PROTECT LINCOLN COUNTY

From
COMMERCIAL WIND
FARMS

www.WE-CAREsd.org

PO Box 204
Canton, SD 57013
605-743-4246

When an activity raises threats of harm to the environment or human health, precautionary measures should be taken even if some cause and effect relationships are not fully established scientifically.


Parcel B
This land belongs to Farmer "B"
His house is here
The circle shows the 1250 foot no-build zone around Farmer 'A's wind turbine falls onto his neighbors land
Parcel C
1250' Building Setback
This land belongs to Farmer "C"
Since the turbine went up he can no longer build within this circle
This square parcel belongs to Farmer 'A'
The wind company put a 400 foot wind turbine here
1250'
500'
500'
Neighbors can't build within the 1250' of it.
23 Acres
Parcel A
He can no longer build anything within this circle
road
His house is here, 1250 from the turbine
road
Farmer 'D' house is here
This land belongs to Farmer 'D
But he cannot build within 1250 feet of his neighbor's turbine
This land belongs to Farmer 'E'
His house is here
He can no longer build within this circle
Parcel E
Parcel F

Florida's New Law to Protect Private Property Rights

by David L. Powell, Robert M. Rhodes, and Dan R. Stengle

On May 18 Governor Lawton Chiles signed into law landmark legislation[1] which creates a new cause of action to provide judicial relief for landowners who suffer a major restriction on the use of their land.

The law capped three years of contentious debate over proposed legislation and constitutional amendments to give landowners protection beyond the existing constitutional guarantee against private property being taken for public use without just compensation.[2] The new statute has stirred fears it will empty the public purse and roll back decades of work to protect the environment and manage growth, as well as concerns it will completely fail to protect landowners confronted by a steady accumulation of regulatory programs.

In reality, it will do neither. The new law grants important new rights and remedies to landowners while protecting existing environmental and growth management programs. The law protects landowners against some regulatory actions which do not rise to the level of a taking, but it is more limited in scope than the property rights legislation considered in Florida in recent years. Perhaps most importantly, it signals a change in the way government will do business with landowners. It is a balanced, measured response to a pressing and emotional issue.

The public policy argument over private property rights has been simmering for years, but it was only in 1993 that lawmakers considered the matter ripe for action. The legislature passed a bill to set up a Study Commission on Inverse Condemnation to review landowner remedies when government action restricts the use of land but does not amount to a taking.[3] Governor Chiles vetoed the bill because he said it was tilted too far toward private interests and instead set up the Governor's Property Rights Study Commission II.[4] It proposed new nonlitigation remedies for landowners,[5] but its recommendations were not acted on by the legislature in 1994. Instead, a citizen's initiative campaign proposed a private property rights amendment to the Florida Constitution, but it was removed from the ballot by the Florida Supreme Court.[6]

Thus, at the start of the 1995 Regular Session, lawmakers had several property rights measures before them. Believing these measures did not strike a reasonable balance, Governor Chiles decided to prepare his own proposal. He directed Secretary Linda Loomis Shelley of the Department of Community Affairs to convene an ad hoc working group to draft a consensus property rights measure. The working group was composed of representatives from local government, landowners, citizens groups, and other constituencies. It met through most of the 1995 Regular Session. With only one significant change by lawmakers,[7] the bill drafted

by this working group was enacted with only one dissenting vote.

New Judicial Remedy

The cause of action is created by the Bert J. Harris, Jr., Private Property Rights Protection Act,[8] named after the Highlands County legislator who has championed property rights legislation for years. The Harris Act seeks to provide compensation to a landowner when the actions of a governmental entity impose an "inordinate burden" on his or her real property. It is intended to apply to governmental actions that do not rise to the level of a taking under the Florida or U.S. constitutions.[9]

The new judicial remedy is intended to protect either a landowner's "existing use" or "a vested right to a specific use" of land from an action by a state, regional, or local government agency that would amount to an inordinate burden.[10] Therefore, in any potential claim it is critical to evaluate the landowner's property interest in light of the statutory requirements for relief.

Existing Use

An "existing use" means an actual, present use or activity on the land, notwithstanding periods of inactivity normally associated with or incidental to the activity.[11] A period of inactivity could include land lying fallow in association with the growing of crops.

An "existing use" also may mean:

> [S]uch reasonably foreseeable, nonspeculative land uses which are suitable for the subject real property and compatible with adjacent land uses and which have created an existing fair market value in the property greater than the fair market value of the actual, present use or activity on the real property.[12]

So long as the requested use is not speculative, is suitable for the property, is compatible with adjacent land uses, and can be justified by an appraisal, and the landowner meets the other requirements, the landowner should be protected by the Harris Act.[13] This alternative definition of "existing use" should benefit a landowner who applies for approval of a land use which is already enjoyed by his or her neighbors.

A "vested right to a specific use" must be determined by applying common law principles of equitable estoppel, constitutional principles of substantive due process, or state statutory principles.[14] These foundations for establishing vested rights are independent; for purposes of the Harris Act, rights may vest under any of the bases.

The Harris Act creates a new cause of action to provide compensation to a landowner when the actions of a governmental entity impose an "inordinate burden" on his or her real property

Equitable Estoppel. The estoppel doctrine is grounded in equity, and focuses on whether it would be inequitable to allow government to repudiate its prior conduct. Equitable estoppel will be applied to government regulation of a land use if a landowner, in good faith, on some act or omission of government, has made a substantial change in position or has incurred extensive obligations and expenses, so that it would be inequitable and unjust to destroy the acquired right.[15] Each of these criteria has received valuable judicial interpretation and application,[16] and the legislature relied solely on these cases in establishing an equitable estoppel basis for vesting.

Substantive Due Process. Rights also may vest for purposes of the Harris Act by applying constitutional principles of substantive due process. This standard enables the judiciary to craft a constitutionally based vesting test separate from takings theories or remedies, and distinct from equitable estoppel. This standard could focus on whether an owner has acquired a constitutionally protected property interest that should not be diminished or frustrated by governmental action.[17] In some instances, the protected interest could be established by applying and satisfying estoppel principles, but the new test should go further.

Statutory Vesting. The Harris Act protects rights vested by state statutes. A variety of statutes create such rights. Among them are provisions in the Local Government Comprehensive Planning and Land Development Regulation Act,[18] the Florida Environmental Land and Water Management Act,[19] the statute creating the surface water management regulatory program,[20] and the statute creating the coastal construction control line program.[21] Local government vesting provisions are not covered by the Harris Act unless they implement a particular state statute. For example, local government comprehensive plan policies and land development regulations that define a "final local development order" or establish when development "is continuing in good faith" should be covered by the new cause of action.[22] Plan policies or local regulations that codify equitable estoppel principles are not covered by the Harris Act's categorical protection of rights vested pursuant to state statute.

Harris Act Limitations

The seemingly broad sweep of the Harris Act is deceptive, because the new judicial remedy is subject to significant exceptions and limitations. The Harris Act does not apply to actions by the federal government, or by any governmental entity otherwise covered when exercising the powers of the United States or its agencies through a formal federal delegation.[23] The Harris Act does not apply to governmental actions which involve operating, maintaining, or expanding transportation facilities, and it does not affect existing law regarding eminent domain relating to transportation.[24] The Harris Act is not intended to affect the sovereign immunity of government.[25]

Finally, and most significantly, the Harris Act is strictly a forward-looking measure. It applies only to specific actions of a governmental entity based on a statute enacted after the final adjournment of the legislature on May 11, 1995, or a rule, regulation, or ordinance adopted after that date. Actions based on a statute enacted before that date, or a rule, regulation, or ordinance adopted before that date, or one formally noticed for adoption before that date, are exempt from the Harris Act.[26] This provision provides perhaps the most significant and—among landowners—controversial limitation regarding the availability of this

new remedy.

Showing an Inordinate Burden. To demonstrate that a governmental action constitutes an inordinate burden on an existing use or vested right to a specific use, the landowner must meet one of two statutory tests.

Under the first test, the effect of the action must satisfy three criteria. First, the action must have directly restricted or limited the use of real property to the extent that the landowner is unable to realize the reasonable, investment-backed expectation for the existing use of the real property or a vested right to a specific use of the real property. Second, the deprivation must be permanent. Third, the deprivation must be to the real property as a whole.[27]

The alternative test for demonstrating an inordinate burden is for the landowner to show that, by virtue of the regulatory action, he or she has been left with existing uses or vested rights that are unreasonable such that, he or she bears permanently a disproportionate share of a burden imposed for the good of the public which, in fairness, should be borne by the public.[28] This test appears to allow the court to take remedial action when governmental action has been unreasonable, or has overreached in limiting the uses on a landowner's property.

An inordinate burden does not include impacts to real property which result from governmental abatement, prohibition, prevention, or remediation of a public nuisance at common law, or to a noxious use of real property.[29] Temporary impacts to land do not constitute an inordinate burden,[30] so a valid, time-limited moratorium would not be actionable under the Harris Act. Finally, impacts to real property caused by governmental action that grant relief under the Harris Act would not be an inordinate burden;[31] this exclusion should encourage governmental entities to grant relief to a landowner without concern that doing so will result in a Harris Act claim by another landowner.

Bringing a Claim

A Harris Act claim must be presented to the governmental entity within one year after the new statute, rule, ordinance, or regulation is applied to the landowner's property in order for a subsequent cause of action to be brought in circuit court. If a landowner elects to invoke other administrative or judicial remedies prior to seeking relief under the Harris Act, the time for bringing the Harris Act claim is tolled until the conclusion of those other proceedings.[32]

At least 180 days prior to filing suit, the landowner must present a written claim to the head of the governmental entity which has taken the action at issue.[33] The claim must be accompanied by a bona fide appraisal that demonstrates the loss in fair market value to the property. If more than one governmental entity is involved in the governmental action—or if all relevant issues can only be resolved by involving more than one governmental entity, in the view of either the landowner or

a governmental entity to which a claim is presented—the landowner must present the claim to each governmental entity involved.

During the 180-day notice period, the governmental entity must make a written settlement offer to resolve the claim. A settlement offer may include an adjustment or variance of the governmental action; increases or modifications in the density or intensity of use of development areas; transfer of development rights; land swaps or exchanges; mitigation; location on the least sensitive portion of the property; conditions on the development or use permitted; a requirement that issues be addressed comprehensively; purchase of the property interest; issuance of a development order; or no changes to the governmental action which occasioned the claim.[34] This broad authority creates an opportunity for innovation in resolving disputes.

Also during the notice period, unless the landowner has accepted the settlement offer, the governmental entity must provide a written "ripeness decision" which identifies the allowable uses of the property. The ripeness decision is intended to permit the landowner to go directly to circuit court, rather than having to pursue other administrative remedies, if dissatisfied with the response of the governmental entity.[35]

The combined effect of the requirement that the governmental entity make a settlement offer and identify the uses to which a property may be put should be to change the way regulators deal with land use and environmental issues. The Harris Act is intended to shift the focus of government agencies and landowners alike from *whether* a proposed use is allowable to *what* uses are allowable. In this regard, regulators may seek options in a more cooperative way which both could accommodate a landowner's wishes while still achieving the public policy objectives of underlying statutes, rules, ordinances, or regulations applied to the landowner's real property.

When a governmental entity's settlement offer would constitute a modification, variance, or special exception to application of an ordinance, rule, or regulation, the Harris Act directs that the relief protect the public interest served by the ordinance, rule, or regulation at issue, and be appropriate to prevent the inordinate burden on the real property.[36] If a proposed settlement would contravene the application of a statute, a "friendly suit" in circuit court must be brought by the governmental entity and the landowner. The court is directed to ensure that the relief protects the public interest served by the statute, and is appropriate to prevent the governmental effort from inordinately burdening the real property.[37]

If the governmental entity does not prevail in the appeal, the court is directed to award the landowner attorneys' fees and costs incurred in the appeal

Prospect for Sanctions

The importance of the 180-day notice is enhanced by the prospect for sanctions to be imposed in a subsequent civil action. Attorneys' fees are recoverable from the governmental entity if the landowner prevails and the court finds that the governmental entity did not make a bona fide offer which would have resolved the claim during the notice period.[38] On the other hand, the governmental entity may recover attorneys' fees from the landowner if the court finds the landowner did not accept a bona fide offer which would have resolved the claim.[39] These provisions place even more importance than usual on a dispassionate analysis of claims for both landowning and governmental clients.

If the governmental entity does not make a bona fide offer to settle the issue, or if the landowner rejects the settlement offer and ripeness decision, the landowner may file a claim in circuit court. The landowner must serve the complaint on each governmental entity making a settlement offer and ripeness decision. Venue for this bifurcated proceeding is the county where the real property is located.[40] The court will decide if the landowner is entitled to compensation,[41] and, if so, a jury will decide the amount.[42]

The court first must determine whether there has been an existing use or a vested right to a specific use of the real property. Thereafter, the court must determine whether an existing use or vested right has been inordinately burdened by the governmental action.[43]

In determining an inordinate burden, the court must consider the standards set forth in the Harris Act as well as the governmental entity's settlement offer and ripeness decision.[44] Thus, the determination by the court in effect is whether the last, best offer, if accepted, would constitute an inordinate burden. If the actions of more than one governmental entity are at issue, the court must apportion responsibility among them.[45]

Interlocutory Appeal

Before the issue is submitted to the jury for an award of compensation, a governmental entity may take an interlocutory appeal of the court's determination that there has been an inordinate burden. The court may stay the proceedings during the pendency of the appeal, but a stay is not automatic. If the governmental entity does not prevail in the appeal, the court is directed to award the landowner attorneys' fees and costs incurred in the appeal.[46]

If the court determines the governmental action has inordinately burdened the landowner's property, the court must impanel a jury for the second phase of the proceeding. The jury must determine the difference in the fair market value of the unburdened land and the fair market value of the property as inordinately burdened. Because the Harris Act requires the award of compensation to take into account the settlement offer and ripeness decision,[47] the award is not calculated by an assessment of the governmental entity's original action, but by its last, best offer. Consideration may not be given to business damages, but the Harris Act requires a reasonable award of prejudgment interest from the date the claim was presented.[48]

By operation of law, the payment of compensation vests in the governmental entity the right, title, and interest in rights of use for which com-

pensation has been paid. The governmental entity may hold, sell, or otherwise dispose of these development rights. When the court has awarded compensation, it will determine the form and recipient of the rights and the terms of their acquisition.[49] The court also is given broad powers to make final determinations to effectuate the relief available under the Harris Act.[50]

In light of the unique purposes and intent of the Harris Act, a court should not necessarily construe it under the case law regarding takings claims under the U.S. and Florida constitutions if the governmental action does not rise to the level of a taking.[51]

The Harris Act creates a new civil action remedy for landowners that will bear a striking resemblance to existing remedies under takings law. Each case will be an ad hoc, fact-intensive inquiry to determine whether a particular action of government intrudes too far into the landowner's domain.

Conclusion

The 1995 property rights legislation was intended to adjust the balance between the private sector and government in the continuing friction between regulators and landowners over the use of land in Florida. It reflects both the popular mood and a shift in legislative sentiment in recent years.

This remedy is not a radical departure from prior law. The Harris Act builds upon common law principles, constitutional decisions, and the tradition of finding an accommodation between public and private interests. It represents an attempt to provide new and measured relief for landowners without undermining Florida's landmark environmental protection and growth management laws. ❐

[1] Fla. Laws Ch. 95-181.
[2] U.S. CONST. amend V; FLA. CONST. art. X, §6.
[3] Fla. SB 1000 (1993).
[4] Fla. Exec. Order 93-150 (June 4, 1993).
[5] Report of the Governor's Property Rights Study Commission II (Feb. 28, 1994).
[6] *Advisory Opinion to the Attorney General re Property Rights*, 644 So. 2d 486 (Fla. 1994).
[7] Fla. H.R. Jour. 1050 (Reg. Sess. May 5, 1995).
[8] Fla. Laws Ch. 95-181, §1.
[9] Fla. Laws Ch. 95-181, §1(9).
[10] Fla. Laws Ch. 95-181, §1(3).
[11] Fla. Laws Ch. 95-181, §1(3)(b).
[12] *Id.*
[13] This approach to defining an existing land use is well grounded in the law of eminent domain relating to valuation. *E.g.*, *Yoder v. Sarasota County*, 81 So. 2d 219 (Fla. 1955); *Board of Commissioners of State Institutions v. Tallahassee Bank & Trust Co.*, 100 So. 2d 67, *cert. denied*, 101 So. 2d 817 (Fla. 1958). *See also* Florida Eminent Domain Practice and Procedure §§9.32-.33 (4th ed. Fla. Bar CLE 1988). A landowner probably would have a cause of action anyway founded on reverse spot zoning, denial of equal protection, or perhaps substantive due process, based on the argument that denying the requested use would be arbitrary and capricious.
[14] Fla. Laws Ch. 95-181, §1(3)(a).
[15] *City of Hollywood v. Hollywood Beach Hotel Co.*, 283 So. 2d 867 (Fla. 4th D.C.A. 1973), *rev'd in part*, 329 So. 2d 10 (Fla. 1976).
[16] Rhodes & Sellers, *Vested Rights: Establishing Predictability in a Changing Regulatory System*, 20 STET. L. REV. 475, 476 (1991).
[17] *Resolution Trust Corp. v. Town of Highland Beach*, 18 F.3d 1536, 1544 (11th Cir.

1994).

[18] FLA. STAT. §163.3167(8).

[19] FLA. STAT. §380.05(18) (areas of critical state concern); FLA. STAT. §380.06(20) (1994 Supp.) (developments of regional impact).

[20] FLA. STAT. §373.414(11)-(16) (1993).

[21] FLA. STAT. §161.052 (1993).

[22] *See* FLA. STAT. §163.3167(8) (1993).

[23] Fla. Laws Ch. 95-181, §1(13)(c).

[24] Fla. Laws Ch. 95-181, §1(10).

[25] Fla. Laws Ch. 95-181, §1(13).

[26] Fla. Laws Ch. 95-181, §1(12). An action based on a subsequent amendment may be a basis for a Harris Act claim "only to the extent that the application of the amendatory language imposes an inordinate burden apart from" the grandfathered statute, rule, ordinance, or regulation. *Id.*

[27] Fla. Laws Ch. 95-181, §1(3)(e).

[28] *Id.*

[29] *Id.*

The Harris Act builds upon common law principles, constitutional decisions, and the tradition of finding an accommodation between public and private interests

[30] *Id.*

[31] *Id.*

[32] Fla. Laws Ch. 95-181, §1(11).

[33] Fla. Laws Ch. 95-181, §1(4)(a).

[34] Fla. Laws Ch. 95-181, §1(4)(c).

[35] Fla. Laws Ch. 95-181, §1(5)(a).

[36] Fla. Laws Ch. 95-181, §1(4)(d)1.

[37] Fla. Laws Ch. 95-181, §1(4)(d)2.

[38] Fla. Laws Ch. 95-181, §1(6)(c)1.

[39] Any proposed settlement offer or proposed ripeness decision, and any negotiations or rejections with respect to the formulation of the settlement offer and ripeness decision, are admissible in the proceeding only for the purpose of determining costs and attorneys' fees. Fla. Laws Ch. 95-181, §1(6)(c)3. The determination of costs and attorneys' fees must be made by the court. Fla. Laws Ch. 95-181, §1(6)(c)1.

[40] Fla. Laws Ch. 95-181, §1(5)(b).

[41] Fla. Laws Ch. 95-181, §1(6)(a).

[42] Fla. Laws Ch. 95-181, §1(6)(b).

[43] Fla. Laws Ch. 95-181, §1(6)(a).

[44] Fla. Laws Ch. 95-181, §1(6)(a). In determining whether there has been an inordinate burden, the final settlement offer and ripeness decision are admissible; proposed settlement offers and ripeness decisions, and negotiations are inadmissible for these purposes. Fla. Laws Ch. 95-181, §1(6)(c)3.

[45] Fla. Laws Ch. 95-181, §1(6)(a).

[46] *Id.*

[47] Fla. Laws Ch. 95-181, §1(6)(b).

[48] Fla. Laws Ch. 95-181, §1(6)(b).

[49] Fla. Laws Ch. 95-181, §1(7)(b).

[50] Fla. Laws Ch. 95-181, §1(7)(a).

[51] Fla. Laws Ch. 95-181, §1(9).

Journal Article Writing Contest

The Florida Bar Journal *gives cash awards annually from an endowment set up in memory of Barbara Sanders by attorney Barrett Sanders, former chair of The Florida Bar* Journal *Editorial Board.*

A first place award is presented each June, and second and third place awards are given at the discretion of the judges. Judges select winners from those lead articles published between May and April.

The Florida Bar Journal *Editorial Board screens the articles and selects finalists for submission to a panel of judges. Winners will be announced in The Florida Bar* News *in June.*

Judges select winners according to writing quality, substantive quality, style, and degree of difficulty.

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This article is submitted on behalf of the Environmental and Land Use Law Section, Mary F. Smallwood, chair, Sid F. Ansbacher, editor, and Bob Fingar, special editor.

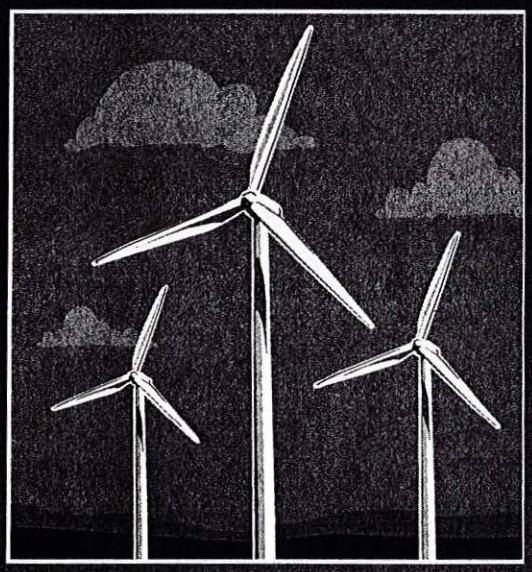
■

A Small Sample of North American Windfarm Proximity Property Value Impact Study Results

Source Information	Reference Date	Value Decline
Landsink Rowe Study 2 Clear Creek	2011	- 23-55%
Landsink Rowe Study Melancthon	2009	- 23-59%
LBNL Wind Zone (3-10 mile range)*	2013	- 32-50%
Upstate NY Heintzelman/Clarkson	2011	- 45+%
East County CA-McCann	2012	- 40%
Lee & DeKalb County Wind Zones- McCann	2012	- 23-33%
Wisconsin-Kielisch Appraisers	2009	- 30-40%
Falmouth MA Wind Zone- McCann	2012	- 27-37%
Barnstable MA Wind Zone	2012	- 24-32%
VanWert County OH Wind Zone-McCann	2012	- 22-26%
Gardner TX Wind Zone	2009	- 25%
Landsink Rowe Study	2012	- 23%
Lincoln Twnshp Wisconsin	2002	- 28%

*Laurence Berkeley Natl Labs(LBNL)

Note: The study cited by wind farm developers (LBNL 2009 by Ben Hoen)
Has been rejected by multiple peer boards and cannot be accepted as accurate or reliable. reviews. Its conclusions cannot be supported by empiricaldata analysis, the published report excluded resale data that showed 36-80% value losses, and Hoen employed analytical methods proven inappropriate .



Wind Turbines & Property Value

A presentation by
Kurt C. Kielisch, ASA, IFAS, SR/WA, R/W-AC
President/Sr. Appraiser – Appraisal Group One

Focus on Value

- PERCEPTION = VALUE
  - The key to understanding real estate value is to understand it is based on perception.
  - Perception drives the buying decision.
    - E.g. perceived enjoyment of home.
    - E.g. perceived income stream of investment.
  - Perception need not be based on a proven, scientific fact. (e.g. the haunted house or electric power lines)
  - When the buyer acts on this perception through a buying action you have established value and the effects of this perception.

Measuring Perception

- To measure the impact of this perception we did two things:
  - Conducted a Realtor Survey of Realtors who worked in a wind turbine area.
  - Conducted an Impact Study using sales of properties impacted by wind turbines compared to those that were not.

Realtor Survey

Purpose: learn from those in the trenches of buying and selling.

Focus: residential land use, both vacant and improved.

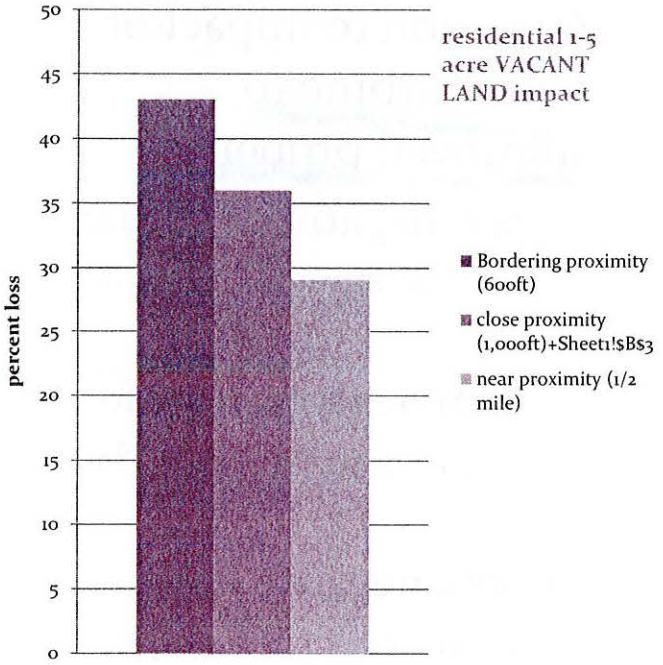
Visual field proximity: 3 different levels...

- 600ft from turbine (border)
- 1,000ft (close)
- ½ mile (2,640ft) (near)

- Survey utilized graphics and pictures to standardize the concept being portrayed.
- Survey used Realtors that were in a wind turbine area.
  - Fond du Lac County
  - Northeast Dodge County
- Surveys were given in person, on-site, verified with date, person's name and contact.

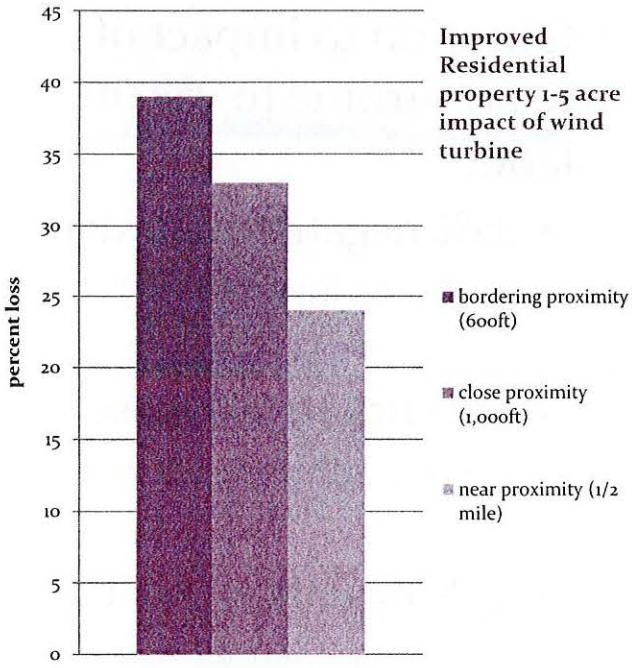
Realtor Survey results . . .

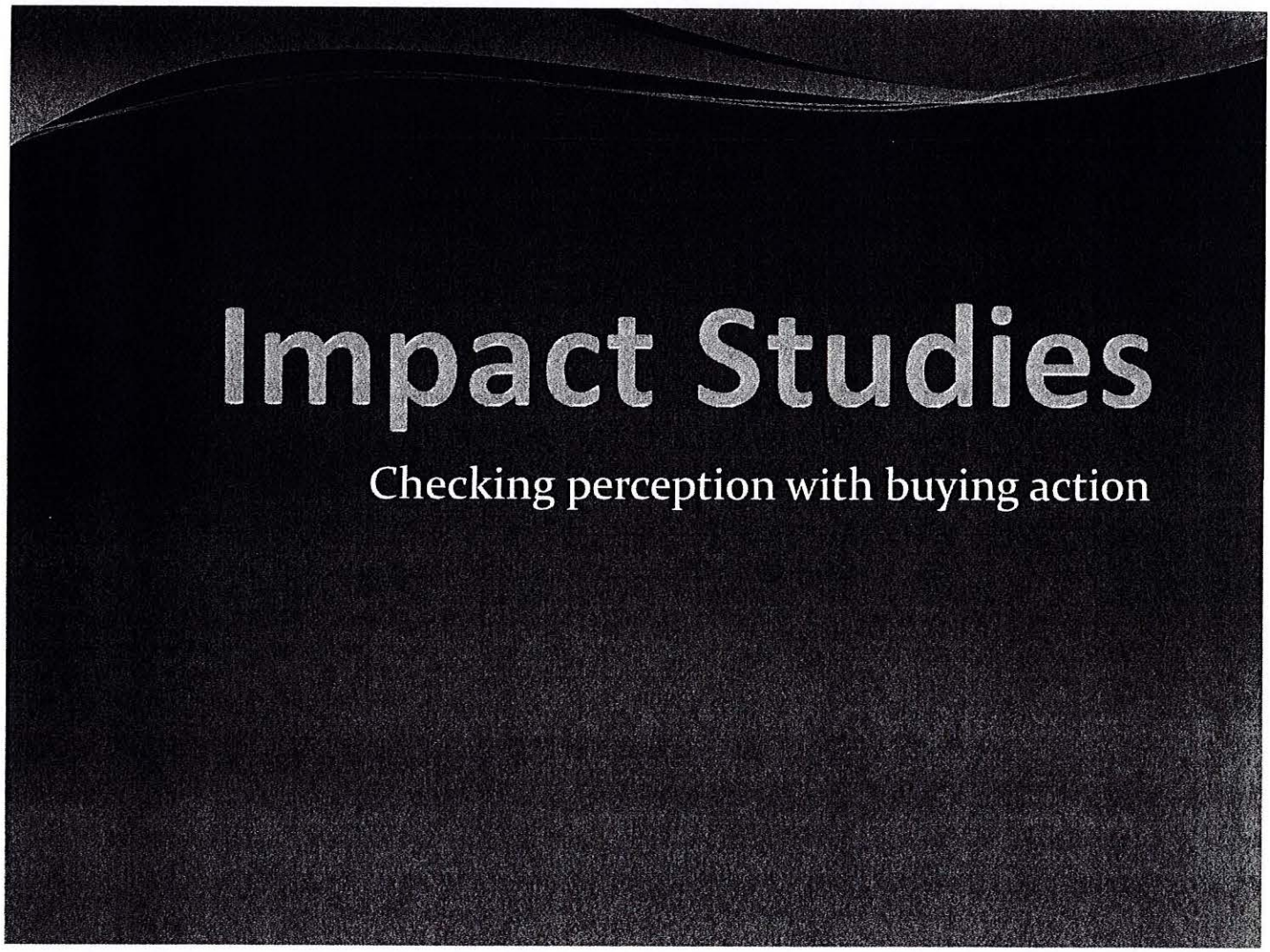
- Question to impact of wind turbine to vacant land:
  - 82% negative if border
    - Loss estimated at -43%
  - 69% negative if close
    - Loss estimated at -36%
  - 59% negative if near
    - Loss estimate at -29%



Realtor Survey results . . .

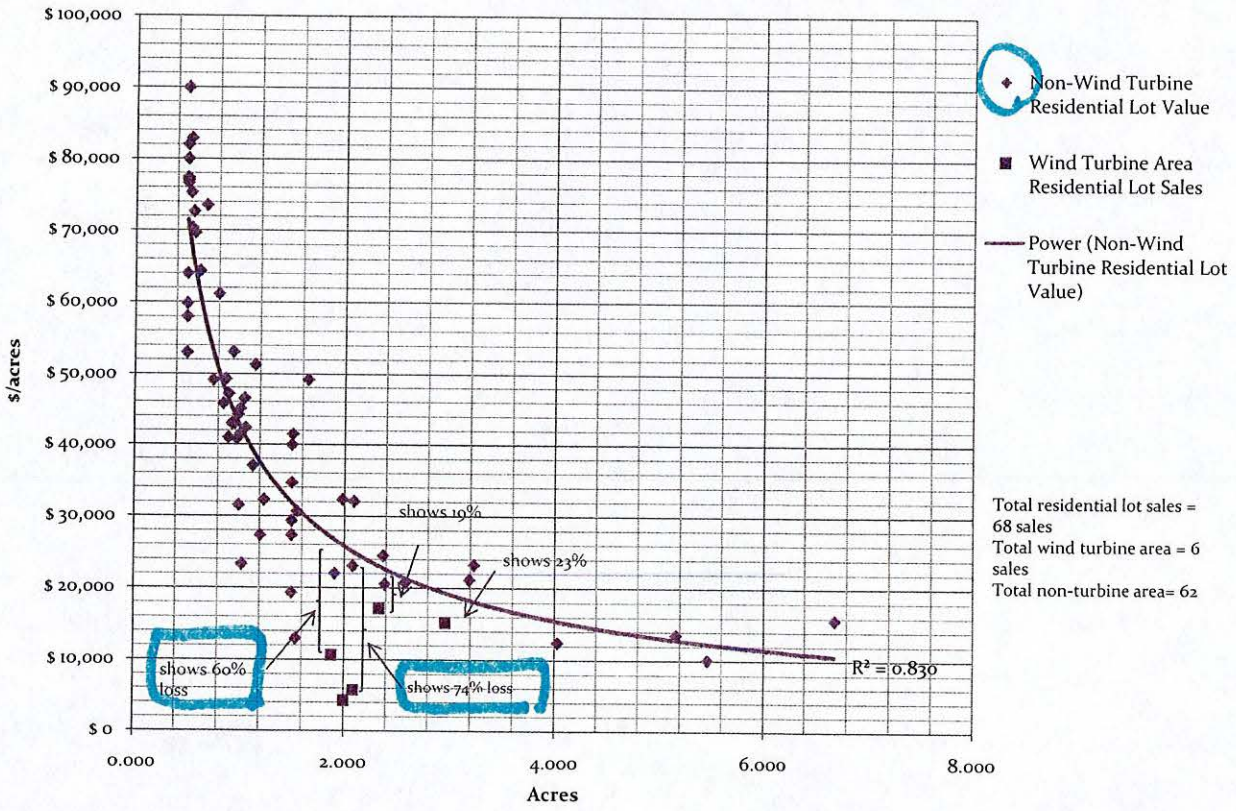
- Question to impact of wind turbine to improved property:
  - 91% negative if border
    - Loss estimated at -39%
  - 86% negative if close
    - Loss estimated at -33%
  - 60% negative if near
    - Loss estimate at -24%




Impact Studies
Checking perception with buying action

WE ENERGIES - BLUE SKY GREEN FIELD WIND FARM

1 acre to 8 acre residential land sales -- all sales included



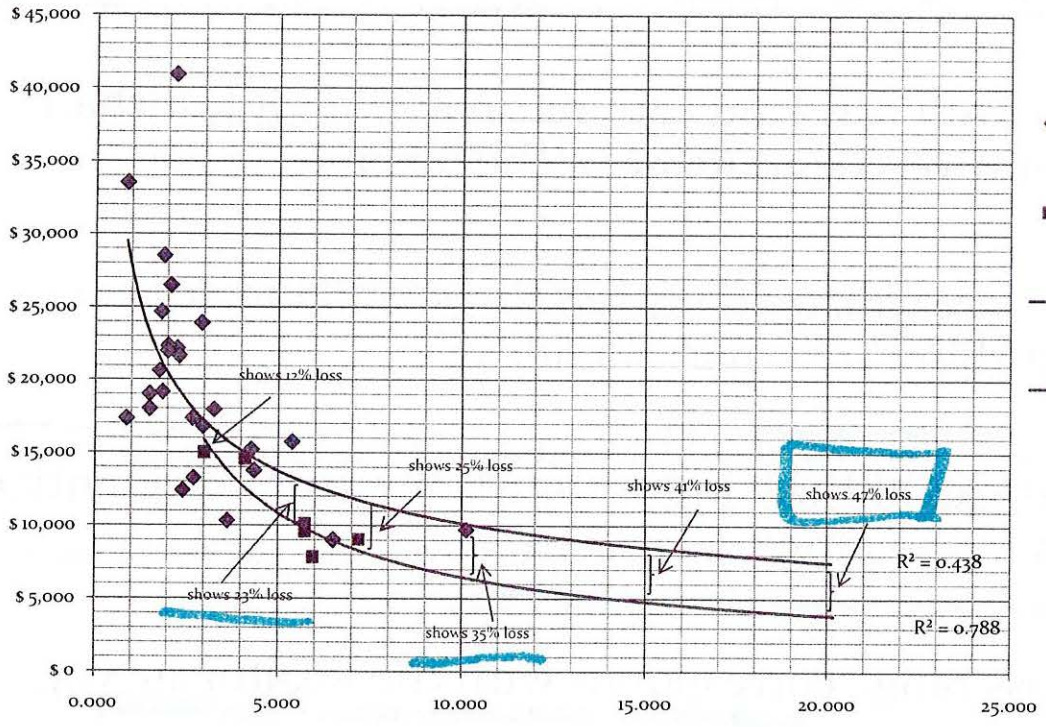
Total residential lot sales = 68 sales
Total wind turbine area = 6 sales
Total non-turbine area= 62

Blue Sky Green Field results . . .

- Sales within the wind turbine area sold for less than comparative sales outside of the turbine area.
- There were substantially less sales available within the wind turbine area than outside of it.
- The impact of the wind turbines on vacant residential land is in the range of -19% to -40%.
- This loss range corresponds with the Realtor survey.

INVENERGY - FORWARD WIND FARM

1 acre to 20 acre residential lot sales -- low sales removed



- Non-Wind Turbine Residental Lot Value
- Wind Turbine Area Residential Lot Sales
- Power (Non-Wind Turbine Residental Lot Value)
- Power (Wind Turbine Area Residential Lot Sales)

Total residential land sales= 34
Sales in wind turbine area = 6
Sales out of turbine area= 28

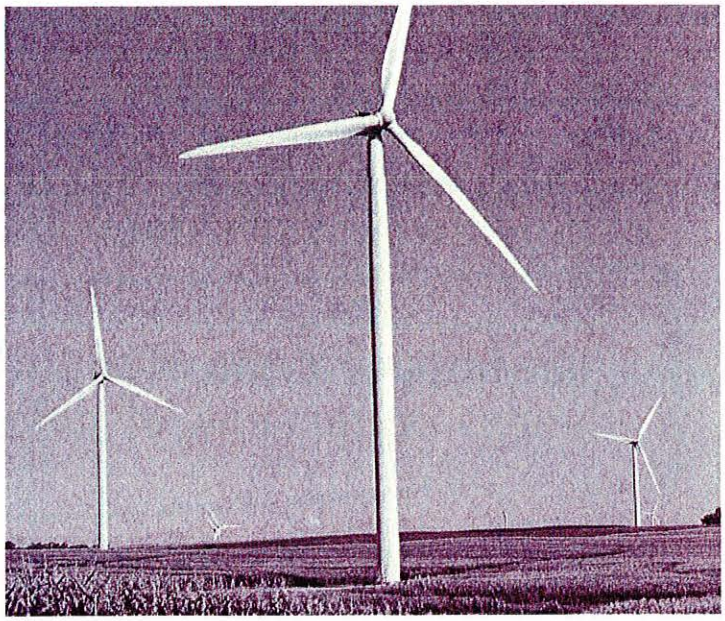
All low sales were removed which included 3 in turbine area and 2 outside of area.

Forward Wind Farm results . . .

- Sales within the wind turbine area sold for less than comparative sales outside of the turbine area.
- There were substantially less sales available within the wind turbine area than outside of it.
- The impact of the wind turbines on vacant residential land is in the range of -12% to -30%.
- This loss range corresponds with the Realtor survey.

Conclusion of Perception of Wind Turbines Impact to Property Value

1. Media has reported on negative health issues and value issues influencing a negative perception.
2. Realtor survey indicated that these perceptions are real in the market.
3. Impact studies suggest the values are substantially negatively impacted in the range of -12% to -40%.
4. The further away, the less the impact.



JUWI Wind
Prairie Breeze Wind Farm, LLC
Tipton County, Indiana

PROPERTY VALUE IMPACT & ZONING COMPLIANCE EVALUATION

McCann Appraisal, LLC
March 20, 2013

JUWI Project Summary

- 16,000 acres leased for "footprint"
- Up to 94 turbines & 150 MW (63 to 94)
- 1.6 to 2.4 MW each nameplate capacity
- 427 to 492 feet to tip of blade
- Setbacks of 1,250 feet

✓If minimum Ordinance setback is allowed, the most proximate residential properties will experience a range of value impact from (25%) to (40%) at those minimum and typically proposed setback ranges.

TIPTON COUNTY ZONING ORDINANCE

- **Section 808: Conditional Use**

C. The use and value of the area adjacent to the property included in the Variance will not be affected in a substantially adverse manner.

2015 McCANN STUDY
LIVINGSTON COUNTY

Livingston County ZBA Special Use Application
Invenergy Pleasant Ridge Wind Project
Livingston County, Illinois

POST CONSTRUCTION IMPACT

POST CONSTRUCTION IMPACT													
Market Study Statistics										Valuation Indications			
Sale No.	Control # Pairs	T-Sale $/SF	C-Sales Avg $/SF	Difference $ Amt	Difference % (%)	T-Sale MT	C-Sale Avg. MT	Difference MT #	Difference MT %	Adj. FMV T-Sale	T-Sale Price $	Impact $ Amt	Impact FMV %
T-3	5	$55.22	$87.43	$32.21	-37%	44	207	-163	-79%	$164,697	$110,000	$54,697	-33.21%
T-5	2	$81.22	$101.07	$19.85	-20%	155	165	-10	-6%	$207,844	$160,000	$47,844	-23.02%
T-6	4	$53.70	$107.98	$54.28	-50%	49	116	-67	-58%	$173,443	$87,000	$86,443	-49.84%
T-7	4	$99.24	$124.79	$25.55	-20%	17	100	-83	-83%	$205,440	$144,500	$60,940	-29.66%
T-8	3	$81.71	$92.23	$10.52	-11%	188	178	10	6%	$165,101	$159,000	$6,101	-3.70%
T-9	1	$125.74	$142.73	$16.99	-12%	215	138	77	56%	$211,242	$170,000	$41,242	-19.52%
T-10	2	$80.65	$93.31	$12.66	-14%	207	169	39	23%	$273,013	$220,000	$53,013	-19.42%
T-11	1	$102.07	$109.28	$7.21	-7%	225	98	127	130%	$276,392	$207,000	$69,392	-25.11%
T-12	2	$52.08	$98.20	$46.12	-47%	66	65	1	2%	$264,911	$165,000	$99,911	-37.71%
T-13	3	$74.04	$72.52	-$1.52	2%	153	183	-30	-16%	$209,518	$170,000	$39,518	-18.86%
T-14	5	$50.21	$72.16	$21.95	-30%	161	240	-79	-33%	$162,014	$117,500	$44,514	-27.48%
T-15	2	$105.94	$110.67	$4.73	-4%	139	53	86	162%	$143,910	$116,000	$27,910	-19.39%
T-16	3	$35.71	$120.67	$84.96	-70%	295	243	52	21%	$113,082	$48,000	$65,082	-57.55%
T-17	1	$105.55	$157.09	$51.54	-33%	285	55	230	418%	$207,437	$172,250	$35,187	-16.96%
Total	38												
Mean		$78.79	$106.44	$27.65	-25%	157	143	14	10%				-27.25%

FORECLOSURE & SHORT SALE TRENDS

Control				Target			
Year	# Sales	# Fcl/SS	% F/S	Year	# Sales	# Fcl/SS	% F/S
2009	32	2	6.25%	2009	3	1	33.33%
2010	32	4	12.50%	2010	4	1	25.00%
2011	20	1	5.00%	2011	4	1	25.00%
2012	24	2	8.33%	2012	8	4	50.00%
2013	27	5	18.52%	2013	8	1	12.50%
2014	16	2	12.50%	2014	3	1	33.33%
Totals	**151**	**16**	**10.60%**	**Totals**	**30**	**9**	**30.00%**

Target - Residential sales within 3 miles of any turbine(s), > 1 acre
Control - Rural residential, > 3miles from turbines or landfill, > 1 acre,

McCann 2012 Study
Lee & DeKalb Counties

- Detailed Paired Sales analysis
- Target & Control sale data selected on basis of sales near turbines (Target) being paired with comparable sales (Control) at much greater distances
- Target sales average distance = 2,618 feet
- Control sales average distance = 10.1 miles

2009 Study Summary
Lee County, Illinois

Avg Sale Price > 2 miles = $104.72 SF

Avg Sale Price < 2 miles = $ 78.84 SF

Difference in Sale Price = $ 25.89 SF

Average Value Diminution

within 2 miles of turbines ***25%***

Paired Sale Analysis Summary

Lee County Study Area

	Target Area				Control Area				
Pair #	T#	Distance Feet	CDOM	SP/LP %	C#	Distance Miles	CDOM	SP/LP %	Impact %
1	1-T	7,860	535	71.4	1-C	10.0	55	100.0	(27.0)
2	1-T	7,860	535	71.4	2-C	16.0	167	87.2	(30.3)
3	2-T	1,469	1,041	70.0	3-C	11.7	544	90.0	(11.9)
4	2-T	1,469	1,041	70.0	4-C	16.3	176	101.0	(24.0)
5	3-T	3,660	339	71.0	3-C	11.7	544	90.0	(15.5)
6	3-T	3,660	339	71.0	4-C	16.3	176	101.0	(25.6)
7	4-T	315	625	82.0	5-C	4.0	241	82.0	(22.5)
8	4-T	315	625	82.0	6-C	4.8	601	94.0	(23.1)
Lee Averages		**3,326**	**635 1.74 yrs**	**73.6**		**10.5**	**297**	**92.4**	**(22.5)**

DeKalb County Study Area

1	1-T	1,000	712	51.0	1-C	10.3	138	90.0	(46.9)
2	1-T	1,000	712	51.0	2-C	5.0	1	95.0	(41.6)
3	1-T	1,000	712	51.0	3-C	11.7	409	90.0	(43.8)
4	2-T	2,139	815	75.0	4-C	11.4	379	81.0	(15.9)
5	3-T	1,880	386	74.0	4-C	11.4	379	81.0	(15.6)
DeKalb Averages		**1,637**	**638 1.75 yrs**	**66.7**		**9.6**	**232**	**89.0**	**(32.8)**
Lee & DeKalb combined		**2,618**	**636**	**70.6**		**10.1**	**271**	**91.0**	**(26.4)**

Van Wert County, Ohio
2012 Residential Sale Summary

Township	# Sales	# Sales via Foreclosure	% via Foreclosure	Avg. Price*	Avg. $/Sq Ft*	Setting
York & Liberty	11	1	9%	$78,980	$41.08	>6 miles away
Union & Hoaglin	15	7	47%	$58,417	$31.97	Turbine Footprint
Difference	+ 4	+ 6	+38%	($20,563)	($9.11)	
% Difference				(26%)	(22%)	

LANSINK RESALE STUDY SUMMARY

Conclusion: Clear Creek, known as Frogmore-Cultus-Clear Creek, about 18 Wind Turbines		
1	1480 Lakeshore Road, Norfolk	-44.17%
2	71 Norfolk County Road 23, Norfolk	-55.18%
3	47 Concession Road A, Norfolk	-22.47%
4	43 Old Mill Road, Norfolk	-32.96%
5	1575 Lakeshore Road, Norfolk	-27.67%
6	1527 Lakeshore Road, Norfolk	-28.88%
7	1921 Lakeshore Road, Norfolk	-38.48%
	Median	**-32.96%**
	Average	**-35.69%**
	Low	**-22.47%**
	High	**-55.18%**

Conclusion: Melancthon, 133 Wind Turbines		
1	375557 6th Line, Amaranth	-48.27%
2	97121 4th Line, Melancthon	-58.56%
3	504059 Highway 89, Melancthon	-23.24%
4	582340 County Road 17, Melancthon	-26.66%
5	582328 County Road 17, Melancthon	-37.30%
	Median	**-37.30%**
	Average	**-38.81%**
	Low	**-23.24%**
	High	**-58.56%**

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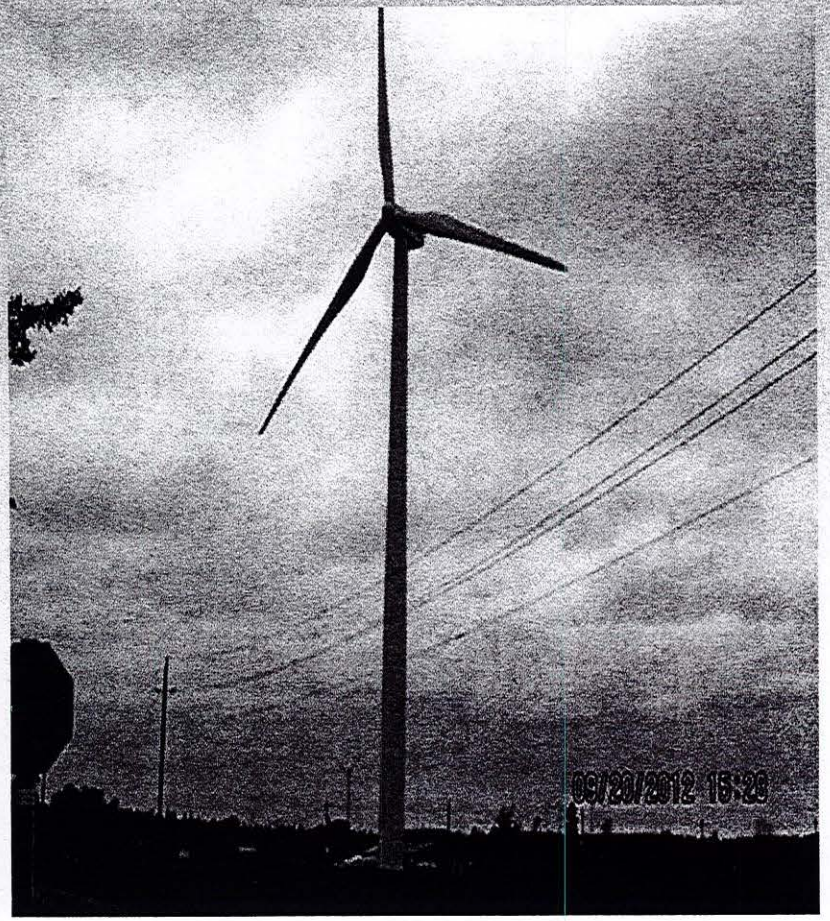
Ben Lansink Resale Study - 2012

Sale and Resale, Property: 504059 Highway 89, Melancthon		
The average Orangeville & District Real Estate Board Residential MLS® price January 2007 was $254,803 and August 2009 when 504059 Highway 89, Melancthon resold the average price was $302,550 resulting in a Change of 18.74%.	Average Price January 2007	$254,803
	Average Price August 2009	$302,550
	$Change	$47,747
	%Change	18.74%
The property, 504059 Highway 89, Melancthon, was purchased by Canadian Hydro Developers, Inc. in January 2007 for $305,000 but would have resold August 2009 for $362,153 as a result of the passage of time.	Actual Price January 2007	$305,000
	%Change	18.74%
	$Change	$57,153
	Adjusted Price August 2009	$362,153
However the Actual Price when the property resold to Egresits / Gooder in August 2009 was $278,000, a loss of -$84,153.	Actual Price August 2009	$278,000
	$Difference	-$84,153
Diminution in Value: -23.24%.	%Difference	**-23.24%**

Sale and Resale Property
Melancthon, Ontario



LITERATURE REVIEW

Summary

Wind Turbine - Property Value Impact Studies

Independent Studies

Author	Type	Year	Location	Method	Distance	Impact %
Lansink	Appraiser	2012	Ontario	Resale (1)	< 2 miles	(39%) Avg. 23%-59%
Sunak	Academic RWTH Aachen University	2012	Rheine & Neuenkirchen	OLS Geographic Weighted Regression (2)	2 Km	(25%)
Heintzelman Tuttle	Academic Clarkson University	2011	Upstate NY	Regression Resale & Census Block	1/10 to 3 miles	Varies to > (45%)
McCann	Appraiser	2009 - 2012	Illinois, (3) MI, MA, WI	Paired Sales & resale	< 2 miles	(25%) 20% - 40%
Gardner	Appraiser	2009	Texas	Paired Sales	1.8 miles	(25%)
Kiellsch	Appraiser	2009	Wisconsin (4)	Regression & Survey	Visible vs. not visible	(30-40%) (24-39%)
Luxemburger	Broker	2007	Ontario	Paired Sales	3 NM	(15%) $48,000
Lincoln Twp.	Committee (5)	2000- 2002	Wisconsin	AV ratio 104% v. 76%	1 mile	(28%)

HALLELAND HABICHT

Public Health Impacts of Wind Turbines

Prepared by:
Minnesota Department of Health
Environmental Health Division

In response to a request from:
Minnesota Department of Commerce
Office of Energy Security

May 22, 2009

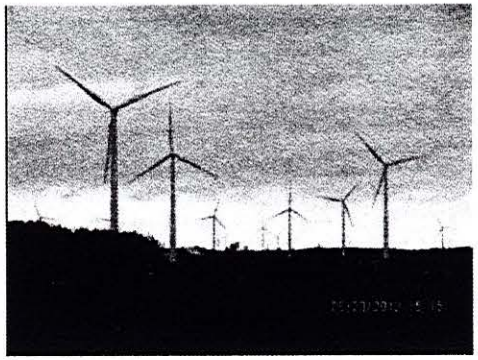
HALLELAND HABICHT

Lansink Appraisals and Consulting
Real Estate Appraisers and Consultants
A Division of Wellington Realty Group Inc.

CASE STUDIES

Diminution / Change in Price

Melancthon and Clear Creek
Wind Turbine Analyses
Municipal Property Assessment Corporation (MPAC)
Current Value Changes



Hwy 89, Melancthon Township, Ontario, Canada Photograph: Ben Lansink

Prepared by

Ben Lansink
AACI, P.App, MRICS

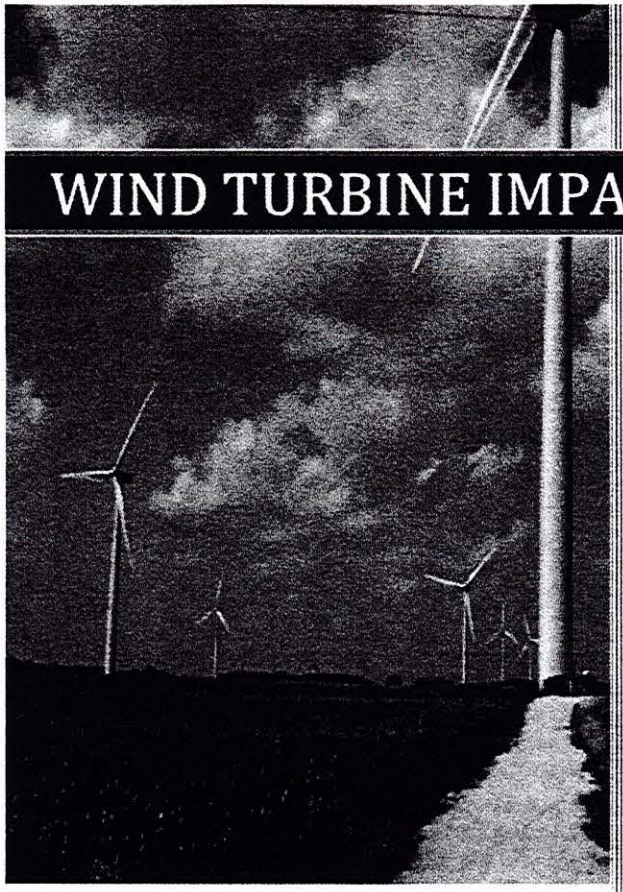
February 2013

HALLELAND HABICHT

SUMMARY & CONCLUSION

- The sales study indicated three factors:
- (1) sales within the wind turbine influence area sold for less than those outside of this area;
- (2) there were substantially fewer sales available within the turbine influence area as compared to those sales outside of the influence area; and,
- (3) the impact of the wind turbines decreased the land values from -12% to -47% with the average being -30%.
- Additionally, it can be said with a high rate of confidence that the impact of wind turbines on residential land sales is negative and creates a loss greater than -12%, averaging -30%..

HALLELAND HABICHT



2009

WIND TURBINE IMPACT STUDY

APPRAISAL GROUP ONE

9/9/2009

HALLELAND HABICHT

What is Blowing in the Wind?

PRESENTED BY: July 21, 2014

HALLELAND HABICHT PA
33 South Sixth Street, Suite 3900
Minneapolis, Minnesota 55402
612-836-5531
dschleck@hallelandhabicht.com

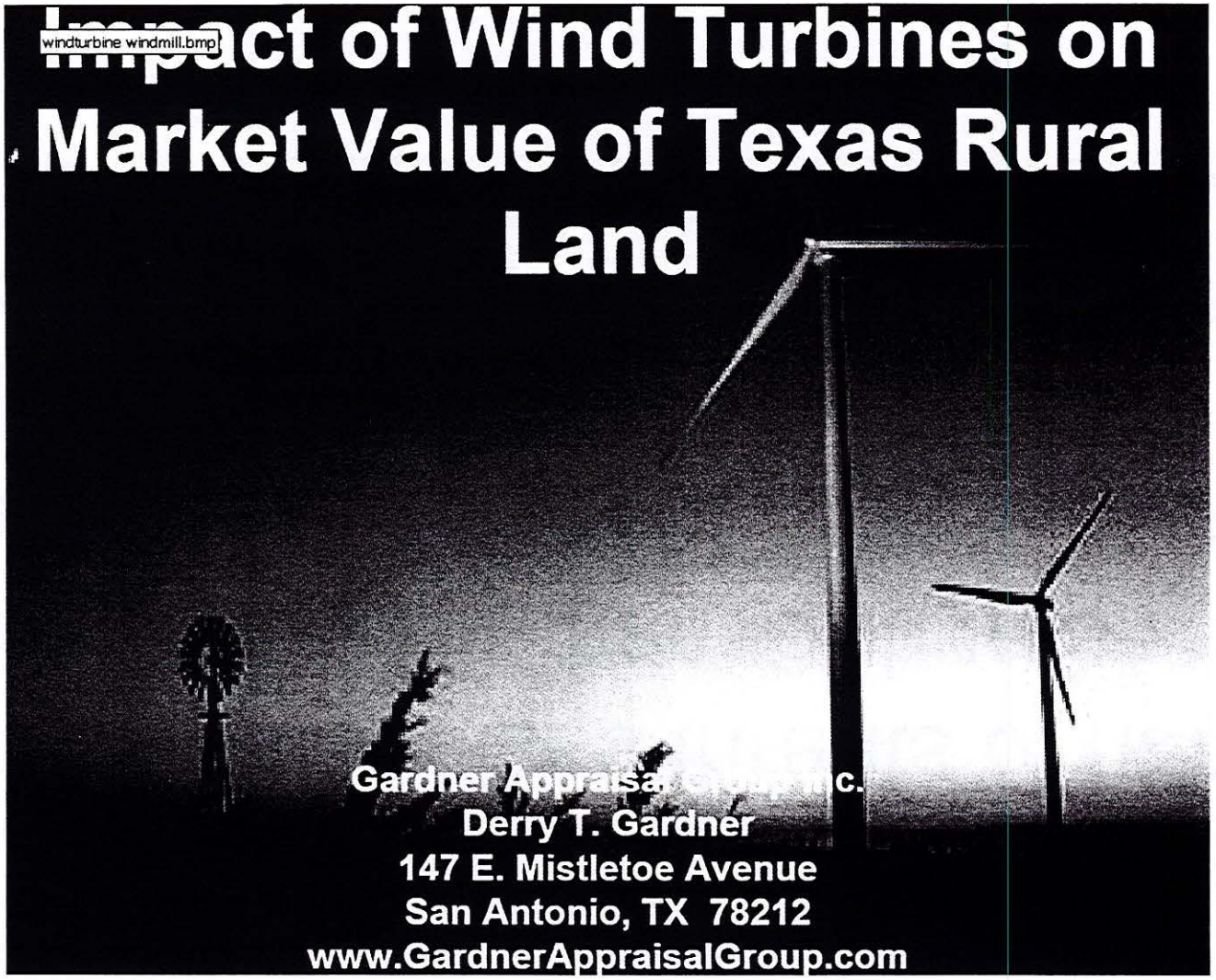
HALLELAND HABICHT

Precautionary Principle

When an activity raises threats of harm to the environment or human health, precautionary measures should be taken even if some cause and effect relationships are not fully established scientifically.

HALLELAND HABICHT

Impact of Wind Turbines on Market Value of Texas Rural Land



Gardner Appraisal Group, Inc.
Derry T. Gardner
147 E. Mistletoe Avenue
San Antonio, TX 78212
www.GardnerAppraisalGroup.com

HALLELAND HABICHT

Appraisal Research Shows:

- A **VIEW adds value** to rural property
- Take view away – added value goes away
- Brokers in rural areas confirm that property values in areas of wind facilities are **10% - 30% less** than property not in areas of wind facilities.
- Wind energy development creates an income stream, increasing property's production value; increased production value does not necessarily result in increased market value

HALLELAND HABICHT

Diminution in Value Summary

Turbines on property

Average 37%

Turbines within .2 -.4 miles

Average 26%

Turbines within 1.8 miles

Average 25%

Ontario court says wind turbines reduce property values

Court decision paves the way for future lawsuits against wind turbine companies and lease holders

By Amanda Brodhagen, Farms.com

An Ontario Superior Court of Justice has determined that landowners living near industrial wind turbine projects do suffer from diminished property values. The court accepts that 22% to 55% loss of property values is occurring today. While the court found that residences may suffer from diminished property values near wind farms, Madam Justice S.E. Healey dismissed the claims made by the Collingwood area landowners who sued the wind company – Canada Corp. and lease holders, because the proposed eight-wind turbine project has yet to receive approval by the provincial government.

The claim was made by Sylvia and John Wiggins, who sued for $2 million and argued that no one would buy their 48-acre horse farm once the wind project was announced for the area. The couple was also joined by other property owners.

The decision states that while the residence of Clearview Township cannot take action for reduced property values prior to the approval of the project, they could take action later. The ruling says "without prejudice to the plaintiffs' rights to commence an action for identical or similar relief when and if the Fairview Wind Project receives the necessary approvals to be constructed."

Eric Gillespie, the lawyer representing the landowners says the decision will clear the way for actions against both wind developers and lease holders. "It now seems clear that as soon as a project is approved, residents can start a claim. This appears to be a major step forward for people with concerns about industrial wind projects across Ontario," said Gillespie.

Wind Concerns Ontario, a coalition of community groups concerned about the negative impacts of wind projects, released a statement saying "…this is vindication for Ontario's rural and small urban residents, and for municipal councils who try to protect their citizens by declaring they are not 'willing hosts' to wind power generation projects," said Jane Wilson, president of Wind Concerns.

While Gillespie is calling this a major breakthrough for his clients, a spokesperson for the wind company - Kevin Surette, downplayed the significance of the courts findings saying that the ruling came early in the proceedings, noting that the court based its opinion on the evidence of the plaintiffs. Surrette said that had the case proceeded, they would have challenged those claims.

The Ontario ministry of environment has six months to either approve the wind project or reject it.

HUD FHA guidelines for appraisals:

Unacceptable Locations

FHA guidelines require that a site be rejected if the property being appraised is subject to hazards, environmental contaminants, noxious odors, offensive sights or excessive noises *to the point of endangering the physical improvements or affecting the livability of the property, its marketability, or the health and safety of its occupants.* Rejection may also be appropriate if the future economic life of the property is shortened by obvious and compelling pressure to a higher use, making a long-term mortgage impractical.

If the condition is clearly a health and safety violation, contact the lender for further instructions before completing the appraisal. The lender must clear the condition and may require an inspection or reject the property. If there is any doubt as to the severity, report the condition and submit the completed report. For those conditions that cannot be repaired, such as site factors, the appraised value is based upon the existing conditions.

Values in the Wind: A Hedonic Analysis of Wind Power Facilities*

Martin D. Heintzelman

Carrie M. Tuttle

March 3, 2011

Economics and Financial Studies

School of Business

Clarkson University

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*Martin D. Heintzelman is Assistant Professor, Clarkson University School of Business. Carrie M. Tuttle is a Ph.D. Candidate in Environmental Science and Engineering at Clarkson University. We would like to thank Michael R. Moore, Noelwah Netusil, and seminar participants at Binghamton University as well as the 2010 Thousand Islands Energy Research Forum and the 2010 Heartland Economics Conference for useful thoughts and feedback. All errors are our own.

combine Clinton and Franklin Counties since the turbines in these counties were installed at very close to the same time and the wind farms are nearly adjacent to one another. We see that proximity effects are still negative, but not significant in Lewis County, which is somewhat surprising, but may result from the small number of observations, or from the fact that familiarity with the turbines has diminished their impact. Meanwhile, proximity effects are negative and strongly significant in Clinton/Franklin Counties. In both areas there continue to be unexplained significant impacts from turbines within some concentric circles.

Another interesting way to segment the data is along the dimension of whether or not the buyers in a transaction are local residents (from the five counties that make up the North Country). The idea is that local buyers might be more aware of the effects of turbines, particularly after the fact, and also more likely to know about turbine locations and potential locations. In Table 11 we see that the proximity effect is more than halved for local buyers vs. non-local buyers.[22] This suggests that non-local buyers are more wary of turbines and their effects than local residents which may also be a function of familiarity.

5 Discussion and Conclusions

The results in this study appear to indicate that proximity to wind turbines does have a negative and significant impact on property values. Importantly, the best and most consistent measure of these effects appears to be the simple,

continuous, proximity measure, the ln(inverse distance) to the nearest turbine. The estimated coefficient on this variable is consistently negative and significant. One reason for this consistency is that, unlike the dummy and count variables, the distance measure changes for nearly every parcel in our dataset between transactions, as long as new turbines are sited in the interim. In contrast, changes in the count/dummy variables are comparatively rare. Also, as we have already mentioned, the count and dummy variable measures are highly collinear and so it is difficult to effectively estimate effects using those variables.

The magnitude of the proximity effect depends on how close a home is to a turbine and is very important since any decision-maker will need to understand both how large the discount is and how far it extends away from the turbines. Since it is a log-log specification, the estimated coefficient represents the elasticity of price with respect to the inverse of the distance to the nearest turbine. So, a coefficient of $-\beta$ implies that a 1% increase in the inverse distance (a decrease in distance to the nearest turbine) decreases the sale price by β%. Inverse distance declines as distance increases, so this tells us that the impacts of wind turbines similarly decay. Using the estimated coefficients above, we can calculate the percentage change in price from a given change in distance. These results are presented in Table 12 for a selection of representative βs from the models above. The double log/inverse distance specification enforces that the relationship between percentage price declines and distance be convex. To test for the robustness of this assumption we also tried quadratic and cubic distance specifications which would allow for a concave rather than

convex relationship. The quadratic specification confirmed the convex shape of the relationship since the linear term was positive and significant and the quadratic term was negative and significant. The quadratic and cubic terms in the cubic specification were not significant.[23]

From the repeat sales model we see that the construction of turbines such that for a given home the nearest turbine is now only 0.5 miles away results in a 10.87%-17.77% decline in sales price depending on the initial distance to the nearest turbine and the particular specification. For the average property in our sample that sells for $106,864, this implies a loss in value of between $11,616 and $18,990. At a distance of 1 mile (about 20% of our sample), we see declines in value of between 7.73% and 14.87% resulting in losses for the average home of between $8,261 and $15,891. Failing to properly control for selection effects, as in the block-group fixed effects analysis, results in price declines that are about 35% higher than those estimated from the repeat sales model.

From a policy perspective, these results indicate that there remains a need to compensate local homeowners/communities for allowing wind development within their borders. Existing PILOT programs and compensation to individual landowners are implicitly accounted for in this analysis since we would expect these payments to be capitalized into sales prices, and still we find negative impacts. This suggests that landowners, particularly those who do not have turbines on their properties and are thus not receiving direct payments from wind developers, are being harmed and have an economic case to make for more compensation. That is, while the 'markets' for easements and PILOT

programs may be properly accounting for harm to those who allow parcels on their property, it appears not to be accounting for harm to others nearby. This is a clear case of an uncorrected externality. If, in the future, developers are forced to account for this externality through increased payments this would obviously increase the cost to developers and make it that much more difficult to economically justify wind projects.

This study does not say anything about the societal benefits from wind power and should not be interpreted as saying that wind development should be stopped. If, in fact, wind power is being used to displace fossil-based electricity generation it may still be that the environmental benefits of such a trade exceed the costs. However, in comparing those environmental benefits, we must include not only costs to developers (which include easement payments and PILOT programs), but also these external costs to property owners local to new wind facilities. Property values are an important component of any cost-benefit analysis and should be accounted for as new projects are proposed and go through the approval process.

Finally, this paper breaks with the prior literature in finding any statistically significant property-value impacts from wind facilities. We believe that this stems from our empirical approach which controls for omitted variables and endogeneity biases. Future studies which expand this sort of analysis to wind and other renewable power facilities in other regions are imperative to understanding the big picture of what will happen as these technologies grow in prominence.

WIND FARMS, RESIDENTIAL PROPERTY VALUES, AND RUBBER RULERS©

by

Albert R. Wilson

I recently examined a document published by the Department of Energy's Lawrence Berkeley National Laboratory titled "The Impact of Wind Power Projects on Residential Property Values in the United States: A Multi- Site Hedonic Analysis" (hereafter "Report")' I express no opinion concerning the impact of wind power projects on residential property values and instead focus on the underlying methods used in the development of the Report, and the resulting serious questions concerning the credibility of the results.

As stated in the title the primary bases for the conclusions drawn in the Report are hedonic analyses of residential real estate sales data. A hedonic analysis in turn is based on the assumption that the coefficients of certain explanatory variables in a regression represent accurately the marginal contribution of those variables to the sale price of a property.

Regression

A regression is a statistical process that attempts to quantify a hypothetical relationship between certain factors (explanatory variables) and the value of an outcome (dependent variable). The explanatory variables are related to the dependent variable through a mathematical formula generally referred to as a regression model. In real estate the explanatory variables are usually such things as size (square feet), number of bedrooms and bathrooms, garage space, presence of basement, location, and the like. The dependent variable is sales price. In the Report the authors are basing their analysis primarily on a set of regression models with the inclusion of variables that attempt to estimate the possible impact of distance from and view of turbines.

The mathematics of regression are executed through a computer program that assigns numeric values to the multipliers (coefficients) of the explanatory variables in such a way that when the estimates of the sales prices computed by the regression model are compared to the actual sales prices of the properties upon which the regression is based, the difference is at a mathematical minimum based on some measure (e.g. R^2 or R-squared, the coefficient of determination). This process is accomplish through the computer program by continually changing the coefficients of the explanatory variables, recalculating all of the estimated sales prices using the new coefficients, comparing the estimated to the actual sales prices and repeating the process until the minimum difference given the data and the regression model is achieved.

Using the hedonic analysts' favorite measure of R^2, the usual hedonic interpretation is that if $R^2 = 1$ then the regression model explains all of the differences between the estimated and actual sales prices. If $R^2 = 0$ then none of the differences are explained and the regression model is a failure. If the underlying regression is not explanatory of the actual data then the dependent hedonic analysis cannot be explanatory.

There are literally thousands of possible real estate regression models. The literature in the hedonic field generally exhibits little agreement on a model's mathematical form or the explanatory variables that should be included.[1] Absent published and recognized standards on the validation of data, model development and testing, and calibration of the model against the real world market, a regression may be nothing more than a rubber ruler that can be stretched to provide a desired result.[2]

Standards

However, a well-developed and tested set of standards do exist. Those standards are published and maintained by the International Association of Assessing Officers (IAAO) and are explicitly for the accurate and reliable estimation of sales prices using regressions, not simply for appraisal purposes as some allege.[3] These standards are employed many hundreds of times a day and are continually tested against the market.

For comparison purposes it should be noted that the usual hedonic regression model has an R^2 from 10% to more than 60% less than an acceptable regression under IAAO standards (IAAO R^2 better than 0.90 versus the best R^2 cited in the Report of 0.78–13% less–for example). No satisfactory scientific explanation of why a regression with a smaller R^2 will provide more accurate and reliable hedonic results has been provided.

There is no evidence whatever that the Report employed any standards. While the authors refer to the literature as support for their method this is little comfort as there is no evidence that any recognized standards were applied to the work reported in that literature. Further, the literature contains a significant number of papers illustrating some of the problems associated with hedonic studies ranging from an absence of proper validation of the underlying data, to models deliberately manipulated to magnify the desired impact, to improper use of indicator variables, to a failure to check the results of the models against the market to determine if the proclaimed results actually represent market behavior.[4]

A common problem with the lack of adherence to standards is that the apparent magnitude and statistical significance of the coefficients of interest may be increased by simply not including important explanatory variables in the regression, generally known as the "omitted variable" problem.[5] This omission may be the result of a lack of understanding of residential

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[1] Atkinson, Scott E.; Thomas D. Crocker, "A Bayesain Approach to Assessing the Robustness of Hedonic Property Value Studies," Journal of Applied Econometrics, Vol. 2, 27-45 (1987).

[2] Wilson, Albert; "Real Property Damages and Rubber Rulers," Real Estate Issues, Summer, 2006

[3] Standards on Valuation Models, IAAO.ORG

[4] SEE FOR EXAMPLE Rogers, Warren, "Errors in Hedonic Modeling Regressions: Compound Indicator Variables and Omitted Variables," The Appraisal Journal, April, 2000

[5] Rogers *ibid.*

sales price behavior or from other considerations but the result is the same, skewed coefficient values. There is strong evidence of an omitted variable issue in the Report.

A method of increasing the apparent importance of a coefficient is to aggregate data into increasingly more expansive variable definitions. This procedure was used in the Report and is acknowledged by its authors. "The Base Model described by equation (1) has variables that are pooled, and the coefficients for these variables therefore represent the average across all study areas (after accounting for area fixed effects). An alternative (and arguably superior) approach would be to estimate coefficients at the level of each study area, thereby allowing coefficient values to vary among study areas."[6]

The consequence of this aggregation is to distort the quantitative meaning of the coefficients. Possible situations in the Report include sales prices in areas of declining population and therefore decreasing demand–a majority of the areas examined–are not directly comparable to sales prices in areas of increasing population and therefore increasing demand, but these markets were combined in the Report. Also in the Report is the aggregation of markets such as those in Washington–used as the base for comparison to all other areas by the Report–where the urban market of Kennewick was aggregated with the rural market of Milton-Freewater 42 miles distant. The failure to recognize and account for the need for homogeneity of markets is a common failing of hedonics.

One of the major issues concerning the hedonic approach on a nationwide basis in ignoring local market homogeneity is addressed by the 2009 Coldwell Banker Home Price Comparison Index.[7] It makes the point that local markets are critical. For example a house in Grayling, Michigan sells for $122,675 while in La Jolla, California the same house sells for $2,125,000. Creating an average sales price representing houses from nine states and at least 20 different markets–as the Report did–is a gross oversimplification that cannot provide for the specificity required to answer a micro-question such as an influence on sales price from a highly localized condition–distance to or view of a wind energy project.

This problem becomes critical when it is recognized that less than 10% of the sales transactions used in the Report had any view of turbines, and that only 2.1% had a view rated greater than minor. The study is dominated by transactions where no influence is reasonably likely. The argument that the report is "data rich" may in fact be an overstatement of the situation because of this issue.

It is worth noting that IAAO standards discourage the use of regression for the analysis of the impact of a proximate condition on value precisely because of the small number of potentially influenced sales available for analysis by regression. Instead the use of the classic three approaches to value (sales comparison, income and cost) is encouraged as

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[6] Report page 134

[7] "2009 Coldwell Banker Home Price Comparison Index," as cited in CNNMoney.com "Same 4-bedroom house - Wildly different prices", September 23, 2009.

more reliable under these circumstances.[8]

A major issue pointed to in the literature is the influence of errors in the data. A recent article reported that, using an IAAO certified regression, as few as 15 erroneous sales skewed the estimated sales prices by at least $500 for all but 43 of the 20,000 sales estimated.[9] In another instance a single error in the age of a property out of some 18,000 data elements skewed the results of the regression from a finding of an influence on sales price to no influence on sales price. Absent access to the Report data these and similar issues cannot be evaluated. It is worth noting that there is no evidence in the Report that any sales confirmation work that might have revealed this issue was undertaken.

Peer Review

The authors of the Report claim it has been peer reviewed and the method and results are supported by the peer reviewed literature. Unfortunately this claim means far less than it seems. Peer review in the context of this Report and the referenced literature consists of the reading of the report by several presumably knowledgeable individuals and the provision of comments to the authors based on that reading, nothing more.[10, 11, 12] The authors may or may not have addressed all of the issues raised by the comments.

What is missing from this process is any semblance of testing for the scientific validity of the results, a testing rendered impossible by the refusal of the Report's authors to provide the underlying data. Absent the data it is not possible to independently validate the

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[8] "Standard on the Valuation of Properties Affected by Environmental Contamination", IAAO.ORG

[9] Cholvin, Brooke, Danielle Simpson, "Assessing Mortgage Fraud," Fair & Equitable, IAAO, August, 2009

[10] Chan, Effie J., "The 'Brave New World' of Daubert: True Peer Review, Editorial Peer Review and Scientific Validity," New York University Law Review, April, 1995, 70, N.Y.U.L. Rev 100. ALSO, Haack, Susan, "Peer Review and Publication: Lessons for Lawyers," Stetson Law Review, Vol. 36, 2007.

[11] "The Editor reads each submitted manuscript to decide if its topic and content of the paper fits the objectives of JRER. Manuscripts that are appropriate are assigned anonymously by the Editor to one member of the Editorial Board and at least one other reviewer. ... The referee presents a critique to the Editor who forwards it to the author. Each author should be encouraged to resubmit the manuscript for publication consideration. The Editor makes the final decision regarding re-submissions. ..." Editorial Policy and Submission Guidelines, Journal of Real Estate Research, American Real Estate Society, Volume 31, Number 2, 2009.

[12] "The mistake, of course, is to have thought that peer review was any more than a crude means of discovering the acceptability–not the validity–of a new finding. Editors and scientists alike insist on the pivotal importance of peer review. We portray peer review to the public as a quasi-sacred process that helps to make science our most objective truth teller. But we all know that the system of peer review is biased, unjust, unaccountable, incomplete, easily fixed, often insulting, usually ignorant, occasionally foolish, and frequently wrong." "Genetically modified foods: "absurd" concern or welcome dialog?" Richard Horton, editor of Lancet, 1999; 354: 1314-1315

accuracy or reliability of the data, replicate the analyses, test alternative regression models (say models that meet IAAO standards), or calibrate the results against the real world market. Absent such scientific testing we have nothing more than opinion upon which to base an estimate of the credibility and applicability of the results.

At best a peer review–as that phrase is commonly used in this field–with respect to both the Report and the literature addresses only the acceptability of the paper for publication but does not in any meaningful way address the validity of the underlying work.

Hedonic Analysis

Hedonic analysis depends entirely on the accuracy and reliability of the underlying regression. If the regression does not conform to recognized standards then we have no independent assurance of that accuracy or reliability, as in this case.

Hedonic analysis also adds a new requirement, specifically that the coefficients of the explanatory variables of interest are quantitatively accurate and represent only the marginal contribution of that explanatory variable to the sales price. This is not a requirement of regression. In this case there is some doubt that the hedonic requirement has been met.

First, computer regression programs are mindless, they simply follow a set of instructions until they are fulfilled and then print the results. It is a simple matter to demonstrate that omitting or adding an explanatory variable will frequently influence both the magnitude and statistical significance of the other explanatory variable coefficients. It is also possible to include a totally meaningless explanatory variable and achieve statistical significance for its coefficient, making it appear meaningful. Absent the application of standards regressions may easily meet the needs of junk science.

Second the accuracy and validity of the coefficients of hedonic interest (in the Report the coefficients associated with View and Distance) must be separately tested to determine if they comply with the hedonic requirement of accurately and only representing the explanatory variables.

In the literature–as in the Report–the usual test employed is that of the statistical significance of the coefficient. Unfortunately all this test may tell us is that the coefficient is statistically unlikely to be zero.[13, 14] Knowing that a number is not likely equal to zero does

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[13] Although difficult to read the following covers both statistical and economic (scientific) significance in some detail, Ziliak, Stephen T., Deirdre N. McCloskey, "The Cult of Statistical Significance", The University of Michigan Press, Series: Economics, Cognition, and Society, Ann Arbor, MI and particularly the reference materials cited.

[14] NOTE that the null and alternative hypotheses in a test of significance are required to be mutually exclusive and collectively exhaustive. The test of significance for a coefficient uses the null hypothesis of equality to zero but the alternative hypothesis is rarely stated. It appears that the hedonic analyst uses the idea that if the null can be rejected, then the coefficient must represent the marginal

not tell us anything about what it does represent or its importance to an analysis.

To determine if the coefficient has any hedonic value the test must be for the economic significance of the coefficient. Specifically a proof that the coefficient accurately and only represents the marginal contribution to sales price for that explanatory variable, and that it is of sufficient magnitude to provide a significant impact on sales price. There is no evidence of such testing in the Report, or indeed in the referenced supporting literature.

In Conculsion

While I have other issues with the Report and again reiterate that I have no opinion on the influence of wind farms on residential sales prices, the concerns I have addressed here lead to the conclusion that the Report should not be given serious consideration for any policy purpose. The underlying analytical methods cannot be shown to be reliable or accurate.

The reasons for this conclusion discussed here may be summarized as:

1) Lack of access to the underlying data prevents the independent validation of the data, replication of the analysis, testing of alternative analyses, or testing of the conclusions against the real market.
2) The peer review process used for both the literature and the Report can only determine the acceptability of the papers for publication. It cannot reveal the validity, accuracy or reliability of the work behind the papers.
3) Given the peer review conducted, the fact that no published and recognized standards for the development of an accurate and reliable regression on sales price were used render the Report of highly uncertain value for any purpose.
4) The exclusive use of a test of statistical significance only indicates that the coefficients for Distance and View variables are not conclusive. What we do not know is what those coefficients actually represent. Only tests of economic significance would provide an answer, and none has been conducted.
5) Low explanatory power, 13% less than an acceptable minimum for an accurate regression on sales price.

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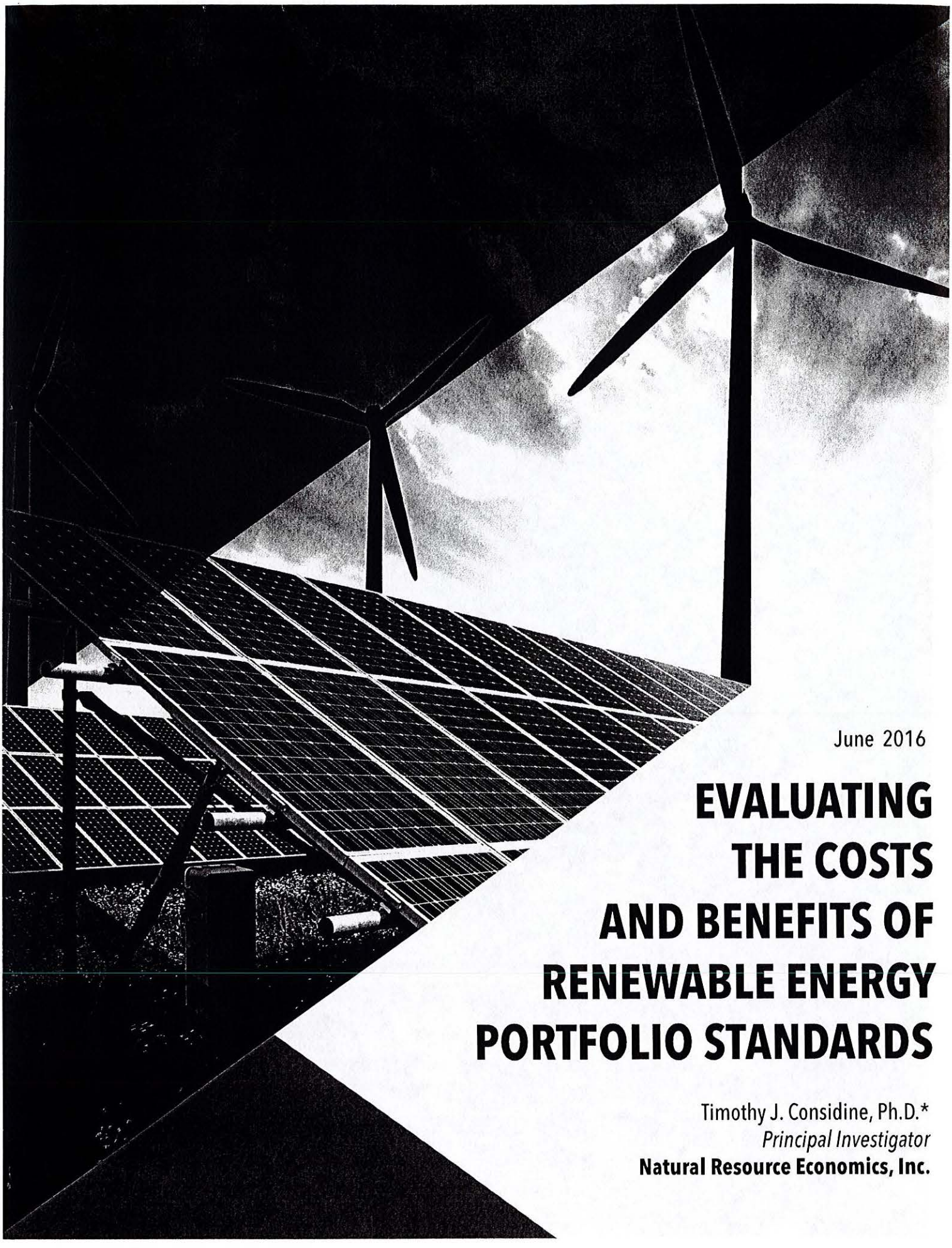
contribution of that variable to the sales price. Unfortunately, as explained earlier, there is no basis for that assumption because there is the strong possibility of many other influences on the coefficient.



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EVALUATING THE COSTS AND BENEFITS OF RENEWABLE ENERGY PORTFOLIO STANDARDS

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EVALUATING THE COSTS AND BENEFITS OF RENEWABLE ENERGY PORTFOLIO STANDARDS

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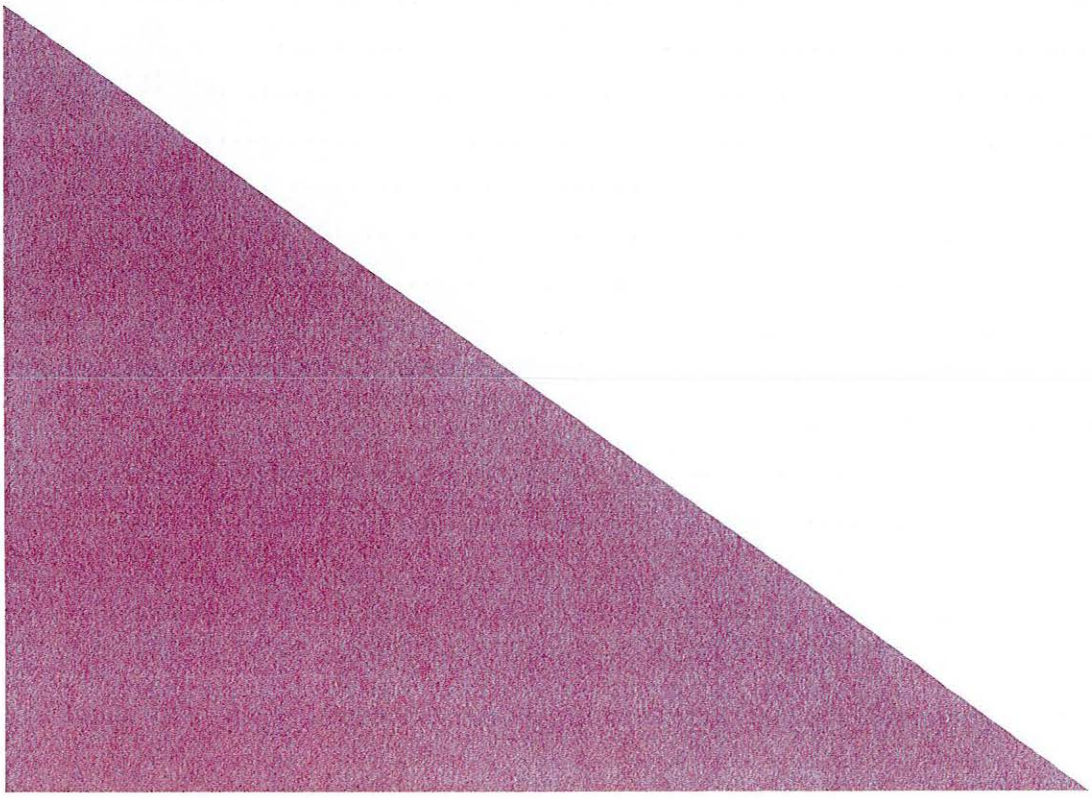


EVALUATING THE COSTS AND BENEFITS OF RENEWABLE ENERGY PORTFOLIO STANDARDS

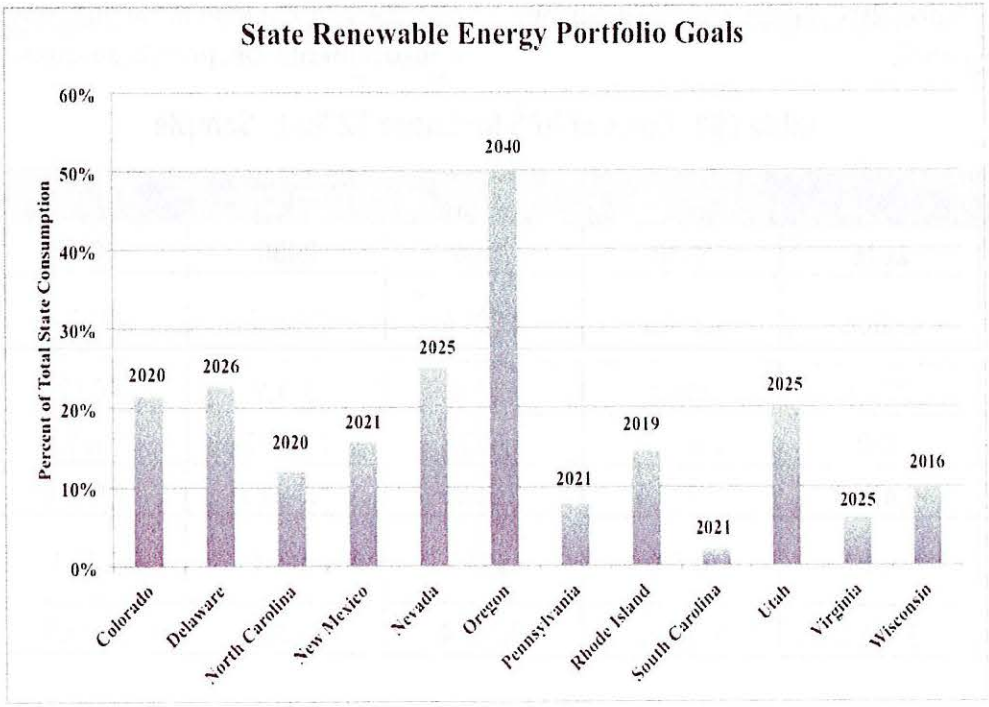
Executive Summary

Renewable Portfolio Standards (RPS), now existing in 29 states and the District of Columbia, require utilities to provide a certain percentage of electricity consumption from wind, solar, and other forms of renewable energy. Federal policies, such as the wind production tax credit and the solar investment tax credit, also promote the production of wind and solar power. Given the widespread use of rate of return regulation based upon average cost pricing, the costs of these policies are less than transparent. Moreover, to the extent that these policies drive up electricity prices, output and employment could be adversely affected. The objective of this study is to understand and estimate these costs and economic impacts.

Central to this effort is the estimation of the opportunity costs of higher cost, intermittent renewable power in terms of the foregone electricity from lower cost, deployable fossil fuel fired electricity. These opportunity costs vary considerably by state based upon the cost of existing capacity and availability of wind and solar resources. Accordingly, this study estimates these costs for the twelve states identified in Figure ES1. The timing and stringency of the RPS goals varies considerably by state. Moreover, there is wide variation in the size and composition of electricity generation for this sample of states.[1]

To estimate the costs and benefits of RPS, this study develops models of electricity supply and demand

Figure ES1: RPS Goals by State



for each state. These models are projected using forecasts for coal and natural gas prices out to 2040 from the U.S. Energy Information Administration. The baseline forecast assumes existing electricity production capacity remains in place with new generation requirements met by natural gas integrated combined cycle (NGCC) plants. The RPS scenario imposes the goals identified in Figure ES1. Average electricity generation costs, power consumption, and retail rates under the baseline and RPS scenarios are then compared.

The costs of RPS policies depend upon the opportunity costs of electricity generation from wind and solar. For states with a fleet of low cost electricity generation capacity, imposition of RPS could raise electricity costs significantly because higher cost wind and solar generation displace low cost sources of power. While this displacement reduces expenditures on fossil fuels, coal and natural gas plants are cycled to accommodate the intermittent generation of renewable generators, which reduces their thermal efficiency and raises generation costs. On the other hand, building more renewable energy plants to meet RPS goals reduces the need to build new NGCC plants. Finally, investments in RPS capacity earn federal tax subsidies. Wind power receives a production tax credit of $23 per megawatt hour (Mwh) while solar plants receive a 30% investment tax credit. Hence, RPS policies contribute to lower federal tax revenues.

These costs are summarized in Figure ES1 for the entire twelve states. For example, in 2016, the RPS goals involve $5.4 billion in additional expenditures to build and operate the required RPS facilities, $271 million in cycling costs, and $1.8 billion of tax subsidies. These costs are partially offset by $1.478 billion in fossil fuel cost savings and $261 million in avoided new NGCC generation costs. Hence, the total net cost of RPS policies is $5.762 billion in 2016. The total net costs of RPS policies reach $8.7 billion in 2025 and increase to $8.9 billion in 2040 after RPS goals are met and the unit costs of solar and wind decline due to technological improvements.

These higher costs are passed on to customers in the form of higher retail electricity prices, summarized in Table ES2. States with modest RPS goals, such as South Carolina, experience moderate rate increases. Similarly, states meeting their RPS goals with wind, such as Colorado, face rate increases of roughly 6%. On the other hand, states meeting rather ambitious RPS goals with relatively higher cost solar power, such as Oregon, North Carolina, Nevada, Utah, and Virginia incur much steeper electricity rate increases.

Electricity rate increases peak as RPS goals are reached in the early 2020s for most states. Thereafter, electricity rate increases begin to taper off as the costs of wind and solar decline due to technological improvements. Despite these expected reductions in

Table ES1: Costs of RPS for Entire 12 State Sample

	MILLIONS OF 2013 DOLLARS					
	2016	2020	2025	2030	2035	2040
Renewable Energy Costs	5,400.0	7,815.2	8,881.6	9,283.8	9,693.2	10,119.0
Cycling Costs	271.1	316.0	339.6	371.9	409.2	452.6
Tax Subsidies	1,830.1	2,672.2	3,098.0	3,287.2	3,485.7	3,698.8
Fossil Fuel Costs	-1,478.3	-2,319.5	-2,966.3	-3,493.3	-4,071.0	-4,687.0
New Fossil Fuel Costs	-260.7	-462.0	-597.5	-619.6	-642.1	-652.3
Total Net Costs	5,762.2	8,022.0	8,755.4	8,829.9	8,875.0	8,931.1

the cost of wind and solar technology, RPS polices increase prices for electricity.

Many economic studies in the peer-reviewed literature demonstrate that higher energy prices reduce economic growth and employment. Energy is an essential factor of production and consumption activities. Given limited substitution possibilities, higher electricity prices raise business costs and consumer energy bills, which reduces spending on other goods and services. Investments in renewable energy, however, constitute an economic stimulus.

A comparison of these economic impacts is summarized in Table ES3 for the entire twelve states. For example, in 2025 higher electricity prices associated with RPS policies reduce value added or net economic output by $23.1 billion. Investments

Table ES2: Impact of RPS Policies on Retail Electricity Prices

	ELECTRICITY PRICE CHANGES IN PERCENT					
	2016	2020	2025	2030	2035	2040
Colorado	6.12	8.23	7.69	7.32	6.69	5.93
Delaware	11.02	14.50	14.99	12.50	10.14	8.20
North Carolina	10.04	16.06	14.12	12.55	11.03	9.79
New Mexico	6.18	6.77	5.95	5.30	4.54	3.92
Nevada	14.77	15.60	15.14	13.28	11.21	9.12
Oregon	9.41	10.00	11.09	14.13	16.42	18.13
Pennsylvania	2.14	2.56	2.54	2.40	2.25	2.08
Rhode Island	13.61	18.16	16.62	15.55	14.46	13.17
South Carolina	0.39	1.52	2.08	1.97	1.85	1.75
Utah	5.13	9.07	12.78	11.78	10.67	9.47
Virginia	5.45	7.75	9.85	8.76	7.74	6.93
Wisconsin	4.34	4.29	4.01	3.70	3.39	3.08

required for new renewable energy plants increase value added by $668 million. With a small offset from reductions in required NGCC plants to meet load growth, the net reduction in value added is nearly $22.5 billion in 2025. Similarly, gross employment losses are over 160 thousand in 2025 but over 9 thousand jobs are created building and operating new solar and wind capacity to meet RPS goals. But again the net change involves over 150 thousand jobs lost in 2025. Overall, this study finds that the stimulus from building and operating renewable energy facilities are offset by the negative impacts that higher electricity rates have on employment and value added. The estimated losses in value added for each of the twelve states are summarized in Table ES4. The largest losses occur in North Carolina with value added reductions between $3.9 billion in 2016 to more than $6.6 billion in 2025. Losses in annual value added exceed $1 billion in seven other states.

The employment impacts of RPS policies are summarized in Table ES5. The jobs lost by state mirror the losses in value added. Again, the magnitudes differ by state depending upon the stringency of the RPS goals, the size of the state, and the technologies available for each state to meet the RPS goals. Solar energy is the main way to attain RPS goals for eastern states due to limited wind resources.

Table ES3: RPS Impacts on Value Added and Employment for All States

	MILLIONS OF 2013 DOLLARS					
Value Added	**2016**	**2020**	**2025**	**2030**	**2035**	**2040**
Electric prices	-16,779	-22,799	-23,140	-21,555	-19,786	-18,100
RPS Invest.	2,069	1,290	668	432	439	456
NGCC Invest.	-146	-34	-22	-2	1	2
Net Change	-14,856	-21,543	-22,495	-21,124	-19,346	-17,642
Employment	NUMBER OF JOBS					
Electric prices	-118,606	-159,094	-161,595	-151,605	-140,199	-129,223
RPS Invest.	29,826	18,332	9,073	5,796	5,870	6,092
NGCC Invest.	-1,246	-305	-206	-21	10	15
Net Change	-90,026	-141,066	-152,727	-145,830	-134,318	-123,116

Table ES4: RPS Impacts on Value Added by State

	CHANGE IN VALUE ADDED IN MILLIONS OF 2013 DOLLARS					
	2016	**2020**	**2025**	**2030**	**2035**	**2040**
Colorado	-1,442	-1,996	-1,992	-1,895	-1,730	-1,530
Delaware	-603	-812	-839	-715	-578	-466
North Carolina	-3,899	-7,145	-6,664	-5,918	-5,196	-4,606
New Mexico	-239	-444	-390	-348	-298	-251
Nevada	-1,711	-1,792	-1,715	-1,534	-1,287	-1,038
Oregon	-1,451	-1,571	-1,636	-2,022	-2,374	-2,636
Pennsylvania	-1,226	-1,503	-1,640	-1,545	-1,449	-1,337
Rhode Island	-629	-890	-813	-760	-707	-643
South Carolina	-63	-198	-349	-318	-298	-283
Utah	-662	-1,420	-2,025	-1,964	-1,777	-1,575
Virginia	-1,865	-2,655	-3,390	-3,149	-2,778	-2,486
Wisconsin	-1,065	-1,116	-1,041	-958	-874	-791
Total	-14,856	-21,543	-22,495	-21,124	-19,346	-17,642

The economic impacts are summarized in Figure ES2 using the present discounted value of lost value added and average annual job losses from 2016 to 2040. The largest losses occur in North Carolina with a cumulative loss in value added of over $106 billion and annual average job losses of more than 37 thousand. The next largest losses occur in Virginia with over $50 billion in lost value added and more than 20 thousand lost jobs per year. Five other states – Colorado, Nevada, Oregon, Pennsylvania, and Utah – incur losses exceeding $25

billion in value added and 9 thousand jobs per year from 2016 to 2040 associated with the economic burdens associated with RPS policies.

RPS policies, however, generate benefits by reducing carbon dioxide emissions. These savings, however, come at a relatively high price with the avoided cost of carbon of between $234 and $38 per ton in 2016 and between $136 and $30 per ton in 2040. An emissions weighted average of CO2 abatement costs across all states is $78 in 2016 and $62 dollars per ton in 2040.

Table ES5: Impact of RPS Policies on Employment by State

	CHANGE IN NUMBER OF JOBS					
State	2016	2020	2025	2030	2035	2040
Colorado	-8,060	-11,619	-12,445	-11,823	-10,779	-9,516
Delaware	-2,705	-3,845	-3,970	-3,536	-2,846	-2,272
North Carolina	-17,821	-43,277	-44,093	-39,107	-34,289	-30,345
New Mexico	-743	-3,483	-3,060	-2,724	-2,333	-1,921
Nevada	-11,827	-12,540	-11,868	-10,813	-9,037	-7,237
Oregon	-12,309	-13,459	-13,547	-16,428	-19,422	-21,637
Pennsylvania	-7,781	-9,712	-11,396	-10,726	-10,046	-9,255
Rhode Island	-4,003	-6,023	-5,496	-5,137	-4,771	-4,339
South Carolina	-561	-1,331	-3,084	-2,794	-2,617	-2,480
Utah	-1,912	-7,137	-10,517	-11,153	-10,077	-8,916
Virginia	-13,182	-18,779	-24,060	-23,144	-20,399	-18,241
Wisconsin	-9,121	-9,862	-9,193	-8,447	-7,701	-6,957
Total	-90,026	-141,066	-152,727	-145,830	-134,318	-123,116

Figure ES2: Cumulative Economic Impacts of RPS

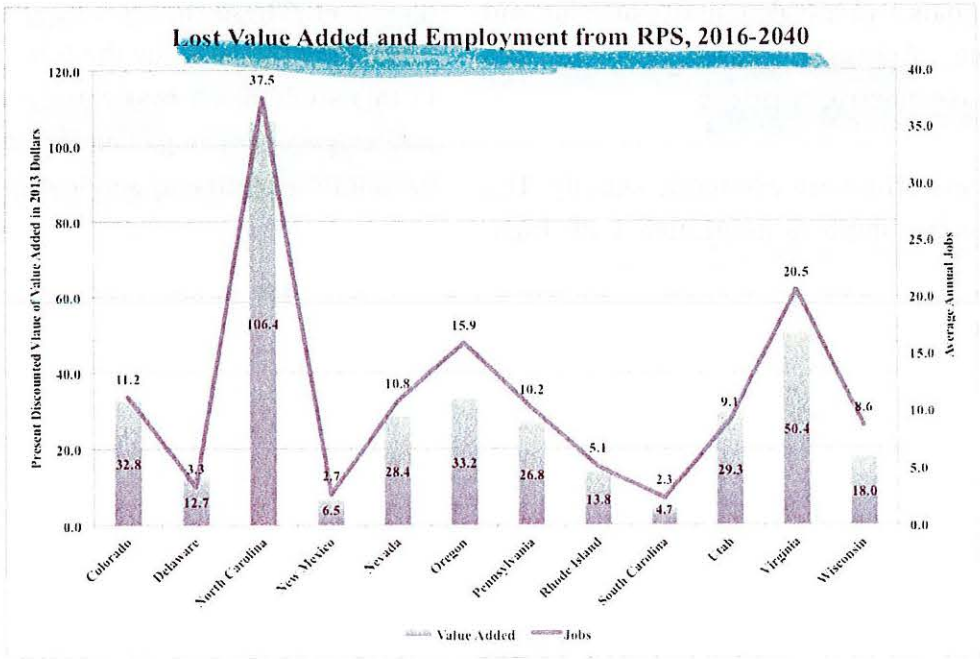


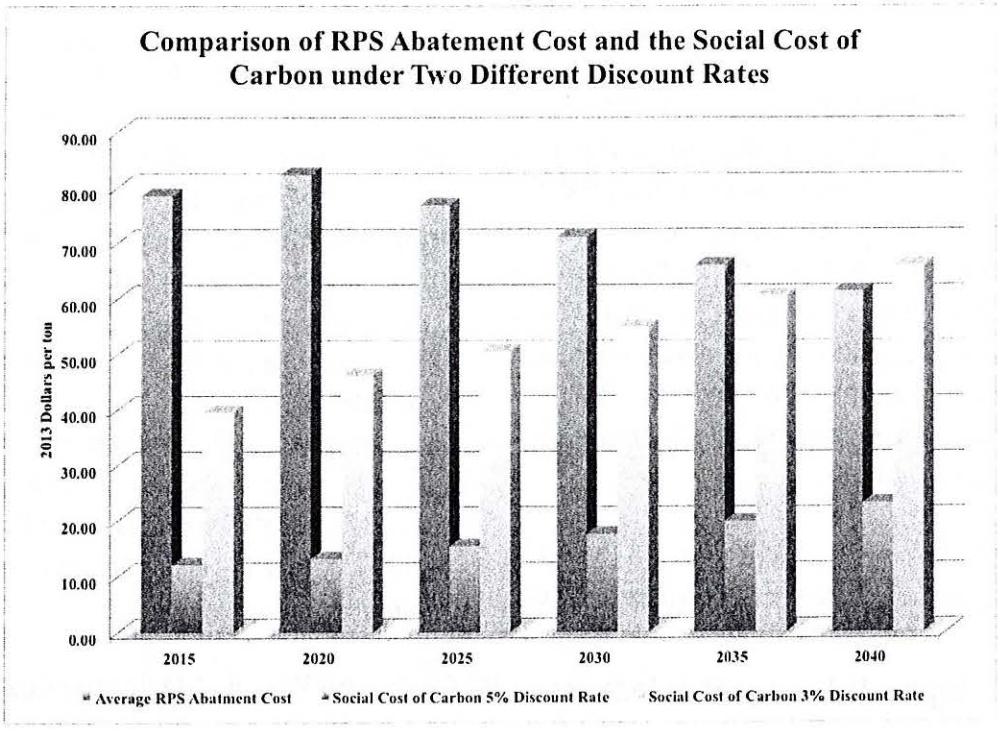
Table ES6: Costs of CO2 Reductions using RPS

	2013 DOLLARS PER TON					
State	2016	2020	2025	2030	2035	2040
Colorado	37.92	41.89	40.22	39.79	38.56	36.78
Delaware	105.74	88.83	77.70	68.22	60.16	53.31
North Carolina	199.03	183.27	162.12	147.65	134.22	122.56
New Mexico	45.92	39.80	37.09	35.02	32.46	30.59
Nevada	76.82	56.83	51.17	46.68	42.64	38.66
Oregon	45.89	49.06	45.93	47.68	47.40	46.51
Pennsylvania	44.05	44.21	42.37	41.43	40.50	39.41
Rhode Island	205.42	172.39	156.73	148.99	141.55	133.72
South Carolina	103.38	156.21	133.88	127.07	120.60	115.27
Utah	97.22	85.42	82.54	76.74	71.33	65.94
Virginia	234.91	203.97	181.92	161.71	147.34	136.03
Wisconsin	54.22	51.15	49.46	47.67	45.88	44.06

The social cost of carbon estimated by the US Environmental Protection Agency is well below these average avoided emissions costs, suggesting that Renewable Portfolio Standards are a relatively expensive strategy to cut greenhouse gas emissions (see Figure ES3). In summary, this study finds that the economic impacts of Renewable Portfolio Standards vary significantly across states depending upon the goals and the availability of solar and wind resources. Across all states, however, RPS policies increase electricity prices.

RPS investments stimulate economic activity. The negative economic impacts associated with higher electricity prices, however, offset the economic stimulus from these RPS investments. In many cases, especially for states that must utilize solar energy technology to meet RPS goals, the costs per ton of carbon is much higher than the social cost of carbon estimated by the US federal government. Avoided carbon costs are lower for wind power but still involve net losses in value added and employment. These findings suggest that Renewable Portfolio Standards for the twelve states examined in this study are a costly and inefficient means to reduce greenhouse gas emissions and they reduce economic growth and employment.

Figure ES3: RPS Abatement Costs and the Social Cost of Carbon

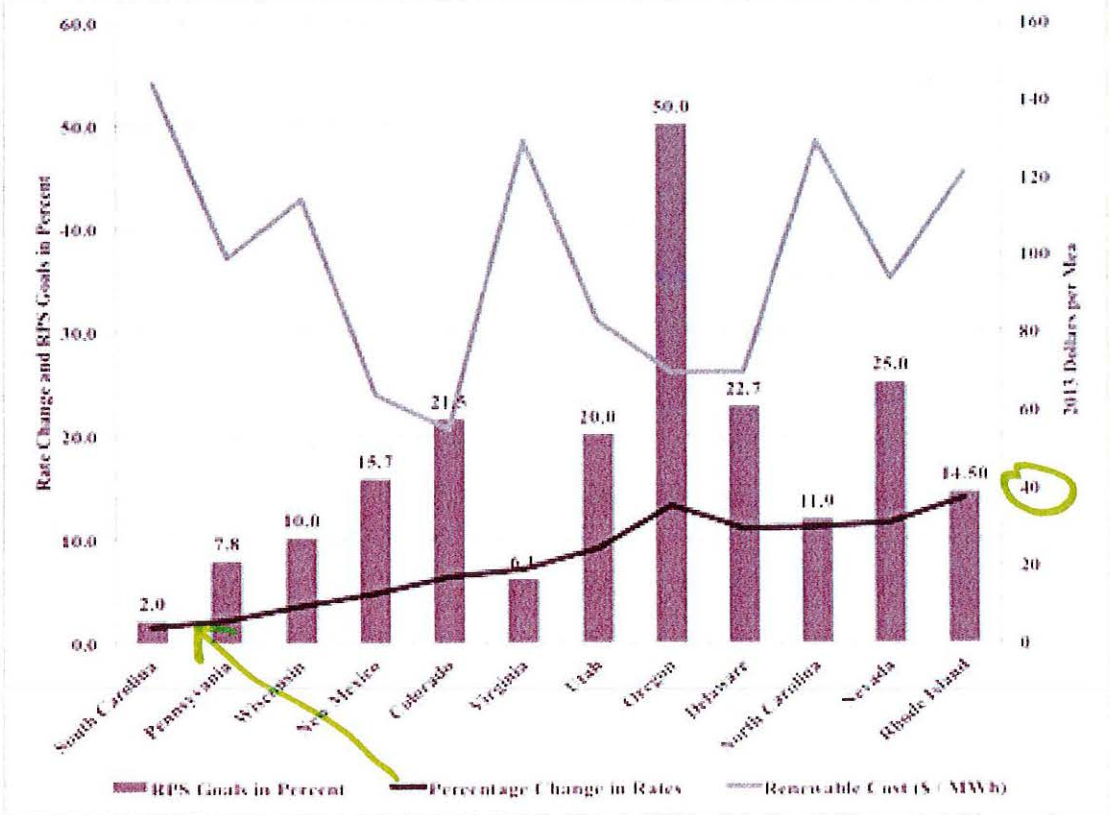


Conclusion

As the prior discussion reveals there are a number of factors that affect the burden of Renewable Energy Portfolio Standards on electricity customers in the form of higher electricity rates. Two of the more prominent factors in determining the size of the rate impacts from RPS policies, the RPS goals and the cost of renewable energy, are illustrated in Figure 3. The cost of renewable energy in Figure 3 (gray line) is a weighted average wind and solar costs for each state over the entire forecast period, 2016 to 2040. The percentage change in electricity rates for reach state are also plotted in Figure 3.

As the Figure 3 illustrates, the higher the RPS goal, the greater the impact of RPS on electricity rate with three notable exceptions: Virginia, North Carolina, and Rhode Island. For these three states, RPS goals are low relative to the targets adopted by other states in the sample but the cost of renewable energy but the cost of renewable energy is quite high, primarily given a reliance on new solar capacity to meet the RPS goals and relatively low solar capacity utilization rates for those states, both of which drive up the levelized cost of solar. Conversely there are other states where RPS goals are relatively high but electricity rate increases relatively modest, such as Colorado, primarily due to relatively lower renewable energy costs due to high efficiency and a greater emphasis using lower cost wind power. The economic burdens of RPS policies, therefore, varies considerably by state based upon solar and wind capacity availability and utilization.

Figure 3: Average Rate Increases, RPS Goals, and Renewable Energy Costs



The economic merits of RPS policies can be evaluated on two margins. The first compares the marginal abatement cost of carbon emissions using RPS policies to the social cost of carbon. At discount rates of 3 and 5 percent, the average cost of cutting greenhouse gas emissions across all 12 states is above the social cost of carbon through at least 2035. This suggests that RPS policies are premature, imposing a deadweight loss on society from their early implementation. Even from a global environmental and economic perspective, RPS policies at least for the 12 states examined in this study, which is probably a representative cross section of the nearly 30 states adopted RPS policies, are inefficient.

These inefficiencies are compounded by the losses in value added and employment incurred by higher electricity rates. Proponents of RPS policies often cite the employment opportunities created by building and operating wind and solar energy facilities. A careful analysis, which balances these two opposing forces, reveals that lost economic growth and employment from higher electricity prices are greater than the gains economies receive from renewable energy development.

If RPS goals are pushed upward in future years, the problems with RPS policies identified in this study, which heretofore have been largely hidden by average cost pricing of electricity by state public utility commissions, will become more evident.

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Appendix A: Econometric Results for Alternative Demand Models

Table A1: Electricity Demand First Difference Model Parameter Estimates by State

STATE	ESTIMATES	LOG REAL PRICE	LOG GSP
Colorado	Estimate	-0.161	0.682
	t-Statistic	-2.677	11.640
	P-Value	[.011]	[.000]
Delaware	Estimate	-0.219	0.378
	t-Statistic	-3.334	3.040
	P-Value	[.002]	[.004]
North Carolina	Estimate	-0.222	0.610
	t-Statistic	-2.706	6.007
	P-Value	[.010]	[.000]
New Mexico	Estimate	-0.350	0.421
	t-Statistic	-2.806	3.603
	P-Value	[.008]	[.001]
Nevada	Estimate	-0.217	0.673
	t-Statistic	-3.203	8.735
	P-Value	[.003]	[.000]
Oregon	Estimate	-0.323	0.584
	t-Statistic	-4.133	5.903
	P-Value	[.000]	[.000]
Pennsylvania	Estimate	-0.204	0.519
	t-Statistic	-3.373	4.512
	P-Value	[.002]	[.000]
Rhode Island	Estimate	-0.118	0.363
	t-Statistic	-2.934	3.661
	P-Value	[.005]	[.001]
South Carolina	Estimate	-0.259	0.783
	t-Statistic	-3.532	8.175
	P-Value	[.001]	[.000]
Utah	Estimate	-0.145	0.752
	t-Statistic	-2.100	11.473
	P-Value	[.042]	[.000]
Virginia	Estimate	-0.188	0.652
	t-Statistic	-3.362	7.937
	P-Value	[.002]	[.000]
Wisconsin	Estimate	-0.302	0.720
	t-Statistic	-3.795	7.415
	P-Value	[.000]	[.000]

Table A2: Elasticities of Electricity Demand for First Difference Model

STATE	OWN PRICE ELASTICITY	GROSS STATE PRODUCT ELASTICITY
Colorado	-0.161	0.682
Delaware	-0.219	0.378
North Carolina	-0.222	0.610
New Mexico	-0.350	0.421
Nevada	-0.217	0.673
Oregon	-0.323	0.584
Pennsylvania	-0.204	0.519
Rhode Island	-0.118	0.363
South Carolina	-0.259	0.783
Utah	-0.145	0.752
Virginia	-0.188	0.652
Wisconsin	-0.302	0.720
Average	-0.226	0.595

Table A3: Panel Data Estimates for Electricity Demand

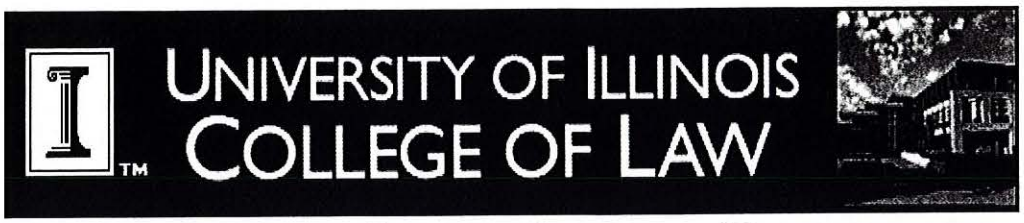
	CONSTANT	LOG REAL PRICE	LOG GSP
Pooled OLS*			
Estimate	0.0118	-0.2011	0.4329
t-Statistic	5.3474	-10.2083	10.6906
P-Value	[.000]	[.000]	[.000]
Fixed Effects			
Estimate		-0.1943	0.4008
t-Statistic		-9.9058	9.7130
P-Value		[.000]	[.000]
Random Effects			
Estimate	0.0124	-0.1983	0.4197
t-Statistic	4.9162	-10.1332	10.3339
P-Value	[.000]	[.000]	[.000]

Appendix B: Comparison of RPS Impacts

	% CHANGE IN PRICES		% IN VALUE ADDED		% CHANGE IN JOBS	
	HOG	REF	HOG	REF	HOG	REF
Colorado						
2016	6.12	5.78	-1,442	-1,354	-8,060	-7,507
2020	8.23	7.10	-1,996	-1,703	-11,619	-9,774
2025	7.69	6.23	-1,992	-1,612	-12,445	-10,048
2030	7.32	5.89	-1,895	-1,520	-11,823	-9,458
2035	6.69	5.14	-1,730	-1,323	-10,779	-8,214
2040	5.93	4.10	-1,530	-1,052	-9,516	-6,501
Delaware						
2016	11.02	10.20	-603	-556	-2,705	-2,479
2020	14.50	11.89	-812	-663	-3,845	-3,108
2025	14.99	11.46	-839	-635	-3,970	-2,953
2030	12.50	9.27	-715	-528	-3,536	-2,588
2035	10.14	6.78	-578	-384	-2,846	-1,871
2040	8.20	4.23	-466	-238	-2,272	-1,143
North Carolina						
2016	10.04	9.50	-3,899	-3,641	-17,821	-16,103
2020	16.06	13.77	-7,145	-6,060	-43,277	-36,048
2025	14.12	11.46	-6,664	-5,399	-44,093	-35,644
2030	12.55	10.08	-5,918	-4,740	-39,107	-31,227
2035	11.03	8.28	-5,196	-3,887	-34,289	-25,541
2040	9.79	6.22	-4,606	-2,908	-30,345	-19,009
New Mexico						
2016	6.18	5.71	-239	-208	-743	-500
2020	6.77	5.29	-444	-347	-3,483	-2,719
2025	5.95	4.13	-390	-271	-3,060	-2,122
2030	5.30	3.60	-348	-237	-2,724	-1,853
2035	4.54	2.82	-298	-185	-2,333	-1,450
2040	3.92	1.88	-251	-117	-1,921	-874
Nevada						
2016	14.77	13.86	-1,711	-1,601	-11,827	-11,064
2020	15.60	13.08	-1,792	-1,499	-12,540	-10,484
2025	15.14	11.48	-1,715	-1,285	-11,868	-8,803

2030	13.28	9.82	-1,534	-1,124	-10,813	-7,869
2035	11.21	7.69	-1,287	-873	-9,037	-6,071
2040	9.12	5.26	-1,038	-585	-7,237	-4,014
Oregon						
2016	9.41	9.08	-1,451	-1,399	-12,309	-11,866
2020	10.00	9.08	-1,571	-1,427	-13,459	-12,226
2025	11.09	9.32	-1,636	-1,366	-13,547	-11,236
2030	14.13	11.55	-2,022	-1,617	-16,428	-12,964
2035	16.42	12.70	-2,374	-1,789	-19,422	-14,407
2040	18.13	12.81	-2,636	-1,800	-21,637	-14,482
Pennsylvania						
2016	2.02	2.01	-1,142	-1,140	-7,138	-7,121
2020	2.39	2.24	-1,385	-1,287	-8,827	-8,158
2025	2.34	2.10	-1,508	-1,351	-10,458	-9,366
2030	2.20	1.99	-1,412	-1,274	-9,784	-8,812
2035	2.04	1.79	-1,308	-1,146	-9,046	-7,913
2040	1.86	1.52	-1,187	-966	-8,194	-6,660
Rhode Island						
2016	12.60	12.37	-579	-568	-3,649	-3,574
2020	16.47	14.10	-805	-689	-5,423	-4,651
2025	14.75	11.38	-718	-554	-4,831	-3,720
2030	13.59	11.08	-661	-537	-4,442	-3,600
2035	12.43	9.59	-604	-465	-4,059	-3,116
2040	11.04	7.34	-536	-355	-3,598	-2,377
South Carolina						
2016	2.40	2.39	-312	-312	-2,063	-2,057
2020	2.94	2.67	-330	-288	-1,668	-1,293
2025	3.75	3.23	-435	-346	-2,325	-1,534
2030	3.14	2.62	-485	-400	-4,073	-3,318
2035	2.54	1.92	-389	-286	-3,232	-2,321
2040	2.05	1.14	-309	-160	-2,522	-1,217
Utah						
2016	4.81	4.79	-818	-815	-4,745	-4,728
2020	8.28	7.68	-1,147	-1,046	-4,049	-3,471
2025	11.19	9.78	-1,618	-1,382	-6,683	-5,331
2030	9.97	8.57	-1,644	-1,408	-9,126	-7,772

2035	8.64	7.14	-1,421	-1,168	-7,854	-6,402
2040	7.28	5.47	-1,192	-888	-6,551	-4,807
Virginia						
2016	4.95	4.94	-1,601	-1,599	-10,800	-10,784
2020	6.96	6.24	-2,241	-1,982	-15,040	-13,146
2025	8.52	7.28	-2,769	-2,322	-18,731	-15,444
2030	7.32	6.23	-2,608	-2,212	-19,042	-16,121
2035	6.22	4.96	-2,213	-1,758	-16,133	-12,773
2040	5.38	3.61	-1,906	-1,271	-13,873	-9,197
Wisconsin						
2016	4.13	4.13	-1,014	-1,014	-8,694	-8,699
2020	4.03	3.91	-1,048	-1,017	-9,257	-8,992
2025	3.73	3.52	-966	-912	-8,533	-8,052
2030	3.41	3.18	-881	-821	-7,764	-7,232
2035	3.07	2.80	-790	-722	-6,958	-6,348
2040	2.74	2.41	-703	-617	-6,176	-5,414
HOG = EIA High Oil and Gas Scenario						
REF = EIA Reference Case Scenario						



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Green Jobs Myths

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Abstract

A rapidly growing literature promises that a massive program of government mandates, subsidies, and forced technological interventions will reward the nation with an economy brimming with "green jobs." Not only will these jobs improve the environment, but they will be high paying, interesting, and provide collective rights. This literature is built on mythologies about economics, forecasting, and technology.

Myth: Everyone understands what a "green job" is.

Reality: No standard definition of a "green job" exists.

Myth: Creating green jobs will boost productive employment.

Reality: Green jobs estimates include huge numbers of clerical, bureaucratic, and administrative positions that do not produce goods and services for consumption.

Myth: Green jobs forecasts are reliable.

Reality: The green jobs studies made estimates using poor economic models based on dubious assumptions.

Myth: Green jobs promote employment growth.

Reality: By promoting more jobs instead of more productivity, the green jobs described in the literature encourage low-paying jobs in less desirable conditions. Economic growth cannot be ordered by Congress or by the United Nations. Government interference – such as restricting successful technologies in favor of speculative technologies favored by special interests – will generate stagnation.

Myth: The world economy can be remade by reducing trade and relying on local production and reduced consumption without dramatically decreasing our standard of living.

Reality: History shows that nations cannot produce everything their citizens need or

---

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desire. People and firms have talents that allow specialization that make goods and services ever more efficient and lower-cost, thereby enriching society.

Myth: Government mandates are a substitute for free markets.

Reality: Companies react more swiftly and efficiently to the demands of their customers and markets, than to cumbersome government mandates.

Myth: Imposing technological progress by regulation is desirable.

Reality: Some technologies preferred by the green jobs studies are not capable of efficiently reaching the scale necessary to meet today's demands and could be counterproductive to environmental quality.

In this Article, we survey the green jobs literature, analyze its assumptions, and show how the special interest groups promoting the idea of green jobs have embedded dubious assumptions and techniques within their analyses. Before undertaking efforts to restructure and possibly impoverish our society, careful analysis and informed public debate about these assumptions and prescriptions are necessary.

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There is some overlap – every report thinks weatherizing public buildings is a good idea, for example. If there are unemployed people, why not put them to work replacing windows in public schools? There are undoubtedly less productive uses of public funds – such as the classical Keynesian suggestion of having one group dig holes and another fill the holes in[97] – but that is hardly a positive recommendation. The question is not whether weatherization is a good thing generally but whether the weatherization that occurs only when subsidized is a good thing. Without a clearer explanation of the theory of market failure underlying the proposals, even these areas of overlap are questionable.

B. What counts as a "job"

The second major problem with the green jobs literature is that it consistently counts jobs that do not produce final outputs as a benefit of spending programs. These jobs should be counted as a cost. For example, the Mayors report includes as green jobs those jobs involved in "government administration of environmental programs, and supporting jobs in the engineering, legal, research and consulting fields.[98] The UNEP report also includes such jobs in its definition.[99] Another estimate of green jobs, by Management Information Services, the primary consultant on the ASES report, found that the single biggest increase were secretarial positions; next were management analysts; then bookkeepers, followed by janitors. Most dramatically, Management Information Services estimated that there were fewer environmental scientists than any of the other jobs just listed.[100]

The impact of including non-productive employees within the definition of green jobs can be seen in the Mayors' list of the top 10 metropolitan areas for current green jobs, which is led by New York City (25,021) and Washington, D.C. (24,287).[101] As there is little manufacturing or corn or soy farming in such locations, this suggests that most of the green jobs in both locations are likely to be in the overhead categories. Indeed, the report emphasizes that "engineering, legal, research and consulting positions play a major role in the Green Economy, as they account for 56% of current Green Jobs. They have also grown faster than direct Green Jobs since 1990, expanding 52%, compared with 38% growth in direct jobs."[102] Note that this lumps engineers and scientists inventing new technologies with lawyers and accountants devising ways to obtain government subsidies, lobbying, or engaging in other forms of unproductive rent-seeking.

The Mayors report makes a "conservative" estimate of one new indirect job for every two direct jobs, conceding that "we do not expect that each marginal electricity generating job will require another environmental lawyer … and not every retrofitting position will require commensurate growth in research or consulting."[103] That it could be seen as a positive benefit if policies required more lawyers or consultants demonstrates the fundamental incoherence of green job definitions. This problem is widespread in the green jobs literature, with the focus

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[97] John Stossel, *Jobs Plan: Dig Holes, Fill Them,* FORT WAYNE JOURNAL GAZETTE (Feb. 22, 2009) available at http://www.jg.net/apps/pbcs.dll/article?AID=/20090222/EDIT05/302229929/1021/EDIT

[98] MAYORS, *supra* note 1, at 5.

[99] UNEP, *supra* note 5. *See supra* note 66 and accompanying text.

[100] Roger H. Bezdek, et al., *Environmental Protection, the Economy, and Jobs: National and Regional Analyses*, 86 J. ENVTL. MGMT. 53, 66 (2008). Bezdek and his associates are primary authors of the ASES report.

[101] MAYORS, *supra* note 1, at 5.

[102] *Id.* at 16.

[103] *Id.* UNEP also notes a high range of indirect jobs from energy efficiency measures, finding estimates from 90percent to 66percent indirect job creation. UNEP, *supra* note 5, at 136-137.

al.'s research.[460] Specifically their results indicate that "biofuels from switchgrass, if grown on U.S. corn lands, increase emissions by 50%." If switchgrass is grown on CRP land, its GHG impacts would be worse.[461]

It is also claimed that using crop wastes would increase the effective yield of biofuel production, and therefore mitigate some negative environmental impacts of crop-based biofuels. However, this argument overlooks the fact that so-called crop "wastes" are often utilized to conserve both soil and moisture (that is, water) on many farms, and they are frequently cycled back to the soil, in order to replenish its nutrient content. That is, crop waste is frequently a misnomer.

From this brief survey of the biofuels debate we can draw two important conclusions. First, biofuels are not necessarily environmentally preferable to fossil fuels, particularly in their present forms. Requiring billions of dollars of investment in biofuels infrastructure and production before we know enough to choose the right technologies will require government planners to have a greater degree of insight into future technological developments than is humanly possible. Policies that require large, early bets on specific technologies are less desirable than ones that spur innovation (e.g. prize competitions). Second, the record of ethanol's development thus far is not encouraging as it reveals an extraordinary degree of rent seeking from the start.[462]

C. Electricity Generation

The green jobs literature contains numerous calls for massive shifts in power generation. As we described earlier, the literature is selectively optimistic about favored power generation technologies (e.g. wind, solar, biomass) and selectively pessimistic about disfavored ones (e.g. coal and nuclear). As with biofuels, the literature barely acknowledges the serious problems facing its preferred technologies. In this section we briefly survey the literature on three power generation technologies: wind, solar, and nuclear, and show how the green jobs literature fails to adequately address the technical issues involved with each.

1. Wind power

Partly because of subsidies, the contribution of wind to *renewable electricity* generation is expected to increase from 7 percent in 2006 to 16 percent in 2020 and 20 percent in 2030.[463] However, despite being heavily subsidized, its total contribution to "energy security" is slight, and unlikely to rise to a significant level over the foreseeable future. Wind contributes less than 0.6 percent of total U.S. energy production, based on federal statistics from January through

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[460] Searchinger et al, *supra* note 81.

[461] *Id.* at 1238, 1240.

[462] *See, e.g.*, Jonathan H. Adler, *Rent Seeking Behind the Green Curtain,* 19 Regulation No. 4, at 26 (1996) (describing rent-seeking in 1990s ethanol programs); Jonathan H. Adler, *Clean Politics, Dirty Profits: Rent-Seeking Behind the Green Curtain*, in POLITICAL ENVIRONMENTALISM: GOING BEHIND THE GREEN CURTAIN 1, 2 (Terry L. Anderson ed., 2000) (same); Jonathan H. Adler, *Clean Fuels, Dirty Air* in ENVIRONMENTAL POLITICS: PUBLIC COSTS, PRIVATE REWARDS (Michael S. Greve & Fred L. Smith, Jr. eds., 1992) at 19 (clean fuels program as ethanol subsidy).

[463] Energy Info. Admin., *supra* note 374, at tbl.17. This report, which is issued each year, provides the Departmernt of Energy's best estimate of future supply and demand for the energy sector, based on its judgments about economic growth, labor supply, technological change, and so forth. It "generally assumes that current laws and regulations affecting the energy sector remain unchanged" throughout the projection period (2030 for this document). *See id.* at 2. In this respect, it differs from the Department of Energy study cited previously, DOE, 20% WIND, *supra* note 112, which was an anlysis of the consequences of meeting a target for wind energy to increase to 20 percent its contribution to total electricity generation.

September 2008.[464] According to the DOE's latest projections, it will account for less than 0.9 percent of total *energy* consumption in 2020 and 1.1 percent in 2030.[465] Wind plays an increasing role in electricity generation, but electricity is only a fraction of *energy* production in the United States which is why wind is such a tiny share of total energy produced.

Wind's contribution to energy security is diminished by its ability to deliver electricity only intermittently. Wind turbines cannot produce when wind speed is either too low or too high, or if the turbine blades or other critical components are iced up. In fact, the Electric Reliability Council of Texas (ERCOT) assumes, based on historical experience, that only 8.7 percent of wind power's installed capacity would be available during summer peak hours, one of the times when electricity is most needed.[466] Because of this lack of reliability and the fact that wind energy cannot be stored to alleviate the reliability/availability problems, electricity generated by wind must be backed up by more reliable electric generation sources, which effectively increases the cost of wind energy substantially.[467] So while wind is free, even if one ignores construction, installation and transmission costs (see below), wind turbines by themselves cannot satisfy consumers' need for reliability and continuous, round-the-clock availability.

Yet another problem associated with wind energy is that the most favorable locations for wind power are often not accessible by the existing electrical grid,[468] a problem recognized by President Obama:

> One of, I think, the most important infrastructure projects that we need is a whole new electricity grid. Because if we're going to be serious about renewable energy, I want to be able to get wind power from North Dakota to population centers, like Chicago. And we're going to have to have a smart grid if we want to use plug-in hybrids then we want to be able to have ordinary consumers sell back the electricity that's generated from those car batteries, back into the grid. That can create 5 million new jobs, just in new energy.[469]

Additional electrical transmission lines are also key to entrepreneur T. Boone Pickens'

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[464] Energy Info. Admin, U.S. Dep't of Energy, REPORT NO. DOE/EIA-0035(2008/12), MONTHLY ENERGY REVIEW: DECEMBER 2008 (2008), *available at* http://tonto.eia.doe.gov/FTPROOT/multifuel/mer/00350812.pdf.

[465] Energy Info. Admin., *supra* note 374, at tbls.1 & 17.

[466] ERCOT, Report on the Capacity, Demand, and Reserves in the ERCOT Region (May 2008). *See also* Drew Thornley, TEX. PUB. POLICY FOUND., TEXAS WIND ENERGY: PAST, PRESENT, AND FUTURE 3 (2008), *available at* http://www.texaspolicy.com/pdf/2008-09-RR10-WindEnergy-dt-new.pdf. A study of small (10 kW or less) wind projects funded by the Massachusetts Technology Collaborative (MTC), which admininisters the state's Renewable Energy Trust and has has been funding small wind systems through the Small Renewables Initiative since 2005 indicates that on average such facilities are generating only 6.6percent of the energy that they could have had they been operating at full capacity for all the time during the year. Mass. Tech. Collaborative, Small Wind Progress Briefing Summary (June, 12 2008), *available at* http://www.masstech.org/RenewableEnergy/sm_renew/Progress%20Briefing%20Summary%20061208.pdf.

[467] This is more than a problem of people shivering in the cold or sweltering in the summer when the power goes off. Hospitals must have constant, reliable power. People who use electric-powered oxygen machines or ventilators require reliable power. "Britain's wind farms have stopped working during the cold snap due to lack of wind, it has emerged, as scientists claimed half the world's energy could soon be from renewables. The Met Office said there has been an unusually long period of high pressure across the UK for the last couple of weeks, causing the cold snap and very little wind". Louise Gray, *Wind Energy Supply Dips During Cold Snap*, TELEGRAPH, Jan 10, 2009, at , *available at* http://www.telegraph.co.uk/earth/energy/windpower/4208940/Wind-energy-supply-dips-during-cold-snap.html.

[468] Matthew Wald, *The Energy Challenge: Wind Energy Bumps Into Power Grid's Limits*, N.Y. TIMES, Aug. 29, 2008, at A1, *available at* http://www.nytimes.com/2008/08/27/business/27grid.html?_r=1&pagewanted=print.

[469] Rachel Maddow Show, *Barack Obama Talks to Rachel Maddow 5 Days Before Election* (MSNBC television broadcast Oct. 30, 2008), *available at* http://www.msnbc.msn.com/id/27464980/.

dream of turning Texas into "the Saudi Arabia of wind."[470] According to the Department of Energy, it would require an additional 12,000 miles of high-voltage transmission lines costing $60 billion (undiscounted) to increase the contribution of wind to national electricity production to 20 percent by 2030.[471]

Wind power thus faces two key problems in increasing its share of electricity generation. First, it is unavailable at some times of peak power demand and so requires costly backup capacity. Second, current infrastructure is inadequate to support a rapid expansion of wind energy generation. Further, as we noted earlier, existing efforts to increase wind generation capacity have run into major hurdles with regulatory laws and NIMBY efforts.[472] Despite these widely known problems, which are never discussed in depth in the green jobs literature, green jobs policy proposals propose enormous increases in wind capacity without detailing a strategy for how these problems will be solved.[473] Green jobs proponents thus exhibit extensive technological optimism with respect to wind's prospects.

2. Solar power

Solar power is a second favored technology in the green jobs literature. As with wind energy, substantial – and largely unacknowledged – hurdles to a significant expansion exist in solar electric generation. First, despite decades of effort and high subsidies,[474] the current contribution of solar to meeting the nation's energy needs is only 0.05 percent.[475] Most of this (95 percent) is from solar thermal and hot water production rather than electricity generation. The remainder is from solar PV.[476] By 2030, the contribution of solar to energy consumption is projected by the EIA to rise to just 0.13 percent, with only half of that from solar PV.[477]

Although solar PV is projected to grow faster than other forms of solar energy, current technical analyses suggest that the costs of current solar PV installations so far exceed their benefits. Indeed, no reasonable valuation of the benefits of greenhouse gas reductions would result in positive estimates for the total net benefits from solar PV.[478] A comprehensive analysis of this issue by Borenstein accounts for the fact that in California and in most U.S. locations, solar electric power is produced disproportionately during summer peak demand hours, that is, at times when the value of electricity is high. Second, Borenstein considers that energy losses from electricity transmission and distribution from PV sources is low because it is primarily generated on-site. Despite taking into consideration these factors that favor solar technology, Borenstein

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[470] *Pickens Set on Turning Texas into Saudi Arabia of Wind*, ENVTL. LEADER, July 23, 2008, http://www.environmentalleader.com/2008/07/23/pickens-set-on-turning-texas-into-saudi-arabia-of-wind/; see also *Pickens Plan: The Plan*, http://www.pickensplan.com/theplan/ (last visited Feb. 22, 2009) (discussing the "Pickens Plan").

[471] DOE, 20% WIND, *supra* note 112, at 95, 98.

[472] *See supra* note 142.

[473] *See supra* notes 113-119 and accompanying text.

[474] *See supra* tbl.1.

[475] ENERGY INFO. ADMIN., *supra* note 374, at tbls.2 & 17.

[476] *Id.* at tbl.17.

[477] *Id.* at tbls.1 & 17.

[478] Severin Borenstein, *The Market Value and Cost of Solar Photovoltaic Electricity Production* (Ctr. for the Study of Energy Mkts., Working Paper, Paper No. WP 176, 2008) [hereinafter Borenstein]; Severin Borenstein, Response to Critiques of "The Market Value and Cost of Solar Photovoltaic Electricity Production," http://faculty.haas.berkeley.edu/borenste/SolarResponse.pdf (last visited Jan. 1, 2009) [hereinafter Borenstein, Response].

underway to enhance research in nuclear energy and to streamline the process to get the approvals for new plants, as they take years to construct.[499]

In 2003, a group of experts at MIT issued a major report on addressing greenhouse gases and urged that nuclear power generation should be taken seriously as an option.[500] The MIT Study concluded that, for the foreseeable future, only four major "realistic options" existed for reducing carbon dioxide emissions in electricity production, including nuclear. Crucially, the authors state that it is not possible to know, looking decades ahead, which strategy is best; rather, "*it is likely that we shall need all of these options and accordingly it would be a mistake at this time to exclude any of these four options from an overall carbon emissions management strategy.*"[501] The MIT Study discusses, in depth, the key issues of cost, safety, proliferation, and waste. None of the issues involved are simple.

What the study illustrates is that technology consistently advances and that there are strategies to deal with real problems inherent in any complex process. The best technologists cannot predict what technology will dominate years from now, as they know technology changes. A policy that eliminates major possible options, assuming that the technology we know today is what will exist in decades to come, will have us locked into costly, economically destructive policies.

This is not to say that there are not serious technological issues that must be addressed if nuclear power use is to be expanded. The crucial point is that the failure of the green jobs and green power advocates to deal in a straightforward manner with alternatives such as nuclear power indicates a bias. The prospects for technological change should be treated consistently across technologies.

V. Conclusion

The costs of the green jobs programs proposed by the interest groups that authored these reports and others with less fully developed proposals are staggering. Already the federal government has committed $62 billion in direct spending and $20 billion in tax incentives to green jobs programs in the recently passed stimulus bill.[502] Even the proponents are reluctant to give a firm price tag. For example, the UNEP report concludes that:

> [n]o one knows how much a full-fledged green transition will cost, but needed investment will likely be in the hundreds of billions, and possibly trillions, of dollars. It is still not clear at this point where such high volumes of investment capital will come from, or how it can be generated in a relatively short period of time.[503]

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[499] Nat'l Research Council, REVIEW OF DOE'S NUCLEAR ENERGY RESEARCH AND DEVELOPMENT PROGRAM (2008), *available at* http://www.ne.doe.gov/pdfFiles/rpt_NationalAcademiesReviewDOEsNE_RDProgram_2008.pdf. The report notes that the federal nuclear energy research budget "had collapsed to $2.2 million" in FY 1998. *Id.* at 9. It has risen rapidly since, allowing further advances in nuclear research.

[500] Deutch & Moniz et al., *supra* note 488.

[501] *Id.*, at 1 (emphasis in original).

[502] *See* Kate Sheppard, *A Green Tinged Stimulus Bill,* GRIST (Feb. 12, 2009) available at http://gristmill.grist.org/story/2009/2/12/83439/6486.

[503] UNEP, *supra* note 5, at 306.

The scale of social change that could be imposed is equally immense. To take just one example, the worldwide production of cement in 2007 was 2.77 billion metric tons.[504] Cement is ubiquitous in modern society. Anyone reading this article in a developed country can likely see cement from where he or she sits. Yet we are told that "[t]he cement industry will only become sustainable if the building industry finds completely new ways to create and use cement or eventually figures out how to replace it altogether."[505] And, as we have described in detail above, green jobs advocates propose equally dramatic shifts in energy production technologies, building practices, and food production. These calls for dramatic changes in every aspect of modern life are wrapped in a new package in the green jobs literature, promising not only a revolution in our relationship with the environment but to employ millions in high paying, satisfying jobs. Despite their new packaging, these calls for creating a new society through central planning are as old as human history. The failure of the twentieth century's utopian experiments suggests caution in undertaking such widespread transformations of society.

Unfortunately, the analysis provided in the green jobs literature is deeply flawed, resting on a series of myths about the economy, the environment, and technology. We have explored the problems in the green jobs analysis in depth; we now conclude by summarizing the mythologies of green jobs in seven myths about green jobs:

Myth 1: There is such a thing as a "green job." There is no coherent definition of a green job. Green jobs appear to be ones that pay well, are interesting to do, produce products that environmental groups prefer, and do so in a unionized workplace. Yet such criteria have little to do with the environmental impacts of the jobs. To build a coalition for a far reaching transformation of modern society, "green jobs" have become a mechanism to deliver something for every member of a real or imagined coalition to buy their support for a radical transformation of society.

Myth 2: Creating green jobs will boost productive employment. Green jobs estimates include huge numbers of clerical, bureaucratic, and administrative positions that do not produce goods and services for consumption. Simply hiring people to write and enforce regulations, fill out forms, and process paperwork is not a recipe for creating wealth. Much of the promised boost in green employment turns out to be in non-productive (but costly) positions that raise costs for consumers.

Myth 3: Green jobs forecasts are reliable. The forecasts for green employment optimistically predict an employment boom, which is welcome news. Unfortunately, the forecasts, which are sometimes amazingly detailed, are unreliable because they are based on questionable estimates by interest groups of tiny base numbers in employment, extrapolation of growth rates from those small base numbers, and a pervasive, biased, and highly selective optimism about which technologies will improve. Moreover, the estimates use a technique (input-output analysis) that is inappropriate to the conditions of technological change presumed by the green jobs literature itself. This yields seemingly precise estimates that give the illusion of scientific reliability to numbers that are simply the result of the assumptions made to begin the analysis.

Myth 4: Green jobs promote employment growth. Green jobs estimates promise greatly expanded (and pleasant and well-paid) employment. This promise is false. The green jobs model is built on promoting inefficient use of labor, favoring technologies because they employ large numbers rather than because they make use of labor efficiently. In a

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[504] U.S. Geological Survey, CEMENT STATISTICS (2008), available at http://minerals.usgs.gov/ds/2005/140/cement.pdf.

[505] UNEP, *supra* note 5, at 203.

competitive market, factors of production, including labor, earn a return based on productivity. By focusing on low labor productivity jobs, the green jobs literature dooms employees to low wages in a shrinking economy. Economic growth cannot be ordered by Congress or by the U.N. Interference in the economy by restricting successful technologies in favor of speculative technologies favored by special interests will generate stagnation.

Myth 5: The world economy can be remade based on local production and reduced consumption without dramatically decreasing human welfare. The green jobs literature rejects the benefits of trade, ignores opportunity costs, and fails to include consumer surplus in welfare calculations to promote its vision. This is a recipe for an economic disaster, not an ecotopia. The twentieth century saw many experiments in creating societies that did not engage in trade and did not value personal welfare. The economic and human disasters that resulted should have conclusively settled the question of whether nations can withdraw into autarky. The global integration of wind turbine production, for example, illustrates that even green technology is not immune from economic reality.

Myth 6: Mandates are a substitute for markets. Green jobs proponents assume that they can reorder society by mandating preferred technologies. But the responses to mandates are not the same as the responses to market incentives. There is powerful evidence that market incentives induce the resource conservation that green jobs advocates purport to desire. The cost of energy is a major incentive to redesign production processes and products to use less energy. People do not want energy; they want the benefits of energy. Those who can deliver more desired goods and services by reducing the energy cost of production will be rewarded. There is no little evidence that successful command and control regimes accomplishing conservation.

Myth 7: Wishing for technological progress is sufficient. The preferred technologies in the green jobs literature face significant problems in scaling up to the levels proposed. These problems are documented in readily available technical literatures, but resolutely ignored in the green jobs reports. At the same time, existing technologies that fail to meet the green jobs proponents political criteria are simply rejected out of hand. This selective technological optimism/pessimism is not a sufficient basis for remaking society to fit the dream of planners, politicians, patricians, or plutocrats who want others to live lives they think other people should be forced to lead.

To attempt to transform modern society on the scale proposed by even the most modest bits of the green jobs literature, such as the Conference of Mayors report, is an effort of staggering complexity and scale. To do so based on the combination of wishful thinking and bad economics embodied in the green jobs literature would be the height of irresponsibility. We have no doubt that there will be significant opportunities to develop new energy sources, new industries, and new jobs in the future. Just as has been true for all of human history thus far, we are equally confident that a market-based discovery process will do a far better job of developing those energy sources, industries, and jobs than could a series of mandates based on imperfect information.

If that is taken as working assumption, what practical guidelines can be extrapolated from such principles to assist governments in the determination of criteria for approving IWT license applications?

In this regard three emerging legal doctrines may be drawn upon for assistance. These have roots in common law and in international law. They appear to be highly relevant to how we might usefully think about how IWT proposals can be fairly evaluated and judged. One doctrine – the Precautionary Principle – has been applied in an administrative law context in Canada already. The other two – the Neighbour Principle and the Least Impactful Means Test – remain to be fully articulated as such in an administrative law context but their emerging shape can be nonetheless discerned from recent cases.

These three doctrines are "before the fact" tools in that they are used to prevent harm from occurring in the first place.

A fourth doctrine – the polluter pay principle – is an "after the fact" financial compensation tool that has long legal roots in all common law jurisdictions.

1. The Precautionary Principle

Imported into Canadian law via the Supreme Court case of Spraytech v. Hudson (Town) [2001] 2 S.C.R. 241 from international law where it was originally approved by Canada in The Bergen Declaration of 1990. Subsequently this doctrine has been embedded in several pieces of Canadian legislation including the Oceans Act, S.C. 1996, c. 31, Preamble (para.6); Canadian Environmental Protection Act, 1999, S.C. 1999, c. 33, s. 2(1)(a); Endangered Species Act, S.N.S. 1998, c. 11, ss. 2(1)(h) and 11(1).

It means: when scientific evidence concerning the harm potential of a given industrial activity leaves room for doubt, that activity should not be undertaken. Proposed mitigating measures are not an adequate response, because if you do not know the nature or degree of risk you cannot prepare for its eventuation.

Some doubt surrounds the standard of care required by this principle. E.g. how much harm could or should be reasonably foreseen if a risk eventuates? How big must the risk be to activate the principle? Currently this principle is being tested in Ontario's legal and quasi-legal systems as it may be applied to IWT licensing. Such testing is likely to go on for some time. A recurrent issue appears to be the extent to which the Precautionary Principle that may be

This means that they should be aware of not only the commercial and business interests of neighbours but also of their reasonable social expectations of privacy, freedom from nuisance and enjoyment of property. These are all "legitimate" interests.

It can be seen that all three doctrines above are allied to the Rawlsian concept of fairness as the recognition and reasonable accommodation of the legitimate interests claims and rights of others.

Indeed it is this very concept of fairness that has the potential to unite the three doctrines into a coherent jurisprudence of social and environmental stewardship.

4. The Polluter Pay Principle

This well established common law principle is evident from many Canadian cases including the Supreme Court case of St. Lawrence Cement Inc. v. Barrette [2008] SCC 64, and Smith v. Inco (2010) ONSC 3790 (CanLII). It is also enshrined in various forms of legislation.

It means that when an industrial operator is found to have caused loss to its neighbours it must compensate them for such loss regardless of whether there was negligence or not. This strict liability rule (a feature in many common law jurisdictions) has most recently been applied in a class action suit involving nickel contamination. The impact zone within which such losses will be considered varies from case to case.

Essentially the polluter pay principle is a generic way of describing a class of private civil remedies that includes nuisance, trespass and negligence. These are legal tools that are used in most cases after damage has been done except where injunctions and other interlocutory measures are used to stop harmful actions before they begin or while they are in progress. They really represent the failure of prevention.

Conclusion

A public health ethics analysis of how IWTs should be licensed and installed if the health of the few is to be balanced with, traded off or sacrificed for the health of the many, leads to the conclusion that the present methods of proposal evaluation need to be critically reviewed.

The only type of test that present methods would easily pass is "strong paternalism" – the argument that the State knows best. But this justification for public health measures enjoys little support in a free and democratic society.

With regard to the broader issue of governmental legitimacy and IWTs we are confronted with an even more profound problem. State actions that do not enjoy the active consent of the people – particularly of those whose health may be adversely affected by IWTs – are fundamentally suspect.

Administrative law systems which stray from the principles of natural justice held to underlie them are also suspect because such departures are in conflict with the Rule of Law.

Unfortunately we do not find ourselves in this situation as a result of any one remediable action or default on the part of government but rather as a result of a gradual erosion of our collective capacity to hold government accountable.

IWT licensing procedures in whatever jurisdiction are a bellwether of the fate of democracy itself and therefore should be closely examined against the criteria suggested in this article, and in particular against the criterion of procedural fairness and active consent advocated by Rawls.

Several tools present themselves as proactive means of addressing perceived threats to procedural fairness and active consent: the Precautionary Principle, the Least Impactful Means Test (supported by the more general jurisprudence of the Proportionality Test) and the Neighbour Principle (drawn from the more specific requirements of the Social Impact Zone Test).

Converted into criteria for evaluation of IWT license applications these principles and tests represent a formidable array of protections against arbitrary governmental action. That said, conversion into practical evaluative tools will require creative thinking and benign intent if we are to emerge with a more robust spine to our system of governance and administrative law.

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A Small Sample of Wind Turbine Setback Distances from Dwellings
County, State and National Laws

Jurisdiction	Setback in Feet
Netherlands	Distance required to ensure 40dB or less at structure
Umatilla County Oregon	10,560
Coconino Couty AZ[e,f,g]	10,560
Caratunk, ME [d]	7,920
Peru ME[c]	7,920
Victoria Australia	6,570
United Kingdom	6,570
New South Wales Australia	6,570
Fayette County PA	6,000
Mason County KY	5,280
Trempeleau County WI	5,280
Sumner ME	5,280
Germany[c]	4,900
Rumford ME	4,000
Vermillion County Wi[a]	3,600
Holland	3,300
Spain, Valencia	3,300
Halifax Nova Scotia	3,300
Australia (3 provences)	3,280
Riverside, CA	3,000
Claybanks Mi[a,c,f]	3,000
Laramie County Way	2,900
Town of Union WI[c]	2,650
Whitley County MI	2,640
Goodhue County MN[a]	2,640
Cape Vincent NY[c]	2,640
Alabama[a]	2,625
Quebec Canada	2,500
Wisconsin PUC[b]	1,800
Scientific recommendations	
National Research Council Recommendation	2,640
UK Noise Association	**5,280**
French Natl Academy of Medicine	4,925

[a] As a function of rotor diameter
[b] As a function of tower height
[c] Also includes a sound restriction in conjunction with setback
[d] measured from property line
[e] Consent and property value guarantee also req'd
[f] Property Value Guarantee also required
g Transponder activated lighting required

Wind Ordinance Debate: The 1,000-foot Set-Back Standard
(Are environmentalists underregulating themselves?)

By Tony Fleming -- January 23, 2012

Editor Note: *Environmentalists like regulation except when it comes to 'green' energy. This post asks: what is the growing acceptance of the thousand-foot voluntary ordinance based on?]*

In Indiana and elsewhere, many counties are falling all over themselves to adopt the so-called "1,000-foot voluntary industry setback" between large wind turbines and residences.[1] In some states, it has become part of "model" wind ordinances created by wind developers and energy agencies.

This buffer zone (who said these structures were *environmental*?) is starkly smaller than those mandated in several countries widely touted by industry proponents as wind "success" stories. In **Denmark**, for example, the setback is four times total turbine height (or about 2,000 feet for a large turbine), along with a built-in mechanism for compensating abutters for property-value losses.

In **Holland**, it is 1 km (3,280 ft). **Germany's** noise-based setback ranges up to a full mile (1.6 km). Dozens of jurisdictions scattered around the U.S. and Canada have also adopted larger setbacks, often in the ½- to 2-mile range from abutting residences. All of these larger setbacks are in line with what is recommended by many independent scientific bodies, medical authorities, and acoustical engineers.[2]

With so many localities adopting the much smaller 1,000-foot distance as a *de facto* setback, however—seemingly with little public discussion—a reasonable person would expect to find reams of scientific and legal information to back it up.

Conflicting Evidence

But despite a concerted and sustained research effort by myself and others, finding a straightforward explanation published by any government agency (or the wind industry) documenting the origin and technical rationale for such a small setback has proven *extraordinarily elusive*.

Instead, what one finds is a remarkably opaque policy-making process wherein any scientific studies reviewed or substantive deliberations that may have occurred are not readily evident from the sparse number of documents publicly available. This post is a progress report, summarizing my attempts to uncover the origin and basis of this setback.

Midwestern States

The first place I turned for an explanation is the Indiana Office of Energy Development (OED), the clearinghouse for state energy policy. The OED wind energy website contained no documents of the state's own making even mentioning things like "model wind ordinance" or "setbacks," but it did turn up copies of wind ordinances from fifteen Indiana counties. [3]

Nearly every one of these counties has adopted a 1,000-foot setback from occupied structures, but none provides any discussion, or even a hint of accompanying regulatory language, of why this distance was chosen. A further search turned up several in-state news reports that mentioned the term "voluntary industry setback," but they offered nothing about its origin.

Visits to the websites of energy-related agencies in other Midwestern states also shed no light on the origin of "1,000 feet," though it did appear in both the 2003 and 2007 versions of the **Wisconsin** Draft Model Wind Ordinance,[4] which was subsequently taken down from the Wisconsin Public Service Commission website.

One 2009 news article from Wisconsin offered some interesting insight, however: when questioned by wind farm neighbors affected by noise and shadow flicker about the 1,000-foot setback in use at that time, a spokeswoman from the Wisconsin Public Service Commission was quoted as saying: "We didn't come up with that number. It is not a PSC requirement."

That left local residents wondering, "if the PSC didn't come up with it, who did? And who decided it was safe?"

California

Since my efforts to find a state agency in the Midwest who could speak to the source of the 1,000-foot setback were not bearing fruit, I next looked to the state that is widely viewed as being the epicenter of all things renewable—**California**—which has had some three decades of experience with large wind turbines. There, the wind industry's preferred setback had for years been 1.1 to 1.5 times the height of the turbine including the blade, measured to the nearest property line and based on the fall zone of the tower.[5]

Variations on this theme persisted over the years, with setbacks ranging up to three-to-four times turbine height.

A study published in 2006 for the California Energy Commission summarized the history of setback requirements in the state and attempted to quantify setback distances for debris throw (that is, the radius

measured from the turbine base which could potentially be impacted by fragments of blades and other debris resulting from the breakup of a turbine in high winds).

This study looked solely at public safety resulting from debris throw, and did not attempt to examine noise or other setback issues. The authors came up with a setback distance somewhat less than 1,000 feet, while acknowledging that the result is contingent upon the assumptions made.

Using a slightly different set of assumptions, for example, physicist Terry Matilsky of Rutgers University presents a convincing mechanical analysis indicating that a 1,700-foot setback is needed to protect abutters from both debris and ice throw, a number mirrored by real-world debris-throw experience.

Interestingly, the California study reported (p. 13) that, of the several counties which had existing fixed setbacks of 1,000 feet or less, none set forth any technical explanation for the setbacks. The report also observed that the authors of these setbacks were, in most cases, "wind industry people" or "ad-hoc public/industry groups" and generally noted the difficulty of both obtaining published rationales for the setbacks, and of relating the statutory setbacks to known or calculated debris-throw distances for the specific turbine models involved.

Like its Midwestern counterparts, the information from the State of California ultimately didn't answer the question at hand, nor was any official government entity evidently willing to publicly justify the "1,000 foot setback" based on empirical evidence—an unsatisfactory result from the perspective of science, which deals in hard numbers and measurable, repeatable outcomes, and certainly not commensurate with the apparent zeal with which this and similarly small setback distances have been adopted by so many local and state governments.

Further, the anecdotal evidence from both Wisconsin ("we didn't come up with that number") and California ("wind industry people") pointed towards the wind industry as the likely source. And who better to speak to this question than the manufacturers of large wind turbines! Yet, what I found there scarcely brought clarity, and left me even more skeptical.

Wind Company Recommendations

Vestas, for example, the Danish company and world leader in wind turbine manufacturing, had this to say to its own staff in the 2007 Mechanical Operating and Maintenance Manual for its V90 turbine: "Do not stay within a radius of 400 meters (1,300 feet) from the turbine unless it is necessary."

It also went on to say "Make sure that children do not stay by or play near the turbine" (contrary to the setbacks in question, which may place households with children well within that range).

General Electric, the largest domestic turbine manufacturer, has refused to site towers that do not meet their own minimum published standards (1.5 times hub height + rotor diameter) for ice throw, or about 1,300 feet for a 350-foot turbine with a 300-foot rotor.

Finally, the large German turbine manufacturer **RETEXO** recommends setbacks of 2 km (6,562 feet) from its turbine hub, citing both safety and noise considerations.

Wind Trade Group Recommendations

Industry trade groups mostly lack such specificity when it comes to setbacks. the **National Wind Coordinating Committee** 's 1998 Permitting and Siting Guide,[6] for example, suggests that setbacks of 1,000 feet to one-half mile may be needed for noise mitigation; however, the 2002 version of the guide, as well as several newer NWCC publications on siting issues, are silent on setback distances, nor do they discuss the underlying technical basis for specific setback distances, instead relying on malleable terms like "appropriate setbacks" without defining what they are.

The current siting handbook published by the **American Wind Energy Association** (AWEA), the principal U.S. industry trade group and lobbying organization, provides no specific guidance on setbacks, only that developers need to ascertain if local setback ordinances exist.

Wind Powering America's "Wind Energy Guide for County Commissioners" also does not mention any specific setback distance. Statements previously attributed to the AWEA website,[7] have suggested setbacks of 1,600 to 2,467 feet (mainly related to noise), a range that implicitly suggests that local considerations should be taken into account and that one size setback does not fit all situations.

Visits to the websites of several domestic wind developers also failed to find any mention of a "voluntary 1,000 foot setback." More typical are misleading statements like "An operating wind farm at a distance of 1,000 ft. is no noisier than a kitchen refrigerator" and "Regulatory agencies agree that 50 decibels at approximately 1,000 ft. present no sound issues for residents." [8] Based on my research, it seems rather disingenuous to say regulatory agencies "agree" when they are essentially silent on the merits of the issue.

My inability to find a clear, scientific explanation for the "1000-foot setback" at any of the above sources finally led me to start looking at local wind ordinances from around the country and world, with the idea that someone, somewhere had already done the work of ferreting out the origins of "1,000 feet." But like the

Indiana county ordinances, most local ordinances are just that, an ordinance, without any underlying technical background to accompany it, or at least not that is posted on a readily available webpage. And most county officials in Indiana typically will tell you that they simply followed another county's ordinance with little modification.

But a few localities did compile background information in support of their ordinances, and conveniently made it available in the form of online reports and outlines. Of these, the 2008 Setback Recommendations Report for the Town of Union[9] (Rock County, Wisconsin) is one of the most comprehensive in regards to presenting a wide range of setback distances from around the world, and discussing their underlying technical basis (see pp. 97-105).

In this process, the town's Large Wind Turbine Citizen's Committee made a concerted effort to determine the basis for the 1000-foot setback used in Wisconsin's 2003 and 2007 model wind ordinances, culminating in the filing of two freedom of information requests to the state agencies that created the ordinance (see pp. 125-199).

No direct answer was given by the agency to support the technical basis of the setback, only incomplete minutes of meetings from 1995-2001, from which it can be inferred that lawyers representing Florida Power & Light (aka, "Nextera," a major wind developer in Wisconsin and elsewhere, including California, around the time all these "1,000-foot" setback ordinances were developed) may have written that part of the Wisconsin model ordinance.

No direct answer was given by the responding agency to support the technical basis of the setback, only what appear to be incomplete minutes[10] of meetings from 1995-2001, from which it can be inferred that lawyers representing utility companies with pending wind projects were actively involved in the process and may have written that part of the Wisconsin model ordinance. This inference was confirmed in a letter from the Chair of the Town of Union Planning and Zoning Committee, describing this process to his state senator, and from which the following is excerpted:

The Committee sought to learn the basis for the PSC recommendation and required a Freedom of Information request to learn that there was no rationale for the 1,000 foot setback—that the distance had been provided by a Florida utility.

Some Observations ... and Many Unanswered Questions

The results of my efforts to date can thus be summarized by the following observations.

First, it is extremely difficult to find any publicly available information from state agencies or the wind energy industry that directly addresses the scientific basis for adopting "1000 feet" or similarly small distances as the de facto setback between wind turbines and residences (or any other kind of occupied premise, including public open space).

The vast majority of county ordinances posted on the Internet, and particularly those that mandate such small setbacks, lack any published rationale explaining why a particular setback was established. This seems to be a major regulatory disconnect in view of the apparent zeal with which a considerable number of counties, and some state model wind ordinances, are adopting a 1,000-foot setback.

Second, the relatively frequent use of a 1,000-foot setback appears to result not from a confluence of independent studies or literature reviews, but rather from the common (and readily admitted) practice of one jurisdiction simply "cloning" another's ordinance with little deliberation or modification. Indeed, other than the California debris-throw study, I found no scientific studies, or recommendations from independent authorities or wind turbine manufacturers, that supported a setback as small as 1,000 feet—and the California study pointed out that 1,000-foot setbacks were in use years before the study itself was commissioned, and could find no technical basis for them.

Simply adopting a setback ordinance because someone else did too does not constitute a scientific basis for that setback, but it does tend to result in a frequent repetition of that distance, both among zoning officials and the media, leading to a perception that it is some kind of "standard" based on empirical evidence.

Third, if there is a consensus among independent authorities, it is towards much greater setbacks, measured in miles or kilometers, not feet. The same pattern seems to be the case with jurisdictions that have taken the time to research the topic and reach their own independent conclusions.

Setback distances of 2,500 feet or more are increasingly common among such jurisdictions, with some recently adopted ordinances specifying as much as 2 km (3 Australian provinces) to 2 miles (an Oregon County). Thus, there is quite a sharp contrast between the "voluntary 1000-foot industry setback" and the kinds of distances these other entities are adopting or recommending.

These contradictions present a number of troubling questions.

Does the 1,000-foot setback have any basis in science? Or is it simply an artifact of wind industry expedience? The anecdotal evidence certainly suggests the latter is the case, as there is little doubt from

either the Wisconsin or California experiences that industry representatives and lobbyists, including those with projects in the pipeline, played the major role in formulating those ordinances.

The quote from the Town of Union letter indicates that 1000 feet was simply pulled out of a hat. And, if 1,000 feet does have a justifiable basis in science and legal theory, why aren't government agencies and wind proponents extolling it? Where are the studies and the independent peer review process showing that a setback of 1,000 feet adequately removes the human health and safety issues associated with ice and debris throw, noise, shadow flicker, and other well documented side effects of large wind turbines?

The thousands of reports of such issues from around the world from people who live in such proximity to wind plants can't all be psychosomatic machinations of people ideologically opposed to wind installations: more than a few are from people who are hosting turbines and receiving significant lease payments.

Perhaps most importantly, why are the small setbacks promoted by many U.S. wind developers so at odds with the much larger setbacks recommended by various independent bodies and experts who have no stake in this debate?

Conclusion: Are Renewable Energy Advocates Underregulating Themselves?

I can think of one explanation: the production tax credit, the primary Federal incentive to the wind industry, which has existed for decades, and whose value as a tax-avoidance vehicle is exquisitely dependent on producing the maximum number of kWh from any given wind project. It is not hard to imagine the structure of this tax-avoidance vehicle creating an intense need in this heavily subsidy-dependent industry to maximize the density of turbines in a given wind project, a goal that is greatly impeded by more protective setback regulations.

And, it is clearly much easier to achieve this goal when the developer can begin the local siting discussion with a lax setback requirement as the baseline. Along with terms like "voluntary industry setback," this helps create the illusion for local officials and the public that 1,000 feet is an authoritative, widely accepted standard that is protective of the community, when in fact, there is little hard evidence standing behind it.

ENDNOTES

1. Although it is the most common distance in Indiana, 1,000 feet is just one of several arbitrary and unreasonably low setback distances in use in the Midwest, such as Wisconsin's current 1,250 feet and Ohio's vanishingly small 750 feet. "Voluntary industry setback" or similar descriptors, typically offered up by wind developers and compliant extension agents in an attempt to pacify the natives, appear regularly in various media accounts and pro-wind presentations. Here is one of many examples: "Let Science be the Guide for Whitley Wind-farm Law," *The Fort Wayne Journal Gazette*, Jan. 26, 2011, page 6A.
2. The National Research Council (1/2 mile or more), French National Academy of Medicine (1.5 km), and the UK Noise Association (1 mile) are just a small sampling of many such recommendations.
3. Wind ordinances from 15 Indiana counties can be found here. They are virtual clones of one another, suggesting that little or no independent research or critical thinking was involved in their creation.
4. None of these early setbacks take noise or ice/debris throw into account. Most of the early California wind farms were constructed in remote, largely uninhabited areas like Altamont Pass, and the main concern with setbacks was preventing turbines from falling on or interfering with adjacent turbines via the so-called "wake effect"[6]
5. Wind Turbine Breaks Up in Storm, Throws Debris 500 meters (1,650 feet)] http://www.wind-watch.org/video-turbinecollapses.php
6. The 1998 guide was superceded by the 2002 edition and is no longer available at the NWCC website. The list of currently available NWCC siting documents is available here.
7. The refrigerator analogy is an oft-cited claim by wind developers[17], but like "1,000 feet", pinning down its origin and scientific basis is an extremely slippery business. Try Googling the statement. Or save yourself a lot of time and see what someone else discovered who did just that, here. References to this or similar statements (with widely varying distances) can be found at literally hundreds of Internet sites, one of the most instructive being this video.
8. "*Wind Capital Group claims its turbines don't make any more noise than a home refrigerator, but KQ2 returned three different times over the span of a week, and we heard a much different story. The sound was the roar of the turbines filling the air, making Charlie's property sound more like an airport than a horse farm".*

- Channel KQ2 in St. Joe, Missouri reports on a wind farm operating adjacent to Charlie Porter's horse farm, February 17, 2009 http://stjoechannel.com/index.php.

9. The Town of Union's final wind siting committee report and large wind ordinance can both be downloaded here.

10. In addition to demonstrating the ubiquitous presence of FP&L attorneys as participants in the Wisconsin Wind Power Siting Collaborative—the committee charged with developing the model ordinance and its attendant guidelines—a careful reading of the meeting minutes reveals a number of other irregularities and discrepancies. Among them are an overwhelmingly industry-dominated composition (at times there were no representatives outside of industry, utilities, and pro-wind agencies), failure to incorporate substantive changes into drafts, at least one discussion of a "FP&L project" outside of official meeting minutes, and a strong tendency to quickly squelch counties that were going off the pro-wind reservation while the model ordinance was being developed.

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International Review of Policies and Recommendations for Wind Turbine Setbacks from Residences: Setbacks, Noise, Shadow Flicker, and Other Concerns

Minnesota Department of Commerce: Energy Facility Permitting

Kathryn M. B. Haugen

October 19, 2011

Introduction

The generation of electrical energy from wind, or wind energy, is a priority for the United States and the state of Minnesota. At the national level, the United States Department of Energy has published a report called 20% Wind Energy by 2030, created tax credit breaks for developing and using renewable energy, and funded wind energy research and development.[1] However, there is no federal renewable portfolio standard requiring that increased amounts of the United States' energy come from renewable energy sources, although thirty of the fifty states have such a standard.[2] Minnesota's renewable energy objective calls for 25% of the state's electrical energy to come from renewable sources including wind energy by 2025.[3]

While many people support wind energy, some have become concerned about possible impacts to their quality of life due to wind turbines, including noise, shadow flicker, and visual impacts, especially when they believe a wind turbine may be placed too close to their home. There is no worldwide agreement on appropriate wind turbine setback distances from homes; in fact, there is very limited awareness of wind turbine setbacks in other countries, or why a particular setback distance or limit was chosen. This report attempts to identify and clarify existing governmental requirements and recommendations regarding wind turbine setbacks from residences. It also attempts to identify the rationale behind current policies and whether or not the policies are based on public opinion or research. This report does not argue in favor of or against wind power, nor does it identify a best setback distance or measure. The goal of this report is to provide a resource of existing policies and recommendations regarding setbacks from residences in major wind energy-producing countries besides the United States.

Method

For this report, a variety of professionals working on renewable energy issues within national and regional governments, wind energy associations, wind energy development companies, and other areas were contacted by email. The email requested information regarding wind energy policies and recommendations about wind turbine setbacks, noise, shadow flicker, and other possible concerns. A transcript of a basic email is included in Appendix A. A list of persons who responded, and their positions, is included in Appendix B. The information gathered from these responses was supplemented by extensive examination of government websites, documents, guidelines, and policies. Google translate was used to translate documents, policies,

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[1] U.S. Department of Energy. (2008). 20% wind energy by 2030. Retrieved from http://www1.eere.energy.gov/windandhydro/wind_2030.html

[2] North Carolina Solar Center, & the Interstate Renewable Energy Council (IREC). (2011). DSIRE: Database of state incentives for renewables and efficiency: Federal incentives/policies for renewables and efficiency: Financial incentives. Retrieved from http://www.dsireusa.org/incentives/index.cfm?state=us

[3] State of Minnesota Office of Revisor of Statutes. Minnesota statues 2007: Chapter 216B.1691: Public Utilities: Renewable energy objectives. Retrieved from https://www.revisor.mn.gov/bin/getpub.php?pubtype=stat_chap&year=current&chapter=216b#stat.216B.1691.0

and websites not available in English. As translation services are not entirely accurate, misinterpretations may have resulted in inaccuracies. However, as a large percentage of this information came from experts on their countries' wind energy policies, and care was taken in reading translated documents, this document is believed to be accurate.

Countries were chosen based on their existing onshore wind energy capacity in 2010. The top 15 wind energy producers in 2010 were China, USA, Germany, Spain, India, Italy, France, United Kingdom, Canada, Denmark, Portugal, Japan, the Netherlands, Sweden, Australia, and Ireland. The wind energy capacities of these countries are shown in Figure 1. Because of language translation difficulties, China, India, and Japan were not included in this report. Additionally, U.S. federal and state wind siting policies were not included as the aim of this report was to examine and summarize recommendations and policies in major wind energy producing countries outside the U. S.* The other top 15 countries are included in this report, along with the European Union and New Zealand due to references to their policies in other documents. New Zealand's wind energy capacity is also included in Figure 1.

In this document, a setback or setback distance refers to the distance between a wind turbine and a residence or residential area. A noise limit refers to the maximum acceptable level of noise at a residence. Shadow flicker refers to the effect when the sun is behind rotating turbine blades and produces an intermittent shadow. In this document, a requirement or guideline for setback distances refers specifically to policies or recommendations regarding distances in terms of a unit of length or a multiplication of a turbine section (i.e. four times the height), not noise or shadow flicker requirements or guidelines. It is acknowledged that noise limits and shadow flicker policies are used to determine wind turbine setback distances, but because there are many countries that have a setback distance, a noise limit, and a shadow flicker limit these terms will be kept separate. Additionally, many wind energy professionals responded that their country did not have wind turbine setbacks but had noise limits or standards, so these terms are kept separate in this report. Wind energy terms and noise terms are listed in Appendices C and D, respectively. The policies and recommendations included in this report generally do not apply to small wind energy turbines that produce less than 100 kilowatts of energy.

*Policies in the USA are not covered in this report as they will be published separately in the fall of 2011 by the NARUC.

designed to meet the nighttime noise levels recommended by the World Health Organization.[108] Based on scientific studies, these noise limits are believed adequate to avoid any possible effects to health or quality of life.

In New Zealand, local government councils are required to have a local planning document for land development; however, these documents are not required to include wind energy development.[106] One local council has proposed a large setback requirement for wind turbines, but as it is not based on scientific data it is being contested. All wind facilities must secure approval based on a Resource Management Act and be consented to by the Environmental Court before development. The New Zealand Wind Energy Association is currently working on best practices for wind facility development, but this document has not been published as of yet.[106]

Discussion and Conclusion

Very few countries have mandatory wind turbine setback distances between wind turbines and homes. Instead of set wind turbine setback distances, many countries regulate how close wind turbines may be located to residences through noise limits or shadow flicker limits. Some countries have requirements for wind turbine setback distances, noise limits, and shadow flicker limits, while other countries may require noise limits but recommend setback distances. It appears that noise limits are usually requirements, but shadow flicker limits and setback distances are more commonly recommendations. Many countries leave wind turbine noise regulation, setback distance determination, and siting to the states, provinces, or local governments. Most of these countries provide guidelines for their state and local governments, but local governments often create their own regulations or recommendations for wind turbine setback distances instead of or in addition to national recommendations.

In general, wind turbine setback distances appear to be fairly similar across countries and regions. Figure 2 demonstrates wind turbine setback distances in countries or regions that have established required or recommended setback distances from residences. As some countries have different setback distances based on the number of residences, size or number of wind turbines, and other factors, Figure 2 shows the lower and upper setback distance for each area, with the blue bars representing the lowest setback distances, and the blue plus the green bars representing the highest setback distances. Of course, developers may choose to locate their wind turbines farther from homes than the setback distances identified by the governments, as these setbacks are the minimum distance a wind turbine can be placed from a residence.

Generally, the more residences and wind turbines, the greater the required or recommended setback distance. Some countries or regions only had one setback distance rather than a range of distances, as demonstrated by the countries with no green bar in Figure 2. For countries with required or recommended wind turbine setback distances, the average lower setback distance is approximately 470 meters (1,542 feet), and the average upper setback distance is approximately 700 meters (2,297 feet). This is demonstrated in Figure 2, with the majority of setback distances falling between 500 and 1000 meters. The major exception is the

≈ 1800 - 5300 ft.

[108] World Health Organization: Regional Office for Europe. (2011). Noise: Facts and figures. Retrieved from http://www.euro.who.int/en/what-we-do/health-topics/environment-and-health/noise/facts-and-figures

upper setback distance for Scotland at 2000 meters (6,561 feet), which is specifically a setback from towns and villages, not individual homes.

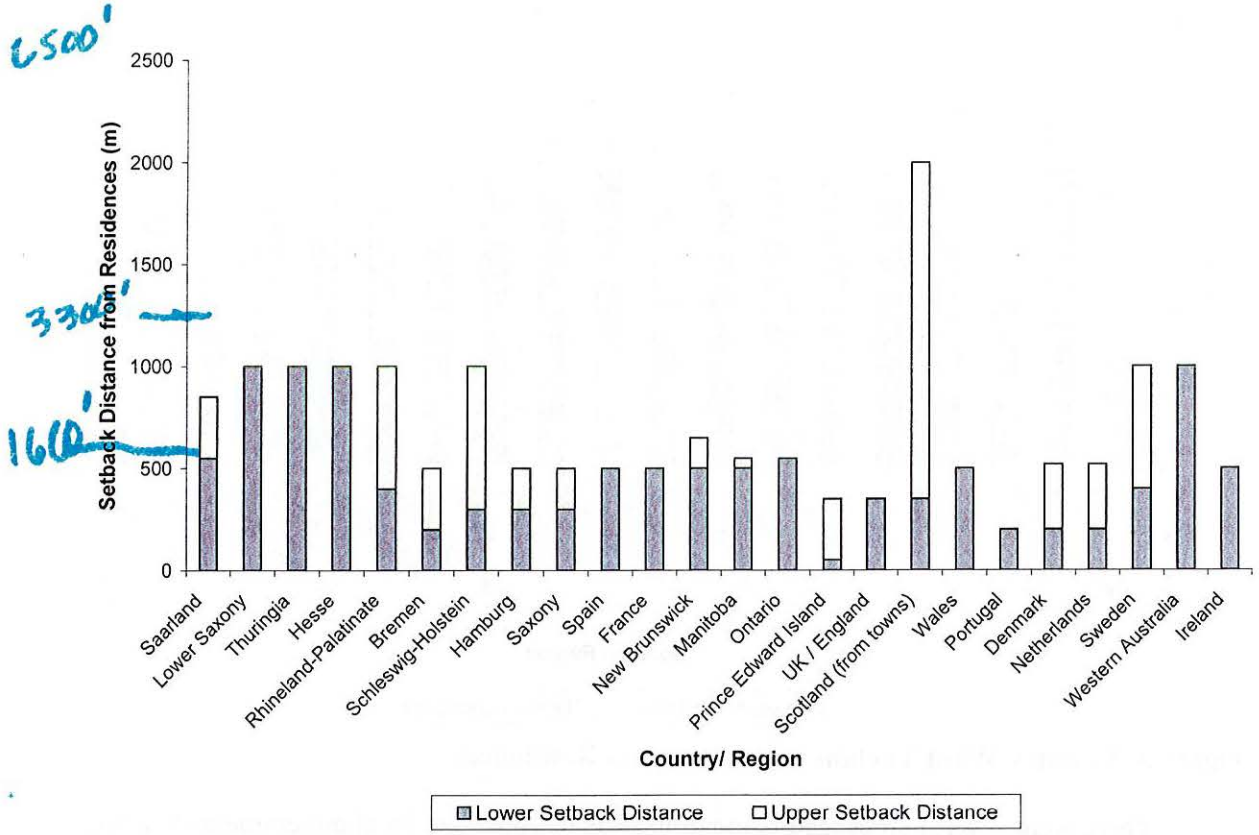

Figure 2: Country Wind Turbine Setback Distances from Residences.

Noise limits for wind turbines are also fairly similar across countries and local regions. Like setback distances, noise limits vary based on the number and size of wind turbines and the number of nearby residences, but are also based on the wind speed and the time of day. Generally, noise limits are lower during the night and in rural areas with few residences, and higher during the day and in areas with a greater amount of residences and pre-existing background sound. In some areas the noise limit increases as the wind speed increases because the natural sound from the wind is amplified along with the noise from wind turbines.

Figure 3 represents the noise limits at residences in countries and regions that have required or recommended noise limits at residences near wind turbines. The blue bars in Figure 3 represent the lower noise limits, and the blue plus green bars represent the upper noise limits at residences near wind turbines. The average lower noise limit is approximately 35 dB(A), and the average upper noise limit is 45 dB(A). This is demonstrated in Figure 3, with most noise limits between 30 and 50 dB(A), and all noise limits between 25 and 65 dB(A). A major outlier is the French noise limit of 25 dB(A), but this is for inside residences rather for outside them like the rest of the noise limits. As with setback distances, wind energy developers may choose to enforce stricter noise limits than the government but are under no obligation to do so.

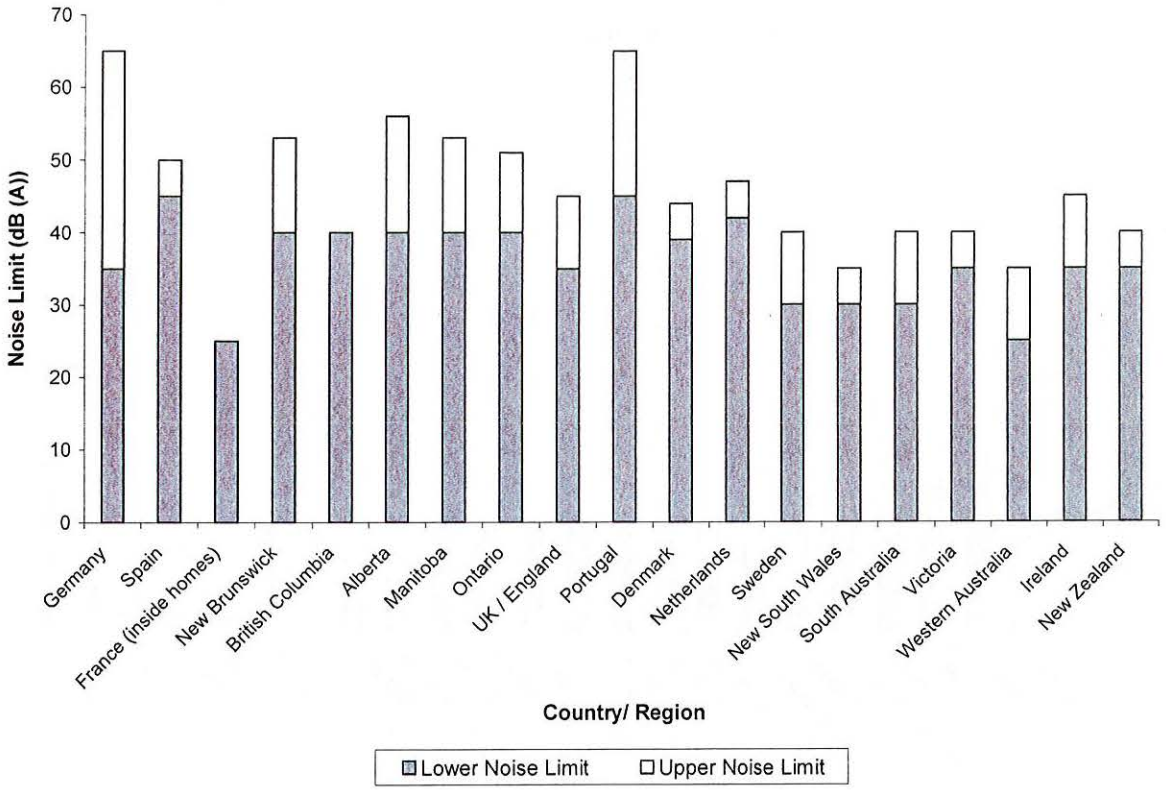

Figure 3: Country Wind Turbine Noise Limits at Residences

There were several other factors mentioned by national and local governments that were taken into consideration in wind energy development. Shadow flicker was most often mentioned, with several countries requiring or recommending a shadow flicker exposure limit of 30 hours per year in a worst case scenario. Germany has done the most work in this area, and countries that focus on shadow flicker usually refer back to Germany's standards, even though many countries do not appear to have much knowledge of actual policies in Germany. Other countries mention that shadow flicker exposure should be investigated, but provide no indication of acceptable levels of shadow flicker.

Besides shadow flicker, the visual impact of the wind turbines seems to be the factor most often mentioned for wind energy developments. The visual impact of wind turbines seems to be a concern, especially in areas with beautiful landscapes. While this is a concern, there do not seem to be any policies or recommendations specifically related to visual impact but instead the visual impact is sometimes used as a rationale for setback distances from residences.

Other concerns mentioned by governments included consideration for resident's preferences and safety concerns. The potential for ice or a blade to be thrown from a turbine were the main safety concerns, but setback distances and noise limit requirements usually made turbines far enough away from residences to be safe, so few countries found it necessary to create recommendations for safe distances from wind turbines. Overall, noise limits and setback distances were the most widely used means of regulating wind turbine siting and placement, and a majority of countries used wind energy siting recommendations rather than regulations.

Countries with more developed and clear wind energy policies generally have more wind energy and less opposition from those living near wind energy facilities than countries with few requirements or guidelines. For example, Denmark has a well-developed booklet clearly stating all of the policies and recommendations regarding wind energy. Denmark also has the largest amount of wind energy per capita and per land area, and little opposition is seen in online websites or comments. Australia, on the other hand, does not have a national policy or recommendations. Although Australia is one of the fifteen top wind energy producers in the world, their actual amount of wind energy is very small compared to the potential based on land features. Australia also just had to complete an inquiry of the general public's opinions of wind energy, and they found many people had negative perceptions of wind energy. It appears that developing clear, direct policies or recommendations for wind energy increases the acceptance of wind energy by the general population and thus increases the overall amount of wind energy in a country or area.