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POTENTIAL LEGAL FACILITATION OR IMPEDIMENT OF WIND ENERGY CONVERSION SYSTEM SITING

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The use of wind to produce energy has ancient roots.¹ Prior to World War II over six million small windmills had been in operation in the United States.² Then, during the post-war industrial boom, wind generation of energy was largely abandoned in favor of cheaper, more convenient fossil fuels. In recent years, the rapidly escalating price of imported oil and consequent search for alternative domestic energy sources has generated renewed interest in the utilization of wind energy. Most recently, perhaps most importantly, Congress has mandated that renewable energy sources be given first priority in planning the future of the Pacific Northwest's power supply.³

Since wind regained its status as an attractive energy source a decade ago there has been a spate of scientific research on the siting of wind energy conversion systems (WECS).⁴ Obviously, optimal wind availability is a primary determinant of WECS siting. However, besides wind potential, a host of legal and policy issues may constrain siting decisions.⁵

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1. For an interesting account of the use of wind machines during the Middle Ages in Europe, see F. ELDRIDGE, *WIND MACHINES* 8-13 (NSF-RA-N-75-051, 1975).

2. L. COIT, *WIND ENERGY: LEGAL ISSUES AND INSTITUTIONAL BARRIERS* 5 (Solar Energy Research Institute/TR-62-241, 1979).

3. The Pacific Northwest Electric Power Planning and Conservation Act, 16 U.S.C. § 839 (Supp. V 1981), defines the procedural framework for meeting future power demands in the Pacific Northwest. The Act mandates that top priority be given to conservation and renewable energy resources. For a discussion of the complete priority ranking of future electricity sources under the Act, see Mellem, *Darkness to Dawn? Generating and Conserving Electricity in the Pacific Northwest: A Primer on the Northwest Power Act*, 58 WASH. LAW REV. 245, 264-67 (1983).

4. Research institutes actively involved in WECS siting issues include the Battelle Institute (Battelle Columbus Laboratories, Columbus, Ohio), the Solar Energy Research Institute (Golden, Colorado), Rockwell International (Rocky Flats, Colorado), NASA's Lewis Research Center (Sandusky, Ohio), the U.S. Department of Energy, and the Electric Power Research Institute.

5. See, e.g., L. COIT, *supra* note 2, at 10-11; R. NOUN, *THE ACQUISITION OF WIND RIGHTS FOR*

The purpose of this article is to broadly identify competing interests at stake in WECS development and the potential constraints of local, state, and federal regulation and common law principles on the siting of WECS. First, the article addresses common law and regulatory means of facilitating wind energy development by protecting the WECS developer's interest in unobstructed wind flow. Second, it examines the potential restriction of WECS development by common law and regulatory responses to the demands of neighbors and the general public whose interests may be detrimentally affected by wind turbine operation.⁶

I. THE IMPORTANCE OF SECURING WIND ACCESS

Perhaps the greatest impediment to widespread commercialization of wind power is uncertainty about unobstructed access to the wind as an energy source. Maintenance of an adequate wind flow is critically important to a wind energy developer. Since the power in wind increases by a factor of eight as wind speed doubles,⁷ variation in wind speed of just a few miles per hour can be the difference between success and failure of a WECS.⁸ Hence, the possibility of even partial obstruction of a WECS's power source threatens the viability of a wind energy development.

Most WECS in Washington have been erected in predominantly undeveloped, rural areas where man-made obstruction of the wind source has not been a major concern. However, legal protection of wind access will become increasingly important in the coming decade. Rising fuel costs will force utilities and homeowners in urban as well as rural areas to seriously consider increased utilization of renewable sources of energy. And rural-recreational development increasingly will encroach upon formerly

WIND ENERGY DEVELOPMENT 5-10 (Solar Energy Research Institute SERI/TP-211-1421, 1981); L. MAYO, LEGAL-INSTITUTIONAL IMPLICATIONS OF WIND ENERGY CONVERSION SYSTEMS (WECS) 100-104 (National Science Foundation NSF/RA-770204, 1977); R. Sandvik & F. Ostrander, Legal Issues Surrounding Wind Energy Conversion Systems (May 21, 1980) (Memorandum from Oregon Department of Justice to Wind Task Force, Alternate Energy Development Commission) (copy on file with the *Washington Law Review*) [hereinafter cited as Oregon Wind Memorandum].

6. Utility interconnection issues, which may represent an additional impediment to WECS development, are beyond the scope of this article. Problems may arise in securing an acceptable contract with a utility to supply back-up power during windless periods and to buy surplus power when the WECS is over-producing. The Public Utility Regulatory Policies Act of 1978 (PURPA) was enacted in part to address this precise problem. Pub. L. No. 95-617, 92 Stat. 3117 (codified as amended in scattered sections of 15, 16, 30, 42, & 43 U.S.C.). However, the complexity of this legislation and its numerous requirements regarding qualifying status leave a great deal of uncertainty. For a discussion of some of these issues, see D. Bain, PURPA for Local Governments (Sept. 15, 1980) (unpublished memorandum) (copy on file with the *Washington Law Review*).

7. Simple calculation reveals that a 12 mile-per-hour wind possesses 70 percent more power than a 10 mile-per-hour wind. P. PUTNAM, POWER FROM THE WIND 15 (1948).

8. R. NOUN, *supra* note 5, at 3.

undeveloped ridges and coastlines which typically are prime wind resource areas.

Traditionally, neither the common law nor public land use regulation directly addressed the protection of access to the sun or wind as energy sources. Recently, intensifying interest in solar energy has generated the adoption of various legal devices to protect solar access which are possible models and precedent for wind access protection.⁹

A. *Securing Wind Access Through Common Law Doctrines*

The common law has never recognized a right to unobstructed flow of wind or sunlight onto a parcel of land as an incident of land ownership. Even the English doctrine of ancient lights,¹⁰ which after early judicial

9. Solar access protection, which has developed sooner than wind access protection, provides guidance for development of wind access protection. However, the two technologies are sufficiently different to warrant separate treatment. For example, the direction in which solar collectors are aimed limits the area of protection needed, while a wind turbine generator generally must be protected from obstruction in all directions.

A recent flurry of literature emphasizes the importance of solar access protection to practical development of the resource. *See, e.g.*, G. HAYES, SOLAR ACCESS LAW (1979); S. KRAEMER, SOLAR LAW (1978); W. THOMAS, A. MILLER, & R. ROBBINS, OVERCOMING LEGAL UNCERTAINTIES ABOUT USE OF SOLAR ENERGY SYSTEMS (1978); Note, *Obtaining Access to Solar Energy*, 45 BROOKLYN L. REV. 357 (1979); Comment, *Obstruction of Sunlight as a Private Nuisance*, 65 CALIF. L. REV. 94-119 (1977); Comment, *Assuring Legal Access to Solar Energy*, 12 CREIGHTON L. REV. 567 (1978); Comment, *Solar Rights*, 57 OR. L. REV. 94 (1977); Note, *The Allocation of Sunlight: Solar Rights and the Prior Appropriation Doctrine*, 47 U. COLO. L. REV. 421 (1976).

Recently, the Wisconsin Supreme Court decided that the owner of a solar-heated residence stated a claim upon which relief could be granted on the private nuisance theory that his neighbor's proposed construction of a residence, although conforming to deed restrictions and local ordinances, would interfere with the plaintiff's access to unobstructed sunlight across the neighbor's property. *Prah v. Maretti*, 108 Wis. 2d 223, 321 N.W.2d 182 (1982).

Also potentially relevant are legal doctrines which may protect a landowner's weather from artificial modification. *See* CONTROLLING THE WEATHER (H. Taubenfeld ed. 1970); Pierce, *Legal Aspects of Weather Modification Snowpack Augmentation in Wyoming*, 2 LAND AND WATER L. REV. 273 (1967); *see generally* Stark, *Weather Modification: Water—Three Cents Per Acre-Foot*, 45 CALIF. L. REV. 698 (1957) (discussing the legal rights and liabilities arising from weather modification operations); Note, *Who Owns the Clouds*, 1 STAN. L. REV. 43 (1948) (applying property law and water law concepts to clouds and rainfall).

10. Under the English "doctrine of ancient lights" a landowner acquired an easement for the passage of light and air over adjoining property through uninterrupted use for a certain period of time. The required uninterrupted time of enjoyment varied through English legal history. Early law established a 60-year period by analogy to a statute of limitations for the issuance of certain writs. Act of Limitation of Actions and for Avoiding Suits in Law, 1623, 21 James 1, ch. 16. This was reduced by statute in 1832 to a 20-year period, Prescription Act, 1832, 2 & 3 Will. 4, ch. 71, and was finally lengthened to 27 years by the Rights of Light Act of 1959, 7 & 8 Eliz. 2, ch. 56. In order to determine a person's entitlement to light under this doctrine, the English courts developed the concept of the "grumble line." This was "the point whereat ordinary common sense people would begin to grumble at the quantum of light." *Semon & Co. v. Bradford Corp.*, [1922] 2 Ch. 737, 747-48 (1923). Normally, at least one-half of the room would be between the "grumble line" and the window.

acceptance¹¹ has been generally repudiated¹² in the United States, merely recognized that passage of light over adjoining land for the requisite period of time entitled a landowner to a quantum of lamination sufficient to read or work. Since a plausible purpose of the ancient lights doctrine was to obviate the need for artificial illumination during daylight hours, the doctrine arguably demonstrates common law recognition of the interest in energy conservation which is closely related to the modern interest in use of renewable energy sources. However, with its long prescriptive periods, protection of only a modest quantum of lamination rather than direct sunlight, and general rejection by American courts, the doctrine offers meager precedent. Given the uncertainty and complexity of the competing interests at stake, common law recognition of a property right to unobstructed access to wind and sunlight is highly unlikely in the foreseeable future.¹³

Absent recognition of a right to unobstructed wind access as an incident of property ownership, wind flow may be impaired by development of land adjacent to a WECS unless precluded by common law principles or public regulation of land use. Relevant common law devices include private nuisance law, acquisition of negative easements, restrictive covenants, or even fee ownership of a protective buffer of land by the WECS operator.

When this rule was violated—resulting in the need for artificial light where none was previously needed—substantial deprivation of light had occurred.

11. See *Clawson v. Primrose*, 4 Del. Ch. 643, 676 (1873), *overruled*, *Lynch v. Hill*, 24 Del. Ch. 861, 6 A.2d 614 (1939); *Story v. Odin*, 12 Mass. 157, 159–60 (1815), *overruled*, *Keats v. Hugo*, 115 Mass. 204 (1874); *McCready v. Thomson*, 10 S.C.L. (Dud. 131) 55, 56 (1838).

12. The doctrine soon came into disfavor in the United States and yielded to the competing public policy of encouraging the growth of cities. In *Parker v. Foote*, 19 Wend. 309 (N.Y. 1838), the first American case which rejected the doctrine, the court held that the doctrine "cannot be applied in the growing cities and villages of this country, without working the most mischievous consequences." *Id.* at 318. In *Fontainebleau Hotel Corp. v. Forty-Five Twenty-Five, Inc.*, 114 So. 2d 357 (Fla. 1959), the court noted that "the English doctrine of 'ancient lights' has been unanimously repudiated in this country." *Id.* at 359. That case involved a dispute between the owners of two oceanfront hotels in Miami Beach, Florida, the Fontainebleau and the Eden Roc. The owners of the Eden Roc brought suit to enjoin the owners of the Fontainebleau from constructing an addition that would have completely shaded the Eden Roc's sunbathing area during the afternoon hours of the prime tourist season. In holding for the Fontainebleau, the court noted that obstructing the Eden Roc's sunlight was not actionable because the Eden Roc had no right to the light in the first place.

13. Other plausible doctrinal bases for recognition of a property right in windflow onto land are: (1) a right to unmodified weather, see *Southwest Weather Research, Inc. v. Duncan*, 319 S.W.2d 940 (Tex. Civ. App. 1958), *aff'd*, 160 Tex. 104, 327 S.W.2d 417 (1959); see also *supra* note 9; (2) riparian water rights, see 1 S. WIEL, *WATER RIGHTS IN THE WESTERN STATES* § 687 (3d ed. 1911); (3) appropriation water rights in the western states, see *id.*; (4) right to support of land, both lateral and subjacent, see 3 TIFFANY, *THE MODERN LAW OF REAL PROPERTY* § 752 (3d ed. 1939); (5) the right to natural diffusion of the air, free from unreasonable pollution, *Evans v. Reading Chemical Fertilizing Co.*, 160 Pa. 209, 28 A. 702 (1894); 3 TIFFANY, *supra*, § 717; (6) the right to natural drainage of land, *Gray v. McWilliams*, 98 Cal. 157, 32 P. 976 (1893); *Duenow v. Lindeman*, 233 Minn. 505, 27 N.W.2d 421 (1947). See Note, *Who Owns the Clouds*, *supra* note 9, at 52.

A landowner's common law right to the use and development of land, including airspace above,¹⁴ is limited by the principle of private nuisance which recognizes that the right to develop land is subject to a duty to avoid substantial and unreasonable interference with the use and enjoyment of adjacent land. The law of private nuisance is the common law doctrine by which courts resolve disputes arising out of incompatible land uses.¹⁵ When a court determines that a land owner's activities substantially and unreasonably interfere with the use and enjoyment of adjacent land, damages¹⁶ and, in some cases, injunctive relief¹⁷ may be awarded to the injured landowner. In general, only abnormally obnoxious land uses which substantially interfere with normal ones are actionable.¹⁸ Since a WECS might be characterized as an abnormally sensitive use and most of the vegetation and structures which obstruct wind would be considered normal,¹⁹ it is unlikely that the law of private nuisance would provide significant assurance of wind access for a prospective WECS developer.

In effect, the law of private nuisance confers legal protection on a normal range of uses. Abnormally obnoxious uses may be enjoined or burdened with damages while abnormally sensitive uses are left to suffer interference without legal redress. However the range of land uses accorded

14. The common-law principle is expressed in the maxim "cujus est solum ejus est usque ad coelum et ad inferos" or "[t]o whomever the soil belongs, he also owns to the sky and to the depths." Black's Law Dictionary 453 (rev. 4th ed. 1968). See *U.S. v. Causby*, 328 U.S. 256, 260-61 (1946). *Guith v. Consumers Power Co.*, 36 F. Supp. 21 (E.D. Mich. 1940).

15. See 6A AMERICAN LAW OF PROPERTY §§ 28.22-.35 (A. Casner ed. 1954); W. PROSSER, LAW OF TORTS §§ 86-91 (4th ed. 1971); Beuscher & Morris, *Judicial Zoning Through Recent Nuisance Cases*, 1955 WIS. L. REV. 440; Ellickson, *Alternatives to Zoning: Covenants, Nuisance Rules and Fines as Land Use Controls*, 40 U. CHI. L. REV. 681 (1973); Comment, *Nuisance as a Modern Mode of Land Use Control*, 46 WASH. L. REV. 47 (1970).

16. *E.g.*, *Boomer v. Atlantic Cement Co.*, 26 N.Y.2d 219, 257 N.E.2d 870, 309 N.Y.S.2d 312 (1970).

17. *E.g.*, *Hulbert v. California Portland Cement Co.*, 161 Cal. 239, 118 P. 928 (1911); *Little Joseph Realty, Inc. v. Town of Babylon*, 41 N.Y.2d 738, 363 N.E.2d 1163, 395 N.Y.S.2d 424 (1977).

18. See, *e.g.*, *Amphitheatres, Inc. v. Portland Meadows*, 184 Or. 336, 198 P.2d 847 (1948) (use of lights for night-time racing at horse racing track neither a trespass nor a nuisance); *Belmar Drive-In Theatre Co. v. Illinois State Toll Highway Comm'n*, 34 Ill. 2d 544, 216 N.E.2d 788 (1966) (toll-road service center lights, which interfered with outdoor movie viewing, held not a nuisance).

19. The application of nuisance law to "spite fences"—maliciously motivated structures designed only to harm a neighbor—is relevant to protection of wind access. Structures erected or vegetation cultivated only to deprive a neighbor's WECS of wind would be actionable. In several of the spite fence cases, courts have recognized the property owner's interest in sunlight. *Hornsby v. Smith*, 191 Ga. 491, 500, 13 S.E.2d 20 (1941) ("[t]he air and light no matter from which direction they come are God-given, and are essential to the life, comfort, and happiness of everyone"); *Burke v. Smith*, 69 Mich. 380, 389, 37 N.W. 838 (1888) ("the right to breathe the air, and to enjoy the sunshine, is a natural one"); *Barger v. Barringer*, 151 N.C. 433, 437, 66 S.E. 439 (1909) ("[l]ight and air are as much a necessity as water, and all are the common heritage of mankind").

legal protection may vary among different districts of a community.²⁰ By determining that different groupings of uses are normal in different geographic areas, courts can apply private nuisance law to effect a crude separation of incompatible land uses.²¹ Thus, a court inclined to consciously employ private nuisance law to promote land use planning objectives might be persuaded to recognize that wind energy generation should be protected by private nuisance law only in optimally situated geographic areas. The law would then create incentive for WECS development to be clustered in the areas best suited for wind energy generation.

While such protection of WECS through private nuisance law is doctrinally plausible, it is improbable.²² Relatively few courts have been inclined to administer private nuisance law with prospective community planning goals in mind. Even if a WECS development were characterized as normal in a particular location, most courts probably would balk at declaring normal vegetation and structures on adjacent land as private nuisances.²³ Although penalizing wind-impairing activities in optimal wind generation locations may be constitutional,²⁴ judicial notions of fairness and self-restraint would probably lead courts to refer to legislative decisionmakers such a major policy choice between legitimate, competing activities. Unfairness might be avoided or greatly reduced by creative design of remedies, such as enjoining wind obstruction contingent upon compensation by the WECS operator.²⁵ But judicial reluctance to make major untraditional resource allocation decisions would be difficult to overcome.

B. *Securing Wind Access Through Acquisition of Property Interests*

Since common law doctrines provide no assurance and scant hope of wind access protection, the risk-averse WECS developer must rely upon

20. See *Bove v. Donner-Hanna Coke Corp.*, 236 A.D. 37, 258 N.Y.S. 229 (court refused to enjoin operation of coke oven located in industrial area), *appeal denied*, 236 A.D. 775, 258 N.Y.S. 1075 (1932); *Bortz v. Troth*, 359 Pa. 326, 59 A.2d 93 (1948) (court enjoined operation of gas station in exclusively residential district).

21. See generally *Beuscher and Morrison*, *supra* note 15 (analyzing extent to which courts meet land use protections demands in unzoned areas).

22. *But see Prah v. Maretti*, 108 Wis. 2d 223, 321 N.W.2d 182 (1982) (holding that a private nuisance action may exist for interference with the access to unobstructed sunlight across a neighbor's property).

23. An example of a court which might not balk at such a characterization is the Wisconsin Supreme Court. See *id.*

24. See *Miller v. Schoene*, 276 U.S. 272 (1928).

25. See *Spur Industries, Inc. v. Del E. Webb Dev. Co.*, 108 Ariz. 178, 494 P.2d 700 (1972); *Ellickson*, *supra* note 15, at 738-48 (1973); *Rabin, Nuisance Law: Rethinking Fundamental Assumptions*, 63 VA L. REV. 1299, 1339-41 (1977).

either acquisition of sufficient interests in adjacent land or public regulation of potentially wind-obstructing activities.

Fee ownership of sufficient surrounding land to assure adequate wind flow would provide the best protection of wind access but also would be the most costly. Purchase of leaseholds, negative easements, restrictive covenants, or other less-than-fee interests in surrounding land might provide wind access protection more cost-effectively.

1. *Easements and Covenants*

Easements and covenants are the most likely less-than-fee property interests which might be acquired to protect wind access. Either may be employed to give the WECS operator a right to unimpeded air flow across adjacent land. In general, the acquisition or retention of easements or restrictive covenants would be significantly less expensive²⁶ than fee ownership or leases of surrounding land, although the usually lower purchase or holding costs of less-than-fee interests may be partly offset by enforcement costs.²⁷ Where the only marketable use of land is precluded by such

26. See 3 R. POWELL, *THE LAW OF REAL PROPERTY*, ¶ 414(5) (rev. ed. 1981).

The recognition that land is a limited resource and that development is virtually an irrevocable process has led to the emergence of the easement as an important tool available to local governments to preserve the open space character of the land.

... Use of the open space easement is far more economical [than use of eminent domain] since the governmental unit is only required to pay the landowner the diminution in value caused by such restriction. Furthermore, in contrast to eminent domain, utilization of an open space easement leaves the subject property on the property tax rolls, albeit at reduced assessment.

Id. at 34-149.

27. See J. BEUSCHER, R. WRIGHT, & M. GITELMAN, *CASES AND MATERIALS ON LAND USE* 147-48 (1976).

Finally, and more generally, there are the inevitable administrative difficulties in enforcing the respective rights of the parties in a situation where a single tract of land is in effect in split ownership. Inevitably there is a clash of interests and the possibility of confusion, which may be mitigated—but not prevented—if the mutual rights are defined as clearly as possible.

Several problems should be noted. First, it is clearly impossible to foresee all the problems of conflicting land use which may arise in such a situation. Therefore, if what the Government owns are certain specified rights acquired from the fee owner, the fee owner remains in substantial control of the situation; any right not explicitly granted remains in his hands. The owner of the servient tenement, i.e., the fee owner, is likely to hold the whip hand in any unforeseen situation.

Moreover, there are very real practical problems on the effective enforcement of the rights under such an easement, as the National Park Service has found out. As indicated above, the courts are normally reluctant to issue injunctions in advance against threatened violations of contract or property rights. In what types of situations will an injunction lie to protect the rights under such an easement? Moreover, once the damage is done, how is it possible to prove damages? Assuming a typical case, where the farmer cuts down trees covered by a scenic or a conservation easement, what damage can the Government prove and how can the damage be evalu-

easements or covenants, their value may be nearly as great as the fee interest.²⁸ Given their relative novelty and rarity, such easements and covenants may prove difficult to value.²⁹

There is common law recognition of two classes of easement which may adequately protect wind flow: airspace easements and negative appurtenant easements. Technically, the airspace easement establishes an affirmative right to space and not the air or wind which occupies or passes through the space.³⁰ But since control of the space precludes obstruction of wind through it, the easement effectively assures wind flow. Airspace easements are described in terms of a three-dimensional space above the burdened land which must remain free from obstruction for the benefit of the land served by the easement.³¹ Thus, an airspace easement for the benefit of a WECS site would preclude obstructions in the described airspace assuring wind flow to the wind turbines. Since airspace easements are recognized as interests in real property,³² they may be recorded to bind and benefit future owners of the burdened and benefitted land.³³

A more common class of easement, which may in some applications be functionally equivalent to the airspace easement, is the negative appurtenant easement.³⁴ The owner of land benefitted by such an easement may compel the owner of servient (or burdened) land to refrain from specified conduct on the servient land. Thus, by acquiring a negative appurtenant easement that imposes specific restrictions on height and location of structures and vegetation, the WECS operator has the right to prevent the burdened landowner from obstructing wind flow. A negative appurtenant easement may be perpetual or for a fixed term³⁵ and may be recorded to

ated? One practical solution here would seem to be to insert a liquidated damages clause, although this might run up the cost of the easement to the Government.

Id. (footnotes omitted).

28. L. MAYO, *supra* note 5, at 3.

29. See R. NOUN, *supra* note 5, at 7.

30. See R. WRIGHT, *THE LAW OF AIRSPACE* 220-23 (1968).

31. R. NOUN, *supra* note 5, at 6.

32. See R. WRIGHT, *supra* note 30, at 259.

33. See R. NOUN, *supra* note 5, at 6. Cf. COLO. REV. STAT. § 38-32.5-101 (1982) (statute permitting recording of solar energy easements); N.M. STAT. ANN. § 47-3-4(3) (1978) (same); OR REV. STAT. § 105.895(2) (1981) (same); WASH. REV. CODE ANN. § 64.04.150(2) (West Supp. 1982) (same).

34. Powell defines a negative easement as "solely . . . a veto power. The easement owner has, under such an easement, the power to prevent the servient owner from doing, on his premises, acts, which, but for the easement, the servient owner would be privileged to do." 3 R. POWELL, *supra* note 27, ¶ 405, at 34-18.

For an easement to be appurtenant, it "must have been created for the purpose of benefiting the owner of the dominant estate as the possessor of such estate." *Id.* at 34-20.

35. *Id.* ¶ 422, at 34-238.

bind and benefit subsequent purchasers of the burdened and benefitted land.

Any ambiguity or uncertainty about the effectiveness of such easements under the common law might be cured by express statutory recognition of wind easements. Several states have accorded statutory recognition to solar easements.³⁶ Washington's solar easement statute³⁷ declares state policy to be strongly supportive of solar energy and expressly recognizes that "solar easements appropriate to assuring continued access to direct sunlight for solar energy systems may be created and privately negotiated."³⁸ An Oregon statute goes a step further by making it impermissible for a person conveying or contracting to convey fee title to real property to "include in an instrument for such purpose a provision prohibiting the use of solar energy systems by any person on that property."³⁹ Such statutes might be broadened or supplemented to include similar recognition of wind easements. Oregon recently became the first state to do so. Paralleling its approach with protection of solar access, the Oregon statute fosters protection of wind access by providing for the creation and termination of wind easements and their recording to bind and benefit future property owners.⁴⁰

Restrictive covenants may be used to impose limitations on the use of land for the benefit of other land. Unlike easements, restrictive covenants tend to be characterized as contractual obligations concerning use of the promisor's land rather than conveyances of interests in land.⁴¹ While in theory they may function similarly to easements, the law of covenants is fraught with complexity and uncertainty which may undermine a covenant's effectiveness against succeeding owners of the burdened land. Covenants may be subject to termination because of change in neighborhood conditions,⁴² government condemnation of the servient estate,⁴³ and leg-

36. See, e.g., COLO. REV. STAT. § 38-32.5-101 (1982); N.M. STAT. ANN. § 47-3-4 (1978); OR. REV. STAT. § 105.885(2) (1981); WASH. REV. CODE ANN. § 64.04.140 (West Supp. 1982).

37. WASH. REV. CODE ANN. § 64.04.140-.160 (West Supp. 1982).

38. *Id.* § 64.04.140.

39. OR. REV. STAT. § 105.880 (1981).

40. *Id.* §§ 105.900-.915.

41. "[A] covenant running with the land is looked upon by a court of law as a contractual obligation only and not as a property interest in the covenantor's land." 2 AMERICAN LAW OF PROPERTY § 9.8, at 362-63 (Casner ed. 1952).

42. E.g., *Trustees of Columbia College v. Thacher*, 87 N.Y. 311 (1881); cf. *West Alameda Heights Homeowners Ass'n v. Board of County Comm'rs*, 169 Colo. 491, 458 P.2d 253, 257 (1969) (covenant void only if changes inimical to the covenant's purpose occur on the land burdened by the covenant).

43. See, e.g., *Arkansas State Highway Comm'n v. McNeill*, 238 Ark. 244, 381 S.W.2d 425 (1964). See generally Wright, *Recent Development in Eminent Domain in Arkansas*, 19 ARK. L. REV. 121, 136-40 (1965) (discussing compensation issue when condemnation of part of tract restricted by a covenant causes diminution in value of remaining, uncondemned part of tract).

islative action.⁴⁴ Thorough legal research and careful drafting are prerequisites to reliance on restrictive covenants to protect wind access.

2. *Eminent Domain*

A WECS developer who must acquire fee or protective less-than-fee interests in adjacent land by voluntary transactions may encounter landowners unwilling either to sell at all or to sell for an affordable price. The values which owners attach to their land are highly personal and hence at times virtually infinite. A shrewd landowner in a superior bargaining position may hold out for far more than either the market or personal value of the land. Thus, the feasibility of protecting wind access through acquisition of property interests may depend upon the availability of the power of eminent domain.

A government agency committed to a policy of promoting wind energy might, by purchase or condemnation, acquire fee or less-than-fee property interests in optimal WECS locations and then provide them to WECS developers at actual or subsidized cost. Such advance acquisition of property interests however, has been held not a sufficiently "public" use⁴⁵ or not sufficiently "necessary"⁴⁶ to justify exercise of the eminent domain power.

Where the WECS developer is a government agency the power of eminent domain normally will be available for acquisition of both the site and protective interests in adjacent land. Even some private WECS operators, as regulated public utilities, may be authorized by state or federal government to exercise the power of eminent domain⁴⁷ which would extend not

44. *E.g.*, CAL CIV CODE § 714 (West 1982) (declaring void and unenforceable those covenants that would preclude solar collectors). *See generally* C. BERGER, LAND OWNERSHIP AND USE 568-69 (1968) (discussing scope of statute which directs courts to refuse to enforce by injunction certain covenants, and which permits courts in such cases to extinguish the covenant upon payment of damages).

45. *Compare In re Seattle*, 96 Wn. 2d 616, 638 P.2d 549 (1981) (condemnation of land for project involving both public and private use of the land violates state eminent domain provision) *and* *Hougue v. Port of Seattle*, 54 Wn. 2d 799, 341 P.2d 171 (1959) (condemnation for industrial use and park improvements violates state eminent domain provision, notwithstanding legislative determination that intended use was "public") *with* *Puerto Rico v. Rosso*, 95 P.R. 488 (1967) (court upheld condemnation of land, notwithstanding absence of *any* specific, planned, public use, where legislature had determined that public utility, social interest, or common welfare was promoted thereby). *appeal dismissed*, 393 U.S. 14 (1968).

46. *Cf. In re Puget Power*, 28 Wn. App. 615, 618, 625 P.2d 723, 724-25 (1981) (private corporation must establish "necessity" by preponderance of evidence; in contrast, a legislative determination of "necessity" for a government entity's exercise of eminent domain will be deemed conclusive, unless arbitrary or capricious).

47. *See* R. NOUN, M. LOTKER, & P. FRIESEMA, UTILITY SITING OF WECS: A PRELIMINARY LEGAL/REGULATORY ASSESSMENT 58 (Solar Energy Research Institute/TR-744-788, 1981).

only to acquisition of the WECS site but also to property interests protecting wind flow.⁴⁸

Protection of wind access through government or government-sponsored acquisition of property interests may be politically more palatable than stringent police power regulation of wind-impairing activities and less vulnerable to constitutional challenge as well.

C. Securing Wind Access Through Public Regulation

Public regulation of potentially wind-impairing uses of land adjacent to WECS installations has significant advantages over other means of wind access protection. Legislated regulation may, within constitutional limits, be specifically designed to protect wind access, thus avoiding the uncertainty and probable inadequacy of common law property and private nuisance doctrines. Public regulation obviates the possibly prohibitive cost of acquiring fee or less-than-fee interests in surrounding property as well as the expensive, time-consuming, and sometimes unsuccessful negotiations to effect such acquisitions.⁴⁹

As long as such regulation does not preclude some reasonable use of regulated land, it should withstand constitutional scrutiny.⁵⁰ However, regulation which severely reduces property value, even though constitutional, may be perceived as unfair, and thus might be politically less acceptable than publicly or privately financed acquisition of protective property interests.

1. Zoning and Subdivision Regulation

The traditional systems of local land use regulation— zoning and subdivision regulation, and their supporting comprehensive plans—can be adapted and administered to promote the utilization of renewable energy resources along with their other objectives. Washington counties are expressly authorized to plan,⁵¹ zone,⁵² and regulate land subdivisions⁵³ for the purpose of fostering “access to direct sunlight for solar energy systems.”⁵⁴ A recently enacted Oregon statute authorizes cities and counties

48. *See id.*

49. R. NOUN, *supra* note 5, at 7.

50. *See, e.g.,* Penn. Central Transp. Co. v. City of New York, 438 U.S. 104 (1978); Department of Ecology v. Pacesetter Constr. Co., 89 Wn. 2d 203, 571 P.2d 196 (1977); Maple Leaf Investors, Inc. v. Department of Ecology, 88 Wn. 2d 726, 565 P.2d 1162 (1977).

51. WASH. REV. CODE § 36.70.350(2) (1981).

52. *Id.* § 36.70.560.

53. *Id.* § 36.70.560(4).

54. *Id.* Similar provisions are contained in RCW chapters 35.63 and 35A.63 for cities. General

to adopt standards for protection of wind access, and authorizes planning commissions to propose wind access ordinances designed to protect the wind sources of existing wind energy systems.⁵⁵ Given the broad purposes for which local land use regulatory authority may be exercised,⁵⁶ such specific authority to foster the objectives of wind or solar access probably is not necessary but may be comforting to cautious local officials.

Provisions relating to wind energy generation are finding their way into local zoning ordinances. A recent Battelle Institute survey identified twelve enacted or proposed local zoning ordinances addressing wind energy.⁵⁷ Such ordinance provisions may be designed either to protect the WECS developer's access to wind, or to protect neighbors from potential adverse affects of WECS installation,⁵⁸ or both. For example, stringent setback requirements of up to seven and one-half rotor diameters from downwind property lines⁵⁹ are designed to protect both wind access and the safety of neighbors. To facilitate WECS development in urban areas especially well-suited for wind energy utilization, stringent zoning restrictions on building and vegetation height may be imposed.⁶⁰

Subdivision regulation, by which newly-created lots are subject to public supervision through a tailored, discretionary regulatory process,⁶¹ may be employed to protect wind access.⁶² For example, the alignment of streets might be regulated to minimize wind impairment; and restrictive covenants limiting the height of structures and vegetation might be required as a condition to plat approval in prime wind energy areas.

2. Flexible Land Use Regulatory Devices

Planned unit development (PUD) regulation, by which a developer is exempted from otherwise applicable zoning restrictions in exchange for submission to flexible, but detailed regulation,⁶³ might be imposed to re-

authority "to encourage and protect" solar access is conferred upon all local governments by RCW § 64.04.140.

55. OR REV STAT. § 105.910 (1981).

56. See, e.g., WASH. REV. CODE § 36.70.010 (1981) (county and regional planning and zoning).

57. M. GREENE & K. YORK. THE U.S. DEPARTMENT OF ENERGY WIND TURBINE CANDIDATE SITE PROGRAM 82-83 (Battelle Human Affairs Research Centers/PNL-4066. 1982).

58. See *infra* part IIIB.

59. M. GREENE & K. YORK. *supra* note 57, at 47-48.

60. Creative planners might design zoning provisions to coordinate the incidental wind tunnel effects of downtown office towers with the location of WECS.

61. E.g., WASH REV. CODE ch. 58.17 (1981).

62. See *id.* § 58.17.110 (1981).

63. See, e.g., *Cheney v. Village 2 at New Hope, Inc.*, 429 Pa. 626, 241 A.2d 81 (1968). Several states have adopted statutes that explicitly authorize their local governments to enact certain types of PUD ordinances. R. ELLICKSON & A. TARLOCK. LAND USE CONTROLS 265 (1981).

strict building and vegetation height, bulk, and location to maximize wind energy potential on and off the site.⁶⁴

Similarly, incentive zoning,⁶⁵ which replaces the regulatory stick with a carrot, may reward with bonus density or site coverage developers utilizing wind energy or protecting the wind access of others.⁶⁶ Land use concepts such as "floating zones"⁶⁷ or transferable development rights⁶⁸ also might be useful in fostering WECS development within existing land use schemes.

Rather than employing systems of land use control, a special regulatory system might be adopted to protect and reconcile the interests affected by wind energy development. For example, a permit system could be established by which WECS permittees would be protected from wind-impairing activities on adjacent land.⁶⁹ Novel regulatory systems, however, must overcome both political inertia and skepticism. Furthermore, development of standards for permit issuance, permit definition, and appropriate restrictions on WECS neighbors would be a major undertaking.⁷⁰

Whatever local regulatory systems are employed to foster wind energy development, all, in theory, are designed to implement the policies of the local comprehensive plan. Appropriate data and statements of policy in the comprehensive plan will facilitate effective regulation.⁷¹

64. Some Oregon counties consider efforts to facilitate use of renewable energy sources in their approval of use plans; and one Oregon county allows a 5% density bonus for PUDs which make provisions for use of renewable energy resources. Telephone interview with Donald Bain and Meg Moorehead, Oregon Department of Energy (Feb. 23, 1982).

65. See, e.g., *Chrinko v. South Brunswick Township Planning Bd.*, 77 N.J. Super. 594, 187 A.2d 221 (1963) (township's "cluster" ordinance reduced minimum lot size and frontage requirements for developers who were willing to dedicate substantial amounts of land to the township). See generally *THE NEW ZONING* (N. Marcus & M. Groves ed. 1970) (discussing the legal, economic, and administrative aspects of various zoning techniques, including incentive zoning).

66. See *supra* note 64.

67. See, e.g., *Rodgers v. Village of Tarrytown*, 302 N.Y. 115, 96 N.E.2d 731 (1951).

68. See *Penn. Central Transp. Co. v. City of New York*, 438 U.S. 104 (1978); *Fred R. French Investing Co. v. City of New York*, 39 N.Y.2d 587, 350 N.E.2d 381, 385 N.Y.S.2d 5 (1976); Carmichael, *Transferable Development Rights as a Basis for Land Use Control*, 2 FLA. ST. U.L. REV. 35, 77-99 (1974).

69. The New Mexico Solar Rights Act, N.M. STAT. ANN. §§ 47-3-1 to -5 (1978), protects the right to use solar energy through a permit system which is based on the prior appropriation doctrine of western water law. If the initial use is beneficial, "first in time is first in right" under this system.

70. Oregon Wind Memorandum, *supra* note 5.

71. See generally Heyman, *Innovative Land Regulation and Comprehensive Planning*, 13 SANTA CLARA L. REV. 183 (1972) (detailing aspects of comprehensive planning that are designed to stimulate desired development without foregoing concerns of fairness).

II. POTENTIAL ADVERSE CONSEQUENCES OF WIND TURBINE OPERATION

Too often overlooked in the siting process are public concerns for a healthy, safe, and aesthetically-pleasing living environment. While the general public may favor wind energy development, segments of society might be adversely affected by particular WECS installations.

As one journalist remarked, "the future of wind power remains clouded by its lack of a past."⁷² Nevertheless, the industry's brief past jeopardizes its future development because of rocky performances of early wind machines.

A. Safety

Convincing people that modern wind energy systems are safe may be difficult because there are many documented cases of hazardous mechanical failures. The first commercial power generating wind machine in the United States, Palmer Putnam's machine at Grandpa's Knob, Vermont, threw an 8-ton blade 750 feet in 1945.⁷³ More recently, the U.S. Government's first large wind machine, the 100-kilowatt MOD-O,⁷⁴ developed

72. Rice, *There's Power, Profit Blowin' in the Wind*, Seattle Times, Sept. 13, 1981, at A3, col. 1 (copy on file with the *Washington Law Review*).

73. P. PUTNAM, *supra* note 7, at 131-33. Apparently, the operators knew that the blade skins had begun to break near the roots, making it necessary to reinforce the section. *Id.* at 12-14. Despite this known defect, the machine was not repaired because of a wartime shortage of steel that threatened to cause a 4-year delay in the project if the blade had to be recast. The blade soon broke off and flew 750 feet, injuring nobody. *Id.*

74. The federal program for planning and development of wind turbines of various sizes is discussed throughout this article. The dimensions and specifications of the installed and planned wind machines are shown in the Table below, compiled from *Wind: Prototypes on the Landscape*, EPRI J., Dec. 1981, at 28-29; Mar. 1980, at 11.

Wind Turbine Model	MOD-0	MOD-0A	MOD-1	MOD-2	MOD-5A	MOD-5B
Height of blade axis (ft)	100	100	100	200	250	262
Rotor diameter (ft)	125	125	200	300	400	420
Rated power (kW)	100	200	20000	2500	6200	7200
Rated wind speed at 30 ft (mph)	14.5	18.3	25.5	20.0	20.4	20.5
Cut-in/Cut out speed at 30 ft (mph)	10.0/35.0	6.9/34.2	11.0/35.0	9.0/36.0	7.0/49.3	4.3/46.3
Weight on foundation (tons)	—	45	325	310	600	630
Weight/Rated power (lb/kW)	800	447	325	247	193	175
Annual electric output at 12 mph (GWh)	—	0.64	2.4	7.0	16.7	18.9
Annual electric output at 16 mph (GWh)	—	0.98	5.1	11.3	27.1	29.9

severe forced oscillations and unexpected impulse loads on the propeller during its first year of operation.⁷⁵ Government officials feared a blade throw accident due to metal fatigue caused by the unexpected stress.⁷⁶

The newer generation large U.S. Government machines still suffer from mechanical failures. One of the three 2.5-megawatt MOD-2 wind turbines operated by the Bonneville Power Administration near Golden-dale, Washington malfunctioned on June 8, 1981. According to a newspaper account, the damage involved "the quill shaft connecting the blade to the gear box and to the rotating element in the generator, which blew apart from going too fast."⁷⁷ One author has estimated that blade failure in a 1.5-megawatt machine could result in fragments cast a quarter of a mile.⁷⁸

A particularly noteworthy embarrassment for the wind energy industry occurred in the summer of 1981 when one of the world's largest Darrieus turbines, a 135-foot tall 500-kilowatt Alcoa vertical axis turbine, toppled to the ground in Palm Springs, California, as hundreds of wind energy experts were assembling nearby for a conference.⁷⁹ Technicians from Alcoa and Southern California Edison Co. watched a rotor-securing bolt rip free, causing a blade to swing out and snap a guy wire.⁸⁰ The machine collapsed, but no injuries were reported.⁸¹

Safety concerns extend beyond machine failure to the discharge of snow and ice from moving parts of wind machines. Opponents of the U.S. Government proposal to site large WECS atop picturesque Lincoln Ridge in Vermont voiced concern that ice would accumulate on turbine blades and be cast great distances into nearby recreational areas.⁸² When

75. *Wind Energy: Large and Small Systems Competing*, 197 SCIENCE 971-72 (1977) [hereinafter cited as *Competing Systems*].

76. *Id.*

77. Wind Turbine Modification, Repair May Cost \$1.5 Million, Seattle Times, Aug. 15, 1981, at D9, col. 4 (quoting Gene Tollefson, public-information officer for the Bonneville Power Administration).

78. Phillips, *NEPA and Alternative Energy: Wind as a Case Study*, 1 SOLAR L. REP. 29, 47 (1979).

79. Frank, *Windmill Clusters and Giant Turbines Log Many Ups, One Down*, SOLAR AGE, June 1981, at 17.

80. *Id.*

81. *Wind: Prototypes on the Landscape*, EPRI J., Dec. 1981, at 34.

82. U.S. DEPT OF ENERGY, ENVIRONMENTAL ASSESSMENT, INSTALLATION OF METEOROLOGICAL EQUIPMENT, LINCOLN RIDGE, GREEN MOUNTAIN NATIONAL FOREST, LINCOLN AND WARREN, VERMONT 9 (DOE/EA-0130, 1981) [hereinafter cited as ENVIRONMENTAL ASSESSMENT]. Citizens supported their assertions with evidence that during winter months in the same climatic zone TV antennas are regularly covered by 5 to 6 feet of rime ice, including one to two inch layers of clear ice. *Id.* app. 4, at 2. Project proponents responded to these arguments by referring to current design parameters that require shut down of turbines when ice thickness on blades reaches 0.05 inches. *Id.* at 9. Opponents of the project remain skeptical of untested design parameters and have vowed to fight until their concerns are adequately addressed.

wind turbines are sited at high elevations or other areas subject to long periods of freezing temperatures, snow and ice buildup presents both engineering and safety hazards.⁸³

B. Noise

For the most part, noise from WECS is not the serious problem that researchers once feared it might be.⁸⁴ A 1977 U.S. Environmental Protection Agency status report on environmental hazards states that “[o]nly a quiet swishing sound can be heard when one stands under a 15-meter propeller-type rotor.”⁸⁵

Yet, prospective neighbors of proposed WECS installations constantly express concern about noise. Noise arguments generally rely upon one very well publicized instance of noise impact, the U.S. Government MOD-1 2000-kilowatt wind turbine generator at Boone, North Carolina. This machine was found to emit an ultrasonic vibration that purportedly made people ill and caused windows to rattle, crockery to shake, and cows to stop giving milk.⁸⁶

C. Other Concerns

In addition to noise, another frequent public complaint over a proposed WECS installation is the impairment of visual resources.⁸⁷ However, where aesthetic affront cannot be avoided by WECS design and location,

83. See H. WEGLEY, J. RAMSDALL, M. ORGILL & R. DRAKE, A SITING HANDBOOK FOR SMALL WIND ENERGY CONVERSION SYSTEMS 54 (Pacific Northwest Laboratory, PNL-2521 Rev. 1/UC-60, 1980) (discussing icing and snow hazards).

84. L. COIT, *supra* note 2, at 17.

85. *Id.* (quoting ENVIRONMENTAL PROTECTION AGENCY, DEVELOPMENT STATUS AND ENVIRONMENTAL HAZARDS OF SEVERAL CANDIDATE ADVANCED ENERGY SYSTEMS (EPA-600/7-77-062, 1977)).

86. *Boone Windmill Arouses Townspeople*, 2 SOLAR L. REP. 468 (1980). The problem, according to an Energy Department spokesman, was that the wind machine “faced away from the wind, creating a wind shadow behind the 135-foot tower, and an uneven flow of air to the massive blades.” Rice, *supra* note 72, at col. 3. The government’s latest MOD-2 design, in operation in southcentral Washington, corrects this problem by facing into the wind.

87. A notable recent example is the U.S. Department of Energy’s candidate site near Lincoln, Vermont. In keeping with a strong Vermont tradition of preserving views and open space, there was massive public opposition to the government’s proposed 160-foot meteorological tower atop picturesque Lincoln Ridge. This opposition, combined with Reagan Administration budget cuts, killed the project. Recent opposition to interference with views in the quaint coastal community of Port Townsend, Washington resulted in a site change for a small wind generator from an in-town golf course to an industrial area of town where it was not opposed. Telephone interview with David Goldsmith, Jefferson County Planning Dep’t. (Mar. 1, 1982). The public reaction to large arrays of WECS in Washington is unknown since no large “windfarm” has been seriously proposed in the state. Also unknown is the public reaction to increased WECS siting efforts in areas of high visibility that have high wind power potentials (e.g., mountain ridges, coastlines, gorges).

the public may be willing to sacrifice some aesthetic values to reduce the nation's dependence on nonrenewable energy sources, particularly foreign oil. As alternative energy systems become an increasingly important power supplement, citizens may welcome a mountainscape or seascape of powerful wind giants bringing renewable sources of power to previously oil-thirsty regions.⁸⁸ Many may agree with Carl Sandburg that there is beauty in technology and the power it brings humanity.⁸⁹

A wind machine's impact on the local natural environment, although slight, must also be considered. Research on climatology, vegetation, soils, mammals, birds, and flying insects concluded that only microclimate modification and airborne organism collision, particularly birds, warranted site-specific design or siting considerations.⁹⁰ Given the bird kill potential of wind turbines, WECS facilities should not be sited in the breeding or wintering territories or along the migratory concentrations of threatened or endangered bird or bat species.⁹¹

An issue related to microclimate modification is the effect that a WECS has on downwind energy potential. Early studies revealed that the diminution in energy potential appeared to persist for distances of about ten diameters (the distance from tip to tip of the blades) in the direction of the wind and three diameters perpendicular to the wind.⁹²

Large wind machines also produce a reflected interference signal which causes video distortion of television reception within a range of 100 feet

88. Taubenfeld & Taubenfeld, *Wind Energy: Legal Issues and Legal Barriers*, 31 Sw. L.J. 1053, 1059 (1977).

89. *Id.* On the other hand, the sentiments of some may be reflected in a paraphrase of Ogden Nash, "I think that I shall never see a [wind turbine] lovely as a tree"

90. S. ROGERS, M. DUFFY, J. JEFFERIS, P. STICKSEL, & D. TOLLE, EVALUATION OF THE POTENTIAL ENVIRONMENTAL EFFECTS OF WIND ENERGY SYSTEM DEVELOPMENT ix (ERDA/NSF/07378-75/1, RA-760188, 1976) (available from Battelle Columbus Laboratories, Columbus, Ohio) [hereinafter cited as S. ROGERS]. The two-year study conducted at NASA Lewis Research Center's Plum Brook Station near Sandusky, Ohio, found that wind turbines, electric transmission towers, and fire towers moderate temperature and evaporation downwind to a minor degree and cast a sun shadow under applicable sun angles and meteorological conditions. *Id.* at vii. Such microclimate changes are measurable and might adversely affect agriculture. *Id.* at 62. The study also concluded that the significance of bird, bat, and insect collisions with the rotating blades of a wind energy conversion system varies with the system's location, the time of day, the seasons of the year, and prevailing climatic conditions. *Id.* at 63.

91. See S. ROGERS, *supra* note 90, at 63.

92. Taubenfeld & Taubenfeld, *supra* note 88, at 1072 (citing R. Ramakumar, W. Hughes & H. Allison, Economic and Technical Aspects of Wind Generation Systems 89-92 (Oct. 1974) (paper reported in the Proceedings of the 1974 International Conference on Systems, Man and Cybernetics, Dallas, Texas (IEEE Catalog No. 74 CHO 908-4 SMC))). Testing is underway at the three MOD-2 wind turbines in operation near Goldendale, Washington, to determine the wake and wind robbing effects of one machine on another. R. NOUN, *supra* note 5, at 5. The three machines are deliberately positioned at the corners of an irregular triangle whose sides are 5, 8, and 10 rotor diameters long (1500, 2400, and 3000 feet respectively) to maximize research potential at the site. *Id.*

to one mile of the WECS, depending on the site.⁹³ In addition, WECS may interfere with microwave or radar beams because of Doppler effects if sited in the main or side lobes of such beams.⁹⁴

III. THE LEGAL RESPONSES TO POTENTIAL ADVERSE CONSEQUENCES OF WIND TURBINE OPERATION

WECS siting may be constrained by a wide range of legal requirements designed to protect neighborhood or broader public interests. As was concluded with respect to protection of wind access, common law principles have fundamental deficiencies.⁹⁵ The most comprehensive requirements are imposed at the local level through zoning, subdivision regulation, and building codes. Significant but less pervasive controls are imposed by state and federal governments. Specialized federal regulations may constrain the siting of WECS in certain locations, e.g., airports and communications centers. Finally, when WECS are sited on government land, development is subject to the land use policies and regulation of the managing government agency.

A. *Common Law Principles*

Land use controls occur not only through legislated regulation and the common law of nuisance but also through privately created rights in the land of another. For example, land may have been conveyed subject to defeasance if it is used for other than park purposes. Installation of a WECS in a park may be construed as a nonpark purpose. However, far more likely constraints upon WECS developers are privately negotiated

93. *Competing Systems*, *supra* note 75, at 971; *see also* Cingo, *Wind Energy Conversion—Is it Environmentally Acceptable*, J. ENVTL SCI. (1980) (discussing factors which contribute to severity of interference). Interference arises because the synchronization speed of U.S. television, 30 cycles per second, is near the rotation speed of large wind systems. *Competing Systems*, *supra* note 75, at 971. Small wind systems rarely create this problem, due to higher rotation speeds and minimal reflection from smaller blades. The use of fiberglass blades rather than metal ones should be considered in areas where interference is anticipated, because the change can cut the range of interference in half. *Id.* Another solution is to wire the affected area for cable television, as was done by the U.S. Government on Block Island, R.I., when the whirling steel blades of the MOD-OA 200-kilowatt experimental wind machine upset local television reception. Rice, *supra* note 72, at col. 3. The next U.S. Government model, the MOD-1 2000-kilowatt machine at Boone, North Carolina, was found to interfere with television reception in approximately 15 nearby residences. *Wind Solving Energy Problems Today*, SOLAR ENGINEERING, August 1980, at 24.

94. Taubenfeld & Taubenfeld, *supra* note 88, at 1075; *see generally* D. SENGUPTA & T. SENIOR, ELECTROMAGNETIC INTERFERENCE BY WIND TURBINE GENERATORS 7 (U.S. Dep't of Energy/TID-28828, 1978) (discussing forbidden zones around microwave link receivers).

95. *See supra* parts IA and IB.

easements and covenants.⁹⁶ Covenants may bar wind turbines outright or may create homeowners associations or architectural review committees which must approve the design and location of structures on subdivision lots.⁹⁷

Covenants which frustrate WECS development may be subject to legislative modification or judicial interpretation. The California legislature passed a statute specifically requiring covenants to yield where they conflict with solar installations.⁹⁸ And on public policy grounds a California court granted declaratory relief against a homeowner's association decision to prohibit the installation of visible solar collectors.⁹⁹ Similar legislative and judicial action to protect wind energy development from private law constraints may occur as utilization of renewable energy systems becomes increasingly important.¹⁰⁰

Private nuisance law¹⁰¹ may constrain the siting and operation of a WECS facility regardless of the existence of privately created limitations on the use of land. While aesthetic affront generally is not sufficient, other potential adverse consequences¹⁰² of WECS installation or operation may be held to interfere unreasonably with normal use and enjoyment of adjacent land.¹⁰³

96. While both impose limitations on the use of land which may preclude or restrict WECS location or design, easements, as interests in land, generally have greater legal potency and longevity than covenants, which are characterized as mere promises affecting the use of land. Restrictive easements or covenants may be negotiated between adjacent property owners but usually arise in the course of land subdivision either as prerequisites to obtaining regulatory approval or in connection with the developer's voluntary undertaking to enhance the value, and hence the marketability, of the new lots.

97. For a legal analysis of the modern homeowners association, see R. ELLICKSON & A. TARLOCK, *supra* note 63, at 633-60 (1981).

98. CAL. CIV. CODE § 714 (West 1982).

99. *Kraye v. Old Orchard Ass'n I*, No. C 209 453 (Cal. Super. Ct. Feb. 28, 1979), *noted in* 1 SOLAR L. REP. 8 (1979).

100. Oregon's recently enacted statute which provides for creation, termination, and recordation of wind energy easements and leases for the protection of WECS evinces a strong public policy in favor of WECS utilization. OR. REV. STAT. §§ 105.900-915 (1981).

101. RESTATEMENT (SECOND) OF TORTS § 821D (1977) defines private nuisance as "a nontrespassory invasion of another's interest in the private use and enjoyment of land." *See supra* part IA.

102. *See supra* part II.

103. *See Prah v. Maretti*, 108 Wis. 2d 223, 321 N.W.2d 182, 191 (1982). A recent case filed in Teton County District Court (Wyoming) illustrates that nuisance principles may be used to challenge solar energy development. A Jackson, Wyoming, couple has filed suit claiming deprivation of the use and enjoyment of their home and property by the glare of "blinding intensity" emitted from solar panels on their neighbor's home. The plaintiffs allege that the value of their property has diminished as a result of the neighboring use and that radiation from the glare may be damaging to plant and animal life on their property. They are seeking preliminary and permanent injunctions requiring removal of the panels as well as compensation for alleged loss of property value and compensation for any health problems which may develop in the future. 3 SOLAR L. REP. 212-13 (1981).

B. Local Land Use Regulation and Building Codes

The experiences of WECS developers in Washington State reveal that zoning restrictions are the principal barrier to development of WECS in urban and suburban areas. WECS generally are not expressly addressed in zoning ordinances because the drafters did not anticipate the technology. In areas subject to zoning, the height of meteorological towers and wind turbines¹⁰⁴ usually will require a variance, conditional use permit, zone amendment, or other form of local regulatory action. Planning staffs may be uncertain about requirements and appropriate administrative proceedings due to the novelty of the technology.

In communities with relatively high incidence of wind energy generation, local governments are beginning to adopt special zoning provisions designed to protect both wind access for the WECS operator and the safety and other interests of neighbors.

For example, in Spokane County in eastern Washington, where there is substantial interest in wind energy, the County Planning Department has developed a zoning policy for wind energy systems.¹⁰⁵ As the first Washington jurisdiction to draft such a zoning policy, Spokane County looked outside the state for guidance. The regulatory approach selected was based on Lincoln, Nebraska's rather restrictive setback provisions which utilize a blade throw curve.¹⁰⁶ The curve attempts to forecast the distance

104. Tower height is a critical component in a WECS facility. "Generally speaking, the least expensive way to increase . . . power output from a wind turbine is to increase tower height. A generally recognized 'rule-of-thumb' is that wind speed increases as the one-seventh power of the height above ground." ENERTECH CORPORATION, *PLANNING A WIND POWERED GENERATING SYSTEM* 32 (1977). For example, a 10 mph windspeed at five feet above ground converts to a 15.3 mph windspeed at 100 feet above ground. *Id.*

105. The draft interim policy for WECS applications is an administrative policy used on a case-by-case basis by the zoning administrator and zoning adjuster. The process of drafting an entire new county zoning ordinance in which WECS applications would be specifically addressed is underway at present. Telephone interview with Wallis D. Hubbard, Planning Director, Spokane County Planning Department (Feb. 23, 1982).

106. Lincoln officials translated the curve into the following ratio of rotor diameter to setback distance:

Rotor Diameter (feet):	5	10	15	20	25	30	35	40
Setback (feet):	100	165	220	270	310	340	365	385

Werth, *Regulating Wind Energy Conversion Systems*, PAS MEMO, August 1980 (published by the American Planning Association) (copy on file with the *Washington Law Review*). Spokane County's draft ordinance adopted these setback provisions as a means of defining the radius of a "WECS Impact Area." Memorandum from Thomas G. Mosher, AICP Special Programs Administrator, to Wallis D. Hubbard, Planning Director, Spokane Planning Dep't, Mar. 13, 1981, at 2 (copy on file with the *Washington Law Review*). The "WECS Impact Area" must be established entirely "within the applicant's property and/or on property containing no living quarters for which the applicant has secured and filed an easement for a 'WECS Impact Area' prohibiting the establishment of future living quarters while the WECS is existing." *Id.* Alternatively, if a WECS qualifies (under another

a rotor blade would fly in the event of breakage or machine failure. However, this simple safety-oriented equation fails to take into account other characteristics such as height of the tower, building materials, or trajectory of falling objects from the windmill.¹⁰⁷

Because so little is known about the dangers of wind energy systems and because few standards presently exist in the industry, safety concerns are paramount in WECS zoning ordinances, especially in urban areas like Lincoln, Nebraska, and Spokane County, Washington. Besides zoning codes, another rigid local code to which WECS development must conform is the applicable building code. Reform is needed in the building code approval system so that technological innovation, such as wind development is fostered, rather than stifled.¹⁰⁸

C. State and Federal Land Use Regulation

Several state level regulatory systems could potentially apply to WECS developments. Whether the Washington State Environmental Policy Act of 1971 (SEPA)¹⁰⁹ would require a WECS developer to prepare an environmental impact statement because "more than a moderate effect on the quality of the environment is a reasonable probability"¹¹⁰ would depend on the scale, design, and location of the proposed installation.¹¹¹ WECS

provision of the ordinance) with a detached or sheared off blade restraint system, the "WECS Impact Area" may be established as 1.5 times the height of the tower. *Id.*

107. *Id.*, attached Draft, at 2. Another approach to zoning setback requirements for small WECS is found in California's model ordinance, which states that WECS shall, with certain exceptions, "be located such that the furthest extension of the apparatus does not cross any site lines." MODEL ORDINANCE FOR SMALL WIND ENERGY CONVERSION SYSTEMS § 4B(12) (California Energy Commission, Office of Appropriate Technology 1982).

108. *But see* M. GREENE & K. YORK, *supra* note 57, at 33. Discussions with officials of the utilities in the U.S. Department of Energy Candidate Site Program revealed that WECS building permits are secured relatively easily and quickly. *Id.* *See generally* C. FIELD & S. RIVKIN, *THE BUILDING CODE BURDEN* (1975) (discussing the building code regulatory system and the need for reform). Building codes specifically addressing WECS structures are nonexistent because of lack of data on wind machine performance. An ongoing small wind turbine testing program by Rockwell International at the Rocky Flats Plant in Golden, Colorado, is producing needed data for developing industry standards, but the program is still young. In addition, the American Wind Energy Association (AWEA) is developing industry standards for small WECS, which could be incorporated into local codes. The AWEA is still one to three years away from issuing comprehensive uniform regulations. 3 SOLAR L. REP. 6 (1981). The development of product standards is essential to inspire public confidence and spur commercialization of WECS.

109. WASH. REV. CODE ch. 43.21C (1981).

110. *Norway Hill v. King County Council*, 87 Wn. 2d 267, 278, 552 P.2d 674, 680 (1976).

111. When Seattle City Light proposed to install a meteorological tower at its Diablo Dam site in the North Cascades (in anticipation of a DOE turbine), a negative declaration was filed with the Washington State Department of Ecology. Officials at City Light expect that a negative declaration will suffice for a turbine at that location as well. M. GREENE & K. YORK, *supra* note 54, at 8, 15.

developments in environmentally sensitive areas, such as shorelines or wetlands, would logically encounter more specific state level regulation.

As an energy generator, WECS developments may also be subject to power plant siting regulations. A single WECS or "wind farm"¹¹² which exceeds a rated capacity of fifty megawatts might be subject to the Washington State Thermal Power Plant Siting Act of 1970,¹¹³ one of the nation's first one-stop siting laws. The one-stop regulatory process allows unified preconstruction certification, technical review, planning, and public hearings.¹¹⁴ Wind farms with rated capacities in excess of fifty megawatts are planned for the U.S., although no such facility has been developed.¹¹⁵

Potential WECS developers must also be attentive to the possibility of required compliance with federal regulations. Any proposed WECS development involving federal sponsorship, federal land, or federal approvals must comply with the requirements of the National Environmental Policy Act (NEPA)¹¹⁶ and the regulations¹¹⁷ implementing it.¹¹⁸ The vast majority of large WECS projects that have been subject to NEPA, however, have required only a "finding of no significant impact" (FONSI).¹¹⁹

Developers of large WECS must not overlook regulatory requirements addressing tall towers, most notably the Federal Aviation Administration (FAA) guidelines.¹²⁰ The FAA must be notified if a proposed structure

112. A "wind farm" is a cluster of interconnected wind turbines.

113. WASH REV CODE ch. 80.50 (1981).

114. *Id.* § 80.50.040 (1981).

115. For example, Pacific Gas & Electric Co. has entered an agreement in principle to buy energy from a 350-megawatt cluster which should be operational by 1989. The U.S. Bureau of Reclamation hopes to install 150 megawatts of wind machines near Medicine Bow, Wyoming. *Wind: Prototypes and the Landscape*, *supra* note 81, at 32. In Oregon, all WECS farms of 25 megawatts or larger require a permit from the state's Energy Facility Siting Council. The Council has regulations for WECS site development permits. OR. ADMIN R. 345-115-010 to -.055 (1981).

116. 42 U.S.C. §§ 4321-4336 (1976).

117. 40 C.F.R. §§ 1500-1508 (1981).

118. See generally Phillips, *NEPA and Alternative Energy: Wind as a Case Study*, 1 SOLAR L. REP 29, 31 n.7 (1979) (noting the unsettled state of the law with respect to judicial review of agency decisions under NEPA).

119. 40 C.F.R. § 1508.13 (1981). In the case of the Bonneville Power Administration's Goodnoe Hills Project in southcentral Washington, negotiations for lease, easement, and purchase of the needed land could not be consummated before the FONSI was issued. Telephone interview with Ron Holeman, Bonneville Power Administration (July 22, 1981). Because the project construction crew needed access to the site in the spring of 1980, time was of the essence in determining the significance of project impacts. *Id.* With an expedited process, initial environmental investigations began in July 1979 and the FONSI was issued in December of the same year. Telephone interview with Nick Butler, Bonneville Power Administration (July 30, 1981). Few wind developments to date have produced significant enough environmental impacts to require preparation of an Environmental Impact Statement (EIS). Only the developers of the largest wind farm developments in California and Hawaii have had to produce EIS's in order to secure federal funds and permits.

120. See generally 14 C.F.R. pt. 77 (1981).

will exceed 200 feet in height, unless there are other structures or natural features which will "shield" the tower. Less lofty structures are required to file such notice if they are sited within certain distances of airport runways or heliports.¹²¹ Additionally, tower lighting and marking will be required if the structure falls within FAA obstruction standards.¹²²

More significantly, perhaps, several WECS installations have caused well-documented television and microwave interference. Some WECS operators have been forced to shut down during broadcast hours¹²³ or take other steps to eliminate the interference. The agency regulating such interference is the Federal Communications Commission (FCC). The current FCC regulations applicable to WECS facilities are rather broad, referring only to "incidental radiation devices" emitting "radio frequency energy" causing "harmful interference."¹²⁴ If harmful interference results, the regulations require prompt elimination.¹²⁵ As with the FAA, as the FCC becomes accustomed to WECS proposals, regulation should become standardized. In the meantime, WECS developers must make a practice of consulting with the local FCC office in the area of proposed action.¹²⁶

D. Government as Landowner

The regulations governing a WECS development depend in part on whether it is located on federal, state, local or privately-owned land.

121. See *id.* § 77.13 (1981) (stating the precise requirements).

122. Telephone interview with Ron Holeman, *supra* note 119. See W. Pennell, Siting Guidelines for Utility Applications of Wind Turbines 2-10 (Jan. 1983) (Final Report prepared by Battelle, Pacific Northwest Laboratories, for the Electric Power Research Institute) (excerpt on file with the *Washington Law Review*). The safety-oriented FAA lighting requirement imposes adverse environmental consequences in its application to WECS. While an unlighted facility poses a serious hazard to aircraft, a lighted WECS facility disorients birds and may arouse public opposition. *Id.* at 2-11.

123. Taubenfeld & Taubenfeld, *supra* note 88, at 1075.

124. 47 C.F.R. pt. 15 (1981).

125. *Id.* § 15.25.

126. A recent WECS installation on a ranch in eastern Washington illustrates the problems a WECS developer may encounter in seeking to avoid "harmful interference." Letter from Tom Heister, Flow Industries, to Kim York (Jan. 21, 1983) (copy on file with the *Washington Law Review*). Initially, the developer sought from the FCC the identity, location, and beam paths of television and microwave stations in the vicinity of the proposed WECS. FCC officials were able to supply geographical coordinates for television repeaters in the area, but could not supply such coordinates for microwave repeaters. However, the official did provide a list of microwave link users, whom he identified by frequency from lists of frequency users. *Id.* The developer next proceeded to contact directly the microwave users (e.g., Pacific Northwest Bell, Burlington Northern, the Bonneville Power Administration) to determine the precise locations and beam paths of their microwaves. *Id.* In addition to microwave beam location, signal to noise ratio became a critical variable in the siting process. *Id.* The greater the signal-to-noise ratio required by microwave users, the less the interference (from physical objects) that can be tolerated. *Id.*

When federal land is involved, the Supremacy Clause¹²⁷ may render the development immune from state and local regulation.¹²⁸ However, in practice, WECS developers on federal land often coordinate their activities with state and local officials in order to maintain good relations and a free exchange of environmental and other technical information.¹²⁹ Similarly, WECS development on state land may be immune from local regulation.

Approximately one-third of the land in the U.S. is owned by the federal government and managed by federal agencies.¹³⁰ These public lands are a potentially valuable resource for wind energy generation, and a variety of federal land exchange provisions are possibly relevant to WECS applications.¹³¹

The Federal Land Policy and Management Act of 1976¹³² comprehensively regulates the use of federal lands. It provides for the sale, lease, and grant of right-of-way to serve important public objectives, including electrical energy generation. However, since wind energy generation is relatively new, existing use standards generally do not provide for WECS development. Variances must be secured from existing land use plans on a case-by-case basis.¹³³

State and locally-owned public lands should also be considered by WECS developers.¹³⁴ As is the case with federal land, there is a need for a state WECS siting policy and identification of potential sites.

IV. CONCLUSION

A broad array of interests may be affected by WECS development. The WECS developer has an obvious, immediate interest in assured access to the wind. While such private legal controls as easements and covenants, or even nuisance law, may theoretically provide adequate protection of

127. U.S. CONST. art. VI, cl. 2.

128. *United States v. City of Chester*, 144 F.2d 415 (3d Cir. 1944); *see generally* Engdahl, *State and Federal Power over Federal Property*, 18 ARIZ. L. REV. 283 (1976).

129. M. GREENE & K. YORK, *supra* note 57, at 39.

130. Most of this public land is managed by four agencies: the U.S. Forest Service of the Department of Agriculture, the Bureau of Land Management (BLM) of the U.S. Department of the Interior, the Fish and Wildlife Service (FWS) of the U.S. Department of the Interior, and the National Park Service of the U.S. Department of the Interior. In addition, extensive landholdings are administered by various branches of the military. NATURAL RESOURCES DEFENSE COUNCIL, *LAND USE CONTROLS IN THE UNITED STATES* 224 (1977).

131. L. MAYO, *supra* note 5, at 95-98.

132. 43 U.S.C. §§ 1701-1784 (1976).

133. R. NOUN, M. LOTKER & H. FRIESEMA, *supra* note 47, at 24. The turbine site of the Lincoln Ridge project in Vermont was within a U.S. Forest Service management area which precluded power-generating facilities. *See* ENVIRONMENTAL ASSESSMENT, *supra* note 82, at 9.

134. For state land leasing program guidelines, see WASH. ADMIN. CODE ch. 32-22 (Supp. 1981).

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wind access, the high costs of private negotiation and legal uncertainty may undermine their effectiveness. Thus, sufficient assurance of wind access may depend upon public regulation through such traditional local land use controls as zoning, subdivision regulation, and their supporting comprehensive plans, or novel special purpose local or state regulatory systems.

Although the general public's interest in cheap and renewable energy may coincide with the interests of WECS developers, various segments of the public may have more pressing interests which are threatened by the installation of WECS. The immediate interests of neighboring residents in safety, quiet, and neighborhood amenity along with the broader environmental and recreational interests of the general public are potential bases for restriction of WECS siting and design through local land use regulation and federal and state environmental laws.

The law may foster or frustrate wind energy development to the extent that it facilitates or restricts WECS siting. Existing common law doctrine and statutes generally do not directly address either the interests of the WECS developer or the community interests threatened by WECS development. Various common law doctrines might be adapted to secure the WECS operator's wind source from interference by neighbors and to protect neighbors from the dangers and annoyances of WECS. But, given the plodding pace and decentralized development of the common law, state and local legislation deliberately designed to reconcile the competing interests of WECS developers and the public would provide swifter, more certain guidance. Recent statutes and ordinances resolving similar conflicting interests in the utilization of solar energy indicate the political feasibility of legislative clarification of the legal uncertainty clouding WECS siting.