland County (NREL, 2010a) (Table 1 and Figure 13). This project would fulfill 1% of the state's land-based wind resource potential at hub heights up to 100 m (Figure 3).

NREL estimates that full development of the 80 m wind resource would annually produce approximately 5.4 million MWh of electricity. The development of the full 100-m wind resource, on the other hand, could provide approximately 10.3 million MWh, or 14.2%, of 2008 net generation (NREL, 2010a and EIA, 2010a). Additional off-shore wind development could significantly increase that contribution.

As shown in Figure 16, Accomack, Rockingham, Highland, Augusta, and Giles counties have the most land with Class 3 and higher wind resources, ranging from 40 to 63 square miles (AWS Truewind, 2003a). None of these are coal-producing counties, suggesting that there is generally little overlap between the state's coal and wind resources.

Coal production in Virginia is concentrated in the six southwestern counties along the West Virginia and Kentucky borders (Figure 16). With the exception of Tazewell County, which has 25 square miles of land with Class 3 and higher wind resources (AWS Truewind, 2003a), these coal-producing counties have some, but not much, land at Class 3 or higher. Newer, finer-resolution wind maps can help to identify wind resources that are not apparent using older data. However, data available today suggests little substantial overlap between the state's coal and wind resources. Figure 16 also displays the Highland County wind farm that is under construction using green dots. This wind farm is not in a coal-producing county.

Figure 16: Wind resource, wind turbines, and 2008-2009 coal production in Virginia counties



Sources: AWS Truewind (2003a) and MSHA (2010).

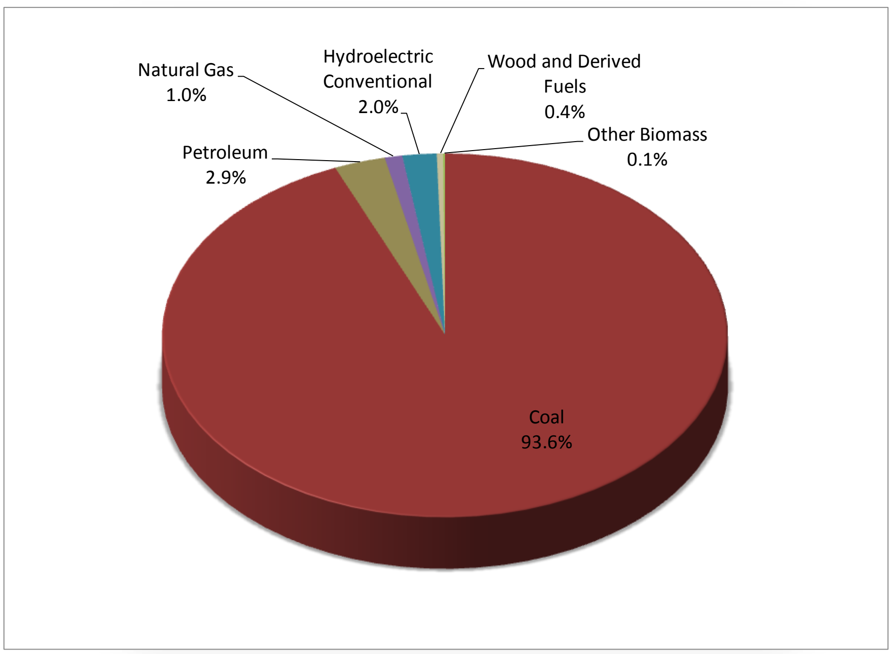
Virginia is the nation's 13th largest producer of coal, producing approximately 24.8 million tons in 2008, which accounted for about 2% of all coal production in the US (EIA, 2010c). Six of Virginia's 95 counties produced coal in 2008-2009, all located in the southwest portion of the state. However, production in only two of those counties—Wise and Buchanan—accounted for 80% of total state production (MSHA, 2010).

2.5 Kentucky

Kentucky is the most like West Virginia in terms of the composition of fuel sources for the bulk of electricity generation. Also like West Virginia, Kentucky produces a significant amount of coal; it is the 3rd largest producer in the nation. Unlike all of the other states in our region, however, Kentucky does not have any current or expected wind turbines.

In 2008, Kentucky generated a net total of approximately 97.9 million MWh of electricity (EIA, 2010a). Of this, coal accounted for 94% of net generation (see Figure 17). In total, renewable energy sources accounted for approximately 2.4% of net electricity generation in 2008, with fossil fuels accounting for the remainder. Kentucky exports electricity, more than 4.4 million MWh, amounting to 5% of its total electricity generation in 2008.

Figure 17: Net generation by fuel and energy source for Kentucky, 2008



Source: EIA (2010a).

During 2000-2008, electricity generation in Kentucky grew by 5%, with the majority of that growth occurring since 2004. This corresponded to an average annual growth rate of 0.7% (EIA, 2010a). No wind farms are currently in operation in Kentucky (Table 6).

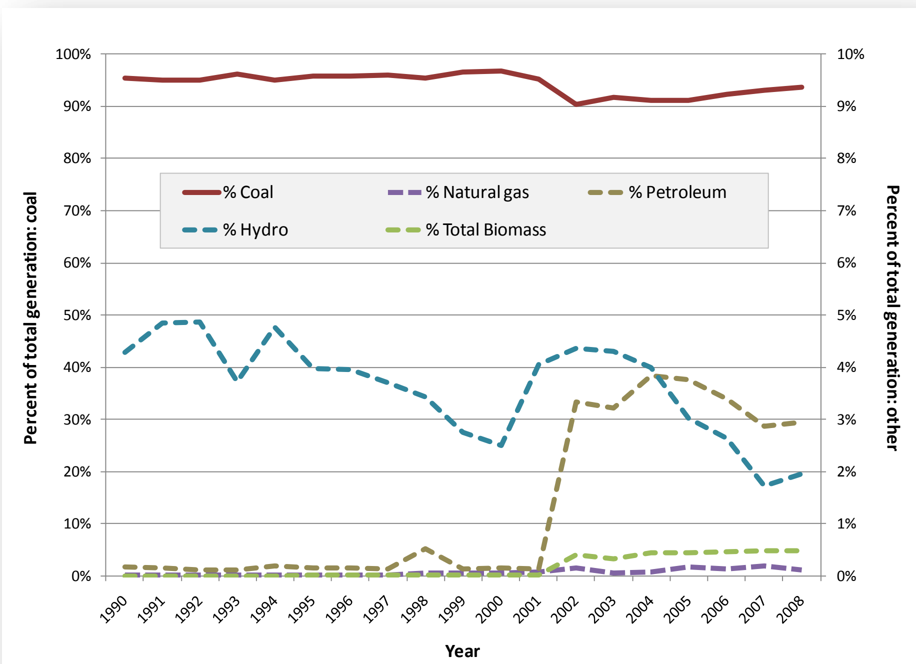
Table 6: Change in electricity generation by energy source in Kentucky, 2000-2008

Source	MWh net change	percent of net change
Coal	1,557,534	32%
Natural gas	517,327	11%
Petroleum	2,729,747	56%
Nuclear	0	0%
Wind	0	0%
Hydro	-407,098	-8%
Total biomass	447,327	9%
Total electricity generation	**4,857,257**	**100%**
Total fossil fuels and nuclear	4,817,028	99%
Total renewables	40,229	1%

Source: EIA (2010a).

Coal's share of electricity generation in Kentucky has remained generally stable since 1990, hovering between 90.4% and 96.8% of net generation (see Figure 18).

Figure 18: Percent of total electricity generation by energy source for Kentucky, 1990-2008



Source: EIA (2010a).

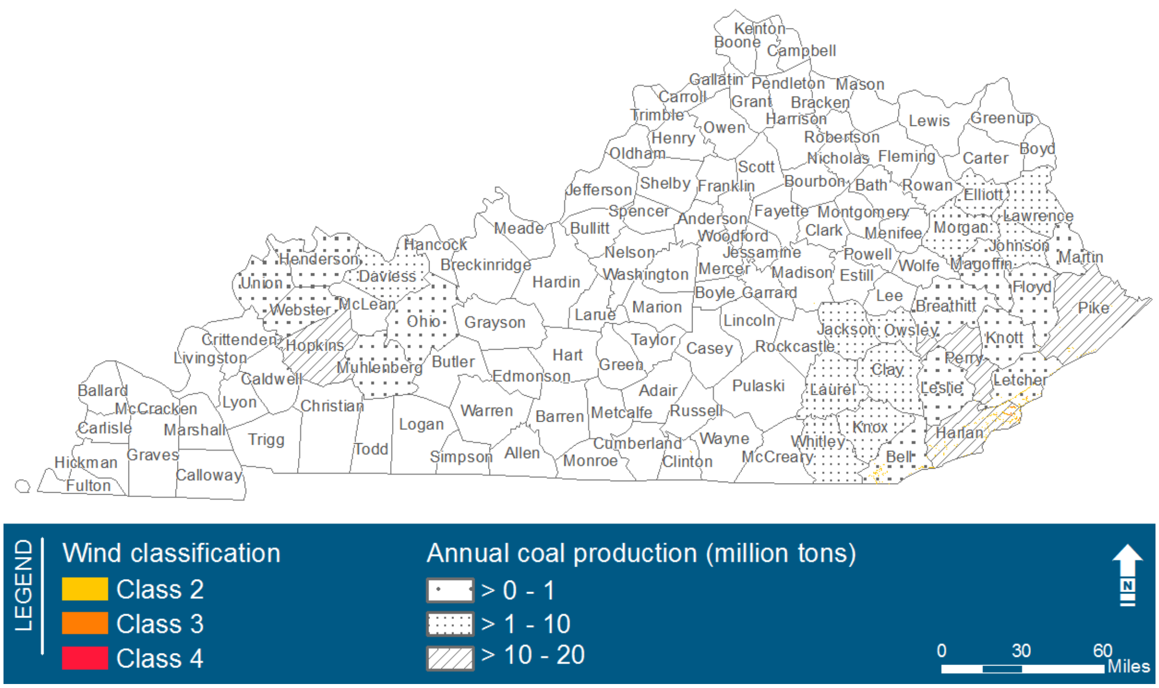
Kentucky ranks 43rd among the 48 continental states for wind potential at an 80 m hub height, with potential installed capacity of 61 MW at hub heights up to 80 m and 699 MW at hub heights up to 100 m (NREL, 2010a), twelve times the resource at 80 m. This capacity is within the range of Kentucky's installed wind capacity in USDOE's 20% by 2030 scenario: 100 to 1,000 MW (USDOE, 2008).

No wind projects have been built or proposed for Kentucky (Table 1). However, given Kentucky's wind resource, it is possible that Kentucky's wind resource will start to be developed in the near future. In fact, a recent study found nineteen sites in Kentucky that meet certain criteria[11] for building utility-scale wind farms on surface-mined land (Lambert, 2008).

NREL estimates that full development of the 80 m wind resource would annually produce approximately 173,000 MWh of electricity. This would equate to approximately 0.2% of the state's total net generation in 2008. The development of the full 100 m wind resource, on the other hand, could provide approximately 1.9 million MWh, or 2% of 2008 net generation (NREL, 2010a and EIA, 2010a).

Only the four southeastern counties—Letcher, Harlan, Pike, and Bell—have any land area at Class 3 and higher; these areas range from two to five square miles (AWS Truewind, 2008). All four of these counties produced coal in 2008-9. Pike County was the largest coal producer in Kentucky (18.3 million tons), Harlan County ranked fourth, Letcher County seventh, and Bell County thirteenth (2.6 million tons). This contrasts with the other four states in the study area where the best wind resources generally did not significantly overlap with the most productive coal counties. However, the total land area in these four counties at Class 3 and above is quite small compared with the other counties with significant wind resources in our study area.

Figure 19: Wind resource, wind turbines, and 2008-2009 coal production in Kentucky counties



Sources: AWS Truewind (2008) and MSHA (2010).

Kentucky is the nation's 3rd largest producer of coal, producing approximately 121 million tons in 2008, which accounted for over 10% of all coal production in the US (EIA, 2010c). Twenty-eight of Kentucky's 120 counties produced coal in 2008. However, production in only five of those counties accounted for 60% of total state

[11] Exclusion and proximity criteria include size, elevation, slope, wetlands, land cover, railways, roads, trails, airports, military danger zones, national parks and preserves, state parks and protected lands, private forests, historic sites, cellular and other masts, incorporated areas, electric substations or interconnection sites, and electrical distribution or transmission lines.

production.[12] These included Pike (18%), Perry (14%), Hopkins (12%), Harlan (9%), and Knott (6%) counties (MSHA, 2010).

2.6 Summary

The five states in our region rely on coal for between 43% and 98% of their electricity generation. All five states are coal producers, ranging between the 18th and 2nd in the nation for most coal produced. Three of the states currently derive some electricity from wind, but coal still dominates over other fuel sources.

On a national scale, Appalachian wind resources are not particularly strong; the five states considered in this report rank 29th, 32nd, 33rd, 34th, and 43rd among the lower 48 states. Still, current and expected wind farms in the region would total 2,039 MW of installed capacity.

In Pennsylvania, West Virginia, and Virginia, wind resources generally are strongest in counties with little or no coal production. Wind projects follow the wind resources and are also most often found in counties with little or no coal production. This pattern, however, is not apparent in Kentucky, which has the weakest wind resource and no wind projects in the pipeline, or in Maryland, where wind is relatively strong in the state's two coal-producing counties.

This study originated from the premise that wind development may be influenced by the pervasiveness of coal production. The analysis presented in this section shows that there is little overlap between the region's most significant wind resources and its most productive coal-producing counties. This observation alone may explain why so much of Appalachia's wind development has occurred, so far, in counties that are not mining significant amounts of coal.

While this may be true, it does not discount the fact that many coal counties, in fact, have numerous opportunities for wind development. In fact, many current and proposed wind farms in Appalachia are on former surface-mined land. As the best wind resources are developed, it would be natural to expect wind developers to seek out additional sites for wind development, including those in coal counties that are not the prime initial sites with known high wind classes. Also, as wind resource maps are improved and as site-specific studies are conducted, developers can find localized wind resources that do not necessarily show up in state-level wind resource maps.

Overlaps between wind and coal are instructive at the site and county level, but the influence of the coal industry also extends beyond county boundaries. The influence of this industry can be seen in barriers related to energy policy and land and mineral ownership, as the industry has played a significant role in the economic and political history of the region.

[12] Production in only ten counties accounted for over 80% of all state coal production.

SNAPSHOT: Coal's influence in Appalachia

Wind power development is invariably considered in the broader context of all energy sources, and is evaluated against other options' generation capacity, pricing, potential revenue, cost effectiveness, and efficiency. Few discussions about wind development in central Appalachia occur without referencing coal as a point of comparison.

Coal's influence, however, transcends energy economics: It infuses the cultural fabric in much of central Appalachia, and persists despite declining coal employment, a reduced contribution to state budgets, and an uncertain future for coal markets. Loyalty to coal's dominance shapes the positions of government agencies: "Wind power will in no way displace coal as a priority for this administration," commented an agency head at a wind power conference in 2010.

The cultural aspects of coal have been documented by academic researchers. Bell and York (2010) highlight strategies recently employed by industry that reinforce the embedded nature of coal in West Virginia; they also point to the historical dependency of coalfields communities on the industry. Wishart (2007) comments on the political and social control of coal capital to limit economic opportunities for the rural labor forces. Such limited opportunities were expressed clearly by a miner outside the Upper Big Branch mine in West Virginia, waiting for recovery of miners who died an explosion in 2010. "Coal mining is all we know," he said.

Accumulated wealth from coal flows in many directions, and perpetuates the prominence of the industry: Coal interests endow university departments, and implicitly exclude alternative energy research and teaching; politicians are supported by coal interests, leading to sustained subsidies for the industry; a "Rally for Coal" in the nation's capital draws students from state universities. "Coal is our future," proclaims one of the student leaders.

SNAPSHOT: In Wyoming, coal and wind coexist

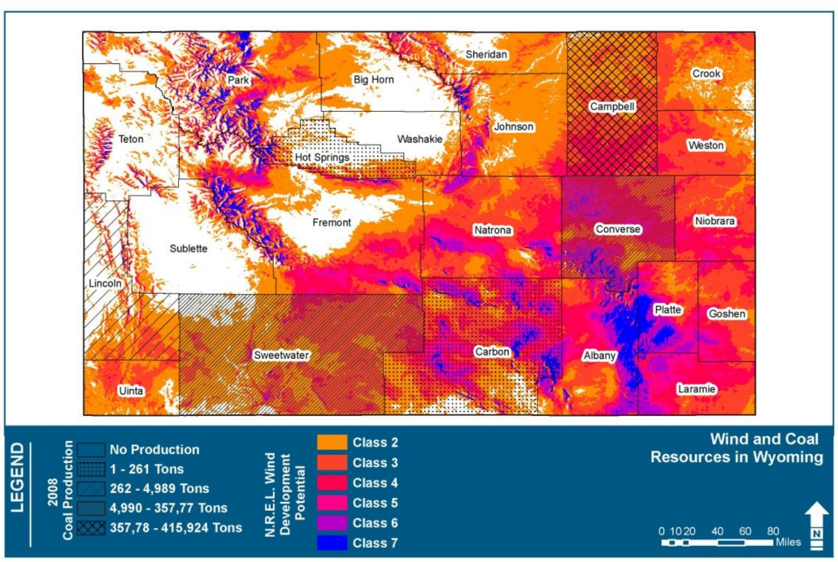
Wyoming is the top coal producing state in the nation; 40% of the nation's coal originates in the state (EIA, 2010c). Coal from Wyoming's basin is cheaper than that of any other basin in the nation (EIA, 2010e), making it a preferred source for electricity generation. In 2008, Wyoming generated a net total of 46.5 million MWh of electricity (EIA, 2010a). Of this, coal accounted for 94%, while wind—the second most prominent power source—accounted for approximately 2%.

In addition to its coal resource, Wyoming has one of the greatest wind resources in the nation, ranking 8th among all states for wind potential (NREL, 2010a). Wind generation has grown by 56% since 2004 and has accounted for approximately 20% of total electricity growth. By comparison, coal-fired electricity has grown by 1%—although in absolute terms, coal has grown by 116,000 MWh more than wind—and has accounted for 27% of total growth since 2004.

In comparing county-level coal production with the locations of existing or expected wind projects, it was found that wind and coal co-exist, or are likely to soon co-exist, in three counties—Carbon, Converse, and Sweetwater. These counties accounted for approximately 10% of total Wyoming coal production, or 46.7 million tons, in 2008 (MSHA, 2010). A total of 809.8 MW of wind were either developed or had been proposed in the three counties through 2009, accounting for 43% of the state's total potential wind development (NREL, 2010b).

Wyoming is a non-Appalachian state, but its mountainous terrain and coal production make it a good comparison state for the others considered in this analysis. Wyoming provides an instructive model of increased electricity generation from renewables—including wind—despite a heavy reliance on abundant and cheap coal.

Figure 20: Wind resource and coal production in Wyoming counties, 2008



Sources: AWS Truewind (2002) and MSHA (2010).

3. GEOGRAPHY

Appalachia is characterized by its mountainous terrain and, in many counties, patterns that concentrate land and mineral ownership in the hands of absentee or corporate landowners. In addition, a significant amount of the region's wind resources are located on ecologically sensitive land. This chapter considers these barriers, which we generally classify as related to geography.

3.1 Mountainous terrain of Appalachia

Mountainous terrain is a defining feature of Appalachia, "a 205,000-square-mile region that follows the spine of the Appalachian Mountains from southern New York to northern Mississippi" (Appalachian Regional Commission, 2010a). Characterized by frequent hollows, valleys, mountains, and streams, the region's terrain hinders development and road construction. As an indication of the severity of this impediment to development, the Appalachian Regional Commission sought funding specifically for roads. Consequently, Congress passed the Appalachian Development Act of 1965, allocating funding specifically to overcome the high "cost of building highways through Appalachia's mountainous terrain" (Appalachian Regional Commission, 2010b).

Fifty years later, Appalachia's mountainous terrain acts as an asset and barrier to wind energy development in the region. While wind developers enjoy windier conditions at higher elevations and more irregular terrain to a degree, they also face additional expenses for access roads to project sites. Estimates of these additional expenses range widely from developer to developer. According to one wind developer, construction of wind projects on mountainous terrain increases expenses by approximately 30%, in comparison to construction on farmland (Caffyn, 2010). In order to make projects economically viable, an Appalachian wind developer must receive between $75-110 per MWh, compared to the required clearing price of $65-80 per MWh in the Midwest (Caffyn, 2010). According to another wind energy developer, some potential wind projects have been forgone due to the high cost of construction to access project sites (Framel, 2010).

Even the New York State Energy Research and Development Authority (NYSERDA) prioritizes "terrain favorable to construction" as one of the five most important qualities for developers to ascertain when siting wind projects (NYSERDA, 2009, p. 85). According to NYSERDA, "the delivery and construction of wind power project equipment requires that the terrain be accessible by heavy-duty vehicles… Areas with excessively steep slopes or deep gullies can be difficult to access and may impose unacceptable safety risks" (NYSERDA, 2009, p. 90). In addition to grade, developers must consider the requisite width of access roads and turning radii for equipment. These roads must be able to accommodate cranes, for example, that are 30 feet wide, requiring roads that are 30-35 feet wide with an additional 50-100 foot right of way for adequate sediment ditches (Caffyn, 2010). Another developer maintains that roads must be at least 50 feet wide to allow for transport of wind turbines (Framel, 2010). This requirement increases the area and perimeter of disturbed terrain, further increasing habitat fragmentation.

3.2 Limited information

In addition to increasing project costs and potential for environmental impact, Appalachia's mountainous terrain presents complexities for collecting accurate data on the available wind resource. In a report on research needs for wind resource modeling, NREL asserts that better meteorological datasets are necessary for overcoming a "key" wind energy development barrier described by "significant uncertainty in the accuracy of meso-scale and micro-scale meteorological models that could be used for predicting wind resources" (NREL, 2008, p. 65). NREL recognizes that even advanced wind modeling fails to capture localized wind resources, particularly in heterogeneous or complex terrain such as in Appalachia. The lack of sufficient data can result in poor prediction of potential capacity, operating conditions, and site design (NREL, 2008).

Currently, the most readily available state-level wind maps were produced for NREL by AWS Truewind (now AWS Truepower). These maps provide wind energy potential estimates at 80 m and 100 m heights and a spatial resolution of 200 m, and were based on computer modeling using available meteorological data. The models were independently validated for 19 states using data from existing meteorological towers 45 m and taller in height, comparing average wind speed measurements from the towers with those produced in the model. According to AWS Truepower, "no gross differences [were] found that would preclude use of model data for wind potential estimates" (Elliot et al., 2010). However, on the state wind map and resource potential websites, NREL notes that "Wind resource[s] at a micro level can vary significantly; therefore, [developers] should get a professional evaluation of [their] specific area of interest" (NREL, 2010c). In other words, the state-level wind maps do not necessarily capture micro-level or localized wind resources.

The complex terrain of the Appalachian mountains likely compounds this problem. Therefore, there is a need for more fine-scale information on wind resources in order to identify additional localized wind resources and make accurate production projections, and this requires the expansion of direct on-site meteorological observations across a wide geographic range and a wide set of conditions.

As one possible solution to the lack of finer-scale resource estimates, USDOE and NREL recommend the development of Wind Energy Testbed sites. According to the agencies, Wind Energy Testbeds would "accelerate the development of wind energy through use of new technologies from the atmospheric and wind energy research communities…[including] deployment of advanced tools (new observational systems, as well as weather, turbulence, and turbine prediction models) in a testbed setting where they are continuously refined, demonstrated, and evaluated" (NREL, 2008, p. 65). The agencies assert that a successful Wind Energy Testbed program would:

- "Remedy the lack of long-term consistent data at [finer] scales;
- Lead to development of improved models that would generate better wind resource information on annual, seasonal, and diurnal scales for improved site design, reduced uncertainty in energy estimation, and increased performance of operational weather forecasting; and
- Allow for the development of instrumentation specifically suited for addressing critical observational gaps for wind energy development (high resolution winds, turbulence intensity and thermal stratification)" (NREL, 2008, p. 68).

The agencies suggest the testing and use of the most site-appropriate instrumentation, and even caution that "all instrumentation systems have their strengths and weaknesses, and no single system will measure all of the parameters necessary for wind energy development" (NREL, 2008, p. 67). They also stress the need for measurements at multiple locations in a given area, especially in complex terrain.

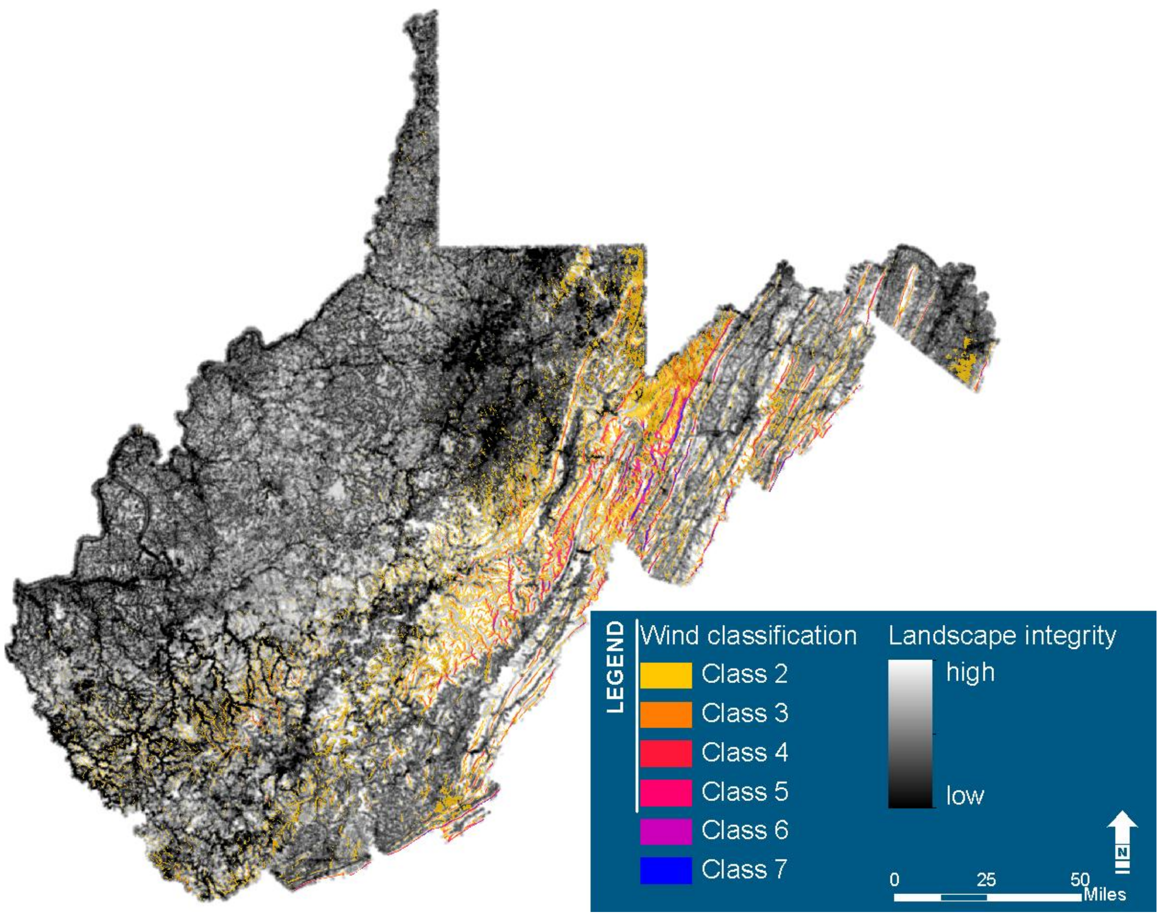
However, the funding necessary to develop Wind Energy Testbeds across Appalachia is not currently available. For example, the cost of a sonic detection and ranging (SODAR) system, or of installing an anemometer at a height sufficient for measuring the actual wind resource, can be prohibitive, preventing many landowners from moving ahead with project development. Some technologies for independent testing of a landowner's wind resource are not readily available to the general public. Both cost and access to technology that would improve information on the wind resource serve as barriers to wind development. Less wind power will be developed due to a lack of information on the local wind resource and the lack of access to available instrumentation or knowledge for remedying the situation.

3.3 Abundance of wind resource on ecologically valuable land

Appalachia's wind resource is, to a large extent, a product of its mountainous terrain. Sites that are ideal locations for wind turbines because of their high wind resource potential may also be valuable wildlife habitat because of their remoteness, low degree of fragmentation, and the unique character of the terrain. According to a West Virginia Division of Natural Resources (WVDNR) ecologist: "High ridges are like islands of habitat for many species of wildlife" (Vanderhost, 2010, p. 2). This observation may be especially true in Appalachian states that have recently faced development pressures from a variety of sources. For example, "West Virginia's high elevation ridges remain among the most remote and least disturbed habitats in the state" (Vanderhorst, 2010, p. 3).

In an effort to quantify these habitats, scientists from WVDNR's West Virginia Natural Heritage Program have created a preliminary methodology for calculating landscape integrity within the state (Dougherty and Byers, 2008). The pair collected data related to structures, highways, land cover, and previous land use; weighted the variables; and mapped the result. They generating high landscape integrity scores for those areas that are least disturbed and low landscape integrity scores for those areas that are most disturbed. This analysis, overlaid with wind resource potential, illustrates the overlap and potential conflict between much of the state's best wind resources and landscapes with high ecological integrity (Figure 21).

Figure 21: Landscape integrity and wind resource potential in West Virginia



Sources: Landscape integrity data from Dougherty and Byers (2008). Wind resource data from AWS Truewind (2003a). Note: Downstream Strategies recreated this figure, which originally appeared in NatureServe (2008).

Federal, state, or other public land holdings are also likely to have high ecological integrity. At least one wind energy project permit in West Virginia has been impeded because of its proximity to a wilderness area (Mount Storm Phase III). See Section 5.5 for a discussion of the policies regarding wind energy on public lands.

3.4 Land and mineral ownership

As described in Section 2.1 the counties in the five states considered in this report with the most land at Class 3 and higher are usually not the largest coal-producing counties. However, coal reserves are widespread across portions of these five states, and the development of some wind resources might be impacted by land and mineral ownership patterns. In this section, we consider patterns outside of the coalfields separately from those within the coalfields.

The concentration of land ownership among a few absentee or corporate owners, as well as low property assessments, can actually be a benefit to industrial-scale wind development in areas where mineral resources are scarce or lacking. Large tracts of land make wind development more economically feasible, as they allow for larger wind installations and minimize transaction costs, and thus improve the economies of scale for development. However, in coal-rich areas, patterns of land and mineral ownership may serve as a hindrance to wind development.

3.4.1 *Patterns outside of the coalfields*

In general, concentrated land ownership provides an advantage for wind developers because large tracts of land are required for utility-scale wind projects. Therefore, a developer would only be required to negotiate a lease with one or a few landowners rather than multiple landowners. Benefits would include reduced time and transaction costs for the developer, as well as a greater likelihood of success for the project. As an indicator of the size of the land parcel required for utility-scale wind projects, the acreage required for a wind farm includes the area cleared for each turbine, the spacing between the turbines (often 5-10 rotor diameters apart), and the roads. The modestly sized Shaffer Mountain Wind project, for example, proposed 30 wind turbines in Pennsylvania with a total proposed project area of 5,358 acres, but with only 174 acres being physically occupied (see Appendix B). Not many residents of Appalachia own land parcels, much less ridgeline, of this size.

Outside of the coalfields, it is more likely that this amount of land would have multiple landowners, each with their own interest regarding wind development on their land. Extensive small-scale private land ownership patterns outside of the Appalachian coalfields make wind farm projects difficult and expensive to plan, and can serve as a roadblock to development if all landowners are not willing to lease their lands for the wind turbines. Landowner collaboratives can potentially bring small landholders together to support wind development.

3.4.2 *Patterns in the coalfields*

Depending on the presence of coal, methods of coal mining that exist in particular areas, wind resource availability, and the particular type and ownership structure being considered for wind development, land and mineral ownership may serve as a barrier to wind development in the coalfields. One key reason is that ownership patterns tend to impede the development of alternative industries due to a financial preference for coal production (Appalachian Land Ownership Task Force, 1981).

For example, according to GIS analysis, Western Pocahontas Properties, LLC owns approximately 40% of Coal River Mountain in Raleigh County, located in southern West Virginia. Computer modeling has shown that much of the ridgeline along Coal River Mountain exhibits Class 4 and higher average annual wind speeds, making it a viable location for wind development. However, much of the land containing viable wind resource has been permitted for surface coal mining operations, following the leasing of the coal to a coal company by Western Pocahontas Properties.

While no specific comments have been made by representatives of Western Pocahontas Properties as to their decision to lease their lands for surface mining activities rather than a wind farm, the availability of the wind resource has gained significant public attention since early 2008. The royalties that the company is likely to receive from leasing its coal resources for surface mining exceeds the royalties it would gain from leasing the land for wind development by a significant margin (Hansen et al., 2008). Additionally, even if the landholding companies desired wind development, they might face legal challenges from the coal company given that changing land uses from coal to wind would likely violate the existing leases (Hansen et al., 2008). Leases such as these help explain why coal production takes precedence over wind generation.

In situations where coal mining is not actively occurring or anticipated, a company might make the opposite decision. For example, the same Western Pocahontas Properties is leasing its land for the Mountaineer Wind Energy Center in Tucker County, West Virginia (Ohio Valley Environmental Coalition, 2002). This is a 66 MW wind farm that began operating in 2002, serving as the first wind farm developed in West Virginia, and is owned by Florida Power and Light. No coal was produced in Tucker County in 2008 (MSHA, 2010). The development of the wind farm, however, shows that wind farms in Appalachia are being developed on corporately-owned lands, and that land companies may be interested in leasing their lands for wind development where coal is not an option.

In coal-producing areas, much of the coal resource has already been leased to mining companies, or is being held under the speculation that a coal company would be interested in producing the coal. Given the wide gap in royalties earned from coal compared with wind development, it is likely that—in coal-producing areas with concentrated land and mineral ownership patterns—coal mining will serve as the preferred land use, thereby acting as a barrier to wind development in Appalachian coal country. This is not necessarily a barrier in areas where coal resources are scarce or lacking.

In addition, concentrated land ownership by corporate entities serves as a barrier to community-owned wind development. The ownership of vast tracts of land and ridgelines in Appalachia, where corporate land owners also own or contract the mineral rights to other parties to produce coal, suppresses community ownership of wind projects. This is likely to be the case more often in coal-producing areas. While updated mapping of land ownership patterns is necessary to ascertain the current availability of wind resources for community-owned wind development, past research showing the high concentration of corporate land ownership in Appalachian counties (Appalachian Land Ownership Task Force, 1981) indicates that there are limited opportunities for community-owned wind development.

3.5 Summary: Barriers and solutions

Geography presents several barriers to wind energy development in Appalachia. Its mountainous terrain can increase project costs, limit site suitability, and increase environmental damage. The complexity of the terrain also limits the accuracy of available wind resource data, confounding developers' efforts in precise site selection. At least in West Virginia, the areas with the greatest wind resource tend to overlap with the areas of greatest ecological integrity.

Paradoxically, both small and large land parcels can delay wind projects. Small land parcels increase transaction costs and may limit the size of wind projects. Large parcel owners may be unwilling or unable to allow wind development due to existing coal leases, for example.

Together, these geographical factors serve as barriers to wind project development and may be aided by the completion of following recommendations:

1. **Establish guidelines for rigorous site selection criteria.** These criteria could include estimates of multi-season road construction and maintenance needs and potential habitat losses. Additionally, lands that already have experienced habitat loss and road construction, like abandoned mine lands, may be a suitable alternatives for wind development.
2. **Establish publicly available, finer-resolution wind resource datasets.** Two federal energy agencies have voiced the need for more resolute data than is currently available. In order for project developers to have an assured project outcome, they require data that captures meso-scale, micro-scale, and localized wind trends.
3. **Provide funding for Wind Energy Testbeds.** Contributing funding to this endeavor would enable the development of reliable on-site wind energy assessment tools, enabling developers to assess their meteorological resource independently.
4. **Expand anemometer loan programs.** While anemometer loan programs have recently been started in the region, they can be expanded. More anemometers can be loaned, and anemometers can be made available to investigate sites classified by state-level data as Class 2 and lower, so long as there are initial indications that strong local wind resources may be found.
5. **Strengthen collaboration among regional wind working groups.** While many wind working groups already exist in the five states considered in this report, these groups could benefit from increased collaboration, building capacity through shared experiences, knowledge, and technical resources. Additionally, these programs could be geared towards serving community-owned or distributed wind projects. Collaboration can enhance the dissemination of tools, information, and knowledge needed for successful wind development.
6. **Establish collaboratives among land owners.** In some counties in Appalachia, it is likely that residents own small parcels. Landowner collaboratives may be formed in order for multiple landowners to be represented, and protected, as a single entity. Such collaboratives provide a good option for the development of both community wind and utility-scale projects. They would likely ease the negotiation process for the leasing of lands for wind projects, thereby lowering the transaction costs associated with developing wind projects on land with many landowners.

4. ENVIRONMENTAL IMPACTS

Like all energy development projects, wind farms have environmental impacts. In Appalachia, environmental impacts have played roles in the approval processes for numerous wind farms, and continue to impact the time that elapses between when a project is proposed and built. Environmental issues are handled differently in each state. While some environmental impacts from wind development are internalized and make project development more expensive, others impose costs on society at large.

4.1 Regulatory review processes in each state

4.1.1 *West Virginia*

In West Virginia, the responsibility for review of environmental and esthetic impacts of proposed electricity-generating projects, including wind projects, lies with West Virginia Public Service Commission (WVPSC). Application requirements for a siting certificate,[13] which allows facility construction, are enumerated in a set of rules that also mandate 30 days' notice before filing an application and 300 days for project evaluation. The siting certificate contains WVPSC's approval and often contains a number of terms and conditions. Notwithstanding WVPSC's consideration of environmental issues, the siting certificate customarily requires evidence that all permits necessary for construction have been obtained from the United States Fish and Wildlife Service (USFWS), WVDNR, West Virginia Division of Culture and History, and West Virginia State Historic Preservation Office.

WVPSC uses a two-part balancing test to "appraise and balance the interests of the public, the general interests of the state and local economy, and the interests of the applicant."[14]

First, WVPSC appraises and balances: "(a) an applicant's interest to construct an electric wholesale generation facility; (b) the State's and region's need for new electrical generating plants; and (c) the economic gain to the state and local economy, against: (i) community residents' interest in living separate and apart from such a facility; (ii) a community's interest that a facility's negative impacts be as minimally disruptive to existing property uses as is reasonably possible; and (iii) the social and environmental impacts of the proposed facility on the local vicinity, the surrounding region, and the State."[15]

If in the first part of the analysis, WVPSC determines that positive impacts outweigh negative impacts, it moves to the second part and decides whether "the terms and conditions of any public funding or any agreement relating to the abatement of property taxes do not offend the public interest, and the construction of the facility or material modification of the facility will result in a substantial positive impact on the local economy and local employment."[16] Only if both tests are passed can WVPSC issue a siting certificate.

4.1.2 *Pennsylvania*

Pennsylvania has not adopted a comprehensive environmental review program; rather, it permits various activities on a resource-specific basis. Responsibility for management of protected resources in Pennsylvania is divided among several agencies. The Pennsylvania Department of Environmental Protection (PDEP) is a primary regulator in the permit process, while the Pennsylvania Game Commission has responsibility for wild birds and mammals, such as bats. The Pennsylvania Department of Conservation and Natural Resources (PDCNR) manages resources such as native wild plants, terrestrial invertebrates, significant natural communities, and geologic features (PDCNR, 2011). PDEP's approach to wind development is best described

[13] W. Va. Code § 24-2-11c
[14] W. Va. Code § 24-2-11c(c)
[15] The test is articulated in Longview Power, LLC, Case No. 03-1860-E-CS (Order dated August 27, 2004 at 190-91, Conclusions of Law #5-7).
[16] W. Va. Code § 24-2-11c(c)

in a brief document entitled "Process and Regulation Specific to Wind Farm Development" (PDEP, 2005). In 2005, PDEP took special action to coordinate with PDCNR and other agencies responsible for protection of special resources in the state. In addition to these efforts to coordinate project review, the State formed a 30-member collaborative, led by the Pennsylvania Game Commission, to create a Wind Energy Voluntary Cooperation Agreement that includes protocols for avian and bat studies that are intended to enable "wind energy development to occur in a more amenable and disciplined manner…" (Pennsylvania Game Commission, 2010).

Land use regulation in individual communities is a development hurdle in Pennsylvania. PDEP encourages early contact with municipal officials and "prospective neighbors" to address local concerns that could affect planning and/or design. In Pennsylvania, either the county or township is likely to have zoning regulations and a permitting process. Projects covering several thousand acres are likely within the jurisdiction of several local entities. To assist local communities in the development of wind resources, a sample model wind ordinance was developed, intended as a template that municipalities could adapt to their special needs. It addresses setbacks, noise, design, lighting, and provisions for waiver of certain of these requirements.

4.1.3 *Maryland*

In 2007, in order to stimulate "small" wind development, the Maryland Legislature passed a bill modifying the authority of the Maryland Public Service Commission (MPSC) by exempting wind projects of 70 MW or less from full review.[17] As further indication of State support of small wind development, a draft model ordinance for land use regulation of small wind turbines (not to exceed 80 feet in height or 100 kW) was later circulated by the State (Maryland Energy Administration, 2008).

In western Maryland, two Garrett County projects—one called Roth Rock Farm and the other on Backbone Mountain near Eagle Rock (Miller, 2010a)—have been in the development process for nine years and counting (Brighterenergy.org, 2010a). Permits have now been issued by state and county officials, but local conservation groups recently sought enforcement of the Endangered Species Act (ESA) due to the potential impact of the projects on Indiana and Virginia big-eared bat populations (Allegheny Treasures, 2010). By contrast, in eastern Maryland, some communities have been receptive to a limited wind installation as a self-selected alternative to fossil fuel–derived electricity, scaled for their own consumption (Brighterenergy.org, 2010b). That project has not, however, progressed far enough to know if development permits will be delayed by public response.

The legislated exemption for wind facilities under 70 MW appears to have had the effect of driving development to the exempted size. MPSC observed that where wind projects are exempt from Certificates of Public Convenience and Necessity (CPCNs), they must receive review of impacts on public safety, health, environment, and esthetics through local regulation and review (which otherwise would be preempted by the Commission's issuance of a CPCN).[18] Notwithstanding the CPCN exemption, wind developers must submit an application to the Maryland Department of Transportation in connection with road access and crossings and the Maryland Department of the Environment with regard to various environmental permits and approvals that may be required in connection with any type of construction in Maryland. These state permits, standard for all construction, are in addition to county review and approval, including land use and soil conservation review.[19] County permits have been received by at least two projects, with more development plans in process (Miller, 2010b).

[17] In re Application of Synergies Roth Rock LLC, Order 8302 p.2 (Public Service Commission, November 18, 2009)
[18] In re Application of Synergies Roth Rock LLC, Order 8302 p.6 (Public Service Commission, November 18, 2009)
[19] In re Application of Synergies Roth Rock LLC, Order 8302 p.6 (Public Service Commission, November 18, 2009)

4.1.4 *Virginia*

In Virginia, the first example of wind permitting is a Highland County project for 19 turbines, which began construction in April 2010 after years of planning and zoning review and court challenges. The project finally commenced following approval by the Virginia State Corporation Commission (VSCC) (Hammack, 2010). Construction was halted by federal court order based on a potential unauthorized “take” of a bat listed on the endangered species list. After addressing this concern, VSCC then re-approved the permit. VSCC re-approved the permit a second time after reconsideration was sought by the State Historic Preservation Officer, due to the farm’s proximity to an 1861 Civil War battlefield in Pocahontas County, West Virginia, just two miles away (Gibson, 2010).

Due in part to the controversy surrounding this project and the forecasted increase in energy demand due to a rapid growth in population, which is 1.5 times the national average, the Virginia Legislature in 2009 shifted permit responsibility for “small renewable energy projects” from VSCC to the Virginia Department of Environmental Quality (VDEQ). This bill also required VDEQ to produce a “permit by rule” to expedite approvals for such projects.[20] Notice of the VDEQ rules was published in June 2010, with public comment through August.[21] Significantly, the definition of “small renewable energy projects” was set by the Legislature at 100 MW. Wind developers are required to apply for land use review from county commissions. Some counties have begun to enact protective ordinances.

4.1.5 *Kentucky*

Excluding the occasional residential or agricultural windmill, there are no wind turbines in Kentucky that have undergone environmental permitting processes; therefore, we do not discuss environmental review processes for Kentucky.

4.2 Specific environmental issues

For states that require CPCNs from a statewide entity such as a public service commission or public utility board, we reviewed the approval process for all proposed wind farms in Appalachia (see Appendices A through E). For those states without a central review process, we reviewed information on how environmental impacts are handled via local ordinances or other permits. Based on this review, we have identified the environmental issues most common to proposed wind energy projects:

- bird and bat mortality and migration,
- noise,
- lighting, and
- viewsheds and esthetics.

4.2.1 *Bird and bat mortality and migration*

Intervenors and government agencies have raised questions about impacts of wind turbines on bird and bat mortality and migration. In response, the conditions of CPCNs have often required post-construction monitoring and/or adaptive management strategies.

In most projects studied, USFWS recommended monitoring bird and bat mortality for three years post-construction. USFWS also recommended mitigation plans to reduce mortality rates if significant mortality were to occur. These USFWS recommendations were commonly adopted as permit conditions. Many permits required migration studies for raptors and other bird species for a certain period post-construction, requiring adaptive management strategies if necessary.

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[20] Va. House Bill 2175 (2009)

[21] Virginia Register of Regulations, Vol. 26, No.21, page 2562 (June 21, 2010)

Appalachian turbines may impact the Virginia big-eared bat or the Indiana bat, both federally listed species under the ESA. CPCNs have often required post-construction monitoring, Habitat Conservation Plans (HCPs), and/or Incidental Take Permits (ITPs).

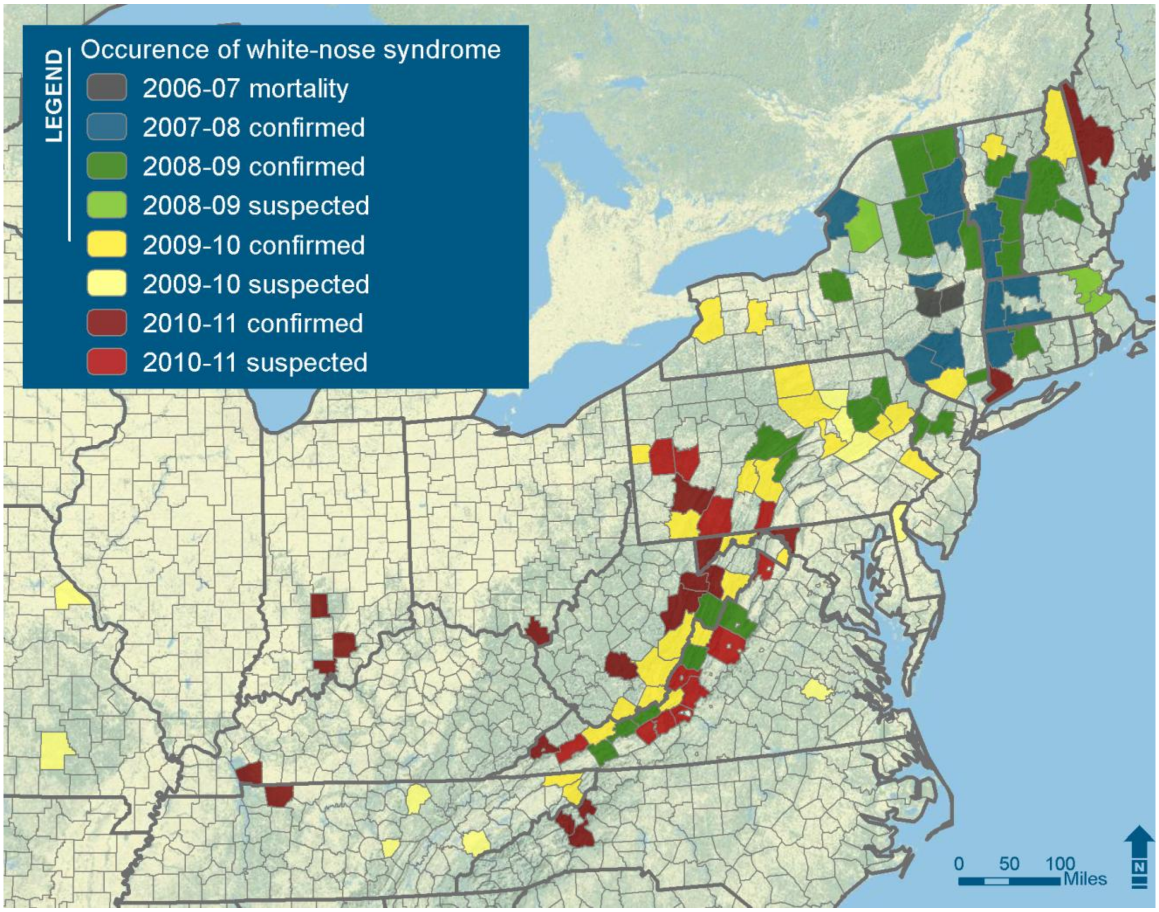
White-nose syndrome is a disease that kills bats in the northeastern US, including all five states considered in this report (Figure 22). It was first observed in caves near Albany, New York in January 2007, and has since spread to many neighboring states in the northeast and south through Pennsylvania, Maryland, West Virginia, Virginia, and Tennessee. The disease is responsible for unprecedented mortality in a range of species of hibernating bats, including the little brown bat, Indiana bat, northern long-eared bat, eastern small-footed bat, tricolored bat, and big brown bat. Indications are that the disease may be spreading to the gray bat, the cave myotis, and the southeastern myotis (USFWS, 2011).

The exact process by which the infection leads to death is still not understood. Several theories exist; however, a fungus, *G. destructans,* creates the characteristic white discoloration on the nose of the bat, and is commonly found in bat populations at affected sites. It is hypothesized that this fungal infection causes bats to prematurely expend their fat reserves during winter hibernation. Another hypothesis is that the fungus infects the skin, impeding normal physiological processes that depend on the healthy functioning of the wing, including thermoregulation, water balance, and flight. Both symptoms lead to rapid and widespread mortality (USFWS, 2011).

Bats play an important role in North American ecosystems; more than half of the bat species in the US hibernate during the winter, and are therefore potentially at risk. All four endangered bat species and subspecies are at risk, and three of these endangered species are already within the impacted area: the Indiana, gray, and Virginia big-eared bat (USFWS, 2011).

Until the cause is found and bat populations stabilize, white-nose syndrome presents a potentially large risk for the development of wind farms in Appalachia. The possibility that already-stressed populations would be further impacted by wind turbines underscores the importance of post-construction monitoring so that the impacts of existing wind farms can be accurately measured. Additionally, the methodologies used for post-construction monitoring should be closely examined. This will allow better predictions of the potential impacts of future wind farms, which can then be incorporated into future permitting processes.

Figure 22: White-nose syndrome occurrence, 2006-2011



Source: Butchkoski (2011).

4.2.2 *Noise*

Intervenors have raised concerns about the noise generated by wind turbines. CPCNs have sometimes required specific conditions: requiring developers to create and maintain a minimum buffer distance to residents, requiring noise monitoring for certain periods post-construction, and requiring developers to use certain technologies and/or part models that reduce turbine noise. Noise has also been addressed locally through conditional use permits or building permits.

While noise levels are considered by most regulating agencies, these concerns do not appear to pull much weight in the approval process. In each of the projects studied, the regulating agency determined the projected noise levels to be reasonable. Some regulating agencies did require post-construction sound monitoring and consequential adaptive management strategies if deemed necessary.

4.2.3 *Lighting*

Intervenors have raised concerns about the lighting of wind turbines. Lighting is related to impacts on birds and bats and visibility by wind farm neighbors. In addition, lighting requirements may overlap with Federal Aviation Administration (FAA) requirements, especially if wind farms are proposed near airports or flight paths of smaller, low flying aircrafts.

Lighting has been addressed by regulating agencies through the imposition of permit conditions. Lighting is often limited to the necessary amount consistent with FAA requirements and other safety regulations. Many permits require a post-construction lighting study for a period of time to evaluate lighting effects on birds and bats. Adaptive management strategies are sometimes required, if necessary and reasonably feasible.

4.2.4 *Viewsheds and esthetics*

Intervenors have raised concerns about viewsheds—the places from which wind turbines are visible. In fact, the viewshed issue was important in WVPSC's denial of a CPCN for one West Virginia project: Mount Storm Phase III. In other cases, however, this issue has been addressed through the mitigation of project views and through permit conditions imposed by regulating agency, which may require relocation of certain turbines.

Viewsheds and esthetics are inconsistently considered by the regulating agencies. Some agencies actually conduct views of the project site from several difference viewpoints, and other agencies merely consider expert testimony during evidentiary hearings. Occasionally, the regulating agency will require the applicant to relocate one or more turbines. However, with the exception of Mount Storm Phase III, neither viewsheds nor esthetics was the basis for denial of any permit reviewed for this report. In Mount Storm Phase III, turbines were to be located within 2,000 m of a designated wilderness area, and WVPSC recognized that the turbines proposed in Phase III could likely be relocated to other phases of the project. In West Virginia's New Creek project, the proposed project site was viewable from two managed land areas within 10 miles of the project and 13 managed land areas within 20 miles. WVPSC determined that the project views from the managed lands and nearby historic sites was not unreasonable or burdensome. The majority of concerns over project viewsheds are discussed at length in final orders; however, these concerns do not seem to have carried much weight in the approval processes.

4.3 Summary: Barriers and solutions

The five Appalachian states considered in this report regulate the environmental impacts of wind energy development differently. Some such as West Virginia have a more centralized process through WVPSC. Others like Pennsylvania rely mostly on local ordinances.

Maryland exempts small wind farms—those under 70 MW—from requirements for CPCNs. Virginia has a similar law, but defines small wind farms as those less than 100 MW.

While state regulatory schemes vary, the environmental issues raised in permit approval processes are similar. Bird and bat mortality and migration, noise, lighting, and viewsheds and esthetics are common environmental themes raised by intervenors in permitting cases. These issues are often addressed by regulatory authorities via permit conditions.

These environmental barriers have generally added to the cost of wind power development through the imposition of conditions such as post-construction monitoring or the requirements to write HCPs and acquire ITPs. These conditions start to internalize the cost of some environmental impacts. It is still too early in the development of wind energy in Appalachia to know whether these conditions are sufficient to fully internalize these environmental costs. Additionally, permit conditions have generally not led to the denial of permits. Mount Storm Phase III in West Virginia is an exception: In this case, the fact that the wind farm would be seen from a nearby wilderness area was a key factor in WVPSC'S denial of a CPCN for one phase of the project.[22]

While these environmental barriers have not resulted in permit denials, they have slowed down the approval process (Liberty Gap in West Virginia and Clipper Windpower in Maryland), curtailed the size of a project

[22] WVPSC allowed the developer to relocate turbines from Phase III to Phase I or II; therefore, the denial for Phase III did not necessarily reduce the total size of the project.

(Beech Ridge in West Virginia),[23] and led project developers to withdraw their projects before a final regulatory decision (Allegany County, Maryland). As such, they are still barriers to wind development in Appalachian coal country.

White-nose syndrome, which has decimated bat populations in Appalachia, presents a significant wild card as to how environmental concerns might grow in importance for proposed wind farms that are to be located near bat habitat. Further complicating the issue, areas in Appalachia with high wind resources usually also have high ecological value.

Several steps can be taken to ensure that environmental protection is accomplished while wind energy is developed:

1. **Continue pre- and post-construction monitoring, and adjust permitting decisions based on the results.** As more pre- and post-construction monitoring is completed in Appalachia, these results should be synthesized to refine our understanding of the impacts of wind turbines on birds and bats. These results should then inform future permitting decisions.

2. **Carefully monitor and integrate information regarding white-nose syndrome.** Scientists working on white-nose syndrome should quickly communicate their findings to wind developers and wind regulators, so that future permitting decisions can be made that reflect the new reality in Appalachia regarding bat populations. If necessary, the impacts of white-nose syndrome may have to be considered with respect to existing wind farms.

3. **Take necessary steps to protect birds and bats.** Wind developers should continue to consult with and accept recommendations from USFWS and state agencies regarding methods for protecting birds and bats. In some cases, developers will have to limit the amount of forest removal; follow Bald Eagle Management Guidelines; place turbines in the low point along the ridgeline to reduce impacts to migratory raptors; and study whether turbines should or could be stopped or free-wheeled during part of the year to minimize bat mortality. Additionally, turbine blades may need to be feathered so as to prevent collisions. Alternative wind turbine designs merit research and testing, especially for those projects that may be cited in Appalachia's migratory bird flyway.

4. **Consult early with municipal officials and prospective neighbors.** PDEP, for example, encourages early contact with municipal officials and "prospective neighbors" to address local concerns that could affect planning and/or design.

5. **Relocate turbines when necessary.** When necessary to protect birds or bats, or when noise levels are too loud, turbines may need to be relocated, or possibly not built. While developers may decide to relocate turbines voluntarily, permit conditions would provide greater assurance that turbines are ultimately moved when these issues arise.

6. **Consider items from Pennsylvania's model local ordinance.** This model ordinance requires turbines to be unobtrusive in visual appearance and considers color, lighting, advertising, and transmission power lines, which should be placed underground to the maximum extent practicable. It includes setback requirements from occupied buildings, property lines and public roads, and limits on audible sound and light impacts.

[23] While smaller than originally proposed, the Beech Ridge project is not substantially smaller and was only curtailed after legal action, not through the regulatory process.

5. POLICY

Many policies impact the development of wind in Appalachia, including federal, state, and local policies. In this report, we focus on a subset of these policies: those that are most important with regards to wind development and that vary state-by-state within Appalachia. We therefore intentionally omit discussions of federal policies such as production tax credits, because these impact wind development across all Appalachian states, and in fact across the entire country. We also omit state policies that are directly related to funding; these are considered in Chapter 6.

5.1 Renewable portfolio standards

RPSs, set by state law, require a percentage of an electric provider's energy sales (measured in MWh) or installed capacity (measured in MW) to come from renewable energy resources. RPSs in Pennsylvania and West Virginia include alternative fossil fuel–based energy sources in addition to renewables.[24] Some cite RPSs as states' most powerful tools to promote wind energy (Bird et al., 2003).

While the existence and characteristics of each state's RPS is important for wind development in that state, the RPSs in nearby states are also important. Regional green power demand, driven by nearby RPSs, can help promote wind development in Appalachia. For example, West Virginia's wind resource is close to Washington, DC and is therefore strategically located to serve that area's green power demand (Bird et al., 2003).

5.1.1 *West Virginia*

In 2009, the West Virginia Legislature passed the Alternative and Renewable Energy Portfolio Act, which requires utilities to obtain 25% of their electricity from alternative or renewable energy sources by 2025.[25] The "alternative energy" definition in the West Virginia statute encompasses a wide range of coal and fossil fuel–based energy sources, including advanced coal technologies, coal bed methane, natural gas, fuel produced by coal gasification or liquefaction facilities, synthetic gas, integrated gasification combined cycle technologies, waste coal, and tire-derived fuel. Renewable energy sources include solar photovoltaic, solar thermal, wind, run-of-river hydropower, geothermal, biomass, biologically-derived fuel, and fuel cell technology.[26] Utilities are awarded double credits for each MWh of renewable energy generation, and three credits for renewable energy generation on reclaimed surface mines.[27]

The Act provides for compliance monitoring, but not until 2015. The compliance target for January 1, 2015 equals 10% of the utility's total in-state energy sold. The terms of the Act are neutral with regards to renewables and wind; therefore, it has done little to influence the selection of wind over other potential types of renewables. In fact, in Allegheny Power's compliance plan submitted to WVPSC, the company stated that it needs no new generation to satisfy this standard for 15 years and will instead rely on its existing, qualifying hydro and coal facilities (Monongahela Power Company and Potomac Edison Company, 2010). American Electric Power (AEP), the state's other major utility, also needs no new generation to satisfy this standard (Appalachian Power Company and Wheeling Power Company, 2010).

[24] In this report, we generally use the term RPS to include true RPSs as well as those that include alternative and renewable energy.
[25] W.Va. Code §24-2F-6
[26] W.Va. Code §24-2F-3
[27] W.Va. Code §24-2F-4

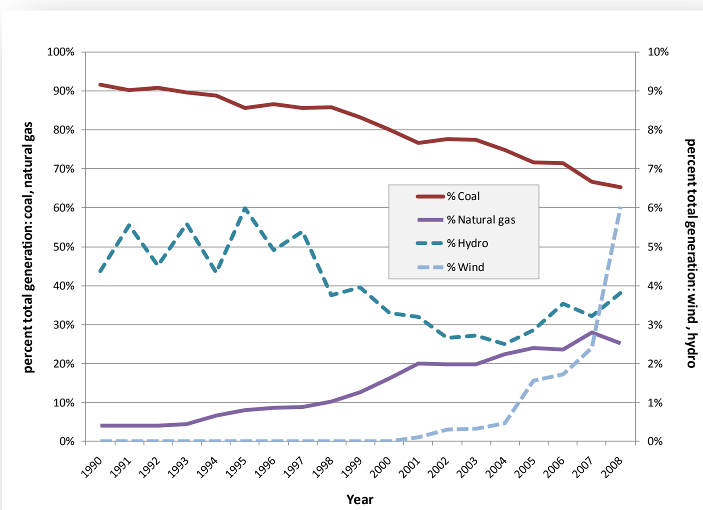
SNAPSHOT: In Colorado, the renewable portfolio standard is king

Colorado was the first state to enact a voter-approved RPS, which passed in 2004 (Eber and Tucker, 2010). Since, the RPS has become one of the highest in the nation, requiring 30% of generation by 2020 to come from eligible energy sources, including recycled energy, solar, wind, geothermal, biomass, hydroelectricity, and fuel cells. Fossil and nuclear fuels are not eligible energy resources. Colorado also established a preference for distributed generation.

Since 2004 and the RPS's inception, wind generation has grown by 1,363% or 3 million MWh. In 2008, Colorado generated a net total of 53.4 million MWh of electricity (EIA, 2010a). Of this, coal accounted for 65% of net generation, while wind power accounted for approximately 6%, the third largest source of electricity in the state. The remainder of the fuel mix consisted primarily of natural gas and conventional hydroelectric power. In total, renewable energy sources—wind, hydroelectric power, and a small amount of biomass—accounted for approximately 10% of net electricity generation in 2008, with fossil fuels accounting for the remainder. Since 2004, total generation increased by 12%, of which fossil fuels accounted for 31% (EIA, 2010a). This growth was dominated by renewable energy technologies, particularly wind. The full development of the 80 m wind resource would annually produce approximately 1.3 billion MWh of electricity. Albeit unlikely, Colorado's fully-developed wind resource would provide twenty-four times more electricity than the state currently produces from all sources (NREL, 2010a; EIA, 2010a).

Colorado is a non-Appalachian state, but its mountainous terrain and coal production make it a good comparison state for the others considered in this analysis. Colorado provides an instructive model of increased renewables—including wind—via an aggressive RPS.

Figure 23: Percent of total electricity generation by source for Colorado, 1990-2008



Source: EIA (2010a).

5.1.2 *Pennsylvania*

Like West Virginia's, Pennsylvania's RPS includes energy sources derived from fossil fuels. In 2004, Pennsylvania adopted an alternative energy portfolio standard, with a goal of 18% of total electricity for suppliers and distributers by 2020.[28] The goal is divided into two categories. Tier I includes several types of solar, wind, coal mine methane, low-impact hydropower, geothermal power, fuel cells, and biomass energy, which comprise 8% of the 2020 goal. Tier II includes large hydropower, waste coal, integrated gasification combined cycle, and energy created using municipal waste or wood manufacturing byproducts, which comprise 10% of the 2020 goal. While there is a carve-out goal in Tier I for solar, there is none for wind. Tier I production must be from in-state sources, with some regional exceptions.

The RPS program has yielded a significant number of alternative and renewable energy facilities in five years. The 1,677 MW of wind energy projects represented 9.2% of approximately 18,200 MW[29] in total qualified projects between 2005 and 2010. By contrast, the capacity of coal and partial-coal projects qualified under the RPS was 16.7 % of the total—3,038 MW—nearly twice the wind capacity. The remaining projects included wood, biomass, hydro, and solar. (PPUC, 2010)

Implementation of the RPS is based on the purchase of alternative energy or credits from qualifying energy producers. If the RPS is not met, utilities are required to make "alternative compliance payments" at a rate of $45 per MWh in the shortfall.[30] The funds received from compliance payments are held in the Sustainable Energy Fund, which is used for renewable energy development. There is a separate, higher rate set for solar set-aside compliance. Investor-owned utilities (IOUs) file plans annually for meeting the requirements; these plans must be reviewed by the Pennsylvania Public Utility Commission (PPUC). IOUs are able, by law, to bank credited generation, but also to purchase and borrow credits against future production, pending approval from PPUC. The statute mandates a tracking system that ensures that credits are sold once, and was recently amended to provide for a market system for RPS credits.

The RPS does not include a special carve-out for wind, yet wind energy development in Pennsylvania has rapidly escalated. This rapid expansion may be attributable to Pennsylvania's unique strategy of linking economic development with wind energy development, described under Section 6.3.2.

5.1.3 *Maryland*

Maryland's RPS is most like other RPSs throughout the US, in that it does not include alternative, non-renewable energy. Maryland passed its RPS in 2004, and the RPS was amended in May 2010 to incorporate a goal of 20% renewable energy by 2022.[31] The current RPS is split into two tiers. Tier I includes an array of renewable energy including wind and solar, as well as "qualifying biomass, methane from the digestion of anaerobic decomposition of organic materials in a landfill or wastewater treatment plant, geothermal, ocean, including energy from waves, tides, currents, and thermal differences, a fuel cell that produces electricity from qualifying biomass or methane, and small hydroelectric power plants."[32] Tier II is comprised mainly of hydroelectric. The RPS prioritizes solar energy; 2% of the 20% goal is a set aside for photovoltaics.[33]

Like Pennsylvania, if a utility does not comply with the RPS, the Maryland Public Service Commission (MPSC) levies a fee on the utility, which goes to the Maryland Strategic Energy Investment Fund, administered by the Maryland Energy Administration. Compliance fees paid into the fund are used to support grant and loan programs for Tier I renewable energy resources, except for compliance fees for the solar obligation, which

28 Pa. Code §1648 (2004), as amended by Act 35 (2007)
29 This includes the capacity of the entire plants and may not be indicative of the capacity that is renewable, especially for multi-fuel facilities because the fuel mix may change on a regular basis.
30 73 P.S. §§ 1648.3(f) and (g) (2007)
31 Md. Public Utility. Code Ann. §7-703 (2010)
32 Md. Senate Bill 595
33 Md. Public Utility Code Ann. §7-703 (2010)

may only be used to support new solar resources in the state. Like West Virginia and Pennsylvania, Maryland's RPS does not prioritize wind. Like Pennsylvania, it prioritizes solar over wind.

5.1.4 *Virginia*

Unique among the states in our region, Virginia does not have a state-mandated RPS. Instead, in 2007, Virginia adopted a voluntary RPS, with a renewable energy goal schedule of 4% in 2010, 7% in 2016, and 12% in 2022.[34] Like most RPSs, Virginia's includes typical renewable energy sources, "derived from sunlight, wind, falling water, sustainable biomass, energy from waste, wave motion, tides, and geothermal power, and does not include energy derived from coal, oil, natural gas or nuclear power."[35] To comply, utilities can either produce renewable energy or purchase renewable energy credits (RECs).[36] Wind and solar development receive double credits towards fulfilling the RPS goals, and off-shore wind receives triple credits.

Unlike other RPSs, Virginia does not levy noncompliance fees; the Legislature enacted a higher rate of return on utility investment in renewables, incentivizing utilities to comply. Also, the law mandates that electricity customers in Virginia have the option to purchase 100% renewable energy from their utility.[37] If their utility does not offer a program that meets the 100% renewable energy requirement, customers are permitted to purchase green power from any licensed retail supplier (USDOE, 2010c).

5.1.5 *Kentucky*

Kentucky does not have any RPS, voluntary or mandatory; however, its Legislature recently considered the adoption of one, outlined in House Bills (HBs) 3 and 408. HB 3, proposed in 2010, requires utilities to meet 10% of total non-industrial demand from renewable sources by 2022 and every year thereafter.[38] HB 3 does not have requirements for any particular renewable energy source. HB 408, an alternative bill proposed during the same legislative session and promoted by various Kentucky advocacy groups, requires 12.5% of total electricity demand, from all sources, be met with renewable energy by 2020, of which solar must comprise 2%. HB 408 further calls for an increase in both solar and total renewable energy of 1% for each year after 2020.

5.1.6 *Summary*

Four of the five states in our region have RPSs; these policies incentivize the development of wind energy along with other renewables. However, only the West Virginia, Pennsylvania, and Maryland RPSs are mandatory. Further, the West Virginia and Pennsylvania RPSs include alternative fossil fuel–based technologies in addition to renewables.

None of the RPSs prefer wind over any other form of renewable energy, and none have stipulations that favor community wind project ownership. Two states—Pennsylvania and Maryland—have additional incentives for solar, which effectively reduce the incentives to develop wind energy. RPSs are a powerful tool for incentivizing renewable energy, but none of the RPSs in our region explicitly promote wind over other energy sources.

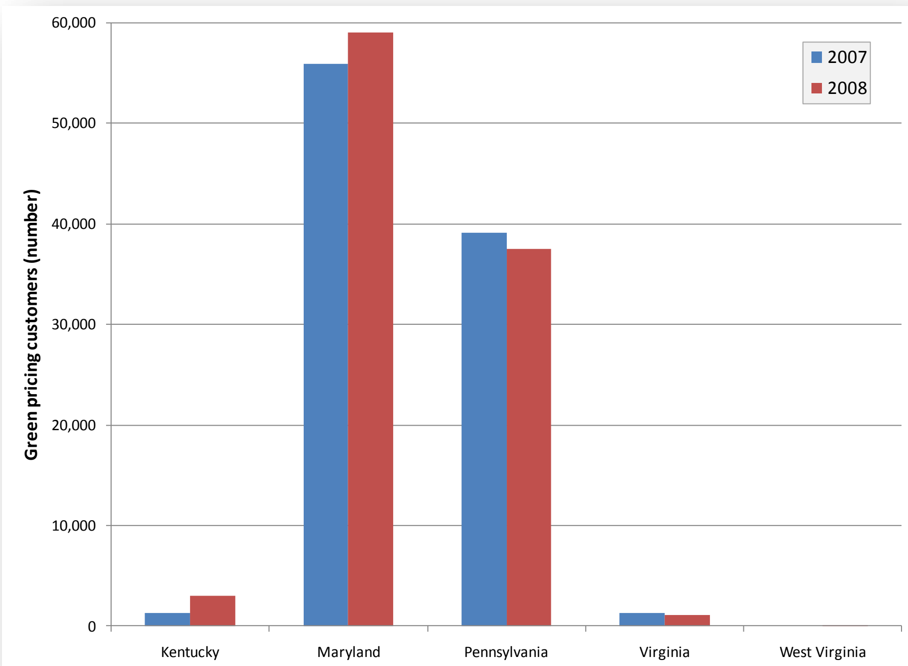
[34] Va. Code §56, 585.1-585.3 (2007)
[35] Va. Code §56, 585.1-585.3 (2007)
[36] RECs are tradable commodities that represent proof that a unit of electricity was generated from a renewable resource. RECs can be sold with or separate from the electricity itself, and represent the environmental attributes of the generated electricity.
[37] Va. Code §56, 585.1-585.3 (2007)
[38] Non-industrial demand in Kentucky accounts for approximately 50% of all electricity demand. Therefore, the actual renewables requirement by 2022 and beyond would be about 5% of total electricity demand.

5.2 Green pricing

Most states in the US, including all five Appalachian states, offer at least some customers the choice to pay extra on their electricity bills for the additional cost of providing electricity from renewable sources. As shown in Figure 24, Maryland and Pennsylvania, by far, have the most green-pricing customers in the five Appalachian states.

This policy, however, does not necessarily incentivize the development of wind within the state. For example, in West Virginia, AEP, which serves the southern part of the state, instituted a green pricing option and is satisfying the demand by purchasing RECs from a hydropower plant in West Virginia and a wind farm in Illinois (AEP, 2011).

Figure 24: Green pricing customers, 2007-2008



Source: EIA (2010f).Note: West Virginia had zero customers in 2007 and 74 in 2008. The 2008 total is not visible due to the small size of the bar.

5.3 Distributed wind policy

While most of this report focuses on the large-scale wind farms, distributed wind is another option that can lead to greater penetration of wind energy. For the purposes of this report, we define distributed wind as turbines installed at the point of consumption that generate electricity matched to the energy needs of homes or businesses where they are located (AEP, 2010). While distributed wind can refer to off-grid locations, it more commonly refers to installations of wind behind the meter. Distributed energy generation requires minimal infrastructure upgrades, delivers energy close to demand, minimizes problems associated with intermittency, and is not likely to overburden utilities, thereby reducing transmission and transportation costs (Farrell and Morris, 2008). Policies that support distributed wind, or incentivize individual homeowners or businesses to install wind turbines, could increase the amount of wind energy development throughout the region.

Net metering is a crucial policy for the promotion of distributed wind. While all five states in Appalachia allow net metering, the capacity limits across the states vary considerably (Table 7). The aggregate limits vary as well. Pennsylvania is most flexible because it does not contain an aggregate limit. Maryland's aggregate limit is fixed: 1,500 MW. In West Virginia, Virginia, and Kentucky, aggregate limits are based on peak loads in the previous year. (North Carolina State University and Interstate Renewable Energy Council, 2010)

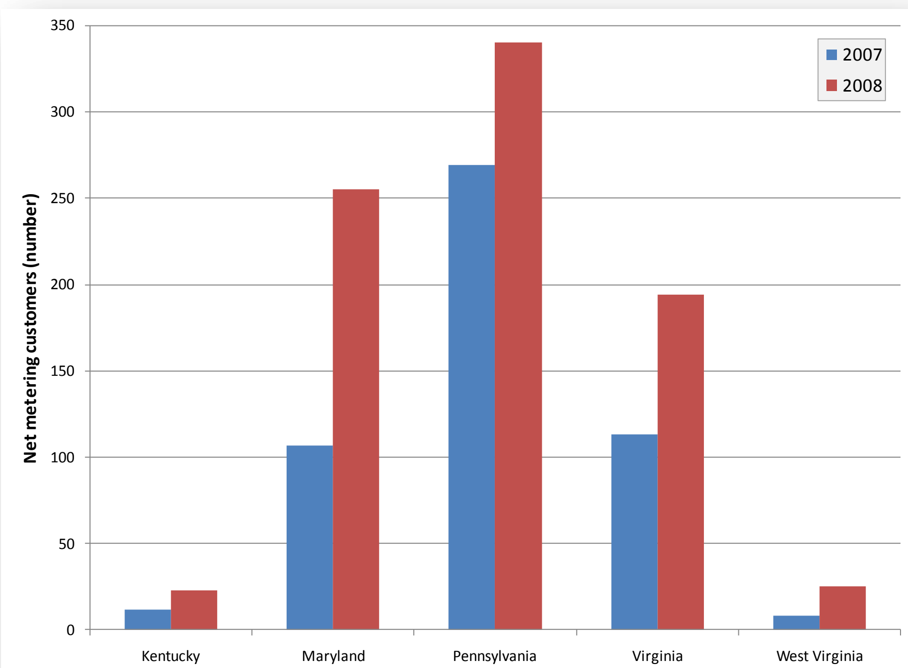
As shown in Figure 25, Pennsylvania, Maryland, and Virginia have the most net metering customers of the five states considered in this report. The total number of net metering customers across the five states in 2008—837 customers—is very small compared with the total across the US: 70,009 customers. However, the US total is significantly impacted by the fact that California had almost 46,000 net metering customers in 2008. All five Appalachian states experienced significant growth in net metering customers between 2007 and 2008 (EIA, 2010f).

Table 7: Net metering capacity limits (kW)

Sector	West Virginia	Pennsylvania	Maryland	Virginia	Kentucky
General			2,000		30
Residential	25	50		20	
Commercial	500				
Industrial	2,000				
Non-residential		3,000		500	
Other		5,000	30		

Source: North Carolina State University and Interstate Renewable Energy Council (2010). Note: West Virginia limits are lower for IOUs with fewer than 30,000 customers, municipal utilities, and co-ops. Pennsylvania's "other" limits are for micro-grid and emergency systems. Maryland's "other" limit is for micro-combined heat and power.

Figure 25: Net metering customers, 2007-2008



Source: EIA (2010f).

In creating its RPS, the Maryland Legislature established a "small generators working group" to develop interconnection standards consistent with federal policies; the goal of this measure is "to facilitate and encourage a simplified connection of small distributed generators to the grid in a manner that ensures the safe and reliable operation of the grid."[39]

5.4 Community wind policy

Community wind is defined as a locally-owned, commercial-scale wind project that optimizes local benefits. Locally-owned means that a significant direct financial stake and decision-making authority in the development of the project (other than through land lease payments, tax revenue, or payments in lieu of taxes) is held by one or more local individuals or entities.[40] Commercial-scale means projects that are designed for bulk power generation and sale to a retail electric utility company distributing electricity locally, or for distribution to a non-residential electricity user.

Community wind projects have a host of potential positive effects for the local community including social, economic, and environmental benefits. Additionally, community wind projects are typically located in rural areas due to the requisite property or project acreage for proper turbine function and compliance with zoning codes. In this light, wind turbines provide an opportunity for often-impoverished regions to create a new, stable, and diversified income stream. This additional income and diversification of the income stream helps to reduce the impact of boom and bust business cycles typically associated with agriculture and mining. According to a report by the New Rules Project: "Farmers can earn a few thousand dollars a year per turbine by leasing their land to developers. Or they can earn [up to] ten times that amount by becoming owners of the turbines" (Farrell and Morris, 2008, p. 12).

Economically, community wind projects tend to benefit the region by using local labor and materials during project development and operations, providing dividends to local shareholders, and patronizing local banks for construction, financing, and operating loans (Lantz and Tegen, 2009). For these reasons, "several studies have investigated the difference between local- and absentee owned wind turbines and all have found substantial increases in net economic benefits when turbines are locally owned, both in jobs and in total economic output" (Farrell and Morris, 2008, p. 22). Even more notably, "in all but one of the studies, the economic impact of community wind projects more than tripled that of an absentee owned wind farm" (Farrell and Morris, 2008, p. 22).

Despite the documented benefits of community wind, none of the states in our region have policies in place that specifically incentivize it. The West Virginia Direct Loan Program helps to incentivize wind by providing grants ranging from $50,000 to $10 million or 40% of eligible costs (USEPA, 2008a). However, because of the large size of these grants, it is difficult for community-based developers to raise the needed matching capital. Technical assistance programs can also be found in West Virginia for the development of renewable energy projects; however, they are not aimed directly at community-based development. The West Virginia Renewable Energy Program "can assist developers by providing detailed maps, interfacing with West Virginia utilities, and contacting local economic developers" (USEPA, 2008a, p. 1).

Pennsylvania's RPS also does not require or incentivize community wind. It includes wind as an eligible source of renewable energy, but includes no specific requirements about the ownership structure of the wind projects. Pennsylvania has a number of direct funding incentive programs for the development of renewable energy resources. None of these programs are aimed directly at community-based development, although they may apply to certain community wind developers depending on the specific situation.

Maryland, Virginia, and Kentucky do not have policies that currently favor community wind.

[39] Md. Senate *Senate Bill 595, Chapter 119* (2007)
[40] This definition is based on the definition of community wind in Windustry's (2010) Wind Energy Glossary.

Minnesota's support for community wind

In 2005, the Minnesota Legislature enacted Community-Based Energy Development (C-BED) tariffs. These tariffs provide higher payments for the first 10 years to wind projects that are small-scale and locally owned. Higher up-front payments incentivize the development of community-based wind projects. These C-BED front-loaded tariffs are calculated using a net present value (NPV) rate, calculated by dividing the NPV of all electricity projected to be produced over 20 years by the kWh projected to be produced over the same time period. Because the NPV depends significantly on the choice of a discount rate, the original 2005 legislation included a maximum tariff of 2.7 cents per kWh; however, this maximum was removed by the Legislature in 2007 (C-BED.org, 2011). To qualify for C-BED benefits, projects must have a local resolution of support via the relevant governing body and local owners, each with no more than 15% ownership (C-BED.org, 2011).

Between C-BED's inception in 2005 and December 2010, the program resulted in the installation of 178.9 MW in 17 community wind projects in Minnesota. An additional 199.8 MW of capacity in two community wind projects were under contract or negotiation at that time (see Table 8). For comparison, through 2010, Minnesota had a total of 2,192 MW of installed capacity in utility-scale wind projects, about twelve times the capacity in community wind projects (American Wind Energy Association, 2011).

Table 8: Existing community wind projects in Minnesota, 2010

Project name	County	Year	No. turbines	Capacity (MW)
Mountain Lake	Cottonwood	2007	1	1.25
Wing River Wind	Wadena	2007	1	2.5
Marshall Wind Farm	Lyon	2008	9	14.7
Cisco Wind Energy	Nobles	2008	4	8
Ewington Wind Farm	Nobles	2008	10	20
GRE Headquarters Wind Turbine	Hennepin	2008	1	0.2
Odin	Cottonwood/Watonwan	2008	10	20
Brewster Wind	Nobles	2008	1	2.1
Welcome Wind	Martin	2008	1	2.1
Jeffers	Cottonwood	2008	20	50
Hilltop Power	Pipestone	2009	1	2
Willmar	Kandiyohi	2009	2	4
Shakopee Mdewakanton Sioux Community	Scott	2009	1	1.5
Uilk	Pipestone	2010	3	4.5
Woodstock	Pipestone	2010	1	0.75
Grant County	Grant	2010	10	20
Ridgewind	Pipestone/Murray	2010	11	25.3
Total	**13 counties**	**4 years**	**87**	**178.9**

Source: C-BED.org (2010).

Maine's support for community wind

The State of Maine enacted a Community-Based Renewable Energy Act, which encourages community wind development through a series of incentives.

It provides new market opportunities by encouraging the State of Maine to "purchase its power from community-based renewable energy projects to the greatest extent possible." It also establishes a green power purchasing option that allows utility customers to voluntarily pay higher rates for electricity coming from community-based renewable energy facilities (Maine Rural Partners, 2009).

Direct incentives include a dedicated long-term power-purchase agreement with fixed rates, which allow the community to leverage traditional business loans from local banks. In addition, 150% multipliers to RECs provide additional value to the electricity generated by community wind.

The Act also includes restrictions to ensure that current ratepayers are not negatively affected by increasing community wind development. The program is limited to a six-year pilot program that will provide incentives for no more than 50 MW of new capacity. Projects must be less than 10 MW to qualify for incentives. With these restrictions, the Act reduces the risk of increased rates while incentivizing community wind development.

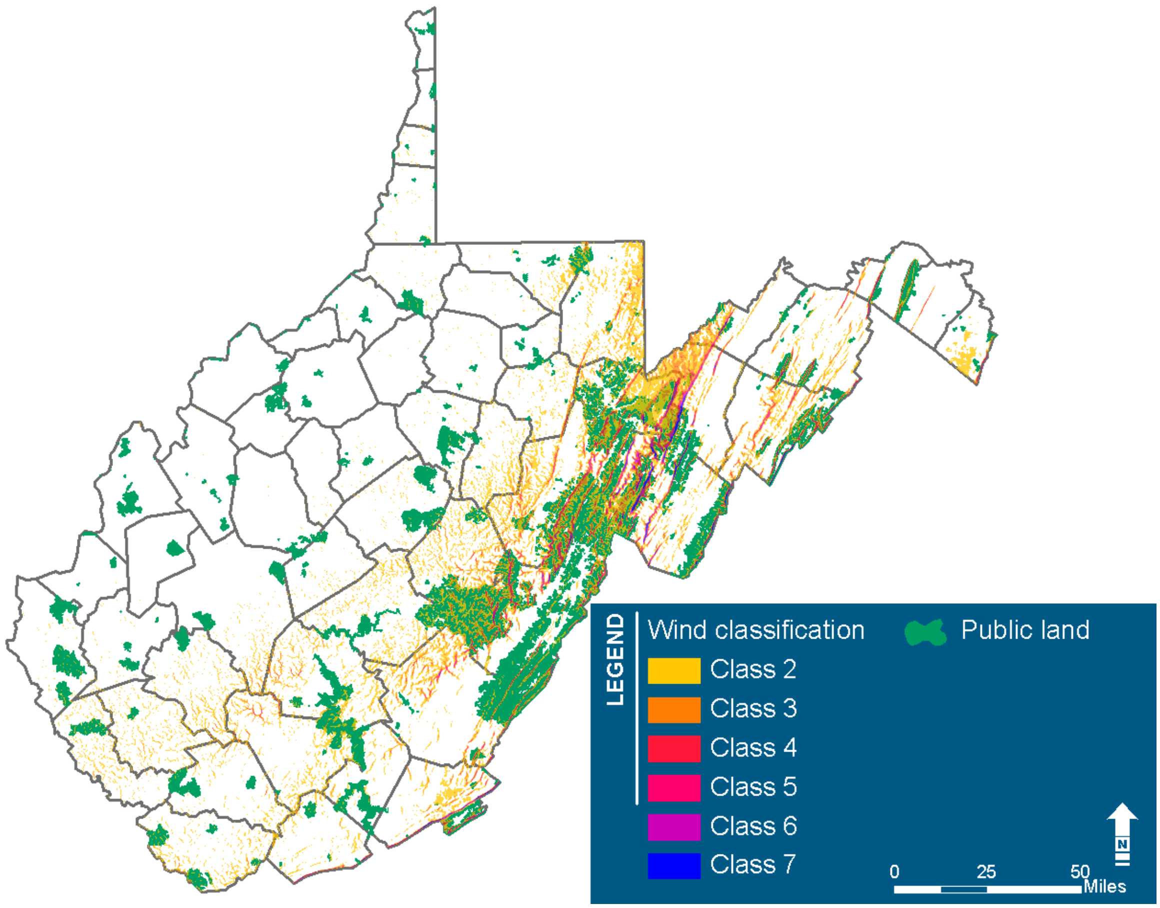
To date, five wind project developers have applied for certification as a Community-Based Renewable Energy Project under the Act's pilot program in order to qualify for the Act's incentives: either the long-term contract as a transmission and distribution utility or the 150% REC multiplier (Maine Public Utilities Commission, 2011). Once certified, it is up to the applicant's discretion whether or not to use the incentives. For example, the Fox Islands Wind Project, located in North Haven and Vinalhaven, Maine, qualified as a Community-Based Renewable Energy Project, but opted to sign a Massachusetts-based REC contract instead (Pude, 2011).

The outcome of the Community-Based Renewable Energy Act is still emerging: about 50 MW of community-based projects, ranging in size from five to 20 MW, are at various stages in the planning process (Jones, 2011).

5.5 Public land use policy

An abundant wind resource lies in Appalachia's public lands. Figure 26 demonstrates this pattern in West Virginia. These wind resources are typically unavailable, however, due to federal policy and public opinion. While the constraints of developing wind energy on public land vary widely, this section focuses on those experienced on national forest land, the primary public land designation in the region.

Figure 26: Public lands and wind resource potential



Sources: Wind resource data from AWS Truewind (2003a). Public land data from WVDNR (2004) and Natural Resource Analysis Center and WV Cooperative Fish and Wildlife Research Unit (2002).

In the eastern half of the country, the US Forest Service (USFS) controls much of the forested federal lands. In contrast to the Bureau of Land Management, which controls most federal lands in the West, USFS has only a minimally developed stance on wind. In 2005, USFS and NREL partnered to assess wind potential on national forest land (Collins, 2006).This partnership resulted in a publication, "Assessing the Potential for Renewable Energy on National Forest System Lands," (USFS and NREL, 2005) and the establishment of the Wind Energy Guidance Team, but little has been accomplished on the national level since.

Because there is no national USFS wind energy development policy, decisions about wind energy development and special use authorization permits are largely made by the administration of each national forest unit, including forest planners, district rangers, and forest supervisors. However, like their parent agency, the national forests within Appalachia have no formal policy for wind energy development. Of the five national forests in the study region—the Monongahela (West Virginia), George Washington (West Virginia and Virginia), Jefferson (Virginia), Allegany (Pennsylvania), and Daniel Boone (Kentucky)—only two explicitly address wind energy in their official forest plans. Of these two forests, one forest planner anticipated incorporating wind energy development language into the 2011 revision of the national forest plan (Landgraf, 2010), while the other mentioned the potential environmental concerns caused by wind energy (Ede, 2010).

Although federal lands may afford a strong wind resource, some members of the public believe that establishing wind turbines on federal lands is a desecration of the space. Within this study area, two groups have been particularly vocal about their opposition to wind energy development on Appalachian ridge tops.

The West Virginia Highlands Conservancy (WVHC) feels strongly about preventing wind energy from encroaching on special natural places like national forests. Wind energy has been an especially divisive issue for the group for the last decade. Its position on wind energy development in West Virginia has evolved: from universal support, to qualified support, and finally to qualified opposition. According to its Web site, WVHC "is deeply involved in the current debate about the massive wind energy facilities now coming to the Highlands. These produce green energy on the one hand, but also seriously damage the ecology and esthetics of the West Virginia highlands on the other" (WVHC, 2011). When asked about the development of wind energy on forest service lands, the WVHC president stated that the Monongahela National Forest is a "special place we pay particular attention to" (Rogers, 2010). The group maintains a general skepticism about wind energy, which is greatly enhanced when wind energy development is proposed on national forest land. Rogers predicts that constructing wind turbines on national forest land would result in a "mini-mountaintop removal site," and is consequently quite opposed (Rogers, 2010).

Virginia Wind is another environmental group that feels particularly strongly about preventing the establishment of wind energy on public land. When asked about the development of wind energy on federal land, one of the group's founders voiced the necessity of reversing the question to "why would anyone install wind energy on public lands?" (Boone, 2010). Boone calls into question the underlying principle that a private individual should benefit from the use of a publicly held good. Secondarily, Boone calls for an examination of the costs and benefits of alternatives to wind turbines on top of mountains, like the capacity for wind offshore or in western states. Thirdly, Boone would like to see measurements of the magnitude and cumulative environmental effects of wind turbines, including habitat fragmentation from road and substation construction, deforestation, and altered migration patterns of birds and bats.

Opinions expressed by these two organizations provide an indication of the potential divisiveness of siting wind farms on national forest land, and help explain the hesitancy of forest planners to pursue wind development ahead of an explicit nationwide USFS policy.

Due to the barriers of siting wind projects on public land, NREL wind resource estimates explicitly exclude the wind resource on these lands. This amount can be a substantial percentage of the total wind resource, depending on the state.

5.6 Summary: Barriers and solutions

While the RPSs in the Appalachian states considered in this report incentivize the development of wind energy along with other renewables, only three are mandatory. Two—West Virginia and Pennsylvania—include alternative fossil fuel technologies in addition to renewables, further reducing their effectiveness at incentivizing wind development. None include provisions that incentivize wind over other renewables.

In Appalachia, there is little incentive to develop distributed wind projects, except for net metering policies and the funding mechanisms described in Section 6.3. Likewise, the states in this region do not provide specific incentives for community wind.

Siting wind projects on public lands, and particularly in national forests, is unlikely at least in the near future. This preserves ecologically valuable land, which often overlaps with areas of high wind resource (see Section 3.3), and also limits the total amount of land area with viable wind resource that can be developed.

Several policy changes could help promote the development of wind in Appalachia:

1. **Strengthen the existing RPSs in the region.** RPSs could be strengthened in several ways. First, Virginia's RPS can be made mandatory. Second, wind carve-outs would likely incentivize the generation of additional electricity from wind. More specifically, carve-outs for community wind, such as that found within Maine's Community Based-Renewable Energy Act, should be considered.

2. **Create an RPS in Kentucky.** One of the most effective ways for increasing the development of wind generation in Kentucky would be to create an RPS for the state, particularly if it did not include fossil fuels and if it included a carve-out for wind. Because the state does not currently have an RPS, it may be easier to incorporate measures to bolster community and distributed wind within a potential RPS as compared with other states with existing RPSs. A proposed RPS could also include the prioritization of the purchase of community and distributed wind through, for example, the use of REC multipliers. In addition, it could create a voluntary option for consumers to pay a premium for electricity generated from these sources.

3. **Strengthen existing net metering policies in the region.** Caps on net metering tend to limit the usefulness of these policies. In addition, while Pennsylvania requires that IOUs provide net metering to consumer-generators, this policy could be expanded so that public utilities would be required to provide net metering as well. This could greatly increase the development of distributed wind generation. Also, aggregate capacity limits for net metering should be expanded. Maryland, for example, has an aggregate capacity limit of 1,500 MW; raising this limit would create long-term incentives for the continual development of distributed generation. In Virginia, raising or eliminating the 1% peak-load cap would likewise encourage more development of distributed wind systems. And while Kentucky does have a net metering policy, it is only available to consumer-generators who utilize photovoltaic solar panels to generate electricity. If this program were expanded to include electricity from wind or other renewable sources, it would incentivize the development of distributed wind projects.

4. **Create policies supportive of community wind.** Policies could be modeled after the Minnesota's C-BED and Maine's Community Based-Renewable Energy Act. This could come in the form of requiring state utilities to prioritize the purchase of electricity generated by community-owned wind facilities as well as giving utility consumers the option to purchase power from these sources at a premium. Additionally, community owned wind farms could be granted fixed rate long-term PPAs or REC multipliers to ensure economic stability and viability. Policies can also include funding or tax incentives specifically for community wind development.

5. **Institute a REC multiplier for community and distributed wind.** Both community and distributed wind facilities would also benefit from the implementation of a REC multiplier, whereby a unit of electricity generated by community or distributed wind would receive more than one REC.

6. **Incentivize the further development of green pricing.** Green pricing is not available across the entire five-state region. For example, while presently available for AEP customers in southern West Virginia, green pricing is not yet available for Allegheny Energy customers in northern West Virginia. In addition, it would be beneficial to learn the lessons of why green pricing is so successful in Maryland and Pennsylvania, so that these lessons can be applied to Virginia, West Virginia, and Kentucky.

6. ECONOMICS

If not motivated by political mandate or consumer demand, the presence of wind energy will, in large part, be determined by its price competitiveness on the retail electricity market and profitability on the wholesale electricity market. The retail market includes power prices that electricity consumers face, which are also those that electric utilities are allowed to levy based on electricity generation costs and government regulation. The wholesale market includes power prices that wind developers take as power producers. Wholesale power prices ultimately determine the profitability of a given wind project. In-state policies have a direct effect on both retail and wholesale power prices, and therefore on the development of wind projects within our region.

While these markets are important, government funding for wind projects helps project developers and investors make returns on their investments. The flow of sufficient benefits to local communities, in addition to outside developers and investors, is important in gaining local support.

6.1 Coal-fired electricity in the retail market

In the most basic terms on the retail market, coal competes with wind as an energy source.[41] In strictly economic terms that exclude environmental, social, and community-level impacts, coal provides the most affordable energy source for electricity for much of the US. Until recently, electricity from coal continued to be cheap, and the wind industry was only just beginning to take hold in the US. Therefore, the cheapness of coal has served as a barrier to wind development in the US and Appalachia.

Throughout the US, coal is abundant. According to EIA, the country has 261.6 billion tons of estimated recoverable coal reserves, and 17.5 billion tons of coal reserves at actively producing mines (EIA, 2010g)—enough to last for about 16 years at 2008 production rates (EIA, 2010b). Twenty-four states produce coal, and there are major coal-producing basins the East, Midwest, and West. As a result of the abundance of coal, coal serves as the primary fuel for electricity in the US, accounting for a greater portion of the US electricity portfolio (48%) than natural gas, nuclear, and hydroelectric power combined (47%) in 2008 (EIA, 2010a).

Despite its abundance, several factors have caused the cost of mining coal to increase substantially in recent years, leading to higher electricity prices. These factors include declining coal quality and productivity per miner and the implementation of more stringent air quality standards. Consequently, coal's competitiveness as a fuel—particularly in the Appalachian region—has begun to decline (McIlmoil and Hansen, 2010). Other sources of baseload generation—especially natural gas—are being developed, while, in total, renewable sources of energy such as wind are being developed at a faster rate than coal (EIA, 2010h). Despite these trends, coal continues to provide nearly half of the nation's electricity, and new coal-fired plants continue to be developed. The "cheapness" of coal-fired electricity remains a barrier to wind development, particularly in coal-dependent states in Appalachia.

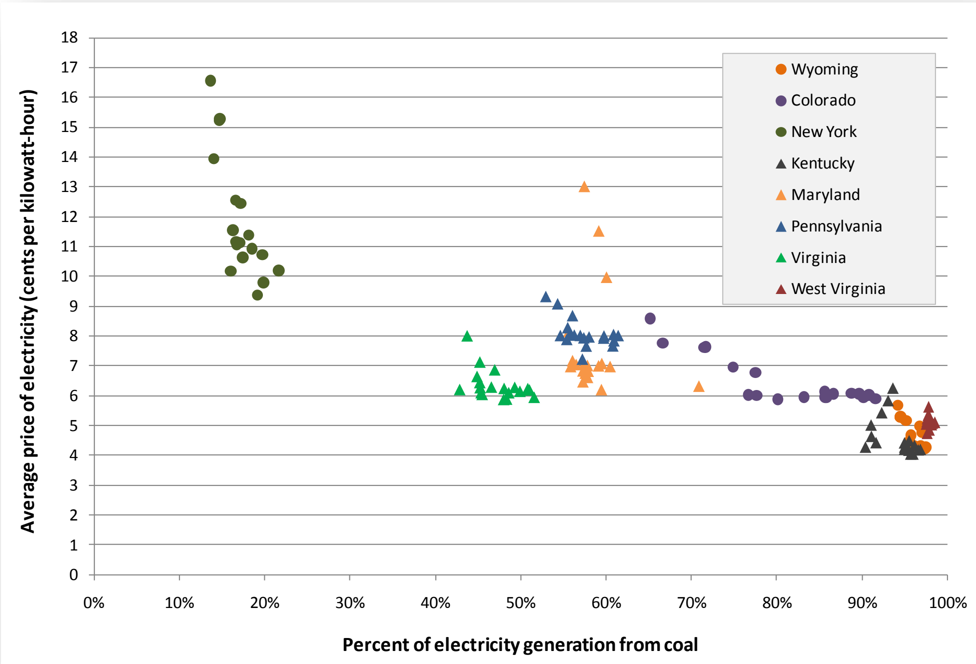
Figure 27 illustrates the relationship between electricity prices and the consumption of coal for electricity for the five Appalachian and three non-Appalachian states in our study. As shown, a greater reliance on coal is generally correlated with lower electricity prices.

Table 9 ranks all 50 states in terms of electricity price and percent generation from coal. The top two coal-producing states in the nation—West Virginia and Wyoming—rank first and third for reliance on coal for electricity generation and also have the lowest electricity prices. Several other factors beyond a state's reliance on coal also affect electricity prices. For example, due to transport costs, electricity generators in states that import coal will tend to pay more for their coal than generators with coal mines close by. Higher coal prices for generators tend to lead to higher electricity prices for consumers. Also, consumers in states

[41] Questions remain about what proportion of baseload generation from coal can ultimately be displaced by wind.

that import electricity will tend to pay more than consumers in states that generate their own electricity due to the cost of transmission. Ohio and Maryland fall into this category (see Table 9).

Figure 27: Electricity prices and dependency on coal for electricity generation, 1990-2008



Source: Average price of electricity from EIA (2010e); percent of electricity generation from coal from EIA (2010a). Non-Appalachian states are represented by circles, while Appalachian states are represented by triangles.

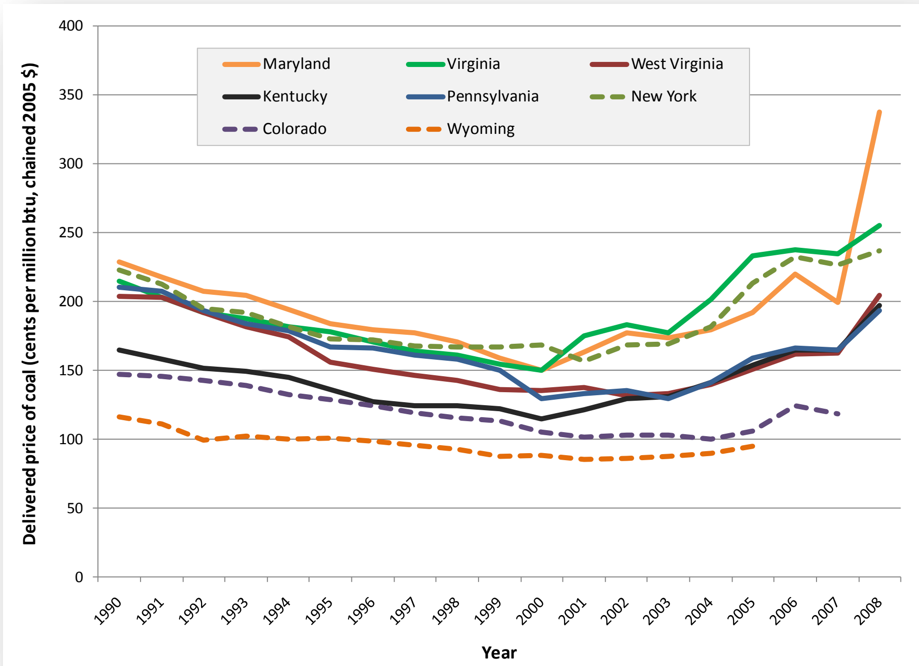
Table 9: State rankings for electricity prices and percent generation from coal, 2008

State	Avg. elec. price (cents/kWh)	Rank	Percent gen. from coal	Rank
West Virginia	**5.61**	**1**	**97.8%**	**1**
Wyoming	**5.67**	**2**	**94.2%**	**3**
Idaho	5.69	3	0.8%	48
Kentucky	**6.26**	**4**	**93.6%**	**4**
Utah	6.49	5	81.6%	7
Washington	6.55	6	7.9%	44
Nebraska	6.58	7	66.3%	13
North Dakota	6.69	8	90.6%	5
Missouri	6.84	9	80.8%	8
Iowa	6.89	10	76.1%	9
Indiana	7.09	11	94.2%	2
South Dakota	7.14	12	51.7%	24
Oregon	7.23	13	6.9%	45
Kansas	7.45	14	72.9%	11
Arkansas	7.60	15	47.4%	28
Montana	7.72	16	61.9%	18
Minnesota	7.79	17	58.0%	21
Oklahoma	7.81	18	47.6%	27
South Carolina	7.85	19	41.1%	30
North Carolina	7.96	20	60.5%	20
Virginia	**8.00**	**21**	**43.7%**	**29**
Tennessee	8.18	22	62.9%	16
New Mexico	8.35	23	73.0%	10
Ohio	8.39	24	85.2%	6
Colorado	8.59	25	65.2%	15
Alabama	8.59	26	51.1%	25
Georgia	8.84	27	62.8%	17
Michigan	8.94	28	60.7%	19
Mississippi	8.99	29	34.6%	33
Wisconsin	9.00	30	65.7%	14
Arizona	9.11	31	36.7%	31
Illinois	9.26	32	48.4%	26
Pennsylvania	**9.32**	**33**	**52.9%**	**23**
Louisiana	9.44	34	26.1%	35
Nevada	9.89	35	22.3%	37
Florida	10.74	36	29.5%	34
Texas	10.99	37	36.3%	32
Vermont	12.33	38	0.0%	50
Delaware	12.36	39	70.0%	12
California	12.48	40	1.1%	47
Maryland	**13.00**	**41**	**57.5%**	**22**
Maine	13.83	42	2.1%	46
New Jersey	14.44	43	14.2%	41
New Hampshire	14.65	44	15.1%	38
Alaska	14.73	45	9.1%	43
Rhode Island	16.01	46	0.0%	49
Massachusetts	16.27	47	25.0%	36
New York	16.57	48	13.7%	42
Connecticut	17.79	49	14.4%	40
Hawaii	29.20	50	14.5%	39

Sources: Average price of electricity from EIA (2010e); percent of electricity generation from coal from EIA (2010a). Note: Price ranked from low to high; percent generation ranked from high to low.

As illustrated by Figure 28, the delivered price of coal for electric utilities has been rising since around 2000—more substantially for states that import a substantial amount of their coal, such as Maryland, Virginia, and New York. However, even the high coal-producing Appalachian states of Kentucky, Pennsylvania, and West Virginia have experienced strong increases in delivered coal prices. For these states, the primary factor has been rising production costs associated with sharp declines in productivity.

Figure 28: Average delivered price of coal to electric utilities for select states, 1990-2008



Source: EIA (2010i).

Rising costs for utilities are largely passed on to consumers, resulting in rising electricity prices across the US, even in coal-producing and coal-reliant states. In Appalachia, AEP, the largest producer of electricity in the region and a provider of electricity to numerous states, has been requesting and receiving substantial rate increases in each of its customer states. The approved increases include a 12.1% annual rate increase over four years for West Virginia customers. Allegheny Power has also requested a non-fuel base rate increase of 12-14%, along with a separate 7% increase for recovering fuel costs (Kasey, 2009). Likewise, the East Kentucky Power Cooperative was granted three consecutive rate increases from 2007 to 2009 of $19 million, $12.3 million, and $59 million, resulting in a 7% increase in electricity rates, and it has been reported that East Kentucky Power Cooperative intends to apply for additional rate increases in the near future (Sanzillo, 2009).The primary reason given for each of the noted rate increases, except for the East Kentucky Power Cooperative, was to recoup unexpected costs related to higher coal prices over the past few years. However, the cost of coal consumed by the East Kentucky Power Cooperative increased by 33% over the same period, so it is likely that some portion of the rate increases were related to rising fuel prices (Sanzillo, 2009).

While current electricity prices for coal may, to some extent, serve as a barrier to wind development, future prices for the development of coal and wind should be considered as well. Trends show wind projects providing a greater proportion of new generating sources in recent years, and EIA projections of development costs for new sources of electricity in 2016 suggest that coal-fired generation will continue to maintain its competitive advantage over wind as a more economical source of energy. Table 10 provides EIA’s projected levelized costs for new development of various plant types for 2016. According to the projections, all forms of coal-based generation will be cheaper to develop than wind power (EIA, 2010j).[42] Still, EIA reports that planned generating capacity additions from wind power for 2008 through 2013 are nearly double those from coal (EIA, 2010h).[43]

Table 10: Estimated United States average levelized costs for new generation sources in 2016

Plant type	Total system levelized cost (2008 $/MWh)
Coal	
Conventional coal	100.4
Advanced coal	110.5
Advanced coal with carbon capture and storage	129.3
Natural gas	
Conventional combined cycle	83.1
Advanced combined cycle	79.3
Advanced combined cycle with carbon capture and storage	113.3
Conventional combustion turbine	139.5
Advanced combustion turbine	123.5
Nuclear	
Advanced nuclear	119.0
Wind	
Onshore	149.3
Offshore	191.1
Other renewables	
Solar photovoltaic	396.1
Solar thermal	256.6
Geothermal	115.7
Biomass	111.0
Hydro	119.9

Source: EIA (2010j).

6.2 Wind-powered electricity in the wholesale market

Average wholesale power prices in the US strongly impact the pace and degree of wind development. When average wholesale power prices are high relative to wind power prices, the incentive for wind development is relatively stronger. Conversely, when prices are low, the pace of new wind development is reduced. Rising development costs increase the minimum power price required for rendering a potential wind project economically feasible.

According to USDOE, 2008 to 2009 was marked by a sharp drop in wholesale power prices combined with a continued rise in the development cost for wind power projects (USDOE, 2010d). For instance, among a

[42] According to EIA, "The key factors contributing to levelized costs include the cost of constructing the plant, the time required to construct the plant, the non-fuel costs of operating the plant, the fuel costs, the cost of financing, and the utilization of the plant" (EIA, 2010j, p. 1).

[43] As discussed earlier, the typical capacity factor for wind is significantly lower than the typical capacity factor for coal. This comparison therefore reflects the difference in capacity, not in expected electricity generation.

sample of projects surveyed that were installed in 2009, "the capacity-weighted average 2009 sales price for bundled power and renewable energy certificates...was $61/MWh (in 2009 dollars), up from an average of $51/MWh for sample projects built in 2008, and nearly double the average price of $32/MWh among projects built during the low point 2002 and 2003" (USDOE, 2010d, p. vi). The reasons for the increase in wind power prices include:

- "decline in the value of the U.S. dollar relative to the Euro" (USDOE, 2010d, p. 47);
- "shortages in certain turbine components" (USDOE, 2010d, p. 47);
- "increased materials and energy input prices" (USDOE, 2010d, p. 47) due to a significant rise in material costs, such as steel and copper, as well as transportation fuels; and
- the "yearly boom-and-bust cycle… caused by periodic short term extensions of the federal production tax credit" (USDOE, 2010d, p. 4).

At the same time as wind power prices have been rising, there has been a sharp drop in national wholesale electricity prices, partially due to the recession, but primarily due to lower natural gas prices resulting from the discovery and development of shale gas deposits (USDOE, 2010d). This provides a significant challenge to the future of wind development in Appalachian states because average wholesale power prices in Appalachia are likely to decline as development of Marcellus Shale natural gas resources expands, "putting the near-term comparative economic position of wind energy at some risk" (USDOE, 2010d, p. 41).

However, according to USDOE, "there are expectations…that average costs [of wind power] will decline over time as the cost pressures…that have challenged the industry in recent years ease" (USDOE, 2010d, p. vii). Should this prove to be the case, then the required power price for making wind projects economically feasible to develop will fall as well, thereby reducing any gap between average wind power prices and average wholesale power prices from all sources.

6.3 In-state funding for wind development

State spending on wind varies significantly within our region. Federal programs for wind production and investment tax credits also significantly stimulate wind development (Bird et al., 2003), but they are not examined here because of their universal application to all five states.

Financing, including loans and grants compatible with wind development, is a part of renewable energy development in the states with the most successful programs. The funds established financed by IOUs in Pennsylvania, and the fund that aggregates an assessment on retail energy customers in New York, are two of the most developed examples of state-facilitated funding. Most Appalachian states in this study have a common concern over the cost of electricity to the consumer. Following this sentiment, Kentucky, Maryland, and West Virginia have not established programs to assess a premium on electricity rates to support the development of renewables.

6.3.1 *West Virginia*

West Virginia has a direct funding incentive program called the Direct Loan Program, which is run through the West Virginia Economic Development Authority (WVEDA), and which provides financial assistance for financing fixed assets for "business classifications currently targeted by the West Virginia Development Office meeting WVEDA's job creation criteria; this includes any renewable energy project" (USEPA, 2008a). WVEDA's program provides grants from $50,000 to $10 million, or 40% of eligible costs (USEPA, 2008a).

Tax incentives in West Virginia include the Special Assessment for Wind Energy Systems program, which lowers the property tax value for wind turbines and towers upon which turbines are affixed. Up to 79% of the total value of these components are classified as pollution control facilities, and are therefore assessed at salvage value: 5% of original cost.[44]

Additionally, there is a tax exemption for wind energy generation program that "lowers the Business and Operation (B&O) Tax on utilities using wind-power generation. For most types of electricity-generating units, the B&O tax is 40% of the generating capacity; the B&O tax on a wind turbine is 12% of the generating capacity of the turbine" (USEPA, 2008a). These tax provisions have benefitted commercial wind development. The Mountaineer project, for example, was able to move forward partly because the West Virginia Legislature made adjustments to two tax laws in 2001 that leveled the playing field for wind energy developers. Prior to these adjustments, wind energy generators would have had to pay three to four times the amount of tax on a per-kWh basis compared to coal generators. These adjustments had a direct influence on the development of wind projects: "Without these changes to the state's tax policy, the Mountaineer Wind Energy Center likely would not have been completed" (DeWolf, 2003; as cited by Bird et al., 2003).

Notwithstanding the reduction in property taxes and state B&O taxes, tax revenue and job creation are regularly cited by WVPSC as a basis for approving applications for wind turbine construction.

6.3.2 *Pennsylvania*

Since 2005, Pennsylvania has stood out as an entrepreneurial facilitator of energy development. State government utilized the restructuring of its electric energy market to seek expansion of a market in "alternative" fuels and as an opportunity to increase jobs, businesses, and economic investment. As part of restructuring its electricity portfolio and market through the Alternative Energy Portfolio Standards Act, Pennsylvania chose to generate funds for programs that foster public investment in energy generation and system manufacturing. By 2008, the Commonwealth had packaged its policy and funding programs as they pertain to wind energy, announcing the creation of the Wind Energy Supply Chain Initiative. Designed to attract wind energy manufacturers and suppliers from around the globe, this initiative sought to create the largest wind energy supply chain on the east coast of the US.

Pennsylvania's comprehensive strategy to foster energy development includes strategic public/private partnerships, utilization of its university technology incubators, and the leveraging of its public resources. For example, in 2005 Pennsylvania designated 1,259 acres of a brownfield near Philadelphia as one of 12 Keystone Opportunity Improvement Zones, a designation that allows companies that move to the zone to apply for exemptions from certain state and local taxes. The Fairless Hills site, once the home of a steel industry complex, is now a renewable energy manufacturing center. The Commonwealth designed an incentive package for each renewable energy manufacturing facility through the Governor's Action Team, a "one-stop" facilitator for business development. The two largest renewable energy tenants on the site are Gamesa Wind US, a wind turbine manufacturer, and AE Polysilicon, a producer of the raw material used in the manufacturing of photovoltaic solar panels.

The Commonwealth's initiatives to capture economic growth from the energy sector stretched to international markets as well. Early in 2008, officials with the Pennsylvania Department of Community and Economic Development travelled to Germany to persuade wind energy parts manufacturers to locate their US operations in Pennsylvania. The initiative leveraged business for Pennsylvania manufacturers so that they could participate in the wind energy supply chain. Shortly after that expedition, the Commonwealth established the German American Dialog on Renewable Energy, a business center for small- and medium-sized German companies in Philadelphia. This center was established to expose German companies to consultants, service providers, and investors from the renewable energy sector. "The market for renewable

[44] W.Va. Code §11-6A-5a

energies will grow, but competition among states will be fierce. Manufacturing follows markets, so development is critical, and we have to think and support the whole thing from the supply chain side to the policy side" (Hopkins, 2008).

In July 2008, Pennsylvania enacted a broad $650 million alternative energy bill designed to provide additional funding for a variety of renewable energy and energy efficiency technologies. The legislation authorized the creation of a grant and loan program for alternative energy and clean energy production projects jointly administered by the Pennsylvania Department of Community and Economic Development and PDEP, under the direction of Commonwealth Finance Authority. Under the program, incentives are available to businesses (including nonprofits), economic development organizations, and political subdivisions such as local governments and schools.

In 2009, Governor Edward G. Rendell announced Pennsylvania's Renewable Energy Program and made $25 million available, in the form of loans and grants, to support wind and geothermal energy projects in Pennsylvania, both system manufacturing as well as actual projects. Loans and grants were made to businesses that created jobs, such as $35,000 loans or $5,000 grants per job to component manufacturers of renewable energy generation equipment. Grants for wind energy generation or distribution projects up to $1 million were also awarded.

Earlier, the Pennsylvania Energy Development Authority was created as part of the Growing Greener initiative, approved by voters in 2005. The Authority, which was closed as a funding source in 2010, spent Commonwealth dollars and leveraged federal money for approximately $52 million in energy-related projects. In 2010 alone, it invested in 40 diverse energy projects estimated to generate or save the equivalent of more than 10 billion kWh of electricity, with reduced carbon emissions of nearly 9 million tons. The majority of the investment was in solar-related industry and generation. The maximum grant under the program was $1 million, and the average grant was approximately $375,000.

6.3.3 *Maryland*

Funding for wind projects in Maryland is collected in several ways. Fees for non-compliance with Maryland's RPS and proceeds from the upcoming auction of carbon allowances to electric power plants under the Regional Greenhouse Gas Initiative[45] are estimated to generate between $80 and $140 million annually for renewables; these funds are invested in a wide range of clean and renewable energy projects and programs, as are proceeds from one of the nation's first carbon taxes.

In addition to providing dollars to offset start-up costs, Maryland offers direct funding incentives for residents who install wind energy systems that have at least 1.5 kW of capacity. These funds, in the form of a limited number of grants ranging from $1,500 per kW (up to $5,000 total), are available through the Windswept Grant Program (USEPA, 2008b). Tax incentives are also available through the Clean Energy Production Tax Credit that provides individuals and corporations a tax credit for "electricity generated by qualified resources of 0.85 cents/kWh" (Maryland Energy Administration, 2011). Maryland does not have any technical assistance programs in place to aid in the development of community-based wind systems.

[45] The Regional Greenhouse Gas Initiative "is the first mandatory, market-based effort in the US to reduce greenhouse gas emissions, [requiring that] ten Northeastern and Mid-Atlantic states… reduce CO_2 emissions from the power sector by 10% by 2018" (Regional Greenhouse Gas Initiative, 2011).

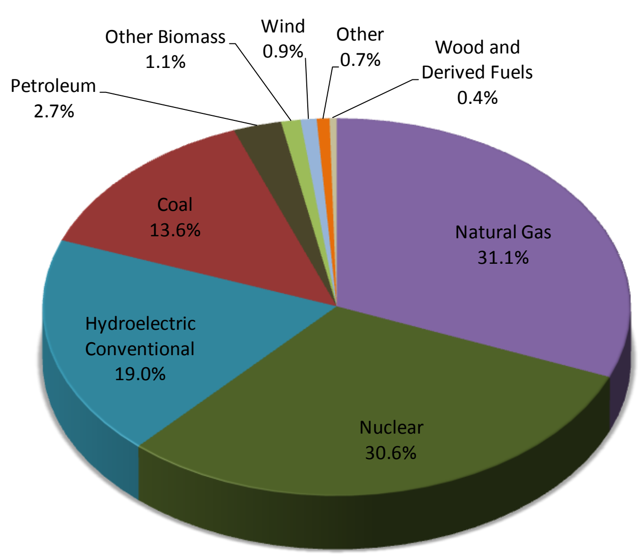
SNAPSHOT: In New York, consumer-driven market demand rules

New York's electricity portfolio is highly diverse, consisting of natural gas, nuclear, conventional hydroelectric, coal, petroleum, biomass, wind, and others. The State's renewable energy portfolio initiative is driven by consumer demand. The State created a centralized energy acquisition and development agency, NYSERDA, which is responsible for fostering steep growth in renewable energy. NYSERDA supports renewable energy generators and assesses every energy consumer a fee for renewable energy development. NYSERDA uses these funds to incentivize renewable energy producers who operate on the New York wholesale market, or to assist customers in installing distributed renewable energy systems "behind the meter."

NYSERDA has supported extensive wind resource prospecting efforts in central, western, and northern New York. As a result of NYSERDA involvement, two wind plants totaling 41.5 MW were located in Madison County, New York. Their success paved the way for wind development at additional locations throughout the state. NYSERDA credits these wind projects with supporting early-stage green marketing efforts, improving regional air quality, and providing economic stimulus to communities interested in renewable resource development (NYSERDA, 2004a). Another NYSERDA wind project currently under construction would total 425 MW.

New York does not produce coal, but its mountainous terrain makes it a good comparison state for the other Appalachian states considered in this analysis. New York provides an instructive model of increased renewables—including wind—via consumer-driven market demand.

Figure 29: Net generation by fuel and energy source for New York, 2008



6.3.4 *Virginia*

Virginia does not offer funding for wind energy development. In contrast, the Commonwealth does authorize up to $4.5 million per year to encourage the production of photovoltaic panels. Also, any county, city, or town is authorized to exempt or partially exempt solar energy equipment or recycling equipment from local property taxes.[46] The presence of these two resources for solar energy developers lies in stark contrast to the absence of funding resources for wind energy developers.

6.3.5 *Kentucky*

Kentucky provides a tax credit of up to 100% of Kentucky income tax for owners of renewable energy facilities with a capacity of at least 1 MW. The tax credit is limited to projects that have $1 million in capital and non-capital costs, provided that recovered expenditures from all incentives do not exceed 50% of the capital investment (North Carolina State University and Interstate Renewable Energy Council, 2010). This approach is aimed at commercial or industrial wind generators, and may not be used to develop wind by municipal- or county-owned utilities.

Another tax incentive in place is a derivative of the Kentucky Environmental Stewardship Act Tax Credit, which "provides companies manufacturing environmental stewardship products (which could include the installation of renewable energy facilities) with 100% tax credit against the tax liability generated by the project" (USEPA, 2008c). This program is only available for projects that develop on contaminated lands or brownfields. It is unlikely that community landowners or nonprofit entities without tax liability would have access to these lands for development.

6.4 Insufficient local benefits

In addition to altering the price competitiveness of wind power on the retail electricity market and profitability of wind power on the wholesale market, economic incentives may affect the receptivity of nearby residents to wind projects.

Existing research suggests that successful local resistance to wind development "is strongly related to an unacceptable balance between local costs and local benefits" (Kildegaard, 2010, p. 3). In other words, local costs—like those incurred due to impacts to the viewshed and environment—could perhaps carry less weight for local residents were the benefits of wind development greater and/or more tangible for the residents. Should the benefits fail to be distributed fairly and somewhat equally among local stakeholders, then it is likely that local opposition would be stronger.

We define "local" as including the county government or county residents. States often earn some revenues associated with wind farms, such as from personal income taxes and, more directly, from B&O taxes such as in West Virginia. These revenues flow to the state government, and cannot be considered "local" benefits.

It is often the case, particularly with wind projects proposed or developed in Appalachian states, that the "local" representative is the county government, rather than local residents. In this case, local residents may or may not be directly involved in the negotiations between the county government and the developer, nor directly benefit from the construction and operation of a wind farm. Conversely, local residents may play a significant role in negotiations and earn direct economic benefits—and could indeed be the primary negotiators—when a local collaborative has been established among multiple landowners, each with a direct stake in the proposed project. Such a collaborative can help ensure that any final agreement with a developer appropriately benefits all interested landowners.

[46] Va. Code § 58.1-3661

There is a question as to what constitutes a sufficient local benefit. A benchmark for measuring sufficiency can be exemplified, for instance, by the amount of foregone property tax revenues when a deal is struck between the wind developer and county government for payment in lieu of taxes. This often occurs in order to protect the landowner leasing his or her property for a wind farm from having to bear the responsibility of tax payments (Caffyn, 2010). This type of local benefit may not address subjective costs to local residents including alterations to the view, environment, or larger community. Another possible benchmark for measuring sufficiency is to compare property tax revenues or payments in lieu of taxes for a particular project to agreements made in association with wind projects elsewhere—either in another county or another state. A third measure of sufficiency could be whether a structure exists for distributing benefits among the locally represented population.

Regardless, it is difficult to determine what constitutes a sufficient local benefit, and perhaps even complicated to define who the local stakeholders are. The question to ask may be whether or not the local benefits have been maximized, given the conditions surrounding a proposed project**.** However, it is commonly assumed that local economic benefits from wind farms exist in the form of landowner lease payments and property tax revenues, which, combined, represent approximately 5.1% of the project cost (Ault, 2006). "Other economic benefits do exist, but apart from the relatively rapid period of project construction, wind generation is not particularly labor-intensive, and many turbine manufacturers source the bulk of components abroad" (Ault, 2006, p. 3).

Regarding maximization of property taxes (or payments in lieu of taxes), it is instructive to consider the comparison between revenues gained in different states and regions. Property tax payments vary widely, ranging from $1,400 to $11,000 per MW of installed capacity (Ault, 2006). While a Texas county may receive $10,000 per MW and a West Virginia county may only receive $3,400 per MW, this does not necessarily mean that the local benefits are skewed. The wind farm in Texas may have been cheaper to construct and perhaps might generate more electricity due to a stronger wind resource, meaning that the wind farm is likely to generate greater revenue and thus would be able to contribute a greater payment per MW to the county government. However, this does not mean that the local benefits were maximized in either case. Additionally, "while it is tempting to simply compare tax rates between states, it is equally important to understand differences in existing tax structures and the intent of local tax policy" (Ault, 2006, p. 2).

Maximization of local benefits can occur in a few ways. First, wind projects can be locally owned, with the associated revenues remaining within the local area and the jobs employing local residents. Existing research shows that community-owned projects elicit greater local benefits in terms of jobs and revenues than corporately owned projects (Kildegaard, 2010). In comparison to corporately-owned projects, where revenues do not necessarily (or often) remain in the local community and wind technicians are commonly imported, community ownership could help maximize local benefits.

Also, county governments could require wind developers to go above and beyond merely a payment of tax revenues or a standard payment in lieu of taxes by funding other economic development, social, or environmental projects. For instance, 61% of the payments in lieu of taxes for the Mountaineer Wind Energy Center in Tucker County, West Virginia are being distributed to the county Board of Education (Tucker County Commission, 2007). This does not necessarily represent a "maximization" of benefit in financial terms, but it does serve to more equitably distribute the revenues so as to ensure that the a broad range of local residents benefit from the project. Additionally, the current level of payment being made to Tucker County has increased since the original agreement, with the per-turbine payment now at $2,273 per MW (Tucker County Commission, 2007). This is roughly comparable to property tax or in-lieu payments from other wind farms in West Virginia (Kasey, 2006).

Another project in West Virginia, Liberty Gap in Pendleton County, was expected to bring an even better deal: $3,150 per MW plus an annual "community partnership grant" to the county in the amount of $110,000-$125,000 per year (Kasey, 2006).

Regardless of the question of sufficiency, research suggests that local benefits from wind farms, even when accounting for potential negative impacts on tourism and property values, could be positive. For instance, a study commissioned by the Tazewell County Commission in southwest Virginia found that a 60 MW wind farm proposed by BP Energy and Dominion Power could benefit the local economy through increased local government revenue and the creation of new jobs. The study estimated that total sales and property tax revenues generated directly and indirectly as a result of the project would total $9.2 million over 20 years. The study assumed, "with no defined evidence of impacts," a negative impact on county tourism and residential property values. Despite those assumptions, the study concluded that the net impact of the proposed project over 20 years amount to a benefit of $6 million, or approximately $300,000 per year. Additional benefits not included in the net benefit calculation were the taxable investments in infrastructure improvements, electrical connections, and related equipment associated with the development of the project (Springstead, Inc., 2009).

6.5 Summary: Barriers and solutions

The availability of price incentives and financing for wind energy developers and consumers varies throughout our region. By far, Pennsylvania has the most aggressive funding strategy, and Virginia has the least. Pennsylvania even went so far as to subsidize wind project component manufacturing in-state and to recruit international interest in the process.

Funding strategies may alter the affordability of wind energy on several levels. Increasing the price competitiveness of wind in comparison to other electricity sources makes wind more affordable on the retail electricity market. Subsidizing the start-up costs for wind projects makes wind more affordable on the wholesale electricity market. State-based funding can affect both of these markets via tax incentives, provision of low-interest loans, or other project financing. Any form of project funding can have a significant impact on the likelihood of project development and long-term viability.

In addition to the various funding mechanisms enumerated in our state-specific sections above, several policy and economic tools can support wind development in the volatile retail and wholesale price market. Potential solutions include:

1. **Establish feed-in laws or tariffs.** Feed-in laws guarantee a fixed price for electricity generated from wind projects. However, rather than being project-specific, feed-in rules apply at the state level. Feed-in laws require utilities to purchase electricity from renewable sources, such as wind.

2. **Invest in the expansion of domestic manufacturing of wind turbines and components.** According to USDOE, "expected future reductions in wind energy costs would come partly from expected investment in the expansion of manufacturing volume in the [domestic] wind industry" (USDOE, 2008, p. 28). Programs are already underway in Appalachian states to help manufacturers tap into this growing market. For example, the West Virginia Manufacturing Extension Partnership's Wind Industry Supply Chain Initiative seeks to work with manufacturers to develop the capacity to supply wind turbine components (West Virginia Manufacturing Extension Partnership, 2011).

3. **Establish subsidies to reduce capital costs on the front end of wind projects.** Wind projects in Appalachia have high capital costs due to the region's mountainous terrain. To help overcome the price competitiveness of other electricity sources in Appalachia, wind projects may require the provision of capital cost subsidies.

4. **Develop a stable market for RECs.** If developers are guaranteed a stable renewable energy wholesale market, they will be more likely to front the initial high costs required of a wind project in Appalachia. Therefore, a stable REC market will encourage project developers to undertake the substantial capital cost burden. REC multipliers for community and distributed wind projects would make it more profitable to build these types of wind projects.
5. **Offer wind-specific funding mechanisms.** Virginia has solar-specific tax exemptions and funding programs. Wind-specific programs of a similar nature would contribute to the overall profitability of wind energy throughout the region. In addition, existing direct funding incentives in Appalachia could also be expanded to favor community-based wind.
6. **Revise current tax-based wind energy incentives so that benefits are primarily available to non-absentee land-owners.** This measure could be implemented within existing tax structure. For example, Kentucky tax credits could exempt wind turbines and related equipment from property tax evaluation for local landowners who are developing distributed or community wind projects. An increase in property tax incentives for community and distributed wind could be achieved by exempting—or accelerating the depreciation of—wind turbines and related equipment.
7. **Establish incentive programs specifically targeted at small wind.** New York State has established the On-Site Small Wind Incentive Program, which provides up to $150,000 per site in incentive payments for eligible new small wind systems. The payments are provided to an eligible installer of wind system models and the rebate is passed on to the site owner (NYSERDA, 2004b). Similar programs can be established in Appalachia.

7. CONCLUSIONS AND KEY FINDINGS

As discussed earlier, USDOE has described a scenario in which the country can generate 20% of its electricity from wind by 2030. It concluded that the country's wind resources are sufficient, but noted that major challenges would need to be overcome such as improvements to the transmission system and a reduction in the capital costs of wind turbines. (USDOE, 2008)

This 20% by 2030 scenario does not assume that each state would generate the same amount of electricity from wind. However, it does provide capacity ranges by state, based on a number of assumptions. As shown in Table 11 in the column labeled "20% by 2030 scenario (range)", the five states considered in this report would need to install 8,100 to 26,000 MW of wind capacity in this scenario.

Table 11: Appalachian coal state wind capacity in 20% by 2030 scenario (MW)

State	20% by 2030 scenario (range)	20% by 2030 scenario (average)	Current and expected projects	Percent of capacity in 20% by 2030 scenario
West Virginia	1,000-5,000	3,000	910	30%
Pennsylvania	1,000-5,000	3,000	941	31%
Maryland	1,000-5,000	3,000	150	5%
Virginia	5,000-10,000	7,500	38	1%
Kentucky	100-1,000	550	0	0%
Total	**8,100-26,000**	**17,050**	**2,039**	**12%**

Source: Range in 20% by 2030 scenario from USDOE (2008). These capacities include off-shore wind. Percent of capacity in 20% by 2030 scenario calculated as capacity of current and expected projects divided by the average capacity in the 20% by 2030 scenario

Although wind capacity has increased substantially in the study area, current and expected wind projects in our region only comprise 2,039 MW. When compared with the average capacity outlined in the 20% by 2030 scenario, the current and expected projects across the region provide 12% of the capacity required.

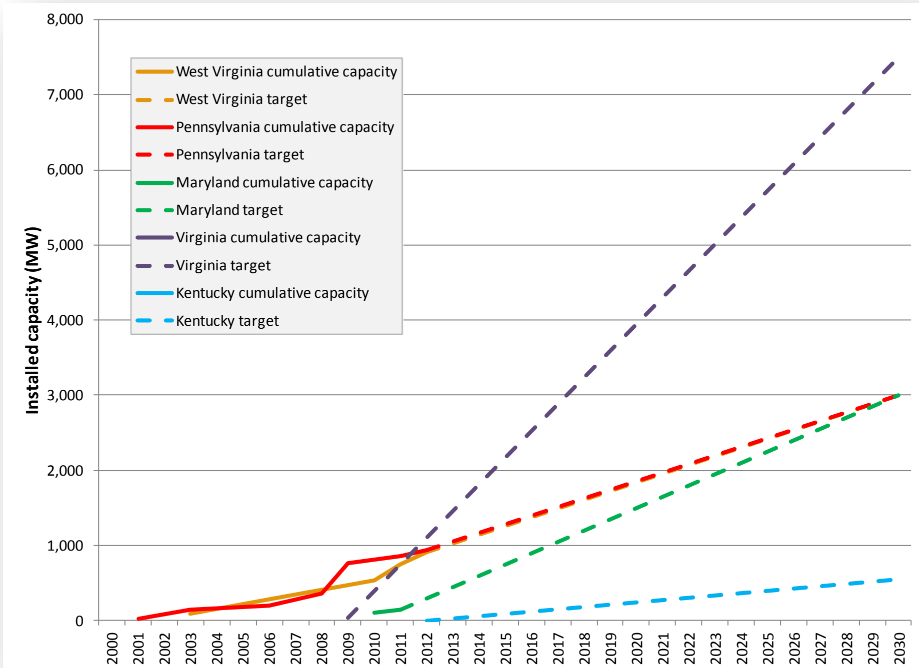
West Virginia and Pennsylvania provide almost one-third of the average capacity required in each state. Maryland's current and expected wind projects, in contrast, only meet 5% of the 20% by 2030 needs. Wind development in Virginia and Kentucky is even further behind.

As shown in Figure 30, if West Virginia and Pennsylvania were to continue developing wind capacity at approximately the same pace as in the previous decade, they would each have approximately 3,000 MW installed by 2030, meeting the 20% by 2030 goal.

Maryland would need to significantly increase its pace of wind development to meet the 20% by 2030 goal. Virginia would also need a very significant expansion of wind capacity. The capacity figures in the 20% by 2030 scenario include both onshore and offshore wind; the rapid expansion of Virginia's wind capacity would be aided by development of its offshore wind resources, given its long coastline and strong offshore wind resources (Hagerman, 2008).

While no wind projects have been installed yet in Kentucky, its required contribution to the 20% by 2030 scenario is much smaller than any of the other four states. Still, approximately 550 MW of wind capacity would need to be installed to meet the 20% by 2030 target for Kentucky.

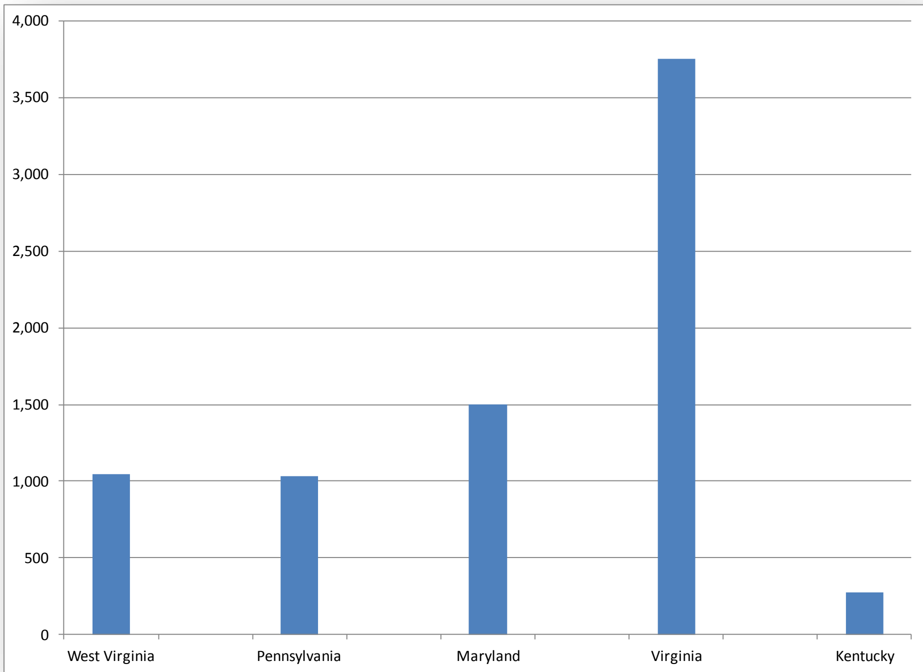
Figure 30: Current and expected wind capacities and 20% by 2030 targets



While much work remains to be done if these targets are to be met over the next 19 years, the wind resources in these five states are generally strong enough to make it conceptually feasible to meet the targets. According to NREL estimates of land-based wind resource potential at hub heights up to 100 m, the five states considered here could install approximately 16,872 MW of capacity (NREL, 2010a), meeting twice the minimum requirement if every resource were fully developed. This capacity is virtually the same as the total of the five states' average required capacities in the 20% by 2030 scenario: 17,050 MW.

Another indication of the challenge of meeting the 20% by 2030 targets is illustrated in Figure 31: Approximately 6,600 2-MW wind turbines would be required across the five states. Virginia would need to add the most turbines, 3,750, although if the state's wind capacity were partially met with offshore wind, this number could come down considerably. Maryland would require 1,500 turbines, and West Virginia and Pennsylvania would require approximately 1,000 turbines each. Kentucky, even though none have been built already, would only require the construction of 275 turbines to meet its 20% by 2030 target.

Figure 31: Number of two-megawatt turbines required to meet 20% by 2030 target



The question of whether it will be possible to meet the 20% by 2030 targets is informed by the scale of construction needed; however, the barriers to the development of wind in Appalachian coal country, as presented throughout this report, are significant. Within the broad categories of geography, environmental impact, policy, and economics, this report assesses many of these barriers.

There are significant land-based wind resources, at least in West Virginia, Pennsylvania, Virginia, and Maryland. While many wind projects have been built in these states, the rate and distribution of project development is different. Although one of the starting premises of this report was that wind and coal resources compete, we find that the true interplay between coal and wind is complex and depends on the spatial scale—site, county, or state. Barriers to wind energy in Appalachia are influenced by many other issues in addition to the geographic distribution of coal production.

These are our key findings:

- Finding 1: Barriers to wind development in Appalachia are related to geography, environmental impacts, policy, and economics.
- Finding 2: Coal influences state energy policies, which impact the rate of wind development.
- Finding 3: The region's strongest wind resources—and the region's existing and proposed wind farms—are generally not found in the counties that produce the most coal.
- Finding 4: Many opportunities exist for wind development in coal-producing counties.
- Finding 5: States within Appalachian coal country are developing wind at different rates.
- Finding 6: Compared with other regions, the geography of Appalachia presents barriers to wind development.
- Finding 7: Barriers related to environmental impacts have common themes—birds and bats, noise, lighting, and viewsheds and esthetics—and often increase project cost and slow down permit approvals; however, these barriers usually do not result in permit denials.

- Finding 8: Factors related to policy have a strong influence on wind energy development.
- Finding 9: Factors related to economics have a strong influence on wind energy development.
- Finding 10: Local opposition is the most cumulative barrier.

The five states in our region are grouped according to proximity; some of the barriers to wind energy in Appalachia originate from factors related to the geography of the region. These factors include small and large land and mineral ownership patterns in the mountains; physical, information-gathering, and cost difficulties arising from the mountainous terrain; and the overlap between ecologically valuable land and areas with high wind resources. Wind in Appalachia is a product of the mountains, and so, too, are some of the fundamental barriers to wind project development.

The five Appalachian states are also unified by wind energy–derived environmental concerns that transcend state boundaries. Some of these issues include potential harm to bird and bat populations and alterations to viewsheds, lighting, esthetics, and ambient sound quality. While these concerns transcend boundaries, the way that governments and individuals deal with these issues does not. The states in our region have diverse policies and permit regulations for coping with these concerns. Concerns related to endangered species populations appear to take precedence over those related to esthetics and land or lighting impacts.

Each state in our region has different policies related to renewable energy. West Virginia, Pennsylvania, Maryland, and Virginia each have some form of RPS, whereas Kentucky currently does not. All five states have some policy that could be loosely construed as supportive of distributed wind. None explicitly favor community wind, especially in comparison to policies found elsewhere in the nation. Finally, all five states have land with high wind resources in national forests. Wind development in national forests is not occurring, and the development of federal policy related to wind on public lands is slow.

Policy largely determines the economics of a given industry. This holds true with wind energy development and the states within our region. While all of the states show some form of public financing in the form of tax incentives and funding, their degree of applicability to wind, effect on wind energy project development, and extent of commitment varies widely state-by-state. Pennsylvania has by far the most aggressive funding mechanisms that advance wind energy development in-state; Virginia and Kentucky have the least.

Unifying all of these concerns—geography, environmental impacts, policy, and economics—is one last issue: local opposition. Ultimately, individuals who live or recreate near wind projects experience the most pointed effects. This last concern is the most cumulative of all of the others presented in this report. A landowner can choose to oppose or solicit wind energy projects in his region based on environmental impacts, pertinent state and local policies, and individually-experienced economic gains or losses.

The less that wind developers are able to overcome local opposition, the slower the pace of wind development in Appalachian coal country. Potential avenues for overcoming local opposition include, for example, ensuring sufficient local benefits, allowing the purchase of electricity generated by local wind farms, and systematically addressing environmental issues. In addition, wind developers can seriously consider community wind structures so that local people are invested in the wind project and, at least over the long-term, share in the financial rewards.

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APPENDIX A: WEST VIRGINIA PROJECTS

WVPSC requires a siting certificate for project proposals by exempt wholesale generators (EWGs) as determined by the Federal Energy Regulatory Commission (FERC). Because of its centralized process, West Virginia presents an opportunity to understand the types of concerns raised by intervenors and government agencies, and the ways in which these concerns were addressed.

Backbone Mountain Windpower, LLC

Backbone Mountain Windpower, LLC ("Backbone Mountain") filed an application with WVPSC for a CPCN on August 7, 2000. WVPSC granted the certificate on December 28, 2000. The application proposed 60 to 90 wind turbines that would output between 0.9 and 1.5 MW each. The total structure height of each turbine would be 98-100 meters. The project would be located on 4,400 acres, however only 2% of the site would be physically occupied. Backbone Mountain agreed to restore the project site to its original condition should the property lease expire or should the turbines not operate for 180 days or more.

WVHC was granted intervenor status. The organization protested on the basis that WVPSC was not adequately and independently examining the environmental impact of the project. However, WVHC and Backbone Mountain reached an agreement memorialized in a memorandum of understanding, and WVHC withdrew its protest and joined Backbone Mountain in seeking a CPCN. A WVPSC staff attorney requested that Backbone Mountain be required to obtain documentation from the US Department of Interior stating that the project would not cause Blackwater Falls State Park to be disqualified from obtaining national park status. The staff attorney also requested that Backbone Mountain submit a hawk and songbird migration study for WVPSC's review. Other environmental concerns included the location of two turbines visible from Blackwater Lodge in Blackwater Falls State Park, and nighttime lighting of the wind towers. Backbone Mountain asserted that FAA requires aviation warning lights on some turbines but agreed to minimize light pollution by obscuring the required lighting where light is needed to warn aircrafts.

While Backbone Mountain was unable to discern from the National Park Service whether the project would prevent Blackwater Falls State Park from being designated a national park, it committed to working with the US Department of Interior to ameliorate the project's impacts on the park's potential national park status. WVPSC also considered the project's potential noise impact. Backbone Mountain's expert represented that even in a worst-case scenario, the impact from the project would not be noticeable or objectionable.

Upon the recommendation of USFWS, Backbone Mountain conducted a risk assessment for endangered species and birds at the project site. The risk assessment indicated that the Indiana bat, Virginia big-eared bat, Cheat Mountain salamander, and northern flying squirrel were not found within the project area. Backbone Mountain also conducted a July 2000 report, *Phase I Avian Risk Assessment for a Wind Power Facility Proposed*, which reported no indication that the project poses a significant adverse impact to birds. The report also indicated that no endangered or threatened bird species were located at the project site. Backbone Mountain also filed a fall migration study with WVPSC, which concluded that the risks to migrating birds are likely minimal due to the fact that only a small number of hawks and songbirds were observed migrating along the mountain, few of which flew into the area where the turbine rotors would be located, and that migrating birds seldom demonstrate a tendency to collide with turbines or communication towers less than 400 feet high.

Backbone Mountain presented that they worked with USFWS and WVDNR to determine what species the project may affect and undertook risk assessment studies for those species. USFWS recommended that a spring and autumn bird migration study be conducted for hawks and songbirds. After consultation with Partners In Flight, a national organization that oversees bird conservation, Backbone Mountain determined that a spring study was not necessary because fewer birds migrate during the spring.

As part of its memorandum of understanding with WVHC, Backbone Mountain agreed not to construct the two southernmost strings of turbines. Backbone Mountain requested to reserve the right to relocate as many turbines from the two southernmost strings of turbines as originally proposed to the north, if suitable lease terms could be negotiated for the property north of the current project area. The memorandum of understanding also stated that Backbone Mountain would conduct a post-construction monitoring program for one year after operations commenced. Backbone Mountain also agreed to form a committee to approve the post-construction monitoring program and review its results. The committee is open to representatives from Backbone Mountain, WVHC, WVPSC, USFWS, WVDNR, a state-wide avian organization, and a representative from a private or academic institution with a background in avian issues.

WVPSC granted Backbone Mountain a CPCN. The Commission found noteworthy the fact that WVHC withdrew its request for an independent environmental impact study and requested that WVPSC grant the certificate as modified in its agreement with Backbone Mountain. WVPSC also noted that this was the first instance where an applicant voluntarily conducted a significant number of studies to determine the project's potential impacts prior to even filing its application with the Commission.[47]

NedPower Mount Storm LLC

NedPower Mount Storm LLC ("Mount Storm") applied for a CPCN for a wind project in Grant County in August 2002. WVPSC granted Mount Storm's application for the Central Phase (Phase I) and the Northern Phase (Phase II), but denied the Southern Phase (Phase III). The project proposed up to 200 turbines with a capacity of up to 300 MW, each turbine being no more than 600 to 800 feet apart. Each turbine would have a capacity of 1.5-1.8 MW and would stand about 100 meters tall. The project area is about 14 miles long, with an average width of one-half mile, running southwest to northeast. The proposed project site consists of 8,000 acres, however, only 3% of the land would be physically occupied.

The West Virginia State Building and Construction Trades Council, AFL-CIO ("Trades Council"), and Friends of the Allegheny Front (FAF) were granted intervenor status. Mount Storm filed an endangered species status and Phase I Avian Risk Assessment for the project on September 24, 2002. Mount Storm and the Trades Council reached an agreement resulting in the Trades Council's full support of the project. In November 2002, Mount Storm filed an Endangered Species Status Report summarizing two species surveys performed for the project, one for the West Virginia northern flying squirrel and the second for the Cheat Mountain salamander. WVDNR requested that Mount Storm be required to file evidence that the US Army Corps of Engineers (USACE) approved and accepted the wetlands delineation study; obtain West Virginia Public Lands Corporation right-of-entry approvals for any stream access road crossings; comply with the ESA, the Migratory Bird Treaty Act and the National Environmental Policy Act of 1969 in both construction and operation of the project; and coordinate all required activities with WVDNR. WVDNR also requested that Mount Storm notify WVPSC should any government agency or court of jurisdiction find that Mount Storm is not complying with the three federal acts within 10 days of such finding. WVDNR additionally requested that Mount Storm be required to file evidence of USFWS's acceptance and approval of required endangered species studies and any mitigation plans, to file post-construction study results including birds and bats and lighting for all project phases with WVPSC; and send copies to WVDNR within 90 days of completion.

WVHC filed a letter of conditional support for the project, expressing concern for visual and noise effects as well as habitats and populations of rare and endangered species of plants and animals, birds, and stream headwaters. The Phase I Avian Risk Assessment concluded that the project would have little impact on avian life; however, it noted some concern for the project's potential effect on the golden-winged warbler habitat and turbine lighting impacts.

[47] PSC Case No. 00-1209-E-CN, Final Order (December 28, 2000)

Mount Storm represented that the project is not visible from any visitor areas or places of significant public interest with tourist traffic. Mount Storm also indicated that the project would not negatively impact noise levels and should any noise so burden any residence or should a turbine be located less than 250 meters from a residence, Mount Storm would relocate the turbine.

Four federally listed species were identified by USFWS and WVDNR at the project site: the Indiana Bat, the Virginia big-eared bat, the West Virginia northern flying squirrel, and the Cheat Mountain salamander. USFWS recommended a habitat survey to determine whether the project site hosts potential habitats for the West Virginia northern flying squirrel and Cheat Mountain salamander. If a taking of these species cannot be avoided, USFWS recommended an HCP and an ITP. Mount Storm committed to modify turbine sites, utility corridors, and secondary road construction locations to minimize impacts to the four federally listed species.

WVPSC granted a CPCN, conditioned upon Mount Storm carrying out its commitment to conduct a golden-winged warbler habitat study and a migration study prior to construction, both for use in final micro-siting of turbines. Mount Storm's certificate was also conditioned upon completing a spring and fall migration study during all local climatic conditions and all daily temporal periods; a determination of patterns of nocturnal migrating birds; avian studies to determine raptor behavior during the breeding season for winter residents; and continued avian and bat mortality studies for three years post-construction.

WVPSC adopted the conditions recommended by WVDNR and USFWS, including requiring Mount Storm to file evidence of approval and/or acceptance of the wetlands delineation by USACE; requiring Mount Storm to file evidence of other necessary environmental permits such as a National Pollutant Discharge Elimination System (NPDES) permit and compliance with the ESA, Migratory Bird Treaty Act, and NEPA; requiring a 150-foot buffer zone around any existing West Virginia northern flying squirrel habitat; conducting a bat biological assessment; conducting a migration study to determine heavy migration areas in spring and fall and during all local climatic conditions and all daily temporal periods; conducting studies to determine special patterns of nocturnal migrating birds and to determine raptor behavior during the next breeding season; conducting six-month construction studies assessing bird and bat mortality for the next three years; and conducting six-month post-construction lighting studies for one year.

WVPSC denied the CPCN application for the Southern Phase (Phase III), as turbines would be located within 2,000 meters of Bear Rocks within the Dolly Sods Wilderness Area. WVPSC noted that it was not presented with overriding evidence that the Southern Phase is absolutely vital to the viability of the project. According to the final order, this "is reason enough for this Commission to withhold approval of the Southern Phase unless NedPower can demonstrate to the Commission that the 200 turbines cannot be located within the Central and Northern Phases, and that such inability will cause the project to become financially unfeasible." Therefore, while this case is an example of WVPSC denying a CPCN for a wind project due to concerns about its location close to a wilderness area, the decision did not necessarily reduce the ultimate size of the project.[48]

[48] PSC Case No. 02-1189-E-CN, Final Order (April 2, 2003)

Beech Ridge Energy, LLC

Beech Ridge Energy, LLC ("Beech Ridge") applied for a certificate with WVPSC on November 1, 2005. The application was approved on August 28, 2006. Beech Ridge proposed to construct a 186 MW facility nine miles northeast of Rupert in Greenbrier County and a 13.8 mile 138 kilovolt (kV) transmission line to connect the project to Allegheny Power's Grassy Falls substation near Nettie in Nicholas County. The proposed project consists of 124 1.5-MW turbines. The facility footprint would be approximately 300 acres with the turbines placed along 23 miles of rural ridge tops on a 100,000-acre tract owned by MeadWestvaco. The land has been timbered and much of it is surface mined, both of which will continue. Beech Ridge proposed to place many of the turbines and transmission lines on land reclaimed from old strip mining sites. The project will have no water or air emissions.

WVPSC granted petitions to intervene filed by eight individual citizens, the West Virginia State Building Construction Trades Council, AFL-CIO ("Trades Council"), Mountain Communities for Responsible Energy (MCRE), Citizens for Responsible Wind Power, Inc. (CRWP), WVHC, and Friends of Greenbrier County (FGC). The project was supported by the Town Council of Rupert, the Sierra Club West Virginia Chapter, and the Midland Trail Scenic Highway Association.

More than 1,400 letters in opposition to the project had been filed as of December 6, 2005, citing lower property values; negative effects on tourism; noise; bat and bird mortality; negative impacts on hunting and fishing; cemetery disturbances; disturbances of scenic views; forest fire risks; pesticide runoff from brush clearing; light pollution; little energy production; limited benefit to citizens; disruption of emergency services' radio traffic; nearby Civil War sites; and negative impacts on local fundraisers. Beech Ridge asserted that none of MCRE's protest letters regarding the loss of hunting and fishing, pollution of local streams and rivers, radio interference, federal tax breaks to wind projects, use of herbicides and pesticides, erosion from clear cutting, loss of tourism, and reduced property values were supported by any proof at all. Beech Ridge provided supporting evidence for its position on several of these topics. WVPSC considered ambient noise levels and operational sound levels. Beech Ridge planned to use reduced-noise transformers in order to minimize its impact on ambient noise.

WVPSC granted Beech Ridge's motion for protective treatment, to keep confidential sensitive biological information such as the location of caves in which federally-protected species of bats have been known to exist. WVPSC referenced public policy of West Virginia to protect wildlife resources,[49] the ownership of all wildlife is declared to be in the state,[50] it being unlawful to disturb the natural condition of any cave,[51] it being unlawful to disturb any plant or animal life within a cave,[52] and it being unlawful to take any endangered or threatened animals under the ESA.[53]

USFWS expressed concern that the project would harm or kill federally listed Indiana bats and/or Virginia big-eared bats. USFWS estimated that 6,746 non-federally listed bats would die annually facility-wide. USFWS also expressed concern about the cumulative impact to the forests, including habitat fragmentation. Beech Ridge conducted a spring avian study and preliminary avian Phase I assessment of bird populations, and a fall and spring avian Phase I assessment. Beech Ridge, through its expert, also conducted fix point count surveys to assess species composition, habitat use, and flight characteristics; raptor studies to assess migratory patterns, relative abundance and nesting; a nocturnal bird survey; a golden-winged and cerulean warbler study; and a mist-netting and bird banding study to assess fall migration patterns. Beech Ridge's expert concluded from all of these studies and surveys that the project did not present unique situations and habitat features likely to accelerate avian mortalities. Beech Ridge prepared a bat risk assessment, a mist-netting

49 W.Va. Code § 20-2-1
50 W.Va. Code § 20-2-3
51 W.Va. Code § 20-7A-2
52 W.Va. Code § 20-7A-4
53 16 U.S.C.A. § 1531

survey of the project site, and a cave survey near the project site. All three studies concluded that federally listed species were absent from the project area in both summer and winter.

No Virginia big-eared bats have ever been captured or seen in Greenbrier County. Only one cave within five miles of the project site has ever hosted Indiana bats, and the last Indiana bat was found there in 1990. No Indiana bats were identified at the facility site in the 2005 mist-netting survey. One cave located at least 6.5 miles from the proposed turbines is historically an Indiana bat hibernaculum, but could not be explored. A Beech Ridge expert testified that this cave would typically be out of range of swarming for Indian bats; however, Beech Ridge proffered that if the proximity of this cave is of consequence, Beech Ridge will move two turbines from their currently proposed locations to cure any of MCRE's concerns. Beech Ridge agreed to conduct post-construction surveys for three years and, if further warranted by data, a one-year post-construction eagle/osprey survey. Beech Ridge also presented that it has increased the cut-in speed to 3.5 meters per second, as bat kills at other sites mostly occur when the wind speed is low. Beech Ridge also agreed to test adaptive management strategies.

Beech Ridge asserted that none of the intervenors offered evidence to support the claim that the project would have negative impacts on tourism. There was limited evidence provided on the project's potential impacts on land values, but Beech Ridge discounted that evidence as merely indicative of rising values in most recent years. Beech Ridge's viewshed analysis also indicated that even from the most open views, less than 15% of the project would be visible with only a few exceptions. Vegetation was deemed an important component of any visibility study by an MCRE expert and Beech Ridge.[54]

In December 2009, a US District Court found that the project violated the ESA and required Beech Ridge to obtain an ITP before constructing turbines beyond the 40 that they had already begun to erect. The order also enjoined Beech Ridge from operating any turbines between April 1 and November 15 in any calendar year. The plaintiffs in the case were the Animal Welfare Institute, MCRE, and caving enthusiast Dave Cowan.[55]

Following this order, on January 26, 2010, a court order and settlement agreement divided the project into two phases. Parties agreed not to build 24 of the original 124 turbines that are closest to known bat hibernacula. Parties further agreed that, while the HCP is under development, Beech Ridge may construct an additional 27 turbines. Phase I, therefore, includes 67 turbines, and Phase II includes 33 turbines that would be constructed upon approval of the HCP and ITP. Beech Ridge announced the completion of Phase I on September 28, 2010 (Stantec Consulting Services, 2011).

This requirement to obtain an ITP has impacted Beech Ridge's post-construction monitoring. WVPSC's final order required that Beech Ridge consult with a Technical Advisory Committee regarding post-construction studies on the following:

- three years of post-construction bat mortality and adaptive management studies after operations commence,
- three years of post-construction bird studies after operations commence, and
- a one-year post-construction eagle/osprey study.

While the eagle/osprey study is ongoing, the bat and bird studies had still not commenced as of February 2011:

> "Because of the December 2009 and January 2010 orders of the U.S. District Court in Maryland requiring Beech Ridge to seek an Incidental Take Permit and allowing operation of 67 turbines during certain designated hours, the project is not yet fully operational and the post-construction bat and bird monitoring studies have not begun." (George, 2011)

[54] PSC Case No. 05-1590-E-CS, Final Order (August 28, 2006)
[55] *Animal Welfare Institute, et al. v. Beech Ridge Energy*, LLC *et al*., Case No. RWT 09cv1519 (D. Md. Dec. 8, 2009)

Liberty Gap Wind Force, LLC – Jack Mountain

Liberty Gap Wind Force, LLC ("Liberty Gap") proposed to construct up to 50 wind turbines—each with a rated capacity between 1.5 and 3.0 MW—and a 138 kV transmission line to connect the project to the grid. The proposed project would have a total output of up to 125 MW. The project would be located along seven miles on the Jack Mountain ridge top, which is approximately ten miles outside of Franklin in Pendleton County. Liberty Gap planned to operate as an EWG and planned to enter into an interconnection and operating agreement with PJM. Liberty Gap submitted an application to WVPSC for a siting certificate on December 7, 2005.

WVHC, Friends of Beautiful Pendleton County (FOBPC), Chestnut Woods Association ("Chestnut Woods"), and the West Virginia Building and Construction Trades Foundation ("Construction Trades"), along with three private citizens filed petitions to intervene in this case. WVPSC recognized the petitioners as intervenors. Chestnut Woods later moved to withdraw as intervenor and substitute John Hargrove, which WVPSC also approved.

Liberty Gap requested and was granted a waiver from the siting rule[56] requirement relating to air and water emissions. WVPSC required Liberty Gap to assure that the construction and installation of the wind turbines would not impact surface waterbodies or sub-surface water sources and to list the reasons why there would be no such impact and, further, to commit to remedy any surface waterbodies or sub-surface water source problems that may occur as a result of the project. FOBPC filed a Motion to Dismiss Liberty Gap's Application on the basis that Liberty Gap had not met the minimum requirements for disclosure as required by the siting rules and failed to provide proper notice of its application.

On July 24, 2006, WVPSC held that Liberty Gap's application should be dismissed without prejudice due to Liberty Gap's proposed terms to WVPSC's order requiring Liberty Gap to allow FOBPC access to the project site. WVPSC determined that Liberty Gap's terms were patently unreasonable and effectively denied FOBPC access to the project site. Liberty Gap petitioned WVPSC for reconsideration, arguing that it misunderstood Liberty Gap's rationale for denying FOBPC access to the project site. Liberty Gap, in its petition, offered to pay the travel expenses for FOBPC experts to visit the site and proffered their willingness to toll the statutory deadline for WVPSC's decision. WVPSC then reinstated Liberty Gap's application subject to conditions, including Liberty Gap's agreement to toll the statutory deadline for its decision.

Liberty Gap consulted with USFWS regarding wildlife species at the project site. Liberty Gap filed an analysis of effects to federally endangered bats at the site and included a post-construction monitoring plan and adaptive management strategies and conservation approaches to address concerns regarding bats. USFWS filed a copy of a letter sent to Liberty Gap encouraging it to pursue an ITP pursuant to Section 10 of the ESA, which requires a permit where any federally protected wildlife species may be harassed, harmed, or otherwise taken.[57] Liberty Gap had previously informed USFWS of its intention to not pursue an ITP, although USFWS strongly urged Liberty Gap to do so. Thereafter, Liberty Gap voluntarily committed to compiling an HCP and an ITP application for the project. WVPSC required Liberty Gap to make bi-monthly status report filings on the HCP and ITP. Liberty Gap filed a motion requesting that WVPSC not consider the project's potential impact to wildlife, including bats. The motion proffered that Liberty Gap's commitment to the issues assured they would be addressed, as evidenced by Liberty Gap voluntarily committing to preparing a HCP and ITP application. Liberty Gap also proffered that they would not object to a permit condition addressing the project's impact on wildlife.

USFWS filed another letter with WVPSC expressing concerns regarding the project's impacts on endangered bat species. WVPSC granted Liberty Gap's motion to abstain from considering evidence of the project's

56 Siting Rule 150-C.S.R. § 30-3.1.c
57 16 U.S.C. § 1531, ESA § 10(a)

impact on wildlife as to the Indiana bat and the Virginia big-eared bat, requiring Liberty Gap to notify the Commission in writing within ten days of any additional species that they would include in both the environmental assessment and HCP. WVPSC denied Liberty Gap's motion as to any other wildlife. Liberty Gap later notified WVPSC that it would include threatened bald eagles, non-listed bats, and migratory birds. However, after objection and petition by FOBPC, WVPSC reversed its prior decision, holding that it would consider the impact on all species pursuant to WVPSC's public interest review of the application.

WVPSC denied Liberty Gap's application on June 22, 2007, based on Liberty Gap's failure to file a materially complete application and satisfy its evidentiary burden on several key issues under the statutory balancing test. It cited numerous inadequacies of the application. Among them were inadequate viewshed impact evidence, inadequate noise impact and intrusion evidence, and WVPSC's "continuing concern about endangered bat species."[58] The Commission found that due to the inadequacy of the application, it was simply unable to balance the interests as required by state code. WVPSC concerned itself with the position of USFWS and WVDNR regarding the project's possible impacts to endangered bat species as well as the unsettled state of the HCP and ITP process. It also found that Liberty Gap provided insufficient and conflicting evidence regarding the ambient noise level at Moatstown, the nearest community to the project.

Additionally, WVPSC reinforced its concern for endangered bat species, referencing testimony that the Mountaineer wind farm in West Virginia has the highest collision mortality rate per turbine in the world. WVPSC relied on evidence indicating that turbines in the eastern US have substantially higher rates of bat mortality than other regions on the country. One expert believed that the Liberty Gap project would produce bat mortality rates of the same magnitude as the Mountaineer wind farm. WVPSC questioned Liberty Gap's reluctance to cooperate with federal and state wildlife agencies prior to notifying WVPSC of its intent to voluntarily compile an HCP and an ITP application. Liberty Gap's agreement to do so came only well after extensive urging by the agencies to cooperate.

WVPSC did note, however, that Liberty Gap adequately evidenced that the project would pose no serious risk of impact on wildlife other than birds and bats. It also found that Liberty Gap met its evidentiary burden as to the project's impact on hydrology, including stormwater runoff and water supplies. Further, WVPSC expressed disappointment with Liberty Gap's compliance with its order to file bi-monthly progress reports on its ITP application and HCP progress. Rather than reporting concrete action on the ITP application, the progress reports indicated mere meetings and discussions. WVPSC gave great credence to the USFWS opinion that the project posed a danger to endangered bat species with a reasonable certainty.[59]

AES Laurel Mountain, LLC

AES Laurel Mountain, LLC ("Laurel Mountain") proposed an EWG facility consisting of up to 65 wind turbines and related interconnection facilities, to be located in Randolph and Barbour counties, five miles from the Elkins-Randolph County Airport. Laurel Mountain filed its application for a siting certificate on January 31, 2008 and WVPSC granted the certificate subject to conditions on November 26, 2008. The proposed turbines would be located on an eight-mile stretch of the Laurel Mountain ridgeline near Belington and Elkins. The project proposed to cover 8,500 acres of forested land, with the project's final footprint encompassing 75 acres. Four homes are located within one-half mile of the project, the closest being more than 2,000 feet from the nearest turbine. Environmental impacts from the project were expected to be minimal. Logging is conducted on Laurel Mountain and is expected to continue during construction and after completion of the project. The wind turbines, in total, would be rated between 125 and 132.5 MW, and would connect to the grid via an existing Allegheny Power 138 kV overhead transmission line that crosses Laurel Mountain.

58 PSC Case No. 05-1740-E-CS, Final Order (June, 22, 2007), p. 23
59 PSC Case No. 05-1740-E-CS, Final Order (June, 22, 2007)

By the end of October 2008, public comment letters in favor of the project doubled that of those opposing the project: 600 in favor and 300 opposed. WVPSC approved requests by the West Virginia State Building Construction Trades Council, AFL-CIO ("Trades Council") and Laurel Mountain Preservation Association, Inc. (LMPA) to intervene. WVPSC conducted a view of the project area in May 2008. Testimony indicated that the project would not be visible from important park and wildlife areas. Due FAA requirements, some project towers must be lit for air traffic safety. Laurel Mountain expects to place lights on the first, last, and every third turbine. Laurel Mountain committed to minimizing lighting other than that required by FAA or necessary due to fire or safety codes, regulations, or generally accepted good utility practices. A member of the Elkins-Randolph County Airport Authority expressed concern regarding the mountain during low visibility, however WVPSC noted that neither the Airport Authority itself nor any individual from the Airport Authority elected to petition for intervenor status. Additionally, WVPSC noted that FAA determined that the project posed "no hazard" and the Airport Authority had not objected to the project.

WVPSC also considered the project's noise impact, which it discussed at length in its final Order. It noted that only 38 residences are located within one mile of the project site, and only four are located within one-half mile of the project. The nearest residence to a turbine is 2,200 feet away; however, the residence that would be affected most by the project's noise is 2,500 feet away from the closest turbine and Laurel Mountain has a lease for that residence. WVPSC concluded that the project will emit only operational noises at levels that should not be objectionable and, further, that any negative noise impacts are expected to be as minimally disruptive as reasonably possible to existing property uses. WVPSC declined to impose a noise condition to the project permit, reciting that neither the statute nor the siting rules prohibit a project from adding any noise, but rather the test is whether the predicted noise will adversely affect the public. WVPSC did, however, adopt a construction noise condition requiring Laurel Mountain to limit noise during construction.

Laurel Mountain consulted extensively with USFWS and WVDNR and granted LMPA access to the project site. The American Society of Mammologists filed a letter with WVPSC regarding the project's effects on bats and other wildlife. Laurel Mountain filed three surveys and assessments for bats and birds at the project site: a spring 2007 *Radar, Visual, and Acoustic Survey of Bird and Bat Migration*; a fall 2007 *Bird and Bat Migration Survey Report*; and a *Laurel Mountain Bird and Bat Risk Assessment*. USFWS accepted the scope of these studies and never indicated that the project posed any particular or significant threat to threatened or endangered species. The surveys documented low levels of raptor migration and a variety of species typical of the region, but found that the project site did not host large numbers of any rare bird species. The surveys indicated that a small number of breeding birds will likely collide with turbines; however, population-level impacts for any single species are not expected. The impacts to bats are expected be similar to those documented at other facilities. Thirteen mist netting surveys were conducted, and no threatened or endangered species were captured through the surveys. Laurel Mountain agreed to several recommendations by USFWS, including limiting the amount of forest removal to reduce impacts to birds and bats; following the bald eagle management guidelines if bald eagles are found at any time during the project's life; placing turbines in the low point along the ridgeline to reduce impacts to migratory raptors; and studying whether turbines should or could be stopped or free-wheeled during part of the year to minimize bat mortality, depending on economic feasibility. Laurel Mountain found that an ITP was not necessary because the project is not expected to affect any threatened or endangered species.

Field surveys were conducted and coordinated with USFWS and WVDNR in 2007. Five separate patches of running buffalo clover were found on the project site. As a result, Laurel Mountain modified the project to include buffer zones around each patch of running buffalo clover, in which no disturbances will be allowed. LMPA expressed concern about the project's effect on local groundwater. WVPSC conditioned the project permit on Laurel Mountain's promise to readily resolve any groundwater impacts. LMPA also raised the concern that this project would drive down large coal-fired generating plants to minimal operational levels. WVPSC was not persuaded that the addition of energy produced by this project to the grid would do such; rather, it determined that it was in the public interest to diversify electricity generation.

WVPSC granted Laurel Mountain a siting certificate subject to conditions on November 26, 2008. LMPA petitioned WVPC to reconsider, which was denied. The case was removed from the docket on March 17, 2009. On April 16, 2009, LMPA petitioned the Supreme Court of Appeals of West Virginia, appealing the WVPSC decision. On June 3, 2009, the Supreme Court of Appeals denied LMPA's petition. On July 6, 2010, LMPA filed a petition to reopen the case for alleged violations of the ESA by Laurel Mountain. Construction commenced in November 2010.[60]

AES New Creek, LLC

AES New Creek, LLC ("New Creek") filed an application for a siting certificate on December 19, 2008, and WVPSC granted a siting certificate on September 30, 2009. New Creek proposed to place up to 66 wind turbines on a seven-mile stretch of the New Creek Mountain ridgeline, beginning one mile north of Greenland Gap near Greenland in Grant County and continuing north to the Mineral County line. The project will be located within 4,900 acres of leased undeveloped woodland, with the project's final footprint requiring approximately 50 acres. The closest residence is a part-time residence located 1,300 feet from the closest proposed turbine. There are nine residences within 4,000 feet of the project and three of those are under lease agreements with New Creek. The proposed project is capable of generating up to 160 MW to an existing Allegheny Power 500 kV overhead transmission line. As of June 2009, 44 public comment letters had been filed in support of the project and 107 in opposition. New Creek planned to use 1.5 MW General Electric or 2.5 MW Clipper turbines.

WVPSC viewed the project area from at least eight different viewpoints on May 1, 2009. New Creek determined that viewshed impacts within one mile should be minimal because of the heavily forested and steep terrain immediately surrounding the site. Four areas of managed land lie within a 10-mile radius of the project, two of which may have views of the project. Thirteen managed land areas lie between 10 and 20 miles of the nearest proposed turbine. These areas, according to New Creek, will have minimal views of the project because of the distance, topography, vegetation, and atmospheric haze. However, the project may be viewable from some small scattered areas in open, high elevation areas in the 10- to 20-mile radius. WVPSC determined that the impact of the project's presence on the viewshed will be minimally disruptive to the community and that the visual impact upon surrounding managed lands and historic and cultural sites as a whole was not unreasonable or burdensome.

WVPSC also addressed the sound studies for the project and evaluated ambient noise levels and operational sound levels. It concluded that while the project will emit some sound, the operational sound levels should not be objectionable and that any negative impacts from operational noise are expected to be as minimally disruptive to existing property uses as reasonably possible. Similarly, WVPSC determined that the predicted construction noise is not unreasonable and any negative impacts are expected to be as minimally disruptive to existing property uses as is reasonably possible. WVPSC also considered the project's potential impact to surface and sub-surface waters and concluded that no surface waterbody or sub-surface water sources are likely to be affected. One wetland and potential jurisdictional watercourse was identified within the project area; however, the project will not affect the wetland.

New Creek consulted with USFWS and WVDNR as to the project's potential environmental impacts. New Creek worked extensively with USFWS in regards to birds and bats, keeping the agency updated on meetings and conference calls and providing all the information gathered. New Creek completed a bird and bat migration survey for spring, summer, and fall 2008 as well as one for fall 2007. New Creek also completed a bird and bat risk assessment for the project. The surveys documented low levels of raptor migration in the project area and a low diversity of breeding birds. Impacts on population levels of breeding birds are not expected for any single species as a result of the project.

[60] PSC Case No. 08-0109-E-CS, Final Order (November 26, 2008)

Nocturnal migration activity was also measured, and while large numbers of nocturnal migrants were detected in the air space above the project area, most night-flying birds pass over the project at altitudes high above the maximum height of the proposed turbines.

The project's potential impact to bats is expected to be similar to patterns documented at other facilities, with the largest collision mortality rates in the spring and fall migration seasons. Bat mortality is expected to be higher on calm, warm nights when long distance migratory species are expected to be most vulnerable to collision mortality. New Creek will feather the turbine blades so they will not operate when wind speeds are less than 24 meters per second to reduce the potential impact to bats and birds. Mist netting surveys were also conducted at the project site and no threatened or endangered species were captured. Eastern small-footed myotis were detected during surveys, and although rare throughout the state, they appear common on New Creek Mountain. The eastern small-footed myotis are expected to forage within the project area but are thought to fly below the tree canopy and, thus, the collision mortality for this species is not expected to be as great the risk for migratory species. WVPSC agreed with New Creek that no federally threatened or endangered species are expected to breed, reside in, or use the project area as primary habitat or breeding area. WVPSC conditioned New Creek's siting certificate in part on New Creek implementing adaptive management strategies, if proven effective and economically feasible, should studies find that the project causes significant bat mortality levels.[61]

Green Mountain

Applicant Pinnacle Wind Force, LLC ("Pinnacle") filed an application for a siting certificate with WVPSC on March 17, 2009 for the Green Mountain project, located near Keiser in Mineral County. The project will consist of 23 turbines, with a total projected capacity of 55.2 MW. Pinnacle noted its intention to apply for EWG status with FERC, but had not yet done so at the time its application was submitted. Should Pinnacle not receive EWG status, under Section 24-2-11 of the Code, WVPSC would require Pinnacle to apply for a CPCN. The project was proposed to be located on a 3.5 mile stretch of Green Mountain, covering between 102 and 245 acres of private, forested land. The developers for the project were US Wind Force, LLC and Edison Mission Group ("Edison"). Edison was expected to purchase the project from Pinnacle once completed.

By statute, WVPSC must balance the public interests and general interests of the state and local economy with the applicant's interest.[62] In addition to balancing interests, WVPSC also considered effects to birds, bats, wildlife, ambient sound levels, shadow flicker, hydrology, and wetlands. WVPSC gave great consideration to the fact that Pinnacle worked extensively with WVDNR and USFWS beginning in 2007. WVPSC found that the project would have no adverse impacts on plants or habitats, that no endangered species were located at the project site, that no wetlands would be adversely affected, and that there would be no unacceptable adverse impacts to avian and bat species. Pinnacle committed to working with WVDNR and USFWS to study the project's impacts on bats and birds during its first year of operation and for up to three years thereafter.

Allegheny Front Alliance (AFA) and the West Virginia State Building and Construction Trades Council, AFL-CIO ("Trades Council") were granted intervenor status to these proceedings. AFA argued that Pinnacle provided no evidence that this project will reduce carbon dioxide emissions in the geographic area but rather only provided vague assertions. Thus, according to AFA, WVPSC should not consider the North American Electric Reliability Corporation *Long-Term Reliability Assessment* submitted by Pinnacle. WVPSC disagreed and found that testimony provided was sufficient to establish the likelihood that the project would reduce carbon dioxide and greenhouse gas emissions. AFA also argued that the project would likely kill a substantial number of eagles, migratory birds, and bats. Pinnacle responded that AFA had provided no evidence supporting this contention. AFA also contended that a letter from USFWS regarding potential impacts to birds and bats

[61] PSC Case No. 08-2105-E-CS, Final Order (September 30, 2009)
[62] W.Va. Code § 24-2-11c(c)

should be taken into consideration. Pinnacle responded that such a letter was not unique to this project and if USFWS believed the letter was crucial to WVPSC's decision, it could have copied WVPSC when it sent the letter. WVPSC found that Pinnacle thoroughly consulted with USFWS and WVDNR during development and implementation of the studies.

This project included input from private citizens, WVDNR, and USFWS. Pinnacle formed a Community Advisory Committee, consisting of 20 local volunteers selected to represent the diverse population, which began meeting in April 2008. Pinnacle hosted four informational open house events and made presentations to numerous civic groups regarding the project. A public hearing was held in September 2009, where 40 individuals spoke in favor of the project and nine spoke in opposition. In October 2009, Pinnacle posted public notice of the scheduled evidentiary hearing. Pinnacle was granted a siting certificate on April 24, 2010. In addition to complying with the siting certificate requirements, WVPSC also mandated that Pinnacle comply with all federal statutes, including the ESA,[63] Migratory Bird Act,[64] and the National Environmental Policy Act of 1969.[65,66]

[63] 16 U.S.C. § 1531
[64] 16 U.S.C. § 701
[65] 42 U.S.C. § 4321
[66] PSC Case No. 09-0360-E-CS, Final Order (January 11, 2010)

Table 12: West Virginia wind projects

Project	Application date	Permit decision	Days from application to decision	Intervenor concerns	Regulating agency concerns	Regulatory basis for approval/ denial
Backbone Mountain	August 7, 2000	Approved	143	Post-construction monitoring of birds and bats	Found it noteworthy that intervenor withdrew objections	W. Va. Code § 24-2-11
Mount Storm Phase I	August 8, 2002	Approved	237	Endangered species	Endangered species, golden-winged warbler, migration studies, intervenor withdrew objections per agreement	W. Va. Code § 24-2-11c
Mount Storm Phase II	August 8, 2002	Approved	237	Endangered species	Endangered species, golden-winged warbler, migration studies, intervenor withdrew objections per agreement	W. Va. Code § 24-2-11c
Mount Storm Phase III	August 8, 2002	Denied (but turbines could be relocated to Phase I or II)	237	Endangered species, wilderness area	Wilderness area, bird and bat migration	W. Va. Code § 24-2-11c
Beech Ridge	November 1, 2005	Approved	604	Birds, bats, endangered species, noise, tourism, property value, light pollution	Endangered bat species	W. Va. Code § 24-2-11c
Liberty Gap	December 7, 2005	Denied	562	Endangered species, noise, viewshed	Endangered bats, noise, viewshed, incomplete application	W. Va. Code § 24-2-11c, Incomplete Application, Conflicting Information, Balance of Interests
Laurel Mountain	January 31, 2008	Approved	300	Bird and bat mortality; noise; lack of reliable, useful generating capacity	Bird and bat mortality, endangered plant species	W. Va. Code § 24-2-11c, Public Interest
New Creek	December 19, 2008	Approved	285	Birds and bats	Adaptive management strategies for bat mortality	W. Va. Code § 24-2-11c
Green Mountain	March 17, 2009	Approved	300	No proof of reducing carbon dioxide emissions, bird and bat mortality		W. Va. Code § 24-2-11c & USFWS and WVDNR consultations

Note: W.Va. Code § 24-2-11 requires the Commission to grant or deny siting certificate within 300 days of the submission of an application. W.Va. Code § 24-2-11c requires the Commission to grant or deny CPCN within 400 days of submission of an application. The Mount Storm application was submitted in December 2001, but the exact application date was not found.

APPENDIX B: PENNSYLVANIA PROJECTS

In 2006, Pennsylvania's governor unveiled a model ordinance to help municipalities direct the development of wind turbines within municipal borders.[67] The model ordinance exempts stand-alone wind turbines for residential or farm use. It requires municipalities to determine and notify applicants whether their applications are complete within 30 days of receipt. Under the model ordinance, the municipality will schedule a public hearing within 60 days of the municipality's determination of whether the application is complete. The municipality will determine whether or not to grant the applicant a permit within 120 days of the completeness determination or within 45 days after the close of any hearing, whichever is later. The model ordinance requires the turbines to be unobtrusive in visual appearance, considering color, lighting, advertising, and transmission power lines, which should be placed underground to the maximum extent practicable. It includes setback requirements from occupied buildings, property lines, and public roads. It also states that audible sound from the project shall not exceed 55 dBA, as measured at the exterior of any occupied building on a non-participating landowner's property, and also requires the applicant to minimize shadow flicker through reasonable efforts.

In Pennsylvania, each county and/or township may have their own ordinance. Many have not yet adopted ordinances. Three counties in Pennsylvania host a majority of Pennsylvania wind energy facilities: Cambria, Luzerne, and Somerset counties. As of November 2009, seven different wind ordinances were enacted in these three counties.

In Cambria County, Portage Township enacted an ordinance requiring a minimum setback area of 2,000 feet from civil structures, 600 feet from participating buildings (or no less than 1.1 times the turbine height), 2,000 feet from non-participating buildings, and 1.1 times the turbine height from neighboring property lines. The Portage Township ordinance also limits noise levels to 45 dBA. Also in Cambria County, Elder Township enacted an ordinance requiring a setback of 2,000 feet from civil structures, 1.1 times the turbine height from participating buildings, 2,500 feet from non-participating buildings, and 1.1 times the turbine height from neighboring property lines. Elder Township also limited noise levels to 45 dBA.

In Luzerne County, Haines Township adopted an ordinance requiring a 2,500 foot setback from participating and non-participating buildings as well as from neighboring property lines and historic and natural sites. Haines Township also limited noise levels to 45 dBA.

Finally, Somerset County adopted an ordinance as did three townships in Somerset County. The Somerset County ordinance requires a setback from non-participating buildings equal to the tower height plus 100 feet. The Somerset County ordinance is silent as to noise level limitations. Allegheny Township in Somerset County enacted an ordinance requiring setbacks of 1.5 times the turbine height from participating buildings and property lines and five times the hub height from non-participating buildings. Allegheny Township limited noise levels to 55 dBA as determined from occupied non-participating buildings. Shade Township in Somerset County requires setbacks 1.5 times the turbine height from participating and non-participating buildings and three times the hub height from property lines of non-participating land owners. Shade Township limits noise levels at 45 dBA. The Quemahoning Township ordinance, also in Somerset County, is silent as to setbacks from structures and buildings; however, it does require a setback from non-participating landowner boundary lines of four times the turbine hub height. The Quemahoning Township ordinance also limits noise levels to 45 dBA and 60 dBC as measured from neighboring property lines. It additionally requires pre-construction noise studies.[68]

Pennsylvania involves at least five state agencies in the review process for wind energy facilities. Pennsylvania takes a collaborative approach to the permitting process, involving the Pennsylvania Natural

[67] A Model Ordinance For Wind Energy Facilities in Pennsylvania (March 21, 2006)
[68] Wind Turbine Ordinance Comparisons, Save Our Allegheny Ridges, http://www.saveouralleghenyridges.org (November 13, 2009)

Heritage Program, the Pennsylvania Game Commission (PGC), USFWS, the Pennsylvania Fish and Boat Commission (PFBC) and PDEP. Local government has the final approval of the building permits, which are subject to any ordinances that the development may be subject to. Many townships and counties have adopted ordinances regulating wind turbines and many do not have a specific ordinance for wind turbines or wind energy facilities. If a project is proposed on state game lands, the proposed project must be reviewed by PGC. PGC must make a final approval of any project proposed on game lands and requires a special use permit before an applicant may conduct surveys for birds or mammals or to collect bird or mammal specimens. The PGC Bureau of Wildlife Protection issues special use permits after the proposed project plan is reviewed and approved by the Bureau of Wildlife Management (Wildlife Diversity Section) and the Bureau of Wildlife Habitat Management (Division of Environmental Planning and Habitat Protection).

Mitigation recommended by USFWS is solely voluntary on the part of developers unless made a condition of a federal or state permit.[69] Wind developers are instructed to contact natural resource agencies during the permitting process and, when requested, the Pennsylvania Field Office of USFWS ("Field Office") will review the project and inform the developer of potential liabilities under the ESA, the Migratory Bird Treaty Act, and the Bald and Golden Eagle Protection Act.[70] PDEP issues habitat alerting permits; however, PDEP consults with PFBC in all matters concerning potential conflicts with rare species of fish, herptiles, and aquatic invertebrates for which PFBC has sole conservation and management responsibility.[71]

PDEP requires an NPDES construction permit for any applicant proposing to discharge stormwater from construction activities disturbing five acres or more of land.[72] PDEP also requires a permit for any applicant planning to construct, operate, maintain, or enlarge any water obstruction or encroachment that will affect a waterway; its 100-year floodway; or any lake, pond, reservoir, or wetland (i.e., utility line stream crossing, minor road crossings, temporary road closings).[73] Applicants must request a Pennsylvania Natural Diversity Inventory (PNDI) environmental review or "large project" review by the Pennsylvania Natural Heritage Program (PNHP) and attempt to resolve any conflicts with the required agencies prior to submitting the NPDES permit application to PDEP.[74] The PNDI satisfies ESA consultation requirements by USFWS as well all other consultation requirements; it also satisfies screening requirements for all PDEP regulations for wind farms.[75] If potential impacts are identified and clearance or recommendation letters include avoidance measures, the application must indicate that they can and will fulfill the avoidance measures.[76]

Once a developer submits an NPDES permit application, it is submitted to the local conservation district. Once the conservation district deems the application complete, notice of the proposed project is published on the Pennsylvania Bulletin for 30 days. If comment is made on the project during that time, a public hearing is scheduled and held in the township or county of the proposed project. PDEP, local government, and the developer participate in the public hearing. PDEP then issues an official response from the public hearing, either granting or denying the NPDES permit. If the project proposes to cross any streams or waterways, the developer also must apply for a stream crossing permit. The stream crossing and any required wetlands permit applications are submitted with the NPDES permit application and joins in the same approval process as the NPDES permit.[77]

69 USFWS, Processes and Authorities Related to Wind Farms, p. 1
70 USFWS, Processes and Authorities Related to Wind Farms, p. 2
71 Description of Permitting Process, Overview of Regulations and Processes for Wind Farm Permitting, Pennsylvania Fish and Boat Commission, Natural Diversity Section
72 Processes and Regulations Specific to Wind Farm Development, Pennsylvania Department of Environmental Protection, p. 1
73 Processes and Regulations Specific to Wind Farm Development, Pennsylvania Department of Environmental Protection, p. 2
74 Policy for Pennsylvania Natural Diversity Inventory (PNDI) Coordination During Permit Review and Evaluation, DEP Document # 400-0200-001
75 Policy for Pennsylvania Natural Diversity Inventory (PNDI) Coordination During Permit Review and Evaluation, DEP Document # 400-0200-001
76 Processes and Regulations Specific to Wind Farm Development, Commonwealth of Pennsylvania Department of Environmental Protection, p. 2
77 Information obtained from Justin Dresch, Northeast Regional Office of the Pennsylvania DEP

Detailed information on permitting for individual wind projects in Pennsylvania is only available by visiting the regional PDEP offices and viewing hard copies of the case files. Below is a short review of one Pennsylvania wind project which was rejected due to the PNDI process.

Shaffer Mountain, Gamesa USA

Shaffer Mountain Wind, LLC ("Shaffer Mountain") proposed to place 30-33 wind turbines on the Allegheny Front in Somerset and Bedford counties. The proposed project area encompasses 5,358 acres of land with 174 acres being physically occupied. Shaffer Mountain filed an NPDES application with PDEP on October 25, 2007.[78] Shaffer Mountain was designated a Pennsylvania Natural Heritage Area of Exceptional Significance. Shaffer Mountain hosts two of the highest-quality trout streams in the eastern US, is a world-renowned raptor migration flyway, and hosts an endangered Indiana bat colony. More than 3,000 citizens signed petitions against the project. PDEP found Gamesa's proposed plan deficient five times. An eight-page letter of deficiency from PDEP was issued on March 17, 2010, citing unacceptable plans for restoration of disrupted streams, an undisclosed timber disturbance, improper labeling and scaling of the construction site drawing, and inadequate documentation of approval by FAA, among other things. PDEP determined that Gamesa had not met its legal obligation to consult with the PNDI.[79] In addition to the federally endangered Indiana bats, the site hosts one other Pennsylvania-endangered species and 16 regionally rare bird species.[80]

[78] NPDES Permit Application, PDEP, Shaffer Mountain Wind Farm
[79] Technical Deficiency Letter, Shaffer Mountain Wind Site, DEP File No. PAI055607001 (March 17, 2009)
[80] http://shaffermountain.com/

APPENDIX C: MARYLAND PROJECTS

Clipper Windpower, Inc. – Kelso Gap

Clipper Windpower, Inc. ("Clipper") applied for a CPCN with MPSC on August 26, 2002, proposing to construct a wind farm with up to a 101 MW capacity, consisting of up to 67 wind turbines of 1.5 MW each. The turbines would be installed on 80 meter towers located on Backbone Mountain near Oakland in Garrett County. At the time of proposal, this facility would have been the largest in the eastern US. The project consists of two sections, a north section (3.3 miles in length) and a south section (5.3 miles in length). Clipper stated it would also consider installing fewer turbines, up to 56 turbines with 1.8 MW capacity each, totaling a maximum capacity of 101 MW. The project site is located on open farmland and wooded land, which has all been previously logged or mined.

Intervenor status was granted to four private citizens, one of whom was a noted wildlife research biologist and another who was a wildlife biologist and consulting conservation biologist. Clipper entered into an agreement of stipulation and settlement ("Agreement") with the Maryland Department of Natural Resources Power Plant Research Program, the Office of People's Counsel, the staff of MPSC, and the intervenors. Under the terms of the Agreement, the parties would recommend that MPSC grant Clipper a CPCN subject to conditions aimed to mitigate potential adverse impacts that may result from the project. The conditions include that MPSC may order mitigation measures if significant bird mortality occurs, including requiring Clipper to relocate or curtail operations of one or more towers. In the Agreement, Clipper also committed to minimizing lighting and an objective post-construction study of bird mortality for a three-year period.

In considering the esthetics of the project, MPSC concluded that most views of the project will be distant views with the project blending in with the landscape and will be mostly shielded from visibility by terrain and vegetation. MPSC also considered the project's effect on aviation safety. It found that no airports or landing strips are located within five miles of the project site and neither FAA nor the Maryland Aviation Administration proposed aviation-related conditions. MPSC also noted that Clipper was in the process of applying for permits from FAA and consulting with FAA on lighting requirements. MPSC found that the project will have no effect on air and water pollution and that stormwater management systems, sediment control facilities, and spill control features will be installed to accommodate construction activities. MPSC determined that the project offered significant environmental benefits by way of air pollution avoidance and water resource maintenance. Lastly, MPSC considered the availability of means for required timely disposal of wastes produced by the generating system. It reviewed the project's plan for storage of oil and diesel fuel, waste materials disposal, temporary portable sanitary facilities, a permanent septic system, solid waste disposal, and disposal of waste oil.

MPSC found that the most contested issue with Clipper's application was the project's potential impacts to bird populations. It concluded that the evidence presented was inconclusive; however, the conditions agreed to by the parties would eliminate that uncertainty.

MPSC granted a CPCN on February 11, 2003, conditioned in part upon coordination with and review by the Maryland Historical Trust for adverse visual effects; granting representatives of the Maryland Department of Natural Resources, Maryland Department of the Environment, and MPSC access to the site to ensure compliance with the CPCN; minimizing lighting on the turbines; undertaking a post-construction study of bird and bat mortality; coordination and compliance with the Maryland Department of Natural Resources to reduce bird or bat mortality; determination by the Natural Heritage Program that there will be no taking of a species; and construction so as to maintain a minimum buffer distance to residences.[81]

[81] Case No. 8938, Proposed Order (February 11, 2003)

Savage Mountain Wind Force, LLC

Savage Mountain Wind Force, LLC ("Savage Mountain") filed an application for a CPCN on August 29, 2002. The project site is 1,052 acres near Lonaconing in western Allegany and eastern Garrett counties. The site is currently used by Clise Coal Company for strip mining. The project proposed to include up to 25 wind turbines, each having an installed capacity of up to 2 MW. Two private citizens were granted intervenor status. At the public hearing, all citizens who commented were in favor of the project. A settlement agreement was reached and submitted on January 3, 2003 between Savage Mountain, the Power Plant Research Program, Office of People's Counsel, and MPSC staff recommending that a CPCN be granted subject to various conditions constituting a comprehensive plan to mitigate potential adverse environmental impacts. A unanimous agreement of stipulation and settlement containing revised conditions was submitted on January 14, 2003 between the parties to the first agreement and the intervenors. The conditions relating to potential avian impacts were of particular significance to MPSC, and provided that if significant bird mortality occurs, MPSC may order measures to mitigate such impacts, including curtailing operations of or relocating towers. The conditions also include minimizing lighting at the project site and on turbine towers and conducting an objective post-construction study of bird mortality for three years. The conditions also call for the performance of an acoustic monitoring study of overflights of birds.

Prior to 2007, MPSC was required to take final action on an application for a CPCN after due consideration of recommendations by the governing body of each county. The Board of Garrett County Commissioners expressed support for the project and urged MPSC to grant the CPCN. The County Commissioners of Allegany County did not correspond with MPSC regarding the project; however, it adopted an amendment to the county zoning regulations, effective November 24, 2003, explicitly allowing wind energy facilities to operate in areas zoned for agriculture, forestry, and mining uses, and in conservation zoning districts. MPSC considered this favorable consideration by Allegany County.

MPSC considered the project's effect on esthetics, finding that the proposed turbines would be visible from some vantage points. However, it determined that the turbines would be screened from most of the more populated areas or would be far enough away to minimize their impact. MPSC found that the project would not significantly adversely impact the developed uses in the area. It also considered the project's effect on aviation safety. The Commission noted that Savage Mountain was in the process of consulting with FAA and applying for FAA permits. Additionally, MPSC considered the project's potential impact to air and water pollution and found that there would be no adverse effects to air and water pollution. MPSC is also required to consider disposal of wastes produced by the project; it found that the project would produce minimal solid wastes, which would be disposed of at a licensed offsite landfill. Hazardous wastes will be handled and disposed of according to state requirements. As such, MPSC granted Savage Mountain a CPCN on February 4, 2003.[82]

Synergics Roth Rock Wind Energy, LLC and Synergics Wind Energy, LLC – Roth Rock

Synergics Roth Rock Wind Energy, LLC and Synergics Wind Energy, LLC ("Synergics") applied for an exemption from the requirement to obtain a CPCN for construction of a wind farm consisting of up to 50 MW of wind turbine generators called the "Roth Rock Wind Farm" on April 21, 2009. The project would be located on a three-mile stretch of Backbone Mountain near Oakland in Garrett County. MPSC found that Synergics met the statutory requirements for exemption and thus granted an exemption from the CPCN requirements on November 18, 2009.

The Code of Maryland states that MPSC "shall exempt" an applicant from the CPCN requirement if the applicant meets the statutory requirements for exemption under Section 7-207.1 of the Public Utilities

[82] PUC Case No. 8939, Order (February 4, 2003)

Code.[83] The statute provides that an applicant constructing a land-based, wind generating station with a capacity not exceeding 70 MW, for which the generated electricity is sold solely on the wholesale market, may apply for approval.[84] The General Assembly limited MPSC's review of an application under this section to "ensur[ing] the safety and reliability of the electric system."[85] The General Assembly enacted the CPCN exemption for small land-based generating stations in 2007 and left all other issues, except for safety and reliability of the electric system, to other state and local agencies.

Synergics first submitted an application for a CPCN in 2004 for a 40 MW wind generating facility at the same site.[86] The CPCN exception was enacted by the General Assembly in 2007. Synergics withdrew its CPCN application in May 2008 and in 2009, Synergics applied for a CPCN exemption for the same project (although larger) as proposed in the 2004 CPCN application.[87]

Dans Mountain Wind Force, LLC

Dans Mountain Wind Force, LLC ("Dans Mountain") applied for an exemption of the CPCN requirement pursuant to the Maryland Public Utilities Code § 7-207.1 on November 4, 2008. Dans Mountain proposed to construct a 69.6 MW wind facility in western Allegany County. The project would consist of up to 29 wind turbines located on 1,767 acres, four miles southeast of Frostburg. The project met the statutory requirements for exemption being that it is land-based, proposes to produce no more than 70 MW of electricity, the electricity generated will be sold only on the wholesale market, and MPSC will provide an opportunity for public comment at a public hearing.[88] MPSC granted Dans Mountain's request on March 12, 2009 subject to certain conditions, including Dans Mountain's commitment to operating a program to measure shadow flicker and adopt reasonable mitigation measures if shadow flicker becomes of concern; compliance with the state's daytime and nighttime noise standards; compliance with the existing buffer requirements to the closest residence; and conducting bat and bird monitoring after construction.[89]

Allegany County

Allegany County recently enacted an ordinance imposing new conditions on wind development in the county.[90] These conditions address minimum separation distances, setback requirements, electromagnetic interference, bonds for decommissioning and groundwater protection, and supplemental safety provisions. Since the adoption of that ordinance, the proposed projects in Allegany County have been withdrawn by the developers.

[83] Md. Code Ann., Pub. Util. Cos. § 7-207.1(a)(1)(ii)
[84] Md. Code Ann., Pub. Util. Cos. § 7-207.1(a)(1)(ii)
[85] Md. Code Ann., Pub. Util. Cos. § 7-207.1(c)
[86] PUC Case No. 9008
[87] PUC Case No. 9191, Order No. 83021 (November 18, 2009)
[88] Md. Code Ann., Pub. Util. Cos. § 7-207.1(a)(1)(iii)
[89] PUC Case No. 9164, Order (March 12, 2009)
[90] Wind Energy Conversion Systems Regulations, Code of Allegany Co., MD, Part 4 Zoning Art. 17 § 141-106 (amended and effective June 4, 2009)

Table 13: Maryland wind projects

Project	Application date	Permit decision	Time from application to decision	Intervenor concerns	Regulating agency concerns	Regulatory basis for approval/denial
Kelso Gap	August 26, 2002	Approved	169 days	Per agreement withdrew objections	Bird and bat mortality, satisfied by agreement conditions	Md. Code Ann., Pub. Util. Cos. §§ 7-207 & 7-208
Savage Mountain	August 29, 2002	Approved	159 days	Per agreement withdrew objections	Bird mortality mitigation, lighting, and noise	Md. Code Ann., Pub. Util. Cos. §§ 7-207 & 7-208
Dans Mountain	Exemption: November 4, 2008	Exemption approved	128 days		Bird mortality, shadow flicker, noise, buffer zone	Md. Code Ann., Pub. Util. Cos. § 7-207.1(a)(1)(ii),
Roth Rock	Exemption: April 21, 2009	Exemption approved	211 days		Safety and reliability of electric system	Md. Code Ann., Pub. Util. Cos. § 7-207.1(a)(1)(ii),

APPENDIX D: VIRGINIA PROJECTS

Highland New Wind

On November 8, 2005, Highland New Wind Development, LLC ("Highland Wind") applied for a CPCN and requested approval from VSCC to construct a wind energy generating facility in Highland County on parts of Allegheny Mountain, specifically Red Oak Knob and Tamarack Ridge. The proposed project would consist of up to 20 400-foot tall turbines with a capacity of 2 MW each. Private citizens, The Nature Conservancy in Virginia, the Virginia Department of Game and Inland Fisheries, and the Highland County Board of Supervisors requested and were granted respondent status.

In 2002, VDEQ coordinated a review of the proposed project prior to Highland filing its CPCN application. The following state and local agencies participated in that review: VDEQ; Department of Game and Inland Fisheries; Department of Conservation and Recreation; Department of Historic Resources; Department of Agriculture and Consumer Services; Department of Health; Department of Aviation; Department of Forestry; Department of Transportation; Marine Resources Commission; Department of Mines, Minerals and Energy; Central Shenandoah Planning District Commission; and Highland County. The VDEQ report recommended specific conditions for approval of a CPCN, which VSCC so adopted. Those conditions included avoiding impacts to wetlands, protecting natural resources during construction, and working closely with the Virginia Department of Game and Inland Fisheries and USFWS to ensure protection of endangered species. Highland Wind requested limitations and/or modifications to these requirements; however, VSCC found them necessary and rejected Highland Wind's request.

Two public hearings were held in March 2006. VSCC, concerned with the project's potential risks to birds and bats, advised Highland Wind to develop a comprehensive post-construction monitoring and mitigation plan. The County issued Highland Wind a conditional use permit pursuant to the county's zoning ordinance. VSCC found that the county's conditional use permit properly took into consideration property values, tourism, viewshed, height restrictions, setbacks, lighting, color of structures, fencing, security measures, erosion and sediment control, signage, access roads, and decommissioning. Therefore, VSCC found that the county's analysis of such matters satisfied the requirements of Sections 56-46.1 and 56-580(D) and declined to impose any additional conditions relating to those subjects.

VSCC approved Highland Wind's CPCN application and granted approval to construct the proposed project subject to several requirements on December 20, 2007. Citizen participants requested that VSCC require Highland Wind to obtain an ITP under the ESA or enter into a HCP. VSCC found that a HCP or ITP was not necessary to minimize adverse environmental impacts, and thus did not require Highland Wind to obtain either. VSCC did, however, require monitoring and mitigation plans for potential adverse impacts to birds and bats. Highland Wind objected to the monitoring and mitigation plan, asking VSCC to balance any wildlife concerns with the positive attributes of a wind energy facility. VSCC responded that even in a light most favorable to Highland Wind, the considerations neither factually nor legally warrant the relaxed monitoring and mitigation plans proposed by Highland Wind. VSCC directed the Virginia Department of Game and Inland Fisheries to implement both the monitoring and mitigation plans.

Highland Wind objected to the monitoring and mitigation plans on grounds that it was the most expensive and intrusive plan in the region and pushed the edges of economic viability of the project. The monitoring and mitigation plans included a long-term objective of reducing bat mortality to 2.1 bats per year per turbine and 2.3 species-of-greatest-conservation-needs birds per turbine per year. The plans also required Highland Wind to pay for each raptor killed at the facility: $500 per osprey, $1,000 per barn owl, and $1,500 per bald eagle. Cost caps were recommended by the hearing examiner, but the VSCC rejected them because the caps were based on revenue only. VSCC imposed monitoring caps of $150,000 per year for the first three years and thereafter, $100,000 or 1.75% of the prior year's gross revenues, whichever is higher. It also imposed a mitigation cost cap of $50,000 or 0.85% of the prior year's gross revenues, whichever is higher.[91]

The Animal Welfare Institute and the public-interest law firm Meyer Glizenstein and Crystal, along with concerned citizens and conservationists, have notified Highland Wind of their intent to sue if Highland Wind proceeds with construction of wind turbines. The parties allege that the project violates the ESA and Highland Wind must obtain an ITP under the ESA. During the application process, Highland Wind advised county supervisors that it would seek to obtain an ITP under the ESA; however, Highland Wind more recently advised that it will begin construction without the permit. Meyer Glizenstein and Crystal is the same firm that represented the plaintiffs in the federal court case against Beech Ridge Wind Project in West Virginia, where the court granted an injunction and required Beech Ridge to seek an ITP.[92]

Dominion Energy and BP Wind Energy

In January 2009, Dominion Energy and BP Wind Energy proposed to erect 60 wind turbines along East River Mountain Ridgeline in Tazewell County. Dominion and BP purchased about 2,500 acres for the project site. The wind turbines would stand 400 feet tall. Tazewell County, faced with much public opposition to the project, adopted an ordinance preventing any structures taller than 40 feet from being constructed on county ridgelines. The County adopted the ordinance in February 2010, before the developers applied for a permit with VSCC.[93]

Table 14: Virginia wind projects

Project	Application date	Permit decision	Time from application to decision	Intervenor concerns	Regulating agency concerns	Regulatory basis for approval/denial
Highland New Wind	November 8, 2005	Approved	407 days	Bird/bat mortality monitoring, endangered species	Monitoring and mitigation, birds and bats, and costs caps	Va. Code Ann. § 56-580 D, Not contrary to the public interest
Dominion Energy and BP Wind Energy	No application submitted					

[91] SCC Case No. PUE-2005-00101, Final Order (December 20, 2007)
[92] http://www.vawind.org/#MGC
[93] An Ordinance to Regulate Construction of Tall Structures on Certain Ridgelines in Tazewell County, Virginia, Tazewell Co. Code Art. 6 § 15-110 *et seq*.

APPENDIX E: KENTUCKY PROJECTS

To date, no wind turbine projects have been proposed in Kentucky. However, a developer wishing to construct a wind farm in Kentucky would need to obtain an NPDES permit, 401 certification, and 404 permit under the Clean Water Act. If back-up generators are installed at the project site, air quality registration maybe required.

In Kentucky, wholesale electric generating facilities are regulated by the Kentucky State Board on Electric Generation and Transmission Siting ("Siting Board"). A CPCN is required for wholesale electric generating facilities and merchant plants that generate 10 MW or more. The Siting Board review focuses on environmental matters not covered by permits issued by the Kentucky Department for Environmental Protection. The Department issues permits for air emissions, water withdrawals and discharges, and solid waste disposal. The Siting Board review focuses on matters such as noise and visual impacts, among others, as well as economic impacts and the impact of the proposed facility on Kentucky's electric transmission grid. A developer must submit a Notice of Intent 30 days in advance of submitting a CPCN application. The Siting Board will conduct an evidentiary hearing, and a public hearing will be held if requested by a local government entity or if requested by at least three residents of the locality where the proposed site would be located.[94] A developer must submit a cumulative environmental assessment to the Energy and Environment Cabinet in accordance with 18 KRS 224.10-280. Once a complete CPCN application is submitted to the Siting Board, the Board has 90 day to grant or deny the permit, or in the event a hearing is requested, the Board has 120 days to grant or deny the permit.[95]

[94] Kentucky's Electric Generation and Transmission Siting Process, Kentucky State Board on Electric Generation and Transmission Siting, http://psc.ky.gov/Home/EGTSB

[95] 807 KAR 5:120

Appendix B: "A Resource List for Community Wind in Appalachia"

A Resource List for Community Wind in Appalachia

Brent Bailey
Evan Hansen

The Mountain Institute
Appalachia Program
235 High Street, Ste. 706
Morgantown, WV 26505
www.mountain.org

Downstream Strategies
295 High Street, Ste. 3
Morgantown, WV 26505
www.downstreamstrategies.com

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This document is a companion to the full technical report: *A Windfall for Coal Country? Exploring the Barriers to Wind Development in Appalachia.* The technical report can be downloaded from The Mountain Institute at www.mountain.org/map/water-and-energy or from Downstream Strategies at www.downstreamstrategies.com/projects.html.

Please refer to the technical report for a full set of acknowledgements; a more detailed analysis related to wind development in West Virginia, Pennsylvania, Maryland, Virginia, and Kentucky; and the full set of references.

DISCLAIMER

This report is accurate as of November 2011, when it was finalized. Even though wind development has continued since then, the authors believe that the fundamental conclusions and recommendations stand as written.

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ABBREVIATIONS

AEP	American Electric Power
CPCN	Certificate of Public Convenience and Necessity
EIA	Energy Information Administration
ESA	Endangered Species Act
HB	House Bill
kW	kilowatt
m	meter
MPSC	Maryland Public Service Commission
MW	megawatt
MWh	megawatt-hour
NREL	National Renewable Energy Laboratory
NYSERDA	New York State Energy Research and Development Authority
PDCNR	Pennsylvania Department of Conservation and Natural Resources
PDEP	Pennsylvania Department of Environmental Protection
PPUC	Pennsylvania Public Utility Commission
RPS	renewable portfolio standard
US	United States
USDOE	United States Department of Energy
VDEQ	Virginia Department of Environmental Quality
VSCC	Virginia State Corporation Commission
WVPSC	West Virginia Public Service Commission

1. INTRODUCTION

Wind is a rapidly growing renewable energy resource in the United States (US); in 2009 and for the fifth consecutive year, growth in wind power generating capacity exceeded that of new coal plants and was only behind that of new natural gas plants (USDOE, 2009). By 2009, the US had more than 35,000 megawatts (MW) of installed wind capacity,[1] more than anywhere else in the world, and only trailing China in annual wind capacity additions (USDOE, 2009). In 2010, US wind capacity continued to expand, but at half the rate of the previous year due to fluctuations in the economy (American Wind Energy Association, 2011).

As shown in Figure 1, the five Appalachian states considered in this report are home to 29 wind projects, ranging in size from 3 to 264 MW. These projects were under construction, partially in service, or in service according to the PJM Active Generation Queue list as of May 2, 2011 (PJM, 2011).[2] If built as planned, a total of 2,039 MW of wind turbines would be installed across the region.

Wind projects can be large or small, and many different ownership structures can be used. This resource list focuses on an ownership structure called "community wind."

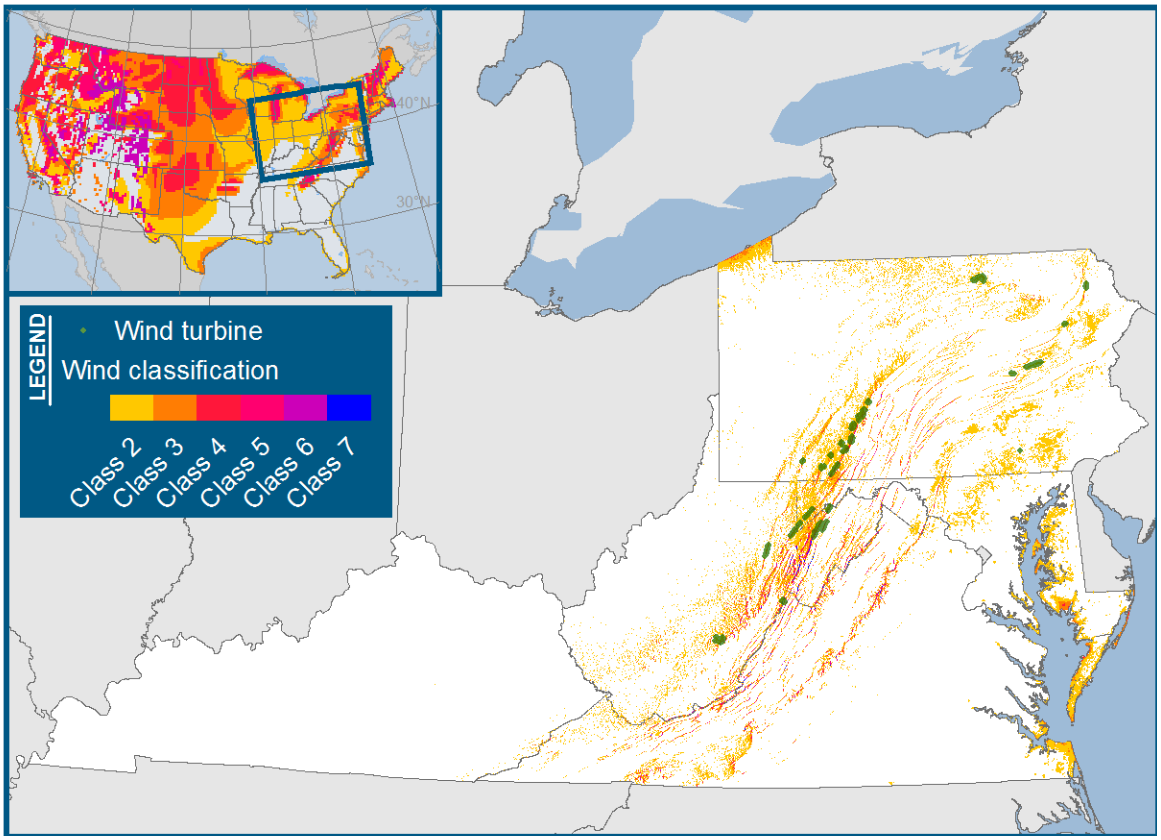
Community wind is defined as a locally-owned, commercial-scale wind project that optimizes local benefits. Locally-owned means that a significant direct financial stake and decision-making authority in the development of the project (other than through land lease payments, tax revenue, or payments in lieu of taxes) is held by one or more local individuals or entities.[3] Commercial-scale means projects that are designed for bulk power generation and sale to a retail electric utility company distributing electricity locally, or for distribution to a non-residential electricity user.

Community wind projects have a host of potential positive effects for the local community including social, economic, and environmental benefits. Additionally, community wind projects are typically located in rural areas due to the requisite property or project acreage for proper turbine function and compliance with zoning codes. In this light, wind turbines provide an opportunity for often-impoverished regions to create a new, stable, and diversified income stream. This additional income and diversification of the income stream helps to reduce the impact of boom and bust business cycles typically associated with agriculture and mining. According to a report by the New Rules Project: "Farmers can earn a few thousand dollars a year per turbine by leasing their land to developers. Or they can earn [up to] ten times that amount by becoming owners of the turbines" (Farrell and Morris, 2008, p. 12).

Economically, community wind projects tend to benefit the local community by using local labor and materials during project development and operations, providing dividends to local shareholders, and patronizing local banks for construction, financing, and operating loans (Lantz and Tegen, 2009). For these reasons, "several studies have investigated the difference between local- and absentee owned wind turbines and all have found substantial increases in net economic benefits when turbines are locally owned, both in jobs and in total economic output" (Farrell and Morris, 2008, p. 22). Even more notably, "in all but one of the studies, the economic impact of community wind projects more than tripled that of an absentee owned wind farm" (Farrell and Morris, 2008, p. 22).

[1] Here and in the rest of the report, the word "capacity" refers to nameplate capacity, or the maximum power generated by a wind turbine should the wind blow at the optimal speed. In reality, winds are variable and turbines' true generating capacities are considerably less than their installed capacity. For example, the average capacity factor of wind farms operating in Pennsylvania and West Virginia in 2009 was 27.5% (EIA, 2009 and 2011). Also, PJM assumes an average summer capacity factor of 13% for new wind projects (PJM, 2010).
[2] In this report, we aggregate PJM's under construction, partially in service, and in service categories to represent existing wind capacity.
[3] This definition is based on the definition of community wind in Windustry's (2010) Wind Energy Glossary.

Figure 1: Wind resources in the United States and Appalachian coal country



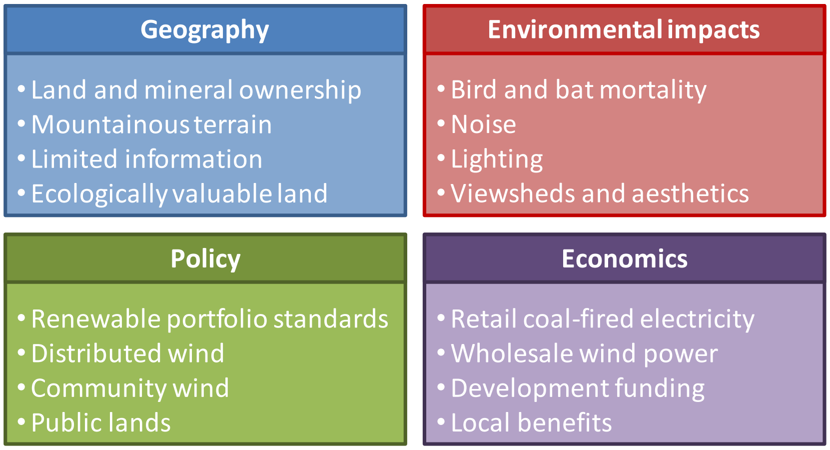
Sources: Wind resources in Pennsylvania, West Virginia, Maryland, and Virginia: AWS Truewind (2003a). In Kentucky: AWS Truewind (2008). In inset: NREL (1986). Note: Wind resources are at 50-meter hub heights. The five Appalachian states are at 200-meter resolution, and the inset is at 30-kilometer resolution. The map does not depict unnamed "Project near Gans substation" in Fayette County, Pennsylvania. Note: turbine locations are shown as green dots.

There are many excellent existing resources for people developing community wind projects. The intention of this document is to provide additional context for community wind developers facing unique conditions in Appalachia. It is strongly encouraged that readers make use of the three resources presented after the state summaries, which were written by:

- Windustry,
- National Renewable Energy Laboratory (NREL), and
- New York State Energy & Research Development Authority (NYSERDA).

Developers of community wind projects should also consider the major barriers to wind energy development in Appalachia, as illustrated in Figure 2. These include barriers related to geography, environmental impacts, policy, and economics. While some barriers—such as state policy—can be changed, others like Appalachia's mountainous terrain cannot. Any one barrier in and of itself may not prevent the development of wind energy in Appalachia, but a cluster of barriers is more likely to do so.

Figure 2: Types of barriers to wind energy development in Appalachia



2. STATE SUMMARIES

As background, we first present key information about each of the five states related to the wind resource and electricity generation. These facts will help potential community wind developers understand the historical context of electricity generation in each state as well as the areas of the state with current wind projects and the most likely sites for viable wind projects.

We then describe the regulatory review process for each state. Finally, we present information on two key wind-related policies that vary between states and that are relevant for potential developers of community wind: renewable portfolio standards (RPSs) and net metering.

RPSs, set by state law, require a percentage of an electric provider's energy sales (measured in megawatt-hours, or MWh) or installed capacity (measured in MW) to come from renewable energy resources. RPSs in Pennsylvania and West Virginia include alternative fossil fuel–based energy sources in addition to renewables. Some cite RPSs as states' most powerful tools to promote wind energy (Bird et al., 2003).

While the existence and characteristics of each state's RPS is important for wind development in that state, the RPSs in nearby states are also important. Regional green power demand, driven by nearby RPSs, can help promote wind development in Appalachia. For example, West Virginia's wind resource is close to Washington, DC and is therefore strategically located to serve that area's green power demand (Bird et al., 2003).

In addition to RPSs, net metering is an important policy for the promotion of distributed wind. While all five states in Appalachia allow net metering, the capacity limits across the states vary considerably (Table 1). The aggregate limits vary as well. Pennsylvania is most flexible because it does not contain an aggregate limit. Maryland's aggregate limit is fixed: 1,500 MW. In West Virginia, Virginia, and Kentucky, aggregate limits are based on peak loads in the previous year. (North Carolina State University and Interstate Renewable Energy Council, 2010)

As shown in Figure 3, Pennsylvania, Maryland, and Virginia have the most net metering customers of the five states considered in this report. The total number of net metering customers across the five states in 2008—837 customers—is very small compared with the total across the US: 70,009 customers. However, the US total is significantly impacted by the fact that California had almost 46,000 net metering customers in 2008. All five Appalachian states experienced significant growth in net metering customers between 2007 and 2008 (EIA, 2010f).

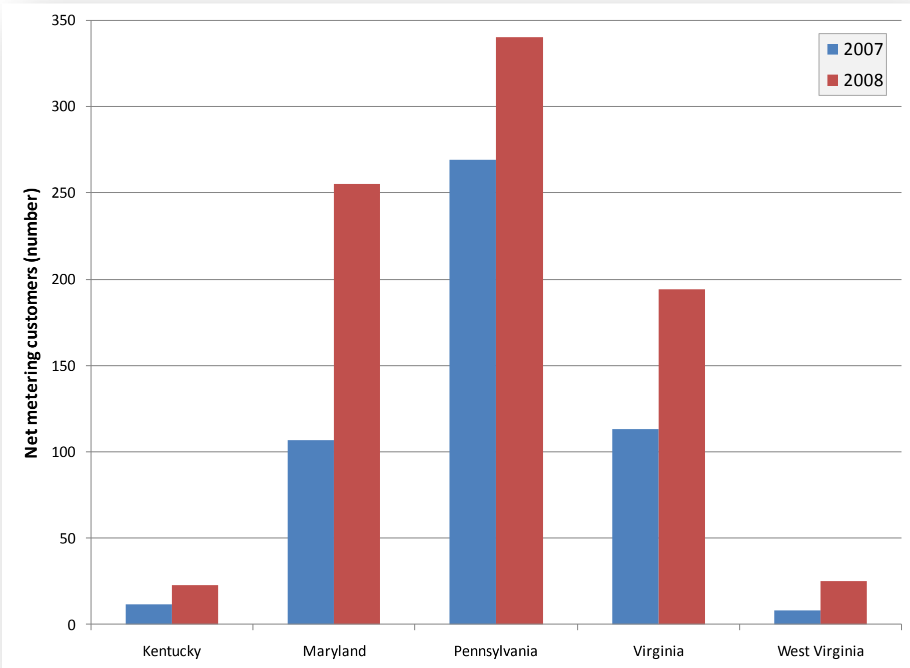
The full technical report that accompanies this resource list provides a more exhaustive discussion of relevant policies.

Table 1: Net metering capacity limits (kW)

Sector	West Virginia	Pennsylvania	Maryland	Virginia	Kentucky
General			2,000		30
Residential	25	50		20	
Commercial	500				
Industrial	2,000				
Non-residential		3,000		500	
Other		5,000	30		

Source: North Carolina State University and Interstate Renewable Energy Council (2010). Note: West Virginia limits are lower for IOUs with fewer than 30,000 customers, municipal utilities, and co-ops. Pennsylvania's "other" limits are for micro-grid and emergency systems. Maryland's "other" limit is for micro-combined heat and power.

Figure 3: Net metering customers, 2007-2008



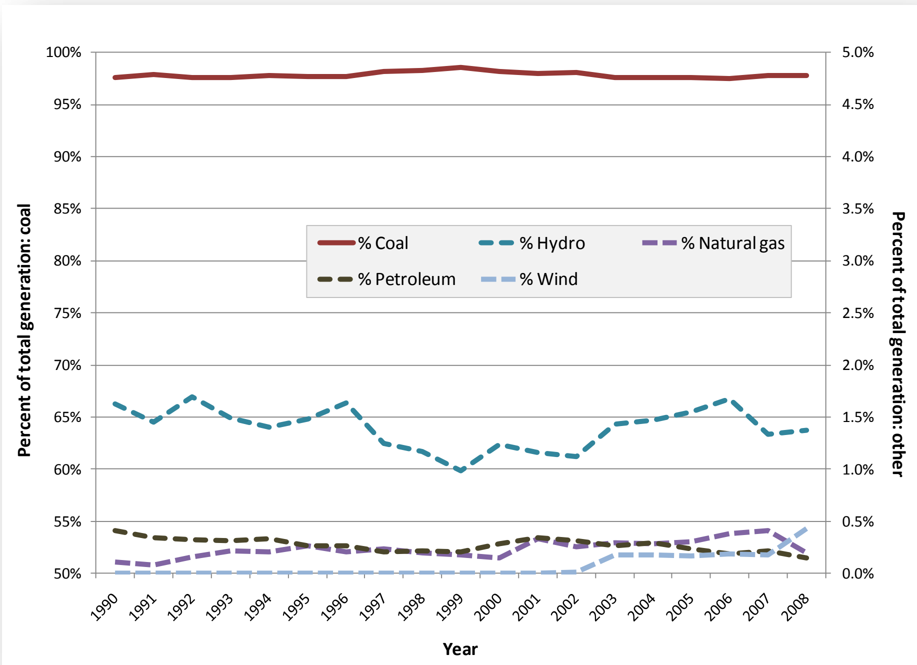
Source: EIA (2010f).

2.1 West Virginia

2.1.1 *Electricity generation and wind resources*

Coal's share of electricity generation in West Virginia has remained stable since 1990, hovering between 97.6% and 98.6% of net generation (see Figure 4). Wind projects in operation in West Virginia as of 2008 generated approximately 0.4% of the state's total electricity generation, amounting to 391,000 MWh of generation (EIA, 2010a).

Figure 4: Percent of total electricity generation by energy source for West Virginia, 1990-2008

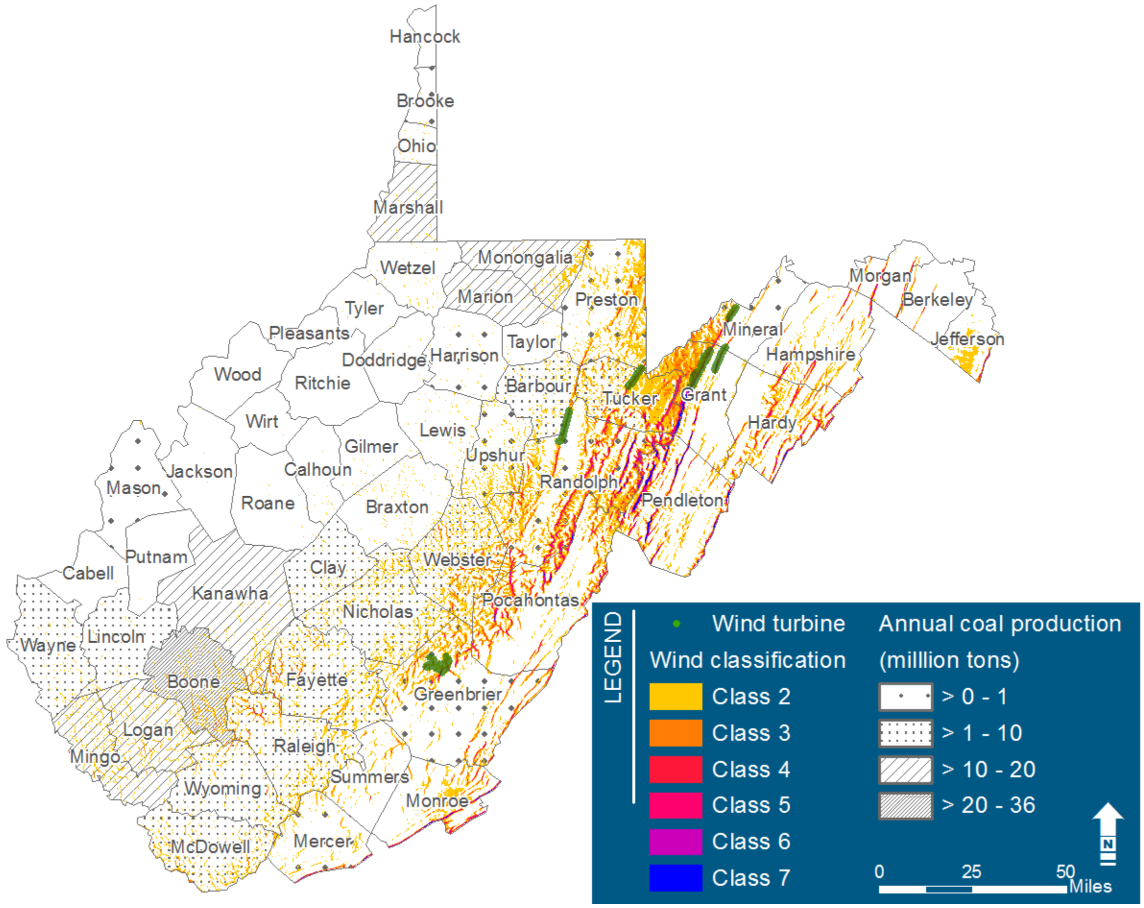


Source: EIA (2010a).

NREL estimates that full development of the 80 meter (m) wind resource would annually produce approximately 5.8 million MWh of electricity. This would equate to approximately 6.4% of the state's total net generation in 2008. The development of the full 100 m wind resource could provide approximately 9.5% of 2008 net generation (NREL, 2010a and EIA, 2010a).

As shown in Figure 5, West Virginia's wind resource is concentrated in the eastern half of the state, with the highest wind classes along its mountain ridges. Randolph, Tucker, Grant, Pendleton, and Pocahontas counties have the most land area with Class 3 and above wind resources (AWS Truewind, 2003a).

Figure 5: Wind resource, wind turbines, and 2008-2009 coal production in West Virginia counties



Sources: AWS Truewind (2003a) and MSHA (2010).

2.1.2 *Regulatory review process*

In West Virginia, the responsibility for review of environmental and esthetic impacts of proposed electricity-generating projects, including wind projects, lies with West Virginia Public Service Commission (WVPSC). Application requirements for a siting certificate,[4] which allows facility construction, are enumerated in a set of rules that also mandate 30 days' notice before filing an application and 300 days for project evaluation. The siting certificate contains WVPSC's approval and often contains a number of terms and conditions. Notwithstanding WVPSC's consideration of environmental issues, the siting certificate customarily requires evidence that all permits necessary for construction have been obtained from the United States Fish and Wildlife Service, West Virginia Division of Natural Resources, West Virginia Division of Culture and History, and West Virginia State Historic Preservation Office.

WVPSC uses a two-part balancing test to "appraise and balance the interests of the public, the general interests of the state and local economy, and the interests of the applicant."[5]

First, WVPSC appraises and balances: "(a) an applicant's interest to construct an electric wholesale generation facility; (b) the State's and region's need for new electrical generating plants; and (c) the economic gain to the state and local economy, against: (i) community residents' interest in living separate

[4] W. Va. Code § 24-2-11c
[5] W. Va. Code § 24-2-11c(c)

and apart from such a facility; (ii) a community's interest that a facility's negative impacts be as minimally disruptive to existing property uses as is reasonably possible; and (iii) the social and environmental impacts of the proposed facility on the local vicinity, the surrounding region, and the State."[6]

If in the first part of the analysis, WVPSC determines that positive impacts outweigh negative impacts, it moves to the second part and decides whether "the terms and conditions of any public funding or any agreement relating to the abatement of property taxes do not offend the public interest, and the construction of the facility or material modification of the facility will result in a substantial positive impact on the local economy and local employment."[7] Only if both tests are passed can WVPSC issue a siting certificate.

2.1.3 *Renewable portfolio standard*

In 2009, the West Virginia Legislature passed the Alternative and Renewable Energy Portfolio Act, which requires utilities to obtain 25% of their electricity from alternative or renewable energy sources by 2025.[8] The "alternative energy" definition in the West Virginia statute encompasses a wide range of coal and fossil fuel–based energy sources, including advanced coal technologies, coal bed methane, natural gas, fuel produced by coal gasification or liquefaction facilities, synthetic gas, integrated gasification combined cycle technologies, waste coal, and tire-derived fuel. Renewable energy sources include solar photovoltaic, solar thermal, wind, run-of-river hydropower, geothermal, biomass, biologically-derived fuel, and fuel cell technology.[9] Utilities are awarded double credits for each MWh of renewable energy generation, and three credits for renewable energy generation on reclaimed surface mines.[10]

The Act provides for compliance monitoring, but not until 2015. The compliance target for January 1, 2015 equals 10% of the utility's total in-state energy sold. The terms of the Act are neutral with regards to renewables and wind; therefore, it has done little to influence the selection of wind over other potential types of renewables. In fact, in Allegheny Power's compliance plan submitted to WVPSC, the company stated that it needs no new generation to satisfy this standard for 15 years and will instead rely on its existing, qualifying hydro and coal facilities (Monongahela Power Company and Potomac Edison Company, 2010). American Electric Power (AEP), the state's other major utility, also needs no new generation to satisfy this standard (Appalachian Power Company and Wheeling Power Company, 2010).

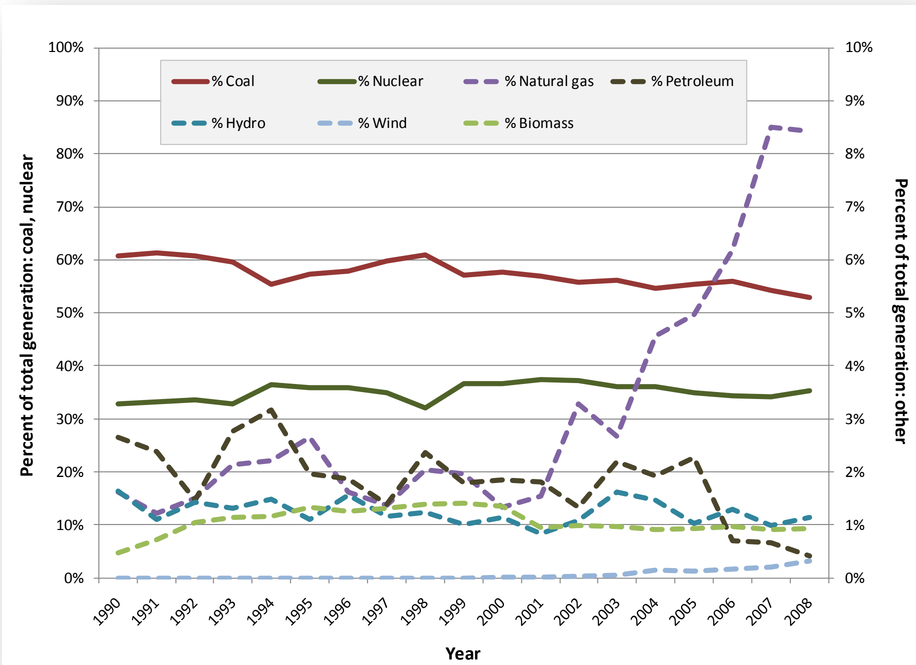
[6] The test is articulated in Longview Power, LLC, Case No. 03-1860-E-CS (Order dated August 27, 2004 at 190-91, Conclusions of Law #5-7).
[7] W. Va. Code § 24-2-11c(c)
[8] W.Va. Code §24-2F-6
[9] W.Va. Code §24-2F-3
[10] W.Va. Code §24-2F-4

2.2 Pennsylvania

2.2.1 *Electricity generation and wind resources*

Coal's share of electricity generation in Pennsylvania has declined since 1990, falling from 61% of total generation to 53% as of 2008 (See Figure 6), even though coal-fired generation has grown in absolute terms. Wind power has grown from 0% in 1999 to 0.3% of total generation by 2008. Natural gas has risen significantly since 2004, accounting for most of the growth in electricity generation in Pennsylvania.

Figure 6: Percent of total electricity generation by energy source for Pennsylvania, 1990-2008

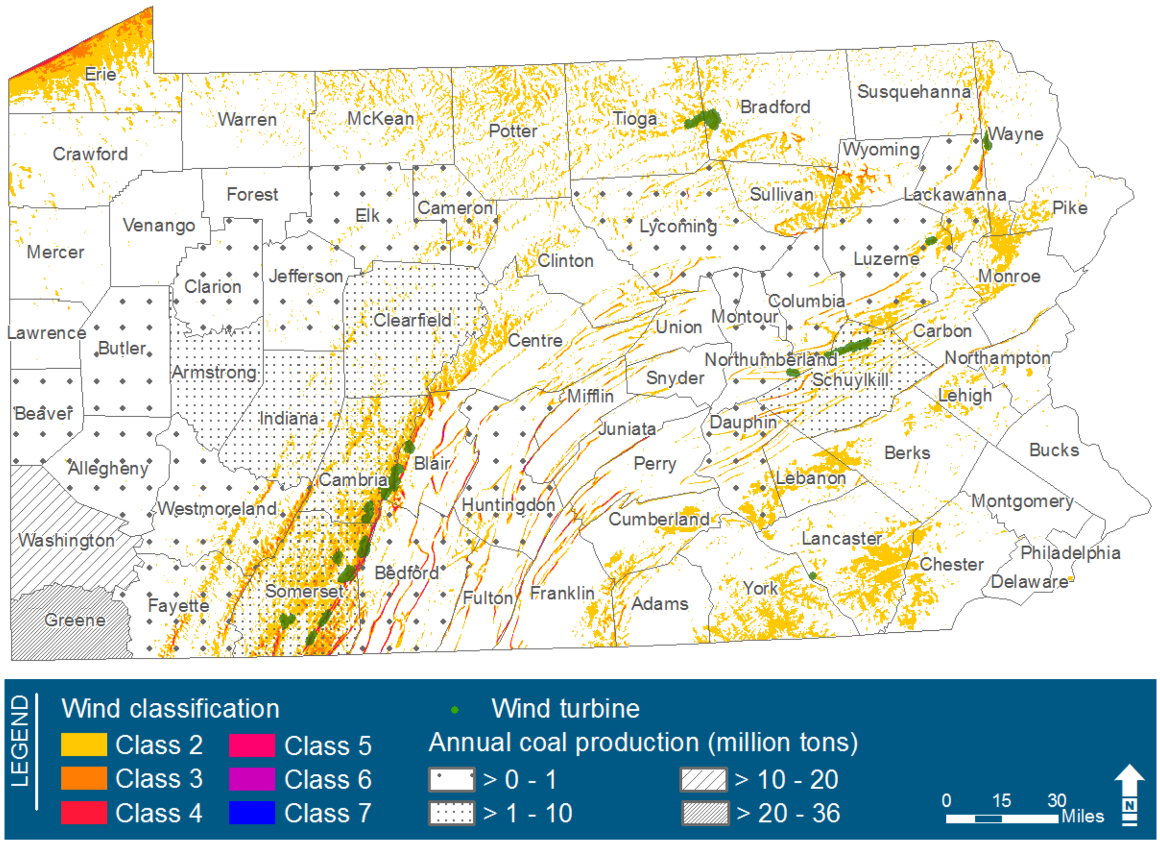


Source: EIA (2010a).

NREL estimates that full development of the 80 m wind resource would annually produce approximately 9.7 million MWh of electricity, approximately 4.4% of the state's total net generation in 2008. The development of the full 100 m wind resource could provide approximately 9.5% of 2008 net generation (NREL, 2010a and EIA, 2010a).

As shown in Figure 7, Pennsylvania's wind resource is strong in Erie County along the bank of Lake Erie, as well as along the mountain ridges that generally run northeast from the state's southern border with Maryland. Erie, Somerset, Blair, Bedford, and Cambria counties have the most land area at Class 3 and above (AWS Truewind, 2003a).

Figure 7: Wind resource, wind turbines, and 2008-2009 coal production in Pennsylvania counties



Source: AWS Truewind (2003a) and MSHA (2010).

2.2.2 *Regulatory review process*

Pennsylvania has not adopted a comprehensive environmental review program; rather, it permits various activities on a resource-specific basis. Responsibility for management of protected resources in Pennsylvania is divided among several agencies. The Pennsylvania Department of Environmental Protection (PDEP) is a primary regulator in the permit process, while the Pennsylvania Game Commission has responsibility for wild birds and mammals, such as bats. The Pennsylvania Department of Conservation and Natural Resources (PDCNR) manages resources such as native wild plants, terrestrial invertebrates, significant natural communities, and geologic features (PDCNR, 2011). PDEP's approach to wind development is best described in a brief document entitled "Process and Regulation Specific to Wind Farm Development" (PDEP, 2005). In 2005, PDEP took special action to coordinate with PDCNR and other agencies responsible for protection of special resources in the state. In addition to these efforts to coordinate project review, the State formed a 30-member collaborative, led by the Pennsylvania Game Commission, to create a Wind Energy Voluntary Cooperation Agreement that includes protocols for avian and bat studies that are intended to enable "wind energy development to occur in a more amenable and disciplined manner…" (Pennsylvania Game Commission, 2010).

Land use regulation in individual communities is a development hurdle in Pennsylvania. PDEP encourages early contact with municipal officials and "prospective neighbors" to address local concerns that could affect planning and/or design. In Pennsylvania, either the county or township is likely to have zoning regulations and a permitting process. Projects covering several thousand acres are likely within the jurisdiction of several local entities. To assist local communities in the development of wind resources, a sample model wind ordinance was developed, intended as a template that municipalities could adapt to their special needs. It addresses setbacks, noise, design, lighting, and provisions for waiver of certain of these requirements.

2.2.3 *Renewable portfolio standard*

Like West Virginia's, Pennsylvania's RPS includes energy sources derived from fossil fuels. In 2004, Pennsylvania adopted an alternative energy portfolio standard, with a goal of 18% of total electricity for suppliers and distributers by 2020.[11] The goal is divided into two categories. Tier I includes several types of solar, wind, coal mine methane, low-impact hydropower, geothermal power, fuel cells, and biomass energy, which comprise 8% of the 2020 goal. Tier II includes large hydropower, waste coal, integrated gasification combined cycle, and energy created using municipal waste or wood manufacturing byproducts, which comprise 10% of the 2020 goal. While there is a carve-out goal in Tier I for solar, there is none for wind. Tier I production must be from in-state sources, with some regional exceptions.

The RPS program has yielded a significant number of alternative and renewable energy facilities in five years. The 1,677 MW of wind energy projects represented 9.2% of approximately 18,200 MW[12] in total qualified projects between 2005 and 2010. By contrast, the capacity of coal and partial-coal projects qualified under the RPS was 16.7 % of the total—3,038 MW—nearly twice the wind capacity. The remaining projects included wood, biomass, hydro, and solar. (PPUC, 2010)

Implementation of the RPS is based on the purchase of alternative energy or credits from qualifying energy producers. If the RPS is not met, utilities are required to make "alternative compliance payments" at a rate of $45 per MWh in the shortfall.[13] The funds received from compliance payments are held in the Sustainable Energy Fund, which is used for renewable energy development. There is a separate, higher rate set for solar set-aside compliance. Investor-owned utilities (IOUs) file plans annually for meeting the requirements; these plans must be reviewed by the Pennsylvania Public Utility Commission (PPUC). IOUs are able, by law, to bank credited generation, but also to purchase and borrow credits against future production, pending approval from PPUC. The statute mandates a tracking system that ensures that credits are sold once, and was recently amended to provide for a market system for RPS credits.

The RPS does not include a special carve-out for wind, yet wind energy development in Pennsylvania has rapidly escalated. This rapid expansion may be attributable to Pennsylvania's unique strategy of linking economic development with wind energy development.

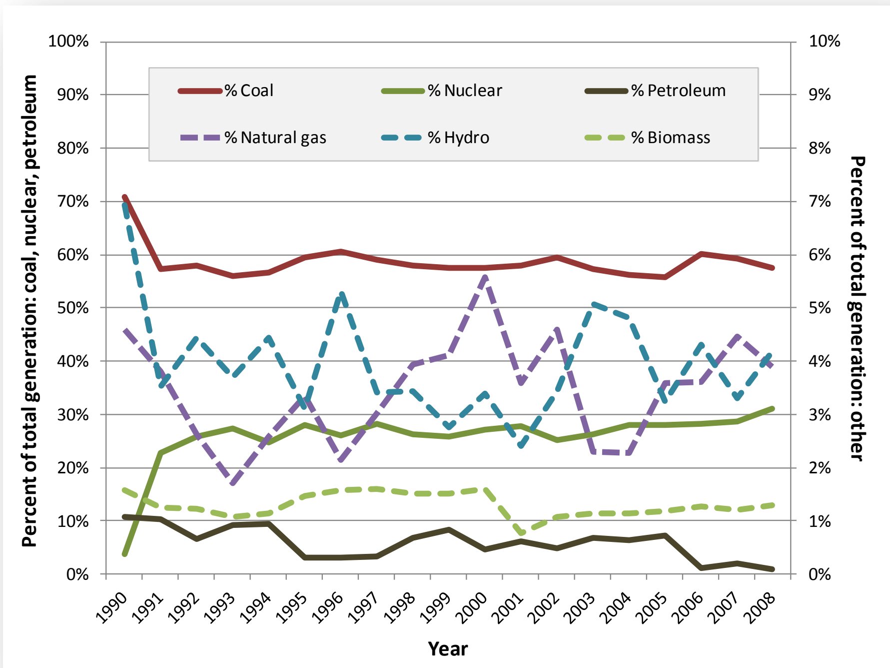
[11] Pa. Code §1648 (2004), as amended by Act 35 (2007)
[12] This includes the capacity of the entire plants and may not be indicative of the capacity that is renewable, especially for multi-fuel facilities because the fuel mix may change on a regular basis.
[13] 73 P.S. §§ 1648.3(f) and (g) (2007)

2.3 Maryland

2.3.1 *Electricity generation and wind resources*

Coal's share of electricity generation in Maryland has fallen from 71% of net generation in 1990 to under 58% in 2008 (see Figure 8). The decrease in coal-fired electricity has been mediated by an increase in petroleum and hydropower.

Figure 8: Percent of total electricity generation by energy source for Maryland, 1990-2008

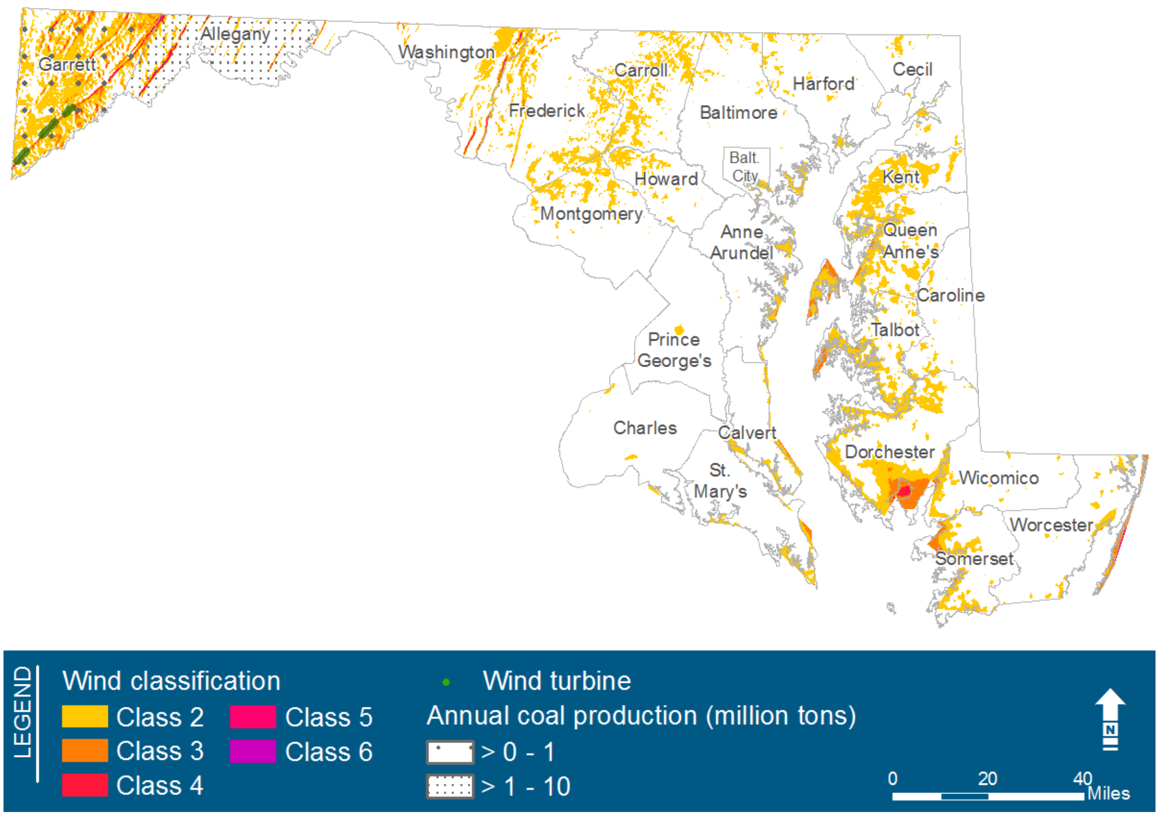


Source: EIA (2010a).

NREL estimates that full development of the 80 m wind resource would annually produce approximately 4.3 million MWh of electricity. This would equate to approximately 9% of the state's total net generation in 2008. The development of the full 100 m wind resource, on the other hand, could provide approximately 8.0 million MWh, or 16.8% of 2008 net generation. Therefore, there is enough land-based wind potential in Maryland to achieve nearly 17% of the state's net generation at 2008 levels (NREL, 2010a and EIA, 2010a). Additional off-shore wind development could significantly increase that contribution.

As shown in Figure 9, the greatest land areas with Class 3 or higher wind resources are found in Garrett, Dorchester, Somerset, Worcester, and Allegany counties (AWS Truewind, 2003a).

Figure 9: Wind resource, wind turbines, and 2008-2009 coal production in Maryland counties



Sources: AWS Truewind (2003a) and MSHA (2010).

2.3.2 *Regulatory review process*

In 2007, in order to stimulate "small" wind development, the Maryland Legislature passed a bill modifying the authority of the Maryland Public Service Commission (MPSC) by exempting wind projects of 70 MW or less from full review.[14] As further indication of State support of small wind development, a draft model ordinance for land use regulation of small wind turbines (not to exceed 80 feet in height or 100 kW) was later circulated by the State (Maryland Energy Administration, 2008).

In western Maryland, two Garrett County projects—one called Roth Rock Farm and the other on Backbone Mountain near Eagle Rock (Miller, 2010a)—have been in the development process for nine years and counting (Brighterenergy.org, 2010a). Permits have now been issued by state and county officials, but local conservation groups recently sought enforcement of the Endangered Species Act (ESA) due to the potential impact of the projects on Indiana and Virginia big-eared bat populations (Allegheny Treasures, 2010). By contrast, in eastern Maryland, some communities have been receptive to a limited wind installation as a self-selected alternative to fossil fuel–derived electricity, scaled for their own consumption (Brighterenergy.org, 2010b). That project has not, however, progressed far enough to know if development permits will be delayed by public response.

The legislated exemption for wind facilities under 70 MW appears to have had the effect of driving development to the exempted size. MPSC observed that where wind projects are exempt from Certificates of Public Convenience and Necessity (CPCNs), they must receive review of impacts on public safety, health,

[14] In re Application of Synergies Roth Rock LLC, Order 8302 p.2 (Public Service Commission, November 18, 2009)

environment, and esthetics through local regulation and review (which otherwise would be preempted by the Commission's issuance of a CPCN).[15] Notwithstanding the CPCN exemption, wind developers must submit an application to the Maryland Department of Transportation in connection with road access and crossings and the Maryland Department of the Environment with regard to various environmental permits and approvals that may be required in connection with any type of construction in Maryland. These state permits, standard for all construction, are in addition to county review and approval, including land use and soil conservation review.[16] County permits have been received by at least two projects, with more development plans in process (Miller, 2010b).

2.3.3 *Renewable portfolio standard*

Maryland's RPS is most like other RPSs throughout the US, in that it does not include alternative, non-renewable energy. Maryland passed its RPS in 2004, and the RPS was amended in May 2010 to incorporate a goal of 20% renewable energy by 2022.[17] The current RPS is split into two tiers. Tier I includes an array of renewable energy including wind and solar, as well as "qualifying biomass, methane from the digestion of anaerobic decomposition of organic materials in a landfill or wastewater treatment plant, geothermal, ocean, including energy from waves, tides, currents, and thermal differences, a fuel cell that produces electricity from qualifying biomass or methane, and small hydroelectric power plants."[18] Tier II is comprised mainly of hydroelectric. The RPS prioritizes solar energy; 2% of the 20% goal is a set aside for photovoltaics.[19]

Like Pennsylvania, if a utility does not comply with the RPS, the Maryland Public Service Commission (MPSC) levies a fee on the utility, which goes to the Maryland Strategic Energy Investment Fund, administered by the Maryland Energy Administration. Compliance fees paid into the fund are used to support grant and loan programs for Tier I renewable energy resources, except for compliance fees for the solar obligation, which may only be used to support new solar resources in the state. Like West Virginia and Pennsylvania, Maryland's RPS does not prioritize wind. Like Pennsylvania, it prioritizes solar over wind.

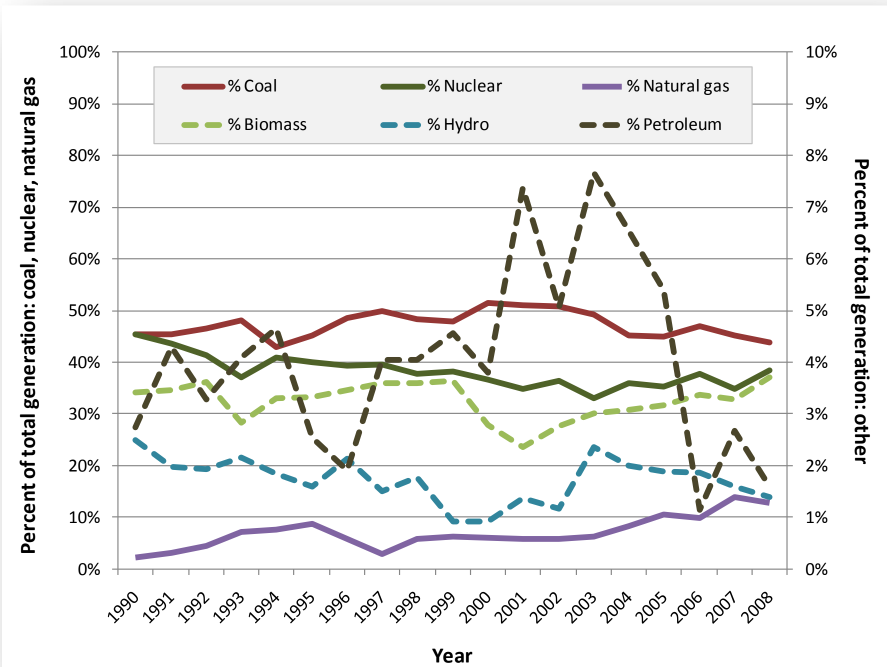
[15] In re Application of Synergies Roth Rock LLC, Order 8302 p.6 (Public Service Commission, November 18, 2009)
[16] In re Application of Synergies Roth Rock LLC, Order 8302 p.6 (Public Service Commission, November 18, 2009)
[17] Md. Public Utility. Code Ann. §7-703 (2010)
[18] Md. Senate Bill 595
[19] Md. Public Utility Code Ann. §7-703 (2010)

2.4 Virginia

2.4.1 *Electricity generation and wind resources*

Coal's share of electricity generation has fallen somewhat since 1990, although coal accounted for about the same share of generation in 2007 as it did in 1990 (see Figure 10). In absolute terms, net generation from coal has risen by 7.9 million MWh since 1990, although approximately all of that growth occurred between 1990 and coal's peak generation level in 2000. Since then, there has been a steady decline in electricity generation from coal in Virginia. Wind power has yet to impact electricity generation in Virginia.

Figure 10: Percent of total electricity generation by energy source for Virginia, 1990-2008

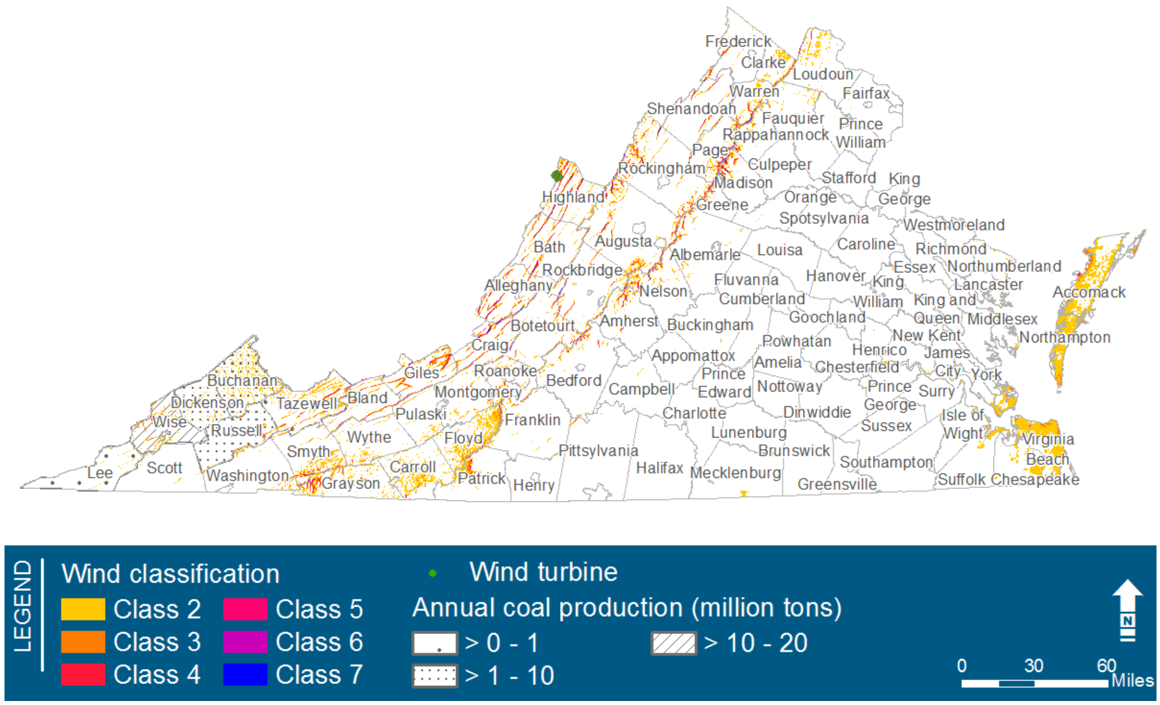


Source: EIA (2010a).

NREL estimates that full development of the 80 m wind resource would annually produce approximately 5.4 million MWh of electricity. The development of the full 100-m wind resource, on the other hand, could provide approximately 10.3 million MWh, or 14.2%, of 2008 net generation (NREL, 2010a and EIA, 2010a). Additional off-shore wind development could significantly increase that contribution.

As shown in Figure 11, Accomack, Rockingham, Highland, Augusta, and Giles counties have the most land with Class 3 and higher wind resources (AWS Truewind, 2003a).

Figure 11: Wind resource, wind turbines, and 2008-2009 coal production in Virginia counties



Sources: AWS Truewind (2003a) and MSHA (2010).

2.4.2 *Regulatory review process*

In Virginia, the first example of wind permitting is a Highland County project for 19 turbines, which began construction in April 2010 after years of planning and zoning review and court challenges. The project finally commenced following approval by the Virginia State Corporation Commission (VSCC) (Hammack, 2010). Construction was halted by federal court order based on a potential unauthorized “take” of a bat listed on the endangered species list. After addressing this concern, VSCC then re-approved the permit. VSCC re-approved the permit a second time after reconsideration was sought by the State Historic Preservation Officer, due to the farm’s proximity to an 1861 Civil War battlefield in Pocahontas County, West Virginia, just two miles away (Gibson, 2010).

Due in part to the controversy surrounding this project and the forecasted increase in energy demand due to a rapid growth in population, which is 1.5 times the national average, the Virginia Legislature in 2009 shifted permit responsibility for “small renewable energy projects” from VSCC to the Virginia Department of Environmental Quality (VDEQ). This bill also required VDEQ to produce a “permit by rule” to expedite approvals for such projects.[20] Notice of the VDEQ rules was published in June 2010, with public comment through August.[21] Significantly, the definition of “small renewable energy projects” was set by the Legislature at 100 MW. Wind developers are required to apply for land use review from county commissions. Some counties have begun to enact protective ordinances.

[20] Va. House Bill 2175 (2009)
[21] Virginia Register of Regulations, Vol. 26, No.21, page 2562 (June 21, 2010)

2.4.3 *Renewable portfolio standard*

Unique among the states in our region, Virginia does not have a state-mandated RPS. Instead, in 2007, Virginia adopted a voluntary RPS, with a renewable energy goal schedule of 4% in 2010, 7% in 2016, and 12% in 2022.[22] Like most RPSs, Virginia's includes typical renewable energy sources, "derived from sunlight, wind, falling water, sustainable biomass, energy from waste, wave motion, tides, and geothermal power, and does not include energy derived from coal, oil, natural gas or nuclear power."[23] To comply, utilities can either produce renewable energy or purchase renewable energy credits (RECs).[24] Wind and solar development receive double credits towards fulfilling the RPS goals, and off-shore wind receives triple credits.

Unlike other RPSs, Virginia does not levy noncompliance fees; the Legislature enacted a higher rate of return on utility investment in renewables, incentivizing utilities to comply. Also, the law mandates that electricity customers in Virginia have the option to purchase 100% renewable energy from their utility.[25] If their utility does not offer a program that meets the 100% renewable energy requirement, customers are permitted to purchase green power from any licensed retail supplier (USDOE, 2010c).

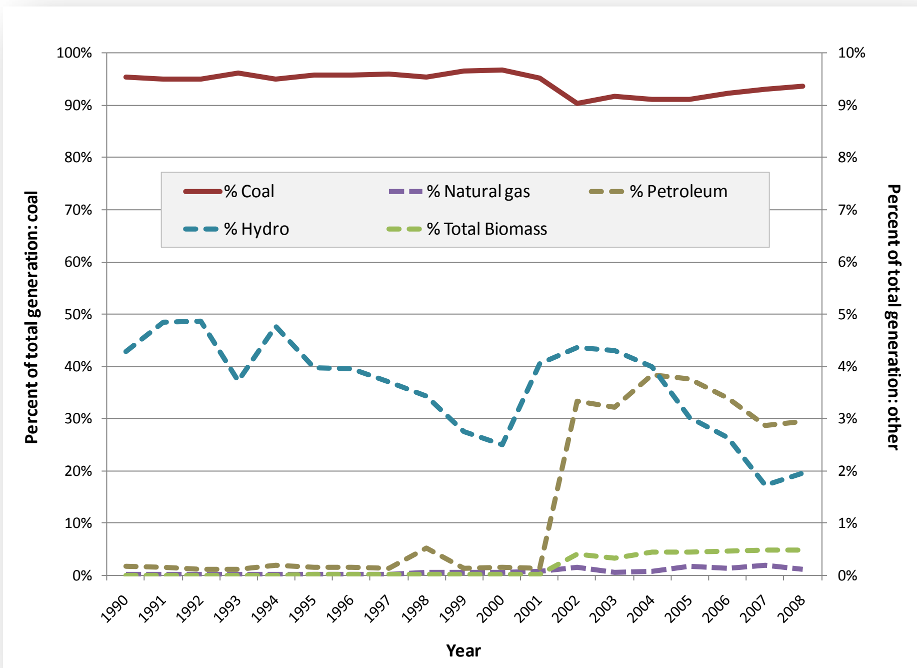
[22] Va. Code §56, 585.1-585.3 (2007)
[23] Va. Code §56, 585.1-585.3 (2007)
[24] RECs are tradable commodities that represent proof that a unit of electricity was generated from a renewable resource. RECs can be sold with or separate from the electricity itself, and represent the environmental attributes of the generated electricity.
[25] Va. Code §56, 585.1-585.3 (2007)

2.5 Kentucky

2.5.1 *Electricity generation and wind resources*

Coal's share of electricity generation in Kentucky has remained generally stable since 1990, hovering between 90.4% and 96.8% of net generation (see Figure 12).

Figure 12: Percent of total electricity generation by energy source for Kentucky, 1990-2008

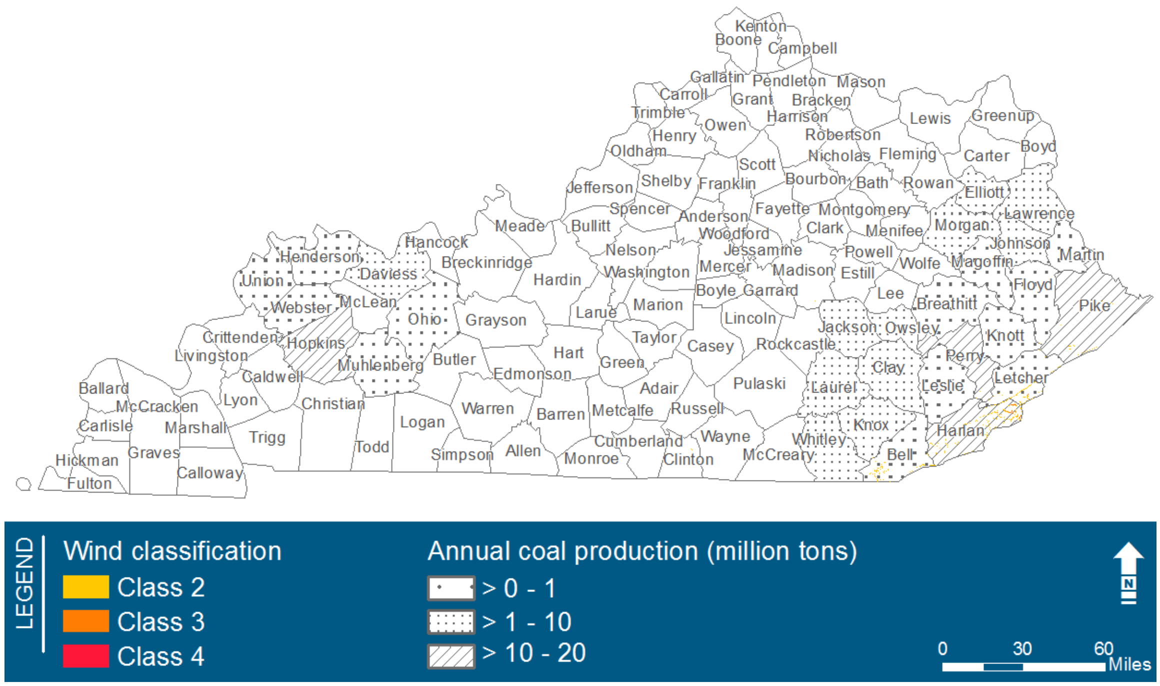


Source: EIA (2010a).

NREL estimates that full development of the 80 m wind resource would annually produce approximately 173,000 MWh of electricity. This would equate to approximately 0.2% of the state's total net generation in 2008. The development of the full 100 m wind resource, on the other hand, could provide approximately 1.9 million MWh, or 2% of 2008 net generation (NREL, 2010a and EIA, 2010a).

As shown in Figure 13, only the four southeastern counties—Letcher, Harlan, Pike, and Bell—have any land area at Class 3 and higher (AWS Truewind, 2008).

Figure 13: Wind resource, wind turbines, and 2008-2009 coal production in Kentucky counties



Sources: AWS Truewind (2008) and MSHA (2010).

2.5.2 *Regulatory review process*

Excluding the occasional residential or agricultural windmill, there are no wind turbines in Kentucky that have undergone environmental permitting processes; therefore, we do not discuss environmental review processes for Kentucky.

2.5.3 *Renewable portfolio standard*

Kentucky does not have any RPS, voluntary or mandatory; however, its Legislature recently considered the adoption of one, outlined in House Bills (HBs) 3 and 408. HB 3, proposed in 2010, requires utilities to meet 10% of total non-industrial demand from renewable sources by 2022 and every year thereafter.[26] HB 3 does not have requirements for any particular renewable energy source. HB 408, an alternative bill proposed during the same legislative session and promoted by various Kentucky advocacy groups, requires 12.5% of total electricity demand, from all sources, be met with renewable energy by 2020, of which solar must comprise 2%. HB 408 further calls for an increase in both solar and total renewable energy of 1% for each year after 2020.

[26] Non-industrial demand in Kentucky accounts for approximately 50% of all electricity demand. Therefore, the actual renewables requirement by 2022 and beyond would be about 5% of total electricity demand.

COMMUNITY WIND TOOLBOX

Author: Windustry

Windustry promotes progressive renewable energy solutions and empowers communities to develop and own wind energy as an environmentally sustainable asset. Through member supported outreach, education and advocacy we work to remove the barriers to broad community ownership of wind energy.

Title: Community Wind Toolbox

Full reference: Windustry. 2008. Community Wind Toolbox.

Online: www.windustry.org/community-wind/toolbox or www.windustry.org/sites/windustry.org/files/Full_CWT.pdf

Summary: Windustry is specifically involved in promoting community wind projects, and this toolbox should be your first stop in your research. It contains over 100 pages of resources specifically for people considering a community wind project. These resources are broadly applicable and will be of great use to anyone considering a community wind project in Appalachia.

Outline:

1. Introduction
2. Community Wind Development Overview and Checklist
3. Community Wind Project Planning and Management
4. Wind Resource Assessment
5. Siting Guidelines
6. Permitting Basics
7. Leases and Easements
8. Costs Associated with Community Wind Development
9. Financing Community Wind Projects
10. Tax Incentives
11. Choosing a Business Model
12. The Minnesota Flip Business Model
13. Power Purchase Agreement
14. Interconnection - Getting Energy to Market
15. Turbine Selection and Purchase
16. Public Policy for Community Wind

WIND ENERGY GUIDE FOR COUNTY COMMISSIONERS

Author: National Renewable Energy Laboratory

> NREL, within USDOE, develops renewable energy and energy efficiency technologies and practices, advances related science and engineering, and transfers knowledge and innovations to address the nation's energy and environmental goals.

Title: Wind Energy Guide for County Commissioners

Full reference: NREL. 2006. Wind Energy Guide for County Commissioners. Project Team: Mike Costanti, Peggy Beltrone, US Department of Energy, National Renewable Energy Laboratory, Wind Powering America National Association of Counties. DOE/GO-102006-2370. October.

Online: www.nrel.gov/docs/fy07osti/40403.pdf

Summary: This guide provides county commissioners, planners, and other local county government officials with a practical overview of information required to successfully implement commercial wind energy projects in their county.

Outline:

1. Introduction
2. Brief Wind Energy Overview
3. Environmental Benefits
4. Wind Energy Myths and Facts
5. Economic Development Benefits
6. Wind Economics
7. The Development Process
8. Public Outreach
9. Siting Issues
10. Property Tax Incentives
11. Power System Impacts
12. Permitting, Zoning, and Siting Processes
13. Case Studies
14. Further Information

NEW YORK STATE WIND ENERGY TOOLKIT

Author: New York State Energy & Research Development Authority

> NYSERDA's aim is to help New York meet its energy goals: reducing energy consumption, promoting the use of renewable energy sources, and protecting the environment.

Title: New York State Wind Energy Toolkit

Full reference: NYSERDA. 2009. New York State Wind Energy Toolkit. Prepared by AWS Truewind, LLC. May.

Online: www.nyserda.ny.gov/~/media/Files/EERP/Renewables/wind-energy-toolkit.ashx?sc_database=web

Summary: This report includes a wealth of information helpful for developers or communities considering utility-scale or community wind projects. While it was developed for New York, many of the concepts are broadly applicable to other states and to Appalachia.

Outline:

1. Overview
    a. Introduction
    b. Wind Energy in New York State
    c. Wind Energy Applications
    d. Utility-Scale Wind
    e. Power Grid and Electricity Delivery
    f. Project Lifecycle
2. Impacts on the Local Community
    a. Economic Impacts
    b. Socioeconomic Impacts
3. Environmental Impacts
    a. Birds and Bats: Impacts and Surveys
    b. Other Environmental Impacts
4. Community Resources
    a. Comprehensive Planning
    b. Developer Site Identification
    c. Land Acquisition
    d. Permitting
    e. Interconnection
    f. Frequently Asked Questions
5. Community Wind Energy
    a. Community Wind Energy Development

REFERENCES

This document is a companion to the full technical report: *A Windfall for Coal Country? Exploring the Barriers to Wind Development in Appalachia.* The technical report can be downloaded from The Mountain Institute at www.mountain.org/map/water-and-energy or from Downstream Strategies at www.downstreamstrategies.com/projects.html.

Please refer to the technical report for the full set of references.