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Blowing in the Wind: How a Two-Tiered National Renewable Portfolio Standard, A System Benefits Fund, and Other Programs Will Reshape American Energy Investment and Reduce Fossil Fuel Externalities

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NOTES

BLOWING IN THE WIND: HOW A TWO-TIERED NATIONAL RENEWABLE PORTFOLIO STANDARD, A SYSTEM BENEFITS FUND, AND OTHER PROGRAMS WILL RESHAPE AMERICAN ENERGY INVESTMENT AND REDUCE FOSSIL FUEL EXTERNALITIES

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INTRODUCTION

The manner in which the United States satisfies its energy needs over the next quarter century will determine the relative health of the country physically,[1] politically,[2] environmentally,[3] and economically.[4] By 2030, the nation will see a 36% rise in electricity consumption.[5] Already the largest energy consumption sector,[6] electric power sector needs will outpace the transmission grid's distribution capacity[7] and the country's ability to absorb the deleterious financial effects of fossil fuel-based energy.[8] Congress must respond.

Respiratory illness, cancer, neurological disorders, and birth defects caused by fossil fuels cost the country billions of dollars a year.[9] These billions of dollars, public health entitlements notwithstanding, represent a mass siphoning of capital that would otherwise, in the form of commerce or workforce participation, contribute to the domestic

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1. *See* Conrad G. Schneider, Clean Air Task Force, *Dirty Air, Dirty Power: Mortality and Health Damage Due to Air Pollution from Power Plants* 7-15, June 2004 (citing Abt Associates, Inc., *infra* note 8).

2. *See* Western Hemisphere Energy Security: Testimony Before Comm. on Int'l Relations Subcomm. on the W. Hemisphere (Mar. 6, 2006) (statement of Karen A. Harbert, Assistant Sec'y for Policy and Int'l Affairs, U.S. Dep't of Energy); U.S. Dep't of Energy, *Energy Policy Act of 2005: Section 1837: National Security Review of International Energy Requirement*, 34-35 (Feb. 2006) [hereinafter U.S. Dep't of Energy, *National Security Review*].

3. *See* Alan Nogee et al., *Powerful Solutions: 7 Ways to Switch America to Renewable Energy*, at 4 (Jan. 1999).

4. *See id.* at 7.

5. *See* Energy Info. Admin., *Annual Energy Outlook 2007: With Projections to 2030*, at 138, DOE/EIA-0383(2007) (Feb. 2007) [hereinafter *Annual Energy Outlook 2007*].

6. Energy Info. Admin., *Monthly Energy Review: March 2007*, DOE/EIA-0035(2007/03), at 25 (Mar. 2007) [hereinafter *Monthly Energy Review: March 2007*]. The electric power sector comprises sellers of electricity, namely utility companies and independent power producers. *Id.* at 176. This is distinguished from so-called "end-use" sectors of the economy: residential, commercial, industrial, and transportation. *Id.*

7. *See* U.S. Dep't of Energy, *National Transmission Grid Study* 4 (May 2002) [hereinafter U.S. Dep't of Energy *Grid Study*].

8. *See* Abt Associates, Inc., *The Particulate-Related Health Benefits of Reducing Power Plant Emissions*, 6-3 to 6-4 (Oct. 2000), *available at* http://www.cleartheair.org/fact/mortality/mortalityabt.pdf; *see also* Schneider, *supra* note 1, at 22 (listing the projected health costs and benefits under several proposals facing Congress).

9. *See* Schneider, *supra* note 1, at 22.

economy.[10] The federal government is clearly complicit in allowing the status quo, for which individual policymakers ought to be ashamed. But more constructive is the fact that the solution is cognizable and can be implemented in a way that solves the mutually reinforcing crises of electricity demand,[11] infrastructural antiquation,[12] rising energy costs,[13] and soaring public and private health care expenses,[14] not to mention going a long way toward providing the environment an overdue respite.[15]

In applying the principles of both giants of twentieth century economic theory, demand-side and supply-side fiscal policy,[16] Congress can cost-effectively and with minimal administrative oversight,[17] change the course of American energy use.[18] Furthermore, it can tailor its legislation to be compatible with existing industrial interests while spreading the benefits of lower emissions and reduced externality costs to the vast majority of the population.[19] The states have already set the example.[20]

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10. *Id.* at 12 (citing findings that over three million work days every year are lost because of the impact of power plants in the United States).

11. *See* U.S. Dep't of Energy *Grid Study*, *supra* note 7, at 5-6 (noting that transmission bottlenecks increase electricity costs).

12. *See id.* at 3 (explaining how the electricity transmission system was developed piecemeal over 100 years by vertically integrated utilities in geographically diverse areas).

13. *See Annual Energy Outlook 2007*, *supra* note 5, at 5-6.

14. *See* Abt Associates, Inc., *supra* note 8, at 6-3 to 6-4.

15. *See generally* Intergovernmental Panel on Climate Change, *Climate Change 2001: Impacts, Adaptation, and Vulnerability* (2001), *available at* http://www.grida.no/climate/ipcc_tar/wg2/index.htm [hereinafter IPCC Report] (arguing that fossil fuels cause climate change, which in turn causes widespread environmental damage and massive public and private insurance risks).

16. *See* David Storobin, *American Economic Policy from 1920's to 1990's*, Global Politician (online magazine), May 9, 2005, http://www.globalpolitician.com/articleshow.asp?ID=700&cid=1&sid=45 (providing a historical overview of supply-side economics).

17. *See* Am. Wind Energy Ass'n, *The Renewables Portfolio Standard: How It Works and Why It's Needed (Oct. 2005)*, *available at* http://www.awea.org/pubs/factsheets/RPSHowWhy.pdf [hereinafter *RPS Overview*] (explaining how regulatory oversight of a renewable portfolio standard is minimal).

18. *See* Union of Concerned Scientists, *Successful Strategies: Renewable Energy Standards* (Mar. 2007), *available at* http://www.ucsusa.org/assets/documents/clean_energy/Climate-Solutions-RES-12-06-Update.pdf [hereinafter *Successful Strategies*].

19. *See infra* notes 442-520.

20. *See Successful Strategies*, *supra* note 18; Database of State Incentives for

By incentivizing renewable power sources and mandating the production, distribution, and consumption of their output, the government can effectively make good on a public mandate for cleaner, cheaper, more reliable energy.[21] To do this it needs to continue to implement methodology it already employs in the form of tax credits,[22] capital financing assistance,[23] and generalized production incentives[24]—all supply-side principles that have effectively resulted in the growth of the renewable energy industry to this point.[25] The expansion of the supply-side tract must be met with an equally vigorous demand-side campaign.[26] Like a parent giving a push to a child's sled atop a snowy hill, Congress must simply dictate the industry's trajectory and provide it catalytic force to supply the direction and momentum needed to encourage self-sustaining investment.

Part I of this Note will address some examples of the health and environmental consequences of fossil fuels and touch on methods used for monetizing these externalities.[27] In particular it will focus on coal-

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Renewables and Efficiency (DSIRE), *Financial Incentives for Renewable Energy*, *available at* http://www.dsireusa.org (follow links to "Summary Tables" and then to "Financial Incentives for Renewable Energy") [hereinafter DSIRE Website] (charting various state-offered tax incentives, rebates, grants, and loans).

21. *See* Lori Bird & Blair Swezey, *Green Power Marketing in the United States: A Status Report (Ninth Edition)*, NREL/TP-640-40904, at 26 (Nov. 2006) (analyzing the growth of the "green power market" attributable to "demand-side stimuli"); *see also* Am. Wind Energy Ass'n, *Windpower Outlook 2006*, *available at* http://www.awea.org/pubs/documents/pdf/Outlook_2006.pdf [hereinafter *Wind Outlook 2006*] (citing a Yale public opinion poll that found that 86% of Americans favor increased funding for renewable energy).

22. Janet L. Sawin, Worldwatch Inst., *National Policy Instruments: Policy Lessons for the Advancement & Diffusion of Renewable Energy Technologies Around the World* 18 (Jan. 2004).

23. *See* Fred Beck & Eric Martinot, *Renewable Energy Policies and Barriers*, *in* Encyclopedia of Energy (Cutler J. Cleveland ed., 2004), *available at* http://www.martinot.info/Beck_Martinot_AP.pdf (manuscript at 10-13).

24. *See* Renewable Energy Prod. Incentive, 42 U.S.C. § 13317 (2005).

25. *See* Beck & Martinot, *supra* note 23, at 22 (listing subsidies, rebates, and net metering rules along with tax incentives as having contributed most to the rise of renewable energy during the 1990s and 2000s).

26. *Cf.* Paul Gipe, *Renewable Energy Policy Mechanisms* 12 (Feb. 17, 2006), *available at* http://www.wind-works.org ("Subsidies alone [including "capital investment" and tax incentives] are never a sufficient support mechanism.").

27. *See infra* notes 88-93.

based energy, the market-share leader in electricity[28] and the biggest threat to public health and the environment.[29] As an answer to fossil fuel hegemony, Part II will examine the progress and potential of wind power,[30] its technological improvement,[31] receptivity to government initiative,[32] response to investment structure,[33] and the market wind already enjoys as exemplified in electricity consumption data.[34] Part III will review state and federal renewable energy policies, with particular attention to wind power, that have supply-side and demand-side impacts.[35] Part IV addresses the technical and regulatory challenges facing wind energy and other renewables, including transmission access rules,[36] output variability[37] and storage techniques,[38] power grid integration,[39] and infrastructural modernization.[40] Technical solutions for many of these challenges offered by experts will be addressed.[41] Finally, Part V will integrate examples of supply-side and demand

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28. *See* Energy Info. Admin., *Annual Coal Report 2005*, DOE/EIA-0584(2005), at 8 (Oct. 2006); *see also Monthly Energy Review: March 2007*, *supra* note 6, at 100 (listing the amount of energy generated in kilowatt hours from various fossil fuel and renewable energy sources).

29. *See generally* Todd L. Cherry & Jason F. Shogren, *The Social Cost of Coal: A Tale of Market Failure and Market Solution* (Appalachian State Univ. Dept. of Econ. Working Paper Series, Sept. 30, 2002) (discussing the social costs, or "externalities," of coal-based electricity).

30. *See infra* notes 102-212.

31. *See* Int'l Energy Agency, *Long Term Research and Development Needs for Wind Energy for the TimeFrame 2000 to 2020*, at 2-4 (Oct. 2, 2001) [hereinafter *Wind Energy R&D*].

32. *See* Energy Info. Admin., *Policies to Promote Non-hydro Renewable Energy in the United States and Selected Countries* 8 (Feb. 2005) [hereinafter *Policies to Promote Renewables*]; Ari Reeves, *Wind Energy for Electric Power: A REPP Issue Brief* 20-22 (Fredric Beck ed., Renewable Energy Policy Project July 2003).

33. *See* Ryan Wisner & Edward Kahn, Energy & Env't Div., Lawrence Berkeley Nat'l Lab., *Alternative Windpower Ownership Structures: Financing Terms and Project Costs* 19-21 (May 1996).

34. *See infra* notes 165-206.

35. *See generally* Gipe, *supra* note 26 (addressing supply-side policy theory).

36. *See* Beck & Martinot, *supra* note 23, at 5.

37. *Id.* at 4-5.

38. *See* Int'l Energy Agency, *Variability of Wind Power and Other Renewables: Management Options and Strategies* 27 (June 2005) [hereinafter *Variability of Wind Power*].

39. *See* Beck & Martinot, *supra* note 23, at 6.

40. *See* U.S. Dep't of Energy *Grid Study*, *supra* note 7, at 5.

41. *See infra* notes 365-90.

policy initiatives into a comprehensive renewable energy policy proposal.[42]

I. THE FINANCIAL FALLACY OF FOSSIL FUELS

Electricity markets in the United States are dominated by fossil fuels, and under current predictions, that fact is unlikely to change.[43] In February 2007 the Energy Information Administration (the "EIA"), a branch of the Department of Energy, released their Annual Energy Outlook, a projection of electricity production to 2030.[44] Using current trends, the EIA contends that fossil fuels will continue to account for the bulk of American electricity production for the next two and half decades.[45] Currently, 50% of domestic electricity production comes from coal,[46] with an additional 15% from natural gas,[47] and 20% from nuclear sources[48]—making up the overwhelming majority of the domestic electricity market.[49] Projections bear these trends out for the foreseeable future.[50] Renewable energy, by contrast—with the exception of hydro power (e.g. Niagara Falls and the Hoover Dam)[51]—has largely failed to catch on because of the high costs associated with production and transmission,[52] variable output,[53] and the perception that a long-term market does not exist for these energies.[54] Wind, photovoltaic (solar), geothermal, and biomass are the leading non-hydro sources of electricity currently available in the United States.[55]

42. *See infra* notes 404-520.

43. *See Annual Energy Outlook 2007*, *supra* note 5, at 7 (graphing projected energy consumption by fuel type and illustrating that future hydropower and non-hydro renewables consumption comprise only a small fraction).

44. *See id.*

45. *See id.* at 14.

46. *See Monthly Energy Review: March 2007*, *supra* note 6, at 35.

47. *Id.*

48. *Id.*

49. *Id.*

50. *See Annual Energy Outlook 2007*, *supra* note 5, at 14.

51. *See Monthly Energy Review: March 2007*, *supra* note 6, at 35.

52. *See* Beck & Martinot, *supra* note 23, at 4-5.

53. *See id.* at 4.

54. *Cf.* H. Sterling Burnett, Nat'l Ctr. for Policy Analysis, *Wind Power: Red Not Green* 1-2 (Feb. 23, 2004) (arguing that the tax credits and accelerated depreciation given wind power show that wind is not yet competitive with traditional fuel sources).

55. *See generally* Energy Info. Admin., *Renewable Energy Trends 2004* (Aug.

Combined, however, they account for only about 2.5% of the nation's electric power sector consumption.[56] Unless the government changes how energy production costs are reflected, the status quo ought to endure for fossil fuels and renewables alike.

Under current federal pricing measurements, coal is the least expensive source of electricity[57] (the EIA does not compile comparable production price statistics for renewables, but the International Energy Agency estimates that utility-scale wind energy costs in the United States are close to that of natural gas in "high quality wind regimes").[58] According to the EIA, the cost of coal at electric generating plants in 2006 averaged $1.70 in nominal dollars per million British thermal units

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2005) (showing statistics highlighting these sources as the leading renewables in producing power).

56. *See Monthly Energy Review: March 2007*, *supra* note 6, at 35 (999 trillion Btu out of 39,710 total in 2006).

57. *See Annual Energy Outlook 2007*, *supra* note 5, at 174.

58. Int'l Energy Agency, *Renewable Energy: Market and Policy Trends in IEA Countries* 656 (2004) [hereinafter *Renewable Energy Report*]. According to a Renewable Energy Policy Project (REPP) analysis, "Utility-scale wind farms in the U.S. produce wind power at a levelized cost of approximately [$0.02 to $0.06] per kilowatt hour. . . . [W]hile the cost of energy of a particular wind project is relatively straightforward, the comparison of the cost of wind generation to other types of generation is often controversial," owing to the fact that levelized cost statistics, used to estimate wind production cost, include the "annual cost of recovering the total capital costs plus the recurring costs such as operations and maintenance and royalty payments divided by annual expected output." Reeves, *supra* note 32, at 11. The EIA's fossil fuel production cost statistics are not measured on the basis of levelized cost. *See id.* at 12. To illustrate, the author cited a 2001 conference paper issued by Ronald L. Lehr, John Nielsen, Steven Andrews, and Michael Milligan of the National Renewable Energy Laboratory. *Id.* *See* Ronald L. Lehr et al., *Colorado Public Utility Commission's Xcel Wind Decision*, NREL/CP-500-30551 (Sept. 2001), *available at* http://www.eere.energy.gov/windpoweringamerica/pdfs/xcel_wind_decision.pdf). The conference paper involved a 1999 contract award decision made by the Colorado Public Utility Commission on a "head-to-head" comparison between natural gas and wind. The commission initially chose to give the contract to the natural gas generator based on "low natural gas costs, low capacity value for wind, and high wind ancillary service costs," but reconsidered and found the wind power bid was "'justified on purely economic grounds'" as long as gas prices were more than $3.50 per million cubic feet in light of the fair capacity value of the wind project (49 MW for a 162 MW project) and the fact that "ancillary services to back up new wind power are not a major cost." Reeves, *supra* note 32, at 12. For more on levelized cost, *see infra* note 154 and accompanying text.

("Btu").[59] Petroleum and gas, the other fossil fuels that are used in electricity production, do not compare with coal's low cost.[60] Furthermore, while the cost of production of coal-based electricity has in fact gone up considerably in the last ten years,[61] the EIA does not project any rise between now and 2030 to be more dramatic than 0.1% in real dollars per year.[62] Thus, there is no reason to expect the status quo of the electricity market to change without outside action. Since coal supplies in the United States are plentiful,[63] limiting coal-burning will not reduce dependence on foreign sources of energy.[64]

The *casus belli* for such outside action is the fact that the government's pricing figures neglect to factor in the full costs of fossil fuel production, including environmental and health costs that are not passed onto consumers directly in their utility bill.[65] For example, utility companies do not have to account for the consequences of approximately six billion metric tons per year of carbon dioxide emissions, a total that will increase to nearly eight billion metric tons per year by 2030, a twenty-five-year increase of about 30%.[66] Nor is a financial charge indexed to other consequences of fossil fuel burning. Increases in the emission of sulfur, methane, carbon monoxide, nitrogen oxides, ozone, volatile organic compounds, and other particulate matter

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59. *See Monthly Energy Review: March 2007*, *supra* note 6, at 135.

60. *Id.* Petroleum is broken into three subcategories, residential fuel oil ($8.02/mmBtu),distillate fuel oil ($12.98/mmBtu), and petroleum coke ($1.29/mmBtu). *Id.* This accounts for less than 1% of coal's consumption. *Id.* at 104. Natural gas costs $6.89 per mmBtu, up from $1.98 in 1995. *Id.* at 135.

61. *See id.* at 135. Coal's cost per mmBtu in 1996 was $1.29, and was as low as $1.20 per mmBtu in 2000—representing an increase of about 32% since the mid-1990s, and 42% since the millennial turn. *See id.*

62. *Annual Energy Outlook 2007*, *supra* note 5, at 174. Using 2005 dollars, this outcome assumes a higher than anticipated economic growth—the reference case would actually place the price $0.01 per mmBtu lower than at present. *See id.*

63. Richard Bonskowski & William D. Watson, Energy Info. Admin., *Coal Production in the United States—An Historical Overview* 1 (Oct. 2006), *available at* http://www.eia.doe.gov/cneaf/coal/page/coal_production_review.pdf.

64. *Cf. id.* ("The 1973 Oil Embargo renewed interest in the vast U.S. coal reserves, *as the nation strived to achieve energy independence*.") (emphasis added).

65. *See* John Carlin, Energy Info. Admin., *Environmental Externalities in Electric Power Markets: Acid Rain, Urban Ozone, and Climate Change* xi (1995), *available at* http://www.eia.doe.gov/cneaf/pubs_html/rea/feature1.html; *see also* Schneider, *supra* note 1 (highlighting the impact of pollution on health and mortality).

66. *Annual Energy Outlook 2007*, *supra* note 5, at 14.

wreak havoc on human and natural habitats alike by causing things like acid rain, urban ozone (caused primarily by nitrous oxide emissions, resulting in respiratory problems in humans), and global climate change.[67] Among fuels used for electricity generation, coal is by far the largest producer of these emissions, producing far beyond its proportional market share.[68] While coal-based power is seen to be the least expensive source of electricity on the market today,[69] the market dynamics that favor coal are substantially flawed.[70]

The indirect costs associated with the production of electricity from coal are simply staggering.[71] During the mining stage land is permanently damaged, air and water sources are contaminated, ground subsidence causes surface collapses, and workers can be injured or killed.[72] During processing and utilization, heavy metal and acid is given off, and particulate matter, carbon dioxide, sulfur dioxide, and nitrogen oxides are emitted into the atmosphere, causing seemingly immeasurable damage and destruction to public and private property, wildlife, and public health.[73]

Every year, the more than 600 coal-burning plants in the United States[74] emit more than 98,000 pounds of mercury into the air[75] while creating another 81,000 pounds of mercury pollution from fly ash and scrubber sludge[76], all after 20,000 pounds of mercury is released in pre-burning "cleaning" procedures—totaling 200,000 pounds.[77] That mercury, along with arsenic, cadmium, and other heavy metals, seeps out during the coal-burning process and travels either directly through ground water and airborne particles, or indirectly through the food chain

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67. *See supra* note 15 and accompanying text (IPCC); Carlin, *supra* note 65.

68. *See* Energy Info. Admin., *Annual Energy Review 2005*, DOE/EIA-0384, at 350-52 (July 2006) [hereinafter *Annual Energy Review 2005*].

69. *See Monthly Energy Review: March 2007*, *supra* note 6, at 135.

70. *See* Cherry & Shogren, *supra* note 29, at 4 ("[I]f the market price of coal or energy or both does not capture the social costs of coal use, individual coal users face incentives that suggest more consumption than society desires relative to alternative sources of energy.").

71. *See* Schneider, *supra* note 1, at 12-15 (revealing the mortality rates for a number of states and linking heart attacks and lung cancer to pollution).

72. *See* Cherry & Shogren, *supra* note 29, at 14.

73. *Id*.

74. *Coal Takes Heavy Human Toll*, USA Today Magazine, Oct. 16, 2004.

75. *Id.*

76. *Id.*

77. *Id.*

(often through fish), to humans.[78] Mercury, even in small doses, is converted easily through human metabolism into the neurotoxin methylmercury.[79] The result of the contamination is that one out of every six women of childbearing age may have enough of a concentration of mercury to permanently damage a developing fetus, meaning 630,000 babies a year born in the United States (out of 4 million) are at risk for severe neurological consequences as a result of gestational mercury poisoning.[80] Coal also causes nearly 554,000 asthma attacks, 16,200 cases of chronic bronchitis, and 38,200 non-fatal heart attacks each year.[81] Not surprisingly, proximity to coal-burning facilities increases the likelihood that a person becomes one of the 23,600 deaths every year attributed to power plant pollution,[82] each death taking an average of fourteen years off normal life expectancy.[83] All told, the health care costs caused by plant emissions total an estimated $160 billion annually.[84] Other grisly consequences from living near coal burning include a high rate of stomach cancer,[85] autism in children (for every 1,000 pounds of mercury released in a Texas county, autism rates rose 17%),[86] and pneumoconiosis in coal miners (also known as "black lung disease").[87]

Environmentally, the externality costs of air pollution, acid rain, and global warming are also significant.[88] For instance, according to one set of estimates, the "annual marginal cost of air pollution and acid deposition" is between $10.39 and $11.02 per short ton of coal; for climate change, the marginal cost is between $0 and $4.50 per million

78. *See* Schneider, *supra* note 1, at 16.

79. *Id.*

80. *Id.*

81. *Id.*

82. *Id.*

83. *Id.*

84. *Id.*

85. *See* Gene Weinberg et al., *A Case-Control Study of Stomach Cancer in a Coal Mining Region of Pennsylvania*, 56 Cancer 703, 703 (1985).

86. *See* Steve Brown, *Study Links Power Plant Mercury Emissions to Autism*, Education Daily, Mar., 24, 2005, at 3.

87. *See* Xiaorong Wang et al., *Respiratory Symptoms and Pulmonary Function in Coal Miners: Looking Into the Effects of Simple Pneumoconiosis*, 35 Am. J. Indus. Med. 124, 124 (1999).

88. *See* IPCC Report, *supra* note 15, at ch. 5 (pp. 235-343); Reeves, *supra* note 32, at 15-17; Nogee et al., *supra* note 3, at 4-7.

Btu.[89] Absent any consideration of climate change, the approximate "social costs of coal as a percentage of private costs range from about 40% to 275%."[90] The range for natural gas is 12% to 95%, 112% to 123% for petroleum, and 14% to 17% for nuclear.[91] Another set of estimates emphasizes that "coal is by far the most under-priced energy resource,"[92] and that at a price of $30 per ton would carry with it external costs of almost $160 without including climate change risks which would bring costs to $190 per ton.[93] While monetizing the total social and environmental costs to society of fossil fuel use is an inexact science, the causal link between polluting fuels and resulting externalities is undeniable.[94]

Despite arguments and economic models that show wide-ranging and heavy social costs to fossil fuel burning, and in particular coal consumption, unless and until the industries themselves are compelled to account for these costs, investment will remain high in traditional energy sources.[95] Alternatives, still too underdeveloped as a whole to compete with the infrastructure[96] and reliability of fossil fuels,[97] will need time

89. Cherry & Shogren, *supra* note 29, at 8 (citing Darwin C. Hall, *Preliminary Estimates of Cumulative Private and External Costs of Energy*, Contemporary Policy Issues Vol. VIII, No. 3, 283-307 (July1990)).

90. Cherry & Shogren, *supra* note 29, at 9.

91. *Id.* (noting that these figures are "rough estimates").

92. *Id*. at 10 (citing W. Kip Viscusi et al., *Environmentally Responsible Energy Pricing,*15 ENERGY J. 23 (April 1994).

93. Cherry & Shogren, *supra* note 29, at 10.

94. *See* Schneider *supra* note 1, at 12-25.

95. *See* Cherry & Shogren, *supra* note 29, at 6 ("By altering the underlying incentive of prices with subsidies or taxes, relative prices can reflect society's tradeoffs and households and firms will voluntarily act according to society's best interest."); Sawin, *supra* note 22, at 22 ("In most cases, it is less a matter of finding new money to invest in renewable energy, and more a matter of transferring money flows from conventional energy to renewables.").

96. *See, e.g.*, Reeves, *supra* note 32, at 18 (explaining how wind power producers "face significant challenges" because of the "transmission infrastructure and related regulatory frameworks" that are in place were designed to meet the needs of traditional energy sources, and in part because "wind is a relatively new entrant to the electricity generation market"); *see also* Nogee et al., *supra* note 3, at A-1 to A-10 (evaluating the particular concerns facing various renewable energy sources).

97. *See* Bonskowski & Watson, *supra* note 63. As the demand for electricity has grown, coal production has risen to meet it. *Id.* at 2. Productivity has increased on average 4% every year since 1973. *Id.* at 7; *cf. Variability of Wind Power*, *supra* note 38, at 9 (noting that all sources of energy derive from nature and thus "vary in their availability," but fossil fuels have "nature cycles of regeneration which . . . occur on a

and money to make up the difference.[98] With technological advances in turbine design reducing the levelized cost of output,[99] and not reliant on fossil fuel burning like biomass power,[100] wind energy has the best chance of all truly clean energy sources to make the most immediate and long-lasting impact on the electricity market.[101]

II. A GUST OF ELECTRICITY: HOW WIND POWER IS TAKING OVER THE WORLD AS AN INCREASINGLY VIABLE INVESTMENT OPTION AND AN ENERGY SOURCE

With rising externality costs and significant health and environmental consequences looming,[102] forty-nine states, the District of Columbia, and Puerto Rico have implemented some form of incentive for the production (supply-side) or consumption (demand-side) of electricity from renewable energy sources.[103] Of those forty-nine states, forty-six include incentives for wind energy,[104] the fastest growing renewable electricity generation source in the world.[105] State wind incentives, as for other renewables, integrate supply-side and demand-side principles into a combination of both production and consumption tax credits, grants, loans, production incentive payments, and sale and use standards.[106] State action that comprehensively addresses energy

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timescale several orders of magnitude longer" than renewables like wind, and photovoltaic power).

98. *See* Sawin, *supra* note 22, at 26-27.

99. *See Wind Energy R&D*, *supra* note 31, at 3-4.

100. *Cf.* Nogee et al., *supra* note 3, at A-7 (explaining biomass electricity generation strategies that would lower production costs including "cofiring biomass in existing coal-fired power plants" and "using high-efficiency gasification with combined cycle gas turbines"); Energy Info. Admin., *Analysis of a 10% Renewable Portfolio Standard* 2 (May 2003) [hereinafter *Analysis of a 10% Renewable Portfolio*] (factoring into its examination of a federal renewable portfolio standard a 1.0 cents per kilowatt-hour production tax credit for biomass cofiring with existing coal plants).

101. *See* Nogee et al., *supra* note 3, at A-7; *Analysis of a 10% Renewable Portfolio*, *supra* note 114, at 4 (finding that a renewable portfolio standard would lead to greater generation from wind and biomass resources).

102. *See* Cherry & Shogren, *supra* note 29, at 6-12, 14 (listing the "direct and external costs" that coal-based energy levies on society).

103. *See* DSIRE Website, *supra* note 20.

104. *See id.*

105. Reeves, *supra* note 32, at 9.

106. *See generally* L. Bird et al., *Policies and Market Factors Driving Wind Power*

distribution and consumption contributes to localized success in encouraging the construction of wind power production facilities (usually called "wind farms") in nearly every region of the country.[107] In fact, because the wind-power industry has proven uniquely responsive to government action,[108] this Note will treat wind power as the bell-weather for assessing the relative effectiveness of renewable energy legislation. The commercial promise, potential proliferation, and likely contribution to national energy needs that wind power represents[109] requires that it be given special attention in the review of renewable energy policy in general.[110]

In February 2006, President George W. Bush voiced his ambition that fully 20% of the nation's electricity could come from wind,[111] mirroring results in Europe where wind accounts for a 10% to 25% electricity market share in Denmark, Germany, and areas of Spain.[112] By late 2006, installed wind-based electricity generating capacity in the United States exceeded 10,000 megawatts.[113] Up from a 2,000 megawatt capacity in 1999, wind is the fastest growing renewable energy source in the world, and is second to only natural gas in newly-

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Development in the United States, NREL/TP-620-34599, at 1 (July 2003) [hereinafter L. Bird et al.] (discussing the "drivers for wind development in a dozen leading states").

107. *See* DSIRE Website, *supra* note 20 (listing the policies by state); Am. Wind Energy Ass'n's Wind Project Data Base, http://www.awea.org/projects (for a table of installed wind energy capacity). While the Southeast—excluding Tennessee—does not have wind energy generation facilities, other renewables benefit from local incentive policies on the state and retailer level. *See* DSIRE Website, *supra* note 20.

108. *See Policies to Promote Renewables*, *supra* note 32, at 8 (Figure 2 illustrates the growth of wind capacity in the U.S. relative to the implementation of certain government policies between 1980 and 2003); *see also* NREL Policies and Market Factors, *supra* note 82 and accompanying text.

109. *See* Global Wind Energy Council, *Global Wind Energy Markets Continue to Boom – 2006 Another Record Year*, Feb. 2, 2007, *available at* http://awea.org/newsroom/pdf/070202__GWEC_Global_Market_Annual_Statistics.pdf [hereinafter Global Wind Energy Council].

110. *See Analysis of a 10% Renewable Portfolio*, *supra* note 100, at 17.

111. *See Emerging U.S. Renewables Grab Presidential Attention*, Env't News Serv., Feb. 22, 2006, *available at* www.ens-newswire.com/ens/feb2006/2006-02-22-02.asp [hereinafter *U.S. Renewables Grab Presidential Attention*]

112. *See* Am. Wind Energy Ass'n, *Wind Energy Basics*, Feb. 5, 2007, *available at* http://www.awea.org/newsroom/pdf/Wind_Energy_Basics.pdf [hereinafter *Wind Energy Basics*].

113. Am. Wind Energy Ass'n, *U.S. Wind Energy Installations Reach New Milestone*, Aug. 14, 2006.

installed generating capacity in the United States, as of 2005.[114] Worldwide, wind energy capacity grew 15,197 megawatts in 2006 alone,[115] accounting for nearly 75,000 megawatts total.[116] Furthermore, busbar costs have dropped from $0.38 per kilowatt hour since government support for wind power began in the early 1980s, to between $0.02 and $0.06 per kilowatt hour now.[117]

One megawatt hour of electricity on average in the United States produces emissions of 1,341 pounds of carbon dioxide,[118] 7.5 pounds of sulfur dioxide,[119] and 3.55 pounds of nitrogen oxides.[120] If wind-generated electricity totaled 10 million megawatt hours per year, or roughly the generation totals at 2002 capacity levels,[121] it would avoid emissions of 6.7 million tons of carbon dioxide,[122] 37,500 tons of sulfur dioxide[123] (which when combined with atmospheric water vapor becomes sulfuric acid, the primary component of acid rain), and 17,750 tons of nitrogen oxides.[124] The more wind energy that is produced in a geographic region, the more effect it will have on displacing toxic emissions.[125]

The American wind energy market is projected by its industry trade association, the American Wind Energy Association (the "AWEA"), to be able to support 10,000 megawatts of wind power installations every year. This in turn would make the goal of producing 20% of the nation's electrical supply achievable.[126] Considering its growth, the wind industry is still remarkably sensitive to legislative action.[127] In fact,

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114. *See id.*

115. *See Wind Energy Basics*, *supra* note 112.

116. *See* Global Wind Energy Council, *supra* note 109.

117. Reeves, *supra* note 32, at 9.

118. *Id.* at 15.

119. *Id.*

120. *Id.*

121. *See Monthly Energy Review: March 2007*, *supra* note 6, at 99.

122. Reeves, *supra* note 32, at 15.

123. *Id.*

124. *Id.*

125. *See id.* Furthermore, "[w]ind has the potential to displace relatively more emissions in areas where more heavily polluting fuels predominate." *Id.*

126. *Wind Outlook 2006*, *supra* note 21, at 1.

127. *See* L. Bird et al., *supra* note 106, at 36-39 for an overview of how a variety of government policies can have a "sizeable effect on the wind industry," especially when transmission access is less discriminatory.

nearly all of the industry's major challenges are addressable through regulatory initiative and tax policy.[128] The wind power industry has shown responsiveness to virtually every type of supply and demand-side incentive policy on the books, including each of the following: installation credits, net metering, system benefits funds, sales and property tax exemptions, grants, loans, production tax credits and incentives, and renewable portfolio standards.[129] For example, in 2003 the EIA released a study in which they examined the possible effects of a 10% national renewable portfolio standard by 2030[130]—a lower percentage and later date than most states currently employing a renewable portfolio standard.[131] Wind energy, the study suggested, would be the greatest beneficiary of such action, while fossil fuels coal and natural gas would be most negatively influenced in terms of production, albeit not heavily.[132] The price of electricity at end-use sectors (residential, commercial, industrial, transportation), the EIA found, would largely remain unaffected.[133]

Furthermore, in addition to legislative incentives and market-adjustment policies, government investment into research and development has allowed the wind industry to help itself as well.[134] The amount of electricity that can be harvested from wind power is a function of the mass of the moving air and its velocity.[135] Therefore improvements in the turbine (which includes a rotor, gearbox,

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128. *See id.* at 35-36 (finding that wind power development is promoted most strongly by state tax and financial incentives, including renewable portfolio standards, and technological improvements "facilitated by federal tax incentives," but stating that transmission costs brought about by regulatory "uncertainties" negatively affect industry growth).

129. *See* L. Bird et al., *supra* note 127 and accompanying text; *see also* Am. Wind Energy Ass'n, *Frequently Asked Questions About Net Metering*, *available at* http://awea.org/pubs/factsheets/netmetfin_fs.pdf (outlining some of the benefits net metering can provide in a small-scale residential wind facility).

130. *Analysis of a 10% Renewable Portfolio*, *supra* note 100.

131. *See* DSIRE Website, *supra* note 20, *available at* http://www.dsireusa.org/documents/SummaryMaps/RPS_Map.ppt.

132. *See Analysis of a 10% Renewable Portfolio*, *supra* note 100, at 4, 17-18.

133. *See id.* at 4.

134. *See Wind Energy R&D*, *supra* note 31, at 4 (arguing that 40% of the reduction in costs for wind power is a result of technological improvements, with government polices that encourage economies of scale accounting for most of the rest); *see also Renewable Energy Report*, *supra* note 58, at 646 (Figure 5), 655-56.

135. *See* Reeves, *supra* note 32, at 5.

monitoring equipment, and a tower)[136] have a direct effect on a wind power facility's output.[137] For example, in 1981, a standard turbine's rotor was 10 meters in diameter with a rated capacity of 25 kilowatts.[138] By 2000, standard rotor diameter measures 71 meters in diameter with a capacity of 1,650 kilowatts.[139] Innovations like larger, better designed turbines, situated in larger wind farms substantially reduce the cost of production per kilowatt hour in large part because they are more efficient to manage and operate.[140] As turbine capacity increases, energy production costs go down[141] and investment goes up.[142] Continued technological improvements, like those that support lower wind speed turbine output,[143] will further support the wind market,[144] and provide power without the risk of rising fuel costs.[145]

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136. *Id.* at 8-9.

137. *Id.* at 5:

> The energy content of a particular volume of wind is proportional to the square of its velocity. Thus, a doubling of the speed with which this volume of air passes through a wind turbine will result in roughly a fourfold increase in power that can be extracted from this air. In addition, this doubling of wind speed will allow twice the volume of air to pass through the turbine in a given amount of time, resulting in an eightfold increase in power generated. This means that only a slight increase in wind velocity can yield significant gains in power production.

Id.

138. Am. Wind Energy Ass'n, *The Economics of Wind Energy*, Feb. 2005, *available at* http://awea.org/pubs/factsheets/EconomicsOfWind-Feb2005.pdf.

139. *See id.*

140. *See id.*; *Wind Energy R&D*, *supra* note 31, at 2-4.

141. *Wind Energy R&D*, *supra* note 31, at 4.

142. *See*, *e.g.*, Am. Wind Energy Ass'n, News Release, *Wind Energy Capacity in U.S. Increased 27% in 2006 and is Expected to Grow an Additional 26% in 2007*, Jan. 23, 2007, *available at* http://www.awea.org/newsroom/releases/Wind_Power_Capacity_012307.html [hereinafter Am. Wind Energy Ass'n Jan. 23, 2007 News Release] (citing the $4 billion aggregate investment used to install the nearly 2,500 megawatts of wind power in the United States in 2006); *cf.* Sawin, *supra* note 22, at 18 (explaining that financial incentives for renewable power industries reduce the cost of production by subsidizing investment in new technology or in the production of the energy itself; accordingly, increased investment is a function of lower costs for more efficient production).

143. *See* U.S. Department of Energy, Energy Efficiency and Renewable Energy, *Wind and Hydropower Technologies Program: Low Wind Speed Technology*, *available at* http://www1.eere.energy.gov/windandhydro/wind_low_speed.html.

144. *See Wind Energy R&D*, *supra* note 31, at 4-6.

145. *See Wind Outlook 2006*, *supra* note 21, at 2.

A. Wind Investment: Blowing Money Is a Becoming a Better Bet

Despite optimistic projections[146] and technological improvements to the turbines that actually generate the electricity,[147] both the AWEA and the President recognize that the long-term health of the industry lies in private investment.[148] Between 1995 and 2005, private investment in renewables totaled roughly $180 billion, including $39 billion in 2005, six times higher than ten years earlier.[149] Despite this growth, and the fact that wind installations are going up faster than nuclear power plants worldwide,[150] the structure of project ownership is crucial.[151] The AWEA notes that because of the capital-intensive nature of wind energy and the cheaper financing options available to utility-owned energy projects, it is still more expensive to produce a kilowatt hour as a private power producer than as a utility.[152] Deregulation of the electric power sector and the rise of IOUs (investor-owned utilities) provide a safer, potentially more lucrative option for investment.[153] IOU ownership, according to a 1996 Lawrence Berkeley National Laboratory study cited by the AWEA, reduced the levelized costs of power production by as much as 30%.[154] While product novelty may benefit certain industries

146. *See* Am. Wind Energy Ass'n Jan. 23, 2007 News Release, *supra* note 142.

147. *See Wind Energy R&D*, *supra* note 31, at 2-4.

148. *See* George W. Bush, "President Discusses Advanced Energy initiative In Milwaukee," Office of the Press Secretary, Feb. 20, 2006, *available at*, http://www.whitehouse.gov/news/releases/2006/02/print/20060220-1.html [hereinafter Bush Speech Feb. 2006] (arguing that to "encourage conservation and new technologies and alternative sources of energy," the government—which provides one-third of research and development dollars as opposed to two-thirds from the private sector—needs to "make sure people [and private businesses] continue to invest"); *see also* Am. Wind Energy Ass'n, *Investing in Wind Power*, *available at* http://www.awea.org/pubs/factsheets/InvestingInWindPowerFS2005.pdf (illustrating the options open to private investors who are interested in putting money into the wind power industry).

149. *See* Worldwatch Institute & Center for American Progress, *American Energy: A Renewable Path to Energy Security*, at 12, Sept. 2006, *available at*, http://www.nfu.org/wp-content/uploads/2006/09/AmericanEnergyReport.pdf.

150. *Id.* at 11.

151. *See* AWEA, Wind Economics, *supra* note 138.

152. *Id.*

153. *See* Wisner & Kahn, *supra* note 33, at 19-31.

154. Am. Wind Energy Ass'n, *Comparative Cost of Wind and Other Energy Sources*. According to the AWEA, "[l]evelized costing calculates in current dollars all capital, fuel, and operating and maintenance costs associated with the plant over its lifetime and divides that total cost by the estimated output in [kilowatt hours] over the

with regard to financing, wind power producers do not enjoy this advantage. In fact, it is the opposite.[155] The AWEA notes that "lenders therefore offer less favorable financing terms and demand a higher return on investment than for more "conventional" energy sources."[156] Higher interest rates on capital investment, if reduced to the same level as natural gas plants, would reduce wind energy production costs approximately 40%.[157]

Nonetheless, as wind energy grows in market share[158]—and the European example offers support for such an eventuality[159]—novelty wears off. From the time of the Lawrence Berkeley National Laboratory study, wind power generation has grown exponentially.[160] In 1996, at the study's publication, installed capacity in the United States was roughly 1,700 megawatts, having languished through relatively slow growth through most of the mid-1990s.[161] Today output is far greater,[162] and industry advocates expect the economics of today's wind industry to attract new capital.[163] Supply-side legislation notwithstanding, potential investors, however, need to be convinced of the long-term marketability of the product.[164]

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lifetime of the plant." *Id*. at n.1; *see also* AWEA, Wind Economics, *supra* note 138 (referencing the same study's findings in February 2005).

155. AWEA, Wind Economics, *supra* note 138.

156. *See id.* (citing Wisner & Kahn, *supra* note 33, at 11).

157. *See id.* (finding that "a 50-[megawatt] wind farm delivering power at just under 5 cents per [kilowatt hour] would, if using typical natural gas financing terms, generate electricity for 3.69 cents per [kilowatt hour]").

158. *See infra* notes 165-206.

159. *See* Global Wind Energy Council, *supra* note 109; Am. Wind Energy Ass'n, *Global Wind Energy Market Report*, March 2004 at 2-4.

160. *See* Am. Wind Energy Ass'n, *Wind Power: U.S. Installed Capacity: 1981-2006, available at*, http://www.awea.org/faq/instcap.html.

161. *See id.*

162. *Id.*

163. *See* Am. Wind Energy Ass'n Jan. 23, 2007 News Release, *supra* note 142.

164. *See* Beck & Martinot, *supra* note 23, at 6 (explaining how a lack of familiarity with renewable technologies, coupled with premiums on acquiring investment capital—among other barriers—result from uncertainty about future technology performance and a generalized lack of information).

B. "Demanding" Wind Power: A Market Analysis

To evaluate the existence of a market and its relative strength and trajectory, in this case the wind power market, often observers point to the relative cost of producing a unit of electricity from one source versus other sources.[165] The federal government's policy for promoting renewable energy relies on supply-oriented tax credits and production incentives in an effort to stimulate the construction of electricity-generating facilities and the sale and distribution of renewable power.[166] State policy involves more of a mix between production incentive strategies and schemes that create markets for renewables (demand-side).[167] This Note proposes that it is most accurate to determine the existence of a power source's market potential not by examining supply as manifested in price, but another fundamental economic concept—demand as expressed in consumption.

There are essentially two distinct, but related markets at work that need to be recognized when reviewing electric power sector data. The first is the producer-distributor market, and the second is the distributor-end-user market.[168] Government, in enacting tax credits and research

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165. *See* Burnett, *supra* note 54 (arguing that there is no natural market for wind power because government subsidies artificially lower cost); *see also* Cherry & Shogren, *supra* note 29 (asserting that the fossil fuel prevalence is a result of a market failure which keep costs artificially low because externalities relating to health and environmental damage caused by certain kinds of electricity production are not factored into utility charges); *but see* Reeves, *supra* note 32, at 11. The author explains that "the comparison of the cost of wind generation to other types of generation is often controversial." The controversy appears to stem from the subjective manner in which variables like project financing or social costs are factored into these cost comparisons. *See id.* For the purposes of this market analysis, social cost concerns are not imputed to either policy-makers or investors. *See* Beck & Martinot, *supra* note 23, at 5 (stating that "investors rarely include [environmental externalities] in the bottom line used to make decisions").

166. *See* U.S. House Comm. on Energy & Com. Press Off., "Energy Policy Act of 2005: Highlights of the Energy Policy Act of 2005," April 2005 (stating that promoting production of renewable-sourced electricity was the purpose for renewing incentives in the Energy Policy Act of 2005, discussed *infra*); *see also* L. Bird et al., *supra* note 106, at 4-5 (providing an overview of "federal tax and financial incentives" that "encouraged wind power *development*") (emphasis added).

167. *See, e.g.,* L. Bird et al., *supra* note 106, at 6-35 (providing examples of state-level policies).

168. *See* J.E. Pater, National Renewable Energy Laboratory Technical Report, *A Framework for Evaluating the Total Value Proposition of Clean Energy Technologies,* NREL/TP-620-38597, at 6, Feb. 2006 (illustrating graphically the "value chains" which

and development grants to fund technological improvement, seeks to provide renewables a chance to compete with fossil fuels for access to consumers by reducing production cost.[169] Market-creation policies like a renewable portfolio standard affect the market primarily by mandating that a specified threshold of electricity sales (often a percentage) come from a particular class of energy source.[170] Electricity consumption is the output of this cascading market system.[171] Price is thus the economic medium through which legislative ends are met, but is not a policy end unto itself.[172] Therefore, even though the legislation might be aimed directly at driving down the cost of production to the power

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exist in the electricity generation markets). In many circumstances, the entity that is the distributor or transmitter of electricity is the same as the power generator (normally a utility). *See* Energy Info. Admin., *The Changing Structure of the Electric Power Industry 2000: An Update*, DOE/EIA-0562(00), at 16-17, 19-20, 22-24, 27-28 (2000), *available at*, http://www.eia.doe.gov/cneaf/electricity/chg_stru_update/update2000.pdf [hereinafter *Changing Structure of the Electric Power Industry*] (outlining the roles of the actors in the electricity supply market). In that situation, the market (as measured by consumption) expresses itself in the energy sources the electricity retailer (utility or non-utility) chooses to use to generate the power it sells to its end-use customers. *See Changing Structure of the Electric Power Industry*, *supra* at 23-24 (discussing the wholesale electricity market). For wind and geothermal energy, independent power producers, which are "non-utilities," generate most of the electricity that is "consumed" (purchased) by the distributor-utilities from these sources. *See Changing Structure of the Electric Power Industry*, *supra* at 24; Energy Info. Admin., *Renewable Energy Trends 2004*, at 13, Aug. 2005.

169. *See Policies to Promote Renewables*, *supra* note 32, at 6-8 (stating, for instance, that (1) "The United States has [used] financial incentives to try to spur the growth of renewable energy," and (2) research and development investments by the government are "intended to accelerate the development and introduction of technologies and practices that provide social benefits, such as increased energy security, reduced energy costs, or reduced pollution associated with energy use . . . because, when successful R&D reduces the capital and/or operating costs of new products or processes"); *see also* NREL Value Framework, *supra* note 168, at 32.

170. *See* Beck & Martinot, *supra* note 23, at 8-9.

171. *See* Pater, *supra* note 168 and accompanying text; *see also Monthly Energy Review: March 2007*, *supra* note 6, at 5, 143. The EIA measures geothermal, wind, and photovoltaic electricity consumption by its net generation and employs a formula to estimate the equivalent fossil fuel burning it would take to replace the generation from those sources. *Id.*

172. *See* Beck & Martinot, *supra* note 23, at 16. "As wholesale electricity becomes more of a competitive market commodity, price becomes relatively more important than other factors in determining a buyer's choice of electricity supplier." *Id.*

producer (e.g. a wind farm owner),[173] whether it creates or boosts a market is not ascertained by looking at price per se, but in measuring consumption and demand—the amount of energy from that source that is actually used (producer-distributors) or purchased (distributors-end users).[174]

The double market means that demand can be measured in two ways. In the electric power sector, consumption is measured by the amount of power that production and distribution facilities (e.g. utility-scale power plants) use to sell to their customers.[175] This is, however, somewhat confusing, because consumption statistics for certain renewables, including wind, are measured by approximate thermal conversion rates (measured in Btu), which are derived from the energy source's net generation (measured in kilowatt-hours).[176] This means that figures measuring the consumption of wind energy (along with solar and geothermal) are actually based on a formula of what a utility would have to consume from a fossil fuel source to generate the same electricity.[177] Therefore, in evaluating demand, either the thermal conversion equivalent of what the electric retailer consumes (in Btu) or the electricity bought by the end-user from a retailer (in kilowatt-hours) can be considered a result of governmental cost-reduction incentives.

The change in the wind power industry's market share is observable though its percentage-share of total consumption in the electric power sector. That change can be traced to the economic impact of governmental policy choices.[178] Owing to the fact that supply is a

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173. *See* Beck & Martinot, *supra* note 23, at 10.

174. *Cf.* Pater, *supra* note 168, at vi, 6 (depicting the flow of value in renewable-source electricity generation markets to illustrate how an input like a tax credit or subsidy at one point in the "value chain" can manifest at the end).

175. *See Monthly Energy Review: March 2007*, *supra* note 6, at 36-37. Given the 58.6 trillion Btu of electricity the United States imported on average between 2001 and 2006, it is clear that electricity producing and distributing facilities would not generate, or take in power they did not intend to sell. Accordingly, this Note imputes consumption data for the electric power sector to end-use consumers of electricity. This is reflected by the EIA's use of "net generation" statistics for certain renewables in their consumption data. *See id.* at 9, 35.

176. *See id*. at 164 (listing the approximate heat conversion rates for fossil fuel plants that apply to wind power and other sources, which generated 10,022 Btu per kilowatt-hour in 2006).

177. *Id.* at 164, 168.

178. *See Policies to Promote Renewables*, *supra* note 32, at 7-8 (asserting that the Energy Policy Act of 1992 which implemented the first production tax credit and

function of a direct relationship between price and quantity, if the supply curve in the producer-distributor market has been out-shifted because of tax credits and technology subsidies, production costs would be lower and the wind power at distributor's disposal would correspondingly be higher. [179] Similarly, market-creation policies like renewable portfolio standards directly out-shift the demand curve by mandating consumption.[180] Therefore, if the policies have any effect, demand and consumption should be higher ex post. This Note, in keying in on demand, posits that logically, the effectiveness of legislative policy choices and thus, the level of investment potential, can be evaluated by whether consumption numbers for wind energy (or any industry) are rising at a faster rate than its peers. If wind energy consumption rates are increasing at a faster rate over time relative to total electric power consumption, they must be gaining a greater market share. Declining consumption rates, or slower increases, for any other energy source would circumstantially reinforce that conclusion.

There is no reason to suggest that the idiosyncratic desire to purchase wind energy is a superseding intervening cause for these results. While many utilities offer green pricing programs that allow end-use purchasers to choose to consume electricity from renewable sources, they accounted for only 0.2% of total U.S. electricity sales in 2005 and only about 3% of wind power consumption for that year.[181] By and large this signifies that end-users buy the default energy their utility offers, reflecting the utility's choice and costs regarding a power source. Moreover, since nearly all of the electricity consumed by end-

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renewable energy production incentive "significantly improved the economics of wind power," as illustrated by the growing U.S. installed wind capacity with each renewal of the credit).

179. *Cf.* Reeves, *supra* note 32, at 22-23.

180. *See* N.H. van der Linden et al., Energy Research Center of the Netherlands (ECN), *Review of International Experience With Renewable Energy Obligation Support Mechanisms* 10 (ECN-C–05-025, May 2005).

181. *See* Bird & Swezey, *supra* note 21, at 4 (citing figures from Energy Information Administration, *Electric Power Annual 2005*, at 46, (Nov. 2006)). It is worth mentioning that of the 8.5 billion kilowatt hours in retail sales of electricity attributed to voluntary purchase markets, 61% of the green power sales came from wind energy. *Id*. at 26. Using the 2005 heat rate conversion factor (999 Btu per kilowatt-hour), that 61% would translate to 5.185 million kilowatt-hours which in turn comes out to about 5.19 trillion Btu (2.92% of the 178 trillion Btu total for wind power in 2005). *See Monthly Energy Review: March 2007, supra* note 6, at 35, 164.

use sectors comes from the electric power sector,[182] that sector's consumption data is an accurate reflection of wind power's electricity demand market share.

The electric power sector consumption numbers bear out the fact that wind power, though still a minor factor in terms of overall market share, grew considerably faster than the electric power sector as a whole since its statistics were first accurately recorded.[183] Total electric power sector energy consumption (all consumption figures for this section in trillion Btu) in 2006 was 29.4% higher than it was in 1990.[184] That 29.4% increase is the standard by which this Note evaluates the relative growth, decline, or stagnation of selected energy sources. Coal consumption in the electric power sector was 26.2% higher in 2006 than it was in 1990,[185] maintaining a slightly declining majority share of the market during that period.[186] Natural gas consumption, which is nearly wholly reliant on the electric power sector,[187] was 92.7% higher.[188]

182. *See Monthly Energy Review: March 2007*, *supra* note 6, at 100 (listing Electric Power Sector statistics), *accord id.*, at 113 (listing Electricity End Use statistics) (showing how roughly 94% of retail electric power sector net generation is reported as sold to end-use sectors). Losses occur mainly during transmission and distribution and as a result of the direct use of generated electricity at "adjacent or co-located facilities." *See Annual Energy Review 2005*, *supra* note 68, at 224.

183. *See Monthly Energy Review: March 2007*, *supra* note 6, at 35. The data for wind power consumption did not include independent power producers until 1989. This analysis begins in 1990, and includes the ascertainable consumption rates during the two years prior to the implementation of the first production tax credit, years in which consumption was relatively stagnant. It also includes slow growth periods between 2001 and 2005 attributable to periods in which the tax credit lapsed or was threatened to lapse. *Id.*

184. *Id.* at 35 (increasing from 30,684 trillion Btu in 1990 to 39,710 trillion Btu in 2006). The percentages have been rounded.

185. *Id.* at 35 (increasing from 16,261 trillion Btu to 20,517 trillion Btu).

186. *Id.* (53.0% in 1990, 51.7% in 2006). The electric power sector's dependency on coal however is mutual, as about 91% of coal's power production in 2006 is accounted for by this sector. *See id.* at 7, 35 (percentage totals rounded to nearest tenth).

187. *See id*. at 7, 35. The electric power sector does not account for nearly the same percentage of total natural gas-produced energy consumption as coal does (only 28.5% compared with 91.0% for coal). *See id.* Still, while the gross consumption of energy from natural gas for all sectors was 14.0% more in 2006 than it was in 1990 (19,730 trillion Btu to 22,495 trillion Btu) its 2006 use in the electric power sector was higher than in 1990 by 92.7% (3,332 trillion Btu to 6,421 trillion Btu). *See id.* (stating that energy consumption from natural gas in all sectors in 2006 surpassed 1990 totals by 2,765 trillion Btu); *see id.* at 7. The 3,089 trillion Btu difference between 1990 and

Petroleum, the weakest of the fossil fuels in electricity production,[189] fell 49.9% in electric power sector consumption from its 1990 totals,[190] while nuclear power, neither a fossil fuel nor renewable, was 33.2% higher.[191] Electricity production represents the major use of renewable energy generally,[192] and the only use for wind,[193] whose market share in the electric power sector was slightly less than 0.1% in 1990, or 29 trillion Btu.[194] In terms of vindicating government policy, however, 1990 was a proper departure point. Iowa passed the first renewable portfolio standard in 1991,[195] and the first federal production tax credit was passed in 1992.[196] In 1997, Massachusetts, Minnesota, and Nevada

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2006 in the electric power sector alone means that 111.7% of the growth in all sectors is accounted for in electricity production. Thus, natural gas's consumption market share for all sectors decreased from 23.3% in 1990 to 22.6% in 2006 (-0.7%)). *See id.*

188. *See id.* at 35 (documenting an increase from 3,332 trillion Btu to 6,421 trillion Btu, which effectively moved a 10.9% electric power sector market share in 1990 to 16.2% in 2006).

189. *See id.* at 35 (documenting a 4.2% market share in 1990 and a 1.6% market share in 2006).

190. *See id.* (documenting 1,289 trillion Btu in 1990; 646 trillion Btu in 2006). It is worth noting that petroleum is by far the most consumed source of energy in the country at 40.4% for all sectors – the bulk of its use being in the transportation sector (68.9%). *See id.* at 7, 33.

191. *See id.* at 35 (accounting for a 19.8% market share in 1990 and a 20.7% market share in 2006).

192. *See id*. at 143, 146. In 2006, the equivalent of 6,523 trillion Btu was consumed from renewable sources of energy in all sectors. *Id.* at 143. Of the total, 3,857 trillion Btu was consumed by the electric power sector, good for 59.1%. *Id.* at 146. While most sources of renewable energy are a product of the electric power sector in terms of total renewables energy consumption, biomass is an exception since only 14.3% is consumed in the production of electricity. *See id.* at 143, 146. Solar, though a mainstay of renewable energy discussions, contributes to less than 1% of renewable consumption, but most of that goes to the residential sector (92.2%), with the remaining 7.8% used in electricity production. *See id.* at 143, 144. Of the other major renewable energy sources (comprising 53.6% of the total), the electric power sector represents the following percentage of their total consumption in all sectors: hydro: 98.9%; geothermal: 90.2%; wind: 100%. *See id.* at 143, 146.

193. *See id.*

194. *See id.* at 35.

195. *See* Barry G. Rabe, *Race to the Top: The Expanding Role of U.S. State Renewable Portfolio Standards*, Pew Center on Global Climate Change 3-4 (June 2006), *available at* http://www.pewclimate.org/global-warming-in-depth/all_reports/race_to_the_top/index.cfm.

196. 26 U.S.C. § 45 (1992) (amended 2006).

passed production standards as well.[197] From 1999 to 2005, eighteen more states including Texas, California and New York, as well as the District of Columbia, followed suit.[198] Although wind power consumption only once actually decreased between any two years,[199] hiccups in the acceleration of wind power's growth are widely attributed to the lapses of the production tax credit.[200] The credit was renewed in 2005,[201] and has not lapsed since.[202] By 2006, though wind power's market share was still only 0.65%, it had grown in consumption from 29 trillion Btu to 258 trillion Btu, an increase of about 790%.[203] Between 1990 and 2006, electric power sector consumption, if wind were not included, averaged an annual increase of slightly less than 1.7%.[204] Wind power consumption on the other hand—with an average annual increase of about 46.5%—grew 26-times faster than the rest of the field.[205] While a 20% market share is not in the picture presently, it is clear that wind energy does enjoy a market. If access to the power grid, which is maintained by utilities, is assured for renewable energy producers, their input of electricity into the marketplace (both of them) would necessarily increase.[206]

The news for the wind industry is not all good. Despite recent

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197. Rabe, *supra* note 195, at 3.

198. *Id.* at 4.

199. *See Monthly Energy Review: March 2007*, *supra* note 6, at 35. The decrease was 3 trillion Btu between 1997 and 1998. *Id.*

200. *See Policies to Promote Renewables*, *supra* note 32, at 8 fig.2 (charting the relationship between wind power's growth in capacity and the several incarnations of the production tax credit); Burnett, *supra* note 54 (arguing that the wind power industry is beholden to the production tax credit, including a reference to the 2003 expiration in which the author argues that wind became uncompetitive when the credit last lapsed); *Renewable Energy Report*, *supra* note 58, at 647.

201. Energy Policy Act of 2005, H.R. 6, 109th Cong. § 1301 (2005).

202. The Tax Relief and Health Care Act of 2006, H.R. 6111, 109th Cong. § 207 (2006) (extending the production tax credit to Dec. 31, 2008).

203. *See Monthly Energy Review: March 2007*, *supra* note 6, at 35.

204. *See id.*

205. *See id.*

206. *See* Jim Caldwell, *Wind in the Pipeline*, Mechanical Engineering Magazine, "Power & Energy" ¶ 15 (Mar. 2004), http://www.memagazine.org/supparch/pemar04/pipeline/pipeline.html (arguing that "streamlined interconnection procedures and fair transmission access and costs [to generators] would allow wind to have a place in interstate commerce as merchant generation"). The author was the policy director for the AWEA when he wrote this article.

gains, long-term growth is still questionable.[207] For one, the current production tax credit is again scheduled to expire (this time on December 31, 2008),[208] but a tougher obstacle remains—wind power's greatest potential lies in relatively geographically remote regions.[209] Therefore, issues involving transmission costs threaten to put the brakes on the industry's growth.[210] The national power grid, as it stands, is not conducive to carrying massive amounts of current, for example, from the wind-rich prairies of the Dakotas to larger population centers near the Great Lakes or the Pacific Northwest.[211] As wind energy production reaches the maximum competitive utility transmission cost, supply-side policies will drive consumption and investment potential upward into a veritable glass ceiling.[212]

III: THE "MORAL EQUIVALENT TO WAR": A BRIEF HISTORY OF RENEWABLE ELECTRICITY LEGISLATION

Equating the battlefield with energy policy and the push for clean sources of power free from foreign and despotic influences reflects the mood of a nation weary of price shocks and embargoes when President Jimmy Carter voiced the above analogy on April 18, 1977 during a televised speech.[213] In fact, modern energy policy in the United States can be traced to the oil embargoes and ensuing energy supply crises of the 1970s.[214] A litany of bills was introduced in the Congress between

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207. *See id.* at ¶ 2 (saying that wind energy's "prospects" were "dimmed . . . by the failure to secure a timely extension for the federal wind energy production tax credit" in 2004).

208. H.R. 6111, 109th Cong. § 207 (2006).

209. Nogee et al., *supra* note 3, at A-4–A-5.

210. *See* Reeves, *supra* note 32, at 18-19 (outlining the difficulties remote wind power producers face in trying to provide their product to consumers).

211. *See* Caldwell Pipeline Article, *supra* note 206 (explaining that the transmission system "across the Missouri River basin or in the interior West" is "brittle" and "leads to significant restrictions on regional electricity exports"); *see* Reeves, *supra* note 32, at 18-19.

212. *See* Reeves, *supra* note 32, at 19 ("When the demand for [access to] a transmission path exceeds its reliable capacity, utilities react by limiting generation.").

213. Jimmy Carter, President of the U.S., *The President's Proposed Energy Policy* (Apr. 18, 1977), *in* Vital Speeches of the Day, Vol. XLIII, No. 14, May 1, 1977, pp. 418-20, *available at* http://www.pbs.org/wgbh/amex/carter/filmmore/ps_energy.html.

214. *See* U.S. Senate Comm. on Energy and Natural Resources, *History of the Committee*, No. 100-46 (1989), *available at* http://energy.senate.gov/about/about_

the Nixon and George H.W. Bush administrations, which sought to promote energy efficiency, reduce dependence of foreign energy sources, and incentivize their alternatives.[215] While most of the legislation proposed during this period was aimed at stimulating domestic energy production from fossil fuel and nuclear sources, nascent renewable sources garnered some attention,[216] most notably solar and geothermal technologies.[217] Over the next three decades, biomass[218] and wind-based power[219] joined solar and geothermal technologies as the subject of legislative policies designed to make use of inexhaustible power supplies.[220] Whether through research and development funding,[221] market approaches like tax credits and investment incentives,[222] or renewable energy-based production and use standards,[223] both the federal and state governments endeavored to fight the energy war, often, however, on both sides of the front.[224]

For the purposes of this Note, the relevant energy legislation of the

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history.html.

215. *See infra* notes 217-28.

216. *Renewable Energy Report*, *supra* note 58, at 645-46.

217. *See*, *e.g.*, Solar Photovoltaic Energy Research, Development and Demonstration Act, Pub. L. No. 95-590 (1978); Solar Energy Research Act, Pub. L. No. 93-473 (1974) (including funding for wind); Geothermal Energy Research, Development and Demonstration Act, Pub. L. No. 93-410 (1974); Solar Heating and Cooling Demonstration Act, Pub. L. No. 93-403 (1974).

218. *See*, *e.g.*, Wood Residue Utilization Act of 1980, Pub. L. No. 96-554 (1980); Biomass Energy and Alcohol Fuels Act of 1980, Pub. L. No. 96-294 (1980) (regarding extended loan commitment guarantees through 1985 in Pub. L. No. 99-24 (1985)).

219. *See*, *e.g.*, Solar, Wind, and Geothermal Power Production Incentives Act of 1990, Pub. L. No. 101-575 (1990), Wind Energy Systems Act of 1980, Pub. L. No. 96-345 (1980).

220. *See Renewable Energy Report*, *supra* note 58, at 661-68 (providing a brief overview of relevant renewables legislation between 1974 and 2005).

221. *E.g.*, Wind Energy Systems Act of 1980, Pub. L. No. 96-345 (1980).

222. *E.g.*, Economic Recovery Tax Act of 1981, Pub. L. No. 97-34 (1981).

223. *See*, *e.g.*, DSIRE Website, *supra* note 20, *available at* http://www.dsireusa.org/documents/SummaryMaps/RPS_Map.ppt (containing an illustration of state renewable portfolio standards).

224. *See* Doug Koplow & John Dernbach, *Federal Fossil Fuel Subsidies and Greenhouse Gas Emissions: A Case Study of Increasing Transparency for Fiscal Policy*, 26 Ann. Rev. of Energy and the Env't 361, at 362-71 (2001); *see also* Public Citizen National Non-Profit Public Interest Organization, *The Best Bill Corporations Could Buy: A Summary of Industry Giveaways in the 2005 Energy Bill*, *available at* http://www.citizen.org/documents/aug2005ebsum.pdf [hereinafter Public Citizen EP Act 2005 Analysis] (analyzing the Domenici-Barton Energy Policy Act of 2005).

last three decades can most appropriately be deemed 'domestic electricity production policy.'[225] Using fiscal policy as its tool, legislatures use ostensibly two methods to encourage greater production and lower prices, supply-side tax credits and subsidies and demand-side purchase, sale, and consumption mandates.[226] In order to promote the proliferation of renewable energy Congress has preferred to use primarily supply-side policies,[227] with one notable exception,[228] while many states tend toward more integrated strategies.[229]

A. Making Renewables Cheaper and More Lucrative: Supply-Side Electricity Production Policy

In order to affect the supply of a commodity—in this case increasing renewable-source electricity production[230]—legislatures have a number of policy options at their disposal. This Note divides them into two categories: capital subsidization and production incentive.[231]

225. Petroleum-oriented laws are not discussed at any length.

226. *See* Dr. Keith Kozloff, Hagler Bailly, Inc., *Renewable Energy Strategies in Developing and EIT Countries Under Restructured Electricity Markets*, Presented at "Accelerating Grid-Based Renewable Energy Power Generation for a Clean Environment," (Mar. 8, 2000), http://www.usea.org/agbrepgconf2000/pdf/b2b_s_p.pdf (providing a breakdown of examples of supply side and demand side methods for promoting the growth in renewable power). To avoid confusion, this Note's use of the term "supply-side" invokes any law that directly impacts the development and/or installation of electricity-generating capacity through subsidy, loan, tax credit, production incentive, rebate, or grant. Conversely, the term "demand-side" implicates legislation designed to foster a new market or economy of scale that provides producers of electricity with purchasers/consumers.

227. *E.g.*, Energy Policy Act of 1992, Pub. L. No. 102-486 (instituting the production tax credit and renewable energy production incentive for the first time in the amount of 1.5 cents per kilowatt hour for the production of electricity from renewable sources).

228. *See* Public Utility Regulatory Policies Act (PURPA), Pub. L. No. 95-617, 92 Stat. 3117 (1978), discussed *infra* notes 309-23.

229. *See* L. Bird et al., *supra* note 106 and accompanying text.

230. *See Renewable Energy Report supra* note 58, at 661-68; *see also Policies to Promote Renewables*, *supra* note 32, at 6-8.

231. *See* Gipe, *supra* note 26, at 12-13. The author refers to supply-promoting policies of this type under the general label "subsidies," which are divided into "capital subsidies" (research and development and/or project financing) and "production" (tax credit, incentive payment and rebate). Low-interest loans, while not a "subsidy" per se, *see id.* at 13, still fit into this Note's categorization as a supply-side capital subsidization

Insofar as they pertain to the goal of stimulating renewable energy production (supply), both act by reducing the cost of developing the resource for market.[232] Thus, these policies directly affect the individual commercial actor (e.g. power producer, investor, etc.),[233] and indirectly promote broader social benefits.[234]

The capital subsidization tools chosen by American jurisdictions typically take the form of grants for research and development (R&D) and loan programs.[235] In many states, however, rebates and investment tax credits act as a substitute for both.[236] Each is designed to work in tandem with the other—R&D funds improve technology while the loans provide start-up capital to encourage the timely implementation of that technology.[237] Likewise, rebates ensure capital recovery on investment and installation of renewable technologies.[238] A relevant example of a loan scheme was passed by Congress as part of the American Jobs Creation Act of 2004,[239] which created the "green bonds" program. In allocating up to $2 billion in tax-exempt bond financing, large building developers were permitted to obtain low-interest loans, the benefits of which are allowed to be spent on renewable energy technologies for

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as they are, in effect, a government-provided discount on project financing.

232. *Id.* at 12 ("Subsidies . . . only affect one side of the development equation: profitability.").

233. *See id.* and accompanying text; *see also* NREL Value Framework *supra* note 168, at 32-33, 40-41 (explaining how in the case of production tax credits, the firm generating the power reaps the benefit of the policy, and in research and development programs, the funds "may be integrated with a firm's operations as a generator, distributor, or an end user—*although this last case is infrequent*" (emphasis added)).

234. *See id.* The graphical representation of the value chain illustrates this principle. *Cf.* U.S. Dep't of Energy, *National Security Review*, *supra* note 2, at 34-35 (arguing in a national security context vis-à-vis China that "diversifying sources and types of energy . . . . toward alternative sources can greatly relieve pressures on markets for conventional energy sources over time, while helping to cope with growing environmental concerns").

235. See DSIRE Website, *supra* note 20 (Table of Financial Incentives for Renewable Energy), *available at* http://www.dsireusa.org/summarytables/financial.cfm ?&CurrentPageID=7&EE=0&RE=1 for examples of how states and the federal government employ capital subsidization policies in the areas of R&D and installation loans.

236. *Id.*

237. *See* Gipe, *supra* note 26, at 12-13.

238. *See* Pater, *supra* note 168, at 37-38.

239. H.R. 4520, 108th Cong. § 710 (2004).

their projects.[240] Likewise, a current example of an R&D grant program is in Florida, where the state will provide matching funds for projects relating to renewable energy technology.[241] The purpose is to encourage the expense of private capital on renewable energy projects in the state, promoting renewable industry while giving Floridians the benefit of a decreased need for local fossil fuel emissions.[242]

Federal research and development funding for renewables grew dramatically in the late 1970s, cresting $1.2 billion in the budget for 1980, before precipitously dropping off over the next decade.[243] Between 1974 and 2002, more than 10% of federal energy funding for research and development went to renewables, totaling more than $100 billion during that time.[244] In 1974, R&D initiatives included the Solar Energy Research Development and Demonstration Act,[245] which first provided funds for solar and wind projects, the Geothermal Energy Research, Development and Demonstration Act,[246] and the Solar Heating and Cooling Demonstration Act.[247] Wind energy was the subject of the Wind Energy Systems Act of 1980,[248] which provided grant money for research and development into the development of wind energy technologies and was supervised by the Department of Energy and NASA.[249]

Current R&D funding is administered primarily through the National Renewable Energy Laboratory ("NREL").[250] Despite funding

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240. *See* Pater, *supra* note 168, at 33-34.

241. FLA. STAT. § 377.801 (2006).

242. Press Release, Florida Department of Environmental Protection, *State Awards Grants for Renewable Energy Technologies*, 07-031 (Feb. 22, 2007), *available at* http://www.dep.state.fl.us/secretary/news/2007/02/0222_01.htm (quoting Lt. Gov. Jeff Kottkamp as saying, "Investments in cutting-edge ventures ensure a stronger economy and a cleaner environment"). The release continues: "Through the 2006 Florida Energy Act, the Florida Legislature appropriated $15 million for renewable energy technologies grants to stimulate capital investment in the state and promote and enhance the statewide utilization of renewable energy technologies . . . ." *Id.*

243. *Renewable Energy Report*, *supra* note 58, at 646.

244. *Id.* at 645-47.

245. Pub. L. No. 93-473, 88 Stat. 1431 (1974).

246. Pub. L. No. 93-410, 88 Stat. 1079 (1974).

247. Pub. L. No. 93-403, 88 Stat. 802 (1974).

248. Pub. L. No. 96-345, 94 Stat. 1139 (1980).

249. *See* Energy Info. Admin., *Public Laws Regarding Renewables*, *available at* http://www.eia.doe.gov/cneaf/solar.renewables/page/legislation/publiclaw.html.

250. See http://www.nrel.gov for more information.

woes,[251] NREL's technological development programs received more R&D awards than any other Department of Energy laboratory.[252] Administered by the Department of Energy's Office of Energy Efficiency and Renewable Energy ("EERE"), NREL has a program for the study and advancement of nearly all forms of renewable energy.[253] For instance, since 1980, turbine design, acoustic studies, and other issues relating to wind power are run by the National Wind Technology Center ("NWTC") in Boulder, Colo., part of the DOE's Office of Wind and Hydropower Technologies.[254] The industry-cooperative arm of NWTC, the Wind Partnerships for Advanced Component Technology ("WindPACT") has a stated objective of lowering the cost of wind energy per kilowatt hour to 3.6 cents (not including the production tax credit), and already claims to have contributed to its dramatic decrease in price and corresponding rise in efficiency over the last twenty-five years.[255]

In many states, R&D financing for renewables, as well as infrastructural modernization, grid integration, and other improvements is covered by a "system benefits fund."[256] The fund itself is essentially a trust fund or a bank account whose money is appropriated to meet state energy mandates.[257] In California, the fund is financed by placing charges on utility companies for each unit of electricity they sell.[258] Between 1998 and 2002, $540 million was generated for such projects, with 45% going to existing facilities, 30% going to new facilities, and the remaining money going to lower costs of renewable power for consumers,[259] meaning the program can be shaped to meet the priorities of the legislature that enacts it.

Just as the capital subsidization programs encourage the improvement and construction of renewable energy facilities, the production incentive angle of supply-side policy is concerned with

251. *See U.S. Renewables Grab Presidential Attention*, *supra* note 111.

252. *See* NREL Overview, *available at* http://www.nrel.gov/overview.

253. *See* NREL's Research and Technology Development, *available at* http://www.nrel.gov/research.html.

254. *See* http://www.nrel.gov/wind/facilities.html.

255. *See* http://www.nrel.gov/wind/advanced_technology.html.

256. *See* L. Bird et al., *supra* note 106, at 37. System benefits funds are also known as a "system benefits charge" or a "public benefit fund." Pater, *supra* note 168, at 37.

257. *See* Nogee et al., *supra* note 3, at 26-28.

258. *See* NREL Policies and Market Factors, *supra* note 106, at 8.

259. *Id.*

encouraging the operation of these facilities, either through direct incentives for capital investment or indirectly using tax credits.[260] Legislation in this mould is most often associated with tax policy and production grants.[261] In the same 2006 legislation that established their R&D grant,[262] Florida implemented a corporate production tax credit of $0.01 per kilowatt hour.[263] Together with the research matching grant, Florida has sought to bridge both gaps in normal electricity production: development capital and output.[264] Likewise, in 1978, one year after the creation of the Department of Energy, the federal government instituted its first production tax credit.[265]

Congress passed the National Energy Act that year in part as an effort to encourage investment in renewable energy technology, broaden the national power grid, and allow small-scale renewable energy producers, including wind, the right to sell their product to public utility companies.[266] Included within was the Energy Tax Act ("ETA").[267] The ETA provided residential energy producers income tax credits for solar and wind-based electricity production equipment installed on the premises: 30% of the first $2,000 and 20% for the next $8,000.[268] Similarly, the ETA authorized an additional 10% business tax credit for investment in wind, solar, geothermal, and ocean thermal technologies on top of the standard 10% investment tax credit,[269] which was later

260. *See* Gipe, *supra* note 26, at 12 (outlining types of policies that promote the production of renewable-based energy via private investment and in particular incentives that pay out to investors based on electricity generated and those that reduce tax exposure to investors through production tax credits).

261. *See id.*; *see also* DSIRE Website, *supra* note 20 (Table of Financial Incentives for Renewable Energy), *available at* http://www.dsireusa.org/summarytables/financial.cfm?&CurrentPageID=7&EE=0&RE=1 (providing links to the incentive policies adopted by each state and the federal government and illustrating the prevalence of tax-based legislation and grants, loans, and rebates used to subsidize and encourage the production of renewable energy).

262. FLA. STAT. § 377.801 (2006).

263. FLA. STAT. § 220.193 (2006).

264. *See* Florida Department of Environmental Protection, *Florida's Energy Plan*, at 45-47 (Jan. 17, 2006).

265. *See* Energy Tax Act, Pub. L. No. 95-618, 92 Stat. 3174 (1978).

266. *See Renewable Energy Report*, *supra* note 58, at 647-48 (providing an explanation of the ETA and PURPA and their effects on the energy marketplace).

267. Pub. L. No. 95-618, 92 Stat. 3174 (1978).

268. *See Renewable Energy Report*, *supra* note 58, at 647.

269. *Id.*

repealed as part of the Tax Reform Act of 1986.[270] While Congress extended certain business tax credits for renewables in the act, the ETA business tax credit for wind was allowed to expire at the end of 1985.[271] During this time, however, California, the most populous state, matched the 1978 ETA's business investment tax credit between 1980 and 1983,[272] and soon became the leader in renewable energy production. Until 2006, when it was surpassed by Texas, California had been the largest wind energy producer in the country for nearly twenty-five years.[273]

By the end of the 1980s, as fossil fuel costs decreased, the only way possible to meet the electricity production cost disparity between renewables and fossil fuels was to go back to Congress and push for new incentives.[274] The Energy Policy Act of 1992[275] included a $0.015 per kilowatt hour (annually adjusted for inflation) Production Tax Credit ("PTC") for private or investor-owned wind, solar, geothermal, and biomass facilities.[276] For publicly-owned utilities producing energy from the same renewable sources, the Act instituted a $0.015 per kilowatt hour "Renewable Energy Production Incentive" ("REPI").[277] While the PTC was available to solar and geothermal power generators indefinitely, wind power producers could only claim the credit for the first ten years of operation of a qualified facility.[278] As technology improved, however, the PTC stimulated a modest growth in wind farm construction and wind energy output and consumption, which rose from 30 trillion Btu in 1992 to 70 trillion Btu in 2001 when the initial PTC expired.[279]

After 2001, the PTC went through a series of extensions and renewals,[280] facilitating a boom-and-bust cycle over the next five

270. Pub. L. No. 99-514, 100 Stat. 2085 (1986).

271. *Id.*

272. *See* NREL, Policies and Market Factor, *supra* note 106, at 7.

273. *See* Am. Wind Energy Ass'n, News Release, *AWEA Quarterly Market Report: Texas Overtakes California As Top Wind Energy State*, July 25, 2006, *available at* http://awea.org/newsroom/releases/AWEA_Quarterly_Market_Report_072506.html.

274. *See Policies to Promote Renewables*, *supra* note 32, at 6-8.

275. Pub. L. 102-486, 106 Stat. 2776 (1992).

276. 26 U.S.C. § 45 (1992) (amended 2006).

277. *See* 26 U.S.C. § 13317 (1992) (amended 2005); *see also Renewable Energy Report*, *supra* note 58, at 648.

278. *See Renewable Energy Report*, *supra* note 58, at 647.

279. *Monthly Energy Review: March 2007*, *supra* note 6, at 35.

280. *See infra* notes 282-90.

years.[281] In 2002, the PTC was extended to 2003 as part of the Job Creation and Worker Assistance Act of 2002, expiring December 31, 2003.[282] The following October, the PTC was again extended by the Working Families Tax Relief Act of 2004[283] to December 31, 2005.[284] The American Jobs Creation Act of 2004[285] expanded the list of qualified electricity production facilities eligible for the PTC.[286] However, the Act also added a tax credit, in the amount of $5.48 per ton produced and sold from facilities placed in operation after October 22, 2004, for the production of refined coal.[287]

Thirteen years after the first PTC was authorized, Congress passed the Energy Policy Act of 2005 ("EPAct 2005") and raised the credit to $0.019 per kilowatt hour, adjusted annually for inflation, and extended it through 2007. [288] In another alteration to the tax code, Congress applied the "Modified Accelerated Cost Recovery System," allowing developers who purchase solar, wind, or geothermal power-producing equipment to claim depreciation deductions on equipment faster than they otherwise would be allowed for such an investment.[289]

Beyond the start-again-stop-again nature of the PTC, a cycle which

281. *See Renewable Energy Report*, *supra* note 58, at 647 ("While the PTC was successful when in place, the "on and off" nature of its availability was disruptive to the steady pace of market development."); s*ee also* L. Bird et al., *supra* note 106, at 4 ("The impact of the PTC on the wind energy industry is evident in the boom-bust cycle of development in recent years.").

282. H.R. 3090, 107th Cong. (2002).

283. H.R. 1308, 108th Cong. § 313 (2004).

284. DSIRE Website, *supra* note 20 (follow link to "Federal Incentives for Renewable Energy: Renewable Electricity Production Tax Credit,"), *available at* http://www.dsireusa.org/library/includes/incentive2.cfm?Incentive_Code=US13F&State=federal&currentpageid=1&ee=0&re=1 (last visited May 27, 2007).

285. Pub. L. No. 108-357, 118 Stat 1418.

286. I.R.C. § 45 (2006).

287. *See* Internal Revenue Service Form 8835, "Renewable Electricity, Refined Coal, and Indian Coal Production Credit," (2006) (illustrating not only the terms of the refined coal credit, but how various forms of energy production incentive tax legislation, with seemingly conflicting aims as far as the fossil fuel-renewable divide is concerned, are each expressed on the same federal tax form).

288. Pub. L. No. 109-58, 119 Stat 594.

289. I.R.C. § 48 (2006) (setting class lives at the 5-year level); *see* Pater, *supra* note 168, at 33 (indicating that the owner of this equipment could "take an additional 30% depreciation on these items during the first year, creating an even larger incentive for the technology").

EPAct 2005 continued,[290] the problem with the legislation as far as both the renewable energy industry and its non-commercially motivated proponents were concerned was that it, like electricity production policies before it, also included heavy appropriations to fossil fuel-based initiatives.[291] The Act provided a 300 million barrel expansion to the Strategic Petroleum Reserve (from 700 million barrels to 1 billion), provided "accelerated review and approval process[es] for new refinery facilities," and appropriated $1.8 billion worth of funding to subsidize costly "clean coal" facilities.[292] The funding of both renewable energy and fossil fuels by the federal government show that Congress is most concerned with keeping prices down for electricity rather than promoting a particular industry over another. Given the stark differences between the two candidates for legislative support, Congress seems to have disregarded fossil fuel externalities. When taking into account the capital-intensive nature of "clean coal," in which one of the most promising procedures involves burning gasified coal and pumping a mixture of the fumes under ground risking leaks and water contamination,[293] the federal government appears to be, as the adage goes, "robbing Peter to pay Paul." Critics cite that the only parties who benefit from a boondoggle like this are fossil-fuel burning utilities, mining companies, and energy lobbyists.[294]

Presently, it is at the state level where the most innovative and effective supply-side measures are pursued to promote renewable-based

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290. *See* Pub. L. No. 109-58, 119 Stat 594 (setting a relatively short-term sunset for the PTC—Dec. 31, 2007). It has since been renewed to Dec. 31, 2008 by The Tax Relief and Health Care Act of 2006. *See* Pub. L. No. 109-432, 120 Stat 2922.

291. *See* Public Citizen EPAct 2005 Analysis, *supra* note 224.

292. U.S. House Comm. on Energy and Commerce Press Office, Energy Policy Act of 2005: Highlights of the Energy Policy Act of 2005, at 2 (2005).

293. *See* Thomas Wilson & Charles Clark, *Financing Clean Coal*, Public Utilities Fortnightly, June 2005, at 73, 74-75 (explaining that the government-favored emissions-reducing technique behind "clean coal" involves burning high-grade bituminous coal, steam, and oxygen under high pressure and mixing the resulting combustible gas with steam and sequestering it underground; and stating further that financing such facilities require taxpayer resources); Robert H. Socolow, *Can We Bury Global Warming*, Scientific American, July 2005, at 49, 54-55 (listing the possible environmental risks to carbon sequestration); Cherry & Shogren, *supra* note 29, at 7-8 (mentioning carbon sequestration as another externality associated with coal use).

294. *See* Public Citizen EPAct 2005 Analysis, *supra* note 224 (pointing out that energy corporations have spent over $100 million in campaign contributions over the past decade).

energy systems.[295] In New York, for example, facilities built for photovoltaic, biomass, and wind power systems and their corresponding equipment are all exempt from state property tax for fifteen years.[296] This not only gives an incentive to utility-scale producers, but also to small-scale, end-use consumers who can install small wind turbines or photovoltaic panels for their own electricity needs.[297] In fact, property tax incentives for various forms of renewable energy are available in twenty-six states,[298] and seventeen offer some form of personal tax deduction for renewable energy use,[299] usually for expenses incurred in the installation of renewable energy systems like solar heating devices for pools[300] or green energy-fueled buildings,[301] or for construction of wind farms on ranch land.[302] By building supply from the ground up, the end-use consumers are not only educated about the science and benefits of renewable energy in general, they become active participants with a commercial stake in renewable energy policy.

"Net metering" rules have similar effects as personal and property tax exemptions and credits but act on the relationship between the residential supplier/consumer and the utility company, rather than on the relationship between the taxpayer and the government.[303] Forty states and the District of Columbia have instituted some form of net metering,[304] and Congress, as part of EPAct 2005, has since applied net metering rules to all domestic public utility companies.[305] The standard

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295. *See Renewable Energy Report*, *supra* note 58, at 648 (highlighting "tax benefits, grants, loans and loan guarantees" as among the measures "augmenting federal policies").

296. N.Y. Real Prop. Tax § 487(2) (2006).

297. *See id*. (giving no ownership restrictions in statute).

298. DSIRE Website, *supra* note 20.

299. *Id*.

300. *See*, *e.g.*, Ariz. Rev. Stat. Ann. § 43-1083 (2006) (providing tax credit for solar energy devices).

301. *See*, *e.g.*, Md. Code Ann., Tax-Gen. § 10-722 (West 2001) (providing tax credit for green buildings).

302. *See id.; but see id*. at § 10-722(a)(3)(ii) (stating that the purchase costs of the wind turbines themselves are not included in the allowable costs).

303. *See* NREL Value Framework, *supra* note 168, at 39; Gipe, *supra* note 26, at 11.

304. DSIRE Website, *supra* note 20 ("Net Metering Rules," *available at* http://www.dsireusa.org/documents/SummaryMaps/NetMetering_Map.ppt).

305. U.S. Dep't of Energy, Energy Efficiency and Renewable Energy, *State Energy Alternatives: Net Metering*, *available at* http://www.eere.energy.gov/states/alternatives/net_metering.cfm.

net metering scheme includes an end-use consumer who contributes to his or her own electricity use through the use of some renewable energy installation—like solar panels or a small wind turbine.[306] The rules essentially require that utility companies (in some states only investor-owned utilities) charge the consumer for just the net amount of electricity the utility provides.[307] In effect, consumers are selling back to the utility the electricity generated by their renewable energy facilities, and utilities are charging them only for the difference between the energy they produce and the energy they consume.[308]

B. Building Markets: Demand-Side Renewable Electricity Policy

Net metering, by forcing the utility companies to purchase back the energy produced from non-utility-owned sources, actually straddles the line between supply- and demand-side policies. The Public Utilities Regulatory Policies Act,[309] or "PURPA", represents the operational counterpart to net metering. The legislation, passed in 1978 as part of the Energy Policy Act, created a category of non-utility-owned electricity producers called "Qualifying Facilities" ("QFs"),[310] which are smaller-sized independent renewable power producers.[311] The QFs were given a market by PURPA in an effort to encourage renewable energy production.[312] PURPA mandated that utilities buy the electricity output from these outside power companies while exempting the independent producers from the taxes and regulations associated with utility power projects.[313] Eventually, the Solar, Wind, and Geothermal Power

306. *See* NREL Value Framework, *supra* note 168, at 39.

307. *Id.*; *see also* Gipe, *supra* note 26, at 11 (analogizing that "net metering allows access on the customer side of the meter").

308. *See* Gipe, *supra* note 26, at 11.

309. Pub. L. No. 95-617 (1978) (codified at 16 U.S.C. § 796 (2005).

310. *See* Richard D. Cudahy & William D. Henderson, *From Insull to Enron: Corporate (Re)Regulation After the Rise and Fall of Two Energy Icons*, 26 ENERGY L. J. 35, 80-81 (2005) (explaining the history and rationale for PURPA and its place in the scheme of energy deregulation).

311. 16 U.S.C. §§ 796(17)(C)(ii), (18)(B)(ii) (2000).

312. *See* Union of Concerned Scientists, *Backgrounder: Public Utility Regulatory Policy Act (PURPA)* (2005), *available at* http://www.ucsusa.org/clean_energy/clean_energy_policies/public-utility-regulatory-policy-act-purpa.html [hereinafter *Backgrounder: Public Utility Regulatory Policy Act*].

313. *See* Michael D. Hornstein & J.S. Gebhart Stoermer, *The Energy Policy Act of 2005: PURPA Reform, the Amendments and Their Implications*, 27 ENERGY L. J. 25,

Production Incentives Act of 1990[314] removed the electricity output qualifications for PURPA.[315]

The QFs signed distribution contracts in the late 1970s and early 1980s with the utilities while the price of fossil fuel energy was still relatively high.[316] PURPA, though it ended the virtual monopoly of utility-owned power sources,[317] only required utilities to purchase the output of independent producers at "avoided cost," or what it would have cost the utility to produce the energy themselves.[318] Since the vast majority of utility-owned and operated power came from fossil fuels,[319] once the price of natural gas, coal, and petroleum decreased, the utilities could certainly honor their contracts with the independent producers. However, those producers were finding it increasingly difficult and eventually impossible to meet their own production costs.[320] The price of fossil fuels, and thus the utility's avoided cost, simply fell farther than renewables technology could match.[321] Many renewable-based independent power companies, once their contracts securing favorable prices expire, face bankruptcy.[322] Despite the legislation's inability to promote the long-term growth of renewables in the electric power market, 12,000 megawatts of non-hydro renewables-based electricity were integrated into the national power grid by 1998 as a result of PURPA.[323]

A modern approach to legislatively ensuring a renewables market was needed. By the early 1990s, the electricity-regulatory paradigm had shifted toward the promotion of competition inside the energy industry.[324] The renewable portfolio standard ("RPS") emerged as an option to sustain renewable energy's progress in a changing electricity

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30-31 (2006).

314. Pub. L. No. 101-575, 104 Stat 2834.

315. Energy Info. Admin., *Public Laws Regarding Renewables*, *available at* http://www.eia.doe.gov/cneaf/solar.renewables/page/legislation/publiclaw.html.

316. *See Backgrounder: Public Utility Regulatory Policy Act*, *supra* note 312

317. *See* Joseph T. Kelliher, *Market Manipulation, Market Power, and the Authority of the Federal Energy Regulatory Commission*, 26 ENERGY L. J. 1, 6 (2005).

318. *Id.*

319. *See Monthly Energy Review: March 2007*, *supra* note 6, at 99.

320. *See Backgrounder: Public Utility Regulatory Policy Act*, *supra* note 312.

321. *Id.*

322. *Id.*

323. *See Renewable Energy Report*, *supra* note 58, at 648.

324. *See* Kelliher, *supra* note 317, at 7.

marketplace.[325] The RPS's flexibility is part of its strength, as it can be implemented in a variety of ways to suit the policy ends of the legislature.[326] The common denominator is that a quota of electricity within a state or nation must be produced, sold, or consumed by a specified time in the future.[327] In all, twenty-two states and the District of Columbia have instituted some form of RPS.[328] California requires that the state's investor-owned utilities obtain and distribute 33% of their power from renewable energy sources by 2020.[329] Texas, by contrast, eschews a proportional standard and instead dictates that its renewable energy capacity reach 5,880 megawatts by 2015.[330] Interestingly, the development of the Texas RPS was derived in part through "deliberative polling," where utilities and regulators estimated the potential demand for renewable energy through customer polling data.[331] New York has perhaps the most ambitious RPS, mandating that a full 25% of the state's energy be derived from renewable sources by 2013.[332]

By 2020, 40,000 megawatts of new renewable energy capacity are projected to come online because of state standards mandating renewable energy.[333] According to NREL, the RPS is the most effective "policy driver" at the state level to encourage wind power development.[334] Between 2001 and 2004, about half of the nation's 4,300 megawatts of newly installed wind energy capacity results from RPS policies.[335] If "set-asides" for solar energy are included, by 2020 an additional 1,000 megawatts of photovoltaic power could be

325. *See* Envtl. Prot. Agency Combined Heat and Power P'ship, *Renewable Portfolio Standards: An Effective Policy to Support Clean Energy Supply* 1 (Dec. 30, 2006), *available at* http://www.epa.gov/chp/pdf/rps_factsheet_123006.pdf ("An RPS creates market demand for renewable and clean energy supplies.").

326. *See id.* at 3-4.

327. *See* Rabe, *supra* note 195, at 7-9; Sawin, *supra* note 22, at 6; *see also Policies to Promote Renewables*, *supra* note 32, at 19 (referencing the Dutch 1997 "Action Programme for Renewable Energy" which "sets targets of meeting 5% and 10% of the nation's total energy demand with renewable sources in 2010 and 2020, respectively").

328. *See* Rabe, *supra* note 195, at 4. The Illinois standard is not mandatory. *Id.*

329. *Id.*

330. *Id.*

331. L. Bird et al., *supra* note 106, at 11.

332. Rabe, *supra* note 195, at 4.

333. *See Successful Strategies*, *supra* note 18.

334. *See* L. Bird et al., *supra* note 106, at 39.

335. *See* Van der Linden, *supra* note 180, at 45.

contributed.[336] For example, Texas raised its RPS target of 1,280 megawatts for 2003 to 2,880 megawatts in renewable capacity by 2009 and saw 1,332 megawatts of wind power alone come online by the middle of 2005,[337] prompting the eventual 3,000 megawatt expansion to the RPS for 2015.[338] The EIA found that in incrementally raising the RPS bar by 2.5% every few years until it reached 10% between 2020 and 2030, the effects would be dramatic.[339] By 2025, without a national RPS, wind power generation is expected to be 32.0 billion kilowatt-hours.[340] With the 10% RPS, wind power generation rises to 140.7 billion kilowatt-hours.[341] Biomass is also projected to grow, particularly when used in a co-firing facility.[342]

New power facilities also mean new jobs. The Tennessee Valley Authority ("TVA"), in an assessment of how it would meet a 10% federal RPS by 2020, indicates it would need to generate a total of 19.7 billion kilowatt-hours from renewables.[343] Of that total, approximately 2.3 billion kilowatt-hours would come from wind power and 10.9 billion from biomass. With the inclusion of solar, hydro-power, landfill gas, and wastewater gas, the total becomes 15.25 billion kilowatt-hours generated within the TVA's boundaries.[344] To make up the difference, 4.45 billion kilowatt-hours of renewable energy credits would have to be purchased.[345] The generation of that much renewable energy by the TVA is projected to create almost 45,000 new jobs, mostly in rural areas of the American Southeast.[346] Per 1,000 megawatt-hours of renewable energy produced, 1.09 jobs are created on the "operating" side, whereas 1.86 new jobs are created on the investment side, with more than 3,000

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336. *Id.* at 46.

337. *See* Rabe, *supra* note 195, at 11.

338. *Id.* at 12 (stipulating a total of 5,880 megawatts).

339. *See Analysis of a 10% Renewable Portfolio*, *supra* note 100, at 10, 13 (documenting the proposed legislative targets and tabulating the corresponding projections).

340. *See id* at 13.

341. *Id.*

342. *Id.*

343. *See* Jack Barkenbus et al., *Resource and Employment Impact of a Renewable Portfolio Standard in the Tennessee Valley Authority Region*, at 15 (University of Tennessee Institute for a Secure and Sustainable Environment 2006).

344. *Id.*

345. *Id.*

346. *Id.* at 30.

jobs attributed to solar technologies and more than 23,000 jobs for wind technologies throughout North Carolina, Virginia, Georgia, Tennessee, Alabama, Kentucky, and Mississippi.[347]

Though the RPS shifts the demand curve vis-à-vis electricity retailers by artificially setting a market floor for what they have to sell,[348] it naturally boosts supply for end-use consumers.[349] This effect is so significant that the policy could easily be deemed primarily supply-side.[350] The unusual nature of the potential impact of the RPS is that depending on how it is structured, both the demand curve (electricity delivered to users) and the supply curve (renewable power project construction and electricity production) can be shifted.[351] The policy question going forward asks how the RPS can be structured to maximize both the necessary commercial benefits to the renewable energy industry and still ensure mitigation of the enormous costs to society attributable to fossil fuels.[352] The best organ to ensure the equitable distribution of renewable power while most effectively meeting the needs of the emerging renewable power industry is Congress.[353] Despite several attempts to do so, the federal government has yet to implement such a standard.[354]

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347. *Id.* at 31-32.

348. *See* Sawin, *supra* note 22, at 6.

349. *See* van der Linden et al., *supra* note 180, at 45-46.

350. *See generally,* Envtl. Prot. Agency, *Clean Energy-Environment Guide to Action: Policies, Best Practices, and Action Steps for States* 5-1 to 5-21 (2006) (classifying state portfolio standards as a "supply action").

351. *See* NREL Value Framework, *supra* note 168, at 35:

> If the RPS establishes a goal that appropriately exceeds the level of existing renewable generation in the state, the immediate benefits will accrue to the producer of the renewable energy technology. The RPS immediately increases the demand for renewable technologies, bringing the market a step closer to generating an economy of scale.

Id.

352. *See* Rabe, *supra* note 195, at *v* (suggesting in the executive summary that economic concerns are paramount to legislatures while environmental concerns are a side benefit).

353. *See* Nogee et al., *supra* note 3, at 45 (explaining that if the country as a whole is to realize the environmental and economic benefits of renewable energy, states and the federal government ought to use current state policies as models on which to base future policies; thus, to ensure comprehensive national results, Congress, as the federal legislature, must act).

354. *See* Union of Concerned Scientists, *Renewing America's Economy* (Jan. 2007), *available at* http://www.ucsusa.org/assets/documents/clean_energy/Renewing-Americas-Economy-2005.pdf ("The U.S. Senate has passed a 10% by 2020 national

IV. PLUGGING IN: THE TRIPLE THREAT OF TRANSMISSION COSTS, VARIABILITY, AND GRID INTEGRATION

A. The Challenges and Some Possible Solutions

Unlike fossil fuel energy, renewable power is intermittent in nature, wind among them.[355] Electricity can be produced from wind only when it is blowing at a sufficient rate and in a sufficient volume, which is not always regular and not always predictable.[356] Power grids, designed for the constant and predictable output of fossil fuels,[357] require a reserve capacity in order to control for outages caused by a system fault.[358] This security standard for the overall reliability of the grid is called the "loss of load probability"—the "probability that the load will exceed the available generation."[359] Power production facilities must schedule time on the grid in advance in order to transmit electricity to the consumer.[360] A degree of uncertainty is factored into the transmission system by integrating intermittent electricity production into a grid.[361] The grid operator must balance the uncertain supply with the predicted demand for power.[362] This is the point at which supply-side policy deviates from incentivizing production and moves toward infrastructural necessities.[363]

The question becomes a matter of whether the grid has the flexibility to withstand these kinds of output fluctuations.[364] The International Energy Agency argues that basic electrical engineering

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standard three times since 2002—most recently in June 2005.").

355. *See Variability of Wind Power*, *supra* note 38, at 9.

356. *Id.* at 12.

357. *See* U.S. Dep't of Energy *Grid Study*, *supra* note 7, at 3 (discussing the construction and development of the national power grid); *Monthly Energy Review: March 2007*, *supra* note 6, at 99 (illustrating the relative dominance of fossil fuels in the electric power sector since 1973).

358. *See Variability of Wind Power*, *supra* note 38, at 17-18.

359. *Id*. at 17.

360. *See* Reeves, *supra* note 32, at 12, 19.

361. *See Variability of Wind Power*, *supra* note 38, at 18-19 (explaining that the increase in unpredictability of power supply due to intermittent sources operating on the grid can increase the needed operational reserve capacity).

362. *Id.* at 17.

363. *See* DOE, Grid Study, *supra* note 7, at 8 (tying policies that encourage economic investment to the need for "modernizing the structure and operation of the nation's transmission systems").

364. *Variability of Wind Power*, *supra* note 38, at 20.

principles suggest that enlarging and integrating the grid on a national or international scale will control for variations.[365] Furthermore, the larger the integrated grid becomes the less of a need exists to keep fossil fuel generation running constantly, even at a low scale.[366] With improved weather forecasting, geographic dispersal of wind or other renewable energy sources can actually broaden their potential market infiltration by reducing the reliance of the grid on one source of power.[367] In the event that large scale climactic occurrences severely depress wind energy output, several options exist to compensate for intermittent output.[368]

Obviously the first option is the one currently used to ensure grid security against intermittency of production—keep fossil fuel plants online in order to compensate for potential variability.[369] The second, a more eco-friendly option, is to implement "hydro storage facilities."[370] Hydro storage is currently the best established and most reliable form of electricity storage, whether in a pumped-hydro or hydro reservoir facility.[371] Moreover, the co-joining of wind facilities and hydro plants has been suggested as a method of facilitating the integration of wind energy into the power grid.[372] The process involves two connected bodies of water, one at a higher elevation, the other at a lower elevation.[373] As with any hydro power facility, the force of the water, in this case due to gravity, turns turbines which produce electricity.[374] In this case, a wind farm would be attached to the hydro power facility.[375] Excess power produced by the wind farm that would otherwise not go to

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365. *Id.*

366. *Id.*

367. *See*, *e.g.*, *id.* at 25 (citing a study in Germany that found that "the extension of wind power to some 36 [gigawatts] in 2015 would not require the addition of new plants to provide operational reserve," and a finding by the French grid operator RTE that "short-term fluctuations of 10 [gigawatt] installed wind capacity would not exceed 100 [megawatt] within 1 minute, a figure which can be absorbed within current dimensioning of reserves without problems").

368. *Id.* at 26 (listing solutions that would control for intermittency).

369. *See id.* at 26-27.

370. *See id.* at 27 (discussing hydro-storage as one of several storage technologies).

371. *Id.*

372. *Renewable Energy Report*, *supra* note 58, at 656.

373. *See* Gemma Allen et al., *Modeling of a Wind-Pumped Hydro Scheme Within the Irish Liberalised Electricity Market*, at 2 (European Wind Energy Conference 2006), *available at* http://www.ucc.ie/serg/pub/ewecga.pdf.

374. *Id.*

375. *Id.*

the grid (e.g., if it were not currently scheduled to be online), would pump the water from the lower elevation basin to the upper.[376] During times when the wind was insufficient to meet the grid's electricity demand, the hydro facility would release the stored water from the higher-elevation facility back through the power-producing turbines.[377] In the event of a supply shortage, a hydro storage facility is capable of replacing a traditional power station for several hours if necessary, with a potential 1,000 megawatt capacity at the typical 80% round-trip efficiency.[378]

Another option is to interconnect and integrate contiguous grids in an effort to further expand supply potential.[379] In Europe, where countries are geographically smaller in scale to the United States, grid interconnectivity between countries can act as a model to domestic regional grid management.[380] The obstacle to efficient interconnection in Europe is nearly identical to the one in the United States—infrastructure.[381] The IEA estimates that by 2030, OECD countries as a whole will need to invest $1.8 trillion for grid maintenance and upgrades as demand grows.[382] One such strategy is the proposed "wind pipeline," supported by the AWEA and Senator Byron Dorgan of North Dakota.[383]

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376. *Id.*

377. *Id.*

378. *Variability of Wind Power*, *supra* note 38, at 27.

379. *Id.* at 29; U.S. Dep't of Energy *Grid Study*, *supra* note 7, at 24-29 (discussing the establishment of regional transmission organizations ("RTOs") that would "coordinate markets and ensure the reliability of the nation's transmission system," including ensuring fair wholesale energy markets).

380. *See*, *e.g.*, 2006 O.J. (L 262) 1 (iterating the priorities of European interconnection projects and policies).

381. *Variability of Wind Power*, *supra* note 38, at 30 (explaining how there exists a "need for further transmission grid development, including strengthening and upgrading existing lines . . ." and that the "interconnection of grids is frequently seen as an important step towards improved competition and full market liberalization . . . in Europe and North America").

382. *Id.*

383. *See* Caldwell, *supra* note 206; *see also* Am. Wind Energy Ass'n, Concept Description: Trans-Prairie and Interior West Wind 'Pipelines' (Sept. 6, 2003), *available at* http://www.awea.org/policy/documents/WindPipeline.pdf (explaining that "each 'pipeline' would consist of three phases"); U.S. Dep't of Energy, *Wind Power Advocate Interview: Jay Haley, EAPC Architects Engineers* (June 1, 2005), http://www.eere.energy.gov/windandhydro/windpoweringamerica/filter_detail.asp?itemid=947 (discussing Senator Dorgan's wind conferences and "Heartland Wind Pipeline"

The AWEA proposal, which would cost between $10 billion and $20 billion,[384] envisions a regulatory scheme that ensures a closer-to-capacity power line use with non-discriminatory access, with $1 billion worth of local 345 kilovolt transmission lines added to the grid to avoid "bottlenecks and bolster secondary-level reliability."[385] This first step would open 26,000 megawatts of wind power capacity.[386] Next, two high-voltage lines from the northern plains, going east and west, would be built to streamline supply to population centers on the coasts and the industrial Midwest. Adding between 30,000 and 60,000 megawatts of wind power capacity to the system, it would be "enough new power to serve up to 18 million homes."[387]

The problem with improving infrastructure is that the electricity market does not operate in a unified manner as part of one large integrated grid, but as a community of smaller regionally managed electricity administrators.[388] Several regional and state transmission organizations, who determine which producers are permitted time on the grid, have gradually instituted discriminatory pricing schemes that essentially punish wind power generators for output variations. Their rationale is that lower-than-expected production requires them to keep backup generators running, regardless of whether it costs the system.[389]

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proposal).

384. Caldwell, *supra* note 206.

385. *Id.*

386. *Id.*

387. *Id.*

388. *See* U.S. Dep't of Energy *Grid Study*, *supra* note 7, at 2 (explaining in Fig. 1.1 that the North American Electricity Transmission Systems includes three interconnected "systems," which in turn are comprised of 140 control areas who control local electricity operations and "coordinate reliability through 10 regional councils").

389. *See* Imbalance Provisions for Intermittent Resources Assessing the State of Wind Energy in Wholesale Energy Markets, 70 Fed. Reg. 21,349, 21,349-50 (proposed Apr. 26, 2005) (to be codified at 18 C.F.R. pt. 35). In this notice of proposed rulemaking, FERC acknowledged that tariff charges levied on intermittent resources have become outdated and have become "unjust, unreasonable, unduly discriminatory or preferential." *Id.*; *see also* Reeves, *supra* note 32, at 19 (listing the disadvantages that wind plants in particular have faced in dealing with utilities, including the regulatory infrastructure that was traditionally geared toward fossil fuels, fees charged to wind power producers for the distance the electricity traveled between its production site and the end-use consumer, charges for each transmission system through which the electricity travels (called "rate pancaking"), and charges based on *peak output*, rather than *average output*, which while not a major issue for fossil fuel producers, is important to wind power producers who have large differences between the two output

The recent granting of regulatory authority to FERC is a step toward reigning in the disparate interests playing out on the grid.[390]

B. Wind versus Utilities?

Up until now, it would appear that wind power, like any intermittent renewable, is a veritable thorn in the side of utility companies who maintain infrastructure, distribute, and deliver electricity to the consumers.[391] With the advent and growth of wind power, utility grid managers must go out of their way to adjust their scheduling formulae to accommodate what would on paper appear to be a marginal producer at the expense of the predictable, easy-to-manage fossil fuel facilities.[392] Prior to FERC regulations mandating nondiscriminatory access rules,[393] utilities could offset costs, even anticipated costs, resulting from the impact of output variability.[394] Now, they are required to act in a non-discriminatory fashion toward wind power facilities.[395] However, wind power is not all bad news for the utilities.[396]

Notwithstanding the fact that in certain regions wind is in fact the low-cost option,[397] a wind energy production presence within the purview of a utility grid manager can be a boon.[398] For instance, wind power, like all renewables, can help offset the risks of supply shortages in fossil fuels.[399] Additionally, since wind power can be added incrementally, excess capacity costs are limited.[400] The inherent

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numbers) (emphasis in the original).

390. *See* Fed. Energy Reg. Comm'n, *Energy Policy Act of 2005* (Aug. 8, 2006) (explaining the agency's new responsibilities with regard to market manipulation and grid integration); S. Dep't of Energy *Grid Study*, *supra* note 7, at 24-29 (referencing FERC Order 2000, 65 Fed. Reg. 809 (2000), which "calls for the formation" of the RTOs discussed *supra* note 7).

391. *See supra* note 390 and accompanying text.

392. *See Variability of Wind Power*, *supra* note 38, at 17-19.

393. *See*, *e.g.*, Interconnection for Wind Energy, 111 FERC P 61,353, 2005 WL 1318317 ("F.E.R.C.").

394. *See* Reeves, *supra* note 32 and accompanying text.

395. *See* 111 FERC ¶ 61,353.

396. Reeves, *supra* note 32, at 13.

397. *See* L. Bird et al., *supra* note 106, at 1.

398. Reeves, *supra* note 32, at 13.

399. *Id.*

400. *Id.*

disadvantage of the remoteness of wind facilities can actually be turned into an infrastructural benefit as electricity generation outposts situated throughout the grid can reduce the risks of voltage concentration and overload in the production areas, thereby reducing maintenance costs.[401] Furthermore, any government action on either the state or federal level to penalize distributors for creating pollution would make a renewable energy production facility a cost-saving asset.[402] The same is true if the utility was faced with meeting a renewable portfolio standard that mandated it sell a certain quantity of electricity derived from non-polluting sources.[403]

V. SAVING THE WORLD AND MAKING A BUCK AT THE SAME TIME: ENERGY SOLUTIONS FOR AMERICA IN THE TWENTY-FIRST CENTURY

The burgeoning renewable energy industry, its investors, [404] and the public[405] need Congress to implement a comprehensive national energy policy. It must integrate market-focused initiatives without losing sight of the social reasons for promoting clean energy. This includes programs that (1) aid renewable power producers, (2) marginalize fossil fuels to the extent possible, and (3) set a permanent standard for ensuring the place of renewable energy in the electricity market. This Note proposes that the federal government can meet these ends. To do so it must enact a scheme that incorporates elements of existing state and national policies while adding certain unique derivations.

The first step is to ensure that current supply-side incentives will remain into the foreseeable future. Otherwise disaster waits in the wings.[406] In fact, during a period (January 1, 2004 to October 4, 2004) between an earlier version of the production tax credit's expiration and subsequent renewal, a deceleration in the increase of new wind farm development[407] made it clear to industry experts that the tax credits were

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401. *Id.*

402. *Id.* at 14

403. *Id*.

404. *See* Pater, *supra* note 168, at vi.

405. *See* Steven Clemmer et al. Union of Concerned Scientists, *Clean Energy Blueprint*, at ix-x (2001).

406. *See Wind Power is a Disruptive Technology that Promotes Positive Change*, Energy Economist, Oct. 2006, at 10 [hereinafter *Disruptive Technology*] (explaining how "credit lapses in the past have caused market havoc").

407. *Id.*

a necessary ingredient if long-term growth were to be assured.[408] Once the federal tax credit was renewed, a sharp spike in wind facilities occurred.[409] This legislative volatility has the unintended consequence of actually raising the price of wind power while the PTC is still in effect. For example, steel supply shortages stemming from white-hot demand for wind power facilities[410] caused a development bottleneck and a 30% cost increase for the turbines as projects scrambled to meet the anticipated PTC expiration of December 31, 2007.[411] Many of the resulting projects came in over-budget or late, setting off credit problems for many producers.[412] If wind power's tax credit and production incentive, duly buffered against inflation, are assured long lives, steady, predictable growth will follow.[413]

Absent any other initiative, wind energy is competitive only when placed on a level playing field with fossil fuels.[414] This requires the continuation of supply-side aid.[415] The degree to which the federal government subsidizes fossil fuel technology,[416] including the billions

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408. *See* Caldwell, *supra* note 206 (referencing the blows sustained by the industry during previous expirations of the credit, including a delay in construction of new facilities worth a total of $3 billion after the 2001 expiration and asserting that the PTC needs to be extended for "several years to provide a signal of stability to the investment community").

409. *See Disruptive Technology*, *supra* note 406 ("When Congress let the credit expire in 2004, wind development slumped, with fewer than 500 [megawatts] of new projects installed. But when the credit was re-instated for 2005, the country added a [then] record 2,400 [megawatts] of wind energy.")

410. *See Disruptive Technology*, *supra* note 406.

411. The Tax Relief and Health Care Act of 2006, H.R. 6111, 109th Cong. § 207 (2006) (extending the expiration of the PTC to Dec. 31, 2008).

412. *See Disruptive Technology*, *supra* note 406.

413. *See* Am. Wind Energy Ass'n, *Wind Energy and U.S. Energy Subsidies*, Jan. 2007, *available at* http://awea.org/pubs/factsheets/Subsidy.pdf [hereinafter *Wind Energy and U.S. Energy Subsidies*] (referring to the need for long-term stability in government subsidies as a key component in wind facility manufacturers' ability to secure more permanent investment).

414. *See* Burnett, *supra* note 54 (asserting, as a negative, that the wind power industry is reliant on government subsidies like the production tax credit to stay competitive).

415. *See Wind Energy and U.S. Energy Subsidies*, *supra* note 413 (arguing that the production tax credit—a supply-side initiative—is required if the wind industry, or any energy industry, is to remain viable).

416. *See* Public Citizen EPAct 2005 Analysis, *supra* note 224 and accompanying text; *see also* Reeves, *supra* note 32, at 21 (arguing that "because the human health and

appropriated to coal,[417] oil, and gas[418] in the same Energy Policy Act of 2005 that extended the PTC and REPI for renewables for two more years, belies the undeniable fact that the energy market as a whole leans heavily on legislative aid.[419] Wind power thus is no more beholden to Congress than any other energy source. If the mandate to reduce dependence on foreign and polluting sources of energy is to be honored, the PTC and REPI must be extended indefinitely.[420] The sooner they are, the sooner the stability can be ensured for the industry, thereby assuring a steady supply of inexhaustible energy.[421]

Research and development funds must continue to be allocated toward wind power development. The PTC, REPI, and the accelerated depreciation plan can only be the tip of the sword however. Successful state renewable energy plans rely on a bevy of supply-side incentives and demand-side initiatives to stimulate wind power development.[422] Research and development grants are credited with helping to improve turbine technology.[423] The ability to build taller towers with larger rotors out of less costly material boosted efficiency and drove down prices[424] to the point where wind energy in certain regions compares favorably with fossil fuels.[425] By being able to produce more energy from the same amount of wind input, power production facilities can better overcome or control for unpredictable or variable output.[426]

Furthermore, the federal government should continue to offer low interest loans, or subsidize a percentage of the interest on private loans to alleviate high capital costs up front.[427] By reducing the impact of one-time overhead expenses, risks to investors decrease.[428] Over time as steady power output (achieved without corresponding fuel costs)

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environmental costs [of fossil fuels] are largely externalized and born by society [it creates] a subsidy of sorts to fossil fuel burners").

417. *See id.* at 5 ($9 billion).

418. *See id.* at 1 ($6 billion combined).

419. See U.S. House Comm. on Energy and Commerce Press Office, "Energy Policy Act of 2005: Highlights of the Energy Policy Act of 2005," Apr. 2005.

420. *See Wind Energy and U.S. Energy Subsidies*, *supra* note 413.

421. *Id.*

422. *See* L. Bird et al., *supra* note 127 and accompanying text.

423. *See Wind Energy R&D*, *supra* note 31, at 2-4.

424. *See id.* at 4-7.

425. *See* L. Bird et al., *supra* note 106, at 1.

426. *See* AWEA, Wind Economics, *supra* note 138.

427. *See* Sawin, *supra* note 22, at 20-21

428. *Id.*

compensates for initial capital outlays,[429] the long-term risk that capital financers see in wind projects should dissipate. The government simply needs to get the proverbial ball rolling.

Congress also needs to enact a comprehensive national electricity distribution policy. First, renewables like wind need their rights to fair transmission access vigorously protected by regulatory bodies like FERC.[430] Next, infrastructural modernization including the implementation of an integrated grid must go hand in hand with the generalized promotion and finance of renewable-energy production facilities.[431] A system benefits fund—a public trust fund used in many states to pay for projects like these—[432] is the proper vehicle to provide grid-wide renovation and upkeep, finance innovation, and even partially compensate for fossil fuel-caused social costs.

A. The System Benefits Fund: Like Social Security but Bigger, More Efficient, and Without the Higher Taxes or that Third Rail Problem

Financing a national system benefits fund to accomplish such a wide range of policy objectives is ambitious, but it need not bankrupt the Treasury. It must simply diversify its revenue streams. Often, a system benefits fund receives its budget through consumption fees whereby consumers pay a charge per kilowatt-hour consumed on their electricity bill.[433] That is not necessary however. Instead, Congress should immediately begin scaling back fossil fuel subsidies.[434] The recovered revenue would be reallocated to form the corpus of the fund. That is not to say that Congress should enact an economy and jobs-killing law effective immediately, but over time, perhaps consistent with the gradual implementation of the renewable portfolio standard discussed below, billions of dollars in fossil fuel subsidies should be siphoned into the to fund. Such a policy merely reflects the growing national mandate for

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429. *See* Reeves, *supra* note 32, at 11.

430. *See* Nogee et al., *supra* note 3, at 32 (arguing that not only do unfair transmission access pricing penalties negatively affect renewables, but that in doing so they would compel renewable-source power generators to mitigate by "bundling" their output with traditional power sources, thereby "reduc[ing] generator and marketer flexibility," which could raise prices across the board).

431. *Id.*

432. *See supra* notes 256-59.

433. *See* Nogee et al., *supra* note 3, at 27.

434. *See* Sawin, *supra* note 22, at 21-22.

renewable energy.[435] Once capitalized, the fund should be structured for invested like a state pension fund – housed in the executive branch and administered by a committee of representatives from existing federal agencies like FERC, the EPA, and the Department of Health and Human Services. Broadly defined funding priorities should be set by Congress, while specific project prerogatives could come through the constituent agencies and be voted on by the committee.

Any revenue mechanism plan for the fund should include a Dirty Energy Tax on all fossil fuel energy merchants.[436] Such a tax should increase at ever-increasing rates for power production that results in the emission of carbon dioxide, carbon monoxide, sulfur dioxide, nitrogen oxides, particulate matter, heavy metals, and volatile organic compounds. As for how the charge is levied, the first step is to place a fee on the actual poundage of emissions released.[437] Just as a portfolio standard awards credits based on kilowatt-hour sales,[438] this tax could be partially derived from a charge on per kilowatt-hour sales of dirty power, with a statutory limitation against passing the charge onto the customer. The Dirty Energy Tax revenue, specifically earmarked to do so, will provide regular income to the fund, like a commission, once recovered subsidy revenue is no longer sufficient. Unlike Social Security, there should be no borrowing against the national system benefits fund; yet, like state pension funds, its capital ought to be invested on the open market. Additionally, the proceeds of the fund ought to be treated in a manner similar to shareholder dividends—distributable to particular projects only when the fund as a whole meets prescribed equity requirements—to help ensure solvency over time. This is especially important if the national system benefits fund is to have a wider social mandate.

As in state versions, the fund is intended to finance infrastructural modernization, supply-side incentives for renewables, and clean electricity generation projects.[439] A national fund, however, can have

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435. *See* Bird & Swezey, *supra* note 21, at 7 (showing evidence for that mandate—a growing number of "green power customers" in regulated and competitive energy markets).

436. *See* Nogee et al., *supra* note 3, at 36.

437. *See id.*

438. *See infra* notes 472-75 and accompanying text.

439. *See, e.g.*, L. Bird et al., *supra* note 106 (including California, *id.* at 8-9, Minnesota, *id.* at 18, Oregon, *id.* at 22, Pennsylvania, *id.* at 30, and New York, *id.* at 33-34).

the means to compensate the public for the externalities it has borne due to the market failure of pricing fossil fuel energy. Therefore, a portion of the fund's available assets should be set aside for environmental clean up and conservation,[440] and to pay a percentage of the heath care costs for those who have fallen ill as the result of unavoidable exposure to toxic emissions.[441] In short, because of the pervasive consequences that energy use has on society, energy *policy* should at least match the scope and gravity of those effects. A fund of this magnitude and purpose can help facilitate such mandate.

B. Bringing it All Together: The National Renewable Portfolio Standard Two-Tiered Plan

There are essentially two ways of looking at the legislative and regulatory policies pertaining to renewable energy in general and wind energy in particular—the industry perspective[442] and the social perspective.[443] The two perspectives, while not mutually exclusive, do stem from wholly distinct motivations. An individual's inclination toward one view, therefore, will tend to characterize their energy policy analysis.[444] The industry perspective is concerned primarily with energy investors or potential energy investors looking at the policies affecting wind power with an eye for how the commercial viability of *this* product and *this* industry are influenced, both in the short-term and the long-term.[445] Legislation that presents a clear roadmap to industry growth

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440. Administered by the EPA.

441. See Schneider, *supra* note 1, at 8 (listing the adverse health consequences related to power plant pollution). Under this Note's proposal, private claims would be adjudicated at the agency level in the mould of claims made under the Social Security Act, with the burden of proof and appeals process being the same.

442. *See generally* Caldwell, *supra* note 206 (illustrating the "wish list" the wind power industry has vis-à-vis governmental action).

443. *See generally* Schneider, *supra* note 1 (explaining how fossil fuel power plants are responsible for illness, death, incapacitation, deprivation of the labor force, et cetera).

444. *See*, *e.g.*, *id.* at 12-15, 17, 22 (evaluating several pieces of proposed and enacted legislation on the basis of how effective they are at curbing fossil fuel power plant pollution with respect to health effects, and the monetization thereof, and aggregate pollutants capped).

445. *See*, *e.g.*, Sawin, *supra* note 22 (discussing the economics of renewable energy markets and policies used both domestically and abroad to promote the renewable power industry).

attracts capital, whereas no roadmap or an indiscernible, contradictory roadmap chases capital away.[446] The social perspective is concerned mainly with environmental,[447] health,[448] and political issues.[449] Questions about the externalities of fossil fuels,[450] including wide-ranging topics like global warming,[451] disease,[452] and the international balance of power are all aspects of the social perspective.[453] Legislation that promotes the renewable energy business is all well and good here, but only as a means to affecting an end.[454]

The RPS is a tool that can act directly on any or all of the following

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446. *See id.* at 26-27.

447. *See* Schneider, *supra* note 1, at 17.

448. *Id.* at 13.

449. *See*, *e.g.*, *Western Hemisphere Energy Security: Testimony Before Comm. on Int'l Relations Subcomm. on the W. Hemisphere* (Mar. 6, 2006) (statement of Karen A. Harbert, Assistant Sec'y for Policy and Int'l Affairs, U.S. Dep't of Energy), *available at* http://commdocs.house.gov/committees/intlrel/hfa26334.000/hfa26334_0.HTM (stating the strategic importance of energy policy in U.S.-Latin American relations); U.S. Dep't of Energy, *National Security Review*, *supra* note 2, at 34-35 (discussing the relevance of congressional energy policy adjustments in the context of global energy markets—specifically relating to China).

450. *See* Schneider, *supra* note 1 at 12-15, 17, 22 and accompanying text (analyzing several pieces of proposed and enacted legislation on the basis of how effective they are in curbing fossil fuel power plant pollution with respect to health effects, and the monetization thereof, and aggregate pollutants capped).

451. *See* Pater, *supra* note 168, at 19-20 (discussing the benefits to a company that reduces its contribution to climate change).

452. *See* Schneider, *supra* note 1, at 8 (illustrating the significant health effects attributed to fossil fuel power plant pollution).

453. *See*, *e.g.*, U.S. Dep't of Energy, *National Security Review*, *supra* note 2 (studying the impacts of energy policy in the United States and China with regard to environmental, economic, and security concerns).

454. *See, e.g.*, *Successful Strategies*, *supra* note 18. The first line reads: "In order to ensure healthy air and a stable climate for our children and grandchildren, we must make responsible decisions about our energy sources. Existing technologies and forward-thinking policies offer practical and affordable solutions o reduce our dependence on the fossil fuels that currently dominate America's electricity system." *Id.* The article goes on to explain, after citing the megawatt capacity increases due to state RPSs, that renewable portfolio standards, "in addition to realizing significant reduction of harmful emissions, the states have found that [RPSs] are an effective means to help meet critical fuel diversity, energy security, and economic goals." *Id. Cf.* Rabe, *supra* note 195, at 6 (stating that in the motivation for developing an RPS, environmental benefits "are deemed ancillary to a variety of economic advantages seen as accruing from an RPS").

market entities: the power producer, retailer, or consumer.[455] The aim is to promote renewable energy and thereby in a once-removed fashion enable the growth of the business of renewable power production while allowing for reductions in fossil fuel use and all that entails.[456] If renewables become more prevalent, costs might go down, the renewables industry could take off, the environment might improve, or health concerns could dissipate, et cetera.[457] In short, the RPS is a catch-all remedy that is increasingly seen as an energy policy panacea.[458]

Given that nearly half the states have adopted some form of a portfolio standard, it is not surprising that speculation exists regarding the eventuality and design of a national RPS.[459] The AWEA is one such organization seeking the enactment of a national RPS.[460] Their proposal, not surprisingly, is perfectly suited for the long-term commercial health and growth of renewable power producers.[461] Using the Clean Air Act's sulfur dioxide regulation as a model,[462] the AWEA sets forth a plan that, while light on specific figures, completely encapsulates the industry perspective in its underlying enforcement mechanism.[463]

If a national RPS is indeed on the horizon, a two-tiered approach that satisfactorily accounts for both the industry and social perspectives

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455. *See* Rabe, *supra* note 195, at 5 (specifying that all RPSs to date act on energy *suppliers*—this Note proposes that an RPS can act on energy consumers as well if it is structured the right way).

456. *See id.* at 6.

457. *See, e.g.*, *id.* (explaining that one of the "biggest factors" weighing in favor of a state's passage of an RPS is the perception that doing so facilitates economic development); *Successful Strategies*, *supra* note 18 (asserting that with a 20% national RPS by 2020, carbon dioxide emissions would be halved from their currently projected levels); Envtl. Prot. Agency Combined Heat and Power P'ship, *supra* note 325 (listing the benefits afforded by an RPS as including: environmental improvement; energy security; lower natural gas prices; reduction in power price volatility; new jobs; and broader local tax bases).

458. *See, e.g.*, Envtl. Prot. Agency Combined Heat and Power P'ship, *supra* note 325 (illustrating the wide scope of concerns potentially addressed by an RPS).

459. *See* Rabe, *supra* note 195, at 25-26.

460. *See* Am. Wind Energy Ass'n, Factsheet, *National Renewable Portfolio Standard*, *available at* http://www.awea.org/legislative/pdf/Federal_RPS_Factsheet.pdf.

461. *See RPS Overview*, *supra* note 17 (emphasizing the "sustainability" of the renewable electricity industry that would be realized with the adoption of an RPS).

462. *Id.*; Nogee et al., *supra* note 3, at 25.

463. *See RPS Overview*, *supra* note 17*; see also* Pater, *supra* note 168, at 34.

is warranted.[464] The AWEA proposal falls short from an industry standpoint in that it fails to appropriately set the means by which the standard comes to fruition. It falls short from the social standpoint in that it fails to account for the likely concentration of the burdens of fossil fuels in specific geographic areas.[465] An RPS—especially a national one—in addition to the fundamental structure of any quota[466] must set bars that are realistically attainable but ambitious enough to change the energy industry in the desired way.[467] To comprehensively meet the concerns of both perspectives, the national RPS approach will have to account for market forces,[468] federalism,[469] and hidden energy costs.[470] If done correctly, a balance can be wrought between each of these.

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464. This Note will use the terminology "two-tiered" to describe two distinct federally-mandated RPSs, one of which in effect is enforced *against* states. This language is not to be confused with the use of "two-tiered" discussed by other authorities. *See*, *e.g.*, Rabe, *supra* note 343, at 26 (discussing the issues confronting federal and state collaboration in integrating one federal RPS with existing or future state models, calling the arrangement alternately a "two-tier" and, more accurately, a "multi-tier" RPS system).

465. *See* Schneider, *supra* note 1, at 14-15, 21.

466. *See* Rabe, *supra* note 195, at 5. While different from one another in their design, RPSs that currently exist (1) stipulate a percentage or an amount of electricity to supplied; (2) define what constitutes a "qualifying renewable electricity source;" and (3) "over time, increases the percentage or amount of capacity or generation that must be provided from renewable sources to meet the standard." *Id.*

467. *Cf.* Sawin, *supra* note 22, at 15 (explaining that in quota systems, like the RPS, setting the target standard and the time in which it is to be achieved is crucial—that if the standard is too high, prices will rise "dramatically" and if it is too low, the desired economies of scale will fail to take root).

468. *See* van der Linden, *supra* note 180, at 47-48.

469. *See* Rabe, *supra* note 195, at 25-26 (explaining the difficulties of reconciling (a) the relationship between state policies; (b) the relationship between state and federal policies, in particular with regard to the Commerce Clause, U.S. CONST. art. I, § 8, cl. 3).

470. *See*, *e.g.* Beck & Martinot, *supra* note 23, at 3-5 (listing the following as "cost and pricing barriers": "subsidies for competing fuels," "high initial capital costs," "difficulty of fuel price risk assessment," "unfavorable power pricing rules," "transaction costs," and "environmental externalities").

C. The Industry Perspective RPS: A Business-Friendly Approach to Revolution (in the Electricity Marketplace)

The Industry RPS must be managed as a federal regulatory scheme.[471] Congress, after setting a production standard, would have to pass an enabling statute that allows an agency (likely the Federal Energy Regulatory Commission) to certify and administer "renewable energy credits."[472] These credits represent one kilowatt hour of electricity each, and for each power generator and distributor, the RPS determines how many credits they must hold at the end of each fiscal year.[473] If the RPS for a given year is 10%, each power retailer must have renewable source energy account for 10% of their total kilowatt hour sales for the year.[474] The credits are proof of these sales.[475] The credits would be tradable between industry actors as a parallel "commodity" to the electricity itself.[476] The credits, while not per se indicative of sales, instead signify that renewable energy has been supported in the amount of one kilowatt hour per credit.[477] Thus, a non-utility-owned wind farm (a power generator as opposed to a power retailer)[478] in North Dakota that produces and sells only renewable energy would have 90% of that year's credits to sell on the open market to power producers and distributors in any other part of the country that do not sell enough on their own.[479]

Credits would not be allowed to be carried over from year to year, and the market price would depend on how ambitious the annual increase in the RPS would be.[480] In this way, every power retailer (like a utility) would have to determine whether it would be more expensive

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471. *See* van der Linden et al., *supra* note 180, at 51 (asserting that a "strong . . . regulatory commitment" is needed for an RPS to be successful).

472. *See* Pater, *supra* note 168, at 36.

473. *See RPS Overview*, *supra* note 17.

474. *See id.* (using a 5% model); Nogee et al., *supra* note 3, at B-6.

475. *See* Beck & Martinot, *supra* note 23, at 9.

476. *See RPS Overview*, *supra* note 17; Nogee et al., *supra* note 3, at 25 (explaining that the credit "could take the form of a piece of paper, like currency," and that "[i]t would list the number of kilowatt-hours, the year and state of origin, and the type of generation (solar, wind, etc.)").

477. *See* Nogee et al., *supra* note 3, at 24-25.

478. *See id.* at B-6.

479. *See id.* at 25 ("Since renewable generation companies produce the power, they would be the original owners of the [credits].").

480. *See* van der Linden, *supra* note 180, at 47.

to produce their own renewable energy or directly subsidize the production of it elsewhere.[481] Industry actors that fail to meet the standard would be subjected to steep fines that substantially outpace the fair market value of the energy credit, making the RPS effectively self-enforcing.[482] Another advantage is that unlike direct government subsidies, no public funding is necessary.[483] Furthermore, it is effective in both regulated and competitive wholesale energy markets.[484] The overseeing agency would merely be required to certify the annual ownership of the credits themselves, administer penalties for non-compliance, and adjudicate disputes over credit transactions.[485] The formula for setting fine rates would be set statutorily along with the RPS to avoid costly and time-consuming bureaucratic rule-making procedures. The AWEA also notes that in an energy credit-based RPS scheme, the market value of credits will ultimately determine when the standard "self-sunsets."[486] Once a credit becomes worthless, the RPS will have accomplished its goal for at least the year.[487] To ensure long-term growth of the renewable energy industry, the RPS will have to start high enough, accelerate fast enough, over a long enough period of time to set off the diminishing rate of return for the credits.[488]

Special attention should be given to how the target for renewable electricity market share is set in establishing an implementation scheme.[489] The congressional proposal of a 10% RPS by 2030 submitted to the EIA for analysis, selects the desired percentage market share figure as the alterable variable.[490] While round numbers are easier to understand, the quadrennial leap of first 100% (2.5% to 5%), then 50% (5% to 7.5%), and finally 33% (7.5% to 10%) does not serve the renewables market well.[491] The RPS should grow over time, but by

481. *See* Nogee et al., *supra* note 3, at 25.
482. *See RPS Overview*, *supra* note 17.
483. *See id.*
484. *See* Nogee et al., *supra* note 3, at B-6 to B-7.
485. *See RPS Overview*, *supra* note 17.
486. *See id.*
487. *See id.*
488. *See* Nogee et al., *supra* note 3, at B-3 to B-4.
489. *Id.*
490. *See* EIA, 10% RPS Analysis, *supra* note 100, at 10 (setting a 2.5% share in first four years renewable credits are mandated, increasing to 5% for the next four years, 7.5% for the next four years beyond that, and finally to 10% until the end of the initiative).
491. *See* Nogee et al., *supra* note 3, at B-3 to B-4.

accelerating the standard this way, it does not provide the renewable electricity industry the chance to develop evenly over time.[492] Rather, this Note asserts that arbitrarily addressing only the bottom-line mandate stresses the market. Instead the relevant variable should be renewable electricity's annual growth rate in market share so as to ease the standard into the market. To be effective, the Industry RPS must give the regulated entities time to prepare sufficient business plans and strategies to either gather the assets needed to sell the requisite power outright or purchase the renewable energy credits on the market.[493]

The current market share of non-hydroelectric renewable electricity in terms of consumption is roughly 2.5%.[494] According to the EIA's latest projections, by 2010 that market share will be 3.95% which is where it is projected to stay with little fluctuation up to 2030.[495] The goal of achieving a specified market share by a specified point in time is best met through an incrementally rising RPS.[496] This Note proposes that Congress employ either of two methods, an Accelerated Growth Rate formula, or a market share compounded interest scheme.

The Accelerated Growth Rate ("A.G.R.") formula begins with the projected market share for renewables on a stipulated date, identifies an easy-to-meet initial target, and compounds that growth rate until the desired market share is reached. The simplest derivation is a constant A.G.R., wherein the factor by which the annual growth rate is multiplied stays the same throughout the life of the RPS. For illustration's sake, a 50% constant A.G.R. RPS could begin January 1, 2010 with a base-line

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492. *Id.*

493. *Cf. id.* at B-4. For the purposes of this discussion, qualifying electricity sources include wind, biomass (dedicated and cofiring plants), geothermal, solar-photovoltaic, solar-thermal, and municipal waste. *See Annual Energy Outlook 2007*, *supra* note 5, at 163. Additionally, preexisting renewables facilities will be eligible for inclusion into the national RPS scheme and receive whatever share of renewable energy credits to which they are entitled upon the implementation of the mandate. *Id.*

494. *See Monthly Energy Review: March 2007*, *supra* note 6, at 35.

495. *See Annual Energy Outlook 2007*, *supra* note 5, at 163.

496. *See* Nogee et al., *supra* note 3, at B-3 to B-4. The actual numbers and market share percentages chosen for this example are electric utility consumption numbers (based on thermal conversion figures) and not net generation numbers (kilowatt-hours) in order to avoid confusion about the certification of credits, which signify sales (also in kilowatt-hours). *Id.* In reality, the choice of which market share figures to use are up to legislative discretion as is the acceleration formula. *Id.*

renewable market share of 3.95% in utility consumption.[497] The alterable variable the annual growth rate—will begin at 0.01%, meaning that by December 31, 2010, all electricity retailers must have enough renewable energy credits to satisfy 3.96% RPS. The following year the 0.01% growth rate will increase by a factor of 50% to 0.015%, so that by December 31, 2011 the RPS would sit at 3.98% (rounding to the nearest hundredth). In 2012, the growth rate accelerates 50% to 0.023%, making the RPS 4.02%. By 2015 the RPS is 4.15%, still only a 4.5% increase over the EIA's projections.[498] By starting small and compounding the RPS's annual rate of increase, the A.G.R. formula backloads the standard and assures the market that a sufficient quantity of renewable energy credits will be available in the beginning to achieve total industry compliance. By 2020, the growth rate would be 0.93%, leading to a seemingly modest 6.68% RPS, a mandate, but one that surpasses the expected 2020 market share by more than 69%. At this point, the acceleration begins to show results, registering RPSs of 8.08% in 2021, 10.18% in 2022, 13.33% in 2023, 18.06% in 2024, and 25.16% by December 31, 2025—a nearly 520% higher market share than projected.

Setting a constant A.G.R. like 50% is the simplest method of implementing the standard with an eye for incremental progress while providing industry participants the chance to adapt over time to the new market. A more complex accelerated growth rate formula can be used to speed up or slow down the desired achievement of RPS milestones. For instance, if in using the same 3.95%-0.01% base in 2010, the initial rate increase is 100% for the first two years with lowering rate increases by a factor of 10% every two years (2013 and 2014 at 90% growth increase, 2015 and 2016 at 80%, etc.), the 2015 RPS would be 4.49%, increasing to 25.08% at 2022, roughly the same standard the 50% scheme reached, only three years earlier.

The sun-setting of the RPS, designed to be a function of the market,[499] kicks in at whatever percentage the statute sets as its ultimate goal for renewable market infiltration.[500] If, for example, 25% were the figure Congress had chosen, in the 50% constant A.G.R. formula

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497. *See Annual Energy Outlook 2007*, *supra* note 5, at 138, 163.

498. *Id.* at 163. The projections referenced are based on current and expected future consumption numbers as compiled by the Energy Information Administration. *Id.*

499. *See* Nogee et al., *supra* note 3, at B-5.

500. Obviously, if renewable-based electricity accounted for 100% of power production, the energy credits would be worthless, rendering the RPS moot.

scenario, the acceleration would cease after 2025. In the staggered acceleration growth rate formula, 2022 would be the end date. At that point Congress could either elect to maintain that 25% as its final RPS, enact a more limited growth formula, or arbitrarily set a final standard number. Once the acceleration ends and Congress finalizes the standard, the end game of the Industry RPS begins.

The other RPS structure that avoids the abrupt increases of the 2003 congressional proposal is one that mirrors any interest rate compounded annually.[501] Using the initial market share as the principle (present value), long-term RPS goal as the future value, the period over which the compounding runs, and the rate of the annual increase, the market share compounded interest approach provides a considerably faster start than the A.G.R. formulae mentioned above, including a 7.28% RPS in 2015—between 60% and 70% higher than either of the two demonstrated A.G.R. scenarios. The drawback to this approach is that it does not provide the same slow start as the A.G.R. permutations, potentially exposing under-prepared retailers to heavy non-compliance penalties. By 2025, what began as a fast start for the interest compounding formula comes in at nearly 25% three years after the staggered A.G.R. approach and one year before the 50% constant A.G.R.

The difference between the implementation schemes is one of strategy and simplicity. The compounding interest formula is more parsimonious, but the A.G.R formulae allow for a broad-based and conservative phase-in over at least the first seven years of the RPS with an option to ramp up the acceleration once the "getting-to-know-you" period is over. Either structural method, however, represents an improvement over the arbitrarily-rounded legislative targets of the 2003 proposal.[502]

D. The Social Perspective RPS: Because the World Does Need Saving

Renewable energy is more than simply a business. For that reason, this Note proposes an end-user-oriented, demand-side Social RPS to go along with the industry version. Fossil fuels are responsible for millions

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501. The formula is expressed as follows: RPS or Target Market Share = Current Market Share (1 + annual rate of increase)^Term. For this example, a 25% RPS over a 15-year term is expressed as: 25% = 3.95% (1+ r)^15; r = 0.13 in this case.

502. *See* EIA, 10% RPS Analysis, *supra* note 100, at 10

of dollars in health care costs,[503] a host of environmental and economic catastrophes,[504] and even national security vulnerabilities.[505] The push for a renewable portfolio standard given this set of concerns necessarily requires a different mode of implementation from the business-centered standard. The Industry RPS, its tailored execution structure notwithstanding, simply uses energy credits as a means to act on those who sell power.[506] The Social RPS makes use of renewable energy credits as well, but the relevant actors here are not utilities or independent power producers, but American states. Through the commodification of energy credits, even in a scheme that backloads implementation, power retailers that lack renewable assets will more often than those holding such assets choose to purchase credits on the market.[507] The risk that the social costs of fossil fuel production will be increasingly concentrated in certain regions is significant.[508] Given that renewable energy sources have geographic restraints, their production and distribution hubs will initially, in all likelihood, be sited at a greater distance from end-users than their larger-market-share fossil fuel competitors.[509]

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503. *See* Schneider, *supra* note 1, at 22.

504. *See generally* IPCC Report, *supra* note 15 and accompanying text.

505. *See* Bush Speech Feb. 2006, *supra* note 148 (speaking specifically of petroleum in this instance, the president declared America's dependence on "unstable governments" for energy sources a "national security issue").

506. *See* Nogee et al., *supra* note 3, at 24-25, B-4 to B-7.

507. *See* Pater, *supra* note 168, at 34. States with an RPS using renewable energy credits form what is called a "compliance market," the value of which was approximated at $137 million in 2004, and is expected to rise to $608 million in 2010. *Id.* This level of growth proves the existence and durability of the market, signifying as a matter of course that these credits have buyers who are unwilling or unable to acquire their own renewable energy assets. *Id.*

508. *See* Schneider, *supra* note 1, at 14-15, 21.

509. *See* Nogee et al., *supra* note 3 (including: (1) solar power, whose utility-scale plants need 7.5 acres of mirrors for one megawatt, or one square mile for an 85 megawatt plant, *id.* at A-3, with deserts representing the viable siting option, *id.*; (2) wind power, which is concentrated in some of the least populated areas of the country, *id.* at A-4 to A-5; (3) biomass, which has no presence in the mountain west or west coast, *id.* at A-7; (4) geothermal, located mainly in California and Nevada, *id.* at A-8; and (5) hydro-power, which needs sufficient water flow and has significant regulatory restrictions, *id.* at A-9 to A-10); *see also* Rabe, *supra* note 195, at 23 (arguing that the biggest problem confronting Texas's RPS is the need to construct more transmission capacity to move wind power electricity from its collection point to higher end-use population centers).

The Industry RPS only acts on businesses, not individuals and not geographic entities.[510] While the aggregate nation-wide market share of renewables would certainly increase under this standard, its positive social benefits like lower emissions are not evenly spread out either geographically or throughout the population.[511] Therefore, the Social RPS will seek to accomplish the overall reduction of fossil fuel emissions across the board, not for the sake of the renewable energy industry, but for the sake of health of its people and environment. To do so, it will have to act on the states by mandating end-use consumption or purchase rates, rather than production or sales rates. While matters relating to the consumption of energy could constitutionally be justified as within the realm of the Commerce Clause,[512] this Note finds that the most effective way to avoid legal challenge[513] and ensure the successful reduction of fossil fuel externalities is to condition certain federal funding to the states on the timely compliance with the standard. Just as Congress conditioned a percentage of federal highway aid for each state on the raising of its drinking age to 21 during the 1980s,[514] Congress would declare that it will release funding packages for highway, education, homeland security, and all other necessary state aid only upon the certification of the required number of renewable energy credits for that fiscal year.

As with the Industry RPS, the Social version will be implemented using a rate-compounding formula to ensure that state legislatures have the opportunity to weigh their own options and adjust over time.

510. *Cf.* Nogee et al., *supra* note 3, at B-1.

511. *See* Sawin, *supra* note 22, at 17. An "argument against" a quota system like an RPS is that it would "[c]oncentrate development in areas with the best resources, causing possible opposition to projects and missing many of the benefits associated with renewable energy (jobs, economic development in rural areas, *reductions in local pollution*)." *Id.* (emphasis added).

512. *See* Federal Power Act, 16 U.S.C. § 824(a)-(b) (2007) (declaring the business of transmitting and selling electricity "for ultimate distribution to the public" to be "affected with the public interest," and that the wholesale electricity market is under Congress's interstate commerce regulatory authority).

513. *Cf.* Steven Ferrey, *Sustainable Energy, Environmental Policy, and States' Rights: Discerning the Energy Future Through the Eye of the Dormant Commerce Clause*, 12 N.Y.U. Envtl. L.J. 507, 578 (2004) (discussing the limits and role of the federal government in energy market regulation).

514. National Minimum Drinking Age, Pub. L. No. 98-363 § 6(a) (codified as amended at 23 U.S.C. § 158 (2007)).

Certainly, states could seek to carry the brunt of the purchasing and consumption requirement on themselves through mandating renewable energy use on government property.[515] A state could choose instead to regulate municipal utilities,[516] enact their own RPS if they haven't done so already, or draft incentives for renewable energy producers to move to their state.[517] In light of the disparate nature of states, their relative geographic advantages, and populations, the Social RPS would necessarily have to be a lower standard, enacted more slowly than its commercially-oriented counterpart. States which already have their own version of an RPS are not restricted in any way from enforcing it, as long as the state does not drop below the mandates consumption/ purchase floor set by the federal Social RPS.[518]

Like the Industry RPS, renewable energy credits would be tradable commodities under the Social tier, but in order to marginalize the trading so as not to defeat the purpose of ameliorating externalities, a substantial percentage surcharge akin to a sales tax will be added to the purchase price of each credit. A smaller surcharge will be added to the Industry RPS, and the proceeds of both surcharges will go into the national system benefits fund. The percentage of the fund's non-investment revenue attributable to these surcharges should be earmarked to fund infrastructural projects like the "wind pipeline" that improve overall transmission access and energy efficiency so as to broaden the interconnectivity of the national power grid.[519] In so doing, it will help control for output variations while directly encouraging the proliferation of renewable power.[520]

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515. *See*, *e.g.*, N.Y. Exec. Order No. 111 (2001) (requiring 20% of the energy purchases for a building owned, leased, or operated by a state agency come from renewable sources of energy by 2010).

516. *See*, *e.g.*, Wash. Rev. Code § 19.29A.090 (2002) (requiring all utilities, including municipal and investor-owned utilities to provide an option to consumers to purchase electricity from "qualified alternative energy resources").

517. *See*, *e.g.*, Okla. Stat. tit. 68, § 2357.32B (2003) (enacting a per-square-footage tax credit for the new construction of wind turbines).

518. *Cf.* National Minimum Drinking Age, Pub. L. No. 98-363 § 6(a) (codified as amended at 23 U.S.C. § 158 (2007)).

519. *See* Caldwell, *supra* note 206.

520. *Id.*

CONCLUSION

Current market trends indicate that the status quo of a fossil fuel-based electricity sector is expected to endure well into this century.[521] While concerns about supply disruptions due to geopolitical worries are more prevalent in other energy sectors,[522] the high external social and environmental costs attributable to coal and to a lesser extent natural gas[523] have stimulated a national discussion.[524] Despite the projections that at current rates renewable power will remain relegated to marginal-player status,[525] renewable energy investors have reason to be optimistic in light of the success of green marketing programs[526] and nation-wide growth of state incentives.[527] Also important is the fact that in the last thirty years, awareness of global climate change,[528] the health effects of exposure to pollution,[529] and the devastating effect toxic emissions have on the natural world[530] has become more acute.[531] Correspondingly, Congress and many states use the power of the purse to influence the direction and trajectory of renewable energy progress.[532] On the federal level, tax incentives, research grants, and low-interest loan programs are aimed at stimulating investment in renewable energy industries.[533] States began implementing their own policies as well to encourage renewable energy businesses to set up shop within their borders.[534] However, as policy turned to progress for renewables, the government was still financing the polluters,[535] whose costs decreased through the

521. *See Annual Energy Outlook 2007*, *supra* note 5, at 14.
522. *Cf. id.* at 70 (discussing how geopolitical instability restricts petroleum supply, a major energy source for the transportation sector in particular).
523. *See* Cherry & Shogren, *supra* note 29, at 9.
524. *See* Bush Speech Feb. 2006, *supra* note 148.
525. *See Annual Energy Outlook 2007*, *supra* note 5, at 14.
526. *See* Blair & Swezey, *supra* note 21, at 5.
527. *See* DSIRE Website, *supra* note 20.
528. *See* IPCC Report, *supra* note 15 and accompanying text.
529. *See* Schneider, *supra* note 1.
530. *See* IPCC Report, *supra* note 15 and accompanying text.
531. *See Policies to Promote Renewables*, *supra* note 32, at 4.
532. *See supra* notes 217-332.
533. *See* Beck & Martinot, *supra* note 23, at 10 (classifying such programs as "cost-reduction policies" whose purpose was to provide incentives for private investment).
534. *Id.*
535. *See* Sawin, *supra* note 22, at 21-22.

1980s and 1990s,[536] rendering ineffectual certain pro-renewables programs.[537]

Of all the alternative energy sources, perhaps the slowest start was had by wind.[538] Hydro power had waterfalls and dams,[539] solar power and geothermal had immediate sources of funding,[540] and biomass could be mixed with coal and still be considered in the same league as the other "green" sources.[541] Nonetheless, through government-sponsored technological development,[542] and incentivization policies, wind power grew faster than any of its peers.[543] Innovations in turbine design[544] coupled with favorable local and national policies[545] should have this industry gaining market share as long as its production tax credit stays in effect.[546] Furthermore, enormous growth in Europe mixed with enormous potential in the United States indicates that wind energy is coming of age. [547] With a viable market[548] and a history of reacting well to government initiative,[549] the wind power industry is on the rise,[550] but like all renewables,[551] has obstacles to overcome.[552] Transmission costs and output variability can all be accounted for with common sense

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536. *See Monthly Energy Review: March 2007*, *supra* note 6, at 135.

537. *See Changing Structure of the Electric Power Industry*, *supra* note 168, at 51 (attributing the decline of PURPA to the).

538. *See Renewable Energy Report*, *supra* note 58, at 665, 662-663 (showing how wind-specific programs did not come about until 1980, and how wine power capacity did not begin to rise in earnest until the late 1990s).

539. *See* Nogee et al., *supra* note 3, at A-9.

540. *See Renewable Energy Report*, *supra* note 58, at 661.

541. *See* Nogee et al., *supra* note 3, at A-7.

542. *See Wind Energy R&D*, *supra* note 31, at 2-3.

543. *See* Reeves, *supra* note 32, at 22 (stating that the "market for wind power generation is rapidly expanding, due largely to decreasing technological costs and institution of government incentives"); *see also* AWEA, Wind Energy Basics, *supra* note 130 (indicating that in 2005 and 2006, no other renewable energy source had more new generating capacity installed in the United States).

544. *See Wind Energy R&D*, *supra* note 31, at 2-3.

545. *See* L. Bird et al., *supra* note 106, at 4.

546. *See Wind Outlook 2006*, *supra* note 21, at 1.

547. *See* Global Wind Energy Council, *supra* note 109.

548. *See supra* notes 165-206.

549. *See* L. Bird et al., *supra* note 106, at 39.

550. Global Wind Energy Council, *supra* note 109 (noting that the value of new generating installations in 2006 alone, are worth $23 billion).

551. *See* Beck & Martinot, *supra* note 23, at 3-6.

552. *See* Caldwell, *supra* note 195.

regulation, infrastructural improvements, and fair access rules,[553] but private investment is the real key to ensuring long-term growth for renewable power industries.[554] So too is the need to reduce or eliminate fossil fuel subsidies[555] and demand that social costs be accounted for.[556]

Indeed, this is an opportunity to win both private wealth and public health. If the need to craft energy legislation is indeed analogous to war,[557] then a national campaign must be undertaken using markets as a battle plan, laws as weapons, and investors as soldiers. The barriers addressed in this Note can be marginalized through a comprehensive energy policy on the federal level, including a system benefits fund and two-tiered renewable portfolio standard.[558] Furthermore, long-term commitments to supply-side policies like tax credits and capital assistance programs are necessary to ensure the successful cleansing of the American energy industry.[559] In the energy war, wind power is a battlefield where ground has been gained. When a breeze from the direction of a power plant no longer carries toxins, but the promise of clean electricity, victory is in the offing.

553. *See Wind Outlook 2006*, *supra* note 21, at 4.

554. *Cf.* Bush Speech Feb. 2006, *supra* note 148 and accompanying text.

555. Sawin, *supra* note 22, at 21-22.

556. Beck & Martinot, *supra* note 23, at 5 (explaining that investors will often not take social costs into account, despite the adverse impacts fossil fuels have on health and the environment).

557. *See supra* note 213.

558. *See supra* notes 443-520.

559. Sawin, *supra* note 22, at 26-27.