Wind Energy's Dirty Word: Decommissioning*

Introduction

On July 21, 2015, British Member of Parliament David Davis stood up in the House of Commons and leveled a startling allegation against Britain's wind companies.[1] These companies, Mr. Davis said, were organizing themselves in a way that rendered them judgment proof against the costs of decommissioning their generation facilities and against nuisance claims brought by neighbors.[2] This could allow wind farms to be abandoned at the end of their operational lifespan, creating "visual blight . . . in perpetuity."[3] The problem that Mr. Davis identified was the use of shell companies—where a large parent creates a subsidiary to set up and control the operations of a specific wind farm.[4] The problem with these subsidiaries, Mr. Davis said, is that they are marginally capitalized and often owe a large loan to the parent company.[5] This "makes it impossible to bring litigation against a wind farm, simply because there is nothing to win from them."[6]

Davis's speech brought some light to an imperative question that has, heretofore, been largely ignored on this side of the Atlantic. That question: What is going to happen to the thousands upon thousands of wind turbines sitting in fields across America when they reach the end of their useful life? More specifically, how are we ensuring that an industry largely dependent on federal and state subsidies, with an incredibly vast physical footprint, can afford to restore the sites where it has placed its massive installations? The short answer to the latter question is, unfortunately, that we are not.

Like in the United Kingdom, the production of wind energy is a relatively novel experiment in the United States.[7] As with many industries in their infancy, regulation of wind-energy production remains largely

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* I dedicate this Note to the memory of my grandfather, Hayes F. Stripling, Jr. A model West Texan, he saw opportunity and beauty in the land and people of a dry, dusty place. Once, he took me to see a wind farm and I listened to him wonder aloud about whether anyone would ever take the massive installations down. I hope that I inherited a fraction of his foresight. I am grateful to Professor Rod Wetsel for his expertise, enthusiasm, and helpful comments. Finally, I thank my fellow members of the *Texas Law Review*, particularly Vin Recca, Matt Sheehan, and Alex Hernandez, for their hard work in preparing this Note for publication.

1. 598 Parl Deb HC (6th Ser.) (2015) col. 1384–86 (UK).
2. *Id.* at col. 1384–85.
3. *Id.* at col. 1386.
4. *Id.* at col. 1384.
5. *Id.*
6. *Id.*
7. ERNEST E. SMITH ET AL., WIND LAW § 1.01[2] (2016).

undeveloped.[8] This is especially true in the realm of wind farm decommissioning. The useful life of a modern wind turbine is thought to be about twenty years.[9] Because of this, worries about cleaning up the massive wind installations now in place across the country remain problems for another day. Texas, the state with the highest wind-energy generation capacity,[10] imposes no requirement that wind farms be decommissioned at all.[11] Other producing states simply have blanket requirements imposing a duty on wind-farm owners to close their facilities but do not require any sort of financial guarantee of performance.[12]

This regulatory framework creates a system highly dependent on promises. In unregulated states like Texas, promises generally come in the form of lease provisions between a wind company and a landowner where the company promises to decommission and restore the surface of the land.[13] In states with decommissioning requirements, some variation of these promises is imposed on wind companies by statute or state regulation.[14] But a promise is only as good as the person that makes it. And promises are especially ineffective when held against companies that have long been bankrupt or otherwise judgment proof. Taking wind-company promises to clean up at face value largely ignores history. Of America's earliest wind farms, six were abandoned in Hawaii.[15] At one wind farm, "37 derelict wind turbines [sat] idle" for six years before being removed.[16] Early developers in California also walked away from several large projects[17]—some think that as many as 4,500 abandoned turbines remain in place in California.[18]

In closing his speech in Parliament, Mr. Davis called for the enactment of a bill that would require wind-farm operators to hold certain amounts of

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8. *See id.* § 1.01[3] (discussing the relative lack of regulation and permitting requirements for wind-energy projects in Texas).

9. *Id.* § 2.02.

10. RICHARD P. WALKER & ANDREW SWIFT, WIND ENERGY ESSENTIALS: SOCIETAL, ECONOMIC, AND ENVIRONMENTAL IMPACTS 66 (2015).

11. JONATHAN VOEGELE & DANIELLE CHANGALA, VT. L. SCH. INST. FOR ENERGY AND THE ENV'T, DECOMMISSIONING FUNDS FOR RENEWABLE ENERGY FACILITIES 1 (2010).

12. *See id.* app. at 5 tbl.1 (citing CAL. PUB. RES. CODE § 25532 (2010) as an example of a state statute imposing general facility-closure requirements for energy-facility licensing, but requiring no bond or financial surety).

13. SMITH ET AL., *supra* note 7, § 2.12.

14. *See* VOEGELE & CHANGALA, *supra* note 11, at 1–3 (discussing several states' legislative or regulatory mechanisms that impose decommissioning requirements).

15. Tom Leonard, *Breaking Down and Rusting, Is This the Future of Britain's Wind Rush?*, DAILY MAIL (Mar. 18, 2012), http://www.dailymail.co.uk/news/article-2116877/is-future-Britains-wind-rush.html [https://perma.cc/T4MD-QMRP].

16. Alan Yonan, Jr., *Turbines Come Down at Defunct Wind Farm*, HONOLULU STAR-ADVERTISER (Mar. 31, 2012), http://www.staradvertiser.com/business/turbines-come-down-at-defunct-wind-farm/ [https://perma.cc/J76R-TPMP].

17. WALKER & SWIFT, *supra* note 10, at 215.

18. Leonard, *supra* note 15.

cash in addition to posting bonds as security against potential liabilities.[19] Under the proposed bill, wind farms that fail to meet these financial requirements would lose their government subsidies—subsidies that amounted to more than £797 million in one year.[20] Mr. Davis's bill had its first reading on July 21, 2015 but received no further action from Parliament.[21]

This bill represents an example of what this Note will call "decommissioning security." Decommissioning security refers to the idea that state regulation should require wind developers, early in the life of wind-farm projects, to provide financial assurances and comprehensive plans for decommissioning wind-farm installations. The United States is not completely devoid of regulations in this vein.[22] However, currently, these regulations have not been enacted broadly and are essentially absent in many of the largest wind-producing states.[23]

This Note seeks to illustrate the general failure of current law to ensure decommissioning of America's wind farms. Part I discusses the history and current landscape of domestic wind-energy generation. Part II focuses on the best practices in wind-farm decommissioning, aesthetic and environmental harms posed by abandoned wind farms, and the challenges and costs of removing wind turbines. Part III surveys the state of current law regarding decommissioning across U.S. jurisdictions. Finally, in Part IV, I discuss common pitfalls of current decommissioning law and suggest how these pitfalls are best avoided.

I. Wind Farms in the United States

Wind-power generation in the United States has a relatively short history. The story can generally be retold by examining two periods where the production of wind energy boomed in the United States. This Part will trace the history of these two great "wind rushes." It will examine lessons learned from America's first wind rush and discuss the coming decommissioning crisis created by the present boom in wind-power production.

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19. 598 Parl Deb HC (6th Ser.) (2015) col. 1386 (UK).

20. *Id.*

21. *Public Nuisance from Wind Farms (Mandatory Liability Cover) Bill 2015–16*, HC Bill [62] (Eng.) http://www.publications.parliament.uk/pa/bills/cbill/2015-2016/0062/15062.pdf [https://perma.cc/R7BS-CV97]; *Public Nuisance from Wind Farms (Mandatory Liability Cover) Bill 2015–16*, PARLIAMENT.UK, http://services.parliament.uk/bills/2015-16/publicnuisancefromwindfarmsmandatoryliabilitycover.html [https://perma.cc/P4Y6-VSQZ].

22. *See* VOEGELE & CHANGALA, *supra* note 11, at 1–3 (discussing states that impose decommissioning requirements and require operators to pay into decommissioning funds or post financial sureties to cover estimated decommissioning costs).

23. *See id.* at 1 (noting that Texas and other states have no decommissioning requirements); WALKER & SWIFT, *supra* note 10, at 66.

A. Lessons from America's First Wind Rush

The United States currently finds itself in the midst of its second great boom period for wind-power production. The first such boom took place over a relatively brief period in the early 1980s. As the price of oil rose to unprecedented levels in the late 1970s, the federal government and individual states promulgated statutes and regulations to promote the development of renewable energy.[24] One such enactment was the federal Energy Tax Act, which "provided tax credits for the private development of alternative energy technologies."[25] As a result of these policies, the first utility-scale wind farms were installed in the United States in 1980.[26] State incentives in California placed it at the forefront of this wind rush.[27] In 1985, half of the world's wind-energy production was being produced in the state's Altamont Pass Wind Farm.[28] By 1986, there were about 6,700 operational turbines at Altamont.[29]

But this first wind rush was not destined to continue. Declines in oil and natural gas prices led to the end of favorable federal tax credits in 1985.[30] Between 1980 and 1986, the United States had installed 1,257 megawatts (MW) of wind power—between 1986 and 2000, the nation would only install another 1,301 MW.[31] The story of America's first great wind rush illustrates a key characteristic of the American wind energy industry: the industry has always relied on government incentives for its existence and expansion. But federal and state governments have played a large role in putting up America's wind farms while largely failing to ensure that these structures will be taken down in the future. As we will later see, due to lack of regulation, these governments could end up footing the bill to remove turbines as well.

As discussed above, federal and state subsidies dried up in the mid-1980s, effectively halting America's first wind-power boom. Changes in tax policies and state energy regulations, and the mechanical failure of turbines caused owners of several early wind farms to just abandon them.[32] Remnants of this first boom continue to provide examples of decommissioning gone wrong. Because wind farms have long operational lives—typically twenty

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24. SCOTT VICTOR VALENTINE, WIND POWER POLITICS AND POLICY 208–10 (2015).

25. *Id.* at 208.

26. *See id.* at 209 (observing that by 1980 there were "only eight megawatts of installed wind-power capacity in the country"); Office of Energy Efficiency & Renewable Energy, U.S. Dep't of Energy, *History of Wind Energy*, ENERGY.GOV http://energy.gov/eere/wind/history-wind-energy [https://perma.cc/73F3-H4MY].

27. VALENTINE, *supra* note 24, at 209–10.

28. *Id.* at 210.

29. *Id.*

30. *Id.*

31. *See id.* at 209 fig.7.2 (illustrating the yearly increases in installed wind-energy capacity from 1980–2012).

32. WALKER & SWIFT, *supra* note 10, at 215.

years[33]—installations from the first wind rush are generally the only projects that have reached an age where decommissioning issues are implicated. Although information about recent decommissioning is not well documented, several projects show that there is cause for grave concern. It is thought that there are six abandoned wind farms in the State of Hawaii and 4,500 abandoned turbines in California.[34] Most of the abandoned turbines in California are located in three large areas of early wind development—Altamont Pass (east of San Francisco), San Gorgonio Pass (near Palm Springs), and Tehachapi (north of Los Angeles, near Bakersfield).[35]

The best documented example of decommissioning gone wrong is the saga of the Kamaoa Wind Farm in Hawaii. The site was developed in 1987 with the installation of sixty Mitsubishi turbines on the South Point of Hawaii's Big Island.[36] However, the wind farm began to face difficulties when Mitsubishi quit making the older turbines.[37] Kamaoa was purchased in 2004 and remained partially operational for two years as operators cannibalized parts from some turbines to allow others to operate.[38] Finally, the turbines were taken out of operation in 2006 and sat idle "with peeling paint and missing turbine blades" for six years.[39] This situation continued although Kamaoa's owner was in the process of constructing a new, fourteen-turbine wind farm several miles away.[40] The turbines were finally removed in 2012 at an estimated cost of $1 million.[41] The operator recovered only $300,000 from selling the turbines for scrap.[42]

B. Wind Farms Today and the Coming Decommissioning Challenge

While this example provides a glimpse of the potential threat of decommissioning failures, it does not adequately convey the scope of America's coming decommissioning challenge. This is because America's second great wind rush, lasting from 2000 until the present, has eclipsed the first rush on a scale that would have previously been unimaginable. Recall that from 1980 through 1986, the United States added 1,265 MW of installed

33. SMITH ET AL., *supra* note 7, § 2.02.

34. Bill Gunderson, Analysis/Opinion, *Some Basic Facts About Wind Energy*, WASH. TIMES (Mar. 16, 2013), http://www.washingtontimes.com/news/2013/mar/16/gunderson-some-basic-facts-about-wind-energy/?page=all [https://perma.cc/888V-4Y3D].

35. WALKER & SWIFT, *supra* note 10, at 215.

36. Yonan, *supra* note 16; *see also* Duane Shimogawa, *Apollo Energy Removing Old Wind Turbines on Big Island*, PAC. BUS. NEWS (Mar. 29, 2012), http://www.bizjournals.com/pacific/blog/2012/03/apollo-energy-removing-old-wind.html [https://perma.cc/5NNN-T296].

37. Yonan, *supra* note 16.

38. *Id.*

39. *Id.*

40. *Id.*

41. Shimogawa, *supra* note 36.

42. *Id.*

wind-energy capacity.[43] By contrast, from 2000 through 2012, 57,519 MW of installed wind-energy capacity were added in the United States.[44] The growth has taken place thanks to enormous increases in the scale of wind projects, both in terms of the number of turbines installed and in turbine size and power-generation capacity.[45] This enormous increase can also be attributed to the enactment and subsequent renewals of federal tax credits for renewable-energy products in recent years.[46] The second wind rush has changed American wind power from a cottage industry to one that reaches across the nation and makes a substantial physical imprint.

Turbines installed today resemble a traditional windmill, with rotor blades attached to a nacelle (which houses the electric generator) sitting atop a tower.[47] What is striking about these turbines, however, is their scale. By 2013, the largest turbines had rotor diameters of 164 meters, or 538 feet, and were mounted on towers as high as 190 meters, or 623 feet.[48] The circular area covered by these rotors when they turn is the size of three soccer fields and the distance across the circle is approximately the same as the length of two Airbus A380s.[49] The towers on which these rotors are mounted reach to approximately the same height as Seattle's Space Needle.[50] The average rotor diameter of turbines installed in 2014 was 99.4 meters.[51] These modern installations bear little resemblance to earlier turbines. In 1985, typical turbines had rotor diameters of only fifteen meters.[52] The increase in turbine size makes dismantling and decommissioning modern turbines a much larger challenge.

In addition to the enormous size of modern installations, the sheer number of wind turbines installed in the United States is also enormous. Today, there are more than 48,000 wind turbines installed in the United States.[53] These turbines are spread over more than 1,000 utility-scale projects

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43. *See* VALENTINE, *supra* note 24, at 209 fig.7.2 (illustrating the yearly increases in American installed wind-energy capacity over the past three decades).

44. *See id.* (illustrating that in 2012 there were 60,009 MW of wind-energy capacity in the United States whereas in 1999 there were 2,490 MW).

45. *See infra* notes 47–57.

46. *See* WALKER & SWIFT, *supra* note 10, at 59–60 (discussing congressional reauthorization of a renewable-energy tax credit and its effect on wind-project construction).

47. VALENTINE, *supra* note 24, at 35.

48. *Id.* at 36 fig.2.1.

49. *Id.*

50. *Id.*

51. Chris Mooney, *The U.S. Wind Energy Boom Couldn't Be Coming at a Better Time*, WASH. POST (Aug. 10, 2015), https://www.washingtonpost.com/news/energy-environment/wp/2015/08/10/the-boom-in-wind-energy-couldnt-be-coming-at-a-better-time/ [https://perma.cc/7ELK-H7WC].

52. VALENTINE, *supra* note 24, at 36.

53. *U.S. Wind Energy State Facts*, AM. WIND ENERGY ASS'N (Mar. 19, 2016), http://www.awea.org/resources/statefactsheets.aspx?itemnumber=890 [https://perma.cc/G73J-G5P9] (showing the number of wind turbines in each state).

installed in forty states and in Puerto Rico and Guam.[54] There are over 8,000 turbines installed in the State of California and over 10,000 installed in Texas,[55] a state with no decommissioning requirements whatsoever.[56] There are over 1,000 turbines installed in New York State and nearly 300 installed in Maine.[57] Gone are the days where wind installations were concentrated in the small handful of states offering tax incentives.[58] With the second great wind rush, wind-power generation capacity has been installed in states stretching contiguously across the country from Maine to California.[59] This expansion makes America's coming decommissioning challenge a national issue with costs and consequences that will touch the vast majority of Americans.

The enormous increases in both size and number of installed wind turbines mean that we face a huge decommissioning challenge in the future. Assuming the standard service life of twenty years, close to 29,000 wind turbines will reach the end of their useful lives between 2017 and 2030.[60] Part II of this Note will analyze the cost of decommissioning individual turbines, but, conservatively, per-turbine decommissioning costs amount to $25,500.[61] This fact means that within the next decade and a half, the American wind industry faces a decommissioning bill of at least $725 million. This amount does not include costs for the 11,000 turbines in the United States that have already reached the end of their useful lives,[62] or for the huge number of recently installed turbines[63] that will require decommissioning further into the future. And costs will continue to grow—

54. *Id.*

55. *Id.*

56. VOEGELE & CHANGALA, *supra* note 11, at 1.

57. *U.S. Wind Energy State Facts*, *supra* note 53.

58. *See* VALENTINE, *supra* note 24, at 209–10 (discussing the success of California's legislative efforts to incentivize wind-power development through tax credits and noting that "[b]y 1985, half of the world's wind power production came from the Altamont Pass Wind Farm" in California).

59. *U.S. Wind Energy State Facts*, *supra* note 53.

60. Katherine Ortegon et al., *Preparing for End of Service Life of Wind Turbines*, J. CLEANER PRODUCTION, Jan. 2013, at 191, 191, 193 (2013).

61. *See infra* notes 85–93 and accompanying text.

62. Ortegon et al., *supra* note 60, at 193.

63. VALENTINE, *supra* note 24, at 209 fig.7.2 (illustrating that over 55,000 megawatts of wind-energy capacity were added between 2000 and 2012); Ortegon et al., *supra* note 60, at 193 fig.1 (observing that more than 20,000 wind turbines were installed in the United States between 2005 and 2012); U.S. DEP'T OF ENERGY, 2015 WIND TECHNOLOGIES MARKET REPORT 3 (2016), http://energy.gov/sites/prod/files/2016/08/f33/2015-Wind-Technologies-Market-Report-08162016.pdf [https://perma.cc/4DHR-VUQS] (reporting 8,598 megawatts of wind-energy capacity added in 2015); U.S. DEP'T OF ENERGY, 2014 WIND TECHNOLOGIES MARKET REPORT 3 (2015), http://energy.gov/sites/prod/files/2015/08/f25/2014-Wind-Technologies-Market-Report-8.7.pdf [https://perma.cc/YXP4-UZ9T] (reporting 4,854 megawatts of wind-energy capacity added in 2014).

"current capacity goals will require the installation of approximately 126,500 new turbines over the next twenty years."[64]

All of this adds up to a huge decommissioning bill that will have to be paid in the not-so-distant future. Given the industry's dependence on tax credits and its history of inconsistent results,[65] it is fair to say that the question of whether the industry will be able to meet this coming challenge remains open. As Part III of this Note will describe, current regulatory frameworks largely fail to provide decommissioning security. Because of this reality, large portions of the costs and consequences of failed wind farm decommissioning may be passed on to landowners and states. Abandonment of energy production facilities is a real threat. In 2000, the Interstate Oil and Gas Compact Commission estimated that there were approximately 57,064 abandoned oil and gas wells waiting to be decommissioned with state funds.[66] This represented an abandonment rate of about 6.9% of active oil and gas wells in the United States.[67] With over 52,000 installed wind turbines, an abandonment rate of 6.9% would result in about 3,600 abandoned turbines. At a decommissioning cost of at least $25,500 per turbine,[68] this problem clearly poses an important policy issue.

II. Decommissioning: What It Is and What It Costs

This Part will briefly illustrate the decommissioning process by discussing why it becomes necessary and the process through which it is carried out. It will then go on to discuss the costs of decommissioning and lingering problems with estimating these costs.

Like most pieces of machinery, wind turbines have a finite useful life. During this useful life, a turbine is maintained, repaired, and even retrofitted. However, turbines eventually reach a point where continuing their operation is no longer technically or economically feasible. This result can be due to part failure and fatigue (as was the case with Hawaii's South Point wind farm) or where advances in turbine technology make the continued use of old turbines impractical.[69] Although many wind turbine studies fail to address

64. Ortegon et al., *supra* note 60, at 193.

65. *See supra* notes 24–31 and accompanying text.

66. Shannon L. Ferrell & Eric A. DeVuyst, *Decommissioning Wind Energy Projects: An Economic and Political Analysis*, ENERGY POL'Y, Feb. 2013, at 105, 112.

67. *Id.*

68. *See infra* notes 85–90 and accompanying text (discussing the approximate costs of decommissioning).

69. *See* Ortegon et al., *supra* note 60, at 192 (discussing how wind turbines reach the end of their useful lives through mechanical failure or where they "no longer satisf[y] the needs or expectations of a user"); Yonan, *supra* note 16.

the end of life of turbines,[70] it is undisputed that all turbines will, one day, come to the end of their operational lives and require decommissioning.[71]

A. The Decommissioning Process

The goals of decommissioning are "to remove the installed power generation equipment and to return the site to a condition as close to its preconstruction state as possible."[72] As discussed in the previous subpart, wind-farm installations are incredibly extensive in terms of their physical imprint on the land.[73] These installations include turbines themselves but also include a variety of transmission stations, power lines, and access roads.[74] The restoration of wind-farm land, therefore, entails a wide variety of tasks necessary to return the land to its original state. States have promulgated regulations that mandate specific requirements for decommissioning[75] and the Fish and Wildlife Service has published its suggested best practices for decommissioning.[76] This subpart will briefly outline general requirements for decommissioning and discuss the methods by which these requirements are accomplished.

There is no standard process for decommissioning a wind turbine.[77] But it is generally accepted that decommissioning "includes the removal of the [turbines], the removal of aboveground and sub-grade structures, re-vegetation, seeding, [and] topsoil replacement."[78] The largest component is removal of the turbines themselves, which essentially involves reversing the installation process, and requires much of the same equipment—including cranes.[79] The turbine deconstruction process requires removal of turbine blades, the nacelle, and the turbine tower; on-site separation of these modules (the turbine is not transportable otherwise); and transportation of the components to some sort of salvage or recovery facility.[80] Transportation

70. *Id.* at 191.

71. Sosi N. Biricik & Noreen A. Haroun, *The Importance of Decommissioning Security*, LAW360 (Apr. 12, 2010, 12:02 PM), http://www.law360.com/articles/158582/the-importance-of-decommissioning-security [https://perma.cc/G8SE-3S2N].

72. *Id.*

73. *See supra* notes 47–52 and accompanying text (discussing the physical size of wind turbines).

74. Ferrell & DeVuyst, *supra* note 66, at 107.

75. *E.g.*, OKLA. STAT. ANN. tit. 17, § 160.14(B)(1)–(2) (West 2011).

76. U.S. FISH & WILDLIFE SERV., U.S. FISH & WILDLIFE SERV. LAND-BASED WIND ENERGY GUIDELINES 52 (2012), https://www.fws.gov/ecological-services/es-library/pdfs/WEG_final.pdf [https://perma.cc/NM28-H7ZT].

77. Ferrell & DeVuyst, *supra* note 66, at 107 n.3 (noting that there is "little published literature" regarding the specifics of wind-farm decommissioning).

78. Ortegon et al., *supra* note 60, at 192.

79. Ferrell & DeVuyst, *supra* note 66, at 107.

80. Ortegon et al., *supra* note 60, at 196.

itself can require as many as eight trucking trips.[81] The other major undertaking in decommissioning is the removal of the wind turbine's underground foundation. Modern turbine foundations can extend anywhere from twenty-five to fifty feet below the ground.[82] Other typical decommissioning steps include removal of electrical-transmission wires and installations, removal of roads, soil recovery and grading, and reseeding of native grasses.[83]

B. Decommissioning Costs

The exact cost of accomplishing these decommissioning efforts continues to be an open question. First, differences in turbines, siting locations, and decommissioning timelines make it impossible to lay down a per-turbine, decommissioning-cost figure as a general rule.[84] Further, there is hardly any public data available with which to estimate per-turbine cost.[85] However, some decommissioning-cost estimates have been made public and give us a glimpse at the size of the future costs that will be incurred to decommission America's wind farms.

81. *Id.* at 197.

82. *See Wind Turbine Foundations*, CONTECH ENGINEERED SOLUTIONS, http://www.conteches.com/markets/wind-turbine-foundations [https://perma.cc/3DME-CK3C] (advertising different turbine foundations, one that extends 25 to 35 feet below ground and another that extends 35 to 50 feet below ground).

83. U.S. FISH & WILDLIFE SERV., *supra* note 76, at 52.

84. *See* Ferrell & DeVuyst, *supra* note 66, at 111 tbl.3 (summarizing estimated net decommissioning costs for nine projects ranging from $54,000 and $651,725); Ortegon et al., *supra* note 60, at 193 tbl.2 (reporting that net decommissioning cost for three projects in Maine and South Dakota ranged from $11,450 to $34,942 per turbines); *see also supra* notes 47–64 and accompanying text (discussing variations in size, siting locations, and decommissioning timelines of modern turbines).

85. Ferrell & DeVuyst, *supra* note 66, at 110.

Table 1[86]

Project	Est. decomm. cost/ turbine	Est. salvage value/ turbine	Net surplus (cost)/ turbine
Maine—Hancock Wind Project—2014	$139,335	$84,047	($55,308)
Maine—Canton Mountain Wind Project—2013	$128,000	$79,729	($48,271)
Maine—Record Hill Wind Project—2012	$148,600	$133,658	($34,942)
Maine—Spruce Mountain Wind Project—2012	$117,000	$90,268	($26,732)
Maine—Rollins Wind Project	$651,725	$631,875	($19,850)
New York—Stony Creek Wind Farm—2012	$27,285	$9,791	($17,494)
New York—Bellmont Wind Park—2011	$56,600	$43,000	($13,600)
South Dakota—Buffalo Ridge II—2011	$90,805	$79,355	($11,450)
New York—Hounsfield Wind Farm—2011	$45,000	$46,000	$1,000
West Virginia—Pinnacle Wind Power Project—2011	$120,600	$122,145	$1,545

86. Ferrell & DeVuyst, *supra* note 66, at 111 tbl.3; CANTON MOUNTAIN WIND, LLC, *Section 29 Decommissioning Plan*, *in* CANTON MOUNTAIN WIND PROJECT (2013), http://www.maine.gov/dep/ftp/WindPowerProjectFiles/CantonMountainWind/section_29_decommission_plan/section_29_decommission_plan.pdf [https://perma.cc/7FPA-LVKX]; Letter from James S. Murchison, Project Manager, James W. Sewall Co., to James Cassida, First Wind Energy, LLC (June 27, 2014), http://maine.gov/dep/ftp/WindPowerProjectFiles/HancockWind/application/29_Decommissioning.pdf [https://perma.cc/78NC-ZYY8].

Table 1 sets out the findings of these reports. These cost reports begin by estimating the total cost to decommission the project per turbine installed—this is the cost of carrying out the decommissioning process discussed above. Against this figure, the reports subtract the estimated salvage value of the wind-turbine equipment.[87] The resulting figure represents the net, per-turbine cost to the developer of decommissioning the wind farm. Regulatory schemes that do provide decommissioning security by requiring some form of financial surety, discussed in Part III, require developers to provide a bond, letter of credit, or other surety in the amount of this net per-turbine cost.[88]

The average decommissioning cost to developers, based on these reports, is about $25,500 per turbine. It is important to point out, however, that the newest reports available, from the Hancock Wind Project and the Canton Mountain Wind Project, contain the highest estimated costs of the ten projects.[89] Turbines are getting larger and are more expensive to take down.[90] Only more data and experience can resolve the issue of improving cost estimations, but it is apparent from the data that we do have that decommissioning will cost tens of thousands of dollars per installed turbine.

A major issue with the accuracy of these reports is the difficulty of estimating salvage value. Salvage value is the amount that developers expect to realize from the sale of wind turbines for their scrap or material value.[91] As is apparent from Table 1, it plays a key role in the cost calculation. In some instances, reports claim that salvage value will completely cover decommissioning costs.[92] But the value of scrap is highly variable. The quality of the scrap itself, and the market value that it can command, are both volatile.[93] Add in the amount of time in question and we are only left with more uncertainties. These uncertainties create risk that net costs are being understated because of overly generous salvage values included in cost estimates.

The concept of salvage value also illustrates why requiring decommissioning security through financial surety is critical. This is because—as the economists consulted by the Oklahoma legislature in

87. Ortegon et al., *supra* note 60, at 193 tbl.2.

88. *See* CAL. ENERGY COMM'N, COMM'N FINAL REPORT: CAL. GUIDELINES FOR REDUCING IMPACTS TO BIRDS & BATS FROM WIND ENERGY DEV. 66 (2007) (discussing the need for decommissioning plans to include documentation showing financial resources).

89. *See supra* Table 1.

90. *See supra* notes 47–52, 87–89 and accompanying text.

91. Ortegon et al., *supra* note 60, at 193.

92. Ferrell & DeVuyst, *supra* note 66, at 111 tbl.3.

93. Ortegon et al., *supra* note 560 at 193.

crafting the Oklahoma Wind Energy Act[94] so brilliantly recognized—salvage value creates a distinction between different wind-farm components in the decommissioning process.[95] If one of the underlying principles of salvage value is that a developer will recoup much of their decommissioning costs through the sale of certain components, it is reasonable to assume that developers will decommission the "high-value, low-cost" components of wind farms while ignoring "high-cost, low-value" components.[96] This means a developer might remove a high-salvage-value turbine but leave its worthless concrete foundation intact. Or the developer may reclaim wire used to convey generated power but leave the footprint of an electrical substation. Salvage value incents partial decommissioning. From this reality comes the realization that "[w]ithout a bond, there can be no assurance of complete decommissioning."[97] Unfortunately, as the next Part will illustrate, incomplete decommissioning remains very much a possibility because current law largely fails to require financial assurances of decommissioning.

III. Current Decommissioning Law

In terms of their current law regarding decommissioning, U.S. jurisdictions can be divided into three general categories: states that require operators to decommission but do not require operators to financially ensure decommissioning, states that do not require decommissioning whatsoever, and, finally, states that require operators to contribute to a fund or post a bond to cover decommissioning costs. In this Part, I will discuss the specifics of these regulatory approaches and analyze their effectiveness.

A. States with Naked Decommissioning Requirements

States with "naked" decommissioning requirements have rules in place requiring a facility owner to decommission but do not require contribution to a state decommissioning fund or the posting of a letter of credit or performance bond. These regulations vary widely in scope. Some impose general requirements, which have been in place for decades, for the closure of energy facilities.[98] These regulations are not specifically tailored to regulate wind farm decommissioning.[99] Other states have enacted statutes that order various state commissions to promulgate regulations regarding

94. OKLA. STAT. ANN. tit. 17, § 160.11 (West 2011). This Act represents the most comprehensive and best crafted, state-level attempt to regulate and secure wind farm decommissioning currently in place in the country.

95. Ferrell & DeVuyst, *supra* note 66, at 110–11.

96. *Id.* at 111.

97. *Id.*

98. *See, e.g.*, CAL. PUB. RES. CODE § 25532 (West 2016) (establishing a required monitoring system for power facilities).

99. *See id.* (enacting general monitoring requirements for power facilities beginning in 1974, but not establishing tailored requirements for wind-energy facilities).

decommissioning.[100] However, in some of these states, the commissions fail to require operators to post financial guarantees for decommissioning.[101] Each of these variations of naked decommissioning requirements is ineffective because it relies on the continued existence and cooperation of operators. Lessons from Hawaii[102] and the Texas oil and gas industry teach us that this method of regulation does not ensure successful decommissioning.[103]

The State of California is the most prominent wind-power producer to fall into this category of jurisdictions. The state is home to 8,413 installed turbines.[104] The California Public Resources Code contains a general permitting requirement that facilities be closed but does not require operators to post a financial surety.[105] The statute that enables state commissions to regulate in this way became operative in 1975.[106] As such, it came into existence before the construction of the first wind farms in California.[107] The regulation operates as a blanket regulation designed to catch all energy-generation facilities without going in depth to specifically regulate any particular type of facility.[108] The California Energy Commission promulgated voluntary guidelines in 2007 that suggested that developers "should submit a decommissioning and reclamation plan" when seeking a permit to construct a wind farm.[109] It is also suggested in the guidelines that the plan "should also include documentation showing financial capacity to carry out the decommissioning," which "usually" should take the form of "an escrow account, surety bond, or insurance policy."[110]

North Dakota, similarly, has statutorily authorized its Public Service Commission to "adopt rules governing the decommissioning of commercial wind-energy conversion facilities."[111] The commission enacted regulations making "[t]he owner or operator of a commercial wind-energy conversion facility . . . responsible for decommissioning that facility and for all costs

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100. *See, e.g.*, N.D. CENT. CODE § 49-02-27 (2015) (requiring the state commission to adopt regulations governing the decommissioning of wind-energy facilities).

101. *See, e.g.*, OHIO ADMIN. CODE WL 4906-4-06 (2016) (mandating disclosure of costs for wind-energy projects, but not requiring wind-energy facilities to post a financial guarantee for decommissioning).

102. *See supra* notes 36–42 and accompanying text.

103. *See* discussion *infra* notes 125–35 and accompanying text.

104. *U.S. Wind Energy State Facts*, *supra* note 53.

105. VOEGELE & CHANGALA, *supra* note 11, app. at 5 tbl.1.

106. CAL. PUB. RES. CODE § 25532 (West 2016).

107. *See* VALENTINE, *supra* note 24, at 209 (describing the development of the first wind farms in California, which occurred in 1980–1981).

108. *See* CAL. PUB. RES. CODE § 25532 (mandating the establishment of a monitoring system for energy-generation facilities but not mandating a system that is specific to particular types of energy-generation facilities).

109. CAL. ENERGY COMM'N, *supra* note 88, at 66.

110. *Id.*

111. N.D. CENT. CODE § 49-02-27 (2014).

associated with decommissioning."[112] The North Dakota statute also required the commission to create rules to address "[t]he method of ensuring that funds will be available for decommissioning and restoration."[113] In response, the commission enacted a regulation whereby it "*may* require the owner or operator to secure a performance bond."[114]

The operative word in the above regulation is, of course, the word "may." The commission is not obligated to require any form of decommissioning security. Further, this election is not made until ten years into the lifespan of the project.[115] It appears that very few wind farms in North Dakota have reached this ten-year threshold.[116] However, in the best-documented case thus far, the commission appears to have merely required that the wind-farm operator issue a corporate guarantee to decommission instead of posting any variation of financial surety.[117] But corporate guarantees do not guarantee anything unless the corporation continues as a business.

Interestingly, Ohio's Power Siting Board recognizes the potential that inadequate decommissioning will become a future expense borne by the public but fails to require operators to post decommissioning sureties.[118] The board's rules for siting permits include a section that requires the operator to provide information regarding "public responsibility."[119] Contained within this section is the requirement that a permit applicant "describe the plan for decommissioning the proposed facility, including a discussion of any financial arrangements designed to assure the requisite financial resources."[120] While its framework for assuring decommissioning, which merely requires a description of some financial plan, is inadequate, the board's inclination to see decommissioning as a "public responsibility" is appropriate.[121] In states like those discussed in this subpart, the law—with varying degrees of strength—seeks to impose on operators a duty to

112. N.D. ADMIN. CODE § 69-09-09-02 (2008), http://www.legis.nd.gov/information/acdata/pdf/69-09-09.pdf [https://perma.cc/6ZAP-SUH8].

113. N.D. CENT. CODE ANN. § 49-02-27.

114. N.D. ADMIN. CODE § 69-09-09-08 (2008) (emphasis added), http://www.legis.nd.gov/information/acdata/pdf/69-09-09.pdf [https://perma.cc/EPW9-NM7J].

115. *Id.*

116. Bryce Martin, *State Delves into New Issue of Wind Farm Site Decommissioning; Sets Big Precedent*, BOWMAN CTY. PIONEER (Sept. 12, 2014), http://www.bowmanextra.com/2014/09/12/state-delves-new-issue-wind-farm-site-decommissioning-sets-big-precedent/ [https://perma.cc/EW2G-D67H] (stating that because of the state's ten-year deferment plan, North Dakota had, until recently, "never previously encountered" the issue of decommissioning security).

117. *Id.*

118. OHIO ADMIN. CODE WL 4906-4-06(F) (2015) (requiring applicants to describe any damage that the public might incur as a result of decommissioning the project).

119. *Id.*

120. *Id.* at 4906-4-06(F)(5).

121. *Id.* at 4906-4-06(F).

decommission owed to the public at large. However, it is important to recognize that merely imposing this duty on operators does not ensure that the public will not eventually bear the monetary responsibility for decommissioning wind farms.

This point is clearly illustrated through historical reference to an analogous situation involving regulation of the Texas oil and gas industry. Typical state oil and gas regulations have long imposed a duty to plug inactive oil and gas wells on well operators.[122] In the late-1980s, Texas law imposed a naked well-plugging requirement on operators similar to wind-farm decommissioning requirements enacted in the states mentioned above. Texas law required that "[t]he operator of a well shall properly plug the well when required in accordance with the commission's rules."[123] However, the state's law did not require the operator to post a bond or other financial surety to cover plugging costs unless the operator sought an exception or extension from well-plugging requirements.[124] When the price of oil sagged in the mid-1980s, this regulatory framework left the state on the hook for a huge well-plugging bill.

The decline in oil prices in the mid-1980s resulted in widespread bankruptcies by oil and gas operators.[125] These bankruptcies were seen as directly responsible for the abandonment of unplugged wells across the state.[126] In 1987, a Texas Railroad Commission report identified more than 8,800 wells that were known or presumed to be unplugged.[127] The cost of plugging these wells was estimated at $53,202,000.[128] Unfortunately, Railroad Commission funds to meet this challenge were "grossly inadequate."[129] The commission's fund to plug wells was funded by a $100 application fee that accompanied any new drilling permit.[130] By the beginning of 1991, this fund contained only $700,000.[131] In September of 1991, the legislature authorized the creation of the Oil Field Clean Up

122. Donald N. Zillman & Ernest Smith, *Abandonment and Reclamation of Energy Sites and Facilities: The United States*, 10 J. ENERGY & NAT. RESOURCES L. 46, 51 (1992).

123. TEX. NAT. RES. CODE ANN. § 89.011 (West 2011).

124. TEX. NAT. RES. CODE ANN. §§ 91.103–91.108 (West 2016) (listing financial requirements for well operators and showing that these provisions were enacted after the decline in oil prices in the mid-1980s).

125. *See* Heather Long, *Red Flag: Oil Company Defaults Are Spiking*, CNN MONEY (Jan. 22, 2016), http://money.cnn.com/2016/01/22/investing/oil-crisis-defaults-rise/ [https://perma.cc/TD9T-WHFD] (noting that 27% of exploration and production companies went bankrupt in the oil bust that began in 1986).

126. Zillman & Smith, *supra* note 122, at 51.

127. *Id.* at 52 & n.47 (citing a Texas Railroad Commission report for the assertion that in 1987, there were more than 8,800 wells known or presumed to be unplugged).

128. *Id.* at 52.

129. *Id.*

130. *History of the Railroad Commission 1980–1990*, R.R. COMM'N TEX., http://www.rrc.state.tx.us/about-us/history/history-1980-1999/ [https://perma.cc/D5LA-JRKN].

131. Zillman & Smith, *supra* note 122, at 52.

Fund,[132] which allowed for the levying of various fees to pay for well plugging.[133] This new fund, however, was only projected to raise about $10,000,000.[134] The Railroad Commission has plugged "[t]ens of thousands of abandoned wells" but, as of April 2013, about 8,400 wells remain unplugged in the state.[135]

This lesson from Texas oil and gas regulation clearly illustrates the ineffectiveness of naked decommissioning and cleanup requirements. These requirements fail to keep cleanup efforts and their associated costs internalized to the industry that creates them. The result has been, and continues to be, that local and state taxpayers are left on the hook to ensure cleanup. But governments do not always have the money, political willpower, or administrative framework to ensure that a proper cleanup even takes place. For example, hundreds of thousands of abandoned or inactive mines continue to litter the United States because there is "simply not enough money to address the problem."[136] Without funding, these lingering environmental hazards remain and result in catastrophes like the one that occurred in August 2015 when an underfunded EPA mine reclamation effort accidentally released the contents of an old mine into Colorado's Animas River, turning the river bright orange and acidic.[137] Naked decommissioning requirements fail to ensure that oil and gas, wind, or mining operators will cleanup. And when these regulatory schemes fail, governments, at best, shoulder the cost and effort of cleaning up and, at worst, allow nondecommissioned facilities to remain.

B. States Without Decommissioning Regulation

Many other states do not address decommissioning by law. These states represent some of the largest wind-producing states in the country. Most notable among this group of states is the national leader in wind-power generation capacity—Texas.[138] The state also leads the nation in the capacity of projects that are currently under construction.[139] Another state without a

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132. Act of June 15, 1991, 72nd Leg., R.S., ch. 603, § 2, sec. 91.110, 1991 Tex. Gen. Laws. 2186, 2188.

133. *History of the Railroad Commission 1980–1990*, *supra* note 130.

134. *Id.*

135. Kate Galbraith, *In Texas, Abandoned Oil Equipment Spurs Pollution Fears*, TEX. TRIB. (June 9, 2013), https://www.texastribune.org/2013/06/09/texas-abandoned-oil-equipment-spurs-pollution-fear/ [https://perma.cc/KUV2-AP9T].

136. Gwen Lachet, Opinion, *When A River Runs Orange*, N.Y. TIMES (Aug. 20, 2015), http://www.nytimes.com/2015/08/20/opinion/when-a-river-runs-orange.html [https://perma.cc/D6GD-3VBW].

137. *Id.*

138. *Texas Wind Energy*, AM. WIND ENERGY ASS'N, http://awea.files.cms-plus.com/FileDownloads/pdfs/Texas.pdf [https://perma.cc/3WE5-D2UQ].

139. *Id.*

statewide decommissioning requirement is Iowa—home to 3,719 turbines.[140] This category of states includes other large producers like Colorado, Kansas, Massachusetts, Michigan, Montana, and New Mexico.[141]

In such states, the process of determining decommissioning requirements and regulations is left entirely to private law. In practice, this means that the rules surrounding decommissioning are generally only those set out in lease agreements between landowners and wind-farm operators. We will call these states "law-of-the-lease states" because unless a lease requires operators to remove wind-farm installations and restore the land, the operator may be able to leave the nonoperating turbines and their related structures in place at the end of the lease.[142] Such an unfortunate result limits the ability to use land and imposes the costs of removal on landowners.[143]

Luckily, because of lessons learned from bad experiences with oil and gas production, most wind leases—even those formed in the very early days of wind production—have required the operator to remove wind-farm installations and make some restorations of the land.[144] As you might expect, however, the terms of these leases vary widely.[145] Some contain very specific requirements regarding the restoration that must take place, while others simply require restoration to original conditions "as near as reasonably possible."[146] As explained in Part II, proper restoration of wind-farm sites requires a great deal more than simply removing turbines, roads, and substations.[147] Law-of-the-lease jurisdictions place a tremendous burden on landowners to specifically set out the exact extent of restoration that operators must undertake. But the way that landowners are often situated in these negotiations should raise questions as to their ability to drive hard bargains with operators on decommissioning. Because they may be especially hopeful for—and in great need of—a lease's financial benefits or know that they will not own the land at the end of a project's decades-long useful life, landowners may not be best situated to negotiate for strong decommissioning provisions.

In addition to these concerns, even the best crafted leases with regard to decommissioning provide little more protection than states with naked decommissioning requirements. Strong lease clauses fail to provide

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140. *Iowa Wind Energy*, AM. WIND ENERGY ASS'N, http://awea.files.cms-plus.com/FileDownloads/pdfs/Iowa.pdf [https://perma.cc/DJ4V-C5EA].

141. VOEGELE & CHANGALA, *supra* note 11, at app. at 5 tbl.5. Thorough research of statutes and regulations in these states uncovered no decommissioning statutes or regulations promulgated after the publication of this source.

142. Biricik & Haroun, *supra* note 71.

143. *Id.*

144. SMITH ET AL., *supra* note 7, § 2.12.

145. *Id.*

146. *Id.*

147. *See supra* subpart II(A).

decommissioning security for the same reason as naked decommissioning requirements: they are ineffective against bankrupt and dissolved operators. Contractual assurances to decommission are, in effect, naked decommissioning requirements imposed in private law rather than by state statute or regulation. The oil and gas industry again teaches us that this method of seeking to ensure restoration by operators fails. Even after sophisticated restoration clauses became standard features of oil and gas leases, landowners were largely unable to enforce these obligations against judgment-proof operators.[148]

The best wind leases seek to avoid the problem of judgment-proof operators by requiring one of several decommissioning-security provisions to be included. It is unknown how many wind leases in law-of-the-lease states contain one of these decommissioning-security provisions. It is thought, however, that wind operators often vehemently oppose the inclusion of these provisions during lease negotiations.[149] Given the negotiating position of operators vis-à-vis landowners, it is doubtful that the strongest versions of these clauses often make it into leases. One decommissioning-security provision calls for the operator to begin to deposit money into a sinking fund starting on a particular date during the life of the project.[150] Deposits are then made according to a schedule provided for in the lease.[151] The provision then provides that the landowner will be permitted to withdraw the money from the fund in the event that the operator fails to remove the wind-farm facilities or restore the site.[152] Other common provisions require that the operator post a performance bond, letter of credit, or guarantee from an entity with a particular credit rating to ensure decommissioning.[153]

C. States with Decommissioning Security Regulations

In stark contrast to the jurisdictions discussed above, some states have enacted comprehensive decommissioning regimes that lay out specific requirements for decommissioning and, more importantly, require contribution to decommissioning funds or the posting of a bond. The list of states that have made decommissioning security the law by statute or regulation includes Oklahoma, Oregon, and Indiana.

The leading state in enacting decommissioning security is the State of Oklahoma. In 2010, the Oklahoma Legislature passed a comprehensive statute to regulate wind-energy generation entitled the Oklahoma Wind

148. SMITH ET AL., *supra* note 7, § 2.12.

149. In a conversation with the author, Professor Rod Wetsel, a leading wind-law scholar and attorney representing landowners, described how he was told by one in-house counsel that his wind company "hates" the inclusion of surface-damage-restoration clauses and bonding requirements.

150. Biricik & Haroun, *supra* note 71.

151. *Id.*

152. *Id.*

153. *Id.*

Energy Development Act.[154] The legislative findings noted that wind-energy conversion "require[d] large wind energy systems" that "if abandoned . . . could pose a hazard to public health, safety, and welfare."[155] To protect against these hazards, "standards for the safe decommissioning of wind energy facilities should be established and assurance of adequate financial resources should be given so that the wind-energy systems can be properly decommissioned at the end of their useful life."[156]

To achieve this end, the legislature began by clearly allocating the duty to decommission, stating: "The owner of a wind-energy facility shall be responsible, at its expense, for the proper decommissioning of the facility upon abandonment or the end of the useful life of the commercial wind-energy equipment."[157] The statute defines "abandonment" as "the failure to generate electricity . . . for a period of twenty-four (24) consecutive months"[158] and requires operators to complete decommissioning within twelve months of abandonment or the end of the installation's useful life.[159] "Proper decommissioning" includes removal of turbines, electrical components, foundations, and all other associated facilities to a depth of thirty inches below grade and reseeding or otherwise restoring the land to "substantially the same . . . condition as existed prior."[160]

But, as it noted in its findings, the legislature understood that this decommissioning requirement could not be achieved without adequate financial guarantees. The legislature included in the law a special section entitled: "Required Filing—Evidence of Financial Security."[161] This section requires the submission of "evidence of financial security to cover the anticipated costs of decommissioning" to the Oklahoma commission that regulates the production of energy in the state.[162] For facilities beginning to generate power before December 31, 2016, this evidence must be provided at the end of the fifteenth year of operation.[163] For facilities beginning to generate power on or after that date, the evidence must be provided by the fifth year of operation.[164] Financial security may come in the form of "a surety bond, collateral bond, parent guaranty, cash, cashier's check,

154. OKLA. STAT. ANN. tit. 17 § 160.11 (West 2016); Oklahoma Wind Energy Development Act, 2010 Okla. Sess. Laws 1251.

155. OKLA. STAT. ANN. tit. 17 § 160.12(4)–(5).

156. *Id.* § 160.12(6).

157. *Id.* § 160.14(a).

158. *Id.* § 160.13(1).

159. *Id.* § 160.14(C)(1).

160. *Id.* § 160.14(B)(1)–(2).

161. *Id.* § 160.15.

162. *Id.* § 160.15(A); OKLA. CORP. COMM'N, ANNUAL REPORTS FISCAL YEAR 2013, at 2 (2016), http://www.occeweb.com/FY13%20Annual%20Report%20FOR%20PRINTING.pdf [https://perma.cc/6GDL-UQZF].

163. *Id.*

164. *Id.*

certificate of deposit, bank joint custody receipt or other approved negotiable instrument" allowed by the commission.[165] The statute, further, specifically regulates the amount of the financial security. For installations beginning to generate power on or after December 31, 2016, security must be in the amount of 125% of the estimate of the total cost of decommissioning minus the salvage value of the equipment as estimated by a licensed engineer.[166] Failure to submit evidence of financial security in the proper amount subjects an operator to a penalty not to exceed $1,500 per day.[167]

Statutory enactments are not the only way that states are implementing decommissioning-security regulation. Other states such as Indiana and Oregon require the posting of financial surety and impose decommissioning standards by way of utility-regulatory commissions.[168] The Oregon Energy Facility Siting Council (OEFSC), for example, has broad authority under its enabling statute that allows it to impose far-reaching requirements on wind-farm operators.[169] With this authority, the OEFSC has adopted a rule that requires a council finding that land at a proposed site can be adequately restored and that "[t]he applicant has a reasonable likelihood of obtaining a bond or letter of credit in a form and amount satisfactory . . . to restore the site."[170] In its discussion of this rule, "[t]he [c]ouncil recognizes the risks that construction of an energy facility could stop in a partially completed state or that an operating facility could cease operating, leaving the community with unusable property and no funds for site restoration."[171] Because of this, the commission interprets the rule as requiring as "a mandatory condition in every site certificate . . . a bond or letter of credit to be in place before construction begins" and an explanation from the applicant regarding "how it proposes to restore the site."[172] The Indiana Public Utility Regulatory

165. *Id.*

166. *Id.* § 160.15(B)(2).

167. *Id.* § 160.15(C).

168. *See, e.g.*, OR. ADMIN. R. WL 345-022-0050 (2016), http://arcweb.sos.state.or.us/pages/rules/oars_300/oar_345/345_022.html [https://perma.cc/T6G5-BA7V] (requiring that the council must find that the proposed site can be restored and that the operator has a "reasonable likelihood" of being able to obtain a financial surety to ensure decommissioning); Meadow Lake Wind Farm III LLC, Cause No. 43579, at 9 (Ind. U.R.C. Nov. 24, 2009), https://iurc.portal.in.gov/_entity/sharepointdocumentlocation/39acf441-3883-e611-810e-1458d04f0178/bb9c6bba-fd52-45ad-8e64-a444aef13c39?file=43759order_112409.pdf [https://perma.cc/6VZQ-DMDY] [hereinafter Meadow Lake] (imposing a duty on the operator to "maintain financial assurance to ensure that the [wind farm] will be properly decommissioned at the end of its serviceable life").

169. *See* OR. REV. STAT. ANN. tit. 36, § 469.501(1) (2015) (requiring the OEFSC to "adopt standards for the siting, construction, operation and retirement of facilities").

170. OR. ADMIN. R. WL 345-022-0050.

171. *Energy Facility Siting Standards: Retirement and Financial Assurance*, OR. DEP'T OF ENERGY, https://www.oregon.gov/energy/Siting/Pages/standards.aspx#Retirement_and_Financial_Assurance [https://perma.cc/57XJ-ZHRZ].

172. *Id.*

Commission has also required operators to establish a decommissioning plan that "include[s] an independent financial instrument in an amount equal to the demolition and removal cost estimate."[173] These states with broadly enabled regulatory commissions have been able to adapt to the new challenge of regulating the wind industry. However, the obvious drawback is that these regulations can change at the whim of the state commissions, while Oklahoma's legislative enactment offers a more stable regulatory framework.

D. Local Ordinances

A discussion of current law governing decommissioning would be incomplete without acknowledging the large role that municipal- and county-level regulations currently play in wind-farm development. These local ordinances largely focus on issues such as location, permitting, and construction,[174] and require developers to adhere to local zoning ordinances and to obtain special construction permits.[175] The U.S. Department of Energy identifies 406 of these ordinances currently in place across the country.[176] In South Dakota, the state regulates wind projects over 100 MW, but encourages the adoption of local ordinances to govern projects under that threshold.[177] The State Public Utilities Commission has published a model ordinance for local adoption in which County Boards of Commissioners "may" require financial assurance after the tenth year of a project's operation.[178]

Although the focus of local regulation is largely on more traditional matters like siting and setbacks, some local regulation does impose decommissioning security requirements on wind-farm directors. A review of local regulations shows that in New York, Michigan, Kansas, Wisconsin, and Illinois, one county imposes mandatory requirements on developers to put up financial assurances of decommissioning.[179] Three counties in Minnesota, one county in California, and one county in Illinois have

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173. Meadow Lake, *supra* note 168, at 9.

174. *Wind Energy Ordinances*, WINDEXCHANGE, U.S. DEP'T OF ENERGY, http://apps2.eere.energy.gov/wind/windexchange/policy/ordinances.asp [https://perma.cc/Q76P-Y8LZ].

175. U.S. GOV'T ACCOUNTABILITY OFFICE, GAO-05-906, WIND POWER: IMPACTS ON WILDLIFE AND GOVERNMENT RESPONSIBILITIES FOR REGULATING DEVELOPMENT AND PROTECTING WILDLIFE 21–22 (2005).

176. U.S. DEP'T OF ENERGY, *supra* note 174.

177. Danielle Changala et al., *Comparative Analysis of Conventional Oil and Gas and Wind Project Decommissioning Regulations on Federal, State, and County Lands*, ELECTRICITY J., Jan.–Feb. 2012, at 29, 37.

178. S.D. PUBLIC UTILITIES COMM'N, DRAFT MODEL ORDINANCE FOR SITING OF WIND ENERGY SYSTEMS (WES) 9 (2008), https://puc.sd.gov/commission/twg/WindEnergyOrdinance.pdf [https://perma.cc/ALM2-JPU4].

179. *See* Changala et al., *supra* note 177, at 41–42 tbl.B1 (setting out decommissioning requirements of local ordinances in Chautauqua County, NY; Huron County, MI; Riley County, KS; Shawano County, WI; and Pike County, IL).

ordinances where developers may be required to set aside funds, purchase sureties, or contractually agree to cover decommissioning costs.[180] Aside from these few examples, however, much of local regulation continues to fail to provide decommissioning security.

In sum, the state of current decommissioning law varies widely and remains largely undeveloped. States span from leaving decommissioning completely to the parties of wind-lease transactions to imposing specific requirements for reclamation along with the posting of financial surety. At present, decommissioning law remains a patchwork of state regulation and local ordinances. As in many new industries, the law is struggling to keep pace with the boom.

IV. Common Pitfalls and Recommendations for Statewide Decommissioning Regulations

The previous sections of this Note have sought to illustrate the enormous task that wind-farm decommissioning will present within the next several decades and highlight the underdeveloped state of current law governing decommissioning. The task of decommissioning includes many challenges. It will require a large monetary outlay, herculean efforts in physical dismantling and recycling, and a great deal of oversight to successfully decommission the installations of America's second great wind rush. But, as illustrated in the previous part of this Note, the state of current law largely fails to ensure that this dismantling will take place and that its costs will remain internalized within the industry that has created them. This section notes some of the common pitfalls of existing regulation and suggests components of regulation that should be adopted to ensure effective and efficient decommissioning. It argues four things: that effective statutes require operators to post a financial surety to cover estimated decommissioning costs; that decommissioning regulations are best promulgated and administered on a state-wide basis; that decommissioning regulations should clearly allocate the burden of decommissioning to operators, not landowners; and, finally, that decommissioning regulations should clearly define events that trigger specific decommissioning requirements. Avoiding these pitfalls improves the state of decommissioning law by making decommissioning mandatory and well-funded.

A. Financial Surety Requirement

In discussing the current state of decommissioning law, this Note seeks to illustrate the ineffectiveness of regulation that requires developers to decommission without obligating these operators to post financial surety to

180. *See id.* at 41–43 tbl.B1 (setting out decommissioning requirements in Clay, Fillmore, and Redwood Counties, MN; Solano County, CA; and Vermilion County, IL).

cover estimated decommissioning costs. Examples of this failure can be found with America's earliest wind farms—like those constructed and abandoned in Hawaii.[181] But even more examples can be found in the oil and gas industry. The point is simply this: in regulatory regimes that fail to require decommissioning security in the form of financial surety, the cost of failed or incomplete decommissioning falls on states and landowners. In some cases, these outside stakeholders pay the cost and complete decommissioning.[182] In others, however, the abandoned operations linger—polluting the environment, reducing land values, and impairing full and free use of land.[183]

It is thought that turbine assemblies "will have significant salvage values at the end of the turbine's useful life."[184] Based on this concept, some argue that it would be irrational for a developer to "walk away" from a project and, therefore, "no external regulation is required."[185] Even if we accept all of this as true—and thereby ignore the whole myriad of practical reasons why a developer might not clean up, or even be around to do so—salvaging cannot guarantee anything more than partial decommissioning.[186] That is because of the distinction that salvage value creates among wind-farm components. When it comes to decommissioning, there will be components whose decommissioning reduces marginal cost due to high salvage value and there will be components that only add to marginal decommissioning cost due to small or nonexistent salvage values.[187] Under this regime, we would expect developers to act in a way that maximizes the salvage value of a project while reducing decommissioning costs. The result is this—that some components get decommissioned and others do not. Accepting the incentives argument advanced above means also accepting this fact: that wind-farm operators will always decommission the wind turbine but not its concrete foundation and that they will always reclaim transmission wires while abandoning the electrical substation. As the theorists behind the Oklahoma Act so aptly observed: "Without a bond, there can be no assurance of complete decommissioning."[188]

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181. *See* Leonard, *supra* note 15 (noting that Hawaii has six abandoned wind farms, including one site displaying the "rusting skeletons of scores of wind turbines").

182. For an example, see the discussion of oilfield cleanup in Texas, *supra* notes 124–37.

183. For an example, see the discussion of lingering hazards from abandoned mines, *supra* notes 136–37.

184. Ferrell & DeVuyst, *supra* note 66, at 110.

185. *Id.*

186. *See id.* at 111 (noting the distinction that salvage value creates among wind-farm components and that "[w]ithout a bond, there can be no assurance" that a developer will completely decommission).

187. Ferrell and DeVuyst identify the former as "high-value and low-cost components" and the latter as "high-cost, low-value components." *Id.*

188. *Id.*

A lingering issue is the question of timing for providing the financial surety. Some jurisdictions require sureties to be in place before construction begins on a project.[189] Others set dates later within the life of the project by which the developer must have made provisions for decommissioning security.[190] There are good arguments to be advanced for either course of action. An up-front provision clearly provides the greatest insurance that the costs of decommissioning the project will not fall to others beyond the developer. This approach protects against the risk that some calamity early in the life of the project will require someone other than the developer to decommission. Further, taking care of the problem at the beginning of the project also makes logistical sense. As noted previously, wind-farm construction implicates a large amount of state and local siting and zoning regulation.[191] Requiring early bonding sensibly takes care of all of this administration at once.

On the other hand, the practicalities of wind-farm financing make delaying the requirement sensible. Wind farms require an enormous initial capital outlay[192]—a developer's payout date comes many years down the road.[193] As a result, it is in the interest of development not to require further outlays from developers until later in the project. Moreover, the sizable investment in the wind farm largely reduces abandonment risk early in the life of the project.[194] Given these realities, it seems sensible enough that surety requirements can be relaxed during the earliest years of a project's operation. What is clear is that regulation should, at a minimum, require decommissioning security to be in place on or before a project's payout date.

While the natural inclination is to think that imposition of these requirements will hinder wind-energy development, there is at least one reason to think otherwise. It has been noted that landowners contemplating wind-lease agreements are often particularly concerned about decommissioning.[195] By providing landowners with the basic protection of a bonding requirement, jurisdictions can address this concern in a way that creates a defined regulatory framework. Making clear the rules of the game can encourage development by alleviating one of landowners' most common objections to contracts offered by developers.[196]

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189. *E.g.*, N.C. GEN. STAT. ANN. § 143-215.121 (West 2016).

190. *E.g.*, OKLA. STAT. ANN. tit. 17, § 160.15(A) (West 2016).

191. U.S. GOV'T ACCOUNTABILITY OFFICE, *supra* note 175, at 21.

192. Ferrell & DeVuyst, *supra* note 66, at 110.

193. Tony Kealy, Martin Barrett & Derek Kearney, *How Profitable Are Wind Turbine Projects? An Empirical Analysis of a 3.5 MW Wind Farm in Ireland*, INT'L J. ON RECENT TECHS. IN MECHANICAL AND ELECTRICAL ENGINEERING, Apr. 2015, at 58, 62.

194. *See* Ferrell & DeVuyst, *supra* note 66, at 110 (discussing developers' substantial investment in and commitment to wind-farm projects).

195. *Id.* at 107.

196. *Id.* at 107–08.

B. Triggering Events and Decommissioning Requirements

Clearly defining the events that trigger decommissioning, and defining what decommissioning requires, will further clarify existing law. This may seem like an elementary question, but outside of Oklahoma and specific lease provisions, it goes largely unanswered in our current legal framework. The first question is determining what events should cause decommissioning to begin. Next is the question of what specific requirements must be met to say that decommissioning has occurred—and in what time frame must these requirements be discharged.

Existing law suggests that decommissioning is triggered when a facility is abandoned or when a facility reaches the "end of [its] useful life."[197] The Oklahoma statute defines abandonment as "failure to generate electricity from commercial wind-energy equipment for a period of twenty-four (24) consecutive months."[198] This two-pronged approach seems well calibrated to cover the variety of eventualities that could arise in a wind farm's course of operation. Defining the end of a wind farm's useful life may seem elementary, but without this definition it is impossible to know when decommissioning requirements are triggered.

Another common pitfall to avoid is failing to set out minimum requirements for decommissioning. Regulation that fails to impose minimum standards invites partial decommissioning. The Oklahoma statute sets out a simple list of specific requirements that developers "remov[e] . . . wind turbines, towers, buildings, cabling, electrical components, foundations and any other associated facilities, to a depth of thirty (30) inches below grade."[199] The inclusion of these specific requirements also helps avoid concern about incomplete decommissioning—especially by mandating removal of components with no salvage value. The statute proceeds to require the restoration of disturbed earth and reseeding so as to return the site to "substantially the same physical condition" as existed prior to construction.[200] With these two simple provisions, the Oklahoma statute clearly defines the scope of decommissioning. The statute goes on to require that the developer complete these steps within one year of the event that triggers decommissioning.[201] It sets out bright-line rules for assessing when decommissioning is required, to what extent the developer must clean up, and the timeframe in which decommissioning must be completed. Without these rules, it is impossible to assess whether a successful decommissioning has taken place as required by regulation or the wind-farm lease. Setting these

197. OKLA. STAT. ANN. tit. 17, § 160.14(C)(1) (West 2016).
198. *Id.* § 160.13(1).
199. *Id.* § 160.14(B)(1).
200. *Id.* § 160.14(B)(2).
201. *Id.* § 160.14(C)(1).

requirements out explicitly provides clarity and helps avoid the necessity of litigating decommissioning questions.

The final topic to note here is that statutes and regulations should explicitly allow landowners and operators to adopt stricter decommissioning requirements in the initial lease or by later agreement. The Oklahoma statute allows for this.[202] Setting this caveat out in legislation or applicable regulation can only serve as a good reminder to courts and contracting parties that legally imposed standards represent only a minimum. The specificities of a particular plot of land or the landowner's activities thereon may mandate additional decommissioning measures. Landowners and operators should be free to agree to these further protections.

C. Allocating the Decommissioning Burden

The idea that statutes and regulations should clearly allocate the burden of decommissioning also seems elementary. However, it is another area where the law, in its current state, has failed. Regulations have been promulgated setting out decommissioning requirements without specifying who is responsible for compliance.[203] For example, a Swift County, Minnesota ordinance requires that "all [wind turbines] and accessory facilities shall be removed to four feet below ground level within 90 days of the discontinuation of use."[204] The ordinance further states that "each Large [wind-energy-conversion system] shall have a Decommissioning plan . . . ."[205] While these requirements are commendable, the ordinance completely fails to set out who is responsible for meeting these requirements. The ordinance could be construed to require compliance by the landowner or by the developer—or by both. Such ambiguity makes landowners anxious about executing leases. In the face of potential liability for decommissioning costs, they should be. Decommissioning law should clearly allocate the decommissioning burden to the developer.

The less apparent part of this issue is the need to designate who will decommission if the primary party fails to meet their duty. In the event of a failed decommissioning, the Oklahoma statute obligates the state's Corporation Commission (which is generally tasked with regulating oil and gas production, among other things)[206] to "take such measures as are necessary to complete the decommissioning."[207] The question of who should decommission where the developer fails is largely a policy question for state

202. *Id.* § 160.14(D).

203. Biricik & Haroun, *supra* note 71.

204. SWIFT CTY., MINN., ORDINANCES § 10.6(K) (2016).

205. *Id.* § 10.6(L).

206. *See generally* OKLA. STAT. ANN. tit. 17 (outlining the Oklahoma Corporation Commission's authority and duties).

207. *Id.* § 160.14(C)(2).

legislators and regulators rather than a legal question. However, the pitfall that the law must avoid here is failing to designate a party responsible for decommissioning in the event the developer fails to carry out its duty.

D. Statewide Regulation

The final point to note in this subpart is the necessity of state action on decommissioning. As illustrated above, federal law is largely absent in regulating wind-energy production.[208] "The federal role in regulation is limited to projects occurring on federal lands or those with some form of federal involvement"—such as projects that receive federal funding.[209] Municipal- and county-level regulation, on the other hand, plays a large role—especially in the current absence of state action. However, there are four strong arguments for why state governments are better situated to regulate in this area.

First, state regulation promotes uniformity. Local controls are a patchwork, and create confusion for developers seeking to meet the requirements of different regulatory frameworks. Further, as evidenced by the Swift County ordinance discussed above, local regulation is often poorly crafted.[210] Finally, wind-farm projects are large and may stretch across a municipal or county border. State regulation sets uniform standards that increase convenience and clearly define the rules of the game.

Further, states possess superior regulatory institutions to local governments. Regulating a growing industry requires a large and sophisticated regulatory apparatus. This is particularly true given the technical nature of wind-energy conversion. Regulators will need to assess decommissioning cost estimates, require correct bonding amounts, and have the expertise to complete decommissioning where developers fail. State governments, with energy and environmental regulatory bodies already in place, are better equipped to meet these challenges.

Conclusion

For many years, the focus surrounding wind energy—from operators, to politicians, to landowners—has been squarely on installing turbines and increasing generation capacity. This rush to expand production has been wildly successful. Today, the United States leads the world in wind-power production and only looks to expand this lead in the coming years. However, during this rush to capture the wind, the long-term implications of the installation of massive wind-energy-conversion systems have been largely

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208. *See* U.S. GOV'T ACCOUNTABILITY OFFICE, *supra* note 175, at 21 (explaining that, because "most wind power development has occurred on nonfederal land, regulating wind power facilities is largely a state and local government responsibility").

209. *Id.*

210. *See* discussion *supra* subpart IV(C).

ignored. There was a time when wind-farm decommissioning could be considered a far-off problem—so distanced by time from the present that it could go unobserved. But today, as many modern wind farms enter their second decade of operation, we move ever closer to facing a problem that will impose huge costs on the industry, governments, landowners, and the general public.

Unfortunately, current law largely fails to allocate, or even recognize the existence of, these costs. Because of this, we face uncertainty. It is largely uncertain whether the wind industry, governments, or landowners will bear the monetary cost of decommissioning. This cost is large and ever-increasing. But the failure to provide decommissioning security raises the possibility of costs much worse than monetary costs. More troubling is the open question of whether many wind farms will be decommissioned at all. Ten years after America's best-documented case of wind-farm abandonment, we continue to face the specter of a day when green energy's glistening installations are instead fields full of falling-down junk.

—William S. Stripling