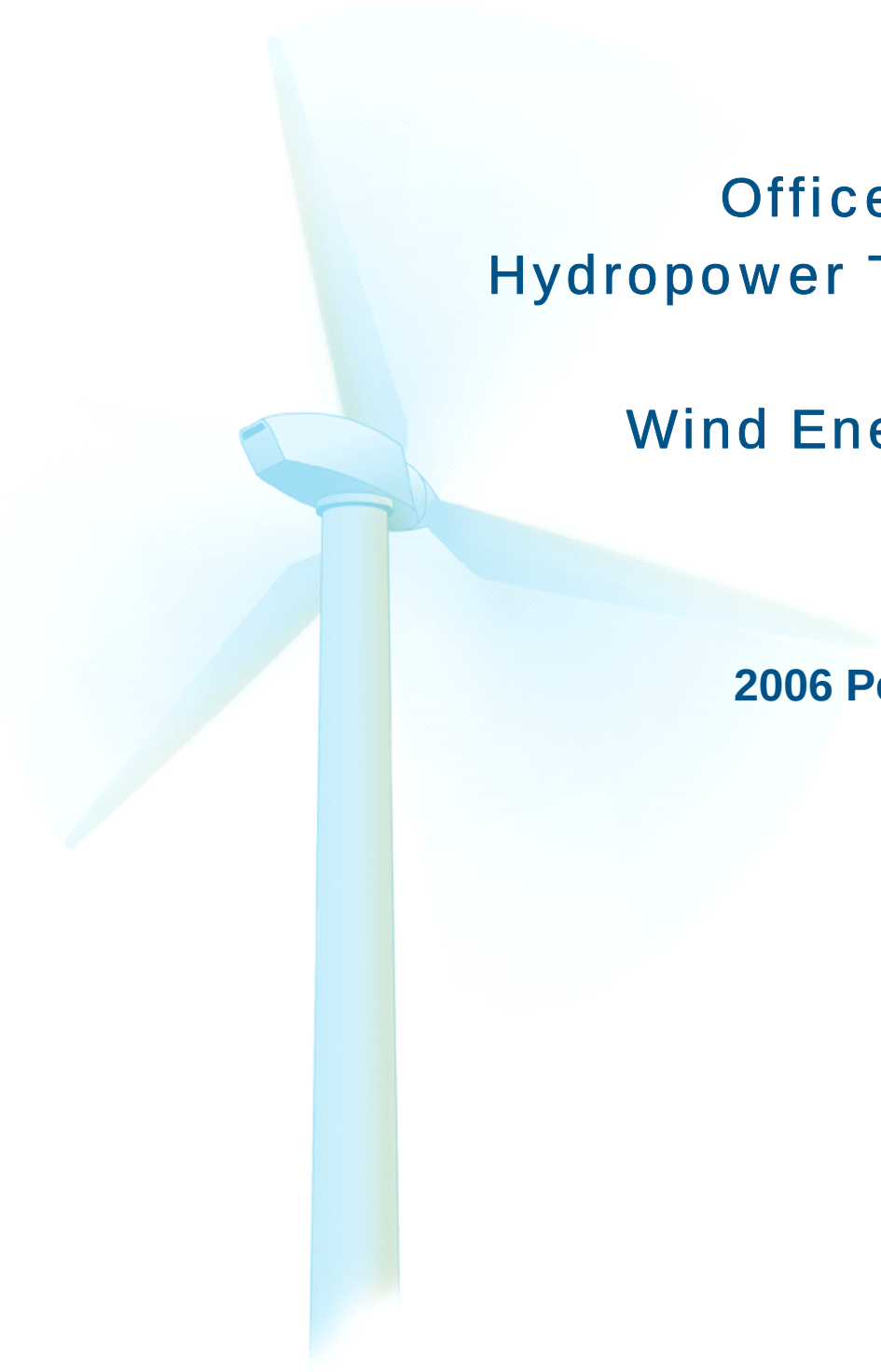

Office of Wind and Hydropower Technologies

Wind Energy Program

2006 Peer Review Report

May 2006

U.S. Department of Energy
Energy Efficiency and Renewable Energy
Bringing you a prosperous future where energy is clean, abundant, reliable, and affordable

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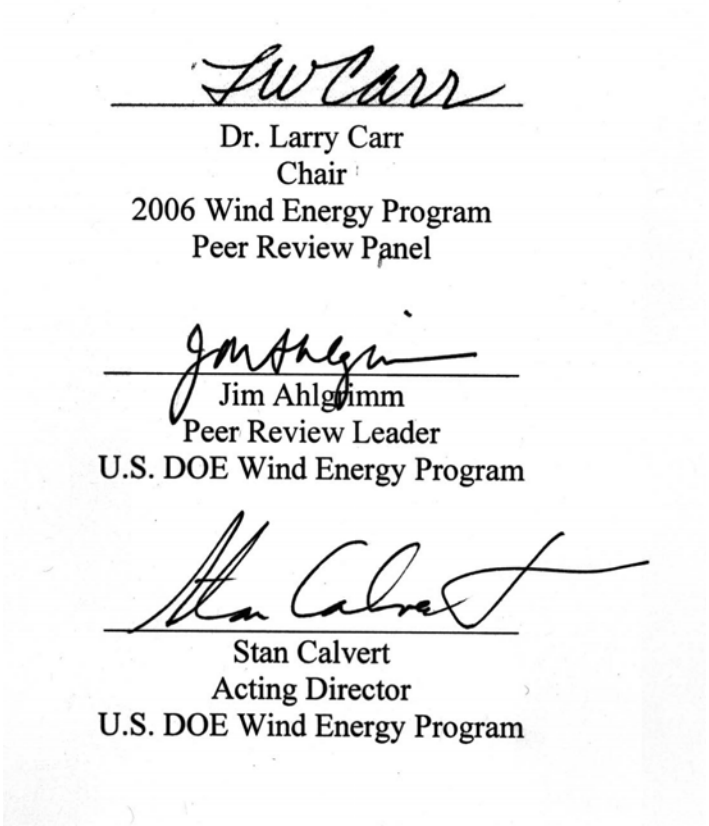

Dr. Larry Carr
Chair
2006 Wind Energy Program
Peer Review Panel

Jim Ahlgrimm
Peer Review Leader
U.S. DOE Wind Energy Program

Stan Calvert
Acting Director
U.S. DOE Wind Energy Program

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. An in-progress 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 development 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 May 9-11, 2006, at the Denver Marriott West Hotel in Golden, CO. Presentations were given on specific technical projects within the Technology Viability program area, specifically Low Wind Speed Technology (LWST) and Distributed Wind Technology (DWT) research areas, as well as the Supporting Research and Testing (SR&T) program activities. The review also included presentations on congressionally-directed projects.

The following document is the peer review panel's observations and findings, 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 only 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.

Table of Contents

Peer Review Meeting Process

The U.S. Department of Energy (DOE) Wind and Hydropower Program's strategic planning framework has two elements (Figure 7). 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 7, technical assessment and peer review provide inputs that the program management team considers in making decisions about strategic program directions and funding priorities.

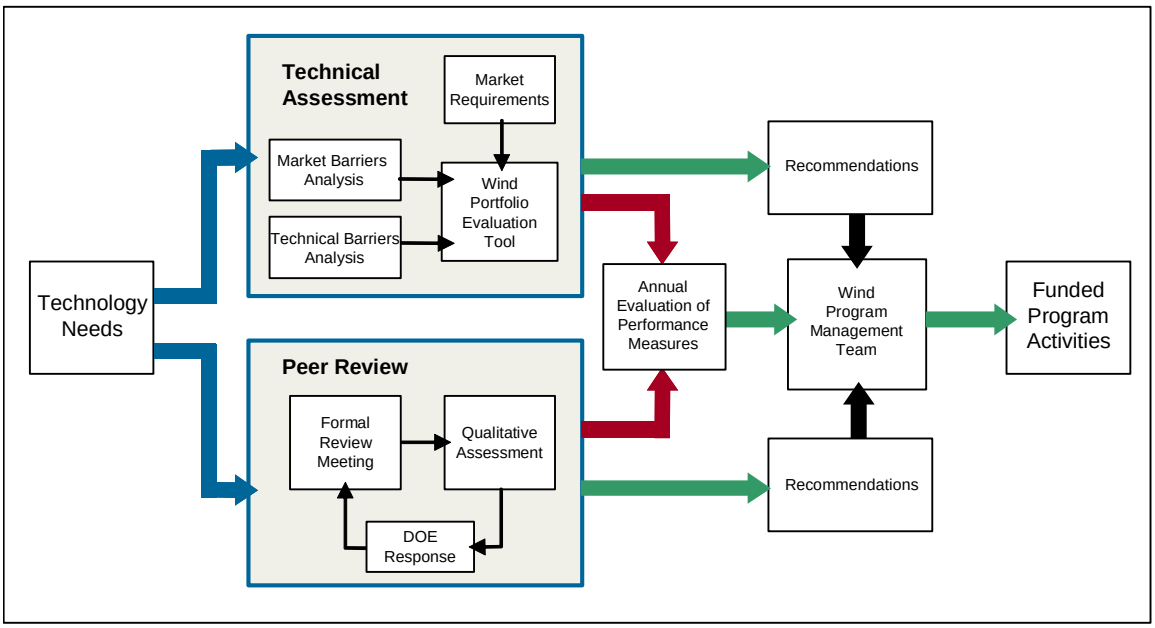

Figure 7. Strategic Planning Framework

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 May 9-11, 2006, at the Denver Marriott West hotel in Golden, CO. The review focused on specific technical projects within the Technology Viability program area, specifically Low Wind Speed Technology (LWST) and Distributed Wind Technology (DWT) research areas, as well as the Supporting Research and Testing (SR&T) program activities. The review also included reports from congressionally-directed projects.

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
Larry Carr (Chair)	US Army AFDD (Retired), NASA Ames Research Center (Chair)
Carl Weinberg	Weinberg & Associates
Mark Haller	Private Consultant
John Mankins**	Artemis Innovation Management Solutions, LLC
Steve Connors**	Massachusetts Institute of Technology
Ken Karas**	Former CEO, Enron Wind Corp.; Former CEO, Zond Corp.

***New Peer Review Panelist*

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 2007-2011, April 2005 Wind Power Today, Wind Energy Program FY 2006 Annual Operating Plan, and Low Wind Speed Technology Annual Turbine Technology Update (ATTU) Process for Land-Based, Utility-Class Technologies. 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 three-day event. The first day focused on Low Wind Speed Technology and Distributed Wind Technology program activities. The second day covered Supporting Research and Testing program activities, and the third day focused on congressionally-directed projects. 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 not to submit numerical scores as part of their evaluation. The peer review teams provided only narrative evaluations 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. Numerical scores were required only as part of the peer review process evaluation surveys (Appendix C), which were distributed to all meeting attendees.

Wind Energy Technology Viability Program Goals

***Technology Viability 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.
- 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.
- By 2007, reduce the cost of electricity from distributed wind systems to 10-15 cents/kWh in 2007 in Class 3 wind resources.

2006 Wind Energy Program Peer Review

Agenda

May 9-11, 2006

Tuesday, May 9

8:00am	Registration & Continental Breakfast	
8:30am	Welcome	Bob Thresher
	Wind Energy Program Vision & Direction	Stan Calvert
9:00am	Review Objectives	Jim Ahlgrimm
9:20am	Technology Viability Overview	Jim Ahlgrimm
	Low Wind Speed Technology Development	
9:40am	LWST Program Overview	Scott Schreck
10:00am	Clipper Prototype	Amir Mikhail
10:30am	Break	
10:45am	GE LWST Prototype	Bill Holley
11:15am	Northern Power Systems LWST Prototype	Garrett Bywaters
11:45pm	Lunch & 2005 Wind Energy Awards Presentation	
1:00pm	Knight & Carver - Sweep-Twist Blade	Gary Kanaby
1:30pm	Genesis Convoloid Gearing	Bernard Berlinger
	Distributed Wind Technology	
2:00pm	Distributed Wind Technology Program Overview	Trudy Forsyth
2:25pm	Northern Power Systems 100 kW turbine	Garrett Bywaters
2:45pm	Southwest Windpower Storm 1.8	David Calley
3:05pm	Break	

3:30pm	Windward Engineering	Craig Hansen
3:50pm	Abundant Renewable Energy	Robert Preus
4:10pm	Princeton Power Systems	Darren Hammell
4:30pm	Adjourn	

Wednesday, May 10

8:00am	Continental Breakfast	
9:00am	Supporting Research and Testing Overview	Mike Robinson Paul Veers
9:15am	State of the Technology and Improvement Opportunities	Sandy Butterfield
9:45am	Design Tools and Codes	Jason Jonkman
10:15am	Controls	Alan Wright
10:45am	Break	
11:00am	Rotor Development	Daniel Laird
12:00pm	Lunch	
1:00pm	Drivetrain Development and Reliability	Sandy Butterfield
1:30pm	Offshore Turbine Development	Walt Musial
2:25pm	Environmental Issues	Bonnie Ram
3:05pm	Break	
3:20pm	Wind Technology Testing and Test Facilities	Dave Simms
4:30pm	Adjourn	

Thursday, May 11

8:00am	Continental Breakfast	
9:00am	Congressionally Directed Projects	Keith Bennett

	Basin Electric Wind to Hydrogen Pilot Project	Randy Bush
9:20am	St. Francis Wind Farm & Education Projects	Eric Foley
9:40am	Utah State University Renewable Energy for a Rural Economy	Ed Stafford Cathy Hartman
10:00am	Vermont State Wind Project	Richard Michaud
10:20am	New Proposals	Keith Bennett
10:30am	Panel Discussion	Bob Thresher
12:00pm	Adjourn	

WIND PROGRAM PEER REVIEW TEAM FINDINGS

Low Wind Speed Technology

With the limited number of US wind turbine developer/manufacturers, the program needs to consider who in the industry are beneficiaries of federally funded research. While component and system development is still beneficial, it will aid the global technology market, so the program should look for opportunities to move beyond this to topics that will specifically benefit the U.S.

Purpose and Objective

The LWST purpose and objective were well described and discussed, and all programs were well defined. The goals of cost-effective wind technologies at lower wind speed wind regimes, allowing closer to grid, closer to load, flexibility were well stated.

The LWST program is directed at high priority-tasks: to develop a major increase in production of electrical energy by wind power, and to effectively use the large areas of the United States where moderate energy level winds exist. This will be the most effective way to increase electrical power production.

The technological goals embedded within the cost of energy goals are quite well defined. The inflexible nature of cost of energy metrics was a recurring theme in the review, and constitutes a major deviation from the industry perspective. As a non-linear metric, the process appears to be working.

Work Plan

Work plans were well managed, even though a midterm correction had to be made on the GE Prototype Multi-Megawatt Low Wind Speed Turbine. NREL understood the need for flexibility and changing the work plan.

The original work plan was a combination of innovative research plus development of prototype demonstration projects. This well-thought-out plan has led to very important developments. In particular, the “flat-back” airfoil is an excellent example of the breakthroughs that can occur from support of university-level research. However, recent reductions in funding for wind energy research has forced the termination of this type of research under the LWST program, an action that will seriously hinder the development of the high-efficiency rotor systems needed for the LWST program to be successful.

The wind industry has seen, or will soon see, real value in the research conducted in most, if not all, of these programs. Most are offspring from the Wind Partnerships for Advanced Component Technology (WindPACT) program. The larger LWST full-scale turbine developments are or soon will see mass deployment in the market place.

However, DOE and the labs need to recognize that the market itself has evolved. The panel questioned the need for complete wind turbine generator program development. The value lies in component development previously defined under the WindPACT programs.

Overall the program and its approach and planning seemed well constructed and presented. The work plan seemed complete, with a comprehensive scope. However, there seemed some question as to future budgets and directions. Because of this uncertainty, it was unclear whether the future plan would succeed.

Results

The results to date from this program have been consistently good, with several of the innovative ideas demonstrating the value of the effort. The LWST program certainly seems to have made significant progress toward its goals and objectives. The results appear significant and have demonstrated utility for the future program and the industry. The various prototype developments have shown that there are indeed ways that wind turbine rotor blades, gearboxes, and generators can be optimized for application in low-wind-energy conditions. The costs of investments in LWST certainly seem to provide exceptional return on investment.

The LWST project results were great. A major impetus was provided for low wind speed turbines and an innovative gear box design was developed, tested and will go into production on the Clipper machine.

It appears that objectives will in most cases be achieved as planned. However, all the projects suffered from funding slow down or termination in mid-stream. Changes to results or timely execution are always a problem when funding constraints develop in the middle of a project. This type of “start and stop and start and stop” is likely to diminish the effectiveness of any R&D program in accomplishing its objectives.

R&D on innovative components ought to be done every two or three years.
To the extent that these programs will actually be finished due to budget cuts and a stupendous amount of budget theft from earmarks, these programs should see timely results based on schedules. Industry would benefit from slight acceleration of all these projects.

Impact/Technical Merit

The projects developed under the LWST program will have a major impact on the future of wind turbine use in low-wind-energy conditions. All of the projects described have the potential to impact COE of wind generation. It is unfortunate that momentum was lost due to funding changes and projects were limited due to funding shortfall.

The Department and Labs have done an excellent job of culling and nurturing an excellent set of projects. All of these projects will serve to reduce the current (real) cost of energy. Identifying potential technology component improvement and then following

on with R&D on the most promising improvements is a process that holds considerable merit. It should be seen as a model for future projects.

Plans for Completion

The program should continue to focus on the critical gaps in our understanding of the behavior of wind turbines that are designed to capture energy from moderate strength winds. This will mean that lighter, more robust rotor blades, gear boxes, and generators must be developed - it will not be enough to simply scale up existing wind turbines without addressing the corresponding increase in weight that will occur. These new wind turbines will directly benefit from improvements that will come from the research being supported under this program.

Budgets will be the larger issue. The congressionally-directed projects may unfortunately serve to put the projects and entire program efforts into an induced coma.

The testing program is absorbing a significant portion of the resources – 15% of the "funds after earmarks" and 33% of entire SR&T budget. Given the maturity of the commercial sector, there may be more prudent ways to use these funds.

The prototypes presently being developed under the LWST program are valuable, but careful analysis of the relative value of future prototypes should be weighed against the potential value of more aggressive investment in innovative research on a smaller scale.

There is some question about the funding for a next round of solicitations for the program—particularly the question of whether there can be a Phase 3 solicitation.

Project-Specific Comments

The innovative WindPACT projects were outstanding. Each of them identified a technology development that had the potential to lower cost. WindPACT design studies were key to getting LSWT program started. These included both paper studies, as well as some limited hardware efforts. From this beginning, significant efforts were devoted to blade research and development—seeking more strength, less mass, more power generation, etc. However, without additional WindPACT-type studies, it was unclear how the future direction and work plan would be framed.

The WindPACT projects were limited by available funding not by R&D need. WindPACT-type studies are innovative and look ahead at potential for improvement. They need to be considered for the future. The Program should continue component development and component operational reliability improvement research expanding on the WindPACT program.

Clipper Windpower has very interesting drivetrain and generator concepts, and how they impact rating and weight of multi-MW turbines. Demonstrating as early as possible that the technological features actually lead to better efficiency and maintenance performance (and how much) should be emphasized.

The innovative research in rotor blade and airfoil design has resulted in very creative ways to design airfoils (the flat back airfoil), and rotor blades (Knight & Carver Sweep-Twist Adaptive Blade). This program has been very productive.

GE gave a very programmatic presentation of its project, with few insights. Its mid-project shift of work scope based upon lessons learned shows good research management. GE's advanced blade work is interesting, especially incremental energy production at lower wind speeds. However, the question remains as to how much longer large multi-nationals (like GE) will benefit from DOE cost-shares for incremental technology improvements.

Northern Power Systems (NPS) has a very interesting direct drive permanent magnet generator. How does it compare to German manufacturers' experiences? Is it parallel? Does it leapfrog what they are doing with the very large machines? Where does NPS see this going from the perspective of their product line? NPS sounded like an R&D contractor in this presentation, not a company that designs, builds and sells wind energy systems. These questions were not properly addressed in the presentation.

The program should think about how to "answer the question" about whether direct drive, parallel generators (Clipper), or evolutionary improvement of common gearbox/generator configurations will be the drivetrain technology of the future.

Distributed Wind Technology

Purpose and Objective

The present DWT program has proposed a dramatic change in the scope of distributed wind technology: the possibility of using moderate-scale wind turbines (200kW-500kW per turbine) as power for small industries without placing this power on the utility grid. This means that the use of wind as source of electrical power will not depend on the ability (or lack of ability) of the power grid to handle an increase in electrical energy load.

The objective is logical, relevant to the need, and relates to the program's goals only to the extent that it supports outreach efforts. The industry is not 1 kW and 5 kW machines. Nor will those machines provide a significant if measurable amount of energy to centrally-generated electricity. However, they can provide a valuable adjunct to behind-the-meter energy use reduction.

The program's purpose and objective is no longer relevant vis-à-vis small machines. The redefined program with specific applications for specific markets has the potential for a significantly greater contribution to the energy security of the country. The projects funded under this program are properly focused on the development of advanced turbine technology without depending on utility networks to deliver this power.

DWT should focus on community wind project implementation as it pertains to bulk power sales in smaller increments, thus maximizing the existing grids. FERC defines a small project as 20MW or less. This capacity can still reasonably compete with larger projects on an economy of scale basis.

Some additional information on the future direction of the DWT investment—perhaps even provided as clear alternatives to be assessed by the panel—would have been useful. Additional information on cost / investment prospects was needed.

Work Plan

The work plan was limited by the redefinition of the program area. The previous work plan for small wind turbine development was structured to meet the objectives. A new work plan is needed to develop the wind products for the identified market applications.

Cost benefit is a function of program goals. If the goal is to design a 1 kW machine, the Lab's efforts to support SWP has been superb. NREL's implementation has been exemplary. It is that goal itself that must be questioned.

This portion of the investment seemed somewhat detached from the advances in technology being made elsewhere in the portfolio. Any future work plan should include better integration of technology development activities.

Results

Progress to date has been reasonable and the technology that is being developed will enhance the applicability of Distributed Wind Technology to future wind systems. The Lab's processes are very efficient.

Impact/Technical Merit

The focus of this program on expanding the range of wind turbines available to small industry offers a potential for a much wider use of wind power by small- and moderate-size industry. This will open up new opportunities for wind power to reduce the U.S. dependence on oil, natural gas, and coal for generation of electricity. The Distributed Wind Program is also an important part of bringing wind closer to "home" and into the consciousness of the American voter.

However, DWT has only served a very small market segment in the industry. It appeared unlikely that the results from past DWT investments are likely to have a major impact on the overall progress of wind technology. There was little evidence of strong industry interest in the prospective commercial applications of the DOE programs investments in DWT—other than the direct financial benefits that the investments had for individual companies. It is time to move on.

Plans for Completion

The present plan for the Distributed Wind Technology program is to gradually eliminate funding for the program. However, the program appears to be realigning its efforts so they are more adapted to the greater industry needs. Program funding should be continued, with effort placed on an evaluation of the potential for implementation of the concept of powering industry using wind energy that does not require power-line distribution.

Project-Specific Comments

Trudy Forsyth's definition of distributed wind (including the categories "Small-Scale Community;" Wind/Diesel; Farm/Industrial; Residential; and Off-Grid) makes sense. Unfortunately, it is based on a range of wind projects that does not currently exist. The "Farm/Industrial" and "Small-Scale Community" sectors indicate significant potential capacity additions (nearly 4000 MW) which would use machines in the 300 to 800 kW range. This is not a new technology sector. Many of the most reliable wind plants in operation today are based upon the 700-900 MW class of machines. What is missing is not technology, but manufacturing capacity to serve that emerging market. Unless there is a specific technology, such as direct high load irrigation or direct thermal applications, there is not a major technology role for the Wind Program here. Markets, integration analyses and outreach would be valuable DOE functions for DWT.

DWT is most effective in its outreach efforts such as UWIG and NWCC, which were not presented in this program. The wind integration efforts heretofore functioning under DWT are exceedingly important as are the outreach efforts in NWCC and UWIG.

The Southwest Wind Power SkyStream turbine is well thought-out, well designed and costs are remarkably low. If this small turbine operates as designed and testing proves its operation, it has the potential to be a major factor in residential application and be as widespread on the American agricultural scene as the old windmill water pumps.

The Windward Engineering 3.75 kW turbine has a nicely designed configuration for the gearbox, generator and brakes. This type of integrated conceptual design type work should happen more.

Princeton Power Systems needs to reach out to wind turbine companies and others who would/could put the technology to good use.

Regarding the NPS 100 kW turbine, the evolution of the 100 kW designs shows very good improvement. Field tests, and moving toward volume production levels (global market), should be expedited.

The program should cease all efforts in small machines. The market will either support them or it won't. The program could focus some effort on DWT in the 500 kW to 1 MW range. Optimizing existing equipment with those lessons learned in the LWST and WindPACT programs could serve numerous special purpose market applications in that size range.

The Wind Program needs to continue funding Wind Powering America and DWT. The Wind Program needs to refocus and examine the DWT program because it provides a distributed system that can help the security of this country.

Supporting Research and Testing

Purpose and Objective

The programs reviewed were uniformly outstanding, and continuation of these projects will be critical to the future development of wind energy.

The Department and Lab's SR&T efforts provide excellent value to industry. Leadership and Management are keenly aware of industry needs, state of the art technology in this sector, and future needs. The Department needs to pay attention to staff leading these efforts and adequately fund them.

The SR&T program is needed to continue product analysis and then feed into innovative component research. The SR&T program is vital to increased deployment to anticipate potential show stoppers. The priority of component work should be a) drivetrain (including both gearbox and direct drive), and b) rotor.

Work Plan

The projects reviewed during the meeting demonstrated the wide range of capabilities that are evident in the team of scientists and engineers of the National Wind Technology Center and Sandia Laboratories. The programs presently under way are focused on the many challenges facing wind energy technologists as they develop the tools needed to analyze the complex systems that are the key parts of future wind turbines. However, budget restrictions have limited the progress of the SR&T program within NREL. Unless these limitations are removed in the near future, the technology needed to meet the requirements imposed by the operation of wind turbines in low energy environments will not be available when required.

Overall, the SR&T work plan was well laid out and largely focused its activities on paper studies or testing, which provided fundamental knowledge about potential improvement and offshore potential.

Having two-thirds of the environmental budget going to offshore environmental issues is a mistake. It would benefit deployment of wind energy if those funds were spent on land-based applications. The allocation of funds seems backwards. There are very significant near-term land-based issues that demand close attention.

The costs of investments in past DOE Wind SR&T certainly seem to provide exceptional return on investment. The apparent plan to significantly increase the emphasis on off-shore wind appeared somewhat problematic, however, and not necessarily likely to provide the same level of benefit as a more balanced investment—particularly if the goal of 20% of U.S. energy coming from wind power is to be realized.

Results

Generally, the "technology R&D program" is achieving its goals. SR&T project results were excellent. The SR&T program is exceptionally broad in its scope and potential impact. It certainly seems to have made significant progress toward its goals and objectives. The results appear exceptionally significant and have demonstrated utility for the future program and the industry. It appears that past objectives will, in most cases, be achieved as planned.

Results were again limited to dollars available, not critical R&D needed—this was particularly evident in modeling and testing. There appears to be some slippage on progress of projects due to funding constraints. NREL appears to be getting very high degree of value for each dollar spent. The rest of government should be this good.

The projects reviewed at the meeting show the high-quality work being performed in the SR&T program. It is clear that the program is properly focused, and will continue to produce quality results. However, there is a need to increase the level of support that SR&T receives from the NREL budget if the development of new technology, and the analysis of the increasingly complex systems involved, are to be accomplished at the rate needed to meet the increasing demand for wind power.

Impact/Technical Merit

The SR&T component of the National Wind Technology Center has the potential to make a major impact on the future of wind energy. During the coming years, wind energy will play an increasing role in the production of power in the United States. However, as the wind turbines grow in size and complexity, there will be an increasing need for technical analysis and testing – the goal of the SR&T program.

The roles of the DOE laboratories, and industry in the program were clear and well documented, including how the technology research results were to be transferred—and in particular the capture of important new knowledge within models and tools that were made available to industry. There appears to be significant and extensive transfer of technology and information.

The program's testing capability is limited by facilities and manpower. Testing activities seem to be overstressing both the facilities and staff available.

Models and standards are critical if the wind industry is to grow more quickly.

SR&T is a very functional and valuable part of the programs efforts. Industry has clearly shown an interest in the prospective commercial applications of the DOE program investments in those elements of SR&T that provided fundamental knowledge, tools, and new technologies of broad applicability.

Plans for Completion

This ongoing program is well focused on the technical issues that are critical to the future increased utilization of wind power. There is a clear need for increased support for the

technology development that is the goal of the SR&T effort. In addition, new testing facilities are needed in order to test the large wind turbine blades and drive trains being developed by industry in response to the growing interest in low wind speed technology — a technology that offers the most promising path to increased energy production by wind power in the U.S.

DOE/NREL wants to test installed state-of-the-art machines. However, doing this would violate the warranty on those machines. Therefore, unless it buys its own equipment, the Wind Energy Program is only able to use out-dated machines for its component testing. Seeking partners for testing components is best accomplished through the manufacturers than through developers/operators. Operators will always be looking for forms of indemnification that the labs are less able to meet than the manufacturers who have already provided such indemnities.

The degree of emphasis on off-shore wind and larger scale demonstrations, rather than investments in more fundamental technologies advancements and tool developments is a question that needs to be addressed by the program.

The program can develop several components, but at some point they must be tested on an actual tower. The same goes for offshore – before one can say this is a good or a bad idea, an offshore turbine needs to be tested.

The expansion of both capability and manpower is critical if wind power is to increase rapidly. The testing capability and associated staff (e.g. modelers, etc.) are going to be vital if “show stoppers” appear in the expansion.

The entire program is subject to too broad a band of uncertainties. This part of the program suffers under the unpredictability of funding. Restoration of funding is imperative.

Project-Specific Comments

Design Tools and Codes

Code development and verification activities are vital to align the innovation created in WindPACT and LWST (and even offshore) with expectations and evolving needs of the industry. Codes are where design begins, and, in a way, ends. Significantly more funding should be allocated to this function. This is one of the most important contributions the DOE Wind Program can make to the deployment of wind energy in America.

The scope and importance of the NREL advanced controls research is much greater than its staffing level. For the future, questions regarding open source versus proprietary code should be examined across the control program spectrum, especially as it pertains to code improvement as the industry matures and globalizes, and the reduced overhead it offers DOE/NREL and industry users.

New testing facilities would serve new market players. Models show that scaling of product elements is relatively accurate. Current models and codes have proven reliable in scaling turbines to larger sizes. This does not mean that the development of codes and model validation is done. To the contrary, the fostering of innovation will require even more sophisticated codes in order to optimize future designs. These codes should be universal to all manufacturers, as this would not only serve those stakeholders, but provide a unified base of science standards by which the market evaluates commercial risk.

The overall problem [with codes and standards work] has been a steady decline in funding for the Wind Program. Failure to continue code development work due to lack of funding in the Wind Program will be problematic for the wind industry. The program needs to identify what needs to be done, how much it will cost and clarify the gap between those needs and the current budget.

WindPACT

The WindPACT program is an effective way to foster innovation. The Wind Program was able to take the best WindPACT Phase I projects and move them into full research development. This should be considered "full component" development. Industry has evolved, and significant resources are available to industry for development of complete turbines. The Program should continue innovation through the WindPACT to support efforts of today's manufacturers.

WindPACT analysis should be done every 2-3 years. Conducting a WindPACT analysis every five years may be too infrequent, as projects may only last two years.

Funding

Continuation of the present situation is not stable. NREL has a decision to make:

1. Increase its fees, which would force industry to support an expansion or more staff at the existing facility.

2. Continue to seek additional funding from DOE. The fall back would be the present public/private partnership with expanded facilities in other locations.

3. Cut back and take in less work.

NREL is overextended in terms of its technology testing and test facilities. It was painful to see to what lengths NREL goes to get the most done for industry and NREL clients. Given trends in funding and technology size, perhaps product verification and research concept testing should be treated as separate activities. Industry has shown the willingness to invest in test machinery to demonstrate their products.

If the program is facing static or decreasing budgets then testing facilities cannot be a top priority. That only $600k of the testing budget is coming from the industry is shocking.

Also, it appears that offshore development is driving the anticipated needs for more testing facilities.

Supporting Research and Testing programs test innovative products and develop new commercial products. The existing facilities can help with the innovative products. The commercial development should be a function of industry. If industry needs expanded capabilities then industry should provide such funding.

Offshore

The degree of uncertainty associated with offshore environments is still very high. Research on these critical aspects, as they pertain to large-scale deployment of offshore wind, needs to be performed before we can answer questions of how much offshore development can realistically take place and how fast.

Environmental Issues

A major question related to environmental issues is: how much is knowledge transportable and what must be examined for each site? Is the product how to do EIA analysis per site, or is it public outreach and education? The regulatory environment will need to evolve with the state of science regarding costs and benefits of wind.

Materials

The materials program is the most under-funded area, though it gets "the most bang for the buck." This program should be better funded and more aggressive.

Aeroacoustics

The panel is concerned that the Wind Program has discontinued its aeroacoustic work. While far offshore projects may not worry about noise, near offshore projects could create huge noise problems because noise propagates quite well over water. Sacrificing noise for stiffness is the wrong approach. More work on aeroacoustics is needed.

Today's 2 MW machines are now warranted by the manufacturers at 106 dB – some higher, very few (if any) lower. This is in stark contrast to the 2000 vintage machines of the 600 – 900 kW class that were warranted to 101 – 102 dB.

Aeroacoustics is only a part of the overall acoustics problems that could severely limit project deployment. Structure-borne noise emissions from gearboxes that emit pure tones (now variable due to variable speed operations) combined with higher tip speed operations to create a much higher sound power level at receptor locations. Both aeroacoustic "white noise" and structure-borne pure tones are areas worthy of study by the program.

Offshore Wind

The program is focusing too much on offshore activities. The driving focus on the new testing facilities is all offshore. Two-thirds of the environmental budget is going toward offshore.

Offshore should be part of a balanced program portfolio, but this is a high-risk, very future-oriented program, and, given limited DOE/Wind Program resources, should not receive a significant portion of those resources. In addition, it would be useful to examine what appears to be an underlying driving assumption, namely that offshore will be the most economic way of delivering wind energy to the nation's load/population centers. It may be that grid improvements/additions from the major wind resources of the Midwest to/towards the Northeast/Central Atlantic and West/Southwest will be more economic.

Offshore work should focus on developing a research plan that defines potential problems with offshore wind development.

The Europeans are far ahead of the U.S. in the pursuit of offshore. DOE should focus on models and validation so the tools are available when experience, reliability and economics are proven elsewhere. The U.S. is not as driven to seek offshore solutions due to its land-based resource and population density. Europe is quite the opposite. Studies at MISO indicate the cost of transmission from North Dakota to Chicago to be up to $0.02/kWhr. The cost delta of offshore will be far greater than that for many years to come. This is exactly the reason the panel is adamant about focusing on integration.

Successfully installing offshore wind technology on the eastern seaboard means the program/industry has the ability to put offshore anywhere.

The offshore program needs further and more precise definition. This is an area the program should monitor, collaborate in, and model. However, offshore deployment it is a mid- to long-term market reality in this country. The Department would do well to focus a majority of funding and efforts for land based deployment. The Department should not invest in hardware or demonstration projects related to offshore at this time.

Congressionally-Directed Projects

Purpose and Objective

Congressionally-directed projects directly impact the DOE Wind program by taking funds from critical programs which are focused directly on the DOE targets, and instead direct this money to tasks minimally aligned with DOE Wind Program Objectives. At the present time, more than 30% of the NREL budget is spent on congressionally-directed projects. This has forced NREL to cancel most of the innovative research that was being developed under the Low Wind Speed Technology program. This diversion of funds will have a direct and very damaging effect on the development of new technology that will be needed in order to implement the goals of the Low Wind Speed Technology program in a timely manner.

These elements of the program are very much a mixed bag. Some of them seem to meet non-technical needs of the program; others addressed some potentially useful technical topics. However, it seemed unlikely that for the level of investment and likely returns that the congressionally-directed activities provide the same level of usefulness as other aspects of the program.

Work Plan

The work plans (overall and individually) seem only partially complete, without solid project implementation methods in use and lacking comprehensive scope.

Results
Although the results of these projects address the issues targeted by the projects, these projects do not significantly contribute to solving the problems presently faced by the wind industry in an environment of severe funding limitation.

The various sub-programs and approaches do not seem to be consistently using best practices; there are various areas where improvement is needed. It is unclear whether or not the specific objectives of the individual projects will in most cases be achieved as presented due to an apparent lack of project management rigor.

The congressionally-directed project program elements seem to be making neither significant nor timely progress toward their goals and objectives. The results do not appear to be significant, nor do they demonstrate utility for the future program and the industry.

Impact/Technical Merit

The congressionally-directed project presentations are uniformly poor, and appeared to have very little intellectual contribution or connection to the overall program, especially given that they appeared to have more than adequate funds to conduct their tasks relative to what the NREL/SNL staff have to work with. Without competitive project formulation

and selection, the quality of the ideas, as well as their execution, appears to be severely affected.

The roles of the DOE labs, and industry (writ larger)—including how the technology research results were to be transferred—were neither well documented nor particularly apparent in any of the congressionally-directed projects. In most cases, these investments do not appear to be planning for the transfer of technology and information concerning research results. More could be done to better integrate some of these activities into the overall Wind Program portfolio. There was also little evidence of strong or active interest by industry in prospective commercial applications of the congressionally-directed project investments.

Since funding of these congressionally-directed projects comes directly from the NREL Wind Energy Program technical budget, the diversion of these already limited funds has had a seriously negative impact on NREL wind energy research.

None of the programs being funded by congressional mandate address the critical needs of the present U.S. wind energy program. In addition, most of the congressionally-directed projects reviewed at the meeting do not offer any significant relevance to the programs presently being pursued by NREL.

Plans for Completion

These congressionally-directed projects should be ended as soon as possible, and the funds presently being diverted to these projects refocused on critical wind energy problems.

Project-Specific Comments

Regarding advocacy in Vermont, the industry has been dealing with market obstacles for many years and is getting good at it. When the market is of significant value, market resources will solve the problems.

The Vermont wind earmarks have a rather large budget for what is effectively developer support, with little beneficial results so far. The local opposition lessons, however, are VERY important. “Best practices” for community wind public interaction and communication techniques may emerge. AWEA provides many excellent resources to support policies mitigation in emerging market areas. The Vermont earmarks provide nothing of value to the program.

The Basin Electric wind to hydrogen program will mostly benefit operational issues, as the system is a mix of near-commercial components. Dynamic scheduling concepts are interesting, but given the size of the electrolyzer, and the demand relative to distribution system, the project could have been a paper study. Data collection, interpretation, and distribution to potential users in academia and industry were not well articulated. The Basin project provides nothing new in technology. The dynamic scheduling outcome

could have been achieved with a very modest paper study. The hardware used to make the hydrogen dates back to the 1930s.

Regarding the St. Francis University renewable energy center, its educational aspects are important, but not well articulated. The project should be able to communicate innovative features of its renewable energy management program, and the public education and outreach initiatives. The project also needs to communicate unique features of the renewables business versus similar small businesses. The value of this project to the program budget needs to be better articulated. The St. Francis region has already seen numerous similar or near-identical projects developments.

Some of the Utah State University Renewable Energy for Rural Economic Development Project outputs look more like bureaucratic/consulting products as opposed to innovative university research topics. A rate impact study could be easily done by state energy office or utility.

Funding

The fact that 33 percent of this year's budget has been diverted to congressionally-directed projects is appalling. These earmarks have to come out of the SR&T budget and are cutting down the Wind Energy Program's staff dollars. Far less funding for congressionally-directed projects is available than was promised in the past if cost of living changes are factored in.

NREL avoided major personnel cuts by deferring funding of LWST projects with industry. Industry has taken up the slack in some cases and delayed projects in other cases. NREL is hoping that regular funding will return in the future. If not, NREL staffing may be affected in the future. Next year's budget does not provide additional funding. The only hope to recover is if congress funds fewer earmarks.

Summary of Peer Review Panel Suggestions and Wind Program Responses

- The panel finds that the Department of Energy, industry, and the taxpayers are getting an excellent value on their investment in the Wind Program from the work being done by NREL and Sandia National Laboratories.

DOE Response: Program planning is highly coordinated with the needs of industry through a technical assessment process, which includes input from a peer review team of industry experts. The technical assessment process ensures that every research activity supported by the program can be demonstrated to have a direct link to achieving the top-level program strategic goals and goals of the Wind Program, the Office of Energy Efficiency and Renewable Energy, and DOE. The program's strategic planning framework has two elements. First, the program has an on-going technical assessment activity – to monitor the current status of wind technology and progress in achieving program cost goals, to evaluate that status within the context of the needs of the marketplace, and to identify technological pathways that will lead to wind's successful competition in the marketplace. The program also uses the peer review process – to benefit from the guidance of industry and the research community, and to provide an outside view of the program. Technical assessment and peer review provide inputs that the program management team considers in making decisions about strategic program directions and funding priorities.

- The program is at a critical crossroads. There will never be a better opportunity to expand DOE's wind efforts than right now. The program should immediately refocus itself to the 20% goal.
    - The program should lay out a plan for this change.
    - Fundamental program changes need to occur in order to achieve 20%.
    - Do not expect that 20% can be achieved without significant and properly focused funding increases.

DOE Response: In response to the President's Advanced Energy Initiative (AEI), the Wind Program teamed with American Wind Energy Association (AWEA) and launched the "Wind Action Plan" project. An initial workshop was convened to formulate a plan and identify a path forward. The Wind Action Plan vision is: "Wind energy will provide 20% of U.S. electricity needs by 2030, securing America's leadership in reliable, clean energy technology. As an inexhaustible and affordable domestic resource, wind strengthens our energy security, improves the quality of the air we breathe, slows climate change, and revitalizes rural communities".

The Wind Action Plan project is comprised of DOE, laboratory, and industry experts organized into a steering committee and seven task force teams focused on issues critical to significant expansion of wind energy in the following areas:

1. *Supporting Analysis*
2. *Technology and Applications*
3. *Utilities and Transmission*
4. *Markets and Acceptance*
5. *Environmental and Siting*
6. *Policy and Regulation*
7. *Communications and Outreach*

The outcome of the Wind Action Plan will help define a new path forward. To align and coordinate Wind Program and AWEA activities to meet the AEI goal, the Wind Program acknowledges that fundamental changes will likely be required.

Many forces are currently at work in redirecting program efforts to realign with AEI objectives. Responding to EERE executive management guidance, the program has redirected program activities on near-term barriers to large-scale wind deployment. For example, some technology development subcontracts were curtailed and funds were redirected to resolve radar interference issues that were preventing wind development projects from moving forward.

- Given the location of load centers and wind resources in the United States, transmission availability and integration will be the key determinants to large scale wind energy utilization. Accordingly, in order to make near-term progress on the Goal of providing 20% of U.S. energy, the Wind Program must find ways to coordinate with and educate other Federal and state governmental agencies, as well as the power industry, to maximize the use of the existing grid for the transmission of wind power, as well as the optimal expansion of the grid in the long-term.

DOE Response: The Wind Program is planning to diversify transmission and integration projects accordingly in FY07 by teaming with the DOE Office of Electricity (OE) and restructuring DOE activities to better accommodate anticipated levels of grid expansion for wind energy. The Wind Program and OE staff are working to define collaborative project areas that best meet these requirements, including education and outreach, grid model development and high penetration analyses.

- In order to make near-term progress on the 20% goal, the program must conduct integration studies in order to optimize the utilization of the existing grid.

DOE Response: DOE is an active participant in the studies being conducted by regional transmission organizations, providing expert wind integration advice and wind regime modeling support. These transmission studies are ongoing and DOE's role will be further defined by the Wind Action Plan and the OE/EERE Wind Program grid integration teams.

- Code development needs to be a major element of the Wind Program. Failure to develop properly validated codes will severely limit our ability to make either near term progress or farther term advances

DOE Response: Continued development of wind turbine simulation codes is important. NREL and Sandia's suite of codes is the repository of many years of scientific research, development, testing, and industry experience. The Wind Program and industry partners rely heavily on the codes to evolve turbine designs, optimize performance, resolve problems, and check compliance to IEC standards. Although code development is important, training and education of skilled individuals in the proper utilization of the codes is equally important. These experts utilize the codes extensively in all areas of wind technology development. The Wind Program will continue to support code development within budget constraints and competing priorities.

- Development of rotors must be expanded and supported to meet the 20% goal.

DOE Response: The development of advanced rotors has been a multi-faceted and multi-year effort that required the integration of technology advances ranging from materials and manufacturing through aerodynamics, structural dynamics and controls. These elements are integrated into advanced rotors though the application of the program's suite of codes. The successes demonstrated this year were facilitated by the first round of WindPACT partnerships. The program is pursuing continued progress by establishing a rotor development task at NREL and continuing to support the blade work at Sandia. The Wind Program is also planning to conduct a second round of WindPACT studies in FY07 to help scope and prioritize the program's wind technology development activities, including rotor development, to best support AEI goals.

- There should be another round of WindPACT in order to continue to foster innovative component-level development.

DOE Response: The Wind Program agrees with the peer review committee – see above response.

- Large scale system-level prototypes should be deferred pending the results of the next round of WindPACT studies.

DOE Response: All current public-private partnerships for LWST system and component development are being reviewed by DOE to ensure alignment with the goals of the AEI.

- The program should reduce its emphasis on offshore wind; it should focus its remaining efforts on critical technology barriers.

DOE Response: Consistent with the peer review committee's guidance, and based on EERE executive management direction, the program is continuing to explore critical offshore wind technology issues. The FY07 plan limits offshore activities to fundamental R&D and does not include hardware development. The reduced emphasis on offshore activities also extends to environmental work, where less than one-third of the environmental budget in FY07 is planned for offshore specific issues.
The program will reevaluate offshore technology development in FY09.

- The program should pursue metrics in addition to cost of energy in order to appropriately guide efforts toward the 20% goal.

DOE Response: The Wind Program is currently reprioritizing the balance between technology viability and technology application to focus more effort on deployment activities consistent with the market transformation goals of the AEI, and is therefore reevaluating metrics accordingly

- In order to achieve the 20% goal, the program must enhance in-house capacity (facilities and staff).

DOE Response: The Wind Program agrees and FY07 plans include enhanced staffing levels in SI, WPA, and facility collaborations. FY07 funding outcome is impacted by many factors (see below) which will determine the program's resulting ability to enhance in-house capacity.

- The new direction of distributed wind looks promising and deserves consideration.

DOE Response: In FY07, the Wind Program will be completing a distributed wind market assessment study, initiated in FY06, which covers both domestic and international markets for the following sectors: off-grid/small remote power, residential, farm/industrial/small business, wind/diesel, and community wind. In addition, the Wind Program is initiating a follow on, more comprehensive study – Assessment of the distributed wind market in the United States. This study will estimate the current size and potential market size for distributed wind, identify drivers and restrainers of deployment of distributed wind, and identify actions that DOE could take to accelerate the deployment of distributed wind and their potential impact. DOE will use the results from these two studies to evaluate how to best invest in distributed wind technology and policy development in order to affect material change in the penetration of this technology.

- Given current funding, the program is spread too thin. Without budget increases, the program must narrow its technical focus and strategic objectives.

DOE Response: The Wind Program has requested funds sufficient to meet the current strategic objectives. Delivery of these funds to the program is contingent on many factors, including congressionally mandated projects. If the funds are not delivered, the program will activate a prioritization plan developed as part of the annual budget planning to preserve the highest priority activities.

The Wind Program is making efforts to leverage its resources through CRADA and Work-For-Others funding opportunities with federal agencies, state agencies, U.S. industry partnerships and international partnerships. For example, the Wind Program is pursuing options for creating a structural testing collaborative with government, private, or academic entities in a public/ private partnership to build larger wind turbine test facilities. A CRADA Opportunity Announcement for a large-scale blade test facility

partnership was released in May 2006 and proposals were submitted in November. The motivation for this effort is to provide testing capabilities of sufficient size and availability to support the Wind Program and U.S. wind industry's anticipated development and deployment of larger land-based and offshore wind turbines. FY07 planned activities include selecting collaborative partners, completing a business plan and market study, and beginning the facility design process. The facility is planned to be commissioned in FY09. In addition, the Wind Program will evaluate the need to pursue a similar partnership for a large-scale drive train test facility, in consultation with the U.S. wind industry.

Two specific work areas were highlighted by the peer review team for their importance, materials research and aeroacoustics. The program will continue to look for opportunities to expand this work through internal R&D activities and collaborative work with universities and industry partners.

APPENDICES

Appendix A. Letter from Larry Carr to Stan Calvert, Preliminary Findings of the Peer Review Panel

Appendix B. Meeting Attendee List

Appendix C. Peer Review Meeting Process Evaluation Survey Scores

Appendix A: Letter from Larry Carr to Stan Calvert, Preliminary Findings of the Peer Review Panel

Stan Calvert
Program Manager, Wind and Hydropower Technologies
U.S. Department of Energy

Lawrence W. Carr
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May 22, 2006

Dear Stan,

On behalf of the full membership of the Department of Energy (DOE) Office of Energy Efficiency and Renewable Energy (EERE) Wind Energy Program Review Panel that met on May 9-11, 2006 in Golden, Colorado, I would like to offer the following preliminary findings.

First, it must be noted that the Panel finds that the Department of Energy (DOE), industry and the taxpayer are all getting an excellent value on their investment in the Wind Program, based on the work being done by the DOE National Renewable Energy Laboratory (NREL), Sandia National Laboratories, and others. However, the Wind Program is at a critical crossroads. There will never be a better opportunity to expand DOE's wind energy efforts than right now. In light of this, the following are a series of preliminary findings from the Panel.

Strategic and Program-Level Recommendations

- The Program should refocus itself immediately to better achieve the Goal of Wind Power providing 20% of U.S. electrical energy. Key points in this regard:
    - The program should lay out a plan for this strategic change in emphasis.
    - Fundamental program changes must occur in order to achieve the 20% Goal,
    - Do not expect that the 20% Goal can be achieved without significant and properly focused funding of the DOE Wind Energy Program.
- Given the location of load centers and wind resources in the United States, transmission availability and integration will be the key determinants to large scale wind energy utilization. Accordingly, in order to make near-term progress on the Goal of providing 20% of U.S. energy, the Wind Program must find ways to coordinate with and educate other Federal and state governmental agencies, as well as the power industry, to maximize the use of the existing grid for the

transmission of wind power, as well as the optimal expansion of the grid in the long-term.

- There should be another round of WindPACT research activities (studies and early R&D) in order to continue to foster innovative component level development.
- The Program should pursue metrics in addition to cost of energy in order to appropriately guide efforts toward the 20% Goal.

Specific Program Technical Content Recommendations

- The Program should substantially reduce its emphasis on near-term, large-scale offshore wind research, refocusing its efforts on critical technology design criteria for both near-shore and deepwater wind energy. It is the panel's belief that even under the best of circumstances, significant offshore wind is a medium to long-term option. Therefore, a balance among on-land and offshore, near and long-term research needs to be maintained, understanding that many technological advances will benefit both.
- All large-scale system-level prototypes should be deferred pending the results of the next round of WindPACT studies.
- Codes development and validation needs to remain a central element of the Wind Program.
    - Failure to develop properly validated codes, applicable to a broad range of wind technology deployments, will severely limit the industry's ability to make either near term progress or farther term advances.
- Development on Advanced Rotors must be expanded and supported if the 20% Goal is to be met.
- The new direction of Distributed Wind Technology looks promising and deserves further exploration.
- Conduct a national transmission system analysis utilizing proven wind integration simulation tools to facilitate:
    - Near term optimization of existing system and line capacities
    - Identification of best-fit resource-to-market corridors for new transmission
    - A facts-based dialogue between regulatory and market stakeholders

Institutional Content Recommendation(s)

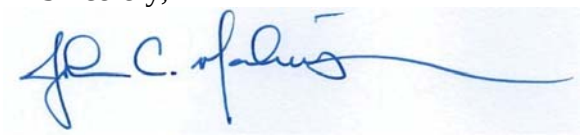
- In order to achieve the 20% Goal, the Program must enhance in-house capacity (both facilities and staff).

If Funding Continues to Be Constrained…

- Given current funding, the Program is spread too thin. Without budget increases, the program must narrow its technical focus and strategic objectives. In this event, the panel offers the following recommendations for the Wind Program:
    - Establish a balance among near and long-term, on-land and offshore research, including.
        - Conduct another round of Wind PACT research activities
        - Preserve critical in-house capacity (both facilities and staff).
        - Place some emphasis on the development of Codes and Rotors
        - Defer large-scale system-level prototypes, pending future Wind PACT results and improvements in funding.
        - Substantially reduce emphasis on near-term, large-scale offshore wind research.
    - Advance the goal of maximum use of the existing grid for the transmission of wind power, and the optimal expansion of the grid in the long-term.

Please regard the above points as preliminary inputs intended to inform planning efforts now underway.

Sincerely,



for Lawrence W. Carr
Chair, Wind Program Review Panel

Appendix B: Meeting Attendee List

2006 DOE Wind & Hydropower Program Peer Review Meeting
May 9-11, 2006
Denver Marriott West
Golden, Colorado
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Appendix C: Peer Review Meeting Process Evaluation Surveys

Peer Review Process Evaluation Surveys were distributed to meeting attendees during the morning sessions of the second day. The purpose of the surveys is to assess satisfaction with the process of the peer review. The surveys were modeled after those provided in the DOE Peer Review Guide. All attendees, including Program staff and peer reviewers, received survey Part I, Parts A and B. Part II of the survey was distributed only to the members of the peer review Panel.

A total of 18 respondents completed the Part I survey. Their responses to both Parts A and B are below. Part B includes narrative responses to qualitative questions as well as numerical scores to questions based on a five-point scale. Where possible, the respondents' narrative answers are herein recorded verbatim.

Part I, Part A

Question Number	Question	Number of Respondents
A-1	What was your role in the review?	
	__ Reviewer or Chairperson on the review panel	**3**
	__ Principal Investigator for project under review	**3**
	__ Member of steering group established for the review	**0**
	__ Staff from program office being reviewed	**7**
	__ Observer (non-program participants)	**3**
	__ Other (please specify) _____	**2**
	Total	**18**
A-2	What is your affiliation?	
	__ Government agency directly sponsoring the program under review	**1**
	__ Government agency with interest in the sponsored work	**1**
	___Academic with interest in the work	**1**
	__ In an industry directly involved in the program under review	**5**
	__ In an industry with interest in the work under review	**0**
	__ National or other government lab whose project is under review	**7**
	__ National or other government lab not being reviewed	**1**
	__ Other (please specify, e.g., --consultant, retired employee, public, etc.)	**2**
	Total	**18**
A-3	Primary Work Location	
	__ United States	**18**
	__ Foreign Country	**0**
	Total	**18**

Part I, Part B

Question Number	Question	Score (Scale: 1.0 to 5.0)
B-1	Purpose and scope of review were well defined.	**4.06**
B-2	The evaluation criteria upon which the review was organized were clearly defined and used appropriately	
	1. Quality, Productivity, Accomplishments	**3.83**
	2. Relevance	**3.94**
	3. Management	**3.72**
	4. Other _____	**0.06 (Handouts)**
B-3	The reviewers had the proper mix and depth of credentials for the purpose of the review.	**4.08**
B-4	The quality, breadth, and depth of the following was sufficient to contribute to a well-considered review:	
	1. Presentations	**4.00**
	2. Other data provided	**2.94**
	3. Question & Answer periods	**4.28**
	4. Answers provided concerning programmatic questions	**3.61**
	5. Answers provided concerning technical questions	**4.33**
B-5	See Below	
B-6	See Below	
B-7	Overall, how satisfied are you with the review process?	**3.78**
B-8	Would you recommend this review process to others and should it be applied to other EERE programs?	
	__Yes	**16**
	__No	**0**
	Total Respondents for B-8	**16**

B-5 What was the most useful part of the review process?

- Getting to know where the industry and government NREL/DOE programs are heading.
- The information provided by each presenter concerning the technical content of their individual elements of the Wind Program investment portfolio.

B-6 What could have been done better?

- More details on impact of budget cutbacks.
- A portion of the test facility discussion would be best done in the field where the actual facilities are for Reviewers to see them.
- The oversight of many of the activities underway across DOE/NREL/SNL. A more expanded review should be encouraged.
- Better visibility of presentations. Lapel microphones to make it easier to hear some presenters.
- Furnishing evaluation criteria to staff members being reviewed. This has not been shared.
- Introduce peer review Panel members and their background.
- A broad overview of the program and showing which part was being reviewed.
- Get more top dog view and interaction such as Assistant Secretary for Renewables.
- Overall management context could have presented in more detail—the work breakdown structure of the program; the organization, including management; the FY 2007 President's budget for the program, and past budgets, by line item; etc. Also, the individual program element management context, with the same sorts of information. These data were not presented—even though management and relevance were criteria.

B-9. Please provide comments on the overall peer review process.

- Excellent job of meeting planning and implementation by NREL.
- Overall, excellent review process.
- This was the best organized, highest quality review I've seen. Demonstrates that NREL, SNL wind programs are relevant and needed. Need better political cover connections, linkages.
- Very well organized. Ran smoothly and on schedule. Extremely informative. Surprising how much is still being done despite all the budget cuts!
- We need a comprehensive review across the industry to allow technical ideas to transfer to other projects/product development activities. This is a different focus than an independent peer review but it's very valuable to get new research into commercial turbines.
- The actual review process is well organized however it would be much more useful to the staff being reviewed to receive feedback.
- Abbreviated format of primary program efforts is very much appreciated! Staff and most contractor presenters were very prepared. Best yet.

- Overall, I thought the review process was well organized and well implemented.

Three members of the Panel provided responses and scores to the peer review Process Evaluation Survey Part II. Their responses are below.

Part II

Question Number	Question	Score (Scale: 1.0 to 5.0)
C-1	Information about the program/subprogram /project under review was requested/provided sufficiently prior to the review session.	**2.7**
C-2	Review instructions provided were sufficient and timely.	**4.3**
C-3	Explanation of the questions within the criteria was clear and sufficient	
	1. Quality, Productivity, Accomplishments	**3.0**
	2. Relevance	**2.7**
	3. Management	**2.3**
	4. Other	**0**
C-4	The right criteria were used to evaluate the project(s)/program.	**1.7**
	1. Quality, Productivity, Accomplishments	**5.0**
	2. Relevance	**4.7**
	3. Management	**3.3**
	4. Other	**0.3 (Other: Using COE for all project may not be appropriate.)**
C-5	Enough time was allocated for presentations	**4.7**
C-6	Time allowed for the Question & Answer period following the presentations was adequate for a rigorous exchange.	**5.0**

C-7	Altogether, the preparatory materials, presentations, and the Question & Answer period provided sufficient depth of review	**5.0**
C-8	During the review, Reviewers had adequate access to research staff or requested sources of additional data	**5.0**
C-9	When considering the final reporting of recommendations: 1. Enough time was allocated for Reviewers to deliberate before recording review comments	**4.7**
	2. Process for developing final reporting was appropriate.	**3.3**
C-10	There were no problems with: 1. Rating schemes	**2.7**
	1. Classification of projects (project groupings)	**3.3**
	2. Proprietary data	**3.3**
C-11	The review was conducted smoothly	**5.0**
C-12	Travel arrangements and amenities were satisfactory.	**5.0**
C-13	The frequency of reviews for this program is: ____ about right ____ too frequent ____ not frequent enough ____ don't know at what frequency reviews are held	**5.0**

C-14 Any added comments:

- There is some confusion among the Panel regarding the administration's intent and direction. We see/feel that NREL has risen admirably to every challenge. The DOE and US taxpayers are getting superb value for funding committed. A meeting with Mr. Karsner, the peer Panel and a few lab and Department staff is recommended.
- These comment forms seem more appropriate for a very technical review. Since this was a broader peer review they didn't quite fit.

- Given “management” and “relevance” as criteria, more information should have been provided in each presentation on the “dull stuff”—budgets, organization, work breakdown structure, etc. These are entirely appropriate criteria, by the way—but the presented materials did not address them in sufficient detail.