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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. As of 1979, over 50 electric utilities in the United States were conducting wind energy projects. Some utilities have already committed substantial resources to the development of wind power generation. Pacific Gas and Electric Company, for example, has included 82.5 megawatts (MW) of wind power (in terms of machine ratings) as part of its generation expansion plans for 1990. Southern California Edison Company has included 120 MW of firm capacity in its plans for 1990. And, Hawaiian Electric Company, Inc., signed an agreement to purchase 80 MW of wind-generated power by 1985.

An estimated 20 utilities in the United States are now investigating potential wind machine sites in their areas. 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 quickly. Utilities are now required, however, to give careful consideration to specific legal, social, and environmental questions raised by the siting of wind energy conversion systems (WECS).

2.0 APPLICATIONS OF LAND-USE LAWS TO WECS

Although many utilities are now 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 with WECS and the absence of multiunit development (a more realistic scenario for future utility development than single-unit installations) make it difficult to assess how land-use laws will apply to WECS. Nonetheless, we examined utilities that have begun siting assessments and that have become involved in the permitting process; they offer some insights into the process and its effect on WECS development.

Most questions about energy facility siting will arise in the context of environmental regulation. To date, the consensus of several federal studies is that (1) WECS will impose only minor changes on the local environment; (2) most potentially adverse impacts will be specific to each site rather than general; (3) the major environmental concerns in siting large WECS will be safety, electromagnetic interference, noise, and aesthetics; (4) in some cases, site location can either exacerbate or minimize a WECS impact on the envi-

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ronment; and (5) in most cases, potentially adverse impacts can be minimized or avoided by careful planning, siting, and design.

The implications of the last two findings for utility siting of WECS are important and go beyond environmental considerations per se. 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, siting authorities, and local governments.

2.1 Land Use and Land Acquisition

Many of the best potential wind resource sites in the United States are in mountain, desert, or coastal areas. For example, preliminary assessments of the wind energy potential in California indicated that about 40% of California's total realizable potential lies in the state's southeastern desert area. However, siting large wind farms in some of these areas could create serious environmental and aesthetic problems. Access roads and interconnecting line corridors between turbines and to the nearest existing lines with sufficient excess transmission capacity must be examined in relation to 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 probability of land-use conflicts and environmental impacts concerns increases.

Besides having to deal with land-use and aesthetic concerns—reflected in 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 multiunit installations, additional land must be obtained or controlled to ensure adequate wind access and to provide sufficient spacing between individual machines. Utilities' acquisition of wind rights, particularly over private land, may become the key issue.

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 forms of ownership. The following sections discuss potential applications of land-use laws based on anticipated WECS land area requirements for three forms of land ownership: federal, state, and private.

2.2 Land Area Requirements

The precise amount of land required for a multiunit 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 turbine's capacity. Since wind is a dispersed resource, WECS also must be dispersed to capture wind energy effectively. Each machine extracts energy from the wind, thereby reducing the wind velocity for a certain distance behind the rotor. If WECS are located too close together the wind is not fully replenished before it encounters the next machine, resulting in 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.

Oregon is one of the first states to consider land area requirements for large-scale utility development of WECS. The Oregon Wind Task Force has developed a method of calculating requisite WECS land areas. 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 that construction machinery, WECS components, and maintenance crews be transported over long distances. Access roads and power transmission tie-in lines would also be longer than those needed for wind farms, increasing the land impacts. Both factors increase potential environmental impacts as well as construction and operation costs.

Most favorable wind regions in Oregon apparently will have few mutually exclusive uses, with the possible exception of sites near coastal recreation areas. Multiple land uses are considered feasible where grazing and agricultural activities occur. These lands are usually far from concentrated activity and population centers, significant in determining effects of such impacts as electromagentic interference, safety, and aesthetics.

Because of relatively large land requirements and the critical need to site wind farms where winds are strongest, conflicts may arise between current federal, state, and local land-use plans and wind farm development. The problem could become especially acute if many appropriate sites are located in areas, such as along mountain ridges or on coastal lands, whose natural beauty or recreational value has been protected against energy or other development. Careful planning by WECS developers and close coordination, particularly with federal, state, and local land-use agencies, can help minimize potential conflicts. Regardless of expected 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 are good sites for WECS development.

2.3 Federal Land

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. Battelle Pacific Northwest Laboratory is under contract to the U.S. Department of Energy to produce a comprehensive wind atlas of the United States at approximately countywide scale. Work such as this will help identify the best 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) mandated a 10-year wilderness review covering all land administered by the Bureau of Land Managment (BLM).

The first phase of the review is to inventory BLM lands for roadless areas of 5000 acres that have "wilderness characteristics." 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 utilities' 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 possible wilderness status. These areas include large portions of the southeastern desert and many forested areas along the Sierra and northeastern mountain ranges.

The California Energy Commission (CEC) 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 eliminated because they were designated wilderness areas; and (3) WECS deployment was disallowed in the so-called "limited" class (among the four land-use categories: controlled or wilderness, limited, moderate, and intensive).

At this state 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 (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 dated.

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., 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 be a major determinant as to whether existing federal land-use and environmental regulations will be an impediment to early WECS development on federal lands.

2.4 State and Local Regulation of Privately Owned Land

The developer's ability to gain access to state lands for wind energy generation will be determined by two factors: (1) the relationship of wind energy use on state lands to long-term state 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 use of land resources. Some states, however, have recently strengthened their land-use policies 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.

California's case illustrates the possible obstacles to WECS development raised by local land-use plans. The potential effect of 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 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 require a full-scale environmental review of all proposed developments. Thus, a WECS developer who locates a favorable site or set of sites in two or more counties could be faced with markedly different regulatory burdens in each county as he or she attempts to comply with relevant county regulations.

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 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 required wading through six months of red tape. The new bill essentially eliminates the need to obtain these permits and applies only to WECS.

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 in enabling legislation for local planning. Oregon, for example, has already incorporated wind energy use to some extent in its land-use goals. 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.

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. Obtaining wind rights is 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 how to determine their value once they are established, will need to be resolved before widespread WECS development on private lands can occur.

The Oregon Attorney General's Office has suggested several ways to acquire and preserve access to wind on private land that could be available to developers. Such methods fall into two groups: (1) private actions and (2) public actions.

(1) **Private Actions.** Given 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.

- Acquisiton of Fee Title to Sufficient Property. If the price were right and financing available, a WECS developer could ensure access to wind by acquiring, either through fee ownership or a long-term lease, sufficient land to preserve an unobstructed flow. This approach has limitations, however; the principal one is cost. Still, the developer could put the "excess" land to a variety of remunerative uses that would not interfere with the operation of the WECS.
- Acquisition of a Negative Easement. 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 be recorded in the county property records to give notice of its existence to others who might later purchase the burdened property.

(2) **Public Actions.** A variety of steps can be taken legislatively to assist in obtaining and preserving wind access. For example, 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, and a decision would be made at the local level. Either approach, however, would probably require case-by-case resolution.