A Downwind View of the Cathedral: Using Rule Four to Allocate Wind Rights

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I. INTRODUCTION

Wind has never been more valuable. In the past decade, soaring oil prices and fears of global warming have transformed ordinary rangelands into prime locations for wind energy projects. Winds that once blew only tumbleweeds now drive massive commercial wind turbines, generating electric power.

As developers scramble to lease or purchase the best sites[1] for future wind energy projects, legal uncertainties about wind rights are becoming increasingly apparent. Among these uncertainties is the question of how conflicting wind rights are allocated between adjacent landowners. The "wake" of a commercial wind turbine causes turbulence and unsteady wind flow that can reduce the productivity of other wind turbines situated nearby.[2] Downwind wake effects can extend for a distance of

1. Numerous factors, including average wind speed, wind direction frequency, air temperature, the availability of adequate transmission facilities, permitting issues, and ease of vehicular access can affect a property's attractiveness for wind energy development. *See* AWS SCIENTIFIC, INC., WIND RESOURCE ASSESSMENT HANDBOOK: FUNDAMENTALS FOR CONDUCTING A SUCCESSFUL MONITORING PROGRAM, at 3-4 to 4-1 (1997), http://www.nrel.gov/wind/pdfs/22223.pdf. Also see the Department of Energy's list of factors relevant to wind turbine siting: New England Wind Forum, U.S. Department of Energy: Energy Efficiency and Renewable Energy, http://www.eere.energy.gov/windandhydro/windpoweringamerica/ne_siting.asp (last visited Dec. 23, 2008) [hereinafter Department of Energy Siting Considerations].

2. For a technical discussion of wind turbine wake effects and references to other resources on this topic, see Angel Jimenez et al., *Large-Eddy Simulation of Spectral Coherence in a Wind Turbine Wake*, ENVTL. RES. LETTERS 1–3 (2008), *available at* http://www.iop.org/EJ/abstract/1748-9326/3/1/015004.

up to ten times a turbine's rotor diameter,[3] or more than a half mile.[4] Thus, even wind turbines that comply with conventional zoning setbacks[5] can negatively impact the productive value of downwind properties.

Consider the following scenario:[6] Two wind energy developers separately go door-to-door along a stretch of rangeland to negotiate wind energy leases with landowners. The owner of Parcel *U* (see Figure A below) leases her land to the first developer (Upwind Developer); her downwind neighbor leases Parcel *D* to the second developer (Downwind Developer). The two developers soon discover they have leased adjacent properties, one immediately downwind of the other. Upwind Developer obtains a permit to install a wind turbine at Site *U*. Downwind Developer obtains a permit for Site *D*. Unfortunately, if turbines are built at both sites, the wake from the Site *U* turbine will disrupt winds flowing to Site *D*, rendering the Site *D* turbine unprofitable.

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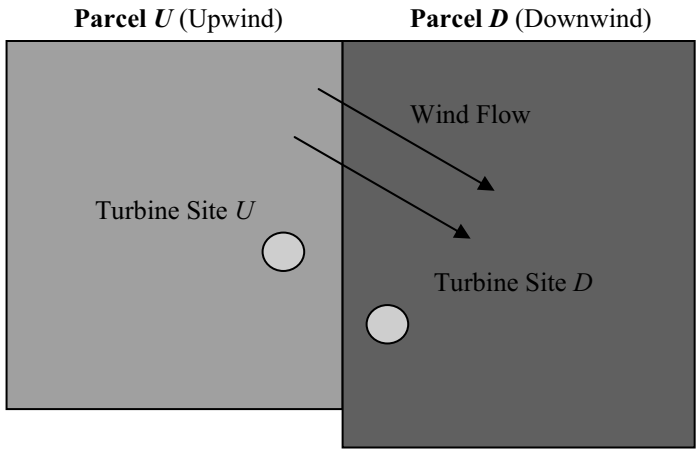
3. *See* Michael Klepinger, *Michigan Land Use Guidelines for Siting Wind Energy Systems*, MICH. ST. U. EXTENSION BULL. WO-1053, Feb. 2007, at 8, *available at* http://web1.msue.msu.edu/wind/Siting_Wind_Systems_Bulletin1.pdf. Perpendicular wind wake disturbances can also result for distances of up to three times a turbine's rotor diameter. *See* Adrian J. Bradbrook, *Australian and American Perspectives on the Protection of Solar and Wind Access*, 28 NAT. RESOURCES J. 229, 232 n.21 (1988) (citing R.W. BAKER & S.N. WALKER, WAKE STUDIES AT THE GOODNOE HILLS MOD-2 SITE (1982), a report prepared for the Bonneville Power Administration, Portland, Oregon).

4. Commercial wind turbines commonly have rotor diameters as great as one hundred meters. *See, e.g.*, GE Energy, 2.5 MW Wind Turbine 5, http://www.gepower.com/prod_serv/products/wind_turbines/en/downloads/ge_25mw_brochure.pdf (last visited Jan. 2, 2009).

5. Because of risk of rotor failure or towers falling in stormy conditions, wind turbine setbacks from residential zoned areas, dwellings, and roads are commonly used to ensure public safety. *See* SCOTT LARWOOD & C.P. VAN DAM, CALIFORNIA WIND ENERGY COLLABORATIVE, PERMITTING SETBACK REQUIREMENTS FOR WIND TURBINES IN CALIFORNIA 12 (Cal. Energy Comm'n Publ'n CEC-500-2005-184, Nov. 2006), http://www.energy.ca.gov/2005publications/CEC-500-2005-184/CEC-500-2005-184.PDF. It should be noted that this paper focuses on commercial scale, land-based wind energy development, which typically takes place in rural areas. A different set of assumptions would apply to analyses of wake interference issues in the context of offshore or urban wind turbine siting.

6. The described scenario is not entirely fictitious. The Author's client found itself in this scenario while developing a wind energy project in Klickitat County, Washington, which ultimately led to this Article. For descriptions of similar disputes occurring in North Dakota, see generally Lauren Donovan, *An Ill Wind Blows in Dickey County*, BISMARCK TRIB., June 28, 2005, http://www.bismarcktribune.com/articles/2005/06/29/news/topnews/top01.txt (describing conflict between competing wind developers over wake interference issues and proposed five-rotor-diameter setback requirement to prevent wake interference); *see also* Lauren Donovan, *Two Energy Projects Competing for the Wind*, BISMARCK TRIB., Feb. 23, 2008, http://www.bismarcktribune.com/articles/2008/02/23/news/local/149494.txt (describing the dispute in Barnes County over setbacks to prevent wind wake interference).

FIGURE A



Upwind Developer knows that, if it installs a turbine at Site *U*, Downwind Developer might sue for nuisance or under some other cause of action for the lost wind energy productivity at Site *D* caused by the Site *U* turbine's wake. Because the law is unsettled as to who would prevail in such a dispute,[7] Upwind Developer finds that the risk of costly litigation is too great and elects not to install its turbine. Downwind Developer similarly dismisses plans to install its Site *D* turbine, unsure whether the law would provide any remedy if Upwind Developer were to later install a turbine at Site *U*. As a result, no turbine is installed and a valuable wind energy source goes unutilized.

This Article asks which set of legal rules would best address the turbine wake interference problem just described. The Article assumes that an ideal rule would promote the efficient allocation of scarce wind resources and remain consistent with existing law. A natural analytical tool for such a discussion is Calabresi and Melamed's "Cathedral Model"—a simple framework of "property rules" and "liability rules" introduced in 1972 that has become a prominent fixture in law and economics literature.[8]

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7. For a discussion of the present status of the law on wind turbine wake interference issues, see *infra* text accompanying notes 22–29.

8. *See* Guido Calabresi & A. Douglas Melamed, *Property Rules, Liability Rules, and Inalienability: One View of the Cathedral*, 85 HARV. L. REV. 1089 (1972). The "cathedral" referenced in the article's title (and in the title to this Article) is the Roeun Cathedral, of which Claude Monet produced a series of paintings from various points of view. *Id.* at 1090 n.2.

Among the greatest contributions of the Cathedral Model was its unveiling of the infamous "Rule Four."[9] When Calabresi and Melamed first uncovered Rule Four, they acknowledged that the rule was rarely used to address private disputes but argued that it could have great value in the right context.[10] Thirty-six years later, Rule Four is still largely shunned as a tool for addressing private disputes,[11] with the exception of the famous *Spur Industries* case that was also published in 1972.[12] Commentators have offered a myriad of explanations for Rule Four's unpopularity.[13] However, such explanations often presume a large number of injured parties—an assumption that does not hold true in the wind turbine interference context. Moreover, a growing public policy interest in promoting efficient wind turbine siting bolsters arguments in favor of the liability rule protection that Rule Four would provide. Indeed, the recent expansion of wind energy development may have introduced a unique set of circumstances for which Rule Four is appropriate: conflicts between landowners over competing wind rights.

9. Henry E. Smith, *Exclusion and Property Rules in the Law of Nuisance*, 90 VA. L. REV. 965, 1009 (2004) (calling the deduction of the possibility of Rule Four in Calabresi and Melamed's article "the most startling and, to nuisance commentators, one of the most influential aspects" of their model). For those unfamiliar with Rule Four and the other three rules or wishing to refresh their memory, see *infra* text accompanying note 34.

10. Calabresi & Melamed, *supra* note 8, at 1117 ("The fourth rule is . . . not part of the cases legal scholars read when they study nuisance law, and is therefore easily ignored by them. But it is available, and may sometimes make more sense than any of the three competing approaches.").

11. In his remarks at a symposium in 1997 to commemorate the twenty-fifth anniversary of the Cathedral Model, A. Douglas Melamed discussed how Rule Four is frequently used in public law but conceded that the rule still was "not common in the private litigation context." A. Douglas Melamed, *Remarks: A Public Law Perspective*, 106 YALE L.J. 2209, 2209 (1997).

12. *See* Spur Indus., Inc. v. Del E. Webb Dev. Co., 494 P.2d 700, 706 (Ariz. 1972) (enjoining a cattle feedlot operator from continuing operations but requiring neighboring property owners to compensate the operator for the costs of relocating or terminating operations). See *infra* text accompanying notes 92–96 for a more detailed description of the *Spur Industries* case.

13. For a more detailed discussion of Rule Four and possible explanations for its unpopularity, see *infra* text accompanying notes 88–104.

II. BACKGROUND

A. Recent Whirlwind of Wind Energy Development

Two thousand seven was an unprecedented year for wind energy development in the United States. Developers installed 5244 megawatts of new wind power capacity in 2007, increasing the nation's total capacity by forty-five percent in a single year.[14] This one-year increase was twice that of the previous record increase set in 2006.[15]

Numerous factors have recently coalesced to boost U.S. demand for wind-generated power. Improved turbine technology has reduced the cost of wind power production which, combined with the rising cost of fossil fuels,[16] has narrowed the cost gap between wind-generated electricity and electricity produced from natural gas or coal.[17] Federal tax credits applicable to wind energy have further accelerated wind energy development in recent years.[18] Ambitious state-level renewable energy portfolio standards could continue to fuel demand for wind energy projects for years to come.[19]

Despite the U.S. wind energy industry's remarkable growth, the industry may still be in its embryonic stages. Wind-generated power presently accounts for only about one percent of the U.S. electricity supply even though one study found that U.S. wind resources are capable of generating more than twice the total amount of electricity

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14. AM. WIND ENERGY ASS'N., ANOTHER RECORD YEAR FOR NEW WIND INSTALLATIONS 1 (2008), http://www.awea.org/pubs/factsheets/Market_Update.pdf.

15. *See id.* at 1, 3 (showing that less than 2500 megawatts of wind power capacity were installed nationwide in 2006).

16. For data showing the recent rise in light crude oil prices, see generally TFC Commodity Charts, Light Crude Oil, Monthly Price Chart, http://futures.tradingcharts.com/chart/CO/M (last visited Dec. 24, 2008). Although oil prices dropped precipitously after peaking at over $147 per barrel in July of 2008, the price volatility risk evidenced by the 2008 spike in oil prices bolsters arguments in favor of greater reliance on wind and other renewable energy forms whose inputs are less susceptible to market price fluctuations.

17. *See* Mark Clayton, *A New Gust of Wind Projects Across the US*, CHRISTIAN SCI. MONITOR, Jan. 19, 2006, at 2 (describing how recent advancements in turbine technology have reduced the cost of wind power from eighty cents per kilowatt hour to between four and five cents per kilowatt hour).

18. Title 26 of the United States Code section 45 provided production tax credits of 1.5 cents per kilowatt hour for the first ten years of operation of certain renewable energy facilities, including wind. 26 U.S.C. § 45 (2005). The credits were set to expire on December 31, 2007, but were extended for one year by the Tax Relief and Health Care Act of 2006, Pub. L. No. 109-432, § 201, 120 Stat. 2922, 2844 (2006).

19. For a description of renewable energy standards and the Environmental Protection Agency's state-by-state summary of such standards, see Renewable Portfolio Standards Fact Sheet, U.S. Environmental Protection Agency, http://www.epa.gov/chp/state-policy/ renewable_fs.html (last visited Dec. 24, 2008).

currently generated from all sources combined.[20] A recent report released by the United States Department of Energy describes a scenario under which the United States could generate as much as twenty percent of its electric power from wind by 2030.[21]

B. Fledgling Legal Framework

As wind energy development continues to expand, new legal questions will inevitably arise. There is minimal case law or statutory law related to rights in wind. Relatively unfettered by existing legislation or precedent, policymakers charged with drafting laws in this area have significant freedom to devise rules that will best serve social goals.

All else equal, public policy favors rules that allocate competing wind rights so as to maximize the amount of wind energy produced over the long run from discrete quantities of property and capital investment.[22] Properties with consistent average wind speeds and other characteristics ideal for wind energy production are a scarce and highly valuable resource. Additionally, although wind is itself renewable, the costs of relocating a wind turbine after initial installation can be quite substantial.[23] Thus, the quality of developers' collective decisions about where to site wind turbines significantly affects the amount of total long-term wind energy generation achievable from a fixed amount of investment. Rational, profit-seeking wind energy developers already seek to maximize the wind energy productivity of those portions of their properties that are immune from turbine wake interference issues. However, rules are needed to ensure efficient use of property that is situated near boundary lines and is thus at risk of being underutilized.

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20. AM. WIND ENERGY ASS'N, TOP 20 STATES WITH WIND ENERGY RESOURCE POTENTIAL 1 (2008), http://www.awea.org/pubs/factsheets/Top_20_States.pdf.

21. *See* U.S. DEP'T OF ENERGY, 20% WIND ENERGY BY 2030: INCREASING WIND ENERGY'S CONTRIBUTION TO U.S. ELECTRICITY SUPPLY 1, 10–13 (2008), http://www1.eere.energy.gov/windandhydro/pdfs/41869.pdf.

22. Other commentators have made this sort of public policy argument. *See, e.g.*, Jacob M. Davidson, *Who Owns the Wind?: The Growth of the Wind Energy Industry in Texas and the Need for Laws to Regulate It*, 39 TEX. TECH. L. REV. 101, 131 (2006) (arguing that the state of Texas has a "genuine interest in the full development of [wind resources] for the benefit of the Texas people").

23. The costs of relocating even a single, relatively small turbine can easily exceed $100,000. *See, e.g.*, *Ag Canada Shuts Down Wind Turbine*, CBC NEWS, July 27, 2007, http://www.cbc.ca/canada/prince-edward-island/story/2007/07/27/agriculture-wind.html (estimating cost of relocating small wind turbine at $120,000 in Canadian dollars).

In recent decades, commentators and governments have explored numerous legal questions relating to wind. Rights in wind have been compared to or contrasted with water rights,[24] oil and gas rights,[25] and even rights in wild animals.[26] A few states have passed legislation to address certain discrete wind energy issues.[27] Yet, there has been little discussion about the broader policy question of which rules would most efficiently allocate wind rights among neighboring landowners so as to maximize the aggregate productivity of wind resources.

Clear, simple legislation for allocating competing wind rights would in itself promote wind energy development by reducing the legal uncertainties that presently abound.[28] Until recently, wind energy developers rarely found themselves in competition with other developers for the same turbine sites. In most cases, a developer could identify an area for potential wind energy development, lease the relevant property, and not have to worry too much about other developers. However, with the recent spike in demand for wind energy, multiple developers are increasingly competing to develop wind energy projects in the same geographic areas

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24. *See, e.g.*, Kim R. York & Richard L. Settle, *Potential Legal Facilitation or Impediment of Wind Energy Conversion System Siting*, 58 WASH. L. REV. 387, 390 n.13 (1983) (referencing water rights as one of several "plausible doctrinal bases for recognition of a property right in windflow onto land"); *see also* Lisa Chavarria, *Wind Power: Prospective Issues*, 68 TEX. B.J. 832, 834–35 (2005) (citing Terry E. Hogwood, *Against the Wind*, 26 OIL, GAS & ENERGY RESOURCES L. SEC. REP. 6, 6–7 (2001)) (stating that wind is "more akin to a wild animal or percolating waters which must first be reduced to possession before they have value"). Davidson also elaborated somewhat on the water rights analogy, arguing that "the act of turbines capturing wind as it flows across the surface of the land seems comparable to capturing water because the owner or lessee must capture the resource to fully own it and receive monetary value for it," and that "like water, wind is fugitive, and its position is relatively predictable with some study and evaluation." Davidson, *supra* note 22, at 129.

25. Hogwood, *supra* note 24, at 6 (arguing that wind is "not like oil and gas in place . . . which can be reduced to possession by one or more mineral owners . . . .").

26. *See, e.g.*, Davidson, *supra* note 22, at 128 (suggesting that Texas could "analogize wind to the courts' approach to wild animal ownership").

27. *See, e.g.*, MINN. STAT. § 500.30 (2002 & Supp. 2008); MONT. CODE ANN. § 70-17-303 (2007); OR. REV. STAT. § 105.900–105.915 (2007); S.D. CODIFIED LAWS § 43-13-17 to 43-13-19 (Supp. 2003); WIS. STAT. § 700.35 (2001 & Supp. 2007). Many of these statutes provide for the enforceability and statutory recognition of wind easements.

28. For decades, commentators have emphasized the need for legislation relating to wind rights. *See, e.g.*, Bradbrook, *supra* note 3, at 260 ("It is unrealistic to expect the courts to provide a judicial safeguard for solar and wind access in the absence of legislation. . . . [T]he prevailing view appears to be that any remedy for solar and wind access must be provided by the legislature."); *see also* York & Settle, *supra* note 24, at 411 ("Existing common law doctrine[s] and statutes generally do not directly address either the interests of the [wind turbine] developer or the community interests threatened by [wind turbine] development. . . . 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 [wind turbine] siting.").

and are vying against each other for the same wind. In this competitive environment, an increase in wake interference conflicts is bound to follow.

Some jurisdictions have established wake setbacks prohibiting wind turbine installations within as many as five rotor diameters of a property line.[29] Widespread adoption of such setbacks would indefinitely put a significant amount of prime wind energy development land out of commission. A more efficient rule would encourage or facilitate agreements among neighboring landowners to promote development of the most productive turbine sites, regardless of proximity to property lines. Of course, any rule chosen based on these policy objectives would still need to stay within the constraints of existing law.

III. EVALUATING RULES FOR WIND RIGHTS ALLOCATION: THE CATHEDRAL MODEL

A. The Model

A useful framework for analyzing resource allocation rules is the "Cathedral Model," introduced by Guido Calabresi and A. Douglas Melamed in 1972.[30] Applying the Cathedral Model to develop such rules involves deciding (i) which party is entitled to the scarce resource at issue and (ii) whether to protect the entitlement by a property rule or a liability rule.[31] An entitlement is protected by a property rule to the extent that other parties wishing to acquire the entitlement from its

29. On January 11, 2008, the Minnesota Public Utilities Commission issued an order establishing "wind access buffer" setbacks of five rotor diameters in the predominant wind axis and three rotor diameters on the secondary wind axis for projects having a total nameplate capacity of less than 25,000 watts. Order Establishing General Wind Permit Standards, Docket No. E,G-999/M-07-1102, 7–8 (Minn. Pub. Util. Comm'n, Jan. 11, 2008), *available at* http://www.windaction.org/documents/14797. S*ee also* LARWOOD & VAN DAM, *supra* note 5, at 12 (describing safety-based setbacks of up to four rotor diameters, in some cases partially or totally waivable with agreements from adjacent property owners).

30. *See generally* Calabresi & Melamed, *supra* note 8. Although critiques of the Cathedral Model have been published over the years—*see, e.g.*, James E. Krier & Stewart J. Schwab, *Property Rules and Liability Rules: The Cathedral in Another Light*, 70 N.Y.U. L. REV. 440, 440–41 (1995)—the Model remains a prominent part of law and economics scholarship.

31. *See* Calabresi & Melamed, *supra* note 8, at 1092. It should be noted that the Cathedral Model also discusses "inalienable entitlements," a third set of entitlements for which the sale of the entitlement is heavily regulated or forbidden altogether—for example, entitlement to one's internal organs. *Id.* at 1092. A discussion of these other entitlements has been omitted as it is beyond the scope of this Article.

holder can do so only by purchasing it in a voluntary transaction at a price acceptable to the seller.[32] An entitlement is protected by a liability rule to the extent that a party other than the entitlement holder has a right to acquire the entitlement by paying some objective, non-negotiated amount—typically determined by a judicial or legislative body.[33]

The Cathedral Model is often summarized in a simple two-by-two table with the (i) entitled party on one axis and the (ii) protective rule on the other. When applied in the context of environmental pollution—the most common example—the Model asks whether a "polluter" should be entitled to pollute or whether landowners downwind or downstream of the polluter (victims) should be entitled to pollution-free water or air. In either case, the "entitled" party's right can be protected by either of the two protective rules. Four different rules are possible, each numbered as follows:[34]

> **RULE ONE**: The *victims* are entitled to be free from pollution and their entitlement is protected by a *property* rule (an injunction against the polluter);
>
> **RULE TWO**: The *victims* are entitled to be free from pollution and their entitlement is protected by a *liability* rule (the victims can force the polluter to pay them compensatory damages);
>
> **RULE THREE**: The *polluter* is entitled to pollute and its entitlement is protected by a *property* rule (the victims have no legal or equitable right to stop the pollution); and
>
> **RULE FOUR**: The *polluter* is entitled to pollute and its entitlement is protected by a *liability* rule (the victims can purchase an injunction to stop the pollution by paying the polluter's costs of stopping the pollution).

The turbine wake interference problem described earlier fits neatly within the Cathedral Model. An upwind landowner whose wind turbine's wake effects cause—or would cause—economic injury to a downwind neighbor is analogous to a polluter. The downwind landowner, whose turbine is—or would be—adversely affected by the wake of the upwind turbine, is the victim. Setting aside arguments about reciprocal or symmetric causality,[35] this upwind polluter and downwind victim paradigm is

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32. *Id.*
33. *Id.*
34. *See id.* at 1115–18. In recent years, other possible "rules" under the Cathedral Model have been proposed. For a discussion of some of these additional rules, see *infra* text accompanying notes 106–09.
35. Ronald Coase challenged the polluter-victim paradigm in favor of a more objective "symmetric" or "reciprocal" causality approach in which the polluter can be

intuitive because downwind turbines are nearly incapable of imposing damaging wake effects on upwind property. Figure B is a table describing the four possible Cathedral Model rules in the turbine wake interference context.[36]

FIGURE B

	Property Rule	**Liability Rule**
Entitlement to Downwind Landowner (*D*)	**Rule One**: *D* may enjoin *U* from installing any turbine on *U*'s property that creates wake effects reducing the productivity of *D*'s turbines.	**Rule Two**: *D* is entitled to damages from *U* for the reduced productivity of *D*'s turbine caused by the wake of *U*'s upwind turbine.
Entitlement to Upwind Landowner (*U*)	**Rule Three**: *D* has no claim against *U* for an injunction or for damages.	**Rule Four**: *D* is entitled to purchase an injunction or easement preventing installation of turbines on *U*'s property that could interfere with *D*'s turbines.

viewed as the injured party rather than the party inflicting the injury. However, at least one commentator has noted that such an approach often has limited practical value. *See, e.g.*, Smith, *supra* note 9, at 1012–13 ("Despite Coase's best efforts to portray the nuisance cases as reciprocal in more than just theory, . . . the . . . cases turn out, on closer examination, to be very asymmetric."). Regardless, the Cathedral Model necessarily proceeds on the assumption that one party causes the harm. For a more detailed discussion of how a reciprocal view of causation impacts Cathedral Model analysis, see generally Lee Anne Fennell, *Property and Half-Torts*, 116 YALE L.J. 1400, 1421–23 (2007) (describing how an analytical approach that distinguishes inputs to pollution from outcomes of pollution and recognizes torts as divisible into two parts—*risk* and *harm*—affects analysis under the Cathedral Model).

36. The table in Figure B and portions of the succeeding analysis purposefully refers to *landowners* rather than *developers* because the discussion relates to allocation of legal rights in wind based on fee ownership. Of course, wind energy developers who obtain lease or easement rights in a landowner's property can acquire no more of a right than such landowner holds under prevailing law.

The Coase Theorem suggests that, if transaction costs are sufficiently low, any of the four rules would result in an efficient outcome because competing wind rights would be assigned to either one of the two parties and protected by some legal rule.[37] However, current law fails to clearly assign competing wind rights to any party. Even if competing wind rights were assigned, the potential transaction costs of negotiations between neighbors might be too great to rely solely on Coasean bargaining to produce efficient turbine siting. Strategic behavior, endowment effects, asymmetric information, or other factors could potentially undermine adjacent landowners' ability to consistently negotiate arrangements that allocate scarce wind resources to their highest valued user.[38]

So which of the four Cathedral Model rules would most fairly and effectively promote the efficient allocation of competing rights in wind?[39] Commentators have considered countless factors affecting which of the four Cathedral Model rules is appropriate in which context such that reasonable individuals could argue in favor of any of the four rules. However, as described below, the weight of existing scholarship seems to favor using Rule Four for wind wake interference conflicts.

B. Choosing the Entitlement Holder

The first step in applying the Cathedral Model is deciding which party should hold the "entitlement." Before considering whether upwind or downwind owners should have an entitlement in wind, we should first

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37. *See generally* Smith, *supra* note 9. The Coase Theorem is based on the premise that parties will always negotiate the transfer of an entitlement to its highest valued user if transaction costs are sufficiently low. To briefly illustrate, suppose that Dan values an entitlement more than Carl. If Carl receives the entitlement from the state, then Dan will acquire it from Carl in an arms-length transaction for a price somewhere between Carl's valuation of it and Dan's valuation. If, instead, Dan receives the entitlement from the state, no transfer is negotiated between them because Dan values the entitlement more than Carl. In both cases, the entitlement ends up with Dan, its highest valued user. *See also* Louis Kaplow & Steven Shavell, *Property Rules Versus Liability Rules: An Economic Analysis*, 109 HARV. L. REV. 713, 732 (1996) (arguing that if transaction costs are sufficiently low, the choice between liability rules and property rules is not material because rational parties will bargain to reach an efficient outcome regardless of which rule is selected).

38. A voluminous amount of scholarship is available on behavioral law and economics. For a useful starting point to researching the endowment effect, strategic behavior, and other behavioral law and economics concepts, see Christine Jolls, Cass R. Sunstein & Richard Thaler, *A Behavioral Approach to Law and Economics*, 50 STAN. L. REV. 1471, 1476 (1998).

39. It should be noted that there are other conceivable rules for allocating scarce wind rights beyond the four Cathedral Model rules. These include, among others, a "first-in-time" rule and a rule by which a court or legislative body would manually allocate Wind Rights to the highest valued user. For a brief analysis of these two alternative rules, see *infra* text accompanying notes 67–73.

clarify both what constitutes an entitlement in wind and what it means to be a "downwind" or "upwind" landowner.

1. "Entitlement" in Wind?

Because natural wind is both ephemeral and location specific, any discussion of who should be entitled to wind invokes a more basic question: Exactly what is an entitlement in wind? Is it vested ownership in the wind itself? If so, what does it mean to "own" wind? In the words of one commentator:

> [T]he ownership of wind is a misnomer. Wind, in and of itself, does not appear to be susceptible of any ownership. It is not like oil and gas in place . . . which can be reduced to possession by one or more mineral owners . . . . Wind itself is more akin to a wild animal or percolating waters which must first be reduced to possession before they have value. To reduce wind to "possession" appears to require that it be focused on driving the fins of a [wind turbine] which turn a generator and ultimately generates electricity. Then and only then can wind (a) be reduced to possession and (b) have value.[40]

This paper necessarily assumes that private landowners can and do hold some sort of interest relating to the wind that passes over their property, whether such right is characterized as (i) an ownership right in wind itself or (ii) a right to capture wind and convert it to electric energy. Such rights are collectively referred to herein as "Wind Rights."

2. "Upwind" Versus "Downwind"

Although the ensuing analysis distinguishes between upwind and downwind landowners, it is worth acknowledging that every landowner is upwind of some neighbors and downwind of others. Landowners have undisputed, exclusive Wind Rights as to all portions of their property that are far enough away from boundary lines to be both (i) immune from the wake effects of neighbors' turbines and (ii) incapable of reducing the productive value of wind flowing onto neighboring properties through installation of wind turbines. Rules to allocate competing Wind Rights between upwind and downwind landowners relate only those portions of a parcel that could *affect* or *be affected by* a wind turbine on a neighboring property.

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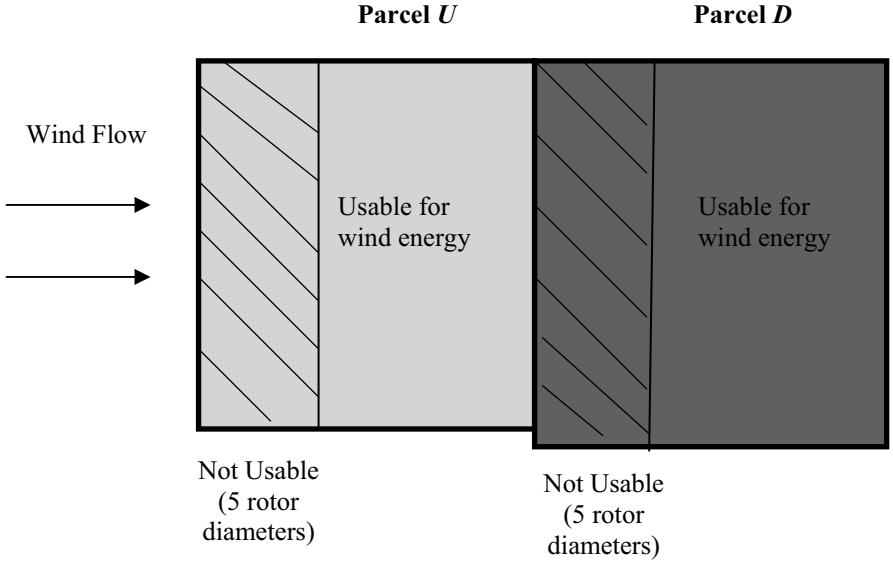
40. Hogwood, *supra* note 24, at 6–7.

The diagrams in Figure C and Figure D below illustrate this point. Each diagram assumes (i) a (conservative) five-rotor-diameter wake interference rule;[41] (ii) that prevailing winds blow from west to east; and (iii) that there are no interference effects involving properties to the north or south.

Figure C shows those portions of Parcels *U* and *D* that would be available for wind energy development by their respective owners if competing Wind Rights were given to upwind owners. Allocating competing Wind Rights to upwind owners would allow landowners to install wind turbines anywhere on their property—in compliance with applicable setbacks—without liability for any wake effects impacting their downwind neighbors. However, such a rule would discourage landowners from installing wind turbines on the upwind-most portions of their property, cross-hatched in Figure C, without obtaining a privately-negotiated wind flow easement or equivalent agreement protecting against future wind interference from their upwind neighbors.

FIGURE C

Entitlement to ***Upwind*** Owners

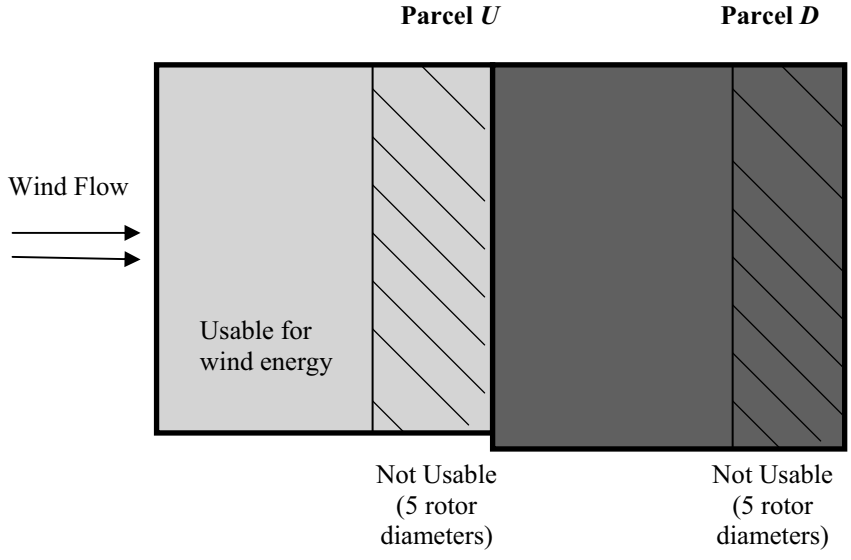


41. This five-rotor-diameter assumption is for convenience and illustration purposes only. As previously mentioned, it is possible for wake effects to extend for at least ten rotor diameters. *See supra* note 3 and accompanying text. Depending on the turbine type and various other factors, a turbine's adverse wake effects might in many cases still be commercially damaging for distances exceeding five rotor diameters.

Figure D shows those portions of Parcels *U* and *D* that would be available to landowners for wind energy development if Wind Rights were allocated to downwind owners. Giving competing Wind Rights to downwind owners would discourage landowners from installing any wind turbine close enough to property lines that the turbine's wake could cross the line and reduce the productive value of property downwind.[42] A privately-negotiated easement or equivalent document from downwind neighbors would be needed to avoid liability for turbines installed in the cross-hatched areas of Figure D.

FIGURE D

Entitlement to ***Downwind*** Owners



In summary, every downwind owner vis-à-vis neighbors to the west is also an upwind owner vis-à-vis neighbors to the east. Thus, the question of whether to allocate competing Wind Rights to upwind or downwind owners is essentially a question of whether landowners should be entitled to exercise Wind Rights on their property regardless of possible downwind

42. Wake setbacks established in some jurisdictions already provide for a rights allocation comparable to that in Figure D. *See, e.g.*, *supra* note 29.

wake effects. Are landowners entitled to install wind turbines on their property, regardless of whether the wakes of such turbines reduce the productive value of downwind property—an entitlement to upwind owners? Or, are landowners entitled to a natural flow of wind across their property, unaltered by upwind neighbors' activities—an entitlement to downwind owners?

3. The Ad Coelum *Rule*

A few commentators have proposed that the "united fee ownership rule" or "*ad coelum*" rule at common law might give landowners the right to capture and make productive use of wind that blows across their land.[43] The legal maxim *cujus est solum ejus est usque ad coelum et ad inferos* means "[t]o whomsoever the soil belongs, he owns also to the sky and to the depths."[44] Under the *ad coelum* rule, an owner of land in fee possesses rights to use as much of the space above that land as can be put to productive use.[45] Such use rights arguably extend to the installation of commercial wind turbines—an argument that supports allocating Wind Rights to upwind owners.

However, the *ad coelum* rule can also be interpreted to favor downwind owners. Nuisance law recognizes landowners' rights or privileges to keep their air space—as defined under the same *ad coelum* rule—free from certain undesirable substances and effects.[46] The question thus becomes which landowner's *ad coelum* right is superior, and this puts the analysis right back where it began. Indeed, the *ad coelum* rule alone is inadequate for resolving situations where a landowner's productive use of its air space necessarily devalues the air space of a neighbor.

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43. *See, e.g.*, Joseph O. Wilson, *The Answer, My Friends, Is in the Wind Rights Contract Act: Proposed Legislation Governing Wind Rights Contracts*, 89 IOWA L. REV. 1775, 1784 (2004) (describing the united fee ownership rule and arguing that "[t]he natural extension" of the rule "dictates a legal right to 'harvest' the wind that blows across one's land . . . ."). *See also* United States v. Causby, 328 U.S. 256, 264 (1946) (stating that a "landowner owns at least as much of the space above the ground as he can occupy or use in connection with the land"), *cited in* York & Settle, *supra* note 24, at 391.

44. BLACK'S LAW DICTIONARY 453 (4th ed. 1968).

45. The right to utilize the space above one's property to exceeding heights is supported at common law. *See, e.g.*, People v. Sears, Roebuck & Co., 287 N.E.2d 677, 679 (1972) (holding that construction of a 110-story building not be enjoined even though it would interfere with television reception in nearby areas because a landowner has the right to construct a building on its property at any desired height, subject to any applicable land use regulations), *cited in* Rita F. Taubenfeld & Howard J. Taubenfeld, *Wind Energy: Legal Issues and Legal Barriers*, 31 SW. L.J. 1053, 1075 (1977).

46. For a discussion of the *ad coelum* rule as applied to nuisance law, see generally Smith, *supra* note 9.

Ronald Coase observed that a court's or legislature's determination as to which party's *ad coelum* right trumps the other's is often normative, with the largest factor being which party's use is more socially valuable.[47] In wind turbine interference disputes, both parties generally want to use a competing wind resource in the same way—to produce electricity for commercial sale—so detailed wind studies on both sides of the property line would be needed to determine which landowner's turbine sites have the greatest productive potential. Preferably, such factual determinations would be done privately by the parties in connection with arm's length negotiations rather than by a county's zoning board or the judicial system.[48] The "invisible hand" of private transactions can work to allocate Wind Rights only after the legal system has granted an entitlement to those rights to one of the competing parties. Hence, there is a need for a bright line rule that allocates competing Wind Rights to either upwind or downwind owners.

4. Analogies to Other Property-Specific Resources

Existing laws allocating analogous natural resources seem to favor giving competing Wind Rights to upwind owners. Unlike in the pollution context, a turbine wake interference dispute asks which of two parties should be entitled to harness a scarce, location-specific resource. Existing laws for allocating mineral rights, oil and gas rights, hunting rights and other property-specific interests are often tailored to create an "exclusion regime" that can ease enforcement and minimize disputes.[49] In each case, the rights are most commonly allocated along property boundary lines. A holder of a fee simple estate is typically entitled to extract minerals, drill for oil, and hunt for wild game only within the boundaries of its own property. A landowner who captures a wild animal just before it exits her property owes nothing to her neighbor.

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47. *See* R. H. Coase, *The Problem of Social Cost*, 3 J.L. & ECON. 1, 15 (1960), *cited in* Smith, *supra* note 9, at 1013–14.

48. This "highest valued user" rule is discussed *infra*, text accompanying notes 72–73.

49. *See* Smith, *supra* note 9, at 972–74 (describing the use of property rules to create an "exclusion regime" giving owners a "gatekeeper right" as to the property being protected).

In some ways, interests in subsurface oil and gas provide a useful analogy for Wind Rights.[50] Like wind, oil and gas are often mobile such that one landowner's capture of them might reduce the amount available for capture by a neighbor. Oil and gas laws in several states provide that landowners have the exclusive right to drill and capture oil and gas directly beneath the surface of their land, up to the property line on all sides.[51] A rule giving competing Wind Rights to upwind landowners would allow landowners to capture wind energy in all air space up to their property line and would thus mirror such oil and gas laws, fitting comfortably within existing law.[52]

5. Contra Costa *and the "Wind Estate"*

Giving competing Wind Rights to upwind owners would also facilitate clearer, simpler Wind Rights transfers—for example, by reservation or as a separate estate—because a landowner's Wind Rights would involve no more nor less than the land and air space within the landowner's property boundary lines. A California appellate court has held that the right to capture wind and convert it to energy can be severed from a surface estate—a clear step in the direction of giving upwind owners competing Wind Rights.[53] The court in *Contra Costa Water District v. Vaquero Farms, Inc.*, was asked to consider whether a municipal water district could sever a property's Wind Rights from the fee estate and reserve such rights to a private landowner in a condemnation proceeding.[54] The court cited the landowner's thirty-year wind energy lease as "irrefutable evidence that one may have a right to use windpower rights without owning any interest in the land," concluding that "windpower rights are 'substantial rights' capable of being bought and sold in the marketplace."[55] Rejecting the argument that fee ownership was inexplicably connected to Wind Rights, the court embraced the water district's argument that "[t]he right to generate electricity from windmills harnessing the wind, and the right to sell the power so generated, is no different, either

50. The analogy to oil and gas can only go so far before encountering material differences with Wind Rights. *See infra* text accompanying notes 80–83.

51. *See* Ernest Smith, *Wind Energy: Siting Controversies and Rights in Wind*, 1 ENVT'L & ENERGY L. & POL'Y J. 281, 301 (2007) [hereinafter Smith, *Wind Energy*] (referencing oil and gas laws in Oklahoma, Louisiana, California, and other states).

52. Multiple articles on Wind Rights have reached this same conclusion. In one commentator's view, the "right to reduce wind to possession is an incident of surface ownership." Davidson, *supra* note 22, at 106, *citing* Hogwood, *supra* note 24.

53. *See* Contra Costa Water Dist. v. Vaquero Farms, Inc., 58 Cal. App. 4th 883 (Cal. Ct. App. 1997).

54. *Id.*

55. *Id.* at 893.

in law or common sense, from the right to pump and sell subsurface oil, or subsurface natural gas by means of wells and pumps" and that Wind Rights could thus similarly be severed from a surface estate.[56]

Statutory adoption of *Contra Costa*, with an assumption that fee owners inherently hold Wind Rights up to the boundary lines of their property, would reduce legal uncertainty surrounding the conveyance or reservation of a Wind Rights "estate" separate from a fee simple estate.[57] In contrast, if Wind Rights were allocated to downwind owners, a fee owner's Wind Rights estate would necessarily be subject to a downwind owners' right to prohibit damaging wind turbine wakes from crossing the property line.

6. An Entitlement in Upwind Owners Minimizes Litigation

A rule giving competing Wind Rights to upwind owners would likely generate less litigation than a rule in favor of owners downwind. The wind flowing into a wind turbine obviously cannot be distorted by other turbines situated downwind. Thus, under a rule allocating Wind Rights to upwind owners, no interested party would both (i) hold an entitlement and (ii) be capable of having that entitlement infringed upon in a legally cognizable way. If a liability rule were ultimately chosen to protect competing Wind Rights, information cost factors that become relevant when government decisionmakers valuate entitlements under liability rules would also favor giving upwind owners the Wind Rights entitlement.[58]

For all of the reasons just described, the preferable approach is to give competing Wind Rights to upwind owners. Property owners should be free to install wind turbines anywhere on their property—within conventional setbacks—regardless of whether a turbine's wake might disrupt the wind flowing onto properties downwind.

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56. *Id.* at 894.

57. Davidson, *supra* note 22, at 131 (advocating Texas's adoption of the *Contra Costa* ruling on the theory that "wind estate owners, using the court's reasoning in *Contra Costa*, would enjoy the same rights as mineral estate owners including the right to develop and the right to lease").

58. Because of difficulties in measuring wake effects, it is easier for decisionmakers to estimate an upwind owner's loss from having to relocate a turbine site than to estimate a downwind owner's economic loss from an upwind turbine's wake. *See infra* text accompanying notes 98–102.

7. *Entitlement to Upwind Owners: Dismissing Rules One and Two*

A decision to give competing Wind Rights to upwind owners effectively eliminates two of the four possible rules in the Cathedral Model's conventional two-by-two diagram (Figure B above). Rules One and Two each would have allocated conflicting Wind Rights to downwind property owners, presumably on a theory that landowners are entitled to undisturbed wind flow across their property. Dismissing Rules One and Two not only seems desirable from a theoretical perspective but is consistent with prevailing law.

a. Rule One

Rule One would have permitted a downwind landowner to obtain an injunction against installation of upwind turbines whose wake effects were capable of crossing the property line. Current law ordinarily reserves such injunctions only for cases of trespass or strong nuisance.

In its most generic sense, trespass is an action for the physical invasion of a visible object onto the property of another.[59] Trespass ordinarily does not cover cases where the physically invading object is invisible to the naked eye.[60] In the case of wind interference, only the invisible turbulence caused by a turbine's wake invades another's property so a claim for trespass in such contexts would be unsupported under common law.

Although the wake of a wind turbine can more easily be characterized as a private nuisance than as a trespass, a turbine wake is not the sort of nuisance that would be expected to merit an equitable remedy. An actionable private nuisance is a "nontrespassory invasion" causing substantial interference and significant harm.[61] If a turbine's wake causes substantial interference to a downwind turbine and results in a significant economic loss to the downwind owner, operating the turbine could arguably constitute a nuisance under this conventional definition. However, an injunction is typically available for nuisance only when damages would inadequately compensate the injured party and a balancing of relative

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59. *See* RICHARD R. POWELL, POWELL ON REAL PROPERTY § P6.07[1] (Michael Allan Wolf ed., LexisNexis Matthew Bender Supp. 2004) (1949).

60. *See* Smith, *supra* note 9, at 993–94 (citing Thomas W. Merrill, *Trespass, Nuisance, and the Costs of Determining Property Rights*, 14 J. LEGAL STUD. 13, 28–29 (1985)).

61. *See* POWELL, *supra* note 59, at § 64.02[1]–[2] (citing RESTATEMENT (SECOND) OF TORTS § 821D (1979); Tenn v. 889 Associates Ltd., 500 A.2d 366 (N.H. 1985) (finding that interference with air and light was not substantial); Hendricks v. Stalnaker, 380 S.E.2d (W. Va. 1989) (finding that digging of water well did not constitute significant harm)).

harms favors injunctive relief.[62] Damages are likely an adequate remedy in disputes between commercial wind energy developers over turbine wake interference. In short, Rule One diverges too far from existing common law principles to warrant further consideration.

b. Rule Two

A Rule Two approach seems a bit more plausible under existing law. Rule Two would have entitled landowners to damages for decreases in the commercial value of their property resulting from the wake effects caused by an upwind neighbor's turbine.[63] Nuisance actions for which damages might be an available remedy often involve nontrespassory intrusions onto others' property, such as noise, odor, or aesthetic blight.[64]

However, a nuisance claim for the damaging effect of a turbine's wake—located hundreds of feet in the air[65]—on a unique, sensitive downwind use like wind energy development is far less likely to succeed. Under common law, nuisance claims for damages to a plaintiff's sensitive, atypical use usually fail.[66] In summary, it appears that little is lost in foregoing Rules One and Two because neither rule would fit comfortably with the existing body of law.

8. Dismissing Alternative Allocation Rules

A mere upwind versus downwind analysis under the Cathedral Model arguably overlooks some other possible rules for allocating Wind Rights.

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62. *See* POWELL, *supra* note 59, at § 64.07[1] (stating that the "usual basis for equitable intervention" is "the inadequacy of the remedy at law").

63. In cases under a hypothetical Rule Two where an upwind turbine is installed prior to installation of any turbine downwind, the likely remedy would be "permanent damages." The upwind landowner would pay a judicially determined dollar amount to the downwind owner, but the downwind owner and his or her successors in interest would be permanently barred from claiming turbine wake interference damages. The classic "permanent damages" case cited in law and economics literature is *Boomer v. Atlantic Cement Co.*, 257 N.E.2d 870 (N.Y. Ct. App. 1970).

64. *See* Smith, *supra* note 9, at 992 (citing W. PAGE KEETON ET AL., PROSSER AND KEETON ON THE LAW OF TORTS § 87, at 622 (5th ed. 1984)).

65. The latest generation of commercial wind turbines can be up to 420 feet high. *See* Donovan, *Two Energy Projects Competing for the Wind*, *supra* note 6.

66. *See* POWELL, *supra* note 59, at § 64.05[5] ("A plaintiff[] whose use of land makes it peculiarly susceptible to harm cannot use those unique circumstances to veto conduct by neighbors that constitutes a private nuisance only because of the plaintiff's particular use." (citing Amphitheaters, Inc. v. Portland Meadows, 198 P.2d 847 (Or. 1948))).

Two conceivable alternatives to the upwind versus downwind approach—and the respective shortcomings of each—are discussed below.

a. "First-in-Time" Approach

Like the water law doctrine of "prior appropriation," a rule for Wind Rights allocation could ignore the relative upwind or downwind locations of competing landowners. Wind Rights could instead be allocated based on which landowner first installs a turbine making productive use of the wind. New Mexico has a permit system for solar rights that is based on the prior appropriation doctrine.[67] Under New Mexico's system, "first-in-time is first-in-right" so long as the initial use of solar energy is beneficial. Oil and gas laws in some states also involve somewhat of a "first-in-time" rule because whichever landowner is the first to extract subsurface oil from immediately below the landowner's property acquires title to the oil extracted.[68]

One positive aspect of a first-in-time rule is its potential to accelerate development of wind turbine sites, thus putting wind resources to productive use more quickly. However, this approach can also promote rash, inefficient development, leading to suboptimal long-term use of a scarce renewable resource. For example, some have criticized New Mexico's solar permit system on the ground that it can allow less productive land uses—for example, a personal solar water heater—to prevent development of more productive uses such as large-scale developments.[69]

A first-in-time rule for Wind Rights would yield an inefficient outcome in every case where the first developed site has less wind energy potential than a competing neighbor's site. To illustrate, suppose that a turbine installed at Turbine Site *D*—from the wind interference fact pattern discussed earlier[70]—could produce electricity capable of generating a profit with a net present value of $200,000. Suppose further that the same turbine would produce a profit with a net present value of $300,000 if it were instead installed at Turbine Site *U*. Under a first-in-time rule, if the downwind developer installed its turbine first, $100,000 worth of potential generating capacity would be lost. Given the fully renewable character of wind and the significant expense of relocating wind turbines once installed, the long-term consequences of a first-in-

67. N.M. STAT. ANN. § 47-3-1–47-3-5 (LexisNexis 1978 & Supp. 2007).
68. *See* Smith, *Wind Energy*, *supra* note 51, at 301.
69. *See* Bradbrook, *supra* note 3, at 262–63 (citing Deborah Zamora Grout, Note, *Access to Sunlight: New Mexico's Solar Rights Act*, 10 N.M. L. REV. 169, 171–74 (1980)).
70. *See supra* text accompanying notes 6–7.

time rule could be substantial. A simple allocation of competing Wind Rights to all upwind landowners would prevent races between neighbors to install turbines solely for the purpose of securing Wind Rights, thus increasing the likelihood of efficient voluntary bargains.[71]

b. "Highest Valued User" Approach

Another possible approach would be for a third-party decisionmaker—for example, a court or a county official—to determine which of two neighboring landowners places a higher value on a set of competing Wind Rights and allocate the Wind Rights entitlement to that owner. As Richard Posner might argue, it may be easier to merely determine which of two landowners places the highest wind energy development value on a given area of land than to quantify the actual value either party places on the land.[72] A subscriber to Posner's perspective might advocate a rule where the decisionmaker determines which party is the "highest valued user" and awards competing Wind Rights to that party, protecting the entitlement with a property rule.

The obvious downside of a highest valued user approach is its high administrative burden. In many wind interference disputes, wind studies are likely to have been conducted on only one side of the property line. Under a highest valued user approach, every time a landowner filed a permit to install a turbine within a wake-sensitive area, the landowner and neighbor would find themselves in costly, fact-specific hearings debating which owner's property had greater productive value. The necessary cost and expense of waiting for studies to be concluded on

71. For example, under a first-in-time rule, opportunistic landowners might also install cheap, smaller turbines in an effort to secure competing Wind Rights, leading to inefficient use of the total capital available for wind energy development.

72. *See* Richard R. W. Brooks, *The Relative Burden of Determining Property Rules and Liability Rules: Broken Elevators in the Cathedral*, 97 NW. U. L. REV. 267, 276, 277 (2002) ("Posner maintains that efficient property rules are easier to determine because judges need only compare which one of two valuations is greater, as opposed to the more difficult task of determining either valuation.") (citing RICHARD A. POSNER, ECONOMIC ANALYSIS OF LAW (5th ed. 1998)). Brooks also points out that "when judicial errors are significant and common to both parties, property rules become relatively easier for the judge to accurately determine . . . . When the observational noise is varied across parties (i.e., negatively correlated or uncorrelated), then the liability rule-like task of determining a single height is marginally easier." *Id.* at 270. A more detailed description of Posner's valuation-cost discussion of property rules is available at RICHARD A. POSNER, ECONOMIC ANALYSIS OF LAW 68–70 (7th ed. 2007).

both sides and then comparing those studies would be substantial.[73] Indeed, a highest valued user approach seems capable of creating greater obstacles to wind energy development than it would eliminate.

C. Property Rule Versus Liability Rule

Having determined that competing Wind Rights should be vested in upwind landowners, we arrive at the second step in applying the Cathedral Model: selecting a rule to protect the entitlement. Now that we have eliminated the top half of our two-by-two table from Figure B, we are left to choose between Rule Three and Rule Four. Rule Three would protect upwind owners' Wind Rights with a property rule. Rule Four would protect upwind owners' Wind Rights with a liability rule.

The choice between property rules and liability rules is the subject of an immense body of law and economics scholarship. Shortly after the Cathedral Model was published, many commentators seemed to embrace the principles that property rules were preferable when transaction costs were low, and liability rules should be used in high transaction cost contexts—for example, where a large number of parties reduces the likelihood of successful voluntary bargaining.[74] All else being equal, property rules were generally deemed preferable in cases where a court's assessment of damages was likely to be costly or inaccurate—for example, where one or more parties likely has highly subjective valuations of the entitlement.[75] For several years, most commentators seemed to generally accept these as very loose principles for choosing between property rules and liability rules. About a decade ago, however, some commentators began arguing that liability rules are almost always preferable,[76] stirring a debate in legal academia that continues today.[77] More than a dozen

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73. A continuous wind study of at least one year is generally recommended in connection with siting of commercial turbines. *See* Department of Energy Siting Considerations, *supra* note 1.

74. For a discussion of Richard Posner's early adoption of the low-versus-high transaction cost approach and citations to many other commentators favoring the approach, see Krier & Schwab, *supra* note 30, at 452–53.

75. For a detailed discussion of the merits and weaknesses of property rules, liability rules, and the Cathedral Model, see generally Krier & Schwab, *supra* note 30, at 450, 467–70. Further development of behavioral economics and other empirical approaches are needed to understand the vast set of nuances relating to property and liability rules and their application.

76. *See* Ian Ayres & Eric Talley, *Solomonic Bargaining: Dividing a Legal Entitlement to Facilitate Coasean Trade*, 104 YALE L.J. 1027, 1033 (1995) (arguing that liability rules are more likely than property rules to facilitate Coasean bargains because liability rules force parties to reveal information about their valuations of the scarce entitlement); *see also infra* text accompanying notes 88–90.

77. Numerous articles have challenged the notion that liability rules are always preferable. *See, e.g.*, Krier & Schwab, *supra* note 30, at 453–55; Daphna Lewinsohn-

factors have been identified in law and economics literature as arguably impacting the superiority of one rule over the other.[78] A case-specific analysis is thus warranted for determining which rule is preferable in the wind wake interference context.

1. Rule Three: Protecting Upwind Owners with a Property Rule

Under Rule Three, property owners would have no recourse—neither damages nor an injunction—against upwind neighbors who install wind turbines that reduce the productive value of downwind air flow.[79] A voluntary bargain for a wind easement or its equivalent would be a downwind owner's only means of securing usable Wind Rights for property located near a boundary line with an upwind neighbor.

At first glance, Rule Three might seem the most compelling rule for allocating Wind Rights. To borrow from the popular first-year property course analogy, Wind Rights can easily be viewed as a "stick" among the "bundle of sticks" that is conveyed with any fee interest in real property. Such property rights are most commonly protected by a property rule.[80] As already mentioned, many jurisdictions have protected oil and gas rights using a property rule, permitting landowners to drill straight

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Zamir, *The Choice Between Property Rules and Liability Rules Revisited: Critical Observations from Behavioral Studies*, 80 TEX L. REV. 219, 222 (2001) (arguing that liability rules can reduce the likelihood of successful bargaining because, among other reasons, "experimental findings support the argument that owners exhibit a stronger endowment effect when their entitlement is protected by a liability rule than when it is protected by a property rule"). Lewinsohn-Zamir's article cites several more articles critiquing arguments in favor of liability rules. *See* Lewinsohn-Zamir, *supra*, at 221.

78. *See* Brooks, *supra* note 72, at 272–73 ("Commentators have based arguments for and against property rules and liability rules on efficient allocation, investment, bargaining, transaction costs, revealing information, concealing information, victim behavior, injurer behavior, undercompensation, overcompensation, risk aversion, loss aversion, endowment effects, holdouts, and unconscionability."). It should be noted that Brooks's article is focused on yet another line of argument—the relative costs of administering each of the rules.

79. Wind energy projects today are constructed in rural areas, and modern commercial wind turbines are often more than 420 feet in height. *See supra* note 65.

80. Coase and others have challenged the "bundle of rights" paradigm that predominates in property law; they argue that a property law and economics approach focuses too much on the most efficient allocation of rights in a scarce resource rather than on one property owner's right to exclude another. *See* Smith, *supra* note 9, at 978 ("[W]hether we have the right to shoot over another man's land has been thought of as depending on who owns the airspace over the land. *It would be simpler to discuss what we should be allowed to do with a gun*." (citing R.H. Coase, *The Federal Communications Commission*, 2 J.L. & ECON. 1, 34 (1959))).

down from the surface of their land and extract oil immediately below, up to the edge of their property line, even if the subsurface oil field involved also flows under a neighboring property.[81]

However, a closer look reveals that analogies to a bundle of sticks or to oil and gas law can ignore some unique and important characteristics of wind. Social cost differences among possible oil and gas rights allocations are relatively low, because the effects of such allocations are often only distributional and have little impact on the aggregate amount or value of the resource captured and sold. In most cases, roughly the same amount of oil ultimately reaches the marketplace regardless of which of two neighbors extracts and sells it.

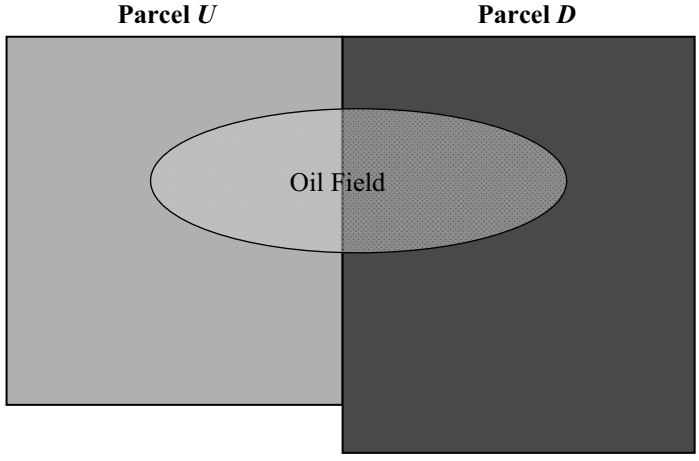
Suppose that Parcels *U* and *D* sat above an oil field containing one million total barrels of oil, as shown in Figure E. One could conceive of rules that allocate the rights to this oil on a pro rata basis based on the proportion of each landowner's surface estate situated directly above the oil field, to whichever party extracts the oil first, on an even fifty-fifty split, or a myriad of other ways. But, ultimately—assuming that the oil is properly extracted—society will likely benefit from the same one million barrels of additional oil supply regardless of which rule is chosen. Any of the allocation rules mentioned would be—at least roughly—Pareto efficient because a rule that increases the oil extracted by one landowner would generally cause an equivalent decrease in the oil extracted by others.[82]

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81. *See supra* text accompanying note 51. Some jurisdictions require "unitization" as a means of allocating landowners' rights in subsurface oil pools. Conflicts over Wind Rights typically involve only two parties, whereas numerous landowner parties are often involved in allocations of common-pool oil. Thus, unlike in the common-pool oil context, administrative and transaction costs associated with allocating wind rights through unitization would likely exceed any benefits from that approach. For an informative discussion of unitization of common oil pools, see generally Gary D. Libecap & James L. Smith, *The Economic Evolution of Petroleum Property Rights in the United States*, 31 J. LEGAL STUD. 589 (2002).

82. An allocation of a scarce resource is "Pareto efficient" if the only means of making one party to the allocation better off requires making another party worse off. *See* HARVEY S. ROSEN, PUBLIC FINANCE 40 (5th ed. 1999). Pareto efficiency, a concept routinely referenced in law and economics literature, takes its name from the famed nineteenth-century economist Vilfredo Pareto. *Id.* at 40 n.4. This conclusion naturally assumes that each landowner has the same wealth-utility function and that each is able to obtain the same price for oil in the marketplace.

FIGURE E



Pareto efficiency is much more difficult to achieve when allocating competing Wind Rights. Property's wind energy potential is highly location-specific, so the effects of rules that allocate Wind Rights affect not just distributional outcomes but also total output. It is possible that installing an upwind turbine fifty meters further to the north than planned might cause only a $100,000 long-term loss to Upwind Developer yet add $200,000 in long-run productivity to a downwind turbine. In such cases, installing the upwind turbine fifty meters to the north is required for Pareto efficiency. Unlike oil or even water,[83] wind is intangible and completely renewable. Efforts to capture the kinetic energy in wind today have no bearing on how much wind will be available for such uses tomorrow. From a Pareto efficiency perspective, disputes over competing Wind Rights thus more closely resemble a polluter-victim scenario than a dispute over oil rights.

As already discussed, public policy favors rules that maximize the productivity of scarce wind resources achievable from a given amount of

83. Analogies to water rights are also flawed. Water rights typically involve more than two parties because rivers typically pass through more than two properties, and the specific location where an upstream landowner diverts water typically has little or no impact on the productive use of remaining water by downwind landowners.

capital investment.[84] Arguably, the single most important factor in achieving such maximization is turbine siting. Once a turbine is installed, it will likely remain on its installation site for decades. Suboptimal turbine siting necessitates more reliance on fossil fuels, nuclear energy, or potentially more expensive renewable energy sources to meet collective energy demands. Rules that lead to suboptimal turbine siting fail to maximize the total electricity output from a fixed amount of wind resources and capital and thus impose excess social costs.

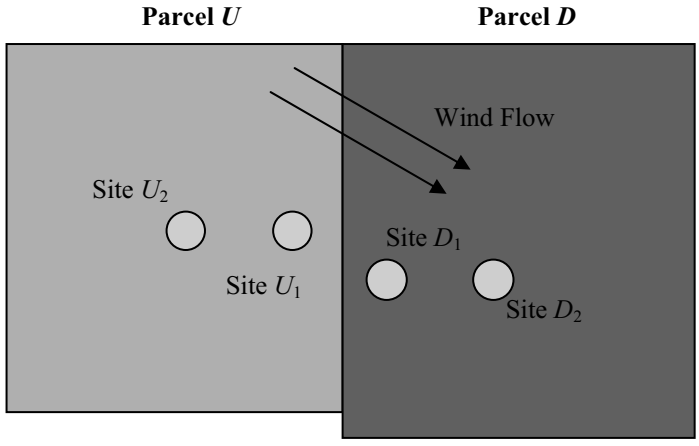
Optimal turbine siting requires successful bargaining between neighboring landowners, and Rule Three provides no "backstop" for situations where such bargaining fails. To illustrate, let us revisit our dispute between Downwind Developer and Upwind Developer.[85] Suppose that Upwind Developer conducts extensive wind studies, concludes that a turbine at Site U_1 (see Figure F) could generate a profit with a net present value of $300,000, and applies for a permit to construct a wind turbine at that site.[86] Suppose further that Downwind Developer has reason to believe that the same type of turbine, if installed on Site D_1, could generate a profit with a net present value of $400,000. However, wake effects from a turbine installed at Site U_1 would reduce Site D_1's net present value from $400,000 to $100,000, and the expected profit from a turbine installed at Site D_2 also would not exceed $100,000. If Upwind Developer were to install its turbine at Site U_2 instead of Site U_1, there would be no damaging wake effect at Site D_1 but the expected profit at Site U_2 would be only $200,000.

84. *See supra* text accompanying note 22.

85. *See supra* text accompanying notes 6–7.

86. Market value is used here as a proxy for the productive value of particular turbine sites. In practice, wind studies often assign expected "capacity factors" to various turbine sites based on the measured consistency and average speeds of wind in particular locations over time. *See* Am. Wind Energy Ass'n., Frequently Asked Questions: How Does a Wind Turbine's Energy Production Differ from Its Power Production?, http://www.awea.org/faq/basicen.html (last visited Dec. 26, 2008).

FIGURE F



In a world with no transaction costs, where bargaining is perfect, Downwind Developer and Upwind Developer would negotiate a Coasean bargain. Downwind Developer, after receiving notice of Upwind Developer's turbine permit application, would approach Upwind Developer about installing the Site U_1 turbine at Site U_2 instead, in return for a relocation payment. The parties would negotiate a payment in an amount between $100,000 and $300,000. Upwind Developer, being rational and seeking to maximize its income, would accept the offer and install its turbine at Site U_2. The policy goal of maximizing the productive value of the competing Wind Rights would be achieved.

Unfortunately, behavioral economists are quick to point out that Downwind Developer and Upwind Developer may not act rationally. Upwind Developer might behave strategically on the misperception that there is greater value in harming its competitor than in receiving the offered payment. Or, Downwind Developer might delay approaching Upwind Developer to discuss an efficient arrangement for fear of stirring up other conflicts between them. Self-serving bias could prevent the parties from recognizing the Pareto optimal arrangement.[87] Due to these

87. *See* Jolls, Sunstein & Thaler, *supra* note 38, at 1503–04 and accompanying text (citing a study of school district strikes in support of the argument that self-serving bias can prevent negotiated agreements).

or other factors, negotiations between the developers may fail, leaving Downwind Developer unable to build on the more productive Site D_1. Under Rule Three, Downwind Developer would have no way of forcing Upwind Developer to relocate to Site U_2 after failed bargaining. Thus, although Rule Three would be a substantial improvement from the present legal landscape for Wind Rights, the rule cannot be relied upon to produce consistently efficient outcomes.

2. Rule Four: Protecting Upwind Owners with a Liability Rule

With nowhere else to turn on our two-by-two Cathedral Model diagram of possible rules, we now consider Rule Four.[88] Like Rule Three, Rule Four would give competing Wind Rights to upwind owners. But the weaker liability rule protection provided under Rule Four would give downwind owners an opportunity to purchase an injunction or equivalent remedy from upwind owners prohibiting installation of any turbines capable of damaging wake effects that cross the property line. The price paid for the injunction would equal the upwind owner's judicially or legislatively determined cost of installing no turbines in the identified area.

In an influential article published in 1996, Louis Kaplow and Steven Shavell set forth an argument for why liability rules might be superior, on average, to property rules in situations where bargaining conditions are imperfect.[89] Their reasoning was simple: The Coase Theorem shows that either a liability rule or a property rule is successful in cases where the parties are able to successfully bargain. However, liability rules are superior in cases when bargaining is impossible because they permit a non-entitled party that values the entitlement more to pay compensation and obtain it. Therefore, liability rules are superior overall in cases where only some bargaining is expected to succeed.[90] When bargaining fails, liability rules force parties to reveal the true valuation of their entitlement and allow a higher-valued user to purchase the entitlement, thus promoting efficient outcomes that would otherwise never come to pass. The liability rule protection of Rule Four would have this desirable effect in the context of competing Wind Rights.

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88. As previously mentioned, other rules beyond the four in the Cathedral Model are possible. To review the earlier discussion of first-in-time and highest valued user rules, see *supra* text accompanying notes 67–73. Commentators have also proposed possible add-on rules to Calabresi and Melamed's conventional four-rule model, some of which are also addressed in this Article. *See infra* text accompanying notes 105–07.

89. *See generally* Kaplow & Shavell, *supra* note 37.

90. *See id.* at 724–28. Kaplow and Shavell ultimately acknowledge that risks of systematic judicial underestimations of harm or possible increased strategic behavior under liability rules qualify their argument in favor of such rules. *See id.* at 728–37. For a discussion of the undercompensation issue, see *infra* text accompanying notes 98–99.

To illustrate, let us assume the same set of facts as described in connection with Figure F above, except that this time Rule Four applies. If voluntary bargaining between Upwind Developer and Downwind Developer is successful, then—just as under Rule Three[91]—Downwind Developer will pay Upwind Developer a negotiated amount to relocate to Site U_2, and an efficient siting of turbines will result. If bargaining fails, Downwind Developer can ask a court—or some other pre-designated, government authorized decisionmaker—to estimate the total loss to Upwind Developer from installing the turbine at Site U_2—or another specified wake area—instead of at Site U_1. Downwind Developer will then have the option to pay Upwind Developer that amount in return for an injunction or equivalent remedy prohibiting installation of the turbine at Site U_1. If Upwind Developer's relocation cost is determined to be any amount less than $300,000, Downwind Developer will purchase the injunction and turbines will be constructed at Sites U_2 and D_1—the outcome that most efficiently allocates the competing Wind Rights.

Rule Four has long been the outlier of the Cathedral Model's four rules. The one familiar application of Rule Four to a private dispute, which is frequently referenced in law and economics literature, was in *Spur Industries, Inc. v. Del E. Webb Development Co.*, an Arizona Supreme Court case decided in 1972.[92] Spur Industries, the defendant, was a cattle feedlot operator that had operated its feedlot in the same location for several years.[93] Del Webb was a real estate developer that sued for nuisance after its sprawling residential development project crept increasingly closer to the feedlot over a period of years until the feedlot's odor began to negatively impact unit sales.[94] In this classic coming-to-the-nuisance case, the court seemed to view Spur Industries as the "innocent" party and recognized its entitlement to operate its feedlot.[95] However, the court may have also recognized that bargaining under a property rule would have failed because Del Webb's loss from the feedlot likely would not incorporate the losses of the several

91. For a general discussion of this scenario under Rule Three, see *supra* text accompanying notes 85–87.

92. *See* Spur Indus., Inc. v. Del E. Webb Dev. Co., 494 P.2d 700 (Ariz. 1972).

93. *Id.* at 704.

94. *Id.*

95. *Id.* at 708 ("Spur is required to move not because of any wrongdoing on the part of Spur . . . .").

residents who had already purchased homes nearby. Regardless, the court chose not to apply Rule Three and simply dismiss the nuisance suit. Instead, the court employed a liability rule, ordering Spur Industries to relocate its feedlot and requiring Del Webb to pay the cost of the relocation.[96] The rare set of facts in *Spur Industries*—that is, an innocent polluter and a guilty victim—seemed to influence the court's decision to, unknowingly, apply Rule Four.

If upwind landowners are viewed as innocent holders of competing Wind Rights, then the same elements that made Rule Four appropriate in *Spur Industries* are present in disputes over turbine wake interference. Just as voluntary bargaining between the *Spur Industries* parties would not have incorporated the external costs and benefits of nearby residents, bargaining between neighboring wind project developers does not incorporate the growing public policy interest in optimal wind turbine siting. In both contexts, there is arguably an increased need for liability rules to provide a second chance at the social welfare-maximizing outcome when voluntary bargaining fails.

3. Responding to Common Criticisms of Rule Four and Liability Rules

If Rule Four is an attractive option for resolving wind interference conflicts, why is the rule not more commonly applied to other situations? A perception exists that number problems, information costs, and endowment effects reduce the desirability of Rule Four. However, wind wake interference disputes differ from typical pollution or nuisance disputes in ways that seem to mitigate the likelihood or severity of these negative effects.

a. Number Problems

Several commentators have blamed the unpopularity of Rule Four on the fact that the typical "innocent polluter" case involves several victims, and strategic behavior problems—for example, free riding—would make it difficult for the numerous victims in such cases to collectively raise funds sufficient to pay off the polluter.[97] No such number problem exists in the wind wake interference context because such disputes almost always involve just two parties—an upwind and downwind landowner.

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96. *Id.*

97. *See* Krier & Schwab, *supra* note 30, at 468 (arguing that "rule four is paradoxical in that it reintroduces the very problem it is meant to solve" because most cases where it would arise involve several injured residents who will face strategic bargaining problems in pooling enough funds to pay the polluter to go away); *see also* A. Douglas Melamed, *A Public Law Perspective*, 106 YALE L.J. 2209, 2209 (1997) (stating that "the *Spur Industries* case, did not have a large number problem; maybe that is why it was able to find a use for Rule [Four]").

b. Information Costs

A general argument against liability rules is that courts or other third-party decisionmakers might fail to capture parties' subjective valuations and thereby underestimate damages, which can result in less efficient outcomes than under a property rule.[98] However, such undercompensation risk is diminished in cases where both parties have purely economic interests, as in the context of a wind wake interference dispute. Such risk is further diminished given that the "chooser" under Rule Four is the downwind owner, who would suffer the wake interference damages and is thus in the best position to weigh any potential loss against the cost of buying an injunction or easement from the party upwind.[99] Regardless, some commentators have argued that even if courts were to apply average estimates of harm from factually similar cases, the outcome would usually be superior to property rules.[100] Giving competing Wind Rights to upwind owners means that Rule Four will never require a highly technical judicial determination of a turbine wake's financial injury to downwind neighbors.[101] In all cases, the only possible judicial valuation would be for an easement or injunction against building a turbine in a certain area—a determination that in many cases could be aided by existing wind studies done on the upwind owner's property.

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98. *See* Kaplow & Shavell, *supra* note 37, at 730–31. Richard Epstein has argued that liability rules are appropriate only in cases where the risk of undercompensation—due to a judicial valuation that is erroneously too low and thus eliminates the possibility of ex-post bargaining—is less than the risk of a holdout problem among the "victim" parties. *See* Richard A. Epstein, *A Clear View of the Cathedral: The Dominance of Property Rules*, 106 YALE L.J. 2091, 2103–05 (1997). Epstein's approach would seem to favor Rule Three, but his approach arguably fails to sufficiently weigh potential behavioral impediments to bargaining, such as strategic behavior or asymmetric information problems. *See supra* text accompanying note 38.

99. Such "best chooser" analysis is commonly applied in law and economics literature. *See, e.g.*, Guido Calabresi & Jon T. Hirschoff, *Toward a Test for Strict Liability in Torts*, 81 YALE L.J. 1055, 1060 (1972) (favoring rules that place the liability on the party who is "in the best position to make the cost-benefit analysis between accident costs and accident avoidance costs and to act on that decision once it is made") (emphasis omitted).

100. Kaplow & Shavell, *supra* note 37, at 719.

101. As previously mentioned, wind wake interference studies are extremely technical. For a sample of such literature, see Jimenez et al., *supra* note 2 (applying a "large-eddy simulation model" to simulate the turbulent flow of air in the wake of a wind turbine).

c. Endowment Effects

A behavioral economics-based criticism of liability rules is that they might create greater "endowment effects" than property rules and thus impede efficient bargaining.[102] An endowment effect exists if a person's aversion to the loss of an item causes the person to demand a superficially high price for it when engaged in voluntary bargaining.[103] In cases where private landowners develop their own wind energy projects on long-held family property, endowment effects might be significant. But most commercial wind energy projects are built by developers who have leased or obtained other interests in the project property. Because such wind energy developers are likely to view wind as a saleable good, rather than as a personally held entitlement, risks associated with endowment effects are greatly diminished in such contexts.[104]

4. Levmore's Rule Five and Asymmetric Valuation Costs

Several other possible Cathedral Model "rules" have been proposed in recent years, one of which seems worthy to note in this context.[105] Under Saul Levmore's "Rule Five,"[106] Upwind Developer could choose to install its turbine at Site U_2 (see Figure F above) instead of Site U_1 on the condition that Downwind Developer make a royalty payment to Upwind Developer. The royalty amount would equal Downwind Developer's financial benefit derived from undisturbed wind flow at Site *D*.[107]

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102. *See* Lewinsohn-Zamir, *supra* note 77, at 250–58 ("We should expect a stronger [endowment effect] . . . and a greater reluctance to part voluntarily with an entitlement when a transfer can be forced upon an owner, as is the case with liability-rule protection.").

103. *See id.* at 250–51.

104. *See id.* at 252.

105. In fact, commentators proposed numerous additions to the classic two-by-two Cathedral Model. *See, e.g.*, Frank I. Michelman, *There Have to Be Four*, 64 MD. L. REV. 136, 155–56 (2005) (arguing that Rule Four actually encompasses three possible rules, meaning that there are six rules altogether).

106. *See* Saul Levmore, *Unifying Remedies: Property Rules, Liability Rules, and Startling Rules*, 106 YALE L.J. 2149, 2169–70 (1997). As Levmore acknowledges, his "Rule Five" is a variation of a Rule Five described by Krier and Schwab under which the best chooser is always given the ability to determine whether to continue its activity or to stop and receive the judicially-determined compensation. In the wind turbine interference context, the best chooser will almost always be the downwind owner. See *infra* text accompanying note 109, for a discussion of the "Double Reverse Twist" rule.

107. More specifically, the royalty amount would be calculated as Site *D*'s expected profit *without* any interference from upwind turbines minus Site *D*'s expected profit *with* such interference.

Although Levmore's Rule Five is intriguing, its tendency to impose higher information costs makes it less attractive than Rule Four. As already mentioned, estimating the actual financial loss to the owner of a downwind turbine from the wake effect of an upwind turbine is exceptionally complicated and would be very expensive.[108] To apply Levmore's Rule Five, a decisionmaker—for example, a court or county official—would be required to determine the turbine productivity loss from such wake effect when calculating the amount of the royalty payment. In contrast, a decisionmaker applying Rule Four would only need to calculate the cost of siting the upwind turbine in a different location—a calculation that is simpler and may often be further simplified by an upwind owner's existing wind study reports. Given that valuation costs are clearly asymmetric between losses to upwind and downwind owners, a liability rule is more likely to generate efficient outcomes if structured to require only the lower-cost (upwind owner) valuation.

But what about cases where Downwind Developer has already conducted wind studies on its property and Upwind Developer has not? In such cases, the court may have ample information about the potential loss to Downwind Developer if Downwind Developer is not able to install its turbine, but the court may have no information about the potential loss to Upwind Developer if Upwind Developer loses its competing Wind Rights. In such a scenario, one might advocate for a modified Levmore Rule Five approach, which would give Downwind Developer the right to acquire Upwind Developer's competing Wind Rights for a royalty fee based on Downwind Developer's expected profit.

Perhaps more intriguing is a hybrid of Rule Four and Levmore's Rule Five, similar to what Krier and Schwab called the "Double Reverse Twist"—a rule regime wherein Rule Four applies if Upwind Developer files its turbine site permit first, and the modified Rule Five applies if Downwind Developer files first—and is thus deemed the best chooser.[109] Unfortunately, a Double Reverse Twist Rule would have greater susceptibility to strategic behavior problems than a simple Rule Four. If Upwind Developer believed that a court or county hearing board would place a higher valuation on Downwind Developer's loss of Site *D* than on Upwind Developer's loss of Site *U*, Upwind Developer might delay

108. *See* Jimenez et al., *supra* note 2, for an example of the complexity of such estimations.

109. *See* Krier & Schwab, *supra* note 30, at 471–73.

filing its permit until Downwind Developer had done so—so that Levmore's Rule Five would apply. Conversely, Upwind Developer might more hastily file its permit in situations where it believed that Rule Four would be more favorable. Downwind Developer would have a corresponding set of perverse incentives under the Double Reverse Twist Rule. The parties' ability to manipulate which rule would apply might also reduce the likelihood of voluntary bargaining. For these reasons, using only Rule Four seems a more promising approach.

IV. APPLYING RULE FOUR: WAIVABLE WAKE SETBACKS UNDER THE SITE PERMITTING PROCESS

As a practical matter, how might a state or local government implement Rule Four to allocate Wind Rights? A law that authorizes governments to force upwind landowners to grant easements to their downwind neighbors for private wind energy development risks violating the Takings Clause of the Fifth Amendment.[110] One means of reducing constitutionality risks when implementing Rule Four would be to impose ex ante wake setback requirements that are waivable upon satisfaction of certain requirements in the turbine site permitting process.

Suppose that the county where Parcels *U* and *D* (in Figure F above) are situated were to amend its zoning ordinance to impose "waivable" downwind wake setback requirements on all properties zoned for commercial wind energy development.[111] The setbacks would prohibit installation of wind turbines in any area where there is a reasonable likelihood that turbine wake effects would extend onto downwind property.[112] When Upwind Developer[113] filed its permit application to

110. For a detailed discussion of constitutional issues associated with the use of eminent domain power for private economic development, see generally *Kelo v. City of New London*, 545 U.S. 469 (2005). Although the *Kelo* Court held that such takings under certain circumstances were constitutional, numerous state legislatures have enacted legislation reacting to *Kelo* that restricts such use of the power of eminent domain. The websites of some political organizations attempt to keep track of such legislation. *See, e.g.*, Castle Coalition, *Eminent Domain Legislation Status Since Kelo*, July 9, 2007, http://www.castlecoalition.org/pdf/legislation/US_States_ED_Legis_Map_2007.pdf.

111. As already mentioned, such setbacks, without the waiver feature described in this Article, have previously been enacted in some jurisdictions. *See supra* note 29 and accompanying text.

112. If a five-rotor-diameter rule were applied, the wake setback would apply to the cross-hatched areas depicted in Figure D above.

113. For simplicity, this illustration avoids drawing a distinction between Upwind Developer—who may hold only a leasehold interest in Parcel *U*—and the owner of Parcel *U*. In many cases, the notices described in this illustration may be delivered to fee owners instead of or in addition to delivery of notice to developers. Fee owners often must sign certain documentation or otherwise participate in the permitting process, and provisions in many wind energy leases require cooperation with developers in such matters.

install a turbine at Site U_1, assuming that Site U_1 is located within the waivable wake setback area, notice of the application would be delivered to Downwind Developer. The notice would give Downwind Developer thirty days to deliver a bond and processing fee and file a form with the county to request that the existing wake setback on Parcel *U* be made nonwaivable and permanent (a Permanent Wake Setback). If Downwind Developer failed to timely take these steps, the county would waive the existing wake setback restriction on Parcel *U*, and Upwind Developer would be free to install turbines at Site U_1 and any other site within the waived setback area—upon satisfaction of any other permit requirements.

A. Determining Upwind Developer's Economic Loss

If Downwind Developer did timely file the Permanent Wake Setback request form, Upwind Developer would be required, within a specified time period, to provide to the county an estimate of its economic loss if it were unable to install turbines within the wake setback area. Upwind Developer would need to produce documentation—for example, relevant portions of wind study reports for Parcel *U* and information about current market pricing for wholesale wind-generated power—supporting its estimate.[114] The county would review Upwind Developer's submitted materials and determine the amount of fair compensation Downwind Developer must pay to Upwind Developer to make the existing wake setback permanent (the Setback Price). The Setback Price would include estimated costs and attorney fees incurred by Upwind Developer in connection with Downwind Developer's request. To prevent delay tactics by downwind property owners, only upwind landowners would be able to appeal the county's decision.

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114. At least one commentator has noted the possibility of excessive investment by the entitled party in an application of Rule Four. *See* Lucian Arye Bebchuk, *Property Rights and Liability Rules: The Ex Ante View of the Cathedral*, 100 MICH. L. REV. 601, 624 (2001) (arguing that a rule similar to Rule Four creates an additional scenario in which an entitled party might capture value from its ex ante investment—that is, a buyout by the non-entitled party—and that this additional possibility of value leads to excessive investment). If Upwind Developer expected Downwind Developer to request a permanent wake setback, it might have an incentive to overinvest on the basis that it can include such investment when submitting its potential loss estimate to the county. To mitigate this risk, an ordinance seeking to enact Rule Four would need to provide clear guidelines on the types of expenses that are includable in an upwind owner's cost estimation.

Assuming that the county's determination of the Setback Price was accurate and that Downwind Developer was rational, Downwind Developer would pay such amount only if the wake-vulnerable areas on Parcel *D* had more wind energy production potential than the Parcel *U* areas subject to the waivable setback. If Downwind Developer elected to pay the Setback Price and no appeal ensued, a "Notice of Permanent Wake Setback" would be recorded against Parcel *U* and would thereby provide public notice that the wake setback on Parcel *U* was permanent and no longer subject to waiver. The amount of Downwind Developer's bond would be transferred to Upwind Developer and credited against Downwind Developer's amount due.

If Downwind Developer declined to pay the Setback Price, the wake setback on Parcel *U* would be permanently waived. A "Notice of Waiver of Upwind Wake Setback" would be recorded against Parcel *D* and would give constructive notice to the public that Parcel *U* was not subject to a wake setback. Such waiver would be subject to expiration by abandonment if no commercial wind turbine were operated within the former setback area for five consecutive years. The amount of Upwind Developer's reasonable costs or professional fees incurred throughout the application process would be paid out of Downwind Developer's bond (to prevent frivolous requests for Permanent Wake Setbacks), and any balance would be remitted to Downwind Developer. After the process, the parties would still be free to voluntarily negotiate and could still record a turbine wake easement against Parcel *U* in the event that they eventually agreed to an arrangement whereby Downwind Developer purchased the competing Wind Rights.

B. If Downwind Developer Is First to File a Permit Application

Thus far, we have assumed that Upwind Developer was the first to file its turbine site permit application. What would the rule be if Downwind Developer were to file its permit for one or more turbines on Parcel *D* before Upwind Developer filed its Site U_1 permit? In conjunction with its permit filing, Downwind Developer would have the option to post a bond, pay a processing fee, and request a Permanent Wake Setback for Parcel *U*—just as already described. Upwind Developer would then be notified of the application and asked to either provide wind study reports and market value documentation to support its own loss estimate, permit a mutually acceptable wind energy engineer to conduct wind studies on the relevant portions of Parcel *U*—at Downwind Developer's expense—and submit results directly to the county, or accept a dollar amount proposed by Downwind Developer.

After a deadline for submitting all documentation, the county would determine the Setback Price in the manner described above. As previously described, if Downwind Developer chose to pay the Wake Setback Price, a Notice of Permanent Wake Setback would be recorded against Parcel *U*. If Downwind Developer declined to pay, a Notice of Waiver of Upwind Wake Setback would be recorded against Parcel *D*. Regardless, Upwind Developer and Downwind Developer would be permitted to keep copies of the wind study reports prepared in connection with the easement application. And regardless of the outcome, Downwind Developer would pay Upwind Developer's costs and attorney fees in the same manner as previously described.

Again, Downwind Developer would be expected to file a request for a Permanent Wake Setback only upon a belief that the net present value of installing its turbines in wake-vulnerable areas of Parcel *D* exceeded the net present value of Upwind Developer's installation of turbines within the wake setback area. The parties would still be free to voluntarily negotiate around any outcome reached through the setback waiver process. The process likely would not be employed in most cases but would be available when one party's irrationality prevents the voluntary bargain needed for optimal turbine siting.

V. CONCLUSION

Rule Four of the Cathedral Model, despite being touted by its discoverers as a potentially useful legal rule, has long been ignored in practice. Surprisingly, Rule Four seems to fit the unique characteristics of disputes between neighboring landowners over the siting of commercial wind turbines. Conventional law supports protecting a landowner's entitlement to install turbines anywhere on its property, regardless of how turbine wake effects might diminish the wind energy generation value of downwind property. However, reliance on a property rule alone to protect the entitlement leaves such conflicts vulnerable to failed bargaining and suboptimal siting of wind turbines. Wind's location-specific and fully-renewable nature creates a strong public policy goal of promoting turbine siting that will maximize productive efficiency, and Rule Four seems to best promote this goal. Like most significant contributions to legal academia, the Cathedral Model has undergone its share of criticism. But new applications of the Model to emerging legal problems, including this Article written thirty-six years after the Model was introduced, reemphasize the Model's great value to the field of law and economics.