2015 Projects

Assessing the Feasibility, Impacts, and Potential for Implementation of a Micro Wind Turbine on the JMU Campus by way of Life Cycle Assessment

Corey Allison

A sub-category of wind turbine technology is that of micro-wind, or wind turbines generating a maximum of 1000 Watts (W). On the James Madison University (JMU) campus, the Engineering Department capstone team, "Aerodynamics and Rotors" (A&R), has set out to develop and prototype a micro-turbine with an output of 10 W. In coordination with A&R, this Integrated Science and Technology (ISAT) capstone project will assess the feasibility, impacts, and potential for implementation of the turbine on the JMU campus by way of life cycle assessment (LCA). The assessment was undertaken in an effort to produce added value for the A&R design project and all associated stakeholders. Using SimaPro 7 LCA software, the turbine, its components, manufacturing processes, end-of-life disposals, and input energy requirements were assessed for total environmental and human health impacts. The turbine LCA was then compared to conventional fossil fuel energy production to determine the overall feasibility of the A&R micro-turbine and whether its implementation would prove beneficial and cost-effective on the JMU campus. Alternative turbine materials and processes were identified, assessed, and compared with the goal of optimizing overall turbine performance on and positive impacts for the JMU community. Focus was placed on the environmental and human health impact sub-categories as directly affecting the greater JMU community. Hypothetical scenarios were also created to determine the immediate costs and benefits for using and developing one turbine, multiple turbines, and an optimal number of turbines on the JMU campus versus conventional fossil fuel power. Based on the findings from this capstone project, recommendations were made to the A&R capstone team with the intention of potentially assisting in the optimization of the micro-turbine design.

2014 Projects

Ridgeline Wind Farm Development Opportunity and Obstacle Analysis

William Fleury, Andrew White

The purpose of this analysis was to identify the potential opportunities for and obstacles to the development of a ridgeline utility-scale wind power plant in Rockingham County, along the border of West Virginia's Hardy and Pendleton Counties. The proposed site sits along a roughly 8-mile ridge with a maximum elevation of 4,032 feet. Prior to undertaking this analysis, several years of Sonic Detection and Ranging (SoDAR) analysis was conducted, and wind data were collected from meteorological towers distributed throughout the area. These data demonstrate a viable wind resource for a utility-scale wind power plant. Several obstacles to the potential development of this land area must be overcome. This report focuses on accessing and altering federal Lands, community outreach and consensus, and quantification and classification of the wind resource available. In order to create a better understanding of the topographical features, land ownership, road access, and federal and protected land distribution, and other land classifications, a comprehensive GIS map of the ridgeline and the surrounding area was created. From this map, it was determined which federal lands would be viable areas for additional access road infrastructure, which lands would be problematic to disturb, which

existing access routes could be utilized, and which privately owned land parcels would likely be available for development.

U.S. Department of Energy Inaugural Collegiate Wind Competition

Ryan Hoag, David Hryvniak

James Madison University was selected to compete in the U.S. Department of Energy's inaugural Collegiate Wind Competition. This competition is the first of its type, and quite different from traditional engineering competitions. It requires interdisciplinary teams to address the economics, political and environmental policies, and social context of wind in addition to the technical aspects of wind turbines. The competition challenges students to three tasks: to design and prototype a small, portable wind turbine capable of charging electronic devices; to develop a comprehensive business plan to market the turbine; and to deliver a market issues presentation on a region-specific topic. In order to complete these tasks, JMU formed a team of faculty and students drawing from a variety of programs and departments, including: Engineering, Integrated Science and Technology, Business, Industrial Design, Political Science, and Communication Studies. The purpose of this capstone project was to assume Project Manager roles for the competition. This involved a number of tasks, including: team formation, communication and dispersion of materials, formulation of timelines, meeting with faculty and students to discuss pertinent topics, helping to plan an ISAT 480 course geared toward the competition, and others. In some cases, this role also involved aiding in more specific aspects of the project, such as brainstorming and problem solving with the Business Team, 3D-modeling blades for the prototype, or helping to research and develop the Market Issues presentation. This project has been effective at applying the skills acquired through the ISAT program, as it has involved approaching a number of issues with a holistic view and working with members from various disciplines to produce cohesive products that thoroughly address social, cultural, political, economic, environmental, and technical factors.

2013 Projects

Remote Data Acquisition, Networking, and Databasing for a Wind-Solar Monitoring Center

Devin Galloway, Andrew Moore

The purpose of this project was to acquire data from multiple instruments and data loggers installed at the Small Wind Training and Testing Facility (SWTTF) at James Madison University and to integrate each set of data into a single organized and publicly-accessible web page. This effort required the application of various aspects of telecommunication and information knowledge management. Data types collected included wind speed, direction, and gusts; temperature; humidity; power output from the wind turbine and photovoltaic panels; and energy exchange with the grid. Data were integrated from four logging devices: Outback Power™ Mate3, Met One Instruments CR1000, Honeywell Web-201, and Weatherbug Station. The data were compiled into a WordPress webpage using a MySQL server and XAMPP database. PHP was used to import the CSV data file containing wind data, and HTML and CSS were used to display the data in an online table. Real-time, daily, and monthly data from the Weatherbug Station were embedded into a webpage using HTML. The Wordpress webpage was organized so that each set of data acquired by the different data loggers could be selected and viewed from the link menu. The data were also made available through a mobile application on both Android and iPhone platforms. The mobile development was accomplished by using the cross-platform Titanium Studio Mobile Application

Development Environment. The website and mobile app will be used to archive and analyze data for future turbine testing at the SWTTF. Ongoing efforts are recommended that would allow utilization of SQL queries to analyze specific data sets and create tables and graphs.

Wind for Schools Implemented at Grassfield and Luray High Schools, Virginia

John Doran, Brendan Lewis, Kenneth McMullen, Matthew Morrissey

Renewable energy technologies, in particular wind energy, represent a fast-growing sector within the power generation industry. Increasing demand for wind energy is promoting an expansion of opportunities for employment in renewable energy fields, and small wind systems are now even appearing at schools throughout the country where they not only supply clean power to facilities, but also opportunities for students at all levels to become acquainted with the technology. Wind for Schools, a program funded by the U.S. Department of Energy and supported in eleven states including Virginia, seeks out K-12 host schools wishing to install small wind turbines that provide a hands-on applied science and technology experiences while also supporting the opportunity to learn about the benefits and challenges associated with wind energy. The partners on this project, working directly with the Virginia Wind for Schools program, assisted Grassfield High School in Chesapeake, Virginia and Luray High School in Luray, Virginia by conducting energy use analyses; siting analyses; wind resource assessments; economic estimates; and community engagement. They also addressed local issues; installation logistics; and social, economic, and environmental impacts. The wind turbines to be installed will eventually help to power football field concession stands at each school, and will provide students the opportunity to work with emerging wind technologies and analyze the data produced. These turbines will also raise awareness in the communities. Finally, the projects at Grassfield and Luray High Schools were compared and contrasted in order to highlight similarities and challenges associated with the projects.

Performance Analysis of Small-Scale Vertical and Horizontal Axis Wind Turbines at a School in Southwestern Virginia

Blaine Loos

The Leonard A. Gereau Center for Applied Technology and Career Exploration in Rocky Mount, VA is an affiliate school with the Virginia Wind for Schools program. At this school, there are three wind turbines: one Southwest Windpower Skystream 3.7 (generating capacity: 2.4 kW) horizontal axis wind turbine (HAWT), and two Windspire (generating capacity: 1.1 kW each, 2.2 kW total) vertical axis wind turbines (VAWTs). This project analyzes weather data from a WeatherBug station, along with turbine manufacturer's specifications, to predict expected electricity generation and compares these predictions to actual turbine outputs. The project studies the effects of turbulence and wind variations attributable to topography and natural and man-made obstacles at the site. The main objectives of this project are to provide insight into the advantages and disadvantages of these two wind energy technologies and to examine the effects of turbine siting on power generation and performance.

2012 Projects

A Study of the Testing Capabilities of the Small Wind Training Testing Facility at James Madison University

Andrew Augustine

The completion of the Small Wind Training and Testing Facility (SWTTF) at JMU will allow students and faculty to engage in hands-on learning in regard to wind energy. The facility will provide the means to advance the wind workforce, to increase community knowledge and engagement, and to test small wind turbines. The testing aspect of the facility will be useful for field-testing new turbine technologies and attracting small wind manufacturers to Virginia aside from the educational benefit. This thesis describes the nature of small wind turbines and testing protocols that are applied across the country, and focuses on determining the capabilities of the SWTTF as a small wind testing site. The deliverables of the project include a testing procedures plan that should be used as a model for future student and faculty efforts in this area. The procedures presented were determined by analyzing practices of regional testing centers and guidance presented within the small wind turbine testing standards developed by the American Wind Energy Association (AWEA) and the International Electrotechnical Commission (IEC).

Tangier Island: A Case study of the Implementation of Renewables in a Small Island Community

Charles Johnson, Yannick Tamm

The Town of Tangier is a small, remote island near the lower Eastern Shore of the Chesapeake Bay. In 2009, the town was awarded a grant by the Department of Mines, Minerals and Energy (DMME) that was sourced from American Recovery and Reinvestment Act (ARRA) funds for the installation of a wind turbine to supplement the electricity needs of the community. The town of Tangier contracted with Sustainable Energy Developments, Inc. (SED) to site and install a 100-kW turbine on the island. The objective of the authors was to deliver a case study of the development process with an emphasis on exploring the regulatory procedures and challenges, while assisting SED throughout the project. The barriers to wind power on Tangier proved to be insurmountable, thus the project evolved into one that features solar photovoltaics. This thesis presents the final outcome and investigates lessons associated with siting projects of a similar nature.

2011 Projects

Wind for Schools - Thomas Harrison Middle School

John Bucci, Rob Jennings

The purpose of this project is to design and develop a plan to implement a small wind turbine at Thomas Harrison Middle School in Harrisonburg, Virginia. The project stems from the Department of Energy funded Wind for Schools Program, through Wind Powering America, which strives to install small turbines at schools and to develop a knowledge base about wind energy for the future. The turbine to be installed will not significantly lower energy consumption at the school, but will act as a hands-on educational tool to integrate wind energy curriculum into the classroom. The major developmental steps that we completed include an energy-use analysis, siting analysis, economics, local issues, and installation logistics. Through support from the Virginia Center for Wind Energy at James Madison University, we created a report that will act as a guide for future Wind for Schools projects in Virginia.

Assisting the Development Phase of a Community Scale Wind Turbine in Tangier Island, VA

Trey Hughes, William Johnson, Bryce Rupnik

The purpose of this study was to conduct an appropriate set of wind power siting activities in order to support the development and construction of a 100-kW wind turbine for community application on Tangier Island, a small island community in roughly the geographic center of the Chesapeake Bay. The town of Tangier was awarded in 2010 a $1 million grant to install a wind turbine. Our team worked directly with Sustainable Energy Development, Inc. and assisted them with the various steps involved in siting the turbine and preparation for installation. The specific tasks include wind data analysis, mapping and measurements, analysis of potential avian issues, visual impact assessment, and permitting. The specific turbine to be installed is the Northwind 100 and has a nameplate generation capacity of 100 kW, hub height of 37 meters, and rotor diameter of 21 meters. This project will reduce the electrical energy imported from the mainland with subsequent economic benefits. This effort will also expose new economic development opportunities for this small fishing community and potentially lead to the development of a new industry on Tangier.

2010 Projects

Eastern Shore Regional Wind Analysis

Andrew Gronan

The purpose of this project is to assess the regional wind resource of the eastern shore of Virginia and the Chesapeake Bay. As the need for renewable and clean energy continues to grow, we must work to obtain reliable and sustainable sources such as wind energy. The wind resource in Virginia lies primarily in the coastal areas and thus it is vital that we have a clear understanding of its potential. This assessment uses existing data at seven sites along the coast and data currently being acquired at Tangier Island. The results will also be compared to the American Wind Energy Association's wind resource map projections to determine the validity of the estimates.

Development of a Wind Turbine Ordinance Database for Land Use Planners

Corinn Pope

This project will provide land use planners with an easy to use tool to help develop wind energy specific ordinances. The tool will include a database housed by JMU of wind ordinances from across the United States and will be searchable on a website. It will promote the development of wind ordinances throughout the country and therefore increase the ease of implementing a wind energy system.

Based Remote Data Acquisition System for a Wind/Solar Hybrid Power Plant

Evan Williams

The purpose of this project is to create a data acquisition (DAQ) system for a wind/solar hybrid power plant. The objective is to make the DAQ system reliable, cost effective, and easily accessible and upgradeable via wireless connections to a central location/site. The DAQ system will be designed and implemented to provide web-based, real-time and remotely accessible weather, and power generation and consumption data. In addition, the DAQ system will store the data and make it remotely available for analysis by students or researchers. The system will be built with the capability for two way communications between the power plant and a central site, thus providing the necessary infrastructure for adding control and remote management at a future date.

Material Selection for Sustainable Wind Turbines

Steven Florian, Will Shoemaker

Our senior thesis is aimed at Sustainable Material Substitution in Wind Turbines. We have developed a method of sustainable material selection to examine the environmental impact of the materials used in wind turbine constructions. We have broken the turbine into two different sections for analysis focusing on the tower and blade materials. We have analyzed the current materials used by researching and contacting wind turbine companies in the United States and compared these current materials to alternative materials using CES software. We will make our alternate material selections based on our analysis of the critical mechanical and environmental properties of the selected materials.

Development of a Residential Site Assessment and Economic Feasibility Calculator for Behind-the-Meter Wind Energy Generation in Virginia

David Ramsey, Brian Rapp

This project developed and implemented a public domain, web-based site feasibility analysis tool for behind-the-meter wind power systems. The tool is designed as a site prescreening/suitability calculator for Virginia property owners, and enables them to assess the technical and economic feasibility of a property for wind power before engaging in costly and time consuming site characterization and analysis. The tool was prototyped for the Commonwealth of Virginia, in an effort to help Virginia's Wind Energy Collaborative.

2009 Projects

Feasibility Study and Implementation Plan for Wind Power in a Developing Country

Brian Burk

The purpose of this project is to design and develop a plan to implement a small-scale wind power system for the town of Paso Bajito located in the Dominican Republic. With consideration for the numerous problems surrounding power generation in these areas such as high fuel costs, lack of infrastructure, and environmental concerns, renewable energy systems present a sustainable alternative to provide these communities affordable access to electricity to meet their basic needs. This project involved analyses of the local needs, the local wind resource, topography, wind turbine technologies, and manufacturers' support, and recommend a wind power system for the community.

First-Order Feasibility Study for Wind Power at a Military Installation in Virginia

Kenneth Howell

The objective of this project is to perform a first-order wind feasibility assessment for a potential wind turbine installation at the Naval Surface Warfare Center (NSWC), Dam Neck, near Virginia Beach, VA. The assessment includes the characterization of land use, topography, and wind resources, and involves site visits, data collection, and the modeling strategies. Potential environmental, regulatory, and technical requirements and conflicts are also examined and addressed. A final report and visual simulation were developed to provide NSWC, Dam Neck with the tools necessary to advance the development of wind power at their site for local power generation.

First-Order Feasibility Study for Wind Power at an Aquaculture Facility in Virginia

Edward Morrison

The purpose of this project was to create a first-order feasibility study for the application of wind power to supplement the electrical demand of Mid-Atlantic Aquatic Technologies in Quinby, Virginia. A 50 m anemometer tower installed on-site recorded wind-speed and direction to confirm and validate existing wind-maps. WASP and WindFarmer wind-analyzing programs were used to create a model of the potential electrical output and economic viability of a given wind turbine installed in the area. An analysis of multi-level government permitting requirements, environmental impacts, and community input was also completed.

Chesapeake Clean Energy Initiative: Preliminary Study for Onshore Wind Turbine Siting in a Remote Island Community

Ryan Powanda

The purpose of this study is to assess the feasibility of siting a demonstration, commercial-scale wind turbine for onshore applications in the Chesapeake Bay, Virginia. The Chesapeake Bay presents a high-quality wind resource, and several studies have been conducted by the Virginia Wind Energy Collaborative (VWEC) investigating offshore wind development options in the region. Several sites were studied for viability including areas on Tangier Island and Port Isobel. Tangier Island is resident to a small fishing community in the Chesapeake Bay, while the adjacent Port Isobel is owned by the Chesapeake Bay Foundation and is used as an education and outreach center. The wind resource on the islands is being investigated using a 50-meter meteorological tower and the energy infrastructure was studied for potential interconnection of a wind turbine and energy storage equipment. Other considerations include impacts on environment and wildlife, siting concerns, project economics, relevant regulatory issues, and public opinion. The results of this study helped to inform a project proposal to the U.S. Department of Energy for funding for further research, development, and demonstration of commercial-scale wind and energy storage applications in the Chesapeake Bay region.

Market Analysis and Usage Study of a Hand Held Instrument for Infrared-Based Non-Destructive Evaluation of Wind Turbine Blades

Michael Bornarth

In 1998, researchers at the NASA Langley Research Center developed a thermal line-scanning technique to non-destructively detect defects in materials by line-heating the surface of a target and imaging the surface with an infrared imager. Image subtraction was conducted to measure the temperature at each point on the material before and after heating and visualize sub-surface defects. Fellow ISAT students Curt Dvonch and Doug Suliga (2008) successfully developed a bench top instrument to perform this technique by utilizing a microbolometer-based infrared imager, other miniaturized components, and space-saving design. My project involved the automation and optimization of the instrument with implementation of a stepper motor and application of testing to further the development of a handheld instrument. I have also conducted a market analysis and usage study of such a handheld instrument as would be applied within the wind power industry.

2008 Projects

Policy and Economic Barriers and Legislative Solutions for Small Wind Energy in Virginia

Megan Shea

Few counties in Virginia have incorporated into their zoning bylaws a mechanism to permit small wind systems. This presents a significant barrier to deployment of these systems as, for most people; the resultant administrative hurdles are often prohibitively onerous or can be met with project delays or cancellations. Analysis demonstrates that the decisions of potential small wind investors are heavily influenced by the perceived burdens associated with the permitting of such projects. Recommendations will be made for possible legislation to facilitate the future deployment and growth of wind power in Virginia.

Testing, Evaluation, and Implementation of the Virginia Renewables Siting Scoring System

Brian La Shier

The goal of the project is to continue to develop and improve the Virginia Renewables Siting Scoring System (VRS3), while laying the groundwork for future projects. The purpose of the VRS3 is to allow a community to proactively assess their lands and quantitatively evaluate and compare wind resources, and thus be well informed to act when wind energy development is considered or proposed. An initial assessment of Bath County, Virginia was compiled to aid future planning efforts. A comprehensive guide to state wind turbine siting policies in the Mid-Atlantic United States was also included for comparison to the VRS3.

Development of an Integrated Monitoring and Data Acquisition System for a Hybrid Wind and Solar Power Station

Paul Dorn Jr., Chris Muth

The CISAT Hybrid Electric Plant (CHEP) consists of a 1-kW photovoltaic system and a 1-kW wind turbine. The purpose of this project is to enhance the functionality and educational experience of CHEP. The hybrid electric plant will be enhanced by developing circuitry to collect electrical performance data. This data will be multiplexed with weather data and sent wirelessly to a receiver located in the CISAT building. A LabVIEW frontend was developed to process, store, and display the data over the internet. These improvements will augment the educational potential of the photovoltaic and wind systems in JMU classrooms and help raise awareness of renewable energy use.

2007 Projects

A Feasibility Study for Wind Power at Tangier Island, Virginia

Jennifer Hock, Robert Gallerani

This project addresses the social as well as the technical issues associated with the development and implementation of community-based wind power at Tangier Island, Virginia. Tangier Island lies centrally in the Chesapeake Bay and the waters that surround Tangier fall under state jurisdiction. This project constitutes a portion of a broader, comprehensive feasibility study and addresses the following aspects: public opinion; jurisdictions; physical resources; environmental impacts; technical infrastructure; wind resource; and options for development. This project analyzes the marine environment as well, and makes recommendations involving the selection and siting of wind turbines as guided by constraint

mapping. This effort will inform a report to the Virginia Department of Mines, Minerals, and Energy that describes the feasibility of community-based wind power at Tangier Island.

2006 Projects

Activities and developments to support the mission of the Virginia Wind Energy Collaborative

Matthew Bonifant, Benjamin Chambers, Dean Gakos, John Trout, Matthew Walters

The college of Integrated Science and Technology (ISAT) at James Madison University (JMU) has coordinated student efforts to support development of wind energy in the Commonwealth of Virginia. With the formation of the Virginia Wind Energy Collaborative (VWEC) in 2002, JMU began collaboration with Environmental Resource Trust Inc. (ERT); Old Mill Power Company; George Washington School of Law; Virginia Polytechnic Institute and State University (VT); the National Renewable Energy Laboratory (NREL); the U.S. Department of Energy's (DOE) Wind Powering America (WPA) Initiative; and the Virginia Department of Mines, Minerals, and Energy (DMME). The James Madison University Office of the Virginia Wind Energy Collaborative (VWEC/JMU) has served instrumentally in its role to promote the development of wind power in Virginia and the subsequent increased diversity of its energy supply. The Virginia Wind Energy Collaborative (VWEC) was established in 2002 and serves as the pioneering alliance to promote and develop wind power in Virginia. The 2005–2006 VWEC/JMU team developed a work plan that addresses a wide variety of tasks designed to promote greater awareness and implementation technologies that harness the wind. The team divided into four groups, each addressed a unique set of issues and tasks. The State-Based Anemometer Load Program (SBALP) was created with two purposes in mind: to validate existing wind resource maps and to inform residents of their potential wind resource. SBALP works toward these goals by providing an instrumented anemometer tower and subsequent data analysis pertaining to the resource at a given site. The SBALP team carried on the administration of this program, and developed a new instructional packet to assist other states who wish to create their own SBALP. The primary objective of the Virginia Small Wind Incentives Program (VSWIP) is to demonstrate the viability of small wind power systems throughout the Commonwealth. The program provides grants to landowners, thus reducing the lifetime cost of a wind energy system. The final round of awards was made in January 2006 bringing the program total number of awardees to twelve. The project team developed and implemented strategies to assist landowners in completing their projects. The Outreach program, the newest addition to the ongoing efforts of VWEC, developed new resources to support public outreach and education including a new touring exhibit. The VWEC Brochure was updated to describe current ongoing projects, and the newsletter, In the Breeze, published three new editions. The touring exhibit offers a comprehensive presentation that encompasses a large background display intended to inform the citizens of Virginia about diversifying their energy portfolio. The CISAT Hybrid Electric Plant (CHEP) project set up performance monitoring and data acquisition for the hybrid system located on the JMU campus. The project specified and installed voltage and current meter displays for the wind turbine and solar array that comprise the hybrid system. Informational posters were created for educational purposes at both the wind turbine and the CISAT Solar Electric Plant (CSEP), a 10-kW solar array also located on the JMU campus. In addition, a data transmission and data acquisition process was developed to log and display data in near real time using a Virtual Instrument developed in LabView. These activities will further enhance the educational aspects of the two campus-based renewable energy systems. These efforts all support the mission of VWEC.

2005 Projects

Activities and developments to support the mission of the Virginia Wind Energy Collaborative

Mikhail Kolyadov, Jason Lee, Christopher Wells, Peter Williamson

The Virginia Wind Energy Collaborative (VWEC) was established in 2002 and serves as the pioneering alliance to promote wind energy in Virginia. The VWEC/JMU team collaborated on four distinct tasks. The Next Step task group created an online economic tools page where landowners can obtain a cost analysis for a small wind energy generation system based on their wind resource and electricity usage and rate structure. Users are provided with a guide outlining necessary steps for installing such a system. In addition, the Next Step initiative has continued issuing reports to interested landowners after collecting wind resource data from their property. The State Based Anemometer Loan Program (SBALP) task group validates current wind resource maps of Virginia and educates residents regarding their site-specific wind resource by providing anemometer towers to collect wind data for one year and generating summary analyses of resources. The SBALP task group developed a framework for actively locating sites of favorable wind resource utilizing GIS. The Wind Powering America-DMME task group completed an educational CD-Rom on renewable energy aimed at middle school students, established a regional wind newsletter for quarterly distribution, and developed a guidebook specific to Virginia that breaks down the processes and issues associated with purchasing a small wind system for the average consumer. Finally, The Virginia Small Wind Incentives Program task group demonstrated the viability of small wind systems for the Commonwealth. The program provided grants to landowners to reduce the lifetime cost of small wind energy systems and increase competitiveness with fossil fuel-generated electricity. The program awarded four grants in 2004 and is currently accepting applications for 2005. These combined efforts support the ongoing mission of the Virginia Wind Energy Collaborative.

2004 Projects

Wind Energy in Virginia: Implementing New Strategies for Clean Power across the Commonwealth

Jeffrey Briggs, Kimberly Josephson, Peter Kim, Kathleen Loughney, P. J. Williamson

The Virginia Wind Energy Collaborative (VWEC) was established in 2002 and serves as the pioneering alliance to promote and develop wind energy in Virginia. The VWEC/JMU team developed a multi-faceted work plan that addresses a variety of tasks designed to promote and encourage the development of wind power in Virginia. The VWEC/JMU team divided into four groups each tasked to assume a unique set of responsibilities. The State Energy Project (SEP) group assisted landowners in determining the viability of small turbine installations on their property. Economic research was extended to create detailed analyses for each of five diverse sites. A Virginia state-specific guidebook for small wind systems was created with NREL support to help educate and inform Virginia residents and businesses. The State-Based Anemometer Loan Program (SBALP) group collected wind data using ten 20-meter meteorological towers installed throughout Virginia. In addition to validation of the Virginia Wind Resource Map it is the intent of the SBALP group to generate interest in wind energy, encourage wind development, and educate the general public. The Wind Powering America (WPA) group conducted public outreach to further the awareness of wind potential and other renewable energy options in Virginia by creating an educational CD-ROM to be distributed to K-12 students; by conducting a series of wind energy workshops; by creating a job and economic development model specific for Virginia; and by upgrading and maintaining a web-based clearinghouse for wind activities and information pertinent to Virginia. The Next Step/VSWIP group generated studies and tools to empower

landowners in conducting personal analyses of potential wind energy projects and also established and implemented the Virginia Small Wind Incentives Program. These efforts, collectively, support the ongoing mission of the Virginia Wind Energy Collaborative.

2003 Projects

Wind Energy in Virginia: An Innovative Plan for Development and Education

Urmil Dharamsi, Melissa Leonetti, Mark Lotts, Beth Mast, Robert Munson, W. Dodge Perry, Kyle Proehl, Peter Salmon, Tyson Utt, David VanLuvanee, Alicia White

The Virginia Wind Energy Collaborative (VWEC) was established in 2002 by this team and its partners across Virginia. VWEC serves as the pioneering alliance to promote and develop wind energy in Virginia and is supported by the U.S. Department of Energy and Virginia Department of Mines, Minerals, and Energy. The VWEC/JMU team developed a work plan to address an array of tasks that reflect the deliverables set forth in three funded grants. The team divided into four project groups, each responsible for a unique set of tasks. The CISAT group conducted analyses to determine the options to develop small wind on the CISAT campus. This group generated economic models and identified potential end-use applications. The SBALP group administered Virginia's State-Based Anemometer Loan Program. Associated tasks included identification of appropriate sites for, and installation of, meteorological towers as well as collection, analysis, and report of wind data. These data are used by the National Renewable Energy Laboratories to validate computational wind resource models. The SEP group researched federal, state, and local issues – legal, political, economic – that present barriers to wind energy development. This group also identified restrictive zoning ordinances, drafted a proposed zoning amendment for Rockingham County, and studied the limitations to consumers of net metering legislation in Virginia. Additionally, the group conducted site-specific feasibility analyses for small-wind systems; these analyses consider wind resources, turbine performance, load profiling, and economic tools to assist landowners to assess the feasibility of wind power on their properties. The WPA group conducted public outreach to promote and raise awareness of opportunities for wind energy in Virginia, developed and distributed educational materials and brochures, organized and hosted a regional wind energy workshop, and established a Virginia wind working group that later evolved into the Virginia Wind Energy Collaborative. The outcomes of these activities will be presented.

2002 Projects

Wind Energy in Virginia: JMU and Beyond

Greg Allen, Bryan Frane, Matt Heck, Adam Jones, David Strong

We have administered the Wind Powering America (WPA) State-Based Anemometer Loan Program (SBALP). The State-Based Anemometer Loan Program helps develop wind expertise throughout the nation, allows Virginia and the National Renewable Energy Laboratory gather data across the state, and heightens the awareness and development of the nation's wind resources. This program involves siting, permitting, installation, data collection, as well as other tasks required to place a meteorological tower for the program at each of ten different locations. Thus far, data has been collected at six sites and is currently under analysis. We also have begun preliminary studies on the feasibility of installing a wind turbine on the east campus of James Madison University. We have assisted in siting a 30-meter meteorological tower that will gather wind data for future analysis by JMU students. We have studied

and modeled other local wind data and have researched relevant issues surrounding wind energy, including visual and noise impacts, regulations, and grid interconnection. We have developed a preliminary economic analysis for a 10-kW turbine located where the 30-meter meteorological tower now stands. The ultimate goal of this study is to further wind energy progress at James Madison University and throughout the state of Virginia.

2001 Projects

Feasibility Study for the Implementation of a Wind Power Installation at Mount Storm, West Virginia

Jon Caley, Andrea Illmensee, Amy McGinty, Ben Orr, Jeanette Studley

This project comprises several related activities in support of a proposed wind power installation at Mount Storm, West Virginia. The project entails analyses of the local wind profile, visual impact of the installation, the permitting process for executing the project, and the marketing potential of the power generated. The existing wind profile, characterized during a previous study, has been validated and improved. This has allowed for the selection of a turbine model to be used at the installation and estimates of the expected generation to be determined. The recommendations resulting from this project will aid Dominion Virginia Power in their decision of whether to move forward with construction of a wind power installation at Mount Storm, and offers guidance to other wind developers in the region.

1999 Projects

The Feasibility of Wind Power in the Shenandoah Valley

Demetrist Waddy, Margaret James

A Feasibility Study of Implementing a Hybrid Wind Farm and Photovoltaic System on the Island Nation of Malta

Brent Flaherty Beerley, Joseph Six Mariano