

U.S. Department of Energy Office of Energy Efficiency and Renewable Energy
Wind and Hydropower Technologies Program



2007
Peer Review Report

July 2007

Denver Marriott West
Golden, CO

Report prepared by:
SENTECH, Inc.



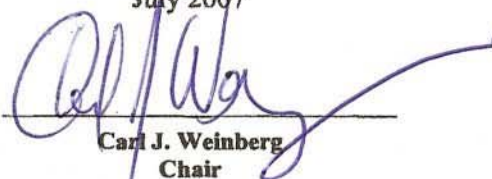
U.S. Department of Energy
Energy Efficiency and Renewable Energy

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**Office of Wind and
Hydropower Technologies
Wind Energy Program**

**2007 Peer Review Report
July 2007**

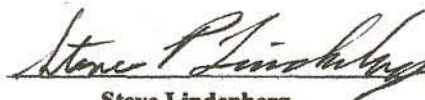
U.S. Department of Energy
Office of Energy Efficiency and Renewable Energy
Office of Wind and Hydropower Technologies
Wind Energy Program
2007 Peer Review Report
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**Carl J. Weinberg
Chair
2007 Wind Energy Program
Peer Review Panel**



**Lisa Barnett
Peer Review Leader
U.S. DOE Wind Energy Program**



**Steve Lindenberg
Acting Director
U.S. DOE Wind Energy Program**

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Summary

Objective review and advice from peers—peer review—provides Department of Energy (DOE) managers, staff, and researchers with a powerful and effective tool for enhancing the management, relevance, effectiveness, and productivity of all of the Office of Energy Efficiency and Renewable Energy (EERE) research, development, demonstration, deployment, and supporting business management programs. A peer review is defined as:

A rigorous, formal, and documented evaluation process using objective criteria and qualified and independent reviewers to make a judgment of the technical/scientific/business merit, the actual or anticipated results, and the productivity and management effectiveness of programs and/or projects.

The Wind Program peer review focused on technology application and acceptance activities that were planned, underway, or recently completed. The findings are considered by Wind Program managers, staff, and researchers in setting priorities, conducting operations, and improving projects.

The DOE Wind Program peer review was conducted July 11-12, 2007, at the Denver Marriott West Hotel in Golden, CO. Presentations were given on specific technical projects within the Systems Integration, Market Policy and Analysis, Environmental and Siting, and Technology Acceptance Activities program areas.

The following document is the peer review panel's observations and findings, the response from the Wind Program to these, and supporting meeting materials including an agenda and participants list. In accordance with the DOE Peer Review Guide Section 6.0, peer reviewers provided both quantitative and narrative evaluations of the materials and projects presented at the peer review meeting. The comments herein are the most direct reflection of reviewers' written evaluations, and where possible have been included verbatim.

Peer Review Meeting Process

The U.S. Department of Energy (DOE) Wind and Hydropower Program's strategic planning framework has two elements (Figure 1). First, the Program has an ongoing technical assessment activity to monitor the status of wind technology and progress in achieving program cost goals, to evaluate that status within the context of marketplace needs, and to identify technological pathways that will lead to successful competition in the marketplace. The program also uses a formal peer review process to benefit from the guidance of industry and the research community, and to provide an outside view of the Program. As shown in Figure 1, technical assessment and peer review provide inputs that the program management team considers in making decisions about strategic program directions and funding priorities.

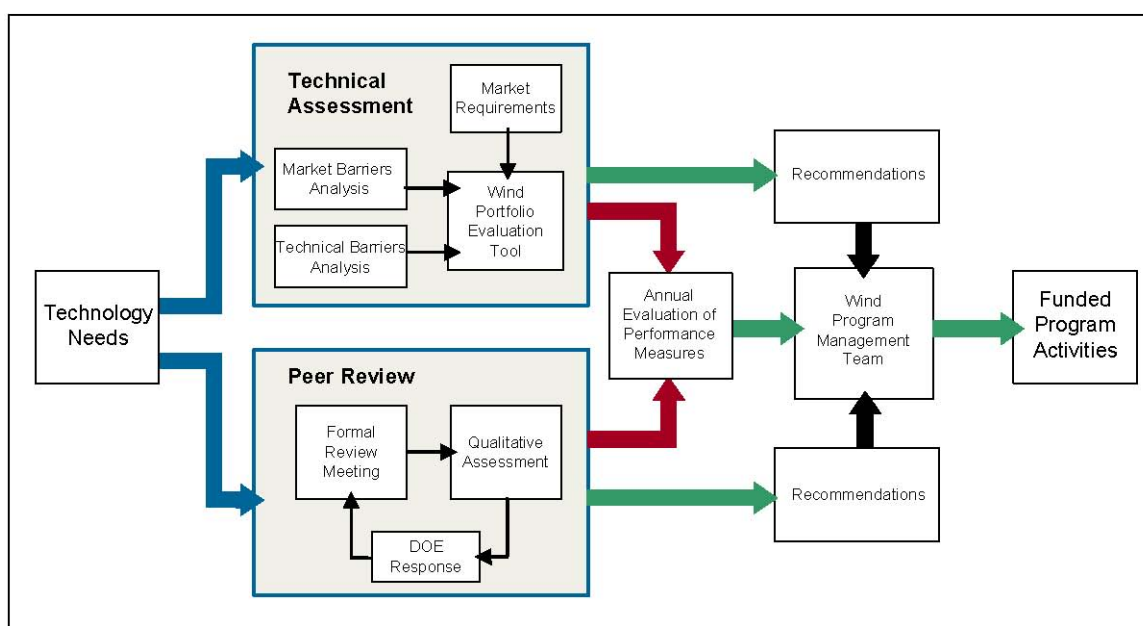


Figure 1. Strategic Planning Framework.

The peer review is designed to provide feedback to Wind Program management on the research and development areas chosen for review. Peer reviews are conducted in conformance with departmental guidance. The results of the review are considered when the program management team evaluates potential adjustments to program direction.

The DOE Wind Technologies Program peer review was held on July 11-12, 2007, at the Denver Marriott West hotel in Golden, CO. The review focused on specific technical projects within the Systems Integration, Market Policy and Analysis, Environmental and Siting, and Technology Acceptance Activities program areas.

The Wind Energy Program peer review panel was comprised of experts in the wind energy field. All committee members are independent of affiliation with the Wind Energy Program. The Wind Energy Program review panel included:

Name	Affiliation
Carl Weinberg (Chair)	Weinberg Associates
John Mankins	Artemis Innovation Management Solutions, LLC
Steve Connors	Massachusetts Institute of Technology
Ken Karas*	Former CEO, Enron Wind Corp.; Former CEO, Zond Corp.
Mike Kelly**	Direction of Operations, Horizon Wind Energy
Dale Osborn**	Transmission Technical Manager, MISO

**Not present for this year's Peer Review*

***New Peer Review Panelist in 2007*

Reviewers received briefing materials to aid in the program review process prior to attending the meeting. This information included an agenda, the Wind Energy Multi-Year Program Plan 2007-2012, Wind Energy Program FY 2007 Annual Operating Plan, the 2007 Wind Power Strategic Planning Meeting report, and DOE's DOE Annual Report on Wind Power 2007. Reviewers also received copies of the review evaluation forms and the EERE evaluation guidelines as provided in the EERE Peer Review Guide. Reviewers were also provided an outline of the Wind Energy Program's mission and goals.

The peer review meeting was conducted as a two-day event. The first day focused on System Integration, and Market and Policy Analysis program activities. The second day covered Environmental and Siting and Technology Acceptance program activities. Peer reviewers completed their reviews in a separate location and provided an initial summary of their findings to members of the Wind Energy Program at the conclusion of the peer review meeting.

In accordance with DOE Peer Review Guide Section 6.0, the peer review team chose to submit both quantitative (i.e., numerical scores) and qualitative (i.e., narrative accounts) evaluations as part of their review of the materials and projects presented. The comments herein are the most direct reflection of their written evaluations, and where possible have been included verbatim. The project evaluation forms were distributed to the Peer Review Panel members prior to the meeting, as well as detailed guidance on how to complete the forms. The panel was asked to rate the projects in the following categories:

1. **Effectiveness** (considering the elements of quality, productivity, and accomplishments);
2. **Relevance** (to mission, goals, strategy, and technical and/or market barriers); and
3. **Overall Impression** (considering all measures, inputs and outputs, and program management).

Numerical scores were based on a ten point scale, with qualitative descriptors given for the numerical scoring index (i.e., a score of 1-2 corresponded to a "Seriously Deficient" rating, 4-6 corresponded to an "Average" rating, and 9-10 corresponded to an "Outstanding" rating). Furthermore, the panel was asked to rate the projects with respect to the Program's Mission and Goals, as shown on the following page.

Program Mission and Goals

Mission: To lead the nation's efforts to improve wind energy technology through public/private partnerships that enhance domestic economic benefit from wind power development and coordinate with stakeholders on activities that address barriers to wind energy use.

Program Strategic Goal: Collaborate with federal, state, industry, and stakeholder organizations and lead wind energy technology R&D and application efforts to support achieving the 20% wind vision for the Nation's electricity by 2030.

Program Performance Goals:

- By 2012, reduce the cost of electricity from large wind systems in Class 4 winds to 3.6 cents/kWh for land-based systems (from a baseline of 5.5 cents/kWh in 2002).
- By 2014, reduce the cost of electricity from large wind systems in Class 6 winds to 7 cents/kWh for shallow water (depths up to 30 meters) offshore systems (from a baseline of 9.5 cents/kWh in 2005).
- By 2016, reduce the cost of electricity from large wind systems in Class 6 winds to 7 cents/kWh for transitional (depths up to 60 meters) offshore systems (from a baseline of 12.0 cents/kWh in FY2006).
- By 2007, reduce the cost of electricity from distributed wind systems to 10-15 cents/kWh in 2007 in Class 3 wind resources (from a baseline of 17-22 cents/kWh in 2002).
- By 2012, complete program activities addressing electric power market rules, interconnection impacts, operating strategies, and system planning needed for wind energy to compete without disadvantage to serve the Nation's energy needs.
- By 2010, at least 30 states with wind momentum needed to ensure wind's continued growth.

2007 Wind Energy Program Peer Review Agenda

July 11-12, 2007

Denver Marriott West, Golden, CO

Day 1 (Wednesday, July 11)

- 7:15 am **Registration & Continental Breakfast**
- 8:00 am **Welcome, Program Overview Perspectives** (Steve Lindenberg, Bob Thresher, Jose Zayas)
- 8:20 am **20% Wind Vision Report** (Ed DeMeo)
 Utilities and Transmission (Charles Smith)
 Markets and Acceptance (Larry Flowers)
- 9:05 am **Review Objectives** (Stan Calvert/ Mike Reed)
- 9:15 am **Technology Application Overview** (Steve Lindenberg)
- 9:30 am **Systems Integration Overview** (Stan Calvert / Brian Parsons)
 Renewable Systems Interconnection (Stan Calvert)
 SI Activity Overview (Brian Parsons)
- 9:45 am BREAK
- 10:00 am **Systems Integration Activities** (Brad Nickell / Brian Parsons)
 UWIG (Charles Smith)
 Stakeholder Collaboration and Outreach (Mike Milligan)
 Integration Studies (Brendan Kirby)
 NWCC Regional Transmission (Ed DeMeo)
 Western Interstate Energy Board/WGA (Doug Larson)
 Western Wind Integration Study (Kevin Porter)
- 11:30 am Panel Q&A
- 12:00 pm **Lunch & 2006 Wind Energy Awards Presentation**
- 1:15 pm **Systems Integration Activities** (Continued)
 Wind and Hydro Integration (Tom Acker)
 Grid Simulators (David Corbus)
 Generator Modeling (Ed Muljadi)
 Wind Farm Data Monitoring (Yih-huei Wan)
 Wind Integration Technical Assistance (Brian Parsons)
 Resource Assessment and Modeling
 Expanding Capacity on Existing Grid
 New Transmission Planning and Expansion
 Education and Outreach on Transmission/Grid Integration
- 2:45 pm Panel Q&A
- 3:15 pm BREAK

- 3:30 pm **Market and Policy Analysis** (Steve Lindenberg / Maureen Hand)
 AWEA Critical Issues and FERC Activity (Ron Lehr)
 Competitive Power Markets (Mark Bolinger)
 WinDS Modeling (Maureen Hand)
- 4:15 pm Panel Q&A
- 4:45 pm **Recess / Peer Review Panel Discussions (Closed Session)**
- Day 2 (Thursday, July 12)**
- 7:00 am **Continental Breakfast**
- 8:00 am Welcome / Review Objectives (Steve Lindenberg)
- 8:15 am **Environmental and Siting** (Brian Connor)
 Radar Mitigation and Impacts (Gary Seifert)
 National Wind Coordinating Collaborative (Abby Arnold)
 Wildlife Research (Bob Thresher / Karin Sinclair)
- 9:00 am Panel Q&A
- 9:30 am **Technology Acceptance Activity Overview** (Phil Dougherty / Larry Flowers)
 Communications and Outreach (Ruth Baranowski)
- 9:55 am BREAK
- 10:15 am **Technology Acceptance Activities- State Outreach** (Larry Flowers)
 High Priority States (Larry Flowers)
 Low-Medium Priority States (Steve Palomo)
 Agricultural Outreach (Marguerite Kelly)
 Regional Wind Institutes (Marguerite Kelly)
 Air Quality and Emissions (Lori Bird)
 Economic Impact Analysis (Suzanne Tegen)
 Wind Mapping (Dennis Elliott)
- 12:00 pm Panel Q&A
- 12:30 pm **Lunch**
- 1:30 pm **Technology Acceptance Activities - Priority Markets** (Larry Flowers)
 Native Americans (Bob Gough)
 Distributed Wind (Trudy Forsyth)
 Public power (WAPA) (Randy Manion)
 Wind for Schools (Larry Flowers)
 Federal loads/Greening DOE (Robi Robichaud)
 Federal Wind Siting Collaborative (Phil Dougherty)
- 3:15 pm Panel Q&A
- 3:45 pm **Adjourn**
- 4:00 pm **Peer Review Panel Discussions (Closed Session)**

WIND PROGRAM PEER REVIEW PANEL FINDINGS

The following is a summary list of the Wind Program Peer Review Panel's main findings and comments:

- 1) The 20% wind vision analysis gives the program a coordinated and unified systems focus, which was previously lacking.
- 2) With the implications of the 20% wind vision, the systems integration (SI) and technology hardware R&D programs should increase coordination. The findings of the SI studies and models need to be integrated into the technology hardware R&D portfolio decision-making process. This will improve the overall architecture of the Wind Program research portfolio.
- 3) In evaluating the job creation and economic development impacts resulting from the 20% wind vision analysis, a coordinated federal program effort (possibly with the Department of Labor and/or USDA) is necessary to ensure that policies are designed to maximize domestic economic development by maintaining or increasing domestic market share and manufacturing capabilities, and that wind turbine manufacturing jobs are created in the U.S. (e.g., DOE's Solar America Initiative has targeted support to commercial or near-commercial solar energy domestic manufacturing capabilities). The program should not assume that the U.S. will achieve all the potential benefits of the 20% wind vision without such a coordinated policy.
- 4) There is a major need for increased educational programs, coordination, and outreach with academia. Academia needs access to free, peer-reviewed, industry-accepted models, as well as the data to train future wind integration analysts. Furthermore, academic coordination between engineering and economics departments is necessary, as the wind industry requires interdisciplinary engineering skills.
 - a. The need for recruiting, educating/training, and retaining skilled staff is prevalent throughout the wind industry, and implementing the 20% wind vision will increase this need. For example, more detailed time series modeling for wind integration and more resources for stakeholder outreach are necessary, which require an increase in properly trained staff in the wind industry.
- 5) Greater collaboration is needed between the two sectors of SI activities within the Wind Program. One sector seems focused on studies, assessments, modeling and data analysis, while the second sector engages in person-to-person interaction and interfaces with industry groups, states and policy makers (e.g., AWEA and NWCC).
- 6) EERE should coordinate more with other federal agencies both within DOE, such as the Office of Electricity (OE), and outside of DOE, such as FERC. If a major focus of the Wind Program is transmission issues, it is critical to interact with OE, which has DOE jurisdiction over national interest transmission corridors.

- 7) Generally, there are good marks for each of the projects. Most of the projects are working toward the same end; that is integrating wind into a system that “doesn’t want it” or is slow to accept it.
- 8) The WinDS, UWIG, WPA and AWEA projects are excellent uses of taxpayer resources. The Wind Program is commended for working with UWIG for several years, because significant benefits have come from this effort, and has had the greatest return on investment compared to all other Program activities.
- 9) The AWEA project should focus on:
 - a. Helping to bridge the gap between political and national policy needs;
 - b. Coordinating and facilitating a meeting of wind developers and DOE staff, so that DOE can make its case for the need to obtain real-time data from developers for modeling and analyses;
 - c. Establishing a consistent set of rules for getting detailed time series “proprietary” data from wind power plants, including what will be scrubbed, averaged or kept confidential, and the timing and frequency of its reporting;
 - d. Integrating the findings of regional modeling and systems studies into a consistent, national-level framework that incorporates the best practices discovered in the state and regional studies; and
 - e. Filling the political void at the state/federal nexus.
- 10) Increased accounting of, and coordination with, planned upgrades to the transmission system are necessary to recognize the value added by wind and optimize its integration.
- 11) The Wind Program should take into account the Canadian energy system, particularly for bordering states and power areas.
- 12) The focus on the integrated planning of wind/hydro and wind/solar projects is applauded and continued activities in these areas are encouraged.
- 13) The detailed models being developed by the Program need to directly or indirectly feed into NEMS and other national or international energy models.
- 14) A clear, stable, long-term energy policy, similar to EU efforts, is necessary to foster market development and technology acceptance.
- 15) Wind Powering America (WPA) should coordinate more with SI activities. As more wind sites are developed this will be an increasingly important endeavor for the 20% wind vision plan. As such, while WPA has been operating on a low budget in the past, it needs to become a more entrenched part of the Program’s activities.

WIND PROGRAM PEER REVIEW PROJECT EVALUATIONS

Systems Integration Activities

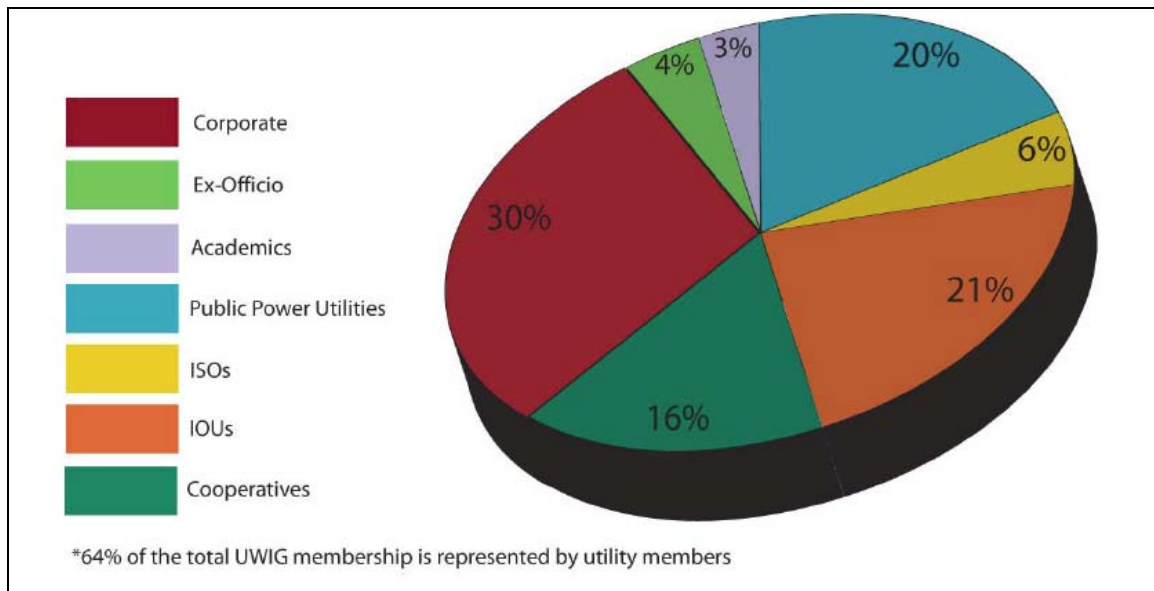
The Systems Integration (SI) activities have become a major focus of the Wind Program’s efforts, in support of the “20% Wind Vision”, which will require significant attention to system operation and transmission needs and planning.

These efforts are guided by the:

- **Programmatic Goal** - “By 2012, complete program activities addressing electric power market rules, interconnection impacts, operating strategies, and system planning needed for wind energy to compete without disadvantage to serve the Nation's energy needs”; and
- **Advanced Energy Initiative** – “Areas with good wind resources have the potential to supply up to 20% of the electricity consumption of the United States”.

Utility Wind Integration Group (UWIG) (J. Charles Smith – Executive Director)

UWIG is a non-profit corporation established by six utilities in 1989 with support from EPRI and DOE/NREL, with a current membership of 111 organizations. The purpose of the UWIG project is to focus on the technical issues of wind integration, with a mission of accelerating the appropriate integration of wind power into the electric system.



Peer Review Panel Scores:

Scoring Category	Average	Range
1) Effectiveness	8.3	7-9
2) Relevance	9.0	8-10
3) Overall Impression	7.8	5-9

Peer Review Panel Comments: The role of an organization such as UWIG is very important, and is seen as an essential mission effort. Many view the problem of wind deployment as an integration challenge, and UWIG is the primary group for the coordination of integration efforts. A key question is whether there are additional power regulation problems due to the introduction of wind, and power plants require 1 second-scale data on wind power output (for at least the first 100 MW of wind power) to confirm that the systems/winds are stable at scales longer than 1-second. The UWIG project is and should continue looking at these questions.

The panel feels the project has produced mixed results, but the quality of work is excellent, vitally needed, and impressive considering the budget and resources. There is opportunity for program expansion in terms of topics and entities. During the presentation, a lot of information was presented (i.e., somewhat of a “trees for the forest” challenge), and additional synthesis would have been helpful.

The panel feels that UWIG has had and can continue to have a major impact on systems integration; that the budget is money well spent, which allows technical information to flow to the Transmission Technology community; and that this project is instrumental in achieving the 20% wind vision plan.

Stakeholder Collaboration & Outreach (Michael Milligan – Consultant, NREL)

This project is focused on bringing together collaborators (e.g., NREL, 3Tier, Renewable Northwest Project, UWIG, Renewable Energy Consulting Services, Xcel Energy, Minnesota PUC, Energy Systems Consulting Services, Northern Arizona University, Enernex Corporation, Arizona Public Service Company, CEC, GE Energy, Exeter Associates, UC Davis) to perform outreach activities with stakeholders (e.g., state and local government agencies, utilities, NGOs). The types of outreach activities include one-time or limited interaction with external groups by giving presentations or attending meetings, writing technical papers, ongoing close association with UWIG, and on-going technical assistance with wind integration studies.

Peer Review Panel Scores:

Scoring Category	Average	Range
1) Effectiveness	7.5	6-9
2) Relevance	8.8	7-10
3) Overall Impression	8.0	6-9

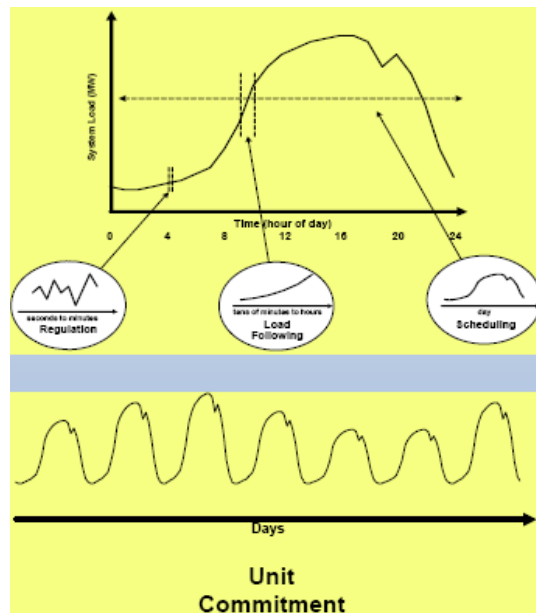
Peer Review Panel Comments: The panel acknowledges that this is a proper role for NREL, a recognized national authority in wind integration. The outreach efforts help greatly to conform the processes of wind studies, which is needed so time and effort are not wasted comparing results that vary due to differences in assumption or methodologies. The stakeholder collaboration provides a forum for all views to be heard and an avenue for discussion without rancor, which are a much needed part of issue resolution.

Informing States about the technical requirements for local power driven by wind and the need for other power sources to be flexible in scaling up or down to complement integrated wind (e.g., gas turbines scale up or down very poorly) is important. Original analyses are also conducted as part of these activities, adding to the body of knowledge. This is deemed important as resources are a severe limit to spreading techniques for wind analysis.

The panel recognizes the relationship between this effort and UWIG, and suggests continuing collaboration with UWIG along with a call to inform members of the IEEE – PE community.

Integration Studies (Brendan Kirby – ORNL)

This project provides technical analysis support for wind integration studies. Specific studies depend on regional and utility interest, with support often requested by regulators to assure a non-biased analysis. The SI expertise helps to ensure the technical validity of the studies and furthers DOE and NREL interests in advancing analysis methodologies. These studies allow for improvements in the state of the art of study methodologies; better understanding of wind integration impacts; identifying physical causes and costs that wind imposes on power systems; and learning how to minimize cost impacts. Specific analyses performed under this project include the Minnesota/MISO, California CEC Intermittency Analysis Project, Xcel/PSCo, Arizona Public Service and the Pacific Northwest Integration studies.



Peer Review Panel Scores:

Scoring Category	Average	Range
1) Effectiveness	8.3	8-9
2) Relevance	9.3	8-10
3) Overall Impression	7.8	7-9

Peer Review Panel Comments: The panel feels that there is a great need to continue this program. The approach and participation of different players in the field was of superior quality, and essential to achieve the goals of systems integration.

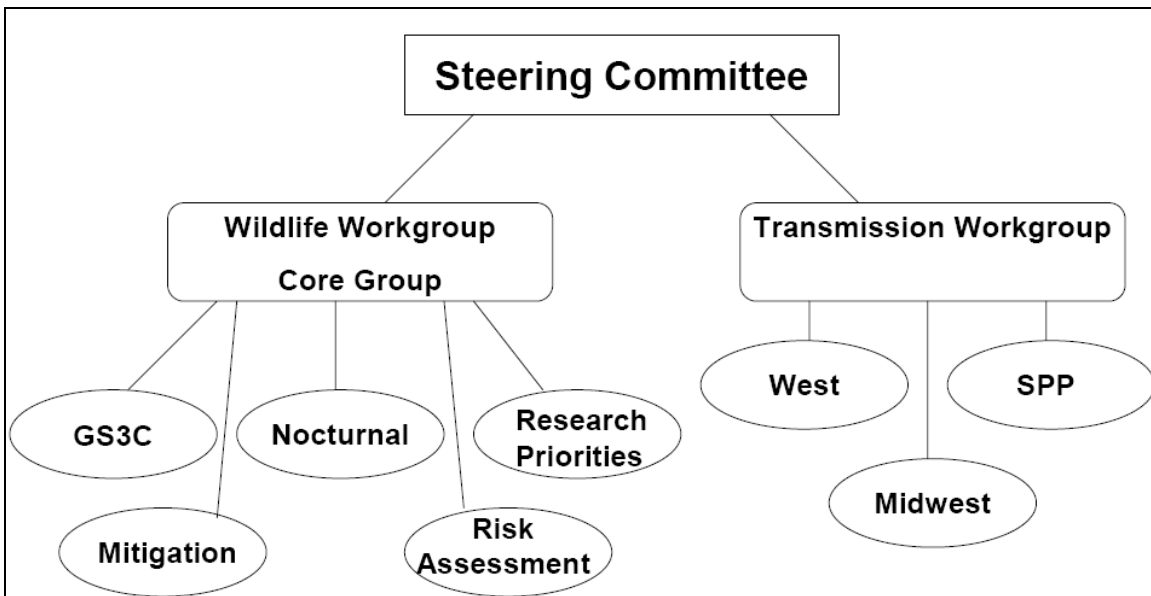
A major barrier to the outreach program is a lack of DOE- or NREL-validated models for all states. Lack of validated models is limiting progress towards the 20% wind vision.

The panel also believes that an important component of what is missing in the

computation of raw data, in addition to developing the integration models, is the sheer manpower (i.e., having many more competent people to handle the various barriers facing wind integration).

NWCC Regional Transmission (Ed DeMeo – Renewable Energy Consulting Services)

This project is designed to create a forum to facilitate collaborative discussion between different stakeholder sectors (e.g., SeaWest Windpower, FPL, Western Governors Association, AWEA, National Conference of State Legislatures, NREL, BP, UWIG) to reduce later adversarial proceedings in regards to transmission. Dialogue amongst stakeholders, as well as regulators, legislators, and energy policy leaders, functions to identify issues that affect the use of wind power and catalyze activities aimed at sustainable wind markets. The NWCC facilitates these types of information exchange through a number of different platforms including workshops, newsletters, web forums, and webcasts.



Peer Review Panel Scores:

Scoring Category	Average	Range
1) Effectiveness	7.3	6-9
2) Relevance	7.8	7-9
3) Overall Impression	7.0	6-9

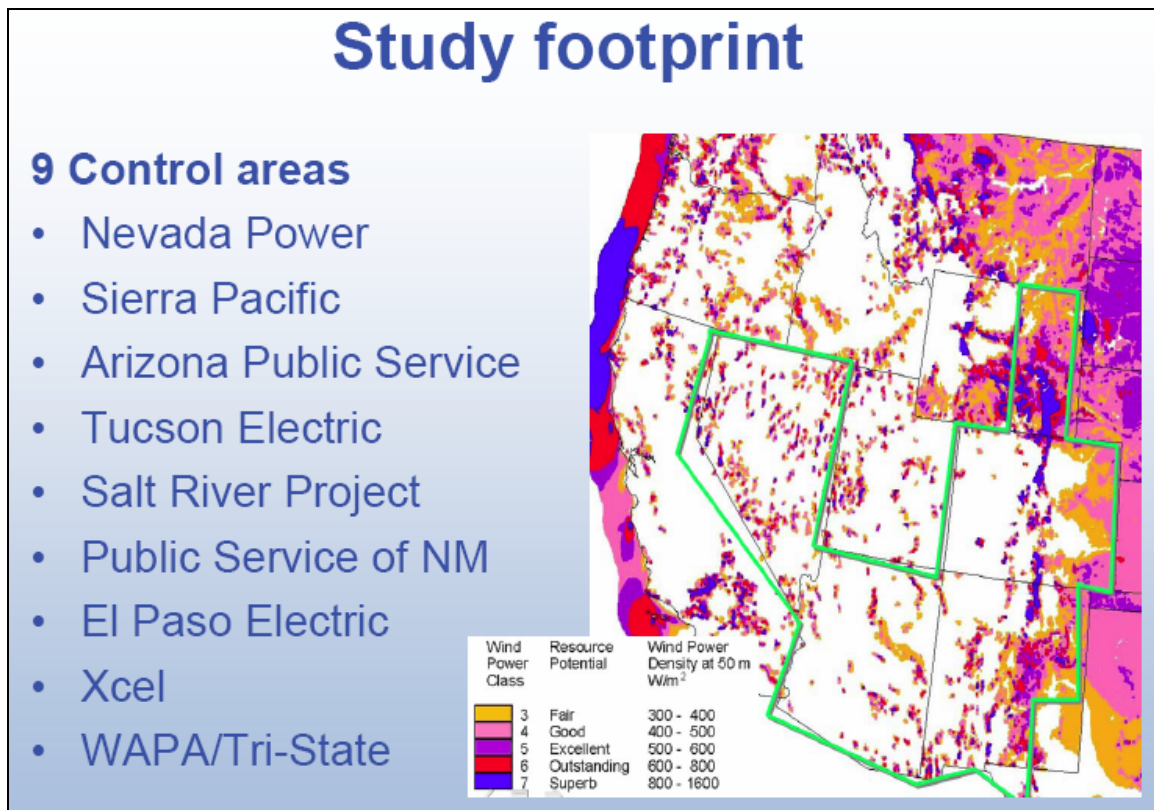
Peer Review Panel Comments: The panel feels that the NWCC is an effective outreach program, which is a much needed part of dispute resolution that provides real data.

The presentation itself lacked some integral information regarding the approach and the people involved within the NWCC. The types of methods employed by the NWCC appear to not translate well into actual action on overall national transmission integration, indicating that “machinery” must be added to affect change after the dialogue has been completed on these issues.

With continued participation, the NWCC conferences are essential to jumpstart a national RPS policy. However, to achieve this goal, members of the NWCC work groups must actively lobby state legislators to achieve a proactive integration policy.

Western Interstate Energy Board /WGA (Doug Larson – Executive Director)

This project is designed to remove barriers to integrating variable wind resources into the western grid. The implementation of this project involves addressing barriers to transmission, barriers to small wind, and the development of financial incentives for wind, with the additional supplemental task of conducting a wind/advanced coal hybrid concept feasibility study.



Peer Review Panel Scores:

Scoring Category	Average	Range
1) Effectiveness	8.3	6-10
2) Relevance	8.8	7-10
3) Overall Impression	9.0	8-10

Peer Review Panel Comments: The role of the Western Interstate Energy Board/WGA in transmission planning and development is absolutely critical to achieving the 20% wind vision. The presentation was clear in its statement of objectives to achieve this goal.

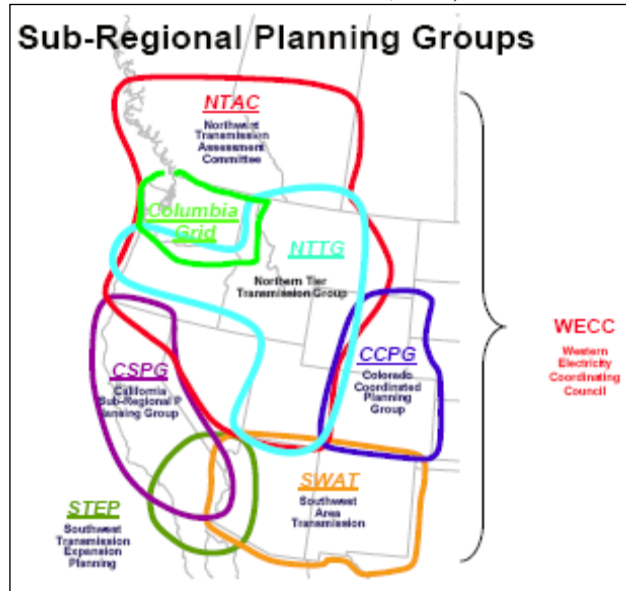
The panel feels that there needs to be more study of both coordination with Canada and in

the area of additional integration of wind and hydro with the western grids. More studies are also needed in the area of sub-regional planning for grid integration.

Further work by the Western Interstate Energy Board/WGA is absolutely necessary to realizing the role of wind in achieving the 20% wind vision through further integration and more streamlined transmission development processes.

Western Wind Integration Study (Kevin Porter – Exeter Associates, Inc.)

This study examines the operating and cost impacts due to the variability and uncertainty of wind and solar on the grid and to investigate mitigation options for those impacts. This study also supports both the Western Governor’s Clean and Diversified Energy Initiative (30GW by 2015) and the President’s Advanced Energy Initiative (20% Wind Vision).



Peer Review Panel Scores:

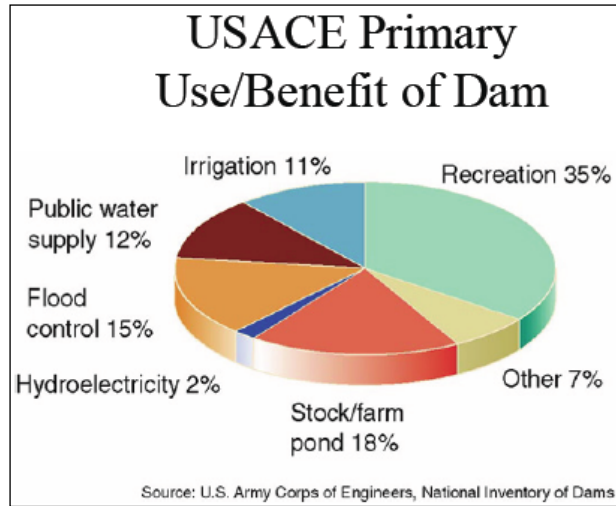
Scoring Category	Average	Range
1) Effectiveness	6.8	5-9
2) Relevance	8.0	7-9
3) Overall Impression	6.7	6-9

Peer Review Panel Comments: The purpose of the study was found to be quite relevant by the panel towards future work in this area. The study highlighted the linkages and benefits to WestConnect and other ongoing grid projects in terms of wind and solar integration.

The panel found the presentation to have some gaps in information on strategic implications and outcomes. The ‘innovative’ aspects of the work were not clear; however, the presentation was able to thoroughly cover the basics of the study (purpose, goal, etc.) as well as smaller details associated with specific tasks.

Wind & Hydro Integration (Tom Acker - Ph.D., Northern Arizona University)

This project is designed to show the benefits that wind and hydro integration have on operational flexibility, opportunity cost to hydro, and the value of energy/water storage. In doing so, a working group consisting of a number of collaborating organizations (e.g., Arizona Power Authority, Oak Ridge National Laboratory, BPA, SMUD, 3Tier, Windlogics, GE, U.S. Bureau of Reclamation, U.S. Army Corp of Engineers) hopes to identify and answer a number of technical, institutional, economic, and political issues associated with integrating wind and hydroelectric generation.



Peer Review Panel Scores:

Scoring Category	Average	Range
1) Effectiveness	7.5	7-8
2) Relevance	7.3	7-8
3) Overall Impression	7.3	6-8

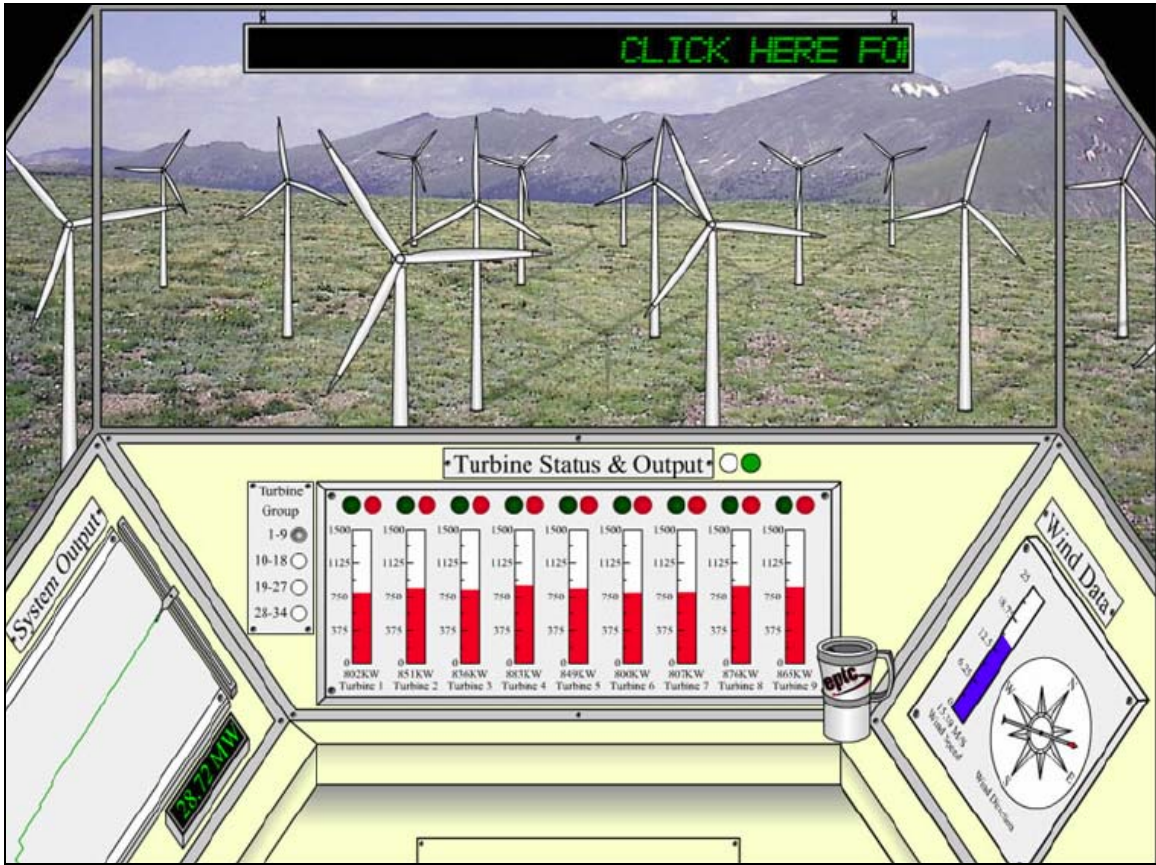
Peer Review Panel Comments: The presentation gave a good characterization of the importance and necessity of analyzing wind and hydro systems simultaneously in order to avoid optimizing just hydro. Specific constraints on a river/dam provide promising opportunities for cogeneration with wind. Although the potential may be limited due to regional geographies, wind/hydro integration is still essential in those regions.

Although most of the panel believed the preliminary findings to be promising, some questioned whether the result from wind/hydro integration was practical. However, it is too soon to make any final judgments without more studies of applicability.

The panel agreed that there was much potential in wind/hydro integration, but the prerequisite to bypassing political and public barriers was a thorough economic study to gain approval for pilot facilities and further field case studies.

Grid Simulators (Dave Corbus, NREL)

This project is designed to model wind plant grid interactions to gain a better understanding of the impacts that wind plants have on the grid. A working group, which consists of NREL, DOE, and EnerNex Corporation, seeks to develop tools to simulate the impact of wind plants on utility grids, familiarize grid operators with this impact, and allow utilities to evaluate wind power impacts on their control areas through hands-on training using wind simulators and models.



Peer Review Panel Scores:

Scoring Category	Average	Range
1) Effectiveness	7.5	5-9
2) Relevance	8.0	6-10
3) Overall Impression	7.8	6-9

Peer Review Panel Comments: There is a definite need for this program as grid operators need exposure to wind metrics before they encounter it in real time. The presentation was exemplary in its statement of the study’s project goals, objectives, and approach.

The panel found it hard to judge the overall quality of the project without it being complete. The models require further tweaking of details in order to match the models to actual conditions. Operator feedback in the final draft would be useful in further tailoring the programs to match the requirements of grid operators and utilities.

Generator Modeling (Ed Muljadi – NREL)

This project represents a collaborative effort by NREL, CEC, and WECC to standardize wind generating models through the use of aggregate data to allow for model validation

and equivalencing for different size wind farms. The project will further collaborate with UWIG, WECC, IEEE, utilities, wind developers or operators, and universities to gain access to data and disseminate the end results in order to give grid stakeholders reliable, validated models.

Peer Review Panel Scores:

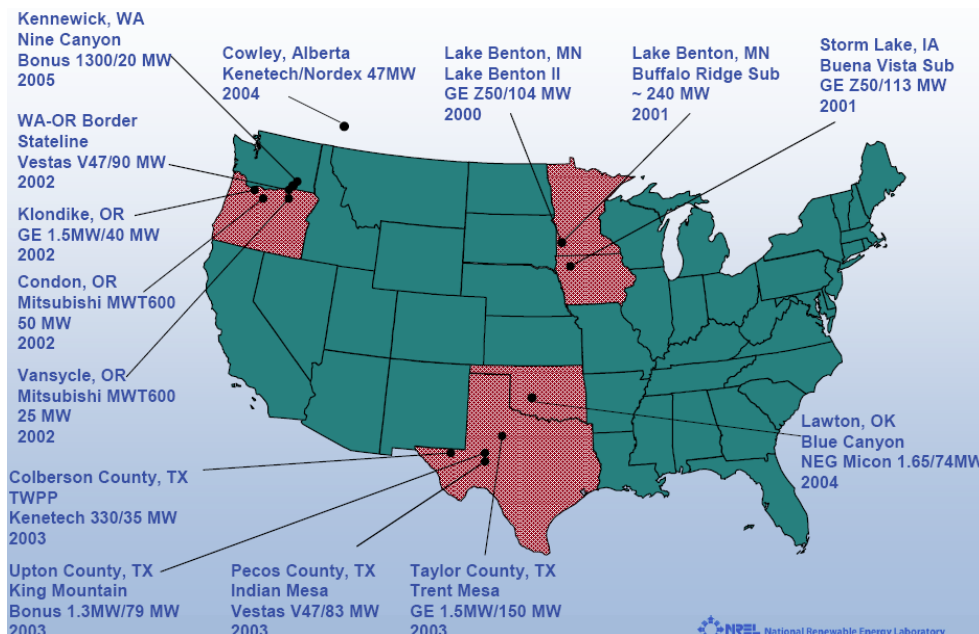
Scoring Category	Average	Range
1) Effectiveness	7.5	4-9
2) Relevance	8.3	6-10
3) Overall Impression	7.5	4-9

Peer Review Panel Comments: This work is absolutely necessary to create a standard method for accurate industry studies on interconnection impact assessments. The presentation was able to aptly create a delineation of the challenges of getting good data, particularly regarding ‘faults’ on the generator.

Some on the panel believed that the driving need for this collaborative to handle these models and validation was not compelling – believing that OEMs should provide models so the industry and NREL can focus on wind farm equivalencing.

Wind Farm Data Monitoring (Yih-huei Wan – NREL)

The objective of this project is to collect long-term, high-resolution, actual wind power plant output data to analyze variability of wind power in order to provide data to study wind impacts on the power grid. Initially, a ~1,000MW portfolio of 14 wind farms located in Texas, Oklahoma, Iowa, Minnesota, and Oregon will be monitored with hopes of adding more wind farms in other regions in order to create a better characterization of wind power’s spatial diversity. This data will be made available to researchers and industry for model validation and integration studies.



Peer Review Panel Scores:

Scoring Category	Average	Range
1) Effectiveness	6.8	6-8
2) Relevance	8.5	8-9
3) Overall Impression	7.3	6-8

Peer Review Panel Comments: This project is indispensable due to the need for a long-term dataset with a common format for a relatively new technology like wind.

This project has demonstrated a successful pursuit of goals. The presentation was very useful in its use of data on wind farm performance and variability. However, it would have been useful to see monitoring data as well as a comparison of daily, seasonal and inter-annual variability. The presentation seemed to miss the big picture in failing to suggest necessary means for data dissemination for maximal benefit of consumers.

Wind Integration Technical Assistance (Brian Parsons – NREL)

This project focuses on four areas: Resource Assessment & Modeling; Expanding Capacity on the Existing Grid; New Transmission Planning & Expansion; and Education & Outreach on Transmission/Grid Integration. The purpose of this project is to decrease barriers associated with the siting and existing line capacity to benefit the upstream wind resource.

Peer Review Panel Scores:

Scoring Category	Average	Range
1) Effectiveness	6.8	6-8
2) Relevance	8.8	8-9
3) Overall Impression	8.0	8-8

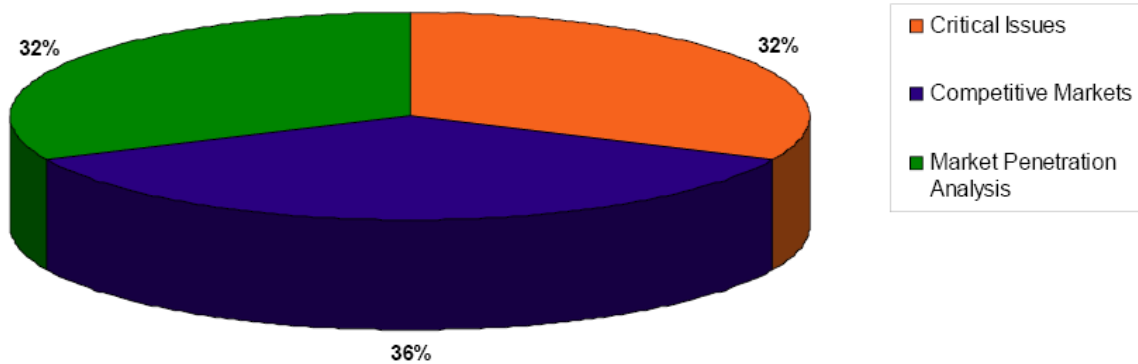
Peer Review Panel Comments: This report provides a well-focused list of tasks, which has been tailored to support the wind program’s missions and goals.

The panel feels that there was insufficient time to assess productivity and accomplishments. Despite the unfinished work, it is clear that there needs to be more staff doing this type of work, which is essential to forecasting necessary future activities in the wind industry.

Market & Policy Analysis

The Market & Policy Analysis activities provide information and analysis to stakeholders seeking to include wind energy generation in the electric power market controlled by incumbents.

For these efforts, approximately \$1.185 million dollars have been allocated as follows:



AWEA Critical Issues & FERC Activity (Ron Lehr – AWEA)

This project represents a five-year contract awarded to AWEA, which has the objective of investigating the critical issues for wind deployment. AWEA has four broadly defined task areas: 1) develop information products; 2) targeted outreach; 3) broad dissemination; and 4) final report and performance metrics. For the first two intertwined tasks, AWEA has conducted a number of seminars/meetings relevant to forecasting as well as transmission and interconnection with system operators. To ensure the broadest dissemination possible, AWEA plans to complete a White Paper by the fourth quarter, 2008. As a concluding task, AWEA’s final report will assess performance metrics based on outreach performance and record operator issues that were not addressed.

Peer Review Panel Scores:

Scoring Category	Average	Range
1) Effectiveness	5.3	3-8
2) Relevance	6.0	4-8
3) Overall Impression	5.5	4-8

Peer Review Panel Comments: AWEA’s particular project area is quite relevant to the goals and is necessary to move forward toward the 20% wind vision. The presentation was able to convey a clear picture of project goals and objectives.

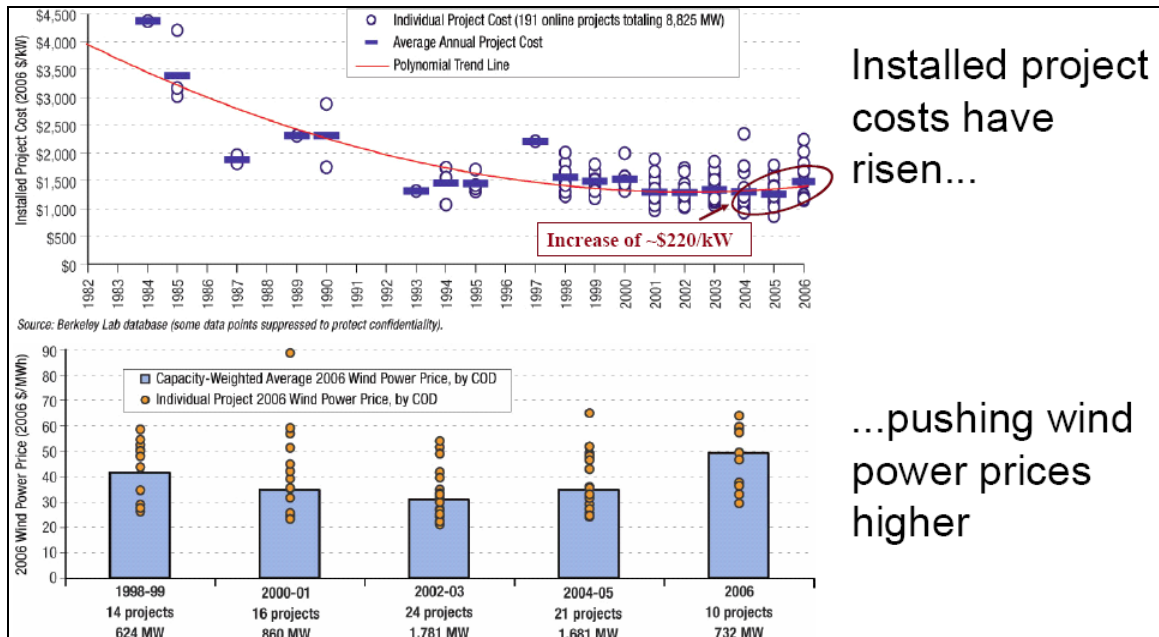
The presentation failed to provide very much detail concerning the accomplishments to date under this particular “Critical Issues” contract. In moving forward, the panel feels that it is very important to carefully word any materials being put forth for broad dissemination.

The panel feels this project was weakened by the fact that there was an interruption in progress due to the loss of a project manager, which significantly reduced the speed and

focus of the project. The panel further questioned the need for this effort as it appeared that AWEA's tasks were redundant with other separate efforts, and therefore suggests specific focuses for this project to take in future years.

Competitive Power Markets (Mark Bolinger – LBNL)

These projects are part of the Lawrence Berkeley National Laboratory's (LBNL) portfolio of wind-related tasks involving economic, market, and policy analysis. Approximately \$375,000 is allocated by the DOE to LBNL's Wind research budget. Within this budget, LBNL publishes a number of annual, publicly available reference documents summarizing key trends in the U.S. wind market, with a focus on the year just ended.



Installed project costs have risen...

...pushing wind power prices higher

These reference documents include the “Annual Market Data,” which covers such topics as wind turbine prices, wind project performance, O&M cost trends, evolution of wind pricing, as well as a prediction of what the remainder of 2007 will hold for the aforementioned variables.

LBNL's second main area of interest regards wind project financing structures, where their goal is to survey the principal financing structures currently being used for wind projects, and publish a report describing their mechanics, as well as their impact on the cost of wind energy.

Third, LBNL analyzes wind's impact on property values (8-12 wind farm sites, with data collected on house values within a 5-7 miles radius of the wind farm) where their objective is to use state-of-the-art field methods and statistical models to evaluate the impact of wind projects on local property values.

Peer Review Panel Scores:

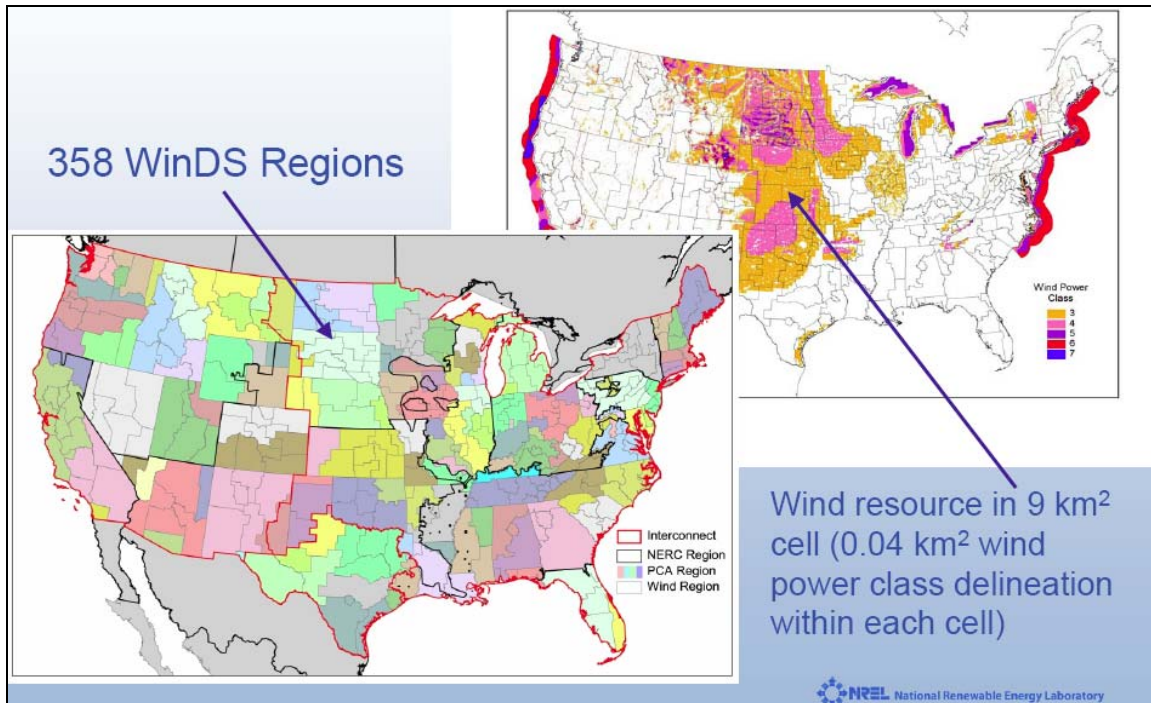
Scoring Category	Average	Range
1) Effectiveness	7.3	6-9
2) Relevance	8.3	8-9
3) Overall Impression	7.5	6-8

Peer Review Panel Comments: A competent effort was made on the part of LBNL to present high quality information on the activities involved in fully realizing the potential of wind.

The panel feels that more time should have been spent on key details, and insights from recent reports would have added much to their report. LBNL needs to address the relative impact that increases in such essential items as steel, copper, etc. will have on cost increases in the price of wind. A further examination of transmission costs is necessary to create a more comprehensive forecast for cost recovery on wind projects.

WinDS Modeling (Maureen Hand – NREL)

This project focuses on further refining the WinDS (Wind Deployment Systems Model) model to conduct analyses of the national potential of wind energy under different policy and technology scenarios to assess R&D opportunities, identify market barriers, and evaluate policy initiatives. WinDS is designed to address the principal market issues for wind, which included access to and cost of transmission as well as resource variability.



Peer Review Panel Scores:

Scoring Category	Average	Range
1) Effectiveness	8.3	8-9
2) Relevance	8.5	8-9
3) Overall Impression	8.5	8-9

Peer Review Panel Comments: This project is a key strategic effort to assure program efforts are prudently focused, as well as an important program management tool.

The panel found that the transmission model being presented by WinDS was somewhat weak. One further weakness was the MISO model that was utilized with full constraints only had about a six-day duration per year of study, which may have been a limiting factor in terms of sample size. However, with a few tweaks the panel feels the project can provide a good long-term overview of market potential in the U.S.

Environmental and Siting

The goal of the environmental and siting programs is to conduct research and outreach to overcome significant barriers to the construction of wind installations. The most prominent of these barriers include the delay or cancellation of wind farms because of radar interference issues and/or wildlife interaction issues. Radar and wildlife concerns have the potential to prevent attainment of the Program’s 20% wind vision. As a result, the bulk of environmental and siting funding is directed towards addressing these two issues.

Radar Mitigation and Impacts (Gary Seifert – INL)

This is a relatively new effort by Idaho National Laboratory (INL) to help ensure that radar interference issues are not a significant barrier to wind development. The project achieves its goals by performing case studies, engaging regulatory agencies, and identifying ways in which radar interference can be mitigated.



Peer Review Panel Scores:

Scoring Category	Average	Range
1) Effectiveness	7.2	6-9
2) Relevance	9.2	8-10
3) Overall Impression	8.2	6-9

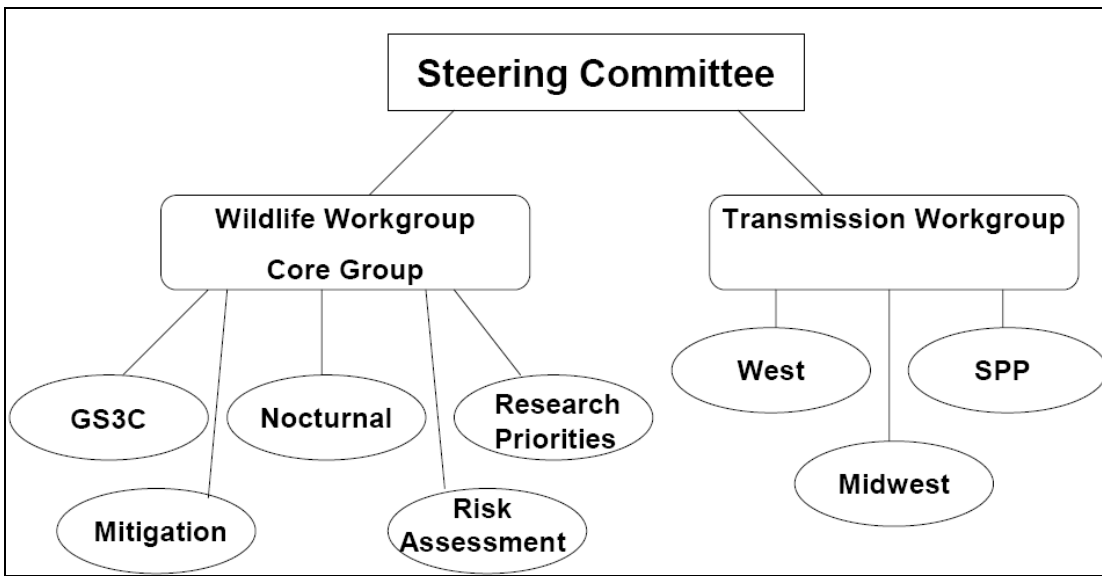
Peer Review Panel Comments: The panel agrees that radar interference is an important issue that needs to be dealt with, as it can present a major barrier to the development of a wind farm. The presentation provided a good overview of the project, and the panel praises the effort’s scope, approach, and management.

The reported “slow start” for the project is unfortunate given the evident importance of the issues involved. A possible improvement to the project would be the use of more

concise metrics to gauge success. Another possible goal for the project going forward should be for political processes to be coordinated to obtain legislation to create a single contact (i.e., a “one stop shop”) for both the FAA and the military.

National Wind Coordinating Collaborative- Wildlife Workgroup
(Abby Arnold – RESOLVE)

The National Wind Coordinating Collaborative (NWCC) Wildlife Workgroup provides a forum for stakeholders to find solutions to wildlife issues and problems related to wind development, such as impacts on birds and bats. The NWCC Wildlife Workgroup conducts research on these issues and helps to disseminate relevant information to stakeholders.



Peer Review Panel Scores:

Scoring Category	Average	Range
1) Effectiveness	8.4	8-9
2) Relevance	9.2	8-10
3) Overall Impression	8.8	8-10

Peer Review Panel Comments: This is an important area for funding because it is necessary to have answers to potential wildlife concerns because of the possible denial of sites for wind development. Even though the problem is expansive and it is difficult to quantify results, it is important to address because it will pose a “clear and present barrier” to the 20% wind vision as deployment scales up.

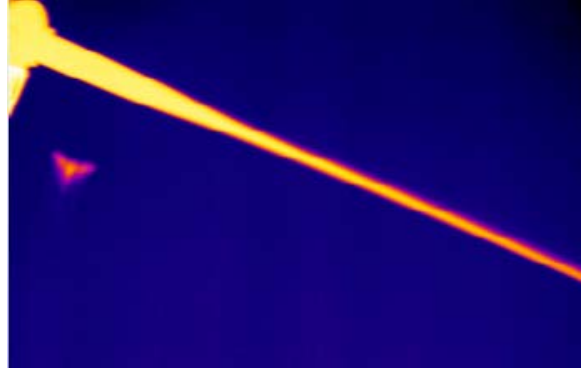
The project has made significant gains in a difficult area showing a thoughtful, careful effort and effective focus on a multi-faceted issue. The presentation provided a good overview of the project’s status and further challenges.

The presentation could have been clearer – perhaps by pulling forward the high level

information concerning the project. Still, more work needs to be done in accord with other agencies because many wind sites face unique wildlife issues.

Wildlife Research (Karin Sinclair – NREL)

Wildlife research at NREL and the National Wind Test Center (NWTC) is focused on conducting credible research on the problem of wind-wildlife interaction and finding ways to mitigate the problem. The findings of this research are distributed to relevant stakeholders.



Peer Review Panel Scores:

Scoring Category	Average	Range
1) Effectiveness	8.0	7-9
2) Relevance	8.4	8-10
3) Overall Impression	8.4	8-9

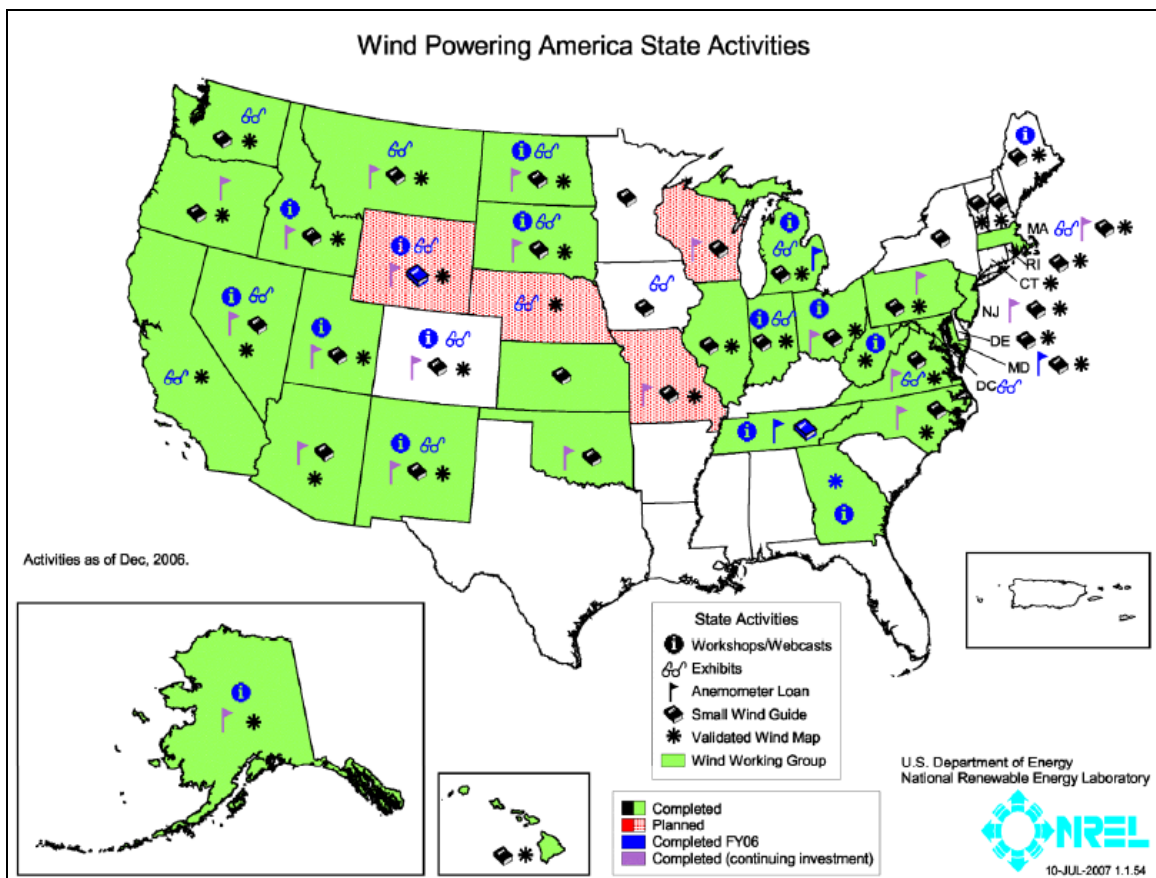
Peer Review Panel Comments: Addressing wildlife concerns is a tough but essential job given their complexity and site-specificity. It is a difficult area for engineers to comprehend, but it is an important issue because of the number of wind sites that have been denied already, and if not remedied, will continue to be a problem.

The panel feels that the presentation did a good job of presenting the project’s purpose, approach, and specific tasks. The presentation was a quality effort providing necessary attention to technical and policy barriers to the 20% wind vision.

The presentation lacked data on the impacts of the project, and requires more information about how many before-and-after studies have been done as well as more attention to the “Fly Way 5.” The topic of wildlife research has been under-emphasized in the context of the 20% wind vision.

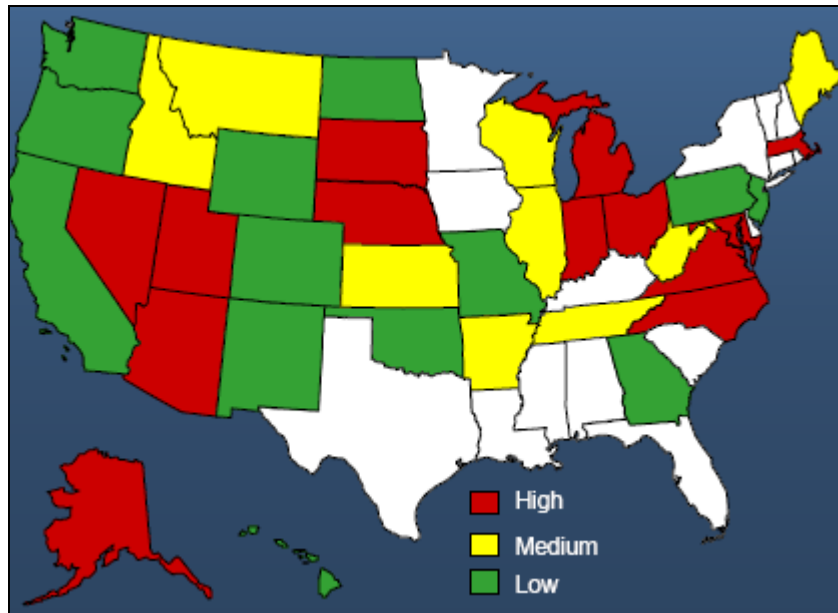
Technology Acceptance Activities – State Outreach

Technology acceptance activities are carried out under the leadership of the Wind Powering America (WPA) program. These activities can be grouped into those focused on State Outreach, which target states and regions where wind development can benefit the most from an additional effort, and Priority Markets, which target interest groups that are likely to be important players in wind development. WPA's goal is the installation of at least 100 MW in each of 30 different states by 2010. The program works primarily through the creation and dissemination of targeted information, analyses, and tools, and by working with and creating strategic partners and working groups.



High Priority States (Larry Flowers – NREL)

This aspect of WPA is focused on developing wind capacity in 13 states (e.g., Alaska, Arizona, Indiana, Maryland, Massachusetts, Michigan, Nebraska, Nevada, North Carolina, Ohio, South Dakota, Utah, and Virginia) that are identified as priority states based on their installed wind capacity, the effectiveness of the Wind Working Group in that state, and the policy environment in that state.



Peer Review Panel Scores:

Scoring Category	Average	Range
1) Effectiveness	9.0	8-10
2) Relevance	9.4	9-10
3) Overall Impression	8.8	8-10

Peer Review Panel Comments: The focus on state-level education is an appropriate response to the current policy environment. The panel identifies this program as the “spark plug” in getting wind Renewable Portfolio Standards (RPS) approved by states, which is seen as an effective tool to achieve the 20% wind vision.

The panel regarded the program’s leadership by Larry Flower’s as overwhelmingly positive, calling him “a super salesman for wind.” The program is exemplary in its precise performance metrics, its tangible results, its effective leverage of state programs, and its broad contribution and support. The program understood the necessity of starting small and getting at least one project installed in regions and states that are currently lagging.

One panelist comments that the presentation was mostly organizational, and that more detail on best practices/lessons learned and how these can help the efforts in medium- and low-priority states was needed. Furthermore, it was suggested that the Regional Transmission Organizations (RTO) should be treated as utilities are and coordinated with in WPA’s regional focus.

Low-Medium Priority States (Steve Palomo – DOE/WPA)

This aspect of WPA is focused on developing wind capacity in 21 states that are identified as low or medium priority states based on their installed wind capacity, the effectiveness of the Wind Working Group in that state, and the policy environment in that state.

Peer Review Panel Scores:

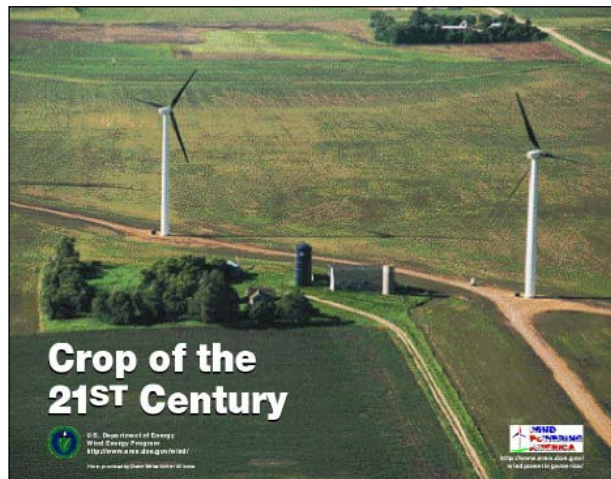
Scoring Category	Average	Range
1) Effectiveness	8.2	8-9
2) Relevance	9.2	8-10
3) Overall Impression	8.4	7-10

Peer Review Panel Comments: Again, the focus on state-level education is an appropriate response to the current policy environment, and this program is a good way to spark wind development in states that have been lagging. The panel praises the speaker for his enthusiasm and his good overview, and again cites WPA for its good leadership and broad contribution and support.

The medium and low priority states are an area that would benefit from funding increases, which could facilitate more interaction with the high-priority states effort (e.g., including sharing best practices/lessons learned). The presentation itself was mostly organizational and could have discussed the project activities in more detail, and one panel member questioned whether WPA has a “toolkit” similar to the NWCC.

Agricultural Outreach (Marguerite Kelly – DOE/WPA)

This aspect of WPA is focused on building acceptance of wind technology in rural areas. The program’s objectives are increasing awareness of the benefits and issues of wind energy in rural areas, providing information to decision makers from multiple credible sources, increasing support for wind energy development among rural leaders and residents, and providing information about opportunities for local ownership and economic development.



Peer Review Panel Scores:

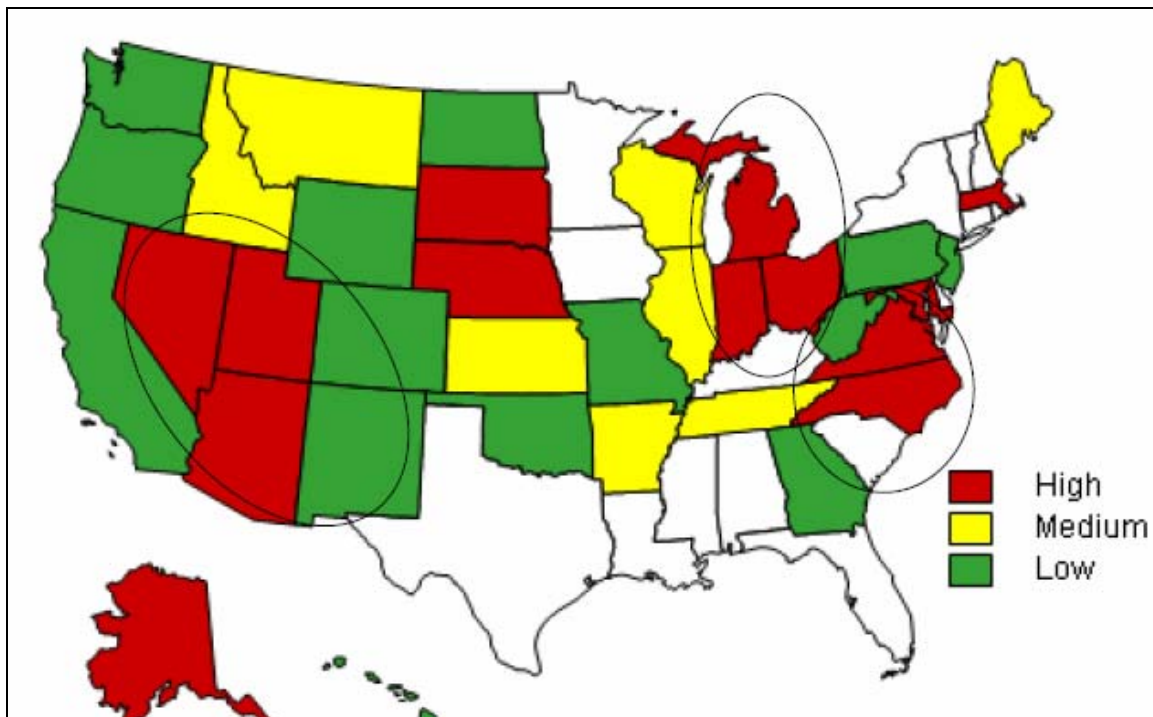
Scoring Category	Average	Range
1) Effectiveness	8.4	8-9
2) Relevance	8.8	8-10
3) Overall Impression	9.0	8-10

Peer Review Panel Comments: The panel believes this effort is important, including the fact that the magnitude of transmission and distribution infrastructure located in rural areas will make these areas critical to achieving the 20% wind vision.

The panel applauds the clear and logical presentation. The effort is a prudent part of a plan to achieve the 20% wind vision, and the panel praises the effort for taking advantage of diverse opportunities to promote wind. In particular, the panel likes the project's emphasis on best practices and on bringing in interested people at the local level to accelerate the effort. The panel suggests a tie to energy markets would greatly improve the economics of this program, and suggests that LBNL may be able to help with that.

Regional Wind Institutes (Marguerite Kelly – DOE/WPA)

This part of WPA is focused on developing a support system for priority states, developing a Strategic Wind Outreach Team in each state, and addressing key regional issues, with an emphasis on building in-state human capacity. Three Regional Wind Energy Institutes (RWEI) have been established, including the Great Lakes led by Windustry, the Mid-Atlantic/Southeast led by the Southern Alliance for Clean Energy, and the Southwest led by the CORE Foundation.



Peer Review Panel Scores:

Scoring Category	Average	Range
1) Effectiveness	7.2	6-8
2) Relevance	8.0	7-9
3) Overall Impression	7.6	6-9

Peer Review Panel Comments: The panel feels that this program is a prudent step towards realizing the 20% wind vision and an appropriate compliment to other efforts. The panel feels this project can lead to increased coordination with RTO's and utilities, which is important for transmission to be developed to a point that it can support 20% wind generation on the system.

The focus, quality, and clarity of this effort indicate a good way to achieve state collaboration in forming an effective strategy for spreading best practices. However, one panel member notes that the focus and purpose of the institutes needs to be clearer.

Air Quality and Emissions (Lori Bird – NREL)

In partnership with AWEA, NREL, SEAC, and consultants, this aspect of WPA focuses on creating and disseminating information on the air emissions benefits of wind development. Wind power presents opportunities for states to meet air quality goals (e.g., SIPs), mitigate air quality violations (e.g., SEPs), and formulate cap-and-trade programs and carbon reduction strategies.

Peer Review Panel Scores:

Scoring Category	Average	Range
1) Effectiveness	7.0	6-8
2) Relevance	8.5	8-10
3) Overall Impression	7.3	7-8

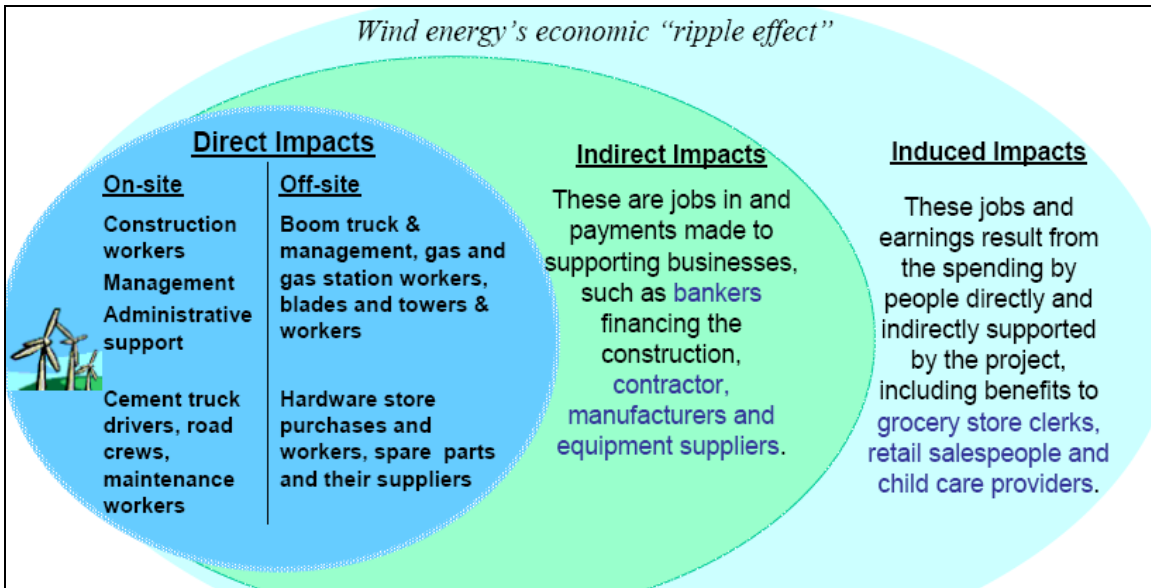
Peer Review Panel Comments: The panel finds that this project is important for establishing the benefits of wind and renewables in general, and for informing states about how wind can help achieve air emissions objectives, which will become an even bigger issue in the future.

This project has an effective approach and a prudent strategy, with a great deal of attention to high quality inputs and outputs.

However, it is unclear how this project connects with the modeling and other studies being conducted as part of the systems integration activities, and the panel felt that some coordination with WinDS may be useful. The panel suggests this project be better thought through, more up to date, and more ambitious in targets and in partnering with entities such as the EPA.

Economic Impact Analysis (Suzanne Tegen – NREL)

This project by WPA conducts analyses and distributes information on the economic development benefits of wind, including job creation, property tax increases, land leases, and increased revenue. These impacts can be seen as direct impacts both on- and off-site, indirect impacts of payments made to supporting businesses, and induced impacts of money trickling through the local economy.



Peer Review Panel Scores:

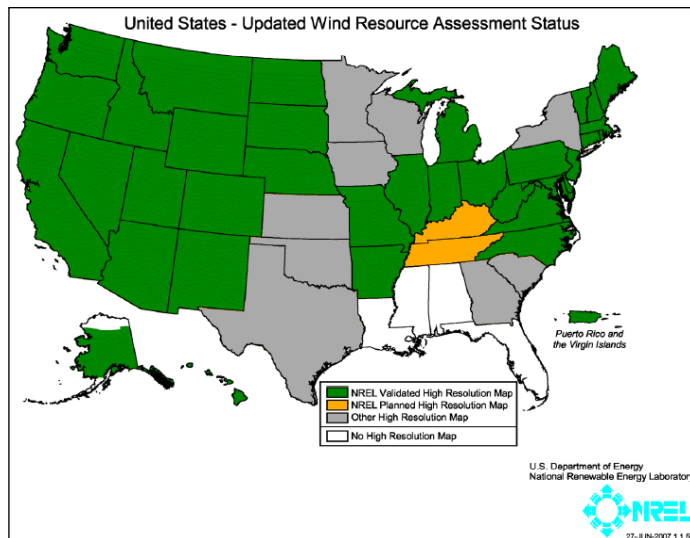
Scoring Category	Average	Range
1) Effectiveness	7.8	7-9
2) Relevance	8.2	7-10
3) Overall Impression	8.2	7-9

Peer Review Panel Comments: This project provides some of the background data that is needed for wind to make a breakthrough, and as such it is a prudent part of the effort to achieve the 20% wind vision.

The panel praised the project for its good management, good analysis, and concise results. However, some additional information on the details of the project, rather than the JEDI model, might have been useful for the panel to review this project. Moreover, there is an apparent need to show transportable insights relative to labor and direct/indirect multipliers.

Wind Mapping (Dennis Elliott – NREL)

This effort is conducted by NREL and supported by several consultants (i.e., AWS Truewind and V-BAR) and state energy offices/organizations. Wind resource maps are generated for 50 m elevation and 70 to 100 m elevation. The purpose of this project is to provide validated wind resource data needed by policy makers, state officials and



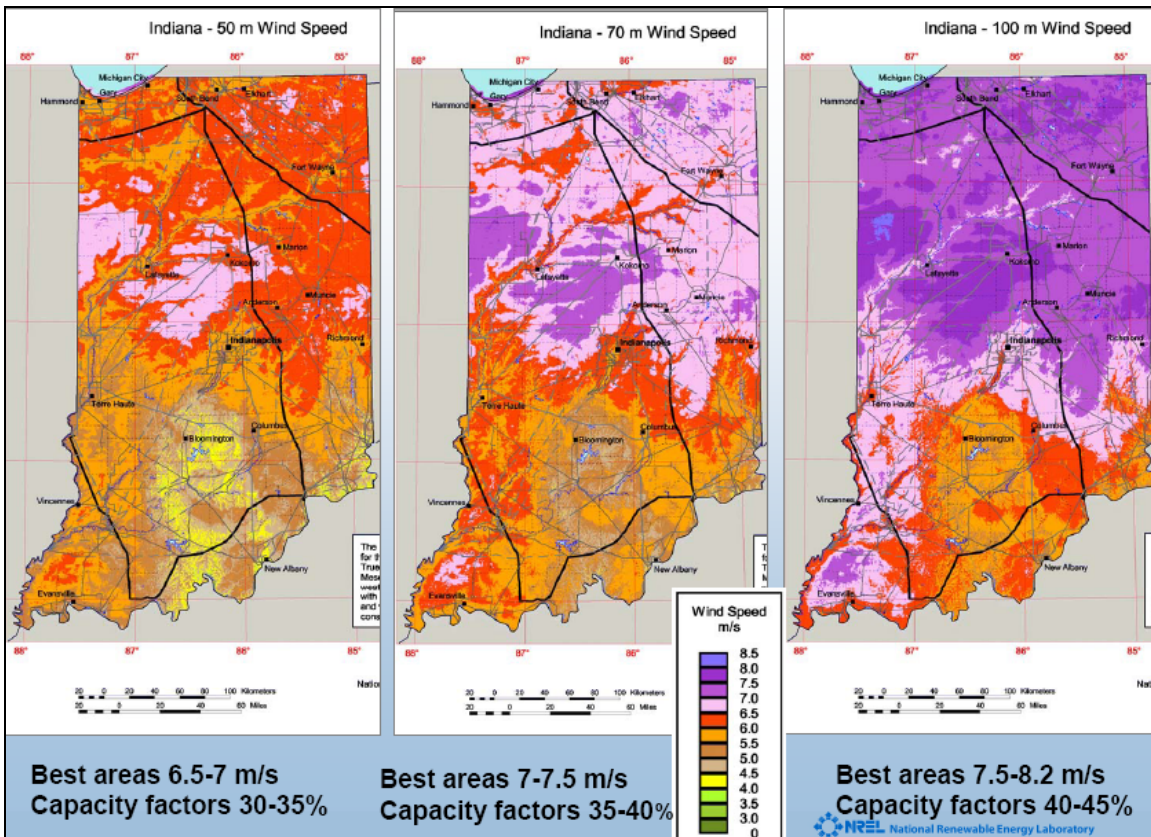
wind developers.

Peer Review Panel Scores:

Scoring Category	Average	Range
1) Effectiveness	9.0	7-10
2) Relevance	9.8	9-10
3) Overall Impression	9.2	7-10

Peer Review Panel Comments:

The panel feels that this project is very important, as it gets people to realize that there are wind resources at specific locations. This is extremely important for fostering policy and development efforts, and is essential for advancing the 20% wind vision, with the case of Indiana’s RPS being a good example.



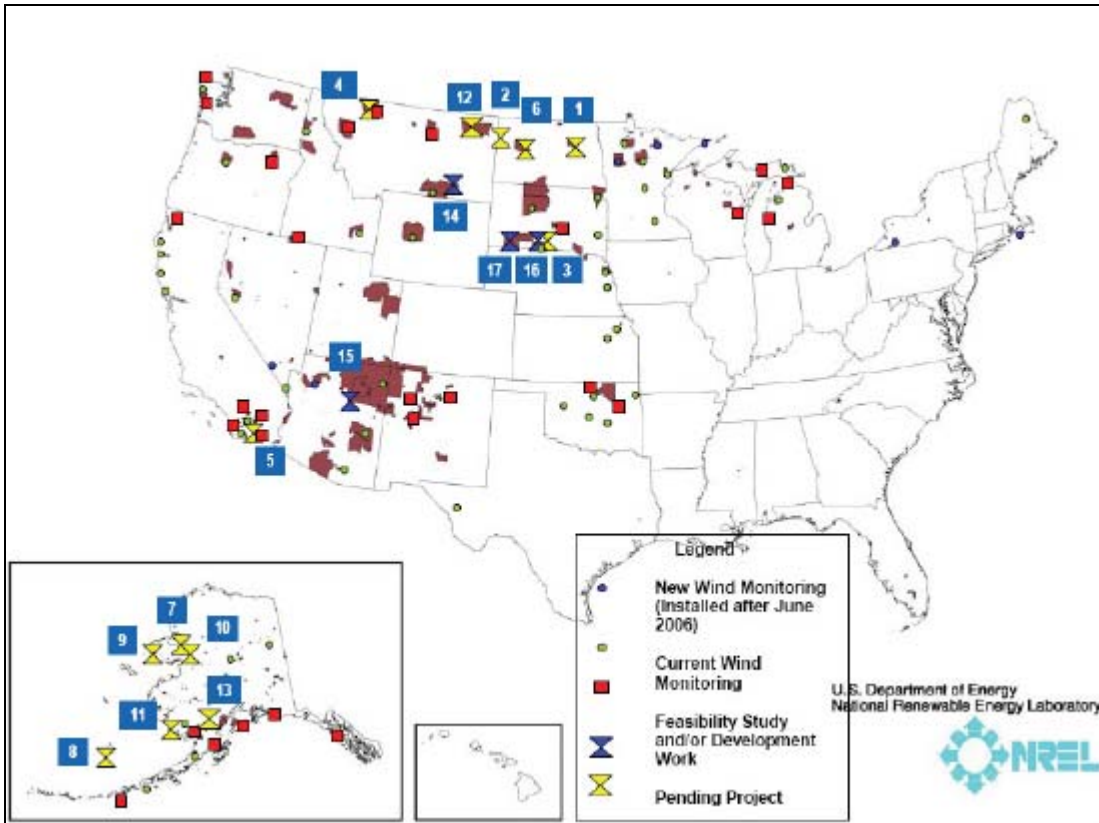
The panel also praises the high quality of the management, results, and impacts for the project, with one panel member noting the presentation was “very succinct and useful.”

The panel calls for the creation of more maps and an increase in resources for this effort, with individual states being a possible source of resources, and emphasizes the importance of adding a time-series element to the data to allow for the creation of seasonality and daily profiles and analysis of variability and other statistical topics.

Technology Acceptance Activities – Priority Markets

Native Americans (Bob Gough - Secretary, Intertribal Council on Utility Policy)

This WPA project seeks to foster the development of wind resources on Native American lands. Activities include the creation of wind maps, an anemometer loan program, and outreach and training efforts.



Peer Review Panel Scores:

Scoring Category	Average	Range
1) Effectiveness	8.0	7-10
2) Relevance	8.8	7-10
3) Overall Impression	8.0	7-10

Peer Review Panel Comments: The panel finds that this work is a valuable contribution to the 20% wind vision, particularly with the magnitude of wind resources on Native American land. The panel feels that the work being done is very good and innovative, and that the presentation was interesting.

However, the presentation is criticized for not addressing the objectives, approach, and budget/schedule of the project. Furthermore, the anecdotal approach to the presentation made it difficult to compare to other projects. One panel member suggests trying to find opportunities for linking this effort into other program activities and applying lessons

learned to other WPA efforts. Another panel member recommends increased efforts be undertaken to identify a market for wind energy produced on reservations, possibly through green tags, and study how transmission factors might impact these efforts.

Distributed Wind (Trudy Forsyth – NREL)

This WPA effort seeks to foster broad acceptance of small-scale distributed wind by creating consumer guides, economic tools, and conducting installer certification. This effort is in conjunction with the Interstate Renewable Energy Council, the American Solar Energy Society, the USDA, and rural stakeholders.

Wind Powering America State Activities

Small Wind Electric Systems
A U.S. Consumer's Guide

U.S. Department of Energy
National Renewable Energy Laboratory
31-MAY-2007 1.1

- Interest in adapting existing Spanish Guide for Puerto Rico
- Numerous reprint requests – move to CDs

WIND POWERING AMERICA

Peer Review Panel Scores:

Scoring Category	Average	Range
1) Effectiveness	7.8	7-9
2) Relevance	7.8	7-9
3) Overall Impression	7.5	7-8

Peer Review Panel Comments: The panel feels that this effort is not as significant as others in terms of its contribution to attaining the 20% wind vision, but that based on public response it is clearly filling a need.

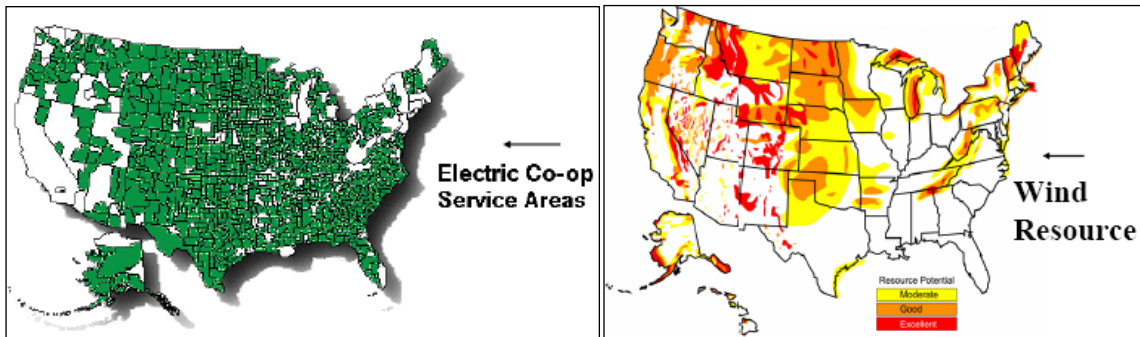
The panel praises the hard work on this effort, feels the presentation gave a good overview of the project, and notes that this project’s leveraging and partnering with other organizations, particularly the solar industry, is excellent.

The panel feels that the presentation could have contained a more detailed plan of future

action and a more strategic perspective on how this effort contributes to the 20% wind vision, and also would like to have seen economic data on the cost of distributed wind electricity relative to grid electricity costs.

Public Power Partnership Program (WAPA) (Randy Manion – WAPA)

This WPA effort is focused on communicating information about wind and its benefits to the nation’s 2900 consumer-owned utilities. Consumer-owned utilities represent 13.5% of the Nation’s energy generation (approximately 142 GW), and while they are free to choose the generation technologies of their liking, they can play a vital role in alleviating the transmission constraints and other barriers to wind development.



Peer Review Panel Scores:

Scoring Category	Average	Range
1) Effectiveness	6.8	5-9
2) Relevance	7.0	5-9
3) Overall Impression	7.3	7-9

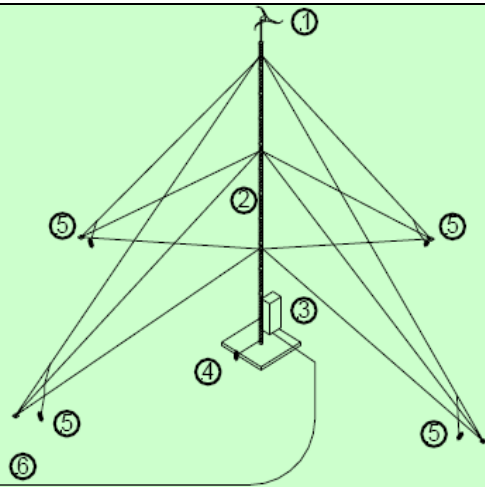
Peer Review Panel Comments: The panel feels that this is an important and appropriate niche to be filled towards achievement of the 20% wind vision, even though its overall contribution to the goal is likely to be small. The panel feels that this effort is well-organized, and praises the presentation for its detail and organization.

One panel member suggests more focus be devoted to synthesizing and disseminating best practices/lessons learned, and to include or partner with non-wind renewable projects for the effort’s case studies.

Wind for Schools (Larry Flowers – DOE/WPA)

The goal of this WPA effort is to engage rural America and rural school teachers and students in wind issues and to equip college juniors and seniors with the interest and tools the wind industry needs to grow. The Wind for Schools project approach is to assist the community and local utility to implement a sustainable school wind project using a low-cost replicable system, work with AWEA/NEED on K-12 curriculum, build in-state capacity to provide TA for community-scale projects, and work with State Universities on college-level program and curricula.

Wind for Schools: System



Components of Standard System

- 1) 1.8-kW wind turbine
- 2) 70-ft guyed tower
- 3) Disconnect and junction box
- 4) Foundation & grounding
- 5) Guy wire foundations & grounding
- 6-8) School electrical connection components

Peer Review Panel Scores:

Scoring Category	Average	Range
1) Effectiveness	8.0	7-9
2) Relevance	8.0	7-9
3) Overall Impression	8.4	7-10

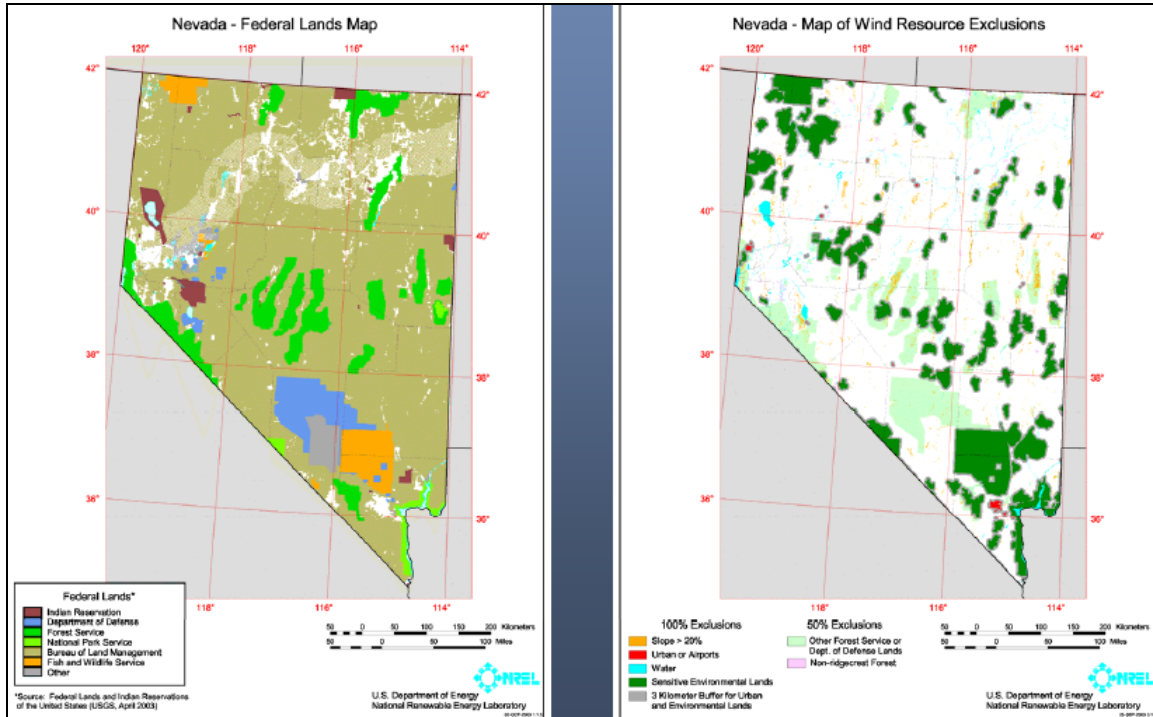
Peer Review Panel Comments: Panelists feel that this program is useful for its role in training new people in the wind industry and familiarizing communities with wind. The panel feels that the modest funding level appropriately reflects the fact that this project is likely to have a smaller impact on the 20% wind vision than other projects.

The panel feels that the project is well organized and managed, and praises the project for its creativity in managing hardware funding. One panel member suggests a greater geographic diversity for the project, and another suggests that state working groups or the financial leverage of states with renewable benefit funds could be used to expand the project beyond more than a handful of deployments. Finally, the panel feels that three years is too short of a timeframe for building capabilities and curricula at colleges, and suggests this timeframe be extended.

Federal Lands/Greening DOE (Robi Robichaud – NREL)

This WPA program is designed to take advantage of renewable energy mandates for federal programs by fostering partnerships with federal agencies to develop wind projects. The project's objectives include entering into 3 Interagency partnerships by

2007, identifying at least 20 viable wind projects at Federal agencies by 2008, demonstrating at least 1 wind power purchase arrangement between the Federal and private sectors by 2009, and providing technical assistance that leads to 10 new wind turbine projects at Federal sites by 2010.



Peer Review Panel Scores:

Scoring Category	Average	Range
1) Effectiveness	7.0	5-8
2) Relevance	7.8	6-10
3) Overall Impression	7.0	4-8

Peer Review Panel Comments: The panel finds this program useful because it taps into federal policy requirements for renewable energy purchasing and because it shows that the government can “walk the talk.”

The project has a good scope and is well-planned, with planners looking at a variety of alternative approaches. The panel feels the program has made good progress for its short life, but cautions that it may be a bit early to judge.

The panel suggests that instead of only looking at federal wind projects for the lessons-learned aspect of the program, the program might look at all types of renewable projects, particularly the government’s experience with solar. Also, the panel feels that the project’s objective is not well-stated and that the presentation did not communicate how the project fits into WPA and the high priority states program. Finally, the panel cautions that the substantial resources required for this effort would not be worthwhile unless the funding can be leveraged, possibly through a public-private partnership.

Federal Wind Siting Collaborative (Phil Dougherty – DOE)

This WPA effort was created in response to the wind-radar interference issue. The collaborative is a team composed of people from a variety of agencies that are relevant to wind development. The focus of the program is to create real-time interactions on information and technology exchanges, provide limited DOE technical assistance and facilitation to agencies and industry, and develop a Federal Wind Siting Information Center.



Peer Review Panel Scores:

Scoring Category	Average	Range
1) Effectiveness	6.7	5-8
2) Relevance	9.0	7-10
3) Overall Impression	8.3	8-9

Peer Review Panel Comments: The panel has few comments on this presentation; however, the panel applauds that this essential effort has started.

The panel feels that a multi-agency pre-approval screening for “show-stoppers” for states and developers might be helpful, and that an assessment of this effort in the context of the 20% wind vision would be useful.

Summary of Peer Review Panel Suggestions and Program Responses

1. There is a major need for increased educational programs, coordination, and outreach with academia.

DOE response: The Wind and Hydropower Technologies Program agrees that there is a major need for increased educational programs, coordination and outreach with academia. The Program continues to advance its coordination with NREL and Sandia in its efforts to broaden the educational opportunities and initiatives that are intended to increase the size and widen the capability of the future workforce that serves the wind industry. The DOE, in concert with the National Laboratories, the U.S. wind industry, and AWEA estimates that nearly 500,000 jobs could be supported by 2030 if the 20% wind scenario is realized. These positions will be best served if universities, community colleges and the K-12 schools are supported to educate and inform about wind technologies and opportunities. The Wind for Schools project is being piloted by Wind Powering America in FY07 with plans to expand beyond the original six participating states in FY08, and will eventually be applied in all WPA high and medium priority states if funding permits. One of the key focuses of this project is to develop wind application centers at universities in each state, developing curricula and creating a coordinated university wind network. The Program intends to expand its partnership with Universities through solicitations aimed at furthering coordinated educational and outreach activities, especially if Congressional appropriations allow for these increased activities in our budget. In addition, the Program plans to work with the Power Systems Engineering Research Center, a collaboration of power systems university programs, in FY08 to provide funding support and stimulation for wind integration research at Universities.

In addition, NREL and Sandia continue to expand participation in established laboratory intern programs that support students from undergraduate to PhD level. Examples include the DOE “Student Undergraduate Laboratory Internship” program, NREL’s “Research Participant Program”, and direct laboratory subcontracts with university partners for professor-directed student support of Program activities. The Wind Program has a proven track record of leveraging such programs to attract promising high-caliber science and engineering students to wind energy technology. The laboratories also have strong post-doc and visiting professional programs that match the expertise of these highly skilled individuals to specific Program areas of need. Typically, 10-20% of DOE Wind Program laboratory staff are student interns and post-doc researchers. The Program is acutely aware of its responsibility to support development of the next generation of wind professionals and help ensure that they are well prepared to contribute toward the goals for future growth of deployment of wind power. The Program has also provided funds in technical assistance to a number of organizations to develop programs and curricula such as Iowa Lakes Community College and St. Francis University.

2. *A coordinated intra-federal program effort is necessary to ensure that policies are designed to maximize domestic economic development by maintaining/increasing domestic market share and wind-turbine manufacturing jobs in the U.S.*

The Wind and Hydropower Technologies Program understands the importance of the U.S. market for wind technology and the impacts that federal and state policy play in the development of that market. To the extent possible, the Program seeks to promote policies that will support U.S. manufacturers or expand domestic wind energy related economic development. Through the Department of Energy the Program does work to inform policy makers, on the state and federal level.

The Program is currently in the process of expanding technical support in the area of manufacturing, building on the industry testing work that has been a mainstay of the Program for many years. It is clearly felt that the expansion of the Program's new large wind turbine blade testing facilities will support the U.S. manufacturing sector, and eliminate the need to transport U.S. manufactured wind turbine blades to Europe for certification testing. Further, the Program included manufacturing as a research area of interest in its first call for proposals that was released in September 2007 under the Collaborative Research and Development Agreement Opportunity for the Research and Development of Systems and Components for Utility-Scale Wind Turbines and Ocean Energy Technology.

The Program also actively engaged in the Federal Interagency Wind Siting Collaboration which was formed to address the siting issues within the purview of federal agency missions. The broad and diverse siting requirements and policies in place across federal agencies, such as the Department of Defense, Transportation, Homeland Security, Commerce, and Interior, have delayed the development of many wind projects. The federal collaboration will continue to expand the understanding of wind across federal agencies, unifying requirements, and make tools available to ensure compliance and timely approvals for wind projects.

3. *SI Collaboration*

The systems integration (SI) and technology hardware R&D programs should increase coordination. Findings from the SI studies and models need to be integrated into the technology hardware R&D portfolio decision-making process. This will improve the overall architecture of the Wind Program research portfolio.

DOE Response: The Wind and Hydropower Technologies Program has also recognized this need for more coordination between the Systems Integration and Large Turbine Technology R&D activities, and has begun exploring areas of common ground to better facilitate coordination. The Program has initiated a new Gearbox Reliability Collaborative R&D activity that will necessitate strong ties to the needs of SI power industry partners. One specific area of support requested by industry is in the design and testing of integrated drivetrain systems (gearbox, generators and power

electronics) to meet anticipated electric grid-fault ride-through standards. Test results will be used to refine turbine drivetrain models used by SI power system modeling codes to better simulate wind farm level grid impacts. The Program's Reliability Collaborative and Systems Analysis R&D activity is focusing on optimizing operations and maintenance practices and improving wind turbine performance and reliability. This work is being done through industry partnerships, including the Utility Wind Integration Group's (UWIG) Wind Turbine O&M User Group and the American Wind Energy Association's O&M Working Group. The UWIG O&M User Group plans to survey UWIG members on O&M research needs that will be useful to prioritize Program R&D activities. Another opportunity for increased collaboration will occur in FY08 as the Program's R&D resource assessment activities are expanded to support meso-scale modeling needed for ramped-up SI wind integration transmission studies.

Greater collaboration is needed between the two sectors of SI activities within the Wind Program in order to create better exchange, use and application of data.

NOTE: We believe that this question is referring to the two major parts of SI: "Tools & Methods Development" vs. "Application & Implementation" (i.e. research vs. outreach).

DOE Response: The Wind and Hydropower Technologies Program's SI application and implementation activities rely heavily on factual information and data produced by other SI staff conducting studies and testing to develop new wind grid integration tools and methods for the power industry. The Program agrees with the Peer Review committee that increased collaboration between these two internal SI groups would benefit both, and improve SI's ability to better support power industry wind integration needs. FY08 plans include increased SI staffing and project activities in both of these SI groups. SI project leaders are aware of the need for increased collaboration and have restructured SI management strategies accordingly. Also, greater levels of collaboration are already evident in that recent ramped-up SI integration studies (e.g. meso-scale modeling and transmission planning) have necessitated increased coordination and interaction between the groups.

4. The AWEA project should focus on coordination and facilitating a meeting of wind developers and DOE staff in order to obtain real-time data from developers for modeling and analyses.

DOE Response: Coordination with stakeholders is in progress. There have been two major Wind Turbine Reliability workshops in addition to the Gearbox Reliability Collaborative. Real-time data has been collected and data partners are being recruited. The data warehouse infrastructure development is currently underway at Sandia, and has been populated with data from one of the data partners. Failure data will be used for baseline statistics while real-time data may be more helpful in forensic analysis of individual component failures. Additional meetings are anticipated including a meeting with wind farm operators and reliability engineers planned in the spring of 2008 that will include modeling and analyses as part of the meeting agenda.

5. *Increased accounting of, and coordination with, planned upgrades to the transmission system are necessary to recognize the value added by wind and optimize its integration.*

DOE Response: The Wind and Hydropower Technologies Program plans to continue to expand collaboration on wide area, high penetration wind interconnection studies in FY08. DOE is an active participant in studies being conducted by regional transmission organizations, providing expert wind integration advice and wind regime modeling support. The Program will continue its active representation of wind characteristics at regional transmission planning processes and through the National Wind Coordination Collaborative (NWCC) Transmission Workgroup activities and regional meetings. This activity increases wind participation and coordination in regional and sub-regional transmission expansion forums, including WECC, MISO, and SPP reliability regions.

6. *The detailed models being developed by the Program need to directly or indirectly feed into NEMS and other national or international energy models.*

DOE Response: The Wind and Hydropower Technologies Program has invested in the development of the Wind Energy Deployment System (WinDS) model in order to best represent the unique nature of a geographically dispersed resource. The capability of WinDS exceeds the capability of NEMS to model regional variations. However, the WinDS model was used in a project initiated by EIA to re-evaluate multipliers that are used by NEMS to incorporate some of these regional variations. The WinDS modeling team also has provided many comments and suggestions to the developers of the wind module of the PNNL Mini-CAM global climate change model. In addition to these personal interactions, the Wind Program seeks to provide information on methods of modeling wind energy used in the WinDS model through publications. By sharing these methods, it is hoped that other developers can incorporate these ideas or data into other national or international energy models.

In addition to modeling methods, input data to these models is critical. The Program produced the first of what is intended to be an annual publication of the status of the wind energy industry in the U.S. As additional data is collected and refined, the information presented will cover more aspects of the wind industry. This resource should be valuable to energy modelers requiring accurate cost and performance data for wind technology.

7. *Wind Powering America (WPA) should coordinate more with SI activities – WPA needs to become a more entrenched part of the Program’s activities.*

DOE Response: Although not highlighted in the presentations, coordination between the WPA and SI activities occurs on a regular basis. WPA outreach efforts to the power industry rely heavily on factual information and data resulting from SI studies and

activities. The Power Partnerships activity within Wind Powering America has historically been the conduit between WPA and SI in providing information to consumer-owned utilities. The Program agrees that increased coordination and integration between SI and WPA in this area will benefit both. FY08 plans include increased SI staffing and project activities focused on providing information needed to better support WPA and other Program outreach activities to the power industry. New staffing will enable increased public outreach on wind grid integration and transmission issues, and will also enable greater SI representation at WPA outreach events such as State Summit meetings.

8. The Wind Program should take into account the Canadian energy system, particularly for bordering states and power areas.

DOE Response: The Program, through AWEA, is collaborating with the Canadian Wind Energy Association (CanWEA) on a transmission workshop to discuss wind and transmission challenges and the solutions being pursued throughout North America. The Wind Program agrees that more coordination with and account of the Canadian energy system, particularly in the Northeast and Northwest is needed.

APPENDICES

Appendix A. Letter from Carl Weinberg to Steve Lindenberg, Preliminary Findings of the Peer Review Panel

Appendix B. Meeting Attendee List

Appendix C. Summary of Peer Review Panel Evaluation Scores

Appendix A: Letter from Carl Weinberg to Steve Lindenberg, Preliminary Findings of the Peer Review Panel

Steve Lindenberg
Program Manager, Wind and Hydropower Technologies Program
U.S. Department of Energy

Carl Weinberg
42 Green Oaks Ct
Walnut creek, CA 94596

September 2, 2007

Dear Steve,

The following preliminary findings are presented on behalf of the membership of the Department of Energy (DOE) Office of Energy Efficiency and Renewable Energy (EERE) Wind and Hydropower Technologies Program Review Panel that met on July 11-12, 2007 in Golden, Colorado. The review focused mainly on the System Integration activities of the Program on the first day, and the Technology Acceptance activities on the second day.

The Panel commends the program for formulating the “20% wind vision”, a vision of achieving 20% of US electrical energy to be produced by wind power, to serve as a coordinated and unified program focus. The program provides US taxpayers with excellent value. The program clearly has taken into account previous recommendations of the Panel. The Panel is also aware that changes in Administration often impact overall goals. We urge continued planning and strategy underpinning to allow R&D, not only on technology, but also the technology-system interface in order to foster a long term energy policy.

Strategic and Program Level Recommendations

In order to implement the 20% wind vision there is a need for increased coordination of wind projects within DOE, other departments of the Administration, as well as States and Utilities. Wind System Integration needs to consider the Office of Electricity for transmission issues, the EIA for inclusion in the NEMS model, the Department of Agriculture, state-level activities stemming from RPS policies, and even FERC for overall electricity system policy direction. The need for the increased coordination will make highly skilled labor even more important for the Wind Program.

The availability of skilled personnel will become crucial as the industry expands, and there is a crucial need for recruiting, educating, training and retaining the labor force. Engineers, economists, and planners need to be trained at universities. While the panel touched on this need, it is not clear, who, how or what the role of the Wind Program

should have in fulfilling this need. The panel would suggest some discussion of this issue at future Peer Review Panel meetings

Specific Program Recommendations

The WinDS, UWIG, WPA and AWEA projects are excellent uses of taxpayer money. The support of UWIG (Utility Wind Integration Group) has had a major impact on the integration of wind. Just the name change from the Utility Wind Interest Group represents a major development. The studies produced under the management of this Group play a major role in presenting data to the utility industry.

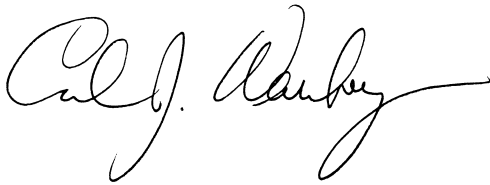
The AWEA project needs to undertake an increased effort to assure that crucial data is available for real-time modeling and analyses. A consistent set of procedures need to be developed so that “proprietary” data from wind power plants can be utilized in the modeling and analyses effort.

The focus on the integration of wind with hydropower is to be commended. Continued activities are encouraged including involvement of Canadian energy systems. More clarity and analyses is needed to detail the tradeoffs involved with maximizing the hydro system as potential cost effective storage for wind.

Wind Powering America (WPA) should increase its coordination with System Integration activities. The expansion of the transmission system integration with wind will touch on state issues. There is a synergistic relationship between WPA and other System Integration activities that can speed the development of wind power.

Please consider the above points as input to continued planning efforts.

Sincerely,



Carl J. Weinberg

Appendix B: Meeting Attendee List
2007 DOE Wind & Hydropower Program Peer Review Meeting
July 11-12, 2007
Denver Marriott West
Golden, Colorado

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Appendix C: Summary of Peer Review Panel Evaluation Scores

Peer Reviewer Project/Program Evaluation Form Scores

Numerical Scoring Index	1	2	3	4	5	6	7	8	9	10	
Qualitative Descriptors	Seriously Deficient			Average				Outstanding			

Scoring Category \ Projects	UWIG	Stakeholder Collaboration & Outreach	Integration Studies	NWCC Regional Transmission	Western Interstate Energy Board/WGA	Western Wind Integration Study	Wind & Hydro Integration	Grid Simulators	Generator Modeling	Wind Farm Data Monitoring
1) Effectiveness (consider the elements of quality, productivity, and accomplishments)	8.3	7.5	8.3	7.3	8.3	6.8	7.5	7.5	7.5	6.8
2) Relevance (to mission, goals, strategy, and technical and/or market barriers)	9.0	8.8	9.3	7.8	8.8	8.0	7.3	8.0	8.3	8.5
3) Overall Impression (consider all measures, inputs and outputs, and program management)	7.8	8.0	7.8	7.0	9.0	7.3	7.3	7.8	7.5	7.3
Average Category Score	8.3	8.1	8.4	7.3	8.7	7.3	7.3	7.8	7.8	7.5

Peer Reviewer Project/Program Evaluation Form Scores

Scoring Category \ Projects	Wind Integration Technical Assistance	AWEA Critical Issues & FERC Activity	Competitive Power Markets	WinDS Modeling	Radar Mitigation & Impacts	National Wind Coordinating Collaborative	Wildlife Research	High Priority States	Low-Medium Priority States	Agricultural Outreach
1) Effectiveness (consider the elements of quality, productivity, and accomplishments)	6.8	5.3	7.3	8.3	7.2	8.4	8.0	9.0	8.2	8.4
2) Relevance (to mission, goals, strategy, and technical and/or market barriers)	8.8	6.0	8.3	8.5	9.2	9.2	8.4	9.4	9.2	8.8
3) Overall Impression (consider all measures, inputs and outputs, and program management)	8.0	5.5	7.5	8.5	8.2	8.8	8.4	8.8	8.4	9.0
Average Category Score	7.8	5.6	7.7	8.4	8.2	8.8	8.3	9.1	8.6	8.7

Scoring Category \ Projects	Regional Wind Institutes	Air Quality & Emissions	Economic Impact Analysis	Wind Mapping	Native Americans	Distributed Wind	Public Power	Wind for Schools	Federal Loads/ Greening DOE	Federal Wind Siting Collaborative
1) Effectiveness (consider the elements of quality, productivity, and accomplishments)	7.2	7.0	7.8	9.0	8.0	7.8	6.8	8.0	7.0	6.7
2) Relevance (to mission, goals, strategy, and technical and/or market barriers)	8.0	8.5	8.2	9.8	8.8	7.8	7.0	8.0	7.8	9.0
3) Overall Impression (consider all measures, inputs and outputs, and program management)	7.6	7.3	8.2	9.2	8.0	7.5	7.3	8.4	7.0	8.3
Average Category Score	7.6	7.6	8.1	9.3	8.3	7.7	7.0	8.1	7.3	8.0