SERI/TR-744-778

May 1981

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Operated for the
U.S. Department of Energy
under Contract No. EG-77-C-01-4042

SERI/TR-744-778
UC CATEGORIES: UC-58,60

SERI/TR--744-778

DE81 025910

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PREFACE

This report documents the early experiences of several electric utilities in dealing with the legal and regulatory issues created by the siting of wind energy installations. The report indicates that utilities will need to address a number of land-use related issues carefully as they seek to obtain sites for wind energy systems.

The authors wish to thank the following individuals for their important contributions to the report: Barbara Glenn, Jim Ohi, and Mary Taylor, Solar Energy Research Institute (SERI); Jo Silversmith, INTERA Environmental Consultants; Eric Simons, student, University of Denver College of Law; Jan Beecher and Cleve Fraser, graduate students, Northwestern University. In addition, the authors thank the following people for their valuable comments and guidance: Donald Bain, Oregon Department of Energy; Gerald Farber, Pennsylvania Power and Light Co.; William Ostrander, Southern California Edison Co.; George Pring, University of Denver College of Law; Jeff Pearson, Colorado Office of Consumer Services; James Welch, Total Energy Consultants; Judy Porpotage, Rockwell International; Irwin Vas and Pete Michaelson, Solar Energy Research Institute.

The authors also are indebted to the many individuals who generously gave their time to be interviewed in connection with the case studies that form the basis of this report, prepared as part of SERI Task No. 3531.30 for the U.S. Department of Energy.

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SUMMARY

OBJECTIVE

A growing number of electric utilities in the United States are considering using wind energy as a power generation source. Currently, many utilities are investigating potential wind machine sites in their areas. Identifying suitable sites for large wind machine clusters, or "wind farms," requires more than finding a location with an adequate wind resource, however. Consideration must also be given to the legal and regulatory questions raised by wind energy system siting. The purpose of this report is to examine the early experiences of several utilities in dealing with the legal and regulatory issues that were raised in the process of siting wind energy installations. The report also makes recommendations as to how utilities can begin to address many of the identified issues.

DISCUSSION

Of all the legal and regulatory issues associated with utility siting of wind machines, two issues will be the most difficult to resolve: (1) land acquisition and use and (2) aesthetic controls. Land-use control regulations dealing with incompatible uses, nuisance factors, building scale limitations, and on-site environmental impacts may constrain wind machine siting by utilities. The siting issue of greatest concern is how the public will react to the hard reality—as opposed to the general concept—of wind power development. Although little public opposition to wind energy projects has been raised to date, it is possible that local attitudes will change as the novelty of the early single-unit machines wears off (and when deployment of multi-unit wind farms begins). In most cases, however, potentially adverse impacts based on local aesthetic concerns can be minimized or avoided by careful planning, siting, and design by utility developers and by close coordination with local planning and regulatory officials.

CONCLUSIONS AND RECOMMENDATIONS

The potential effect of land-use laws on wind machine siting by utilities will depend largely on the ownership of the land being sought for development. The issue that may pose the greatest obstacle to wind energy development on federal lands is whether emerging wind resource assessment efforts can be successfully integrated with the Federal Government's current comprehensive land-use review. A successful cooperative effort between the State of California and the Bureau of Land Management (BLM) to allow wind energy development on BLM lands in California may become an important precedent for future federal and state cooperation in this area.

The utilities' ability to gain access to state and locally regulated lands for wind energy development will be determined largely by the relationship of wind energy use to state and local land-use planning. To minimize potential land-use conflicts and ensure access to these controlled lands for wind energy development, the best approach may be for state and local governments to include wind energy use in state-required local land-use plans and in enabling legislation for local planning.

To help ensure access to federal lands for wind energy development, federal land-holding agencies should work with the states to ensure that land-use plans are compatible with wind power generation where appropriate and encourage a uniform wind development

leasing procedure. Similarly, states with wind resource potential should begin to develop mechanisms to hold and transfer wind rights and to develop criteria and procedures for siting wind farms in terms of land-use, environmental, and aesthetic considerations.

"Wind rights," the acquisition, holding, and transferring of guaranteed access to the wind resource for electric power generation, are vital to utilities' development of wind energy. The questions of whether and how to establish such rights, and determine their value once they are established, must be resolved before widespread wind energy development, particularly on private lands, can occur. Several methods for acquiring and preserving access to the wind resource are available.

Many states have adopted special laws for siting power plants. The potential application of these laws to wind machine siting by utilities may help speed the siting process. One state, Oregon, has already incorporated wind-electric generation in its energy facility siting law and has prescribed site development rules explicitly for wind machines.

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SECTION 1.0

INTRODUCTION

Wind energy could well be the first of the solar electric technologies to emerge for serious consideration as a utility power generation source [1]. As of 1979, over 50 electric utilities in the United States were conducting wind energy projects [2]. Some utilities have already committed substantial resources to the development of wind power generation. Pacific Gas and Electric Company, for example, has included 400 megawatts (MW) of wind power (in terms of machine ratings) as part of its generation expansion plans for 1990 [3]. Southern California Edison Company has included 120 MW of firm capacity (360 MW nameplate rating) in its plans for 1990 [4]. And Hawaiian Electric Company, Inc., signed an agreement to purchase 80 MW of wind-generated power by 1985 from a private firm that will retain ownership of the wind machines [5]. And in January 1981, Public Service of New Hampshire began purchasing electricity from the first operational "wind farm" in the United States [6].

Identifying sites for wind machine clusters ("wind farms") involves more than just finding a location with a suitable wind resource. Consideration must also be given to the proximity of sites to existing transmission lines, environmental impacts, aesthetics, and legal concerns as well as the availability of and alternative uses for the land. These issues have made it increasingly difficult for utilities to bring conventional power plants on-line in a timely way. Utilities will now be required to give careful consideration to a different set of legal, social, and environmental questions raised by wind energy system siting.

Delays in siting new energy facilities are often caused by a combination of complex and interrelated factors. The lack of effective advanced planning by developers, decreases in projected electrical energy demand, and difficulty in complying with regulatory requirements can all cause delays [7]. Federal Energy Regulatory Commission data, however, indicate that permit requirements and legal problems have combined to cause 25% of all delays for completing new power plants [8]. These particular problems involved in siting new energy facilities may be attributed to three basic institutional and social developments: (1) the large and growing body of regulatory laws at all levels of government that deal with specific environmental, health, and safety risks; (2) the ever-increasing geographic areas affected by environmental impacts and resource requirements of large new energy facilities; and (3) the increased willingness of public and private parties to oppose, by legal means, aspects of energy projects they perceive to be detrimental to their interests—environmental or otherwise [9].

A factor inherent in all three developments is the relationship between land use and power-plant siting. Land-use control measures dealing with incompatible uses (limiting the potential for multiple land-use options), nuisance factors (restricting the location and development of systems that generate noise, dust, etc.), building scale (limiting project scale for aesthetic reasons), and on-site environmental impacts may constrain wind energy conversion system (WECS) siting by utilities. Land-use laws are a reflection of public concerns about development impacts at any given time; thus, public attitudes about WECS may in part determine the constraints imposed on WECS development by land-use regulations. As a result, a significant difference in ease of siting may exist between WECS and conventional power plants, and between large and small clusters of WECS, since conventional plants and large arrays of WECS may invite greater regulatory scrutiny and public review.

1.1 PURPOSE AND SCOPE OF THE REPORT

In this report we do not attempt to make a definitive comparison of differences in siting WECS and conventional power plants. Indeed, we caution the reader to avoid making, such comparisons, given the early stage of WECS development and the lack of utilities' experience to date in siting WECS installations. Rather, the report's intent is to supplement information already available to utilities on a subject familiar to them—compliance with energy facility siting laws and procedures—with information on a subject not so familiar to them—the potential application of these laws and procedures to the siting of WECS. Any comparisons between WECS and conventional power plants that can be drawn from the report about siting will therefore be left to the utilities themselves.

It is also hoped that the report will benefit state and local regulatory agencies and their staffs, who will be called on to consider utility proposals for WECS developments more often as the technology gains wider acceptance and is put to greater use.

The report focuses on three questions:

- How are existing federal, state, and local energy facility siting laws and procedures, particularly land-use control measures, likely to affect the siting of WECS by utilities?
- How might public attitudes about WECS siting affect the level of public intervention in WECS regulatory proceedings?
- Are there significant differences in terms of regulatory requirements and public attitudes between small and large arrays of WECS such that, for example, smaller clusters of WECS may be more easily sited?

All three questions are examined first in light of the rules and procedures currently governing power-plant siting in the states, and then by comparing the letter and intent of those rules and procedures to their actual application in some early utility siting experiences with WECS installations.

Part of the overall WECS system is the wind turbine generator (WTG), which has a high speed rotor to drive a generator that produces electricity. WTGs comprise two generic types. A horizontal-axis WTG has its rotor rotation axis parallel to the direction of the wind flow (see Fig. 1-1). A vertical-axis turbine has its rotational axis perpendicular to the wind flow (see Fig. 1-2). Both types are used to generate electricity and/or mechanical power for direct applications. WTGs are expected to be available with nominal or nameplate ratings up to approximately 4 MW [10].

Only WTGs rated at 200 kW and above are considered in this report. This size turbine will be used mostly by utilities because of the substantial economies involved. Turbines of this size will also be purchased by private wind energy supply firms who will sell the energy output to utilities and other large institutions. The Windfarms, Ltd., contract with Hawaiian Electric Company is the first such arrangement. Although these large WTGs may be sited individually, the most likely configuration is in groups of 10 to 200 units per "farm," or cluster, of machines [11] (see Fig. 1-3).

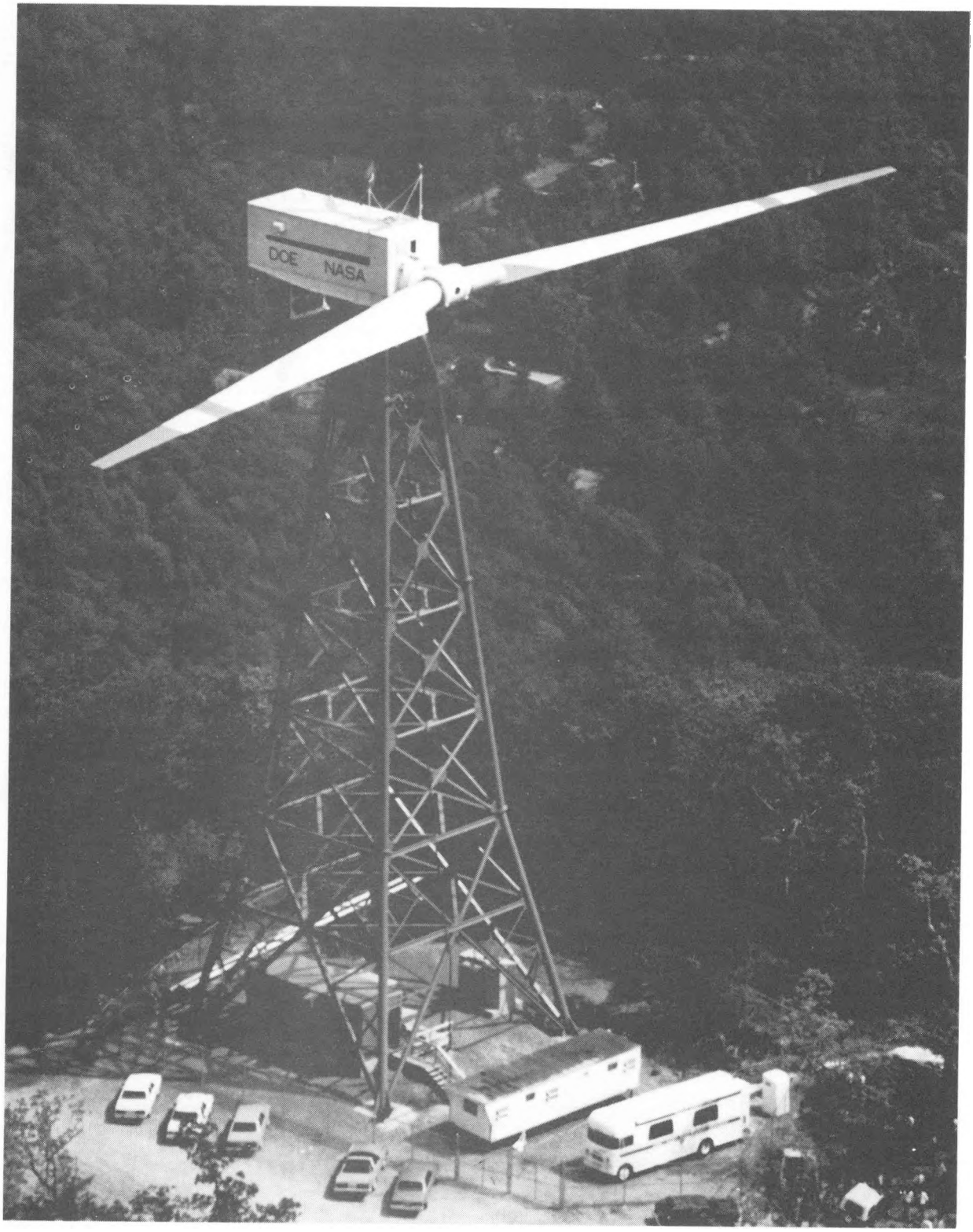


Figure 1-1. DOE MOD-1 — Boone, North Carolina

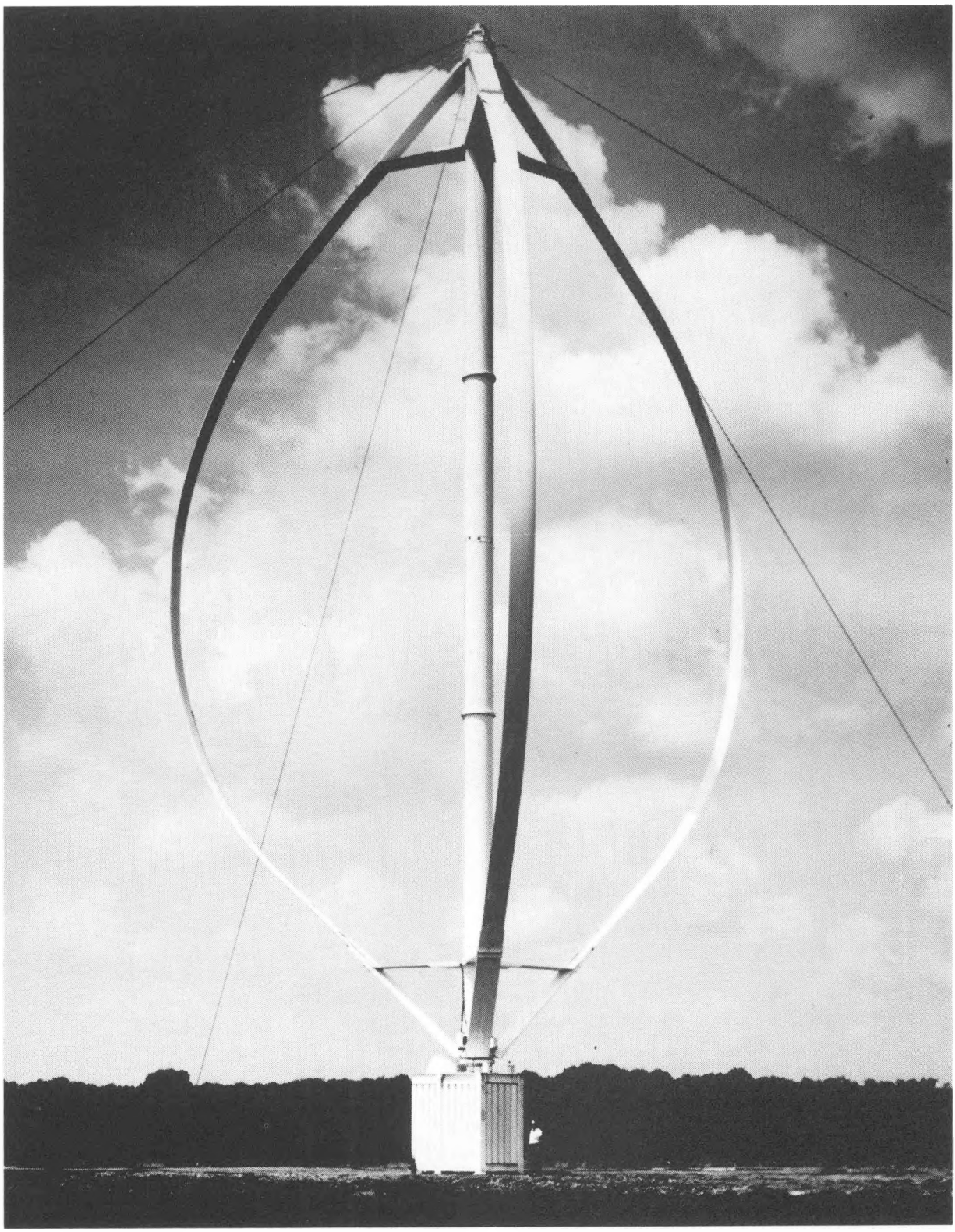
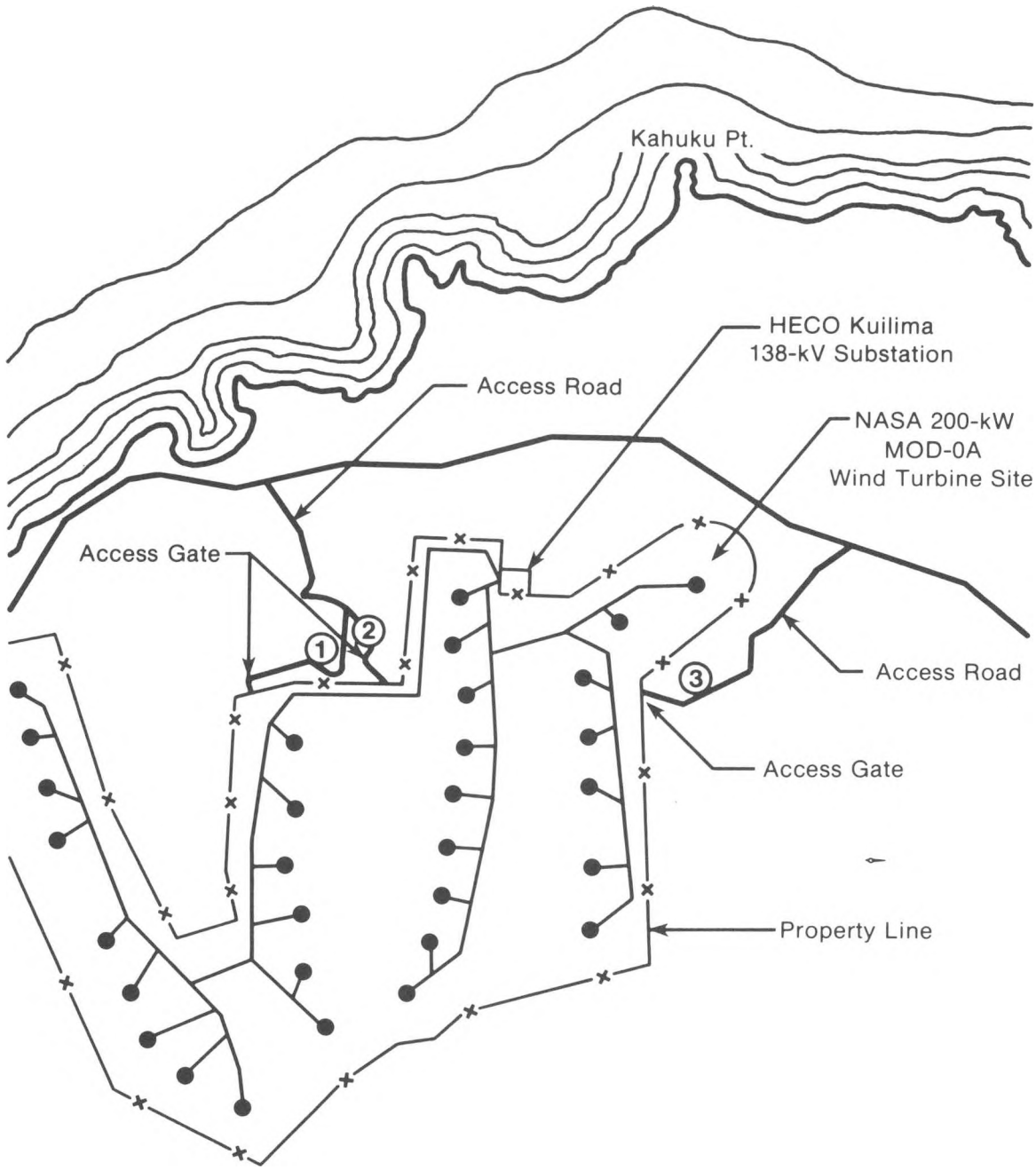


Figure 1-2. ALCOA Vertical-Axis WTG



Source: Hawaiian Electric Company, from **Wind Energy Report;** *Nov. 1979.*

Figure 1-3. Proposed Kahuku Hills 80-MW Wind Farm — 32 Units, 2.5 MW Each

The report will deal only with WECS defined as wind energy conversion systems that:

- range from 200 kW to 3 MW rated output;
- have application only in the electric utility industry to feed electricity directly into existing power grids; and
- include individual and multiple units (either grouped as "farms" or dispersed across a utility network).

Siting of small and moderate-sized WECS (1-200 kW) by homeowners, businesses, and other nonutility operators presents a host of issues associated with wind access, zoning, and liability. This report, however, will concentrate on the siting of WECS (as defined here) outside built-up areas, since this represents a more realistic scenario for conventional utility ownership and management.

This report will not deal directly with siting issues faced by nonutility developers of WECS (see Section 4.3). Although most of the legal and regulatory issues are the same for both utility and third-party WECS developers, some considerations that may be unique to the latter will not be examined here.

The term "siting" as used in this study refers to the activities beginning with long-range planning by utilities having identified the need for WECS generating capacity, continuing through the evaluation of alternative WECS sites and the selection of a candidate site, through the application for and receipt of necessary permits and approvals prior to construction [12]. Thus, the term refers to siting in the legal and regulatory sense and not in the sense of economic feasibility or resource assessment.

Power-plant development generally proceeds in three preconstruction phases: (1) need-for-power certification, (2) siting, and (3) permitting. Need-for-power certification requires the utility to demonstrate to the State Public Utility Commission or other siting authority, that there is a need for new resources either to meet rising electricity demand or to replace old facilities. The issue of need-for-power certification is generally beyond the scope of this report, except when it becomes an issue linked to siting or permitting. "Siting," as distinguished from the earlier, general use of the term, refers here to the actual process by which a utility obtains the necessary state (and sometimes local) approvals for a specific physical site on which to construct an energy facility. "Permitting" refers to construction and operating permits specific to a site that are required under various federal, state, and local environmental regulations. These permits usually pertain to a specific aspect of the facility's construction and operation such as air or water pollution discharge, waste disposal, or noise generation [13].

1.2 ORGANIZATION OF THE REPORT

We begin with an overview of the siting and permitting phases of power-plant development. General categories of federal laws and representative state and local procedures governing siting and permitting processes for new energy facilities are identified and reviewed briefly. State energy facility siting laws that have emerged in recent years and state and local land use regulations receive special attention. These laws and regulations are having an increasing influence on power-plant siting; we discuss their potential application to WECS siting.

How some of these laws and procedures have already been applied to WECS siting through a series of case summaries is examined next. The case summaries detail early experiences of six utilities in obtaining permits and approvals for new WECS installations. In addition, two potential WECS sites are compared. Finally, several conclusions and recommendations are offered based on utility experience to date.

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SECTION 2.0

POWER PLANT SITING AND PERMITTING: AN OVERVIEW*

Before considering current power-plant siting and permitting procedures, it is important to note the considerable geographic implications of siting new energy facilities. In regulating power-plant siting, the influence of a power system is not confined just to its geographic area of service. First, each individual system is interconnected to neighboring systems. Second, mainly because of public pressure and resource location, new plants often must be constructed at sites far removed from their load centers. Third, plant sizes and construction costs often require that several utility companies build a single-generation facility and share the power produced. Since a utility's sphere of influence extends beyond its geographic boundary of service, each siting action must be viewed not only in terms of its local effects, but its statewide and regional effects as well [14].

2.1 FACILITY SITING

The process of selecting and approving sites for new energy facilities has become increasingly complex and time consuming. Greater consideration is being given to the physical impact on local resources required by such facilities, as well as to prevailing institutional, environmental, and socioeconomic conditions. To cope efficiently with the uncertainties raised by these developments, more flexible approaches to selecting sites might be necessary [15].

In choosing a site for a new generating facility, a utility decision maker's principal concerns are the availability and proximity of resources that the facility will require. However, facility siting regulations introduce other issues that must also be considered in the siting decision. These include the potential impacts of the proposed facility on the surrounding environment, the socioeconomic effects of the plant on the community where it is to be located, and specific health and safety risks. For example, California law prohibits the siting of large energy facilities in areas where potential earthquake damage could occur [16].

2.1.1 Federal Requirements

The Federal Government generally does not play a direct role in approving sites for new energy facilities. However, federal agencies are indirectly involved, because a facility cannot be sited where it will violate federal pollution-control standards or land use regulations [17].

Although the Federal Coastal Zone Management Act of 1972 [18] has brought the Federal Government closer to direct involvement in energy facility siting in the 30 states that border on the coastlines or the Great Lakes, the states themselves are required to develop Coastal Zone Management Plans to implement and enforce the Act [19], often by incorporating special provisions into state facility siting laws.

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*Section 2.0 is derived from an excellent review of the energy facility siting process by Wellborn and Williams, "Improving the Energy Facility Siting and Permitting Process" [7].

Legislation was proposed in the last session of Congress to establish an Energy Mobilization Board (EMB) [20]. Enactment of this proposal could bring the Federal Government, through the EMB, into more direct involvement with the energy facility siting process. The legislation would allow a project to be designated a "priority energy project" before site selection, so that the EMB could expedite both the siting and permitting processes. Significantly, opponents of the measure are particularly concerned about the Board's authority to waive, with congressional consent, any state and local laws based on authority in federal law. It is argued, for example, that this would threaten most clean air and water rules because they were based on federal statutes [21].

2.1.2 State and Local Regulation

Most energy facility siting regulation takes place at the state level. As shown in Table 2-1, many states now have some kind of energy facility siting law and procedures. In general, developers are required to obtain a siting certificate or permit from a state agency, board, or commission after submitting a formal application. The application usually must include a detailed description of the proposed facility, its resource needs and the type and amount of pollutants it will produce. The siting application review process typically includes hearings to allow public comment and input from local governments in the area of the proposed energy facility site [22].

Historically, state regulation of major energy facility siting has usually followed what is referred to as the "single-site" approach [23]. Typically, the process starts when a developer selects a candidate site and conducts the required environmental impact analysis for the surrounding area. A plan is then submitted to the appropriate state agency for approval. The state then formally considers the application, conducts hearings under whatever procedures are required by state law, and makes a decision on whether to approve the developer's site proposal [24].

Two reasons are offered about why this process has grown increasingly complex and time-consuming in the past few years. First, as concern for the environment has increased and technical advances have allowed researchers to conduct more precise environmental monitoring, new state facilty siting laws have required more technical data and analysis to support siting and permitting decisions. Second, public interest groups and environmentalists have become more active in challenging siting proposals and have effectively used the threat of litigation as a tool to force utilities and state agencies to collect as much data as possible to defend their positions. As a result, the inflexibility of the single-site approach can lead to much wasted time and expense if the site proposal is rejected [25].

2.1.3 New Developments

Because the National Environmental Policy Act (NEPA) [26] and other environmental laws require that alternatives to a proposed project be examined, some states, notably New York [27] and California [28], now require that the developer submit multiple site proposals for a facility and conduct an environmental impact assessment for each site. The state siting authority then reviews the proposal for each site and approves either one or none of them. Generally, two or three alternative sites are required [29].

The newest approach to energy facility siting is known as "site banking." This procedure requires the greatest degree of involvement by the state government in siting decisions.

Table 2-1. STATE ENERGY FACILITY SITING LAWS

State	Certificate or Permit Required	Power Plant Siting Authority	Comment
Arizona		Power Plant and Transmission Line Siting Committee	One stop; 100 MW or more and $50,000 or more
Arkansas	X	Public Service Commission	
California	X	Power Facility and Site Certification	One stop; 50 MW or more; "thermal" facilities only
Colorado	X	Public Utilities Commission	
Connecticut	X	Power Facility Evaluation Council	One stop
Florida	X	Electrical Power Plant Siting	One stop; 50 MW or more
Hawaii	X	Public Utilities Commission	
Idaho		Public Utilities Commission	
Illinois	X	Department of Conservation	
Iowa	X	Iowa State Commerce Commission	
Kansas	X	State Corporation Commission	
Kentucky	X	Energy and Utility Regulatory Commission	
Maine	X	Public Utilities Commission	
Maryland		Power Plant Site Acquisition	One stop; site banking
Massachusetts	X	Energy Facilities Siting Council	One stop
Minnesota	X	Power Plant Site and Transmission Line Route Selection Authority-Minnesota Energy Authority	One stop
Mississippi		Public Service Commission	Utilities exempt from site certification
Montana	X	Board of Natural Resources and Conservation	Major Facilities Siting Act 75-20-101 et seq.
Nebraska		Power Review Board	700 volts or more unless municipal
Nevada	X	Public Service Commission	
New Hampshire	X	Bulk Power Supply Facility Evaluation Committee	

Table 2-1. STATE ENERGY FACILITY SITING LAWS (Concluded)

State	Certificate or Permit Required	Power Plant Siting Authority	Comment
New Jersey		Board of Public Utility Commissioners	
New Mexico	X	Public Service Commission	
New York	X	Public Utility Authorities	One stop; 50 MW or more
North Carolina	X	Utilities Commission	Dept. of Natural Resources and Community Development 113-1 to 113-28
North Dakota	X	Public Service Commission	One stop
Ohio	X	Power Plant Siting Commission	
Oklahoma		Corporation Commission	
Oregon	X	Energy Facility Siting Council	One stop; WECS Standards for 25 MW or more
South Carolina	X	Public Service Commission	
South Dakota	X	Public Utilities Commission	
Tennessee	X	Public Service Commission	Tennessee Energy Authority 4-28-103
Vermont	X	Department of Public Service	
Virginia		State Corporation Commission	
Washington	X	Energy Facility Site Evaluation	One stop
West Virginia	X	Public Service Commission	
Wisconsin	X	Public Service Commission	
Wyoming	X	Public Service Commission	One stop

Under this approach, the state conducts an ongoing program of environmental research and land-use planning to identify appropriate sites for future energy and industrial facilities. The utility's role is limited to demonstrating the need for a new power plant of a given size to be constructed by a certain date. Once that need is established by the state Public Utilities Commission, the state chooses the best site for the facility and assigns that site to the developer [30].

The Maryland Power Plant Siting Program [31] (PPSP) is the oldest site banking program in the United States, dating back to 1971. The program authorized the state to acquire up to eight sites suitable for future power plants. The sites may be obtained by contract or eminent domain and, following acquisition, are exempt from local zoning. Utilities may then either purchase the sites from the state or lease them on a long-term basis.

Since site banking removes the need to conduct a complete review procedure "from scratch" each time a new site is needed, it may lead to certain economies of scale with respect to the complex procedures for siting energy facilities. And, although site banking has experienced implementation problems and has not proved to be a panacea for siting problems in these states, it is thought to be fairly effective in minimizing some of the uncertainty and time associated with site selection and approval [32].

2.2 PERMITTING

In addition to need-for-power certification and siting approval, a new energy facility usually requires construction and operating permits called for by environmental and other regulations. These permits, issued at the federal, state, and local levels, usually deal with some aspect of the plant's operation, such as air or water pollution discharge. An increasing number of permits for federal environmental programs are now being issued by state agencies which have authority to administer the programs within the state [33].

The number of government laws and regulations that apply to the siting of energy facilities has steadily increased sinced the early 1970s. For example, in 1972 a utility needed only six government permits to construct an electric generating plant in Colorado; by 1980 the number of permits needed for such a project had increased to 60 [34].

2.2.1 Federal Requirements

Over 60 major federal statutes deal with some form of environmental regulation that can affect the siting of energy facilities [35]. While an examination of how these laws interact and who is responsible for carrying out their directives is important to a discussion of energy facility siting, the individual statutes will not be examined here, since they have been reviewed exhaustively in previous work on the subject [36]. However, brief summaries of the federal laws and regulations most likely to influence the siting of WECS by utilities are presented in Appendix A.

Apart from the growing number of permits that must be obtained, several factors might explain why current permit programs have often delayed completion of energy facilities. One typical source of delay is the institutional complexity faced by permit applicants. Developers frequently find it difficult to identify the correct agency and the correct office within that agency to which they must apply for each permit [37].

Redundant information requirements can also lead to delays. Different permit applications require the applicant to submit the same information in a revised format for each application. For example, data quantifying the size and functions of a facility and its environmental impacts must often be provided several times. Finally, regulatory uncertainty presents a significant problem for developers. Future regulations arising from new or existing environmental laws could seriously inhibit the development of new major energy facilities [38].

Generalizations about the sources and the nature of delays in the siting and permitting processes for nuclear and fossil-fuel power plants have been difficult to make because of the site-specific character of each situation [39]. Yet, because of widespread concern about the impacts of environmental permit procedures on timely facility development, attempts have been made to quantify the costs and delays. These efforts have had limited success, however, for three basic reasons. First, there has been no agreement on the definition of "delay." A choice must be made between using the applicant's or regulatory agency's target issuance date to determine how long the permit process was actually delayed. Second, data have been difficult to obtain on the causes and incidence of delays. Third, because accurate data on delays are so hard to acquire, translating delays into costs is almost impossible. Some utilities volunteer information on costs incurred, but their estimates are difficult to verify [40].

2.2.2 State and Local Regulation

As previously mentioned, the first phase of power-plant development requires a utility to obtain a certificate of public convenience and necessity from the state. Without this certificate, the utility is not allowed to include the new plant in its rate base and, therefore, is not permitted to recover the capital invested in the new plant. Thus, a regulated utility will not construct a power plant without this certificate.

The process of obtaining the certificate involves public hearings and substantial documentation to ensure that the plant is necessary to meet new energy demands or replace old facilities [41]. Some states with comprehensive siting laws include the environmental site evaluation in the process of considering the granting of a certificate of public convenience and necessity [42]. In other states with comprehensive siting laws, the certificate cannot be issued until the site selection and approval process is complete [43]. Either way, the states with special siting and permitting procedures require that the proposed site satisfy state and federal environmental regulations before a certificate of public convenience and necessity is issued. States that do not have special siting laws will issue the certificate only when all other applicable permits are obtained [44].

Most of the early specialized power plant siting laws were based on a procedure known as "one-stop" permitting. The one-stop concept is designed to reduce the number of permits that must be obtained and to coordinate all regulatory interests in the siting process. This is achieved by giving a single state agency, board, or commission control over all aspects of government review and regulation of the siting, permitting, construction, and operation of a power plant and transmission network [45].

The Washington State Thermal Power Plant Siting Act of 1970 [46] was the nation's first one-stop siting law. The act created an Energy Facility Site Evaluation Council with the power to adopt rules and regulations and to develop criteria for the design and location of thermal power plants and other energy facilities. The Council consists of representatives from the various state agencies and commissions having an interest in the siting

process. The Council attempts to develop sensible trade-offs where agency responsibilities conflict and to compromise diverse interests. The one-stop forum allows singular preconstruction certification, technical review, planning, and public hearings [47].

The results of one-stop permitting inititatives have, however, been mixed. Several administrative and interpretative problems have arisen. First, a state agency, no matter how broad its legislative mandate, cannot preempt the field of Federal Government regulation. For example, nuclear safety, air pollution, and water pollution remain the primary responsibility of federal agencies. Second, as these "super agencies" were formed, problems arose with existing state environmental and other regulatory bodies. Those state agencies possessing broad authority over power-plant siting and permitting have been reluctant to yield control over matters they felt were still within their domain. Third, local authorities, such as zoning boards, have found that state agency goals are often different from those of local constituents. These governing bodies often have refused to defer to state agencies on power-plant siting matters [48].

As more states have adopted power-plant siting commissions, the one-stop goal is regarded more as a consolidation or coordination of all government review and regulatory functions (including the Federal Government). Although much has been done to improve the original idea, questions still remain about the merits of the one-stop approach. Some studies of these initiatives have shown that no significant net improvement results from the one-stop procedure if each individual permit review step is inefficient [49].

2.2.3 New Developments

In a continuing effort to make permitting programs more efficient, several new programs have been started at the federal and state levels. Although not all of these programs are directed specifically at energy facilities per se, new energy facility projects could benefit from them. The four major programs are: (1) systems and procedures to help federal agencies coordinate their permitting activities, (2) Council on Environmental Quality (CEQ) regulations calling for advanced scoping of Environmental Impact Statement (EIS) requirements, (3) Environmental Protection Agency (EPA) permit consolidation programs, and (4) the Colorado Joint Review Process for federal and state permits [50].

To eliminate problems of institutional conflict and overlapping authority, federal agencies have begun two programs designed to improve interagency cooperation and coordination in administering permitting programs. First, to promote information sharing, the Office of Management and Budget (OMB) Permit Review Assessment Task Force has helped to establish an automated data base within the Office of Resource Applications of DOE. The data base contains permit action status reports from different federal agencies. Second, to develop cooperative procedures, several agreements have been reached among federal agencies having jurisdiction over environmental control of energy facilities [51].

The requirement to prepare an EIS freqently causes delay, because the applicant performing the initial environmental monitoring may be unsure about what specific questions need to be addressed and what level of detail is appropriate. To deal with this problem, new regulations established by the CEQ call for an advanced "scoping" procedure to be performed early in the NEPA process, before EIS preparation begins. This scoping procedure would ensure that all major environmental issues are considered and would obtain public input from people who live near a proposed facility [52].

EPA has also initiated a permit consolidation program to standardize permitting forms and procedures for many of the permit programs the agency administers. By consolidating certain review procedures, this effort seeks to eliminate duplicative information requirements and to take advantage of potential economies of scale in the permit application review process [53].

The State of Colorado's Department of Natural Resources (DNR) has recently begun a voluntary Joint Review Process (JRP) which will coordinate federal, state, and local permit procedures for energy facilities in the state [54]. Under the JRP, officials of the applicant firm and state regulatory agencies cooperate in designating a lead agency to coordinate the permit process and schedule permit applications in a manner that minimizes regulatory delay [55]. The Colorado program may provide an important precedent for federal, state, and local cooperation on energy facility siting matters.

As noted, legislation to establish an Energy Mobilization Board has been introduced in Congress. One provision of the proposed bill authorizes the Board to establish a permit status-tracking system for critical energy facilities, and would exempt state water laws from waiver by the Board [56].

SECTION 3.0

APPLICATION OF SITING LAWS AND PROCEDURES TO WECS

3.1 OVERVIEW

Although many utilities are now seriously considering wind energy as a source of electric power generation, only a few have had experience in siting machines. Moreover, most early sitings of WECS installations have involved only one unit, usually as a government-supported demonstration facility. This lack of utility experience and the absence of multi-unit development (which is a more realistic scenario for future utility development than single-unit installations) make it difficult to assess the potential application of energy facility siting laws to WECS. Nonetheless, those utilities we examined that have begun siting assessments and that have become involved in the permitting process offer some early insights into the process and its effect on WECS development.

It is significant that some states have already begun to consider the potential application of existing energy facility siting laws to large-scale WECS development. Table 3-1 outlines the key factors that California believes may affect the siting of large wind energy systems in the state [57]. Oregon's Energy Facility Siting Council (EFSC) has recently enacted rules for obtaining site development permits for WECS facilities of 25 MW and larger (see Appendix B). Hawaii also has enacted a new law that would make electricity generation by WECS a permitted use in state agricultural districts [58].

At the federal level, two major areas of potential involvement in the WECS siting process exist. The first occurs when either a federal power marketing agency (see Sec. 4.2.4) or developments on federally owned lands (see Sec. 3.2.2) are involved. Either case could require some form of environmental review under the National Environmental Policy Act (NEPA) [59]. Second, the Wind Energy Systems Act of 1980 speaks of procurement of WECS for use at federal facilities and establishes a WECS grant/loan program [60]. Numerous potential intersections with WECS siting will result from implementation of these programs under the Act.

Again, many questions about energy facility siting will arise in the context of environmental regulation. Dozens of studies dealing with possible environmental consequences of WECS development have been completed or are under way, and more are planned by DOE [61]. Many other projects have assessed potential environmental impacts of WECS as part of a larger project goal. To date, the consensus of these studies is that (1) WECS will impose only minor effects on the local environment; (2) most potentially adverse impacts will be specific to each site; (3) the major environmental concerns with siting large WECS will be safety, electromagnetic interference, noise, and aesthetics; (4) in some cases, site location can exacerbate or minimize a WECS impact on the environment; and (5) in most cases, potentially adverse impacts can be minimized or avoided by careful planning, siting, and design [62].

The implications of the last two findings for utility siting of WECS are important and go beyond environmental considerations per se. For of all the legal and institutional concerns associated with WECS development, most observers now believe that the issues of land use and aesthetics will be the most troublesome for utilities, state public utility commissions and siting authorities, and local governments [63].

Table 3-1. FACTORS AFFECTING THE SITING OF LARGE WIND ENERGY SYSTEMS IN THE STATE OF CALIFORNIA[a]

A. Environmental Factors

1. Strong and persistent winds
2. Elevation
3. Slope of terrain
4. Icing zones
5. Areas of special biological significance (including rare and endangered species, migration routes, etc.)
6. Earthquake zones
7. Cultural resources

B. Conflicting Land Use Factors

1. Farm lands (existing and potential prime)
2. Urbanized areas
3. Rural highways, roads, railroads, rights of way, airports, and airport approach paths
4. Scenic highways and sites
5. Recreational areas (existing and potential)

C. Aesthetic Considerations

D. Institutional Factors

1. National parks, state parks, national wilderness areas, primitive areas
2. State and national forest preserves, forest land in parks
3. Jurisdiction of State Coastal Commission
4. Areas administered by State Fish and Game Department
5. Military bases and reservations
6. Flood control areas
7. Indian reservations
8. State lands
9. Federal lands (Bureau of Land Management)
10. Privately owned land

E. Operational Factors

1. Existing power lines, 6 KV or more
2. Existing all-weather roads

[a]California Energy Commission 1980.

3.2 LAND USE AND LAND ACQUISITION

Many of the best potential wind resource sites in the United States are in mountain, desert, or coastal areas [64]. Preliminary assessments of wind energy potential in California, for example, indicate that about 40% of California's total realizable potential lies in the state's southeastern desert area [65]. However, siting large wind farms in some of these areas might create serious environmental and aesthetic concerns [66]. Access roads and interconnecting line corridors between turbines and to the nearest existing lines with sufficient excess transmission capacity must be examined in view of local land use laws and aesthetic considerations. Since many of these potential wind resource areas are in national forests, established wilderness, and wilderness study areas, the potential for land-use conflicts and environmental impacts concerns increases.

Moreover, WECS developers often will be required to determine whether development of potential WECS sites will be compatible with local, and, in some cases, state comprehensive land-use plans. In Sec. 3.2.3, we see that at least one state has attempted to incorporate WECS use as part of the state's long-term land-use planning goals.

Besides having to deal with land-use and aesthetic concerns as reflected by federal, state, and local energy facility siting and land use laws, utilities also face the question of how to acquire sufficient land for WECS sites. This problem involves more than the usual purchase or lease of lands for construction of facilities and for routing transmission lines; in the case of WECS, particularly for large multi-unit installations, additional land must be obtained or controlled to ensure adequate wind access and to provide sufficient spacing between individual machines. As demonstrated in Sec. 3.2.4, utility acquisition of wind rights, particularly over private land, may become the key issue in large-scale WECS development.

The potential effect of siting and land-use laws on WECS development will depend largely on the amount of land affected, current land uses, and form of ownership. Sections 3.2.1 to 3.2.4 include a discussion of the potential application of energy facility siting and land-use laws based on anticipated land area requirements for three forms of land ownership: federal, state, and private.

3.2.1 Land Area Requirements

The precise amount of land required for a multi-unit WECS site is difficult to calculate because the land required per megawatt of electric output is determined by many factors, including on-site wind characteristics, the geologic and natural features of a specific site, and the individual wind turbines' capacity [67]. Since wind is a dispersed resource, WECS must be dispersed to capture wind energy effectively. Each machine extracts energy from the wind, thereby reducing the wind velocity for a distance behind the rotor. If WECS are located too close together, the wind is not fully replenished before it encounters the next machine; the result is a loss in power produced by the downstream unit. Equidistant WECS spacing is necessary in areas without prevailing winds. In areas with prevailing winds, WECS may be sited closer together, perpendicular to the wind direction, with minimum loss in the total array output.

California and Oregon are among the first states to consider land area requirements for large-scale utility development of WECS. The Oregon Wind Task Force has developed a WECS land area calculation methodology, presented in Subsecs. 3.2.1.1 and 3.2.1.2. Significantly, the Task Force's calculations suggest that land impact economies of scale

can be achieved on two levels. First, by using larger diameter (i.e., greater capacity) and fewer WECS, impacts on land within the wind farm can be minimized. Second, compared with siting the units individually, wind farms can also offer economies in construction and operation. Dispersed sites require construction machinery, WECS components, and maintenance crews to be transported over longer distances. Access roads and power transmission tie-in lines would also be longer, increasing the land impacts. Both factors increase the potential environmental impacts of dispersed siting as well as the cost of construction and operation [68].

In California, almost all windfarms are expected to be sited in remote locations with an average of about 25-50 units per farm. For 250-ft-diameter turbines, the spacing would be 2000-2500 ft between units, or roughly the same as the 10-rotor diameter spacing suggested in the Oregon study.* Machine density would be about five units per square mile. This would correspond to between 10-25 megawatts per square mile, depending on the turbine generating capacity. Again, the actual density of units per farm depends to a large extent on whether the winds blow from any direction, or if winds predominate from one direction. In the former situation, individual turbines may have to be spread over a wide area; in the latter, the units could be placed much closer together. For example, in mountainous areas rough terrain and diverse wind directions could make siting difficult and require large amounts of land. Along mountain ridges, however, where the direction of high-speed winds is fairly constant and perpendicular to the ridge line, spacing could be reduced to as low as one diameter between units [69].

3.2.1.1 Land Area Calculations for Wind Farms

The following calculations illustrate a method suggested by the state of Oregon (see Ref. 10) to determine approximate land areas required for the siting of large WTG farms. It is assumed that all WTGs are arranged in a series of equilateral triangles which form rows such that the farm has an approximately square overall configuration. This method is useful for comparative purposes and estimations only for it does not account for irregular configurations which are likely to be used in the field.

Dedicated WTG Site Area. There are two basic categories of land that constitute the dedicated site area. They include the areas around each WTG pad which must be continuously clear for access and maintenance purposes. The area occupied by interconnecting roadways must also be included. It is assumed that the electrical interconnections are integrated with the roadways. The dedicated WTG site area is calculated as follows:

where

A = Area of pad around each WTG, $ft^2 = piR^2$
D = WTG rotor diameter, ft
I = Distance between WTGs, ft
R = Radius of dedicated zone around each WTG, ft
S = Number of rotor diameters WTG spacing
W = Interconnecting roadway width, ft
# = Number of WTGs in array

*Throughout this report, we have expressed measurements in English units, as is common in wind machine technology. To convert these measurements to metric units, use the following conversion factors: 3.048 ft = 1 m, 1 mile = 1.609 km, and 1 mi^2 = 2.590 km^2.

Dedicated Site Area, Acres = Acres conversion x (Roadway area + WTG pad area)

$$= 2.296 \times 10^{-5} \{\#[W(I-D)+A]\}$$

Note: This calculation includes an additional length of access road, the length of which is I less D.

Gross WTG Farm Area. The outer dimensions of a WTG farm encompass a much larger area than is calculated above. The gross area is "dedicated" only in the sense that wind access must be ensured within the boundaries of the area. The land area within the farm boundaries, less the dedicated area, can be used for many other purposes which are compatible with preserving access to the wind resource. Such uses include open range, grazing, and farming activities. The following calculation includes a buffer zone for wind access around the array of WTGs. The depth of the buffer zone is equal to I.

where $n \approx \sqrt{\#}$, $m = (2\#)/(n+n-1)$ — These calculations define the number of rows in a square array; n is rounded to the nearest whole number.

Gross WTG farm area acres = $2.296 \times 10^{-5} [(n+1)D^2(\sqrt{3/2})(m-1)+2)]$

Note: This approximation progressively loses accuracy when used for lower numbers of WTGs. This loss results in an overstatement of the gross area.

3.2.1.2 Basis for Calculations Used

All figures on land use presented here were taken from Environmental Data for Energy Technology Policy Analysis (see also Ref. 10). This document expresses data as resources used per 10^{12} Btu. This is equivalent to a 33.4 average megawatt plant. Capacity elements are factored into this figure.

Plant size	=	33.4 average MW
Land use	=	variable
Hours in 1 year	=	8,760
MWh/acre/year	=	$\frac{33.4 \times 8{,}760}{\text{land use}}$

3.2.2 Access, Wind Regime, and Other Site Considerations

It is important to note that the net, or dedicated, land impact of the individual unit will only be a small fraction of the gross farm area, as this represents the land area which will actually be disturbed during the construction and operation of the wind farm, access roads, and transmission lines [70]. For a 50-unit, 100-MW wind farm, the land dedicated exclusively to turbines would be about 3 acres (plus land for transmission and access), and the total dedicated land would be roughly 70 acres [71]. Except in forested areas where regrowth is not allowed during operation, the remaining land is available for other uses, since the turbines are high enough above the ground to provide adequate clearance between the blade tips (for a horizontal-axis WTG) and the ground (about 50 feet for a

typical 250-ft-diameter turbine design). Although the actual land needed for turbines and supporting facilities is small, it is dispersed over the entire, or gross, wind farm area. Further, the access roads and transmission lines will crisscross between units, which could limit some possibly compatible land uses [72].

Most favorable wind regions probably will have few mutually exclusive uses, with the possible exception of coastal recreation areas. Multiple land uses are considered feasible where grazing and agricultural activities occur. These lands are usually far from intensive human activities and population centers. This, in turn, is significant for the determination of other possible impacts including electromagnetic interference, safety, and aesthetic concerns (except in or near parks) [73].

Because of the relatively large land requirements and the critical need to site wind farms where winds are high, conflicts may arise between current federal, state, and local land-use plans and wind-farm development. The problem could become especially acute if many potential sites are located in areas such as along mountain ridges or on coastal lands, whose natural beauty or recreational value has been protected against development, as some expect. Careful planning by WECS developers and close coordination, particularly with federal, state, and local land-use agencies, can help minimize potential conflicts. Regardless of the potential land area requirements for wind farms, the key question for developers will be how to gain access, and at what cost, to those lands now under federal, state, or private control that offer good sites for development.

3.2.3 Federal Land

Lands under the control of the Federal Government offer some of the most favorable sites for large-scale WECS development. For example, the western rangelands are among the most desirable WECS sites in the nation [74]. Combining large, undeveloped tracts of land with a high wind resource, the wind power-producing potential of these areas is enormous. The question for developers is how to gain development rights from public landowners consistent with federal land-use policy.

Among the 11 contiguous western states, the Federal Government holds title to more than 40% of the land area [75]. Most of this land is controlled by either the Bureau of Land Management (BLM) or the U.S. Forest Service. Both agencies are given broad authority to manage their holdings consistent with federal policy, which generally requires that all uses of such land must both serve the national interest and comply with multiple use and environmental regulations [76].

Many federally owned lands hold great promise for WECS development, but sufficient wind resource data are not available at this time to pinpoint the best WECS installation sites on these lands. Much existing wind velocity data have been recorded at ground level, or at airports where favorable velocities are not likely to be found. Moreover, data are not standardized and measurement techniques are inconsistent [77]. Battelle Pacific Northwest Laboratory is under contract to DOE to produce a comprehensive wind atlas of the United States at approximately countywide scale. Thus far, the Pacific Northwest and Northeast regions have been documented, and remaining regions should be forthcoming during 1981 [78]. Efforts such as this will help identify preferred locations and establish a comprehensive inventory of favorable sites.

The issue that may pose the greatest obstacle to WECS development on federal lands is whether these wind data efforts can be successfully integrated with the Federal Government's comprehensive lands review currently under way. The concern is that, in the absence of sufficient wind resource data to pinpoint favorable sites on federal lands, many of these lands will be reclassified under the current review to preclude future WECS development; or that lands will be designated in a way that will make it difficult to change their classification in the future, when later resource data may show their great potential as WECS sites.

The Federal Land Policy and Management Act of 1976 (FLPMA) [79] mandated a 10-year wilderness review covering all land administered by BLM. The first phase of the review is to inventory BLM lands for roadless areas of over 5000 acres that have "wilderness characteristics" [80]. A study phase considers land use and resource management issues to determine which of the areas identified in the inventory should be recommended to Congress for permanent designation as wilderness areas. Such Congressional designation closes an area to all development.

The case studies we conducted dealing with utility experience in WECS siting revealed an interesting, and perhaps precedent-setting, development in this area. California was selected as a case study for the BLM review process. The BLM and the U.S. Forest Service are identifying areas with wilderness potential through the BLM California Desert Wilderness Inventory and Roadless Area Review and Evaluation II (RARE II) programs, respectively. A majority of the locations identified by California as potential wind resource areas are presently being assessed by these agencies for wilderness status. These areas include large portions of the southeastern desert and many forested areas along the Sierra and northeastern mountain ranges. Although both of these wilderness programs have potential for affecting WECS development in California, the BLM Wilderness program probably will cause the most significant and immediate effect [81].

The major concern surrounding WECS development is that BLM owns some 12 million acres, or 50%, of the desert lands in Southern California—including some of the highest wind resource regions. The California Desert Plan proposes four alternatives for classifying future use of the BLM desert area:

- A Use Alternative favors management policies that would make maximum consumptive and intensive use of the California desert, such as mineral development, utility corridors, and power plants, and would mandate minimal rules and procedures for protection and conservation of desert environmental resources.
- A Protection Alternative favors protective policies and limited uses of land resources (including electric generation) to ensure preservation of sensitive desert values, such as desert plants and animals and scenic quality.
- A Balanced Alternative seeks "the best of both worlds," considering social and economic demands and uses of resources equally with the need to protect and preserve sensitive desert resources and environmental values.
- A No Action Alternative would leave present BLM management practices intact [82].

The California Energy Commission (CEC) has expressed concern about three aspects of the BLM review with respect to wind energy development: (1) wind energy was lumped together with other energy development concepts; (2) key wind resource areas were removed by designation as wilderness areas; and (3) WECS deployment was disallowed in the so-called "limited" class (there are four land-use categories: controlled or wilderness, limited, moderate, and intensive) [83].

The Commission informed BLM of potential high wind sites. This led to further formal comment on the BLM review by the CEC; the Commission's position was formally endorsed by DOE [84].

The final California Desert Plan will include recommendations to be presented to Congress, probably late in 1982. The BLM's effort could either promote or hinder WECS development in certain areas of the state, depending on which alternative is chosen. Preliminary CEC studies indicate that as much as 40% of the wind energy potential in California is in the Desert Plan area [85]. At this stage of the process, it appears that the efforts of the CEC and the BLM to achieve a reasonable balance between wilderness protection and the need for wind energy development in California have been successful. As evidence of this, the Commission has been informed by the BLM that:

- the BLM will allow wind, geothermal, and solar energy development in "limited" areas of California (an Environmental Impact Report will be required, however); and
- the Commission will be allowed to pursue wind resource assessment anywhere (even in wilderness areas) on BLM lands in California in the hope that land designation can be changed at a later date [86].

In a related development, the first major attempt by a private party to gain access to federal lands for WECS development began recently. Windfarms, Ltd., [87] has filed a request to lease 2000 acres of BLM lands at the San Gorgonio Pass in California. BLM consideration of the Windfarms proposal could set an important precedent for the application of BLM and other federal land-leasing policies to large-scale WECS development. The Windfarms case will go far in determining whether existing federal land-use and environmental regulations will be an impediment to early WECS development on federal lands. The potential exists, as indicated in Sec. 2.1.1, for a lack of coordination among the numerous federal agencies that could become involved in the decision-making process. BLM is requiring that an EIS be prepared in connection with the Windfarms development at San Gorgonio Pass. One option under consideration is to merely require a generic EIS for the area with Windfarms being responsible only for dealing with any specific issues associated with its site and project [88].

If large-scale wind power projects are to be successfully sited on federal lands, two potential land-use problems must be resolved soon. First, the U.S. Forest Service and BLM must begin to work closely with the states and DOE to identify potential WECS sites, establish WECS development as a permitted use, and include such use in the long-range planning process. Otherwise, when a WECS siting application is presented it will be necessary for federal agencies to develop specific review procedures in each case. The lack of coordinated government planning for WECS could also cause the developer considerable delay if he/she must obtain a variance to existing land use plans in each instance. Second, as the California and BLM effort and the Windfarms experience suggest, there is a need to establish a siting policy for WECS now, to reduce the current uncertainty about WECS development on federal lands at a time when far-reaching federal lands review is already under way.

3.2.4 State and Local Regulation of Privately Owned Land

The developer's ability to gain access to state and locally regulated lands for wind energy generation will be determined by two factors: (1) the relationship of wind energy use on such lands to long-term comprehensive land-use planning, and (2) the availability of effective mechanisms for the developer to lease or acquire such lands.

State land-use controls are usually in the form of regulations designed to restrict or encourage particular uses and forms of uses of specified lands. Such controls are generally exercised by state planning bodies attempting to establish desirable patterns of growth or land resource use. Some states [89], however, have recently strengthened their land-use policy by imposing minimum standards of compliance with state standards on local municipalities or by assuming direct control of the permitting process for specified activities or areas [90].

California offers a good illustration of the potential role of a state government in local land-use planning. The state has mandated local planning [91] and established a statewide program within the Governor's office [92] to assist local and county government and all other state agencies in coordinating their planning activities [93]. The Office of Planning and Research has no direct regulatory authority [94], but it does provide guidelines for local general plans. Without general plans, local municipalities do not have the power to approve developments, because the state requires that development must be consistent with a general plan [95]. The local general plans must contain nine elements, including a "conservation element" for conservation, development, and use of natural resources. Thus, while resource planning must be a part of all local land-use planning in California, there is no specific direction that such planning must take. Resource planning can therefore be as comprehensive or as superficial as the local government decides to make it. Because there is no comprehensive statewide plan, all statewide planning is performed on a functional basis (e.g., air, water, transportation). The Office of Planning and Research attempts to encourage these functional planners to coordinate with each other and with the local general planners to arrive at compatible land-use plans [96].

The potential effect of state-level land-use planning on WECS development is not likely to be so much in the existence of such plans as in their interpretation and enforcement, or lack of it, exercised at the municipal and county levels. For example, in California, as in most states, the siting of WECS installations will be subject to the land-use planning and control laws of the county in which the site is located. California county governments vary widely in their concern for environmental and related land impacts from proposed energy and other developments; some counties may not enforce environmental regulations aggressively, while other counties may require a full-scale environmental review of all proposed developments. Thus, a WECS developer who locates a favorable site or set of sites situated in two or more counties could be faced with a markedly different regulatory burden in each county as he or she attempts to comply with county land-use plans and environmental regulations [97].

At least two states have attempted to minimize the potential conflict between existing land-use plans and future WECS development. Hawaii recently enacted a law [98] making generation of electricity by WECS a permitted use in state agricultural districts. Before passage of this legislation, permits for operation of WECS in agricultural districts (which contain some of the state's most favorable wind sites) were required from both the county and the state, a process that entailed wading through six months of red tape. The bill essentially eliminates the need to obtain these permits and applies only to WECS [99].

To reduce potential land-use conflicts and ensure access to state lands for WECS development, the best approach may be for states to include WECS use in state-required local land-use plans and in enabling legislation for local planning [100]. Oregon, for example, has already incorporated wind energy use to some extent in its land-use goals [101]. Currently, three statewide planning goals affect the planning and siting of WECS. One goal calls for each jurisdiction to include in its comprehensive plan an inventory of the "location, quantity, and quality" of wind energy resources, among others. The inclusion of a wind energy resource in the inventory implies that work will begin to adopt appropriate local procedures, codes, and ordinances that would allow for the use of WECS. Another goal stipulates that renewable resources, including wind, will be "provided for" whenever possible within the land conservation and development process [102].

Unfortunately, actual WECS-related achievements have fallen far short of expectations. Significantly, one of the perceived difficulties is in determining the value of wind rights and in establishing an effective mechanism by which developers can lease or acquire such rights to protect wind access at any given site [103]. To address this problem, the Oregon Department of Energy is considering several proposals to establish rules for WECS development. One draft administrative proposal would prescribe uniform procedures for leasing "wind resource development rights" to individuals, businesses, and public bodies to encourage development of state lands with wind resources. Another draft legislative proposal would give authority to cities and counties to adopt standards and procedures to protect future wind generation site areas and to require wind lease recordation within their jurisdictions [104].

3.2.5 Wind Rights

"Wind rights" is a term that describes the acquisition, holding, and transferring of guaranteed access to the wind resource over land for electric power generation. Wind rights are vital to the development of wind energy. Without the means to obtain guaranteed wind access, developers may be forced to acquire large tracts of land just to have some control over the long-term availability of the wind at a potential site. Such an alternative would be unduly expensive and impractical in most cases. There are currently no protected "rights" to the wind in any state. The questions of whether and how to establish such rights, and determine their value once they are established, will need to be resolved before successful, widespread WECS development can occur.

The issue of acquiring and preserving access to the wind resource is essentially a legal one. Questions about wind rights have only recently been identified as a legal concern, however, and have not yet emerged in the public consciousness about large-scale WECS development. Few, if any, actual conflicts leading to litigation have occurred. There is, therefore, a lack of directly applicable legal precedent or other authority for acquiring wind rights. The analysis, therefore, must rely on general applications of traditional legal theory or possible legislative approaches.

The Oregon Attorney Generals' Office has suggested several methods for acquiring and preserving access to wind on private land that could be available to developers [105]. Such methods fall into two groups: (1) private actions and (2) public actions.

- Private Actions. Given the existence of a willing seller and a willing buyer, access to wind flow can be readily acquired or preserved. Current real property devices could lawfully be employed to that end. Two such methods are relevant to large-scale WECS development.

- Acquisition of Fee Title to Sufficient Property. If the price were right and financing were available, a WECS developer could ensure access to wind by acquiring, either through fee ownership or long-term lease, sufficient land to preserve an unobstructed flow. This approach has limitations, principally the cost involved. However, it may be that the developer could put the "excess" land to a variety of remunerative uses that would not interfere with the operation of the WECS [106].
- Acquistion of a Negative Easement. An easement is a nonpossessory interest in the land of another which entitles the owner of the interest to a limited use or enjoyment of the other's land and to protection from interference with this use [107]. If a WECS developer could determine the amount of space needed on adjoining land to preserve wind access, he or she could negotiate to acquire a negative easement on that land. The negative easement would prohibit the owner of the adjoining land from building structures or planting vegetation that would obstruct the wind flow. A negative easement can be perpetual or of limited duration, and can usually be recorded in the county property records to give notice of its existence to others who might later purchase the burdened property. Acquiring a negative easement may be less expensive than obtaining fee title to an equivalent amount of real property, depending on the development potential of the land and the amount of development permitted under the easement [108].

- Public Actions. There are a variety of steps that can be taken legislatively to assist in the obtaining and preserving of wind access. Three examples of such steps follow.

  - Statutory Recognition of a Wind Access Easement. Several states have now given statutory recognition to solar energy easements [109]. In Oregon, for example, a 1979 law recognizes a solar energy easement and states that such an easement "runs with the land." The law also provides that solar easements can be recorded [110]. While such legislation is probably not required to make solar easements valid as a matter of law, they can act to clear the air on such transactions [111]. An analogous statute for wind access easements could be equally useful [112].
  - Wind Access Permits. Cities and counties could establish systems whereby WECS developers could obtain a permit, similar to a building permit, defining one's wind access. Once the permit is issued, owners of adjoining land would be prohibited from using their property in ways that would interfere with the WECS installations. Alternately, a permit could be sought based on a prospective installation or wind farm of a certain size and configuration. Under either approach, a comparison is permitted of the costs and benefits of competing property uses, with a decision made at the local level. Either approach, however, would probably require case-by-case resolution [113].

    If wind access permits were to be issued prospectively, it seems likely that the government body issuing the permit could set conditions on the continued validity of that permit, requiring the recipient to take steps to develop WECS installations within a certain period of time. This should prevent speculators from cornering the market on good WECS sites [114].

- Public Acquisition of Wind Easement. Oregon law permits the state and local governments to acquire by purchase, agreement, or donation (but not through the use of eminent domain) "conservation or scenic easements" [115]. Such easements can be transferred to nonprofit corporations actively involved in protecting the scenic or conservation values in question. Analogous legislation could authorize the state to acquire wind access easements—a process that would be similar to the site banking programs of states like Maryland. Without any government efforts to get into the WECS business, the easements could be leased or otherwise assigned to WECS developers [116].

Windfarms, Ltd., and Southern California Edison Co. currently are active in acquiring land for wind access near California's San Gorgonio Pass. Wind access rights from lands adjacent to planned wind farm sites are being acquired through the purchase of negative easements. The value of the easements and, hence, the development rights, are being negotiated as a stated percentage of the fair market value of the land over which the wind access is desired [117]. Clearly, the question of how to determine the value of development rights will be a major factor in gaining access to private land for early WECS development.

3.3 PUBLIC ATTITUDES AND AESTHETICS

The WECS siting issue of greatest concern, according to many observers, is how the public will react to the hard reality—as opposed to the general concept—of wind power development [118]. In one 1977 survey [119] 80% of those persons sampled were favorably disposed to the use of wind energy as a method of generating electricity [120]. How these people will respond to the actual appearance of clusters of 25, 50, or more machines the size of 20-story buildings is another question.

The visual impact of WECS installations can be influenced by the public's general attitude toward the concept of wind energy. To date, little public opposition has been raised to wind projects. For example, in most of the latest DOE proposed demonstration sites, the wind energy project has been enthusiastically supported by the public as well as by local and state officials. The earlier demonstration units are considered aesthetically acceptable and, in some cases, have become tourist attractions [121].

Information we obtained from our case study site operators generally supports this conclusion. However, we note one important exception reflected by the experience of Green Mountain Power in Vermont. As the case summary indicates (Sec. 4.2.6), Green Mountain has run into considerable local opposition to the construction of a meteorological tower to take wind data at a proposed site as a precursor to the siting of a wind machine. The opposition to the meteorological tower seems to center entirely on the issue of the aesthetic "setting" in which a later WECS installation would be placed (the proposed site is on the west slope of Lincoln Mountain). Significantly, although opponents have raised a variety of issues about wind systems use in the area—including safety, noise, and icing—these issues appear to be secondary to the major concern of siting a WECS where it will be seen as an intrusive disruption to a popular and visually attractive mountain ridge.

The Vermont case raises a number of questions about the impact of aesthetic concerns on WECS siting. First, it may be that, as the novelty of WECS wears off and large-scale deployment begins, local public attitudes may change to those espousing greater scrutiny of siting proposals from an aesthetic point of view. Second, aesthetic concerns may become more serious if there proves to be a strong correlation between sites of high wind

power potential and sites of high visibility (mountain ridges, gorges, etc.). Third, although aesthetics is primarily a social issue, it can have profound legal impacts. For example, before granting a right-of-way on federal lands, the appropriate federal agency must consider the impact of aesthetic and scenic values [122]. Also, NEPA regulations require that the environmental assessment include aesthetic impacts [123]. Eminent domain hearings must afford the affected parties the right to be heard [124].

The public has many misconceptions about wind machines and is largely uninformed about WECS [125]. In dealing with the aesthetics issue, therefore, a key element of any siting project will be an information campaign designed to involve the affected community in the siting process.

3.4 WECS SITING UNDER STATE ENERGY FACILITY SITING LAWS

Many states have adopted special laws for siting power plants and transmission lines (see Table 2-1). The purpose of such laws is to reduce the number of agencies from whom permits must be obtained, to coordinate all interests in the siting process, and to ensure that siting is consistent with state and local land-use plans.

It is significant that many states with comprehensive siting laws reserve access to the facilitated or so-called one-stop siting procedure to only major energy facilities [126]. A common threshold for inclusion in the comprehensive siting process is 50 MW [127]. Thus, any power plant that produces less than 50 MW would be required to go through the usual multiagency permit process rather than the expedited procedure.

This power threshold has important implications for the potential application of state siting laws to WECS development. In contrast to most other electricity generating facilities, WECS may be deployed incrementally through very small capacity additions. This raises a number of questions:

- How much land (or wind rights) should a developer acquire before installing the first WECS?
- Should environmental impact assessments consider the facility site firmly planned or the maximum practical site for the area?
- Where size of an installation triggers special siting procedures, should a developer's plan be evaluated when the threshold is passed (i.e., the fiftieth MW is installed) or when it becomes possible that the threshold will be passed?

Because there are only a handful of wind farm developments under way, it is still too early to predict how state energy facility siting officials will view WECS installations that may be developed incrementally. One Oregon official told us that the regulatory environment and threshold minimums were likely to change in his state once large-scale WECS proposals began to come in [128].

Even if wind farms are eventually brought under the authority of state siting procedures, perhaps by reducing the megawatt threshold, they may still not be eligible since some states also limit coverage to "major steam electric generating facilities" [129] or "thermal energy sources" [130].

The Oregon Energy Facility Siting Council (EFSC) is the first energy siting body in the United States to extend its procedures explicitly to WECS. The EFSC is a one-stop siting agency for major energy-related facilities in the state. The Council's jurisdiction includes electrical generating facilities and major electrical transmission lines. The siting process provides for direct participation by private citizens as well as state agencies. A positive finding on the part of the EFSC results in the issuance of a site certificate containing specific conditions for construction and operation [131].

Importantly, the issuance of a certificate also binds all state agencies and affected counties and cities to the issuance of all permits required for construction and operation, subject only to the conditions of the site certificate. As a matter of practice, the EFSC requires compliance with local comprehensive land-use plans. EFSC general standards require that the siting conform to the statewide planning goals and comprehensive plans and zoning ordinances of political subdivisions where facilities are to be located [132].

In August 1980 the EFSC approved rules for obtaining site development permits for WECS facilities (see Appendix B). All wind farms of 25 MW and larger will be required to obtain a permit from the EFSC. Facilities of less than 25 MW must obtain their site development permits separately and individually from all applicable state and local authorities [133]. As to whether WECS facilities that are developed incrementally will be subject to the new rules, the EFSC looks at the cumulative MW potential of the site for which development is sought, the developer's plans, etc. Incremental additions for less than 25 MW each do not merit exclusion from the EFSC process. Also, crossing the 25-MW "barrier" is not an automatic trigger for EFSC consideration, since it is assumed that an EFSC permit would have been required initially [134].

SECTION 4.0

UTILITY EXPERIENCE WITH WECS SITING: CASE SUMMARIES

4.1 UTILITY SITING OF WECS: CURRENT STATUS

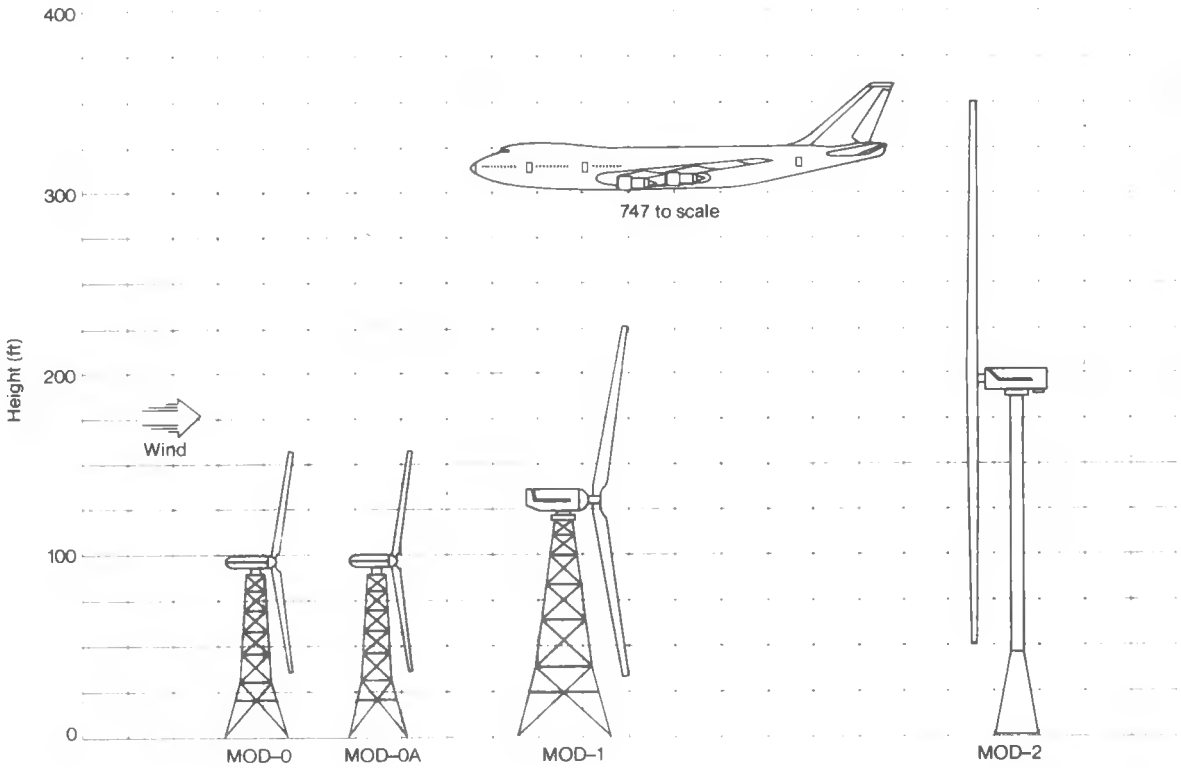
Utility-scale application of wind power is the subject of a good deal of current experimental and analytical activity. Activity is not only at a high level (in terms of the installed megawatt capacity, either on-line or in planning stages) but also extremely diverse (the number of utilities participating) and advanced (relating to the scale of demonstrations—i.e., full-scale machines are currently being installed). Much of this effort has been associated with DOE funding. Key large-scale demonstrations include the 100-kW MOD-0 at Sandusky, Ohio; four 200-kW MOD-0s in Rhode Island, Puerto Rico, Hawaii, and New Mexico; a 2-MW MOD-1 in Boone, North Carolina; and three 2.5-MW MOD-2s in Goodnoe Hills, Washington (see Fig. 4-1). In addition, the federal program has stimulated significant site evaluation and even preliminary licensing activities under DOE's competitive site selection program [135].

In addition to these federally sponsored efforts, a number of strictly private efforts are developing. These include:

- Southern California Edison—one unit in operation in Palm Springs, California;
- Pacific Gas & Electric—one unit planned for 1982;
- Eugene Water and Electric Board—leading a consortium that has installed a 500-kW unit in Newport, Oregon;
- Pacific Power & Light—operating one unit in Coos County, Oregon;
- Windfarms, Ltd.—planning an 80-MW wind farm in Hawaii;
- U.S. Windpower—operating a 600-MW wind farm in New Hampshire; and
- WTG Enterprises—200-kW machines at Cuttyhunk Island, Massachusetts, and Whiskey Run, Oregon.

A third category of activity is that associated with many utilities and communities that are conducting evaluations of wind power prospects. Such entities may have been encouraged by DOE preliminary evaluations, the prospects for federal grants, or their own needs for energy alternatives. Two examples discussed below are Luddington, Michigan, and Amarillo, Texas.

In the following pages, this report discusses eight WECS siting cases in some detail. Of these, three are federally related, three are private, and two are associated with potential sites, those where actual hardware-oriented activity has not yet begun. In each of these cases, the sites have been visited by one of the authors and detailed discussions have been held. The focus has been on the environmental, legal, and regulatory issues faced by the actual or prospective installations, and their implications for future WECS development. Although only a handful of utility-operated or planned WECS sites existed at the time the study began, those sites we did examine were chosen on the basis of six criteria, listed in Table 4-1, to help ensure the validity and usefulness of our findings.



	MOD-0	MOD-0A	MOD-1	MOD-2
Tower height	100 ft	100 ft	135 ft	200 ft
Rotor blade span	125 ft	125 ft	200 ft	300 ft
Rated power output for rated wind speed	100 kW	200 kW	2.0 MW	2.5 MW
Rated wind speed (at 30 ft)	14.5 mph	17.3 mph	25.7 mph	19.9 mph
Expected energy output per year*	700 MWh	820 MWh	3.7 GWh	9.3 GWh
Mean wind speed (at 30 ft)	14 mph	14 mph	14 mph	14 mph
Cut-in/Cut-out speed	10/35 mph	10/35 mph	11/35 mph	9/35 mph
Weight/kW	800 lb/kW	450 lb/kW	328 lb/kW	240 lb/kW
Location (first rotation)	Sandusky, Ohio (1975)	Clayton, New Mexico (1977) Culebra, Puerto Rico (1978) Block Island, Rhode Island (1979) Oahu, Hawaii (1980)	Boone, North Carolina (1979)	Goldendale, Washington (1980)
Prime Contractor	NASA	Westinghouse Electric Corp.	General Electric Co.	Boeing Engineering & Construction

*For the given mean wind speed and standard wind duration curve. The actual wind characteristics at any specific site may differ from those used in computing the expected energy values in this table.

Source: EPRI Journal; March 1980.

Figure 4-1. Federal Large Wind Turbine Program: Scaling Up Horizontal-Axis Machines

Table 4-1. CRITERIA FOR WECS/UTILITY CASE STUDIES

Criteria	Objective
1. Project type	Achieve balance of federal demonstration and commercial projects.
2. Utility characterization	Obtain representative sampling of utility types; e.g., investor-owned, municipal, and cooperative.
3. Geographical distribution	Account for regional differences in regulatory environment, sociopolitical character, etc. (e.g., coastal site vs. inland site).
4. Regulatory environment	Ensure broad range of regulatory environments faced by WECS siting; e.g., differences in state energy facility siting laws and procedures, environmental laws, PUC requirements, public vs. privately owned sites, etc.
5. Real vs. potential sites	Choose some potential sites to compare with actual WECS/utility projects.
6. Utility planning considerations	Wind farms vs. dispersed sites, scale, load characteristics.

4.2 CASE SUMMARIES

4.2.1 Pacific Gas and Electric Company

Pacific Gas and Electric (PG&E) of California investigated two potential locations for the installation of a WECS. After an extensive review by the company in cooperation with the California Energy Commission, sites in the counties of Solano and Alameda were chosen as targets for in-depth examination of their potential. The Solano site is near the intersection of Highways 680 and 80; the Alameda location is near the intersection of Highways 580 and 5. Both may be described as lands of rolling hills, low density populations consisting mostly of cattle ranchers, and warm climates. Presently, the company operates about 12 meterological towers and continues to collect wind data in order to facilitate its selection decision. The company is also in the process of preparing a final draft report of its site selection process. The company plans to construct a Boeing MOD-2 (2.5-MW) wind turbine by January 1982, and another unit in 1985. Long-term plans include 87.5 MW by the end of this decade and 120 MW by 1982. The first wind turbine will be located at the 5000-acre Solano site, which the company has recently purchased. PG&E emphasizes, however, that no final decisions have been reached regarding which of the two sites represents the best candidate for further development. PG&E will continue its extensive monitoring program at both sites for the next two years.

4.2.1.1 Environmental/Legal/Regulatory Experience

The site selection review conducted by PG&E consisted of a set of several site criteria, all of which are of interest to this study. This information was made available in an interview with a representative of the company's Siting Department and it illustrates the company's simultaneous concern with technical and environmental issues in choosing between the two locations.

Geological/Geotechnical. As with nearly any California WECS site, there is a potential earthquake threat. This problem seems to be more of a threat to the Solano location. The implications of this condition are most immediate for WECS designs which must, of course, accommodate potential earthquake stresses. Although the company has ordered a MOD-2 WTG from Boeing, it did indicate that if the Solano site were chosen, special design questions would require attention.

Ecological Impacts. Both sites are found in areas used mainly for cattle grazing. It is felt that this activity could continue relatively undisturbed, since the turbines would occupy only a small portion (5% was mentioned) of the land area. Special ecological considerations are apparent, though, in both counties. In Alameda County, there is a particular type of snake whose habitat might be disturbed significantly. In Solano, the issue is somewhat more complex, because the site is near a marsh which the county seeks to protect. This area is also a migratory path for some birds. Because of these considerations, the Solano County government is requiring an environmental impact report (EIR) from PG&E prior to approval of the project. Alameda County would require only a route review from the company that would specify the proposed location of transmission lines from the turbine. PG&E does, though, plan to conduct an environmental impact review of both sites even though one is not actually required by Alameda County.

Noise. PG&E has established a noise criterion of a 4000-ft acceptability range for any site considered. Noise apparently will not pose a serious problem in either Solano or Alameda. The company is aware of this issue; apparently it seeks to avoid the Boone site's problem of noise.

Electromagnetic Interference. No interference problems are expected and both sites are comparable under this criterion. The Solano site is near Travis Air Force Base, which has informed the company that siting would not interfere with its operations.

Electric Power Transmission. There is some differential between the sites in terms of transmission. The lines would be longer to the Solano site; existing lines abound in the Alameda area. But, the construction of new lines would be cheaper in Solano because presently the company owns the land.

Access and Site Development. The Alameda land is currently being leased to the company from a private citizen, making access somewhat difficult. In terms of access roads, both existing and with required upgrading, Alameda has the cost advantage. But, again, if such roads were to be constructed at Solano, they might be less expensive in the long run because the roads could be used in the construction and operation of a wind farm of five or six wind turbines.

Design Requirements. This remains an open question. The company is concerned, above all, with design in terms of size of machines and the possibility of earthquake damage.

Land Use and Permits. Both sites are in areas presently zoned agricultural. The Alameda location is amidst rolling hills used for cattle grazing. The Solano area is nearer to residential properties and to migratory bird habitats. The company has purchased the Solano land, and feels that this site would be conducive to wind energy research on the natural and the human environment. Alameda would not require a zoning change, but would simply provide "allowed use" within agricultural zoning. But, despite this zoning change requirement, PG&E feels that the county favors the WECS project because the land could still be kept available for grazing. A more political motivation of the county, suggested only by the company, is that PG&E ownership of the Solano land would prevent the encroachment of nearby urban areas.

Visual Impact and Aesthetics. The Solano site is nearer to the highway intersection. It would be more accessible and visible to the public. The company recognizes that this presents problems as well as benefits. Problems include environmental impacts; the benefits would probably be in public education. Because the State of California is encouraging utilities to pursue alternative sources of energy, the Public Activities Department of PG&E feels that the Solano site would provide a better opportunity to demonstrate the company's alternative energy pursuits and educate the public than would the Alameda site.

Economic Value. Based on limited data, the Solano site wind speeds seem slightly higher than Alameda's, and thus is also better matched to PG&E's peak load periods. This makes the Solano site appear to have the economic advantage.

4.2.1.2 Institutional Issues

In the presentation of PG&E's site selection criteria, some institutional issues arose. Several governmental bodies were contacted to elaborate on points of interest. Dick

Flynn of Alameda County's Zoning Department stated that no zoning problem existed should the Alameda site be chosen; i.e., no rezoning would be required, regardless of WECS size or number. PG&E has been informed about the descriptive report it would be required to submit to the County Planning Department. Flynn expressed no opinion on possible public reactions to a WECS at the site.

The Solano County Zoning and Planning Department representative was knowledgeable and concerned about these issues. He first expressed very positive feelings about the development of wind energy, saying that it was an excellent idea and something that should have been pursued a long time ago because the technology has been available. He did not, however, approve of the site in Solano County proposed by PG&E. Major concerns he stated were:

- Land use. While grazing could continue, the turbines and transmission lines would affect the "complexion" of the area negatively.
- Visual. A WECS at the Solano site would be very noticeable from Highways 680 and 80. The area is open now and aesthetically pleasing as one of the last vestiges of open land enroute between San Francisco and Sacramento. This spokesman did not want to see the area "abused." Because of the airport nearby, the system would have to be well lighted, and this would make it visible 24 hours every day.
- Earthquakes. While the WECS itself would not disturb the geography of the area, siting near a fault, as proposed, did not seem appropriate.
- Transmission. He felt that transmission lines might prove to be a distraction to highway users.
- Noise. While noise would not necessarily pose a problem for one or two turbines, there was a concern about the amount of noise that could be caused by several WECS.

The requirements of an Environmental Impact Report by the County have not been specified at this time. This process would entail:

- submission of an application by PG&E;
- review by the Bay Conservation and Development Commission (BCDC) for the identification of salient issues;
- determination of the BCDC of the documentation (EIR) required; and
- a final decision by the planning commission of Solano County.

The Solano County representative was disturbed about PG&E's choice of site in that county. He would have recommended a Collinsville location, adjacent to the Sacramento River, which is already owned by the company and where he thought the wind speeds were better. He was aware, though, that the company plans to construct a coal-fired plant at that site. He was informed that PG&E could eventually install up to 150 turbines at the proposed WECs site. While one or two machines might be acceptable, he and his office oppose the construction of several WECS. He also commented on public apathy in the county about this issue, despite the growing concern of county and environmental groups.

Bob Hickman of the Bay Conservation and Development Commission (BCDC), a state agency whose purpose is to ensure that development in the San Francisco Bay is controlled and to ensure maximum feasible public access to the Bay, was contacted. The Commission's main concern for a WECS project would be how it would impact the "natural values" of the area. For example, he wondered about effects on the ducks in the marsh. The agency would be interested in impacts in terms of (1) the turbine itself, (2) the transmission lines, and (3) the use of the marsh. Hickman did not indicate the type of formal documentation required, but did say that BCDC would probably review the EIR submitted to Solano County.

Bill Stadler of the California Public Utilities Commission (CPUC) said that the CPUC is currently looking at PG&E's resource plan, including alternative energy sources. It is encouraging continued development of such resources and is seeking some form of legislation that will prevent cogeneration from encountering regulatory barriers. While WECS issues are not specifically addressed now, they probably will be in the future. The CPUC would like PG&E and utilities in general to follow "normal stages of development" but hopes to allow them to pursue these new interests somewhat freely, encouraging the trend.

Two representatives of the CEC were also contacted. Dave Waco informed us that little written material was presently available about the PG&E project from their office, although one final report was due for submission by the company. Dr. Mat Ginosar elaborated on site selection. He reported that site selection was made for PG&E, as well as for Southern California Edison, principally on the basis of wind speeds. He also referred to the joint wind exploration activities of CEC and PG&E. He did say that little information was available at this time on the environmental side of the PG&E program—much less than for the Southern California Edison (SCE) project near Palm Springs; most of the PG&E documentation appears to be technical, emphasizing the wind resource, etc. It was apparent that the CEC does not pose any regulatory barriers to utility interests in WECS development. In fact, at this time, the CEC, the state agency responsible for power plant siting, does not have any jurisdiction for wind energy conversion, because these systems do not fall under the 50 MW or thermal power source requirements of the CEC charter.

State environmental groups—California Tomorrow, Sierra Club, and the Environmental Defense Fund—all expressed their interest and support for WECS development in the state.

4.2.1.3 Observations

The siting process has gone fairly smoothly up to this point, perhaps because of the small scale of the proposed installation. California state bodies (either the CEC or the CPUC) do not have jurisdiction since the facility is below 50 MW. PG&E's aggressive WECS development plans will certainly arouse further public and private interest.

4.2.2 Southern California Edison Company

Southern California Edison (SCE) is currently operating a WECS installation in the California desert outside Palm Springs in Riverside County, near the intersection of Highways 10 and 62. The 191-ft machine, easily visible from Highway 62, is a Schachle-Bendix design; its rated output is 3 MW at a wind speed of 40 miles per hour. SCE actually plans to be operating two such turbines at the site in the near future (the second machine will be an ALCOA 500-kW Darrieus). SCE has an active wind energy policy.

The company's goal, recently announced, is to install 360 MW (nameplate rating) of WECS by 1990, and an additional 1050 MW between 1990 and 2000.

One of the company's highest priorities is data collection about both the natural and the human environments. In addition to the first two turbines at the site, SCE plans to construct a public information office to distribute information to interested citizens and monitor public reaction to the WECS.

SCE owns the land on which the Schachle-Bendix WECS is located. The company operates a substation on the same property. The surrounding land is used primarily for cattle grazing by local ranchers. The area is considered to be of low population density and is occupied by ranchers and some farmers. It is also relatively free of commercial growth and has remained rather stable over the last several years. No unusual demographic changes are expected.

This WECS project has no government financial support. SCE ownership of the site and structures is expected to continue throughout the operation of the WECS. Although this does not obligate the company to conduct certain environmental studies, it has voluntarily acted to provide such reports to the CEC.

4.2.2.1 Environmental/Legal/Regulatory Experience

The project's natural environment comprises an area of desert (surrounding the site) and rolling hills (used for grazing) nearby. The only plants near the tower are cactus plants and small bushes. A variety of animals, birds, reptiles, and amphibians occupy the land, although no endangered species are known habitants. Some state-protected species, though, such as the desert tortoise and the golden eagle, are found in the area. There are no known archeological or historical sites nearby that might be disrupted by the WECS. One major environmental problem is, as mentioned, the threat of a damaging earthquake. This particular site has a known history of and future potential for earthquakes and surface faulting, which pose serious engineering problems for the company. The site is located in a seismic risk zone. All in all, however, no serious adverse impacts are expected in terms of the natural environment of this site.

The human environment also does not appear to pose a present, serious threat to WECS adoption. The low density population means that few residents will be able to see the turbine or will be directly affected by it. Some complaints may be anticipated, though, as such complaints did occur when SCE constructed a substation on the same property. Data are not presently available on the possible problems of television interference and noise, but no safety problems are expected since the turbine is already enclosed by a fence. The company will coordinate with the Federal Aviation Administration (FAA) on matters of aircraft traffic. The site is visible from Interstate Highway 62, providing an excellent opportunity to expose the turbine to the public. However, the issue of aesthetics must ultimately be determined by public reaction once the WECS is in operation. In view of its high visibility, the WECS will probably be painted so as to blend into the background environment.

The environmental issues relevant to the SCE site were discerned in a series of interviews with the individuals involved. Michael C. Gardner, the Regulatory Affairs Representative, and Tony K. Fung, the Senior Research Engineer of SCE, informed us that the only permits required for the construction at the site were from the county government. The company applied for, and received, a "negative declaration" from Riverside

County—meaning that no significant adverse environmental impacts were expected from the construction and no EIR (California's version of the federal EIS) would be required of the company. Even so, the company plans to investigate environmental impacts that might occur. Gardner suggested that two major research questions could be answered in part by the operation of this WECS test site. The first is a technical question: what is the potential of wind energy conversion in practical applications? The second is: what are the public reactions to WECS? The company is well aware of the scarcity of data on this matter, and these representatives of the company suggested that public reaction could have a significant impact on SCE's future course of action in the realm of wind energy. In terms of regulatory (or institutional) barriers, though, Gardner stated that SCE experienced no significant impediments thus far in its WECS project.

SCE provided us with a copy of the Notice of Intent which it submitted to Riverside County to obtain the negative declaration. It is three pages long, with three attachments. The first part includes a series of questions to the company, in which the project is briefly described and the company requests a Public Use Permit. Attachment A contains the legal description of the site. Attachment B elaborates on the location and the structures to be constructed on the site. Attachment C discusses the environmental setting. In that section, the company suggests the basis for the negative declaration request: that first, the environmental impact from the WECS is not considered to be significant, and second, the construction of such a plant "will provide an environmental benefit in that it will help demonstrate the possibility of a nonpolluting energy source."

Michael McCall, the Supervising Planner of the Riverside County Planning Department, elaborated further on the zoning issue. The property on which the site is located was zoned "RR" at the time of application. This means that the land was available for multiple uses, including those of public utility companies. A Public Use Permit would be required only if the land were otherwise zoned. This would require several stages, including public hearings, but did not apply in SCE's case because of the RR zoning. The county was pleased that the company had voluntarily submitted a plot plan because the county is concerned with the aesthetics of the plant, especially landscaping and parking facilities. They will also monitor the safety of the plant, as provided for by the building permit process. The building permits were routinely processed for the WECS; they posed no barrier to the company. McCall noted that there had been no objections from nearby residents. He suggested that there would be much greater controversy if the company proposes a coal-fired or nuclear plant in the vicinity. In addition, he mentioned that because SCE is pursuing this renewable energy source, the county would continue to support it, even for large-scale conversion systems.

It is estimated that SCE's WECS electric generation could benefit approximately 800-1000 homes, though none is within the Palm Springs city limits. The city understands that future generation could reach into those limits. A representative of the Palm Springs Chamber of Commerce stated that local sentiment toward WECS had not fully matured or surfaced. The Chamber has acted and will continue to act to educate the public about energy issues and alternative sources. A wind energy display, with turbine demonstrations, was evidently a big public attraction at a recent energy fair sponsored by the Chamber. It also sponsors an Energy-Environment Committee, which appears to be the only local environmental group.

Ralph Hitchcock, former Chairperson of the Energy-Environment committee and an SCE official, suggested that the utility company must deal with some private skepticism. He said that the substation on the property was a "constant irritation to some local residents, and that one or two WECS would be a novelty, but beyond that, the machines

would present a problem in terms of public reaction." He also stated that the committee which he currently chairs would continue to provide information on energy issues, including these, to both the Palm Springs Chamber of Commerce and to the public.

Other environmental groups contacted were statewide organizations, including California Tomorrow, the Environmental Defense Fund, and the Sierra Club, all of which expressed support for the development of alternative sources of energy, including wind energy.

The two state offices interviewed were the Public Utilities Commission and the California Energy Commission. These do not now have jurisdiction in the area of WECS development and, thus, do not pose any institutional barriers to deployment. Because of the state's support of PG&E's WECS proposal, the role of these agencies was discussed in more detail in that study. In general, though, the agencies are pleased with SCE's efforts and the documentation it has provided to the state. The PUC representative suggested that the state would like to see utilities continue to develop this energy source and continue the trend without state interference at this time.

4.2.2.2 Observations

Although the siting went smoothly, SCE is concerned about potential problems with larger wind farms. Specifically, it believes that a more detailed environmental review will be required with attention paid to wind rights, aesthetics, and land-use issues. They also foresee possible land acquisition problems in the immediate vicinity of the Palm Springs site, since the land is generally privately owned in small parcels.

4.2.3 Eugene Water and Electric Board

4.2.3.1 Background

A consortium of Oregon's publicly owned utilities and the American Public Power Association are underwriting the cost of constructing a large-scale WECS unit on the Oregon coast. Objectives of the demonstration project are to determine actual costs and reliability of wind turbine generation; to examine impacts of integrating an intermittently operating power source into a utility system; and to study environmental impacts of operation, including public attitudes toward visual factors.

Project planning began in December 1979. As the unit is sized to make optimum use of a site where the average annual wind speed is 18 miles per hour, site choice was governed by this criterion. Additional criteria were the site's accessibility to Lincoln City Peoples Utility District (PUD) power lines and to existing roads.

The site ultimately chosen is on a bluff overlooking the Pacific Ocean approximately three miles north of Newport, Oregon. The consortium of utilities has obtained a five-year lease ($32,000/year) from the Longview Fibre Company for the four-acre site. There is little possibility for lease renewal, even if the project is successful.

The wind machine is a three-bladed, vertical-axis unit manufactured by ALCOA Laboratories. It is one of the largest vertical-axis wind turbines in North America—approximately 140 ft high.

The unit begins generating electricity at a wind speed of 12 miles per hour. The turbine's output increases with wind speed until it reaches its maximum capacity of 500 kW in a 35-mile-per-hour wind. Output decreases as the wind speed exceeds 35 miles per hour, and in very high winds the unit shuts down. The unit is started by a separate starting motor. It is expected to generate approximately 1.1 million kWh per year—enough electricity to power 60 homes.

Project costs have been estimated at between $250,000 and $450,000. Funding for the project will come from 19 publicly owned electric utilities in Oregon, and a $20,000 grant from the American Public Power Association. No federal funds are involved in the project. The Eugene Water and Electric Board (EWEB) is the lead utility for the project. The Central Lincoln People's Utility District is the host utility. Benefits of the wind turbine's generation will be shared among all participants.

The unit was delivered on November 1; it is scheduled to go into operation in early January 1981. At the time of our visit to the site, concrete foundations for the six support cables were being poured. The final unit was erected December 9, 1980.

Approximately 90 miles southwest of Portland, the city of Newport, Oregon, is a seaport community nestled on Yaquina Bay. It has grown steadily in the past several years. The population is now 7650; the population of Lincoln County is 32,000.

Fishing, tourism, lumbering, and wood products manufacture are the main industries of the area. With the recent improvements in Yaquina Bay, such as extending the harbor of the South Jetty and dredging the channel to a width of 300 yards and the entrance to the channel to a depth of 40 ft, the potential for importing and exporting products and materials is increasing the economic growth of the community.

4.2.3.2 Environmental/Legal/Regulatory Experiences

The WECS unit is located in what was a heavily timbered area, now cleared. Newport Municipal Airport is approximately 6 miles from the WECS site; however, the FAA has informed the consortium that no special provisons are required with respect to marking and lighting the structure.

The unit is clearly visible from U.S. Highway 101. The project site near the Coast Highway provides the public the opportunity to view the wind turbine's operation. The area along the Highway in the vicinity is urbanized, with some commercial development adjacent to the roadway.

As the project participants have not had to submit any environmental analyses, it is difficult to assess environmental issues such as the potential for electromagnetic interference, and so forth. On the basis of observations and discussions with EWEB and PUD officials, it appears that, given the relatively secluded location of the project, noise will not present any major problems. No new access roads were necessary for the project. The present access road is a logging road which will experience some increased use but will be locked off at its base. After the five-year lease expires and the unit is dismantled, little lasting ecological damage is envisioned, as all traces of the unit will be removed (the six concrete guy anchors will not be removed, but will be cut off below ground and covered over). Upon the project's completion, the site will be reseeded.

The utility consortium has been required to acquire county building permits and the site has been rezoned from agriculture to commercial to accommodate the wind system. These regulatory requirements were easily satisfied, in part because there is a pervasive general support for wind and other alternate energy programs in the area. Indeed, the only apparent skepticism about wind energy came from some of the representatives of the utility consortium itself, who seemed to view the project as a public relations gimmick.

Few (if any) state regulatory requirements applied to this project. In an interview with Donald H. Snyder, of the host Central Lincoln PUD, he asserted that the consortium had ignored Oregon's environmental impact assessment and energy facility siting legislation. But the actual situation was a little different. EWEB, as lead utility, commissioned studies of state and federal regulatory requirements, and consciously tried to avoid regulatory or procedural delays in this project. It discovered that the Oregon Energy Facility Siting Act, the complex state land-use planning legislation, and the Coastal Zone Act either did not apply or their requirements were satisfied without regulatory delay or burden. By siting the plant on privately owned land, EWEB avoided what seemed to be a serious institutional barrier—getting the authority to build a wind system on public (BLM) lands. By siting on recently cleared land, the utility avoided the need for a permit for removing forest products, which would have been required from the lands branch of the State Highway Department. Because the project received no federal funding, there was no need for filing a consistency statement concerning compliance with the coastal zone plan.

The point here is not only that these regulatory requirements did not apply, but that EWEB rather consciously sited the wind system so as to avoid regulatory or other institutional delays. EWEB did keep the wind specialist at the State Department of Energy informed of its efforts during the process.

4.2.3.3 Observations

Oregon Energy Facility Siting Council standards for the siting of wind energy facilities, if they had been in effect, would not have applied to this wind power system because the site certificate to be issued would be required only for a system rated at 25 MW or greater. State adoption of rules concerning wind systems was for the purpose of facilitating the adoption of wind systems by centralizing the permitting process in a single operation. However, the institutional burden in siting this EWEB unit was so small as to suggest that the centralization of wind regulation might not make much difference in the initial promotion of wind power demonstrations. However, a very large wind array or farm could encounter more serious institutional barriers than any that existed at this site.

4.2.4 Bonneville Power Administration

4.2.4.1 Background

The Bonneville Power Administration (BPA), in conjunction with DOE, the National Aeronautics and Space Administration (NASA), and Boeing Engineering and Construction, is participating in a two-year study of the electric power supply potential of large-scale WECS systems, by constructing a group of wind machines.

Candidate sites throughout the country were solicited by DOE for the installation and field testing of three MOD-2 (2.5-MW) wind turbine systems. The site in the Goodnoe Hills area of Washington proposed by BPA was one of nineteen potential locations and was selected for the siting of a cluster of three units.

The WECS design to be tested is a MOD-2 unit manufactured by Boeing Engineering and Construction. The turbine is a two-bladed horizontal-axis model with a diameter of 300 ft. The hub, the point where the blades are attached to the generator system, is located on top of a 200-ft tower. The blades clear the ground by 50 ft.

The turbine is designed to operate in an environment with a mean wind speed of 14 miles per hour. It will become operational at wind speeds of 14 miles per hour and will "feather" at wind velocities greater than 45 miles per hour. The structure is capable of withstanding winds up to 120 miles per hour. At its rated capacity (2.5 MW at a wind speed of 27.5 miles per hour), each unit will provide enough electrical energy to power about 750 homes. Together, the three units will produce about 12% of the average load of the Klickitat County Public Utility District.

The estimated cost of the first unit is $4.8 million, with units two and three costing $4.3 million each. The first unit was completed in December 1980; the remaining two units are expected to be operational in May and June 1981. At the time of our visit to the site, about half of the tower section of unit number one had been completed.

The Goodnoe Hills site is located in Klickitat County, 13 miles southeast of Goldendale, Washington, not far from the Columbia River. Goldendale is a town of 3200 and is the administrative center for a predominantly rural area. It is also the county seat of Klickitat County. Goldendale's economy is growing. The forests near Goldendale total more than 500,000 acres and sustain hundreds of jobs. About 600 persons are employed by the Martin-Marietta aluminum plant on the Columbia River 19 miles southwest of the town. Other local industries include a Boise-Cascade mill, a fiberglass boat assembly plant, and a wood products specialty plant. Agriculture (crops such as alfalfa, wheat, and barley) and ranching also contribute to Goldendale's economic activity.

The 1977 estimated population of Klickitat County was 13,900. The County's economy is based on agriculture and forestry; forest products are the principal industry. Education, retailing, and aluminum production are the next largest industries. Of the total area of the county (1908 square miles), 67% of the land is government-owned.

The turbine project will cost about $35 million. The bulk of the funds, approximately $30 million, was awarded by NASA to Boeing for design, fabrication, and installation of the machines. The remaining costs will involve expenditures by NASA for administrative costs.

BPA responsibilities include completion of environmental studies, interagency coordination, and acquisition of the site to accommodate the wind turbine generators. BPA must also obtain necessary leases, permits, and easements for transmission lines, access roads, etc. The project will be operated by BPA and connected to the northwest power grid through 69-kV lines owned by the local utility, the Klickitat County PUD. This is a new type of endeavor for BPA, which is the federal power marketing agency in the Pacific Northwest.

4.2.4.2 Environmental/Legal/Regulatory Experience

The site occupies a windy and somewhat barren area, a habitat where wildlife populations tend to be sparse. The U.S. Fish and Wildlife Service (FWS) indicated that, because Goodnoe Hills is considerably higher (about 2600 ft) than the nearby Columbia River Gorge, the turbines would not present an obstacle to migratory birds. Resident waterfowl would also stay near the Columbia River and not be affected by the wind turbines. No large nighttime waterfowl migrations have been observed in the area. Collisions from migrating songbirds are not expected. The FWS also indicated no endangered species are expected on the site.

The large rotating blades will increase the apparent roughness of the earth's surface in the immediate area of the tower, thus affecting the vertical distribution and ground-level swirl patterns of the wind. These changes will, in turn, produce minor effects on patterns of temperature, precipitation, drifting snow, and evaporation in the immediate area. These minor changes in microclimate will have little effect on the surrounding land.

An observer at the base of the tower will hear the hum of the transformer or the natural noise of the wind. The blades of a WECS are extracting energy from the wind rather than imparting energy as with an airplane propeller; hence, operational noise levels are expected to be indistinguishable from ambient noise levels.

Since the Goodnoe Hills site is sparsely populated, interference with local TV reception is not anticipated. The only potential interference would be with a commercial television rebroadcast station. Western Telecommunications Co. operates a television repeater station one-half mile south of the site. In the event interference does result, BPA indicates it will correct the problem by relocating the transmitter.

The towers will be visible at distances of 20 miles from various vantage points in the surrounding area. Most views of the towers will be silhouettes against the sky. Appropriate markings, as recommended by the FAA for aircraft warning, will be provided.

4.2.4.3 Institutional Issues

Because BPA is an agency of the Federal Government, this case offers an interesting counterpoint to the regulatory impediments which would be faced by a private utility if it sought to institute a similar project. For example, in an interview conducted with Nick Butler of BPA, we were informed that BPA is not required to meet Washington state energy siting facility requirements or submit state environmental impact assessments. He noted, however, that BPA did have to work with state officials on these matters. BPA is also exempt from local land-use and zoning regulations. However, Boeing had to obtain construction permits from the county, and BPA had to comply with county regulations relating to road approaches, road crossings, and load limits. And, DOE did conduct an Environmental Assessment of the site selection.

It appears that the only institutional issue associated with WECS siting in this case was the procedure by which BPA acquired the land for the Goodnoe Hills site. Although the

site had been dedicated and construction on the first unit had commenced, BPA was still negotiating the purchase price of the land.

The issue surrounds the factors that prevented BPA from acquiring the land before beginning construction. According to Butler, BPA, as a federal agency, is constrained by certain federal regulations which prohibit optioning and/or purchasing land before all environmental assessment work has been completed. This process has the effect of expanding a project's time frame, which, in turn, inhibits completion of agreed-upon conditions. He suggested an alternative action which could circumvent similar problems associated with land acquisition—the use of an intermediary such as a private utility or entrepreneur. This way, the intermediary could option/buy the land, then sell/lease the land to BPA immediately upon notification that environmental work was completed. The problem with this approach is that it tends to commit the agency to a course of action before the completion of the environmental review, which is meant to be an evaluation of whether a project should even be undertaken.

BPA spokesmen indicate that the area's population is interested in wind power, citing good turnouts at both the site dedication and various public hearings on the matter. They identify some beneficial "spinoffs" of the project. One of the most important is that the local utility upgraded its power lines/poles at no cost to BPA to aid in construction, etc., with the concomitant effect of increasing system reliability. As the Goodnoe Hills project was primarily one of research and development, final ownership is still a question.

We spoke with Gary Stark, a staff attorney at BPA who had dealt with Hoctor on the ownership issue. In response to our question about why the land was not acquired before work on the project started, he argued that condemnation was not a viable alternative at the outset because BPA was uncertain as to exactly how much land was required; hence, BPA could not formulate the required maps and descriptions necessary for hearings. His argument boiled down to the proposition that there was no "lead time" in which to invoke BPA's power of eminent domain and enter into negotiations. He seemed to feel that if the project were to expand, BPA would not encounter the same kinds of problems again. He noted that a settlement had been reached, and that BPA now owns the land.

Because the project site is close to the Columbia River Gorge, an area of spectacular scenic beauty, we spoke to Jeffry P. Breckel, Program Director of the Columbia River Gorge Commission. The Commission is an advisory body consisting of five members from Oregon and six from Washington whose goal is to "preserve, protect, and enhance the scenic, recreational, historic, and cultural values of the Gorge and to ensure that all Gorge resources be utilized only in a manner which is compatible with its unique qualities."

Breckel told us that, while the Commission favored increased economic activity in the Gorge region, it also insisted that the fostering of such activity should be compatible with the natural quality of the area. With respect to the Goodnoe Hills site, he did not envision any problems if the BPA project were expanded; however, he did voice some concern if other projects attempted to site along the Gorge. He gave us a copy of the Commissions's "Goal and Policy Statement" (June 1980) that addresses energy siting issues. The statement says "that the siting of wind and geothermal energy generation installations be done in a manner that does not dominate the scene visually or audibly.

Where possible, utility lines shall either share existing utility right-of-ways, be underground, or be out of sight from the highways of either state." So, while the Goodnoe Hills site seems to be generally acceptable, it might prove to be more difficult to site a WECS in specially protected or potentially protected nearby areas.

4.2.4.4 Observations

Goldendale City officials, Klickitat County officials, and community leaders in Goldendale generally support the WECS project at Goodnoe Hills although they have little detailed knowledge of and do not participate in the project. Apart from the support which Mr. Hoctor generated in his efforts to obtain a better price for his land, no opposition to the Goodnoe Hills wind cluster was discovered.

4.2.5 Blue Ridge Electric Membership Corporation*

DOE's 2,000-kW MOD-1 WECS, located on Howard's Knob in Boone, North Carolina, is the second largest operating wind power system in the world. Blue Ridge EMC is the host utility for DOE's MOD-1 project. It has been very active in working with General Electric (GE), the prime contractor, and NASA during the installation and operation of the unit. The MOD-1 is the only generation plant on Blue Ridge EMC's system, a system with a winter peak of 137 MW and annual sales of some 600 million kWh (purchased from Duke Power Company). EMC has no plans for installation of any additional generation of any kind.

The unit is currently operated from Blue Ridge's offices in Lenoir, North Carolina, some 28 miles away, when not undergoing NASA tests. Ultimately, the unit will be turned over to the cooperatively owned utility for full remote, unattended operation.

The original proposal to DOE was prepared in 1976, largely because of interest by EMC General Manager, Cecil Viverette, who was interested in wind power and possible EMC generation ownership. Other than some modest TV interference and noise problems affecting a few families (discussed following), the installation and test period seem to be proceeding without problems.

4.2.5.1 Environmental/Legal/Regulatory Experiences

The site for the WECS is a mountain top called Howard's Knob, elevation 4420 ft, located in Watagua, North Carolina. Watagua County is located in the northwest corner of North Carolina and borders the state of Tennessee. The site is one mile north of and overlooks the town of Boone, North Carolina. It is situated on land owned by the county and leased to the EMC for a 10-year period (the maximum allowable) for a fee of $1 per year.

The site is generally free of natural hazards. Tornadoes, hurricanes, and severe icing conditions are rare. In addition, there is no history of earthquake activity. Since the site is on a mountain top very close to the town of Boone, it is easily visible from the town. Boone is a small town with a population of approximately 11,000. Appalachian State University, with 8500 students, is located in Boone, a year-round tourist center. People from all over the southeastern part of the country travel through this area. There are several ski resorts near Boone that attract tourists during the winter. In the summer,

*For purposes of this case study, only individuals from the utility were interviewed.

tourists are attracted to this area because of the cool climate and mountain views. The Blue Ridge Parkway, a very popular scenic highway, is located 4.5 miles from the site. The site is accessible to the public and is easily reached by roads. Visitors may observe the turbine from as close as 20 ft.

The only formal permit required for this project was a certificate of convenience and necessity from the state PUC. The approval process associated with this certificate provides for a public hearing if, after due publicity, anyone raises questions or objections. In this case, no one did.

In general, the public reaction to the MOD-1 project has been highly favorable and supportive. There has been no organized opposition to the machine; the local Sierra Club Chapter President has announced the club's support. This general support is notable since the unit is widely visible (there is a 25¢ charge to "See The World's Largest Windmill" through pay binoculars in the center of town). In fact, there seems to be quite a bit of pride about the machine and particular interest in its tourism potential. The county plans to build a park next to the site.

There has been widespread discussion of the noise problem from the MOD-1. While it was not the intent of this study to investigate this problem in any detail, the utility personnel did point out that only a dozen or so people could actually hear the WECS and only two could be described as upset. Most of the noise and TV interference is located within a mile of the unit (it is noteworthy that most of the individuals had requested TV cable even before the WECS installation). The largest public reaction reported by the utility personnel is disappointment that the WECS operates so infrequently. Grant Ayers, project manager for the utility, attributes this reaction to the failure to adequately characterize the unit as a demonstration machine which will require an extensive testing period before becoming truly operational.

In reaction to these "public relations" issues, Blue Ridge EMC has gone to great lengths to see that community members' concerns are addressed. Activity in such areas consists of public meetings, telephone interviews, and forms which are completed by residents reporting on either noise, TV interference, or both. While such attention to public concerns is natural for a cooperative utility (which is owned by its customers), it is nevertheless a noteworthy precedent for other early WECS installations.

4.2.5.2 Observations

Although there was little opposition or controversy associated with the original siting of the MOD-1 machine, the noise and TV interference some nearby residents experienced suggests similar controversy could occur concerning the siting of later wind turbines. We have already seen evidence of this in connection with Lincoln Ridge, Vermont. Thus, the precedent value of this machine is not associated with its original installation and licensing, but connected with its actual operation.

4.2.6 Green Mountain Power Corporation

Green Mountain Power Corporation (GMP) is a private utility located in Burlington, Vermont. GMP responded to a recent DOE wind energy program opportunity notice, and its

proposed number one site was selected as 1 of about 35 in the country on which meteorological towers are placed to measure wind speeds. Sometime in the future (after two years' worth of wind data are available), DOE will select, from among these sites, a small number for the actual placement of large-scale WECS units.

The site on which Green Mountain Power proposed to place a meteorological (met) tower is in the Green Mountains of Vermont. It is on a mountain known as Lincoln Ridge, which is within the Green Mountain National Forest and within the small rural town of Lincoln. The approach to the site is not through Lincoln, however, but through Warren, Vermont, on the side of the mountain which is already developed as a ski area. The met tower is very close to some of the ski area facilities and is alongside the famous Long Trail, which winds along this mountain top. The proximity to the ski area was seen as a desirable feature of the site. There was already adequate access to the site, and the met tower would not be visually intrusive because the site was already developed. However, serious opposition surfaced to the placement of a met tower on Lincoln Ridge.

4.2.6.1 Institutional Issues

The opposition to the met tower came from people in the town of Lincoln, which is on the east side of the mountain. The west slope of the mountain is undeveloped, and presents a scenic vista which is prized by Lincoln residents. While a met tower might not present a serious visual intrusion, a MOD-2 or larger wind system would substantially disrupt this vista. So, the met tower raised serious concerns in Lincoln, and spawned an active and effective opposition group known as the Save Lincoln Mountain Committee. There was little concern expressed by other groups who might be affected by this decision, such as skiing or hiking groups or people from Warren.

The opposition to the met tower on Lincoln Ridge was active in a variety of institutional arenas, even though a preliminary reading of state and local laws suggested few institutional barriers. There are neither local nor state planning or zoning requirements in effect for this area, and no permits are required from the Public Utility Commission for a met tower. However, the site is within the Green Mountain National Forest, so the U.S. Forest Service will be required to issue a special use permit. Given its multiple-use mandate and the fairly general Green Mountain Forest Plan, it appears that a met tower is certainly a permissible activity in the national forest, particularly at this site. The Forest Service is bound by NEPA, of course (as is DOE). NEPA has been the first of the institutional impediments to the placement of a met tower on Lincoln Ridge.

When opposition to the met tower first surfaced, Green Mountain Power held a public meeting to explain the proposal. The opposition was sufficiently adamant at this May 14, 1980, meeting that the Forest Supervisor for the Green Mountain National Forest wrote DOE (lead agency on this project) to request both an environmental assessment and impact statement. He noted, "This specific area of National Forest land is considered very sensitive from both ecological and aesthetic viewpoints."

DOE agreed to this request and prepared an environmental assessment specific to Lincoln Ridge.

On January 30, 1981, DOE announced that it had determined that the proposed installation of meteorological equipment at Lincoln Ridge does not constitute a major federal action significantly affecting the quality of the human environment. Therefore, an environmental impact statement would not be required for this action. However, due to

decreased funding, DOE subsequently made a programmatic decision not to put in a met tower at Lincoln Ridge.

NEPA was not the only institutional issue that had to be addressed. While Vermont has no general state land-use control legislation applicable to this site, it does have Act 250, which requires a state permit for any construction above 2500 feet. The Lincoln Ridge site is at 4000 ft. Act 250 is designed to protect the mountains of Vermont from unregulated ski resort or other development. The Forest Service took the legal position that Act 250 did not apply to Forest Service or other federal land. The Forest Service counsel wrote the Chairman of the Vermont Environmental Board and stated that:

> To the extent that 10 V.S.A. Chapter 151 (Act 250) would purport to deny or veto the Federal permit issuance process or permitting activities authorized by Federal law or regulation, such denial or veto would be invalid, and this office would recommend that such attempt be resisted in Federal courts.

The Save Lincoln Mountain Committee pursued this issue with Vermont, and the state claimed jurisdiction. Green Mountain Power stated that it did not intend to apply for an Act 250 permit. As with the question of whether a full EIS is required, this issue seems to be a close legal question involving not only Commerce Clause issues but also the specific charter of Green Mountain National Forest and perhaps some recent federal legislation directing the Forest Service to integrate its activities with state and local planning efforts. On November 17, 1980, the Vermont Environmental Board ruled that the met tower is a federal research project on federally-owned land and is therefore outside the jurisdiction of Act 250.

Spokesmen for Green Mountain Power Corporation seem to think that the difficulties they have encountered in siting a met tower are significant in their consideration of wind as an energy resource. They believe that if it takes this much time, effort, and money to site a meteorological tower, it will take a considerable additional effort to site the wind energy system itself. Indeed, further institutional issues might arise in the effort to get approval for a wind energy system on this site. While a wind system is nonpolluting, the siting of a single unit or multiple units in a region of extensive unsupervised recreational use could pose enough safety concerns to cause the Forest Service to deny a special use permit for a wind system. The need for a transmission line in this corridor could also be a source of opposition and ultimate Forest Service disapproval. While no state PUC permit is required for a met tower, all electrical utility generation facilities come under state PUC review. Although the state PUC has been generally supportive of GMP and of wind power (it submitted a letter of support for the GMP site to DOE), its response to a contested permit application is unclear.

4.2.6.2 Observations

For all of the institutional obstacles, the viability of a met tower or wind system on Lincoln Ridge seems to center entirely on the issue of the aesthetic setting into which a WECS would be placed. The Save Lincoln Mountain Committee and Lincoln residents have raised a variety of concerns about wind systems in this area, including safety, noise, icing, television interference, federal imposition on states' rights, and public versus private ownership. These other issues are subordinate to the major issue of siting a system where it will be seen as an intrusive disruption to the west slope of Lincoln Mountain. The Save Lincoln Mountain Committee went to some pains to indicate they are not

against wind power. They have, for example, joined in some alternate energy efforts in the village of Lincoln. They have also presented informal wind data and proposed that GMP and DOE consider siting a WECS within the village limits of Lincoln rather than on Lincoln Ridge. But it seems reasonable to conclude that the problems of GMP at Lincoln Ridge stem almost entirely from the aesthetic characteristics of the site, combined with the institutional barriers that arise because of these same aesthetic characteristics. It may be, of course, that in Vermont there will be a strong positive relationship between areas of high wind potential and areas of aesthetic (and therefore institutional) sensitivity. As some of our other cases indicate, the relationship does not always exist.

4.2.7 Ludington, Michigan

4.2.7.1 Background

This case study deals with a potential WECS site. The proposed site is located within Ludington State Park in Hamlin Township and Mason County, Michigan. It is northeast of the park's historic lighthouse on the shore of Lake Michigan. The proposal for a WECS demonstration was originally offered to DOE by a Michigan consortium that included six utility companies, the Michigan Department of Natural Resources (DNR), and Michigan State University. The principal utility company involved is Consumers Power Company.

DOE is currently considering the site for a meteorological tower as a first stage in the identification of future wind farm demonstration sites. There are no signs of surveying or construction at the site. The proposal implementation is awaiting further wind data collection and deliberation by the principals. DOE results of its current evaluation of siting a met tower can be used to assess the issues likely to occur if a full wind energy system were to be installed at this location.

The present proposal does not elaborate on a WECS design for the Ludington site. It does imply the installation of a meteorological tower and "one or more turbine(s) of the MOD-2 size" (400 x 450 ft per turbine). A proposal diagram implies eventual construction of a farm of three or more wind turbines.

The WECS site is located approximately 15 miles north of Ludington. Ludington, population 9500, is the Mason County seat. Practically all industry in the county is centered in the greater Ludington area; it is also a popular summer resort area.

The population of Mason County is 25,000 (1974), with a population density that is quite low. Its economic base is diversified; agriculture, manufacturing, tourism, retail trade, and goverment services account for a large proportion of its economic activity. The county encompasses large areas of publicly owned land (62,039 acres, of which 57,549 constitute national forest lands).

Because of its location, the community of Ludington, relies heavily on its tourist industry. It offers several recreational facilities, principally the state park. The community takes pride in its attractiveness to vacationers, but like so many other such areas, Ludington is suffering from the "energy crunch." High gasoline prices may discourage some vacationers from traveling long distances to this location. On the other hand, some tourists who might have otherwise traveled farther might seek out the type of nearby facilities which Ludington has to offer. In either case, the community may benefit by the development of certain low-cost, clean energy sources—such as wind. One hope expressed by the town officials is that the adoption of a WECS at the lakeshore would become a tourist attraction. At present, the demographic characteristics of the area

appear to be stable, and the serious planning efforts being pursued by Mason County may be expected to contribute to some continued stability.

The major utility interests in the Ludington WECS proposal are Consumers Power Co. and Detroit Edison Co. Consumers Power provides the Project Manager, R. E. Albrecht. The consortium provides the technical team, with training in electrical and mechanical engineering and meteorology.

Funding for the proposed WECS project is to be furnished by the Michigan consortium, which agrees "to furnish all items described under (commitments) without cost to the Government." The items to which the proposal refers include the provision of the required land area, after the appropriate arrangements with the government. The consortium would, upon project approval, secure all necessary permits, licenses, easements, leases, zoning approvals, etc., for the installation. The met tower would be financed, installed, operated, and maintained by the Federal Goverment, with the appropriate assistance of the consortium. The consortium would supply the project manager and the technical team. If the WECS were to be installed, the generated energy would be sold at a cost equal to that charged for energy from other sources. After one year of operation, the utility rate schedule would be reviewed for possible adjustment, so that expenses are appropriately covered and rates are equitable. After the initial testing period, funds not used to cover operation costs and consortium capitalization are to be paid to DOE.

The future ownership of a Ludington WECS is unclear. It appears that if the initial stage proves successful, the original consortium may excercise continued interest in the project. However, the consortium itself represents some competing interests. First, the necessity of goverment participation over the long term is unclear, once the land-use arrangements have been addressed. Finally, and most importantly, the utility interests may change drastically. If wind energy becomes a competitive resource, these companies may seek to invest in their own systems. For all these reasons, the ultimate future of the Michigan Consortium is uncertain, making the issue of eventual ownership of the Ludington site also uncertain.

The site for the proposed WECS is in sand dunes and wetlands along the Lake Michigan coast. The area is in an undeveloped natural area at the north of the park. Access to the site is available because of a way which the Coast Guard uses to reach the operating, but unmanned, North Sable Point lighthouse. This way also serves as a trail for hikers who often make the lighthouse a destination. The foredunes are sparsely vegetated with grasses, cedar, and jackpine, bent by the wind. Waterfowl and shore birds abound in the area, and the coast is a migration corridor for birds. Deer are common and bear live in the area, as do many smaller mammals.

4.2.7.2 Environmental/Legal/Regulatory Experiences

The stability of the dunes area could be an environmental issue for a WECS siting. The proposed site sits in the midst of a vast area of sand dunes, which shift and erode. There is obvious beach erosion at the site which is threatening to topple the lighthouse, despite past attempts to armor the shoreline around the lighthouse. The Coast Guard makes regular measurements to record further evidence of erosion. The other environmental issue that may emerge concerns siting of a WECS in a protected area high in natural values.

There seems to be broad public support for wind energy in the Ludington area. All of the people we interviewed were enthusiastic about wind energy's potential, except some Con-

sumers Power employees who preferred other systems. There are small wind systems in the area, and Dutch windmills are frequently used as decorations in this area of Dutch settlement. The 1976 NSF study, "Public Reactions to Wind Energy Devices," surveyed attitudes in western Michigan. Survey respondents were very favorably disposed to wind energy.

Interviews with local officials indicated that a wind energy system would encounter few local impediments. The area is currently zoned recreational, and would probably require rezoning to commercial and perhaps industrial (industrial because an energy conversion system may be classified as industrial). The township zoning officials thought that rezoning would be easily accomplished, although some cottagers and others might resist rezoning, not because of opposition to a wind development, but because they do not want more development in their area. The county building inspector indicated that a private utility would need to obtain a construction permit like any other applicant but anticipated no difficulties in the utility's getting one.

Though there are likely to be few local impediments to a WECS at the Ludington site, state regulation might pose some problems. Significantly, it has taken the professional staff of Consumers Power more than three months to obtain the approvals necessary for installing a met tower, and the process is not complete. This is so, even though it was DOE rather than Consumers Power that prepared the environmental assessment on the met tower. The environmental assessment will be submitted for review to the Michigan DNR and Environmental Review Board (as well as DOE) even though there is no opposition to the tower. The regulatory requirements for a met tower include the building permit from Mason County and an FAA permit, both of which are routine. But a state park use permit is also required, a statement of consistency with the state's coastal zone act, and perhaps a sand mining permit. Each of these could still cause difficulties for siting a met tower and seem likely to cause more serious difficulties if a WECS were actually planned for the site.

Because the Michigan DNR is one of the participants in the proposed project, it is not likely to oppose either a met tower or a WECS in Ludington State Park. But it is likely to condition a permit. In fact it preferred a different site for the met tower than did the utilities. The DNR has received federal funds for developing Ludington State Park, and the placement of a met tower or a wind system could amount to an improper conversion of property to nonpark uses. This is probably not much of a problem for a met tower, but could be more significant for a major WECS project.

Because Michigan has a federally approved and supported Coastal Zone Management Program, any federal actions must be consistent with the Act. The applicant must file a consistency statement with the state agency responsible for coastal zone management (another division of the Michigan DNR). This consistency requirement is that federal action must be consistent with federally approved state coastal zone management plans. This should pose no difficulty for a temporary met tower but might be more difficult for a WECS system at this site for a variety of reasons, including the Shorelands Protection and Management Act, which limits permanent structures in areas designated as high-risk erosion areas. While the DNR has not yet classified any state-owned land as a high-risk erosion area, dune and shorelands similar to the proposed site have been so classified.

The State of Michigan also has legislation to control sand mining (the Sand Dune Protection and Management Act). This Act states that no sand removal may occur within two miles of Michigan's Great Lakes, for commercial purposes, without a permit. Thus far the Act has been administered only for sand dune mining, and DNR staff are divided as to

whether the Act applies to other kinds of sand removal (such as would occur in site preparation of a WECS) for a commercial purpose. This is not an issue for the met tower (which is not commercial), but might be for a wind energy system.

There are other issues of state regulation and concern likely to emerge at the time of WECS siting which are not apparent with met tower siting. One is the transmission line that will be necessary. The met tower will be in a remote, seldom-visited area. The WECS would be, too, of course, but the transmission facilities would not. Electrical power for the met tower can come from the buried line to the lighthouse. But power from a wind energy system would have to be transmitted across state park land of intense use and high natural value. Michigan does not have a state siting law, but the Public Service Commission does require a transmission line permit, and both the DNR and the active recreational and environmental interests seem likely to object to the least costly transmission alternatives, once that issue surfaces.

4.2.7.3 Observations

There are a number of obstacles that may emerge to siting a WECS along the shore of Lake Michigan, in an area already protected by state and federal legislation. However, many potential regulatory pitfalls might be avoided by siting a WECS system at another nearby location with similarly good wind characteristics.

4.2.8 Amarillo, Texas

4.2.8.1 Background

This case study concerns Southwestern Public Service's (SPS) proposal to provide a site for four MOD-2 wind turbine generator systems. The proposed site is eight miles northeast of Amarillo, Texas. The site is owned by the utility and is the present location of both a coal-fired and a natural gas-fired generating facility. The proposal was one of 18 prospective sites evaluated by DOE under the auspices of its MOD-2 wind turbine project, and SPS continues to think of it as a prospective site for a small wind farm.

The site was chosen largely because of its relative lack of population, its excellent wind regime, and availability of land. Other important factors that influenced SPS's decision to propose this site were its proximity to technical experts during the testing period (because of nearby existing SPS' generating facilities) and its accessibility to the utility's existing power grid. The present SPS proposal has not developed the WECS design for the Amarillo site. However, SPS has had preliminary discussions with Boeing and ALCOA.

Again, our approach to this study was hypothetical; that is, we wanted to identify and isolate the legal/institutional issues that might be involved in the siting of the WECS units if the utility were to institute a project of the type they are considering.

Located in the center of the Texas Panhandle, the city of Amarillo has a population of 157,180 (1980 estimate). It is the hub of what is know as the "Golden Spread"—8 million acres of irrigated farmland producing grain, sorghum, and other crops. It is also the center of the nations's largest cattle feeding region. The combined crop and livestock income for the area is approximately $4 billion per year. There are approximately 200 manufacturing firms in Amarillo, employing a total of 9600 people. Some of the more

notable industries include Asarco (copper, silver, and gold), Bell Helicopter Division of Textron (helicopters), and Texaco (petroleum products).

Southwestern Public Service is an investor-owned electric utility serving almost a million people in a 45,000 $-mi^2$ service area that stretches from the southwest corner of Kansas through the Panhandles of Oklahoma and Texas, the South Plains of Texas, and the Pecos Valley region of eastern New Mexico.

If DOE had initially accepted the proposal for the MOD-2 unit, SPS's responsibilities would have included the preparation of site access roads, the installation and erection of the WECS unit, and the operation and evaluation of the unit(s). According to the proposal, if the evaluation of the first unit was favorable, SPS would then proceed to install units two, three, and four at 3-month intervals.

The project would be placed under SPS's Environmental Branch of Engineering Services. The utility would provide the Project Manager (coordination with NASA Project Officer and technical staff), and the Project Engineer (oversight and coordination of actual project activities).

4.2.8.2 Environmental/Legal/Regulatory Experience

The proposed WECS site would be on land owned by the utility. Two electrical generating facilities, Harrington Station, a three-unit (360 MW per unit) coal-fired installation, and Nichlas Station, a natural gas-fired unit, are also located in the site area. The site is the scene of continuing heavy construction leading to the completion of Unit Three of Harrington Station.

The only structure currently related to the wind project is an approximately 100-ft-high met tower which has yielded 2-3 years of wind data. The wind speed at the site averages 13.4 miles per hour at 10 metres. The location of the met tower is also the proposed location for WECS unit number one.

The area surrounding the site is sparsely populated, gently rolling grassland. The grass-covered prairie is fairly immune to problems associated with erosion; however, if erosion began to occur after installation of the WECS, implementation of proper drainage techniques and replanting should remedy any problems.

No transportation problems have been encountered in delivery of heavy equipment, machinery, and materials required in the recent construction of Harrington Station. Routes via state and U.S. highways are well maintained and no steep terrain would be encountered. The railroad line that serves Harrington Station (a spur line owned by SPS) is close to all four WECS sites, and could be used for the delivery of all equipment and materials.

Tornadoes, thunderstorms, turbulence, and icing are all at least possibilities at the site area. An Asarco plant (also recently constructed) is located approximately one mile southeast of the site; the Amarillo Air Terminal is 4-5 miles to the southeast. The area's population appears to be located primarily a few miles southwest of the site.

WECS units would be plainly visible from major thoroughfares surrounding the site, most notably U.S. Highways 87-287 and Texas Highway 136. The site is also visible from the airport (and from various points in Amarillo itself). Land area is available for construction of a visitors center, which would present a panoramic view of all WECS with space for various exhibits, models, and visual aids.

A problem of the proposed first WECS unit site is the potential for disruption of electrical transmission in the event of tower failure or blade throw. This particular site is virtually surrounded by transmission lines, and, while it appears that enough space is available to meet the required dimensions (i.e., 400 ft x 450 ft), a structural failure in a high wind could conceivably propel debris into the lines and potentially disrupt service. Sites 2-4 are in more isolated settings and would tend less to cause this type of problem.

Although the presence of historical and/or archeological factors in the site area cannot be ruled out, there is no evidence at this time of their existence. It should be noted, however, that the only national monument in Texas, the Alibates Flint Quarries, is located 30 miles northeast of Amarillo.

4.2.8.3 Institutional Issues

On the basis of interviews conducted with those chiefly involved in the project, we concluded that there are virtually no institutional barriers that would impede the installation of WECS systems in Amarillo. SPS seems to have virtual autonomy over energy facility siting. For example, we spoke with SPS's Alan Higgins, Supervisory Engineer, and Kenneth Ladd, Senior Engineer, Energy and Environment, who informed us that the only permit required was a Certificate of Necessity and Convenience from the Texas Public Utilities Commission (PUC). No county or other state permits were required. This scenario was verified in conversations with Milton Lee, Assistant Director of Engineering at the Texas PUC in Austin. He told us that Texas does not have an energy facility siting law, and that the only requirement with which a utility such as SPS would have to comply would be to obtain the Certificate of Necessity and Convenience. He noted that the criteria usually applied to such a request (i.e., the "need" for the facility in terms of projected peak demand, water usage, etc.) would probably not be relevant in this instance. He added that the Commission was receptive to approvals of R&D projects of this kind.

In conversations with Alan M. Taylor, Amarillo City Planner, it was noted that the city had no jurisdiction over a project of this type, and that Potter County does not have the capacity to formulate and implement land use (i.e., zoning) ordinances. He remarked that during the past two sessions of the Texas Legislature, bills that have been introduced to vest ordinance-making power with the counties have been defeated. Hence, it appears that local units of government in Texas present little or no impediments to large-scale WECS siting.

The only issue that could present a problem was identified by Alan Higgins of SPS, who noted that county property tax could be levied, although he noted that a good interface exists between the county and SPS. In addition, he said that a law is pending in the Texas Legislature that would allow tax exemptions for alternative energy sources, and that it was worded generally enough so that large-scale WECS would qualify.

Ladd noted that SPS in general "has never backed away from any energy alternative," but he stressed that it must ultimately be economically feasible. He pointed with pride to the fact that SPS is one of the few utilities in the nation that does its own engineering and design on its energy-generating facilities. Ladd also commented on the area's favorable public attitude toward renewable energy systems, noting the interest in a joint SPS-General Electric solar plant in the southern part of the company's system.

4.2.8.4 Observations

The general manager of the Amarillo Chamber of Commerce commented that the community was "very sympathetic" to projects of this type, and said that he did not envision any adverse reaction with regard to aesthetics. He remarked that the area was noted for the size of its feedlot operations and stated that a WECS project would be an additional tourist attraction.

4.3 OTHER UTILITY-SCALE WECS ACTIVITIES

As noted earlier, there were a number of cases of utility activity where time constrained the study team from performing detailed case studies. For example, Pacific Power and Light is installing a 200-kW system in Coos County, Oregon, at a site previously proposed for a nuclear plant. An Environmental Impact Statement has been prepared and a county conditional use permit granted after a June 17, 1980, public meeting. In other areas, the case of licensing the MOD-0A units in Clayton, New Mexico, and Kahuku Point, Hawaii, has been noted but not reviewed or examined in detail.

In addition to such utility oriented activity, the potential for "third party" ownership of large WECS installations has been reviewed. This form of ownership was stimulated by the passage of the Crude Oil Windfall Profits Tax Act of 1980 (which provided an additional 15% Energy Tax Credit for wind systems, a credit denied to utilities) and the Public Utility Regulatory Policies Act (PURPA) of 1978 (which created a special category of entities, Small Power Producers, who could sell electricity to utilities at relatively attractive rates). By requiring utilities to purchase wind-generated electricity from Small Power Producers at utilities' incremental costs, the Congress created potentially attractive investment opportunities. A number of companies, most notably Windfarms, Ltd., of California and U.S. Windpower Inc., of Massachusetts, have sought to take advantage of these opportunities with proposed 5-MW, 80-MW, and 100-MW installations. Although as private entities they may lack some of the perogatives of regulated utilities (such as eminent domain), the magnitude of financial incentives encouraging them suggests great potential as commercialization vehicles.

Windfarms, Ltd., is planning an 80-MW installation at Kahuku Hills, Oahu, on land owned by the Campbell Estate and on a portion of state-owned land. The current tenant of the land is the U.S. Army, who uses the land for infantry training. Windfarms and the army are planning to continue this dual land use. Licensing activity includes permits for additional transmission facilities which, since they cross scenic and mountainous areas, may incur public opposition. In any event, these facilities require Windfarms to deal with a number of landowners. The company is preparing for a full-scale NEPA review of the project in the event that this proves to be a requirement because of coastal impacts (related to transporting equipment) or state land-use requirements.

SECTION 5.0

SITING CLUSTERED AND DISPERSED WECS ARRAYS: A COMPARISON

The case studies suggest some considerations of the comparative regulatory burden and the institutional issues likely to occur with wind systems of various sizes and configurations. Based on the set of cases we have studied, we can say the following:

- There already exist some so-called "triggering" criteria whereby proposals for large arrays of wind power systems require certain regulatory approvals, while smaller arrays or single WECS do not. The recently enacted Oregon rules are a case in point. In most instances the triggering level is fairly high—in Oregon 25 MW at a single site. Twenty-five megawatts at a single site may ultimately not be a large wind system, of course, but at current levels this would amount to 10 MOD-2 units at a site.

  In most states neither size nor megawatt levels trigger regulatory requirements. Whether state PUC approval is necessary and whether a wind system comes under the jurisdiction of a state siting authority do not generally depend on the size or configuration of the WECS.

- One area of review and approval in which the size of the wind array might trigger different institutional needs concerns compliance with NEPA. A need for NEPA compliance will exist if there is a federal action associated with the siting of a wind power system. Such federal action may come in the form of demonstration grants (see the final EIS on the Block Island Wind Turbine Generator System (DOE, July 1978); loan guarantees, such as REA support for a rural electric co-op wind system; the siting of a system on public lands; and others. However, NEPA applies to federal actions, not to utility actions. So if a utility installs a WECS system of any size or configuration without any federal involvement, then no NEPA issue arises. Notably, WECS systems are likely to avoid serious NEPA entanglements, compared with other electrical energy production systems, because they do not require federal water permits. Many conventional and unconventional power systems come under the NEPA umbrella because they require either a National Pollution Discharge Elimination System (NPDES) permit from the Environmental Protection Agency or a Section 404 or Section 10 permit (structure in navigable waterways and wetlands) from the U.S. Army Corps of Engineers, or both.

  If NEPA does apply to a project it does not necessarily mean that a full EIS is required. If a project is deemed to have only minor potential environmental consequences, then only environmental assessments (EAs) will be required for NEPA compliance (and perhaps not even these). Agencies vary in their criteria for defining a major action requiring a full-blown EIS, but the size of the proposed array will surely be a factor in any decision about the need for an EIS. Thus, dispersed WECS might not require an EIS but large arrays might.

  However, note that the size of the proposed system is only one criterion for such a decision, and the two wind arrays currently under construction requiring NEPA compliance (the Goodnoe Hills array of BPA and the Water and Power Resource Service's initial installation of up to five units on public lands near Medicine Bow, Wyoming) have prepared only environmental assessments. The agency decisions

have not been contested, even though these are issues of first impression. The EAs which have been prepared indicate only minor environmental problems. So it would seem that fairly large arrays of WECS may not require the preparation of EISs, even when NEPA does apply.

- The single most common source of opposition and potential environmental-impacts conflict that has emerged for wind power systems is aesthetics. That issue is at the heart of opposition to the met tower on Lincoln Ridge, and it will cause problems in any attempt to install a WECS in Ludington State Park. Large areas of high wind potential in the Pacific Northwest may be unavailable to certain types of WECS development because of restrictions based on aesthetics in such places as the Columbia River Gorge and the Oregon coast. Moreover, there is some evidence to suggest that large arrays of wind systems will indeed be more aesthetically jarring than will single units. This has led some people to speculate that public opposition may surface for large arrays of wind systems, when such opposition would not occur for single units or smaller arrays. On the basis of the case study evidence, this interpretation seems unlikely. For it is not the aesthetics of the units that causes problems. Though people might express a preference for a Dutch windmill to an "eggbeater," that is not an issue in real siting situations. The issue of concern is the environmental and aesthetic setting in which the WECS is placed. It would appear to be relatively unimportant in a regulatory or public involvement sense whether a large number or a small number of units are planned for a particular site, if that site has defenders who desire to keep the area in a natural state, or have regulations in effect to protect it from development.

- The institutional obstacles to the siting of large arrays of wind systems do not appear to be great, in any absolute sense. Nor are such obstacles notably more different for large arrays than they would be for dispersed units. However, one institutional issue peculiar to larger arrays surfaced in a case study: that of acquiring property rights in the land where an array might be sited, from the case study of the BPA-Goodnoe Hills project. There BPA had serious problems in acquiring the land rights to the site, even with the power of eminent domain as an ultimate recourse. Generally, however, private utilities do not have the power of eminent domain for the acquisition of power sites (although they do have this power for transmission lines). The issue that may develop for potential wind farm sites will occur where a utility will need to acquire property rights to parcels of land owned by different people. Then the utilities may be faced with the same problem facing an urban redeveloper; namely, that a hold-out can thwart a large endeavor, and the longer a person holds out the more valuable his property right may become.

  This issue may be particularly important when a wind farm is built incrementally, and where a utility may not acquire all the land needed for some ultimate wind farm of undetermined size when it wants to build the first units. This issue may not become a major hindrance, because sufficiently large acreages may be available from single owners. However, once a wind farm is sited, subsequent development will depend on the acquisition of specific parcels of land, not just any one suitable site. Further study might prove the desireability of states' conveying a power of eminent domain to utilities for the acquisition of wind rights to further wind development. The federal urban renewal program achieved many of its goals as much by providing this tool for urban redevelopment to cities as it did by the massive infusion of federal funds. Of course, there are also very good public policy reasons to limit the use of eminent domain.

SECTION 6.0

CONCLUSIONS AND RECOMMENDATIONS

It is important to reemphasize that our study was conducted at a time when only a handful of large WECS installations had been sited and when utilities were just beginning to gain experience in dealing with siting and permitting issues peculiar to WECS developments. As such, our findings are preliminary on a subject that has only recently begun to attract the attention it deserves from utilities, private developers, state PUCs, DOE, and energy siting officials. Our review of the relevant federal and state laws, and particularly our discussions with the case-study site operators, suggests the following preliminary conclusions and recommendations.

- We conclude that wind energy may offer the one electricity generation concept that can frequently avoid NEPA review. The key reason for this is that WECS do not use water for any purpose (raw material, cooling, etc.). Thus, if the WECS site is privately owned and no concurrent federal action occurs (such as locating a transmission line across federal lands), there may not be a need for an Environmental Assessment or Environmental Impact Statement (since no EPA or Army Corps of Engineers permits will be required). Significantly, many private entities found it difficult to deal with federal landholders who were largely uninformed about WECS. On the other hand, the single federal utility examined (BPA) avoided some local permits but had to perform an Environmental Assessment.
- In general, WECS are seen to be compatible with a wide variety of other uses (agriculture, parks, forestry, etc.), thus lessening the concerns of local planners.
- The issue most likely to arouse public intervention is aesthetics. Although many people view the early demonstrations as attractions and curiosities, these attitudes could change when the novelty wears off (i.e., when units are no longer one of a kind) and when large-scale deployment occurs (i.e., when units are no longer one at a site). Aesthetic concerns will be even more serious if there proves to be a strong correlation between sites of high wind power potential and sites of high visibility (mountain tops, coastal zones, ridges, gorges, etc.).
- The study revealed almost no local opposition to WECS siting. The single and most important counter-example was the case of Lincoln Ridge, Vermont.
- The Boone, North Carolina, and Lincoln Ridge, Vermont, cases may prove to be significant precedents. In Vermont, the degree of effort involved in siting a meteorological tower may do much to discourage the local utility (and, by extension, other utilities) from aggressively pursuing wind power. The technical problems of noise and TV interference at Boone are being carefully monitored at other locales. Failure to resolve these problems could lead to local opposition elsewhere.
- The California Energy Commission's efforts to ensure that the BLM adequately consider WECS development in its land-use planning in that state proved to be highly successful. Important questions about wind power use on federal lands (BLM-owned and otherwise) will continue to be raised, especially in the western United States.

- There is considerable uncertainty associated with wind rights and how prospective developers may obtain them (short of outright purchase of the land). There are indications that landowners in windy regions may sell wind rights to their land via fees, leases, or royalties on energy actually generated. Procedures for leasing federal lands (and pricing those leases) have yet to be determined.

- Unlike many other electricity generation concepts, WECS may be installed incrementally by means of very small capacity additions. This raises a number of issues:
  - How much land (or wind rights) should a utility acquire before the first installation?
  - Should environmental impact assessments consider the facility site firmly planned or the maximum practical development for an area?
  - Where size of an installation (e.g., see the next paragraph) triggers a set of procedures, should a plan be evaluated when the limit is passed (i.e., the 25th MW installed) or when it becomes possible that the limit will be passed?
- An open issue is whether an additional state-created siting process, such as that recently established in Oregon for wind installations of 25 MW or more, serves as an advantage or disadvantage for wind systems developers. Supporters of such regulations point to their one-stop nature. However, we found that few utilities had problems with existing siting procedures (perhaps because NEPA can be avoided).
- The success of the California Energy Commission's work with BLM highlights the importance of DOE's working with BLM in other parts of the country. We recommend, therefore, that DOE address questions of federal land use for WECS and help standardize federal agency approaches. It should focus on identifying which BLM lands may offer potential for WECS and encourage BLM to establish a wind development leasing procedure.
- States should begin to address issues of incremental siting. Specifically, state and local planning and site evaluation bodies will require guidance as to how to address such WECS siting issues.
- Related to the incremental siting issue is the possible importance of a model state siting code. Even before the need for and desirability of one-stop siting is established, state and local governments could use guidance on key environmental, aesthetic, and land-use siting criteria.
- Further work is required to examine questions associated with:
  - use of eminent domain for WECS development;
  - mechanisms to hold and transfer wind rights;
  - time requirements for the WECS siting process, exclusive of resource assessment, under various regulatory scenarios; and
  - identification of sources of relevant information for all those involved in the WECS siting process.

It is clear that this kind of study needs to be repeated at regular intervals to keep up with rapidly changing regulatory developments in the WECS field. A follow-up study would be particularly useful if it focuses on changes that may occur in procedures for siting power plants as a result of WECS siting experiences examined in this report.

SECTION 7.0

REFERENCES

1. Nesbit, William. 1980 (Mar.). "Going With the Wind." EPRI Journal. Vol. 5 (No. 2): pp. 6-17.
2. Furness, Robin. 1979 (Dec.). Electric Utility Solar Energy Activities: 1979 Survey. EPRI ER-1299-SR. Palo Alto, CA: Electric Power Research Institute; 211 p. Available from: Research Reports Center, Box 50490, Palo Alto, CA 94303.
3. Id. at 9.
4. Noun, R. 1980 (Dec. 17). Personal communication with Bill Ostrander, Southern California Edison Co.
5. "World's Largest Wind Cluster Planned by Windfarms, PG&E, California." 1981 (Apr.). Solar Energy Intelligence Report.
6. "World's First SWECS Windfarm Built on Mountain Ridge in New Hampshire." 1981 (Jan.). Wind Energy Report.
7. Wellborn, Suzanne; Williams, Ted. "Improving the Energy Facility Siting and Permitting Process." Paper presented at the Seventh Energy Technology Conference. Washington DC; 24-26 March 1980.
8. Id. at 1.
9. Id.
10. Bain, Donald; et al. 1980 (June). Final Report of the Wind Energy Task Force to the Oregon Alternate Energy Commission. Salem, OR: Wind Energy Task Force; p. 2.
11. Id.
12. Borko, B.; et al. 1975 (May). Legal and Institutional Problems of Electrical Facility Siting. MTR-6917. McLean, VA: Mitre Corporation; 83 p. Prepared for the National Science Foundation. Available from: NTIS, Springfield, VA 22151.
13. Wellborn and Williams, supra note 7, at 3-8.
14. Winter, John V.; Conner, David A. 1978. Power Plant Siting. New York, NY: Van Nostrand Reinhold Co.; 198 p.
15. Wellborn and Williams, supra note 7, at 5.
16. Id. at 6.
17. Id.
18. Coastal Zone Mangement Act (as amended). 1974. 16 U.S.C. § 1451 et seq.
19. See 15 C.F.R. 920-928.
20. S. 1308, 96th Cong., 2nd Sess. 1980 (H.R. Rept. No. 96-1119, 96th Cong., 2nd Sess. 1980).
21. "House Shelves Energy Mobilization Board." 1980 (28 June). Congressional Quarterly. p. 1790.
22. Wellborn and Williams, supra note 7, at 6.
23. Id.
24. Id. at 7.

25. Id.
26. 42 U.S.C. § 4341.
27. N.Y. Pub. Serv. Code § 140 (1978).
28. Cal. Pub. R. Code 25120 (West Supp. 1978).
29. Wellborn and Williams, supra note 7, at 7.
30. Id.
31. Ann. Code of Md. § 3-305.
32. Wellborn and Williams, supra note 7, at 7.
33. Id. at 8.
34. Rocky Mountain News. 1980 (4 Jan.). p. 4 (column 1).
35. 91 Cong. Rec. S9127. 1979 (10 July).
36. See, e.g., Hoffman, Peter. 1980 (July). Site Selection Considerations for Land-Based Biomass and Wind Energy Conversion Systems (WECS) from a Legal Viewpoint. SERI/TR-434-372. Golden, CO: Solar Energy Research Institute; 77 p.
37. Wellborn and Williams, supra note 7, at 8.
38. Id. at 9.
39. Winter and Conner, supra note 14, at 58.
40. Wellborn and Williams, supra note 7, at 9, 10.
41. Hoffman, supra note 36, at 40.
42. See, e.g., Ark. Stat., 1977 Supp. Chapter 73-276. 4(a)(9).
43. Hoffman, supra note 36, at 40.
44. See, e.g., Colo. Rev. Stat. 1973. Chapter 40-5-103(1).
45. Winter and Connor, supra note 14, at 25.
46. Rev. Code of Wash. Ann. 1979. Chapter 80 §§ .50.010 et seq.
47. Id. at § .50.040.
48. Winter and Connor, supra note 14, at 25.
49. See, e.g., Felman D; et al. 1977 (June) CAPS: Comparative Analysis of Power Siting in the U.S. Columbus, OH: Ohio Power Siting Commission.
50. Wellborn and Williams, supra note 7, at 10.
51. Id.
52. Id.
53. Id. at 11.
54. Wellborn and Williams, supra note 7, at 11.
55. Id.
56. S. 1308, supra note 20.
57. California Energy Commission. 1980 (May). Solar/Wind Programs, Final Environmental Impact Report. Sacramento, CA: CEC; 90 p.
58. H.B. No. 2418-80. 1980.

59. Note 26, supra.

60. Public Law 96-345.

61. U.S. Department of Energy, Assistant Secretary for Energy Technology and Assistant Secretary For Environment. 1979 (July). Environmental Development Plan—Wind Energy Conversion. DOE/EDP-0030. Washington, DC: DOE. Available from: NTIS Springfield, VA. 28 p.

62. Id. at 2. See also U.S. Department of Energy, Assistant Secretary for Environment. 1978 (Sept.). Evironmental Readiness Document—Large and Small Wind Systems. DOE/ERD-0006. Washington DC: DOE. Available from: NITS Springfield, VA. 15 p.; Department of Energy, Wind Systems Branch 1979 (Dec.). Environmental Assessment-Eighteen Prospective MOD-2 Wind Turbine Sites-The Goodnoe Hills, Washington Installation Site, Klickitat County, Washington. DOE/EA-0096. 14 p.

63. See, generally, California Energy Commission. 1980 (Jan.). Wind Energy Program Progress Report. 17 p.

64. In Oregon, for example, initial studies of potential WECS Sites indicate high wind resources in the Columbia River Gorge area, the offshore and exposed sites along the Pacific Coast, and the ridge crests in the Coast Range, Cascades, Blue and other mountains in the State. Elliot, D. L.; Barchet, W. R. Wind Energy Resource Atlas Volume 1-Northwest Region. 1980. PNL-3195 WERA-1. Richland, WA: Battelle Pacific Northwest Laboratory.

65. Solar/Wind Programs, supra note 57, at 81.

66. Id. at 76. See also Lindly, Charles A.; Melton, Walter C. 1979 (Feb.). Electric Utility Application of Wind Energy Conversion Systems on the Island of Oahu. ATR-78(7598)-2. El Segundo, CA: The Aerospace Corporation.

67. Solar/Wind Programs, supra note 57, at 78.

68. Bain, supra note 10, at 18.

69. Solar/Wind Programs, supra note 57, at 78, 79.

70. Bain, supra note 10, at 17.

71. Solar/Wind Programs, supra note 57, at 79.

72. Id.

73. Bain, supra note 10, at 18.

74. Wiberg, Bob. 1980 (June). WECS and Federal Lands: Questions of Access. Golden, CO: Prepared for the the Solar Energy Research Institute. 43 p.

75. Love, Morton. 1970 (Feb.) "Rangelands of the Western United States." Scientific American.

76. Morrison, Lee. 1979. "Rights of Way Through Federally Owned Lands." Land and Water Law Review. Vol. 14 (No. 1); pp. 31.

77. Wiberg, supra note 74, at 9.

78. Id. at 11.

79. 43 U.S.C. § 1701 et seq.

80. Id. at § 1703.

81. Solar/Wind Programs, supra note 57, at 80.
82. Id. at 80-81.
83. Lotker, M. 1980 (24 June). Personal communication with Dr. Vincent Schwent, California Energy Commission.
84. Id.
85. Solar/Wind Programs, supra note 57, at 81.
86. Lotker, supra note 83.
87. Id.
88. Noun, R. 1980 (3 Nov.). Personal communication with Gene Valentine, Windfarms, Ltd.
89. Lidstone, Herrick K., Jr. 1977. "Regionalism or Parochialism: The Land-Use Planner's Delimma." 48 U. Colo. L. Rev. 575, 587.
90. Natural Resources Defense Council. 1977. Land-Use Controls in the United States: A Handbook on the Legal Rights of Citizens. pp. 320-321.
91. Cal. Gov't Code § 65100 (West Supp. 1978).
92. Id. at § 65037.
93. Id. at § 65040.
94. Id. at § 65035.
95. Id. at § 65860.
96. Id. at § 65302(d).
97. Noun, R. 1980 (19 June). Personal communication with Jim Lerner, California Energy Commission.
98. H.B. No. 2418-80. 1980.
99. Buchanan, D. 1980 (23 Apr.). Personal communication with Frank Skrivanek, Hawaii Office of Planning and Economic Development.
100. Noun R. 1980 (18 Apr.). Personal communication with Donald Bain, Oregon Department of Energy.
101. Bain, supra note 10, at 25.
102. Id.
103. Id.
104. Bain, Donald. 1980 (18 July). Memorandum. "Wind Rights" Draft Legislative Proposals. Salem, OR: Oregon Department of Energy.
105. Sandvik, Richard M.; Ostrander, Frank W., Jr. 1980 (May 21). Memorandum. Legal Issues Surrounding Wind Energy Conversion Systems. Portland, OR: Oregon Department of Justice.
106. Id. at I-3.
107. Real Property. (OCLE 1975). Vol. 2, § 35.2.
108. Sandvik, supra note 105, at I-4.

109. See, e.g., Colo. Rev. Stat. Supp. 1976, § 38-32.5-101, 102; N.M. Stat. Ann. Supp. 1978, § 70-8-4; Kan. Sess. Laws 1977, Ch. 227 §§ 1, 2.

110. Or. Rev. Stat. § 105.885.

111. Sandvik, supra note 105, at I-5.

112. Id.

113. Id.

114. Id. at I-6

115. Or. Rev. Stat. § 271.710-271.750.

116. Sandvik, supra note 105, at I-6.

117. Noun, R. 1980 (3 Nov.). Personal communication with Gene Valentine, supra note 88.

118. Nesbit, supra note 1, at 13.

119. Ferber, Gerald. 1977. Public Reaction to Wind Energy Services. Survey Research Laboratory, University of Illinois. NSF/RF-77-0026. Prepared for the National Science Foundation.

120. Id. at 4.

121. Environmental Assessment, supra note 62, at 8.

122. 43 U.S.C. § 1702 (f) (1978 Supp.).

123. Maryland National Capital Park and Planning Commission L. C. v. U.S. Postal Service. 487 F. 2d 1029 (D.C. Cir. 1973).

124. 26 Am. Jur. 2d 1966. "Eminent Domain," § 8.

125. Coty, U. A. 1976. Wind Energy Mission Analysis: Final Report. SAN/1075-1/1, 9-1 Prepared for the U.S. Energy Research and Development Administration.

126. See, e.g., N.Y. Pub. Serv. Code 1980, § 140.

127. See, e.g., Ark. Stat. 1978, 73-276.2(b)(1); Cal. Pub. R. Code 1978, § 25120; N.Y. Pub. Serv. Code 1978, § 140.

128. Noun, R. 1980 (18 Apr.). Personal communication with Donald Bain, Oregon Department of Energy.

129. N.Y. Pub. Serv. Code 1978, § 140.

130. N.Y. Pub. R. Code 1978, § 25120.

131. Or. Rev. Stat. § 469.450.

132. Id.

133. Standards for the Siting of Wind Energy Conversion System Facilities. 1980 (8 Aug.). Salem, OR: Oregan Energy Facility Siting Council.

134. Noun, R. 1980 (23 Dec.). Personal communication with Donald Bain, Oregon Department of Energy.

135. See U.S. Department of Energy. 1979 (4 July). "Candidate Sites for Installation and Field Testing of New Large, Experimental Wind Turbine Systems." PON 06-79RL10081.000. U.S. Department of Energy. 1979 (July 31). "Installation Site for MOD-2 2500-kW_e Wind Turbine Generator Systems." PON 06-79RL10085.000.

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APPENDIX A

MAJOR FEDERAL LAWS AFFECTING WECS SITING

Title: Federal Land Policy and Management Act (FLPMA)

Cite: 43 USC §1701 et seq.

Purpose: Encompasses almost every topic to be dealt with regarding federal lands. As such, it will be one of the major federal laws to be considered when siting WECS on federal lands. Following are pertinent sections of the act.

43 USC §1712 - Among the many land use management policies set forth in the act, this particular section mandates the coordination of this act with Indian Land Management Policies.

43 USC §1713 - This section might be useful in the acquisition of lands for WECS, within the boundaries of public land areas. The section provides that the sale of public lands is subject to the following 3 criteria:

1) That the land is difficult and uneconomical to manage and is not suitable for management by another federal agency.
2) The tract was acquired for a specific purpose and is no longer requried for that purpose.
3) The disposal of such tract will serve important public objectives, including but not limited to, expansion of communities and economic development, which cannot be achieved on land other than public land, and which outweigh other public objectives and values, including but not limited to, recreation and scenic values, which would be served by maintaining such tract in federal ownership.

43 USC §1711 - This section directs the Secretary of the Interior to prepare and maintain, on a continuing basis, an inventory of all public lands, their resources, and other values. The inventory shall identify new and emerging resources and values within the public lands.

43 USC §1761(a)(4) - This section authorizes the Secretary of the Interior and the Secretary of the Department of Agriculture, to grant, issue, or review rights of way for systems which generate, transmit, or distribute electrical energy, subjects to various requirements (among which is compliance with FPC (FERC) requirements under the Federal Power Act of 1935).

43 USC §1763 - Rights-of-way "in common" shall be encouraged. To the "extent practical" such multiple use rights-of-way shall be required in order to minimize environmental impacts.

43 USC §1764 - In determining the boundaries for rights-of-way land, the Secretary of the Interior shall consider, inter alia, the following factors:

1) That the land granted be limited to that which is necessary for the particular project.
2) That the land granted is necessary to protect public safety.
3) That the land granted be only that type of land upon which no environmental damage will be done.

43 USC §1765 - The terms and conditions of each right-of-way will take into consideration a federal and state environmental and safety laws.

43 USC §1767 - As regards rights-of-way for federal projects, the Secretary of the Interior may impose the terms and conditions which he considers necessary.

Regulations:

43 CFR §160	Bureau of Land Management - Planning, Programming, Budgeting (cites 43 USC 1740 as authority).
43 CFR §§4100-4300	Grazing Administration
43 CFR §8000	Recreation Programs
43 CFR §8200	Natural History Resource Management - Procedures
43 CFR §8300	Recreation Management - Procedures
43 CFR §8340	Off-Road Vehicles
43 CFR §8350	Management Areas
43 CFR §8360	Operations
43 CFR §8370	Use Authorizations
36 CFR §254	Forest Service - Land Ownership
36 CFR §222	Range Management
43 CFR §1880	Financial Assistance - Local Governments

Title: National Environmental Policy Act (NEPA)

Cite: 42 USC §4341

Purpose: Establishes a national policy of productive and enjoyable harmony between man and his environment. NEPA stipulates that any "major federal action significantly affecting the quality of the environment requires an environmental impact statement (EIS) detailing the environmental consequences of carrying out the proposed project." NEPA's mandate that EIS' include assessments of alternatives to the structure being built might prove to be beneficial to WECS siting. That is, in considering conventional power plants, the inclusion of WECS as an alternative might lead to a preference for WECS over conventional plants.

The other side of the coin is that EIS will be required for WECS which are either government-sponsored or government-owned.

Regulations:

42 USC §4321

7 CFR §654	(Agriculture) Support Activities - Operation and Maintenance
7 CFR §650	(Agriculture) Support Activities - Compliance with NEPA Guidelines
7 CFR §799	(Agriculture) Environmental Protection - Preparation of Environmental Statements Guidelines
4 CFR §1204	(CAB) Administrative Policy and Authority
18 CFR §305	(Conservation of Power and Water Resources) - Land Between the Lakes
23 CFR §751	(Highways) Junkyard Control and Acquisition
43 CFR §3040	Public Lands) Environment and Safety
43 CFR §6290	(Public Lands) Off-Road Vehicles
49 CFR §1100	(Transportation) ICC - Rules of Practice
50 CFR §251	(Wildlife and Fisheries) Financial Aid Program Procedures

42 USC §4331

14 CFR §312	(CAB) Implementation of NEPA Including the Preparation of EIS's
23 CFR §772	(Highways) Procedures for Abatement of Highway Traffice Noise and Construction Noise
40 CFR §6	(Protection of Environment) Preparation of EIS

46 CFR §10	(Shipping) Merchant Marine Officers and Seamen/Licensing of Officers, Motorboat, Operators and Registration of Officers
46 CFR §12	(Shipping) Certification of Seamen
46 CFR §31	(Shipping) Inspection and Certification
46 CFR §71	(Shipping) Inspection and Certification
46 CFR §91	(Shipping) Inspection and Certification
46 CFR §105	(Shipping) Commercial Fishing Vessels Dispensing Petroleum Products
46 CFR §176	(Shipping) Inspection and Certification
46 CFR §187	(Shipping) Licensing
46 CFR §189	(Shipping) Inspection and Certification

42 USC §4332

10 CFR §711	Guidelines for Environmental Review (Energy)
14 CFR §399	(CAB) Policy Statements
16 CFR §1	(FTC) General Procedures
21 CFR §6	(Food and Drugs)
22 CFR §216	(Foreign Relations) Environmental Procedures
23 CFR §420	(Highways) Planning - Program Management and Coordination
23 CFR §770	(Highways) Air Quality Guidelines for use in Federal Aid Highway Programs
23 CFR §771	(Highways) Environmental Impact and Related Statements
29 CFR §1999	(Labor) Procedure for the Preparation and Circulation of EIS
32 CFR §214	(National Defense) Environmental Considerations in Dept. of Defense Actions
41 CFR §516	Peparation of Environmental Statements
49 CFR §520	(Transportation) Procedures for Considering Environmental Impacts
49 CFR §613	(Transportation) Planning Assistance and Standards

42 USC §4341	
14 CFR §201	(CAB) Applications for Certificates of Public Convenience and Necessity
23 CFR §712	Federal Highway Administration - The Acquisition Function
23 CFR §752	Federal Highway Administration - Landscape and Roadside Development
28 CFR §19	Regulation Relating to the LEAA Implementation of the National Environmental Policy Act
49 CFR §1108	I.C.C.--Revised Guidelines for Iimplementation of NEPA
32 CFR §1999	OSHA—Procedure for Preparation and Circulation of Environmental Impact Statements
32 CFR §214	Environmental Considerations in Department of Defense Actions

Title: National Energy Conservation Policy Act (NECPA)

Cite: 42 USC §6201 et seq.

Purpose: Designed to provide an energy conservation program for the nation. The act advocates the continued development of petroleum reserves, the reduction of oil consumption, the implementation of energy conservation measures, and the consideration of alternative energy measures. As such, Title II, §224 of NECPA deals with retrofits of existing structures and mandates consideration of conservation devices. WECS are included among these energy conservation devices. Of interest to the siting of wind systems is the RCS requirement that the minimum distance between the WECS support tower and another structure or property line is one and one half (1.5) tower lengths.

Applicable regulations that have been promulgated under NECPA may be found in the Federal Register of Nov. 7, 1979. §456.307(b) discusses wind power in connection with home energy audits. This regulation allows the determination that wind power be prohibited (excluded), upon the observation that there is either a lot size of less than .75 acres, wind obstruction, or less than 50 feet of clearance between the proposed WECS tower and transmission or distribution rights of way. Other regulations that may affect the siting of WECS are §456.307(b)(4) and §456.307(c)(10) which require the analysis of climatological data needed for an "Energy Savings Cost Calculation."

Regulations:

Federal Register: Nov. 7, 1979 - §456.307(b) - Discusses wind power in connection with home energy audits. This regulation allows the determination that wind power be prohibited (excluded), upon the observation that there is either a lot size of less than .75 acres, wind obstruction, or less than 50 feet of clearance between the proposed WECS tower and transmission or distribution rights of way.

Federal Register: Nov. 7, 1979 - §456.307(b)(4) and §456.307(c)(10) require the analysis of climatological data needed for an "Energy Savings Cost Calculation."

Title:	The Federal Power Act of 1970
Cite:	16 USC §791(a) et seq.
Purpose:	The section of the Federal Power Act of 1970, as amended by the Public Utilities Regulatory Policy Act of 1978, which is applicable to WECS siting, deals with the classification of certain power facilities as "small power production facilities." Under final FERC regulations, a "qualifying facility" is that facility which produces at least 10KW but not more than 30 MW (for wind). Once the facility "qualifies" it is eligible for exemption from state and federal utility law. The effect of these provisions on WECS siting has not been examined, but exemption from the standard utility requirement of "public convenience and necessity" may open up many previously restricted sites.
Regulations:	
	Under §797 (Power of the Federal Power Commission) the following CFR sections are mentioned
18 CFR §8.1 et seq.	Conditions of Licenses
18 CFR §131.1 et seq.	Forms
18 CFR §2.1 et seq.	Guidelines and Statements of Policy
18 CFR §4.1 et seq.	Issuance of Licenses, and Permits
18 CFR §141.1 et seq.	Reports
	Under §799 (License, duration, conditions, revocation, alteration, or surrender) the following CFR sections are mentioned
18 CFR §5.1 et seq.	Amendment to License
18 CFR §16.1 et seq.	Surrender or Termination
	Under 16 USC 824a the following CFR Sections are mentioned:
18 CFR §32	Interconnection of Facilities; Emergencies; Transmission to a Foreign Country
18 CFR §141	Statements and Reports

Title: Coastal Zone Management Act of 1972

Cite: 16 USC §1451 et seq. (1974)
See also 3 CFR §121 (1978) (Executive Order 11990); Reprinted in 42 USCA §4321 (West's Cum. Supp. 1979).

Purpose: Authorizes the Secretary of Commerce to make grants to any coastal state of up to 80% of the cost of planning and administering a coastal zone management program. The plan must coordinate local, area-wide, and interstate land use plans. The plans must allow for energy facility siting in a manner that considers the facility's national interest as well as the local and interstate interest. Once the state program is approved, all coastal activity would have to conform to that program.

Regulations:

15 CFR §927 Administrative grants, Allocation of Section 306 Funds to States

15 CFR §923 Develoment and Approval of State Programs

15 CFR §926 Development Grants, Allocation of Funds to the States

15 CFR §920 Development Grants, General

15 CFR §928 Development Grants, Outer Continental Shelf

15 CFR §930 Federal Consistency with Approved Coastal Management Programs

15 CFR §932 Interstate Grants

15 CFR §933 Research and Technical Assistance

15 CFR §925 State Program

15 CFR §921 Estuarine Sanctuary Development and Operation Guidelines

14 CFR §1204 NASA—Administrative Authority and Policy

30 CFR §250

15 CFR §931 Coastal Energy Impact Program

Title:	Multiple-Use Sustained Yield Act of 1960
Cite:	16 USC §528
Purpose:	Establishes a multiple use and sustained yield policy for national forests, with an emphasis on renewable resources.
Regulations:	
36 CFR §212.1 et seq.	Forest Development Transportation System, Administration of
36 CFR §251.1 et seq.	Land Use Provisions
36 CFR §261.1 et seq.	Prohibited Activities
36 CFR §221.1 et seq.	Timber, Use and Disposal of

Title:	Wilderness Act of 1964
Cite:	16 USC §1131
Purpose:	Protects the federally established designated wilderness areas. The act would prohibit the construction of structures (WECS included) within the wilderness areas. The President may authorize power projects and other development in these areas, but the likelihood of disturbing Congressionally designated wildlife preserves for a few hundred megawatts of electricity is remote.
Regulations:	
50 CFR §35.1 et seq.	Preservation and Management Policies
36 CFR §251	Forest Service, Deptepartment of Agriculture—Land Uses
36 CFR §293	Forest Service, Department of Agriculture—Wilderness, Primitive Areas
43 CFR §19	Office of the Secretary of the Interior—Wilderness Preservation

Title:	The Endangered Species Act of 1978
Cite:	16 USC §1531 et seq.
Purpose:	Provides protection for any species that is in danger of becoming extinct and includes both plants and animals. The act provides for the nullification of any state law that would allow what this act would otherwise prohibit. Exemptions are allowed under the act if denial of such exemption would result in undue economic hardship. The act's effect on siting is that, in the event a WECS would endanger members of any protected species, the WECS would be prohibited (unless undue economic hardship existed).
Regulations:	
	Under 16 USC §1533 the following CFR sections are cited:
50 CFR §17.1 et seq. and Appendices	Endangered Species Conservation and Listing Of
50 CFR §227	Threatened Fish and Wildlife
50 CFR §402	Interagency Cooperation - Endangered Species Act of 1973
50 CFR §450	Endangered Species Exemption Process - General Provisions
50 CFR §452	Endangered Species Review Boards
50 CFR §453	Endangered Species Committee
50 CFR §810	Export of Appendix II Species
50 CFR §226	Designated Critical Habitat
7 CFR §650	Soil Conservation Service—Compliance with NEPA

Title:	National Forest Management Act of 1976
Cite:	16 USC §1600
Purpose:	Establishes the National Forest Service policy of intensive land use without depletion, and restricts the allowable uses of National Forest Lands to those uses which are consistent with land management plans. The act also provides for the assessment of renewable resources within the National Forest System.
Regulations:	
36 CFR §251.1 et seq.	Land Uses

Title:	Indian Land Acts
Cite:	25 USC §323, 324, 177, 341
Purpose:	Deals with the granting of easements and rights-of-way over Indian lands. The Secretary of the Interior is authorized to grant rights-of-way for all purposes over any tribal and restricted individually-owned Indian lands subject to such conditions as the Secretary may prescribe. In order for this grant to be effective over lands owned by a tribe organized under the 1934 Indian Reorganization Act, consent of the proper tribal officials must be obtained. These acts, enacted in 1948, did not repeal former laws, thus there are several approaches to obtaining easements over Indian lands. However, it appears as if tribal or individual consent is a prerequisite to the grant. 25 USC §177 provides that the government and the appropriate federal laws shall protect the Indians from exploitation (with regard to land matters).
Regulations:	
25 CFR §161	Rights-of-Way Over Indian Lands
25 CFR §163	Roadless and Wild Areas on Indian Reservations, Establishment
25 CFR §131	Leasing and Permitting
25 CFR §203	Concessions, Permits, and Leases on Lands Withdrawn or Acquired in Connection with Indian Irrigation Projects
25 CFR §121	Issuance of Patents in Fee, Certificates of Competency, Removal of Restrictions, Sale of Certain Indian Lands
25 CFR §128	Sale of Irrigable Lands, Special Water Contract Requirements
25 CFR App.	Trust or Restricted Status of Certain Indian Lands, Establishment

Title:	Rivers and Harbors Act of 1899
Cite:	33 USC §§401-466
Purpose:	Designed to prevent the obstruction of navigable waters, it requires approval from Congress, the Secretary of the Army, and the Chief of Engineers (Army Corps of Engineers) before any structure may be built upon any of the navigable waters of the United States. Should navigable waters or parts thereof be designated as sites for WECS, all three authorities would have to be consulted.

Regulations:

33 CFR §329	Definition of Navigable Waters of the United States

Another applicable regulation that finds its authority in the River and Harbor Improvement Act of 1920, 33 USC 547 is:

33 CFR §277	Water Resources Policies and Authorities: Navigation Policy: Cost Apportionment of Bridge Alterations
33 CFR §320	General Regulatory Policies applies directed to the 1899 Act
33 CFR §322	Permits for Structures or Work in or Affecting Navigable Waters of the United States
33 CFR §321	Permits for Dams and Dikes in Navigable Waters of the United States
33 CFR §206	Fishing and Hunting Regulations
33 CFR §221	Work for Others
33 CFR §325	Processing of Department of the Army Permits
33 CFR §326	Enforcement
33 CFR §252	Corps of Engineers - Framework and Basin Study Programs
33 CFR §329	Definition of Navigable Waters of the United States
33 CFR §221	Corps of Engineers - Work For Others
33 CFR §70	Interference with or Damage to Aids to Navigation

Title: Noise Control Act of 1972

Cite: 42 USC §§4901-4918

Purpose: Under 42 USC §4901(b), the purpose of this act is to provide a coordinating effort directed toward alleviating excessive noise pollution in the United States. The act seeks to provide for research and activities in noise control, and to establish federal noise emission standards for products distributed in commerce, and to provide information to the public respecting the noise emission and noise reduction characteristics of such products.

If such noise emission standards are promulgated, they will possibly transform normal nuisance actions into nuisance per se actions. Though WECS do not present noise problems on the scale of conventional power facilities, infra-sound has already proved to be a problem at the Boone, North Carolina WECS site.

Regulations:

42 USC §4903 cites the following CFR sections:

14 CFR §§1204.1100 to 1204.1103 — National Aeronautics and Space Administration, Environmental Assessments and Statements

42 USC §4905 cites the following CFR sections:

40 CFR §204.1 et seq. — Construction Equipment Standards

40 CFR §205.1 et seq. — Transportation Equipment Controls

42 USC §4911 cites the following CFR sections:

40 CFR §210.1 et seq. — Notice Requirements

42 USC §4912 cites the following CFR sections:

40 CFR §2.100 et seq. — Availability of Information

42 USC §4914 cites the following CFR sections:

40 CFR §203.1 et seq. — Certification Procedures

42 USC §4916 cites the following CFR sections:

40 CFR §201.1 et seq. — Standards Applicable

42 USC §4917 cites the following CFR sections:

49 CFR §325.1 et seq. — Compliance Requirements

40 CFR §202.1 et seq.	Standards Applicable
40 CFR §209	Rules of Practice Governing Proceedings Under the Noise Control Act of 1972

Title:	Taylor Grazing Act
Cite:	43 USC §315 ([a] in particular)
Purpose:	43 USC §315(a) provides for the protection, regulation, and improvement of grazing districts. The purpose is to preserve the land from destruction and unnecessary injury. Should WECS be detrimental to soil conservation and related matters, this act may prove to be a hindrance.
Regulations:	
43 CFR §§4100.0 to 4170.2	Range Management
43 CFR §2400	BLM—Land Classification
43 CFR §4200	Grazing Administration; Alaska; Livestock
43 CFR §4300	Grazing Administration; Alaska; Reindeer
43 CFR §5500	Nonsale Disposals—General

Title: Outer Continental Shelf Lands Act

Cite: 43 USC §1331 et seq.

Purpose: Recognizes the jurisdiction of the United States over the submerged lands of the Outer Continental Shelf and authorizes the Secretary of the Interior to lease such lands for certain purposes. The outer continental shelf is defined as all submerged lands lying seaward and outside of the area of land beneath navigable waters and of which the subsoil and sea bed appertain to the the United States and are subject to its jurisdiction and control. Though the act deals primarily with oil, gas, and mineral leases, the rights-of-way for power lines from offshore WECS to onshore facilities would have to be scrutinized under this act. In addition to rights-of-way questions, the head of the Department in which the Coast Guard is operating has authority to promulgate and enforce regulations with respect to lights, safety equipment, warnings, and other navigational matters.

Regulations:

33 CFR §143 Construction and Arrangement (of offshore structures)

33 CFR §140 Artificial Islands and Fixed Structures on the Outer Continental Shelf

33 CFR §146 Operations (of the structures)

33 CFR §147 Safety Zones

46 CFR §110 Electrical Engineering - General Provisions

Title: Federal Aviation Act

Cite: 49 USC §1501

Purpose: Requires that anyone contemplating the construction of any structure which might interfere with air traffic must notify the Federal Aviation Administration of his/her intention (in the interests of air safety). FAA regulations established in 14 CFR 77.11 and 14 CFR 77.15 stipulate that notice must be provided to the Federal Aviation Administration where the proposed structure will reach a height of 200 or more feet off the ground, unless there are other structures or natural features which will "shield" the structure. The most probable result of falling under FAA notice requirements is that, if the structure is determined to be an obstruction, FAA lighting and marking requirements will be imposed (FAA Advisory Circular # AC 707460-1).

Regulations:

14 CFR §77.1 et seq. Obstructions in Navigable Airspace, Standards for Determining

Title:	Airport and Airway Development Act of 1970
Cite:	49 USC §1701 et seq.
Purpose:	The act was designed to encourage the proliferation of airports, in order to meet the projected increase in air traffic. Funds are allocated for the expansion of existing airports, and for the construction of new airports. An increase in the number of airports may affect the development of WECS in those targeted areas. Flight path regulations, building height restrictions, and a multitude of restrictions related to airports and air traffic may prove to be a problem for WECS.
Regulations:	
14 CFR §152.1 et seq.	Policies and Procedures, Airport Aid Program
7 CFR §15.1 et seq.	Nondiscrimination in Federally Assisted Programs

Title: Historic Sites, Buildings and Antiquities Act

Cite: 16 USC §461-470

Purpose: 16 USC §462(e) provides that the Secretary of the Interior may contract and make cooperative agreements with states, and everyone else, where deemed advisable, in order to:

> protect, preserve, maintain, or operate, any historic or archeologic building, site, object, or property used in connection therewith for public use, regardless as to whether the title thereto is in the United States.

The "National Register" created under 16 USC §470(a) is a comprehensive catalogue of all historic or archeologic sites in the United States. Also, under 16 USC §470(f), the head of any federal agency or department, in cases concerning federal or federally assisted undertakings in any state, shall take into account the effect of the undertaking or any district, site, building, structure, or object that is included in the National Register. Though this act may prove to be a minor obstacle to WECS siting, has already presented difficulties in the siting of the Block Island demonstration WECS.

Regulations:

36 CFR §1.1 et seq.	Parks, Forests, and Public Property: Applicability and Scope of Provisions
36 CFR §60	National Register of Historic Places
36 CFR §61	Criteria for Comprehensive Statewide Historic Surveys and Plans
36 CFR §63	Determinations of Eligibility for Inclusion in the National Register of Historic Places
36 CFR §5.1 et seq.	Commercial and Private Operations (see 36 CFR 5.7 in particular).
36 CFR §800	Advisory Council on Historic Preservation - Protection of Historic and Cultural Properties
36 CFR §1207	The Secretary of the Interior's Standards for Historic Preservation Projects
36 CFR §67	Historic Preservation Certifications Pursuant to the Tax Reform Act of 1976
23 CFR §771	Federal Highway Administration—Environmental Impact and Related Statements
7 CFR §650	Soil Conservation Service—Compliance with NEPA

Title: Fish and Wildlife Coordination Act of March 10, 1934

Cite: 16 USC §661-666C

Purpose: Applies to, and protects, all game, fur-bearing animals, and fish throughout the United States. Though provisions are made for surveys of solely federal lands, the Act applies to game, animals, and fish on all lands. As such, this act may (as in the case of the snail darter) prove to be a fairly substantial obstacle to WECS. Though WECS may be an environmentally benign power source, wind farms could affect the natural habitat of certain animals.

Regulations:

Under 16 USC §664 the following code sections are listed:

50 CFR §30.1 et seq.	Animal Management
50 CFR §25.1 et seq.	Applicability and Scope of Provisions
43 CFR §21.1 et seq.	Cabin Sites on Public Conservation and Recreation Areas
50 CFR §27.1 et seq.	Enforcement of Provisions
50 CFR §71.1 et seq.	Hunting and Fishing Activities (Fish Hatchery Areas)
50 CFR §70.1 et seq.	Management of Fish Hatchery Areas
50 CFR §32.1 et seq.	Hunting, Provisions Applicable
50 CFR §29.1 et seq.	Land Use Management
50 CFR §26.1 et seq.	Prohibited Acts
50 CFR §28.1 et seq.	Public Use and Recreational Activities
50 CFR §33.1 et seq.	Sport Fishing, Provisions Applicable
50 CFR §31.1 et seq.	Wildlife Species Management
23 CFR §777	Federal Highway Administration-Environmental Impact and Related Statements

APPENDIX B

STATE OF OREGON

STANDARDS FOR THE SITING OF WIND ENERGY CONVERSION SYSTEM FACILITIES

Rule 345-115-010 - Purpose:

The purpose of these rules is to establish standards that applicants for site certificates for wind energy facilities must meet. The Council [Energy Facility Siting Council] will apply these standards in reaching a decision for or against issuance of a site certificate for the construction and operation of a wind energy facility and its "related and supporting facilities", as defined in ORS 469.300(10) and (13), respectively. The same standards will be applied by the Council in deciding whether an existing site certificate should be amended to the extent and in the manner amendment is authorized by the site certificate. When the Council deems appropriate, it will adopt additional standards. Any additional standards will be adopted sufficiently in advance of the close of testimony at a hearing on a site certificate to allow parties to address the rule, or if after the close of testimony, in sufficient time to allow the parties an opportunity to supplement their testimony to offer evidence relating to the new rule.

Rule 345-115-012 - Applicability:

These specific standards are applicable to site certificate applications for all wind energy facilities rated at 25 megawatts or greater.

Rule 345-115-015 - Interpretation:

These specific standards are authorized under ORS 469.470 (3) and shall be interpreted so as to carry out the purposes of ORS 469.300 through 469.570, 469.990 and 469.992 governing energy facility siting in Oregon. The fundamental policy of that law is set out in ORS 469.310.

Rule 345-115-020 - Definitions:

1. The definitions set out in ORS 469.300 are hereby incorporated as the definitions to be used in interpreting these specific standards, unless a term is specifically defined within these specific standards.

2. A wind energy facility means all wind turbines or other such devices, owned by a person, which produce electric power from wind, and are:

(a) connected to a common switching station, or

(b) constructed, maintained, or operated as a contiguous group of devices.

3. "Related or supporting facilities" means structures or equipment adjacent to and associated with a wind energy conversion system and shall include but is not limited to transmission line towers and substations.

Rule 345-115-030 - Specific Standards Relating to Public Health and Safety:

In order to issue a site certificate for wind energy facility the Council must find that:

1. To the extent feasable, the facility will be designed to satisfy the Department of Environmental Quality's octave bands limitations set forth in OAR 340-35-035(1)(f) in effect as of the effective date of these specific standards

2. The proposed wind turbine facility and its related and supporting facilities will be designedurbines or other such devices, owned by a person, which produce electric power from wind, and are:

(a) connected to a common switching station, or

(b) constructed, maintained, or operated as a contiguous group of devices.

3. "Related or supporting facilities" means structures or equipment adjacent to and associated with a wind energy conversion system and shall include but is not limited to transmission line towers and substations.

Rule 345-115-030 - Specific Standards Relating to Public Health and Safety:

In order to issue a site certificate for wind energy facility the Council must find that:

1. To the extent feasable, the facility will be designed to satisfy the Department of Environmental Quality's octave bands limitations set forth in OAR 340-35-035(1)(f) in effect as of the effective date of these specific standards.

2. The proposed wind turbine facility and its related and supporting facilities will be designed to exclude members of the public from close proximity to the turbine blades and electrical equipment.

3. The wind turbine and related and supporting facilities will be designed to preclude, to the greatest extent feasable, structural failure of the tower or blades which could endanger the public safety; and that adequate safety devices and testing procedures designed to warn of impending failure or to minimize consequences of such failure will be employed by the applicant.

Rule 345-115-040 - Environmental Impact:

1. The proposed site is not in one of the designated natural resource areas listed below and the proposed project is not likely to produce significant adverse impacts on any such area including:

(a) National Parks, National Monuments and National Wildlife Refuges;

(b) State of Oregon Parks, Waysides, Wildlife Refuges and Natural Area Preserves;

(c) Wilderness areas as established under the Federal Wilderness Act (16 USC 1131 et seq.) and areas recommended for designation as wilderness areas pursuant to Section 603 of the Federal Land Policy and Management Act of 1976 (P.L. 94-579);

(d) Scenic Waterways designated pursuant to ORS 390.825;

(e) Federally-designated wild and Scenic Rivers established pursuant to P.L. 90-452;

(f) Experimental areas established by the Rangeland Resources Program, School of Agriculture, Oregon State Unversity;

(g) Areas having unique or significant wildlife, geologic, historic, botanical, research or recreational values as lawfully designated by the state agency having jurisdiction over such values.

2. Studies have been performed characterizing the relative abundance and diversity of the plant and animal species at the proposed site. (Shannon-Weaver index H' shall be a satisfactory measure of diversity) and

(a) The proposed project is not likely to jeopardize the continued use of deer, elk and antelope wintering ranges or migration routes.

(b) The above ground portions of the proposed facility shall not be located on antelope fawning areas, sage grouse strutting and nesting areas or water fowl nesting and rearing areas which are necessary to sustain the existing local or migratory populations of such species.

(c) Areas within the project boundary with unstable or fragile soils have been satisfactorily identified and available construction techniques can be employed to reduce adverse impacts such as erosion and compaction.

(d) The bird species within the area affected by the proposed facility have been identified and the project is not likely to jeopardize the continued existence of local or migratory populations of such bird species.

(e) Construction and operation of the proposed facility is not likely to jeopardize the continued existence of any of the following species, or destroy habitat critical to continued existence of these species.

i. Wildlife

(A) Deer, Columbian white-tailed (Odocoileus virginianus luecurus),

(B) Wolf, Gray (Canus lupus).

(C) Eagle, Bald (Haliaeetus leucocephalus),

(D) Falcon, American peregrin (Falco peregrinus anatum),

(E) Falcon, Arctic peregrin (Falco peregrinus tundrius),

(F) Goose, Aleutian Canada (Branta canadensis leucopareia),

(G) Pelican, brown (Pelecanus occidentalis),

(H) Butterfly, Oregon silverspot (Speyeria zarene hippolyta),

ii. Plants

(A) any of the fifty-one species proposed by the Fish and Wildlife Service as endangered in Oregon by publication in the Federal Register (41 FR 24524; June 16, 1976).

NOTE: The species identified in subsection (A) consist of endangered and threatened wildlife and plants listed as of October 1, 1978, in 50 CFR Part 17 with a range which includes Oregon, and species in Oregon proposed by the Fish and Wildlife Service for addition to the list in 50 CFR Part 17 as published in the Federal Register.

3. The proposed wind turbine facility can be designed to reduce its interference with radio, television and microwave signals to the lowest practicable level; and the operator of the proposed facility agrees to restore reception of radio, television and microwave signals to the levels present prior to operation of the proposed facility, at no cost to those experiencing interference resulting from the proposed facility.

Rule 345-115-045 - Land Use:

In order to issue a site certificate for a wind energy facility the Council must find that:

1. The Land Conservation and Development Commission has acknowledged, pursuant to ORS 197.251 (1979 replacement part), the comprehensive land use plan(s) and implementing measures of the general purpose local government(s) having land use planning jurisdiction over the site of the energy facility and its related and supporting facilities; and that the energy facility and related and supporting facilities have been determined by the local government(s) to be consistent with the plan(s) and measures.

2. That if the plan and implementing measures have not been acknowledged by the Land Conservation and Development Commission, the applicant has demonstrated to the council that after providing notice and opportunity for public and other government agency review and comment, the statewide planning goals (OAR Chapter 660, Division 15) have been considered and applied by the local government(s) during a land use review of the energy facility and related and supporting facilities and such facilities have been determined by the local government(s) to be consistent with applicable statewide planning goals and local land use plan(s) and measures.

3. That if the local government(s) having land use planning jurisdiction over the site of the energy facility and its related and supporting facilities have not completed a land use review of the energy facility and its related supporting and facilities prior to approval of a site certificate as required by subsection (1) and (2) of this rule, or if such local government has denied that the energy facility and its relating and supporting facilities are consistent with applicable statewide planning goals and land use plans and measures the Council has determined that the application is consistent with the statewide planning goals and land use ordinances. Provided, however, that a site certificate authorizing the construction within the boundaries of an incorporated city shall be conditioned on compliance with city ordinances in effect on the date of the application of the site certificate as required by ORS 469.400 (6).

Rule 345-115-050 - Socioeconomic Impacts:

In order to issue a site certificate for a wind energy facility the Council must find:

1. The applicant has identified the major and reasonably foreseeable socio-economic impacts on individuals and communities located in the vacinity of the proposed facility resulting from construction and operation, including, but not limited to, anticipated need for increased governmental services or capital expenditures, and

2. The applicant and the affected local government have reached agreement to provide adequate resources to mitigate the impacts identified pursuant to (1), and

3. The applicant has an adequate process for periodically updating, during construction and operation, its assessment of anticipated impacts of the facility.

Rule 345-115-051 - Historic and Archaeological Sites:

In order to issue a site certificate for wind energy facility the Council must find that:

The proposed facility is not likely to cause significant adverse impacts within historic sites or upon archaeological resources.

Rule 345-115-052 - Standard Relating to Water Rights:

In order for the Council to issue a site certificate for a wind energy facility the Council must find that: the requirements for water used in construction and operation of the facility without infringing upon the existing water rights of other persons.

Rule 345-115-053 - Organization, Managerial and Technical Expertise:

In order for the Council to issue a site certificate for a wind energy facility the Council must find that:

The applicant has the organization, managerial, and technical expertise to construct, operate, and retire the proposed facility. To this end, the applicant shall present evidence relating to:

1. The applicant's previous experience, if any, in constructing, operating, and retiring similar facilities;

2. The qualifications of the applicant's personnel who will be responsible for constructing, operating and retiring the facility; and

3. The qualification of any architect-engineer, major component vendor, or prime contractor upon whom the appplicant will rely in constructing, operating, and retiring the facility.

Rule 345-115-054 - Financial Assurance:

In order to issue a site certificate for a wind energy facility the Council must find that:

The applicant, together with all co-owners, possesses or has reasonable assurance of obtaining the funds necesary to cover estimated construction costs, operating costs for the design lifetime of the facility, including, but not limited to, related fuel cycle costs, and the estimated costs of retiring the facility.

Rule 345-115-055 - Applications:

1. The applicant shall submit an application which includes, but is not limited to:

   (a) description of the project;

   (b) description of the site and the existing environment;

   (c) description of construction and operation of the facility and any regulated and supporting facilities with their attendant impacts;

   (d) description of proposed techniques for monitoring facility impacts;

   (e) description of any required decommissioning or waste disposal sites and methods;

   (f) approvals required from governmental agencies; and

   (g) a proposed site certificate.