To: Interested Parties

From: NWCC Distributed Wind Working Group

Re: Distributed Wind Proposals Due August 22

The National Wind Coordinating Committee (NWCC) invites proposals for its new Distributed Wind Project. Federal funding for the project will be provided through the Electric Power Research Institute (EPRI), which will manage the project for the NWCC. The NWCC is a collaborative endeavor formed in 1994 that includes representatives from electric utilities and their support organizations, state legislatures, state utility commissions, consumer advocacy offices, wind equipment suppliers and developers, power marketers, environmental organizations, and state and federal agencies. The NWCC identifies issues that affect the use of wind power, establishes dialogue among key stakeholders, and catalyzes appropriate activities to support the development of an environmentally, economically, and politically sustainable commercial market for wind power.

Through this research project, the NWCC hopes to gain an understanding of the benefits and costs associated with developing wind projects in a smaller, distributed model. If appropriate, NWCC will endeavor to develop options for policies, programs, or incentives that might efficiently support and facilitate distributed wind development in the US that is both cost-competitive and highly beneficial to local economies.

Specifically, the NWCC is interested in an assessment of the level of opportunity for distributed wind systems, as well as options for wind technology development that can enhance the value of wind energy in distributed utility settings. The NWCC wants to identify specific situations in which distributed wind generation is the best development model and circumstances under which large wind farm developments are the most appropriate. The NWCC is also interested in the similarities and differences between opportunities for distributed wind projects in Europe over the last few years and in the US today. In particular, the NWCC wants to understand where distributed wind development is constrained by market, institutional, or regulatory factors.

The overall research activity is divided into two areas: (1) technical issues and (2) infrastructure, market, and local economic issues. The technical issues section is intended to address questions regarding the costs and utility benefits that might be systematically different between distributed wind installations and wind farm installations. The infrastructure, market, and local economic issues section is a less quantitative evaluation of the local or regional factors that may be necessary to support
development of distributed wind projects. Interested parties are requested to provide a description of how they will perform the functions outlined in the attached scope of work, as well as biographical information about the key personnel who would be engaged in the project. Proposals may address one or both of the issue areas, but the NWCC has a preference for comprehensive projects encompassing both issue areas.

Proposals should include descriptions of relevant past research projects completed by the team or individuals. Qualifications desired include demonstrated experience researching technical and economic wind energy topics and the ability to work in a neutral and unbiased manner with parties representing a cross section of interests. All costs to research or prepare the proposal shall be borne by the submitter. Proposals will not be returned to the submitter unless requested to do so in writing.

A proposal review committee will review the proposals and make recommendations to the full NWCC based on criteria including: project cost, implementation and management plans, experience and qualifications of personnel, and a detailed work plan and timetable of tasks and deliverables. The NWCC expects that the budget for the entire effort will require the equivalent of approximately one-half of a person-year. The NWCC will be looking for, among other things, qualified teams that offer the best plan to meet the project objectives. The NWCC reserves the right not to select any of the proposals.

The Distributed Wind Project proposals should be no more than 10 pages total and should be sent to the NWCC, via e-mail or diskette (preferably in ASCII or MS Word 6.0), at the address above, for receipt by the close of business on Friday, August 22, 1997. Proposals received after that date will be considered at the discretion of the NWCC.

For additional information, contact Heather Rhoads, NWCC Outreach Coordinator, 202-965-6209, or Edgar DeMeo, Manager, Renewables, EPRI, 415-855-2159.
NWCC DISTRIBUTED WIND RESEARCH PROJECT

PROPOSED SCOPE OF WORK

Introduction
The National Wind Coordinating Committee has expressed a strong interest in exploring the opportunities for using a more distributed style of wind development to complement the current wind farm model in the United States. While the NWCC has had some difficulty developing a definitive definition of a distributed wind project, we have developed some key attributes that singly, or in combination, qualify a project as “distributed.”

One key element in distributed projects is their interconnection to the utility grid at the distribution system level rather than the transmission system level. A number of projects with individual or small numbers of wind turbines have been interconnected at the distribution level in Iowa and Minnesota, and many believe that lower costs might be associated with this type of interconnection compared to the substation and transmission link approach typical for wind farms. Installation at the distribution level may under some circumstances allow this type of wind project to earn higher value on the utility system, giving projects the potential to defer growth related investments—line or substation transformer upgrades—or deliver benefits in terms of distribution operation—improved voltage control, reduced losses improved reliability.¹

Another element in the definition of a distributed wind project is the degree to which this class of project is integrated into the local economy. The NWCC goes to Europe for examples of this aspect of the distributed model where individuals or groups of locals purchase a few wind turbines to produce electricity for their use and for sale to the local utility system. These distributed wind projects are conducted through local transactions involving landowners, wind turbine dealers and service providers, local banks and insurance agents, land-use officials, and utilities. This high level of local participation may impact project acceptance as well as overall awareness of the potential for renewable energy to deliver economic and environmental benefits. This type of development—hundreds of relatively small wind turbine purchases versus a few very large purchases—may also have been an important factor in the successful development of the wind industry.

It will be critical for the NWCC to understand the key economic factors and policy or industry developments or milestones that led to the establishment of the infrastructure that currently supports this market segment of the industry in Europe and to have a critical evaluation of the direct and indirect benefits and costs of this approach to wind development. The NWCC would like to understand the role and contribution of policy to the development of wind and the risks

¹ However, this type of installation may also pose risks in degrading system power quality and reliability, which would not be desirable. Evaluation of these benefits or impacts is entirely analogous to the “distributed utility” assessments of a variety of technologies including photovoltaics, fuel cells, energy efficiency and load management, and storage technologies conducted by PG&E, EPRI, NREL, DOE, and private companies. Consequently, an evaluation of the costs and impacts of distributed wind installations on system reliability, what system changes are required for wind power, and who plans and pays for upgrades, would enhance this project.
and discount rates in project finance in the European examples studied, to determine how much policy is worth to those projects, and what investors require in returns.

In this research project, the NWCC hopes to obtain the information necessary to understand the benefits and costs associated with developing wind projects in a smaller, distributed model. If appropriate, NWCC will endeavor to develop policy options that might efficiently support distributed wind development in the US that is both cost-competitive and highly beneficial to local economies.

In the following, the overall research activity is discussed in two sections: (1) Technical Issues and (2) Infrastructure, Market, and Local Economic Issues. The Technical Issues section is intended to address questions regarding the costs and utility benefits that might be systematically different between distributed wind installations and wind farm installations. The Infrastructure, Market, and Local Economic Issues section is a less quantitative evaluation of the local or regional factors that may be necessary to support development of distributed wind projects.

A. Technical Issues

1. Assess Distributed Project Costs

In Europe, installations of single or small numbers of large wind turbines are very common and are used by industry observers to explain all manner of differences between the US and European wind industries. In the US, wind developers who have installed small wind projects interconnected to the distribution system claim that these installations are less costly than large wind farm installations. On the other hand, other analysts suggest that there are many cost elements in wind project development that are fixed and that are particularly burdensome to small projects. No definitive assessment of these different costs has been conducted to date, so policy makers, including members of the NWCC, have little engineering basis for evaluating distributed wind opportunities in this country. This task is designed to fill our need for solid engineering and cost information on distributed wind installations. The selected researcher will:

- survey existing wind installations at the distribution level in the US and, to the extent feasible, in Europe, determining the technical specifications and costs including installation and interconnection, as well as reporting any local impacts or benefits that have been experienced;
- characterize the interconnection requirements for wind installation at the distribution level throughout the US;
- evaluate wind turbine manufacturers’ ability to meet interconnection requirements of local utilities;
- assess the sensitivity of wind project energy costs to project scale, number of turbines, and development schedule (number per month or year) of a wind procurement and installation project, including wind turbine and balance of system procurement, project financing, permitting and approval, wind resource assessment, foundation preparation, crane and crew utilization, etc.; and
• assess the sensitivity of wind project energy costs to project size and geographic distribution of a wind project operation, including operations personnel requirements, inventories of spare parts, maintenance crane and crew utilization, etc.

2. Compare and Contrast Distributed and Wind Farm Project Costs
In this task the selected researcher will explore the cost tradeoffs between distributed wind projects and wind farm developments (representative size - 50 MW to 100 MW) and identify differences in the project installation and operating costs as a function of development scale. This analysis will determine any inherent advantages or disadvantages of the different development models and allow policy makers to evaluate their relative importance. For instance, costs of a number of essential wind development activities including project financing, permitting and approval, and wind resource assessment may be significant and inherently insensitive to the scale of the wind project. Conversely, certain activities or cost elements might be significantly less costly at a smaller project scale.

3. Outline the Potential “Distributed Utility” Benefits and Costs
The selected researcher will prepare an overview of the opportunities for wind energy to earn “distributed utility” benefits in the US utility industry. This section should be based on the existing literature on the “distributed utility” and would include a list of the potential benefits that distributed generators of any sort could potentially earn on utility distribution systems. These benefits should include but not be limited to deferrals of growth related upgrades, reduced distribution system losses, and improved operations including VAR and voltage support. This section will include a discussion of the specific challenges faced by intermittent generators in earning these types of benefits and of the circumstances within the utility industry—load patterns, factors affecting load growth, etc.—that influence the magnitude of the opportunity for distributed benefits. For each potential benefit, the selected researcher shall provide specific examples of the distribution system characteristics and the intermittent resource characteristics necessary for the benefit to occur. The NWCC would like to gain insight into the overall system performance with and without distributed wind power, and the impacts on system operating parameters resulting from distributed wind facility operation.

4. Identify Representative Distributed Wind Opportunities in the Utility Sector
Based on the general requirements assessment discussed above and a high-level review of the utility industry in the twelve windiest states, the selected researcher will identify representative opportunities for wind systems interconnected on the distribution network to deliver each type of benefit. In addition, the selected researcher will present case studies describing the utility system and wind technology and resource characteristics that create these opportunities.

5. Evaluate Current Wind Technology’s Ability to Deliver Distributed Benefits
Given the perspectives and circumstances of the utilities and regions involved, the selected researcher will evaluate the technical capabilities of current wind turbine technologies so that we can understand their strengths and limitations in delivering distributed benefits. With this understanding, the selected researcher will make recommendations as to the technical capabilities that might best enhance the value of distributed wind systems to utilities. Examples of capabilities that might add value include power generating capability, which allows turbines to provide
voltage support and power factor correction on the distribution system. Another might be wind turbine control and other systems with the capability of dispatching storage or stand-by generation to assure high distribution system reliability.

6. Conclusions and Recommendations
The NWCC is interested in an assessment of the level of opportunity for distributed wind systems. We are also interested in research or case studies that might improve our understanding of these opportunities, as well as recommendations for wind technology development that can enhance the value of wind energy in distributed utility settings. Finally, we are interested in the specific situations in which distributed wind generation provides extra benefits and, therefore, is the best development model. We would also like to be able to identify the circumstances under which large wind farm developments are the most appropriate.

Schedule
This research could be completed by an experienced team in ten calendar months, based on the following:

1. Assess Distributed Project Costs 4 months
2. Compare and Contrast Distributed and Wind Farm Project Costs 1 month
3. Outline the Potential “Distributed Utility” Benefits and Costs 1 month
4. Identify Representative Distributed Wind Opportunities in the Utility Sector 2 months
5. Evaluate Current Wind Technology’s Distributed Benefits 1 month
6. Conclusions and Recommendations, and Report 1 month
TOTAL 10 months

B. Infrastructure, Market, and Local Economic Issues

1. Survey European Distributed Wind Market and Industry Infrastructure
Through a literature review and conversations with industry participants and observers, the selected researcher will develop a thorough description of the wind industry capability and infrastructure serving the distributed wind market in Denmark or other active distributed markets in Europe. In addition to characterizing the current status of the industry in Europe, the selected researcher will characterize the market conditions and infrastructure that existed in the years when the deployment of wind systems in distributed installations was just beginning, and will attempt to determine the key developments that facilitated this deployment method.

These descriptions should include:
• an evaluation of the differences between participants in a distributed versus “central” wind installation—defining buyers, wind turbine suppliers, financial and insurance services, installation and maintenance selected researchers, local officials;
• characterization of the economics of typical projects including power purchase and sale arrangements, payments per kilowatt-hour, debt coverage ratios, equity and debt ratios, and other contract terms and conditions;
• quantification of benefits that utilities credit to distributed wind generation projects;
• an assessment of the market share of wind systems in “distributed” versus wind farm configurations over the last five to ten years;
• a description of the infrastructure in place in European countries to service distributed installations and wind farms including sales, construction, wind assessment, financial, and O&M;
• a representative schedule for a typical distributed installation in Europe including the tasks and time requirements for the various participants; and
• characterization of the wind supply and service infrastructure businesses—how many dealers, service organizations and personnel, wind resource measurement sites and contractors, etc.—and an assessment of the geographic scope of these businesses and their annual business volume (i.e. number and capacity of wind turbines served, nature of contractual arrangements with distributed project owners, etc.).

2. Detail Local Economic Impacts of Distributed Wind
The selected researcher will assess the role that the wind industry plays in the local economies where distributed projects are common. This assessment should include consideration of the benefits to property owners, other investors, local tax impacts, perceptions of lenders, and the business community in general. The perspectives of the public interest sector should be explored as well. Are these projects perceived as being in the public as well as the private good? Local economic benefits of distributed wind generation will be compared to that of a representative, large (50 to 100 mw) wind farm development; the comparison should include consideration of the different cost of energy that might be produced with the two different development models.

Based on the assessments conducted in earlier tasks, the selected researcher will evaluate the factors or circumstances that need to be present in a local or regional wind market in order to support distributed wind development. What are the essential precursors to distributed wind project proliferation—large, local wind farms; ready profitable markets for wind generated electricity; etc.? What roles do local utilities, power markets, lenders, wind turbine dealers, and other businesses have to play in a vigorous distributed wind market?

4. Local Identity (Social) Implications
In addition to the economic implications of distributed wind projects, there are likely to be social considerations of note. The selected researcher will make an effort to assess the implications of distributed projects on the localities in which they are constructed. Do people take pride in these facilities or feel negatively about them? Is there a sense of community participation and benefit from these projects? Are issues such as public safety, aesthetics, avian impacts, or interference with communications of concern to the population or local officials? How have problems been resolved? The selected researcher might obtain this information through contacts with community leaders, local officials, newspaper reporters, etc.

Using current US examples of emerging distributed wind projects in Iowa, Minnesota, Michigan, and Colorado, the selected researcher will explore the market demand in the US for distributed wind and how “green” markets may impact distributed development, including the sensitivity of “green” customers to being supplied with local as opposed to distant or out-of-state wind power.
5. Conclusions and Recommendations

The NWCC is very interested in understanding the fundamental similarities and differences between the opportunities for distributed wind projects in Europe over the last few years and in the US today. In particular, we would like to understand circumstances where distributed wind development is constrained by economic, market, institutional, or regulatory factors, and if appropriate we will endeavor to develop options for policies, programs, or incentives that will facilitate such development in the future.

With an understanding of the key economic factors and policy or industry developments or milestones that led to the establishment of the infrastructure supporting distributed wind development in Europe, the project should conclude with comprehensive recommendations and policy options that might efficiently support distributed wind development in the US that is both cost-competitive and highly beneficial to local economies.

Schedule

This research could be completed by an experienced team in ten calendar months, based on the following:

1. Survey European Distributed Wind Market and Industry Infrastructure 4 months
2. Detail Local Economic Impacts of Distributed Wind 2 months
3. Critical Review of Infrastructure and Industry Needs in US 2 months
4. Local Identity (Social) Implications 1 month
5. Conclusions and Recommendations and Report 1 month
TOTAL 10 months