Diversifying Energy in America: Moving Towards Renewable Wind Power.

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A. Energy Policy in America.

Today, energy is on the minds of most Americans. When world oil prices rose to approximately $78 per barrel in the summer of 2006, gasoline/petrol prices for consumers rose to unusually high levels of $3.50 per gallon (or 11 rmb/liter). At the same time, electrical utility companies passed on their higher fuel costs to their consumers in the form of higher electricity rates. Airlines did the same thing by imposing fuel surcharges in addition to their basic ticket prices. Recently during 2006, sales of new trucks and sport utility vehicles (vehicles with poor fuel economy) drastically declined from recent sales levels substantially harming the earnings of General Motors and Ford Motor Company and leading to corporate restructuring and substantial employee layoffs. As these items reveal, energy functions an essential part of the American economy powering manufacturing, agriculture as well as the commercial sector. America's high per capita consumption of energy, when considered in conjunction with rapidly escalating fuel prices, has made the public acutely aware of the implications of the patterns of our energy consumption. Once again, recent increased oil prices have made American consumers and policy makers both aware of the significance of energy as a major component of the American economy and the overall quality of life.

The central implication of this recent petroleum pricing increase has been to focus attention, once again, on the sustainability of American energy consumption patterns. Even before the summer oil price hikes, President George Bush summarized America's energy problems in his 2006 State of the Union address in the following terms, "Here we have a serious problem: America is addicted to oil."1 While his comment indirectly identified the increasing dependency on costly, imported petroleum as the most serious energy policy problem,2 other serious energy issues loomed as well before America. How could the nation satisfy its ever increasing demand for electricity to power its homes, offices, manufacturing plants and commercial venues? Where would the necessary emission reductions in air pollutants and greenhouse gases be obtained in the future, especially if more, not less, energy was consumed by Americans? How could American business and citizens shift away from their near-total dependence on fossil fuel energy sources in coming years?3 These and other important energy questions remain unanswered.

However, the disadvantage of higher cost, imported energy sources has lead to the consideration of energy alternatives that were previously considered too costly or too technically infeasible. Economic and public policy changes make it possible to seriously consider that were, at best, speculative ideas just a few years ago. The central question addressed by this paper is what are the prospects for the large-scale development of an inexhaustible, non-polluting source of electricity energy derived from the winds: wind power? Throughout history, the wind has been harnessed to mill grains and pump water for irrigation and human consumption.4 However, its

[1]President George W. Bush, State of the Union Address, January 31, 2006.

[2]The fuel efficiency of American motor vehicles reveals an ever increasing American demand for motor fuel. While the fuel rate (miles per gallon) for passenger cars has gradually improved to 22.4 miles per gallon in 2004, the annual average number of miles traveled per car has steadily increased to 12,497 miles per year. As a comparison, in 1991 passenger cars had an average fuel economy of 21.1 miles per gallon but only an average number of miles traveled of 10,571. See Energy Information Administration, Monthly Energy Review 17, Table 1.9 (August, 2006). The number of cars has increased by approximately 5 million since 1990. See Statistical Abstract of the United States: 2006 at 692, Table 1044. The fuel economy of vans, pickup trucks and SUVs has actually declined recently from prior levels in the mid-1990s to 16.2 miles per gallon. EIA Monthly Energy Review 17, Table 1.9. The number of these vehicles has doubled since 1990.

[3]In 2004, fossil fuels (petroleum, coal and natural gas) comprised over 86% of the total U.S. energy consumption with nuclear electric power contributing 8% and renewable energy sources adding 6%. U.S. Department of Energy, Energy Information Agency, Renewable Energy Trends 2004 Table 1 (cited http://www.eia.doe.gov/cneaf/solar.renewables/ page/trends/table1.html). In the last two years, renewable forms of electrical energy have increased to provide approximately 11% of American generation.

[4]The first windmills were developed to automate the tasks of grain-grinding and water-pumping and the earliest-known design is the vertical axis system developed in Persia about 500-900 A.D. There is also historical evidence that the vertical axis windmill was used in China in the 12th Century A.D. The functionality of the device encouraged its spread throughout Europe throughout the 13th-14th Centuries. Even in America, windmills were used in the western territories and states after 1860 for stock watering, milling and water pumping. See Peter Asmus, Reaping the Wind- How Mechanical Wizards, Visionaries, and Profiteers Helped Shape Our Energy Future 24-32 (Island Press, 2001).

principal modern significance is its usefulness as both a small and large scale generator of electrical current. Wind energy has been generating electricity in extremely small amounts in America since 1981[5] but during the last five years, this form of electrical production has dramatically increased at an annual rate of approximately 30%. This recent expansion of wind power has been spurred on by escalating fossil fuel costs as well as an increasing concern about the environmental impacts of current energy sources. At the same time, wind power has rapidly expanded as the result of improvements in wind turbine technology, the significant reduction of generating costs and favorable public policies. These factors have all combined to encourage investment in the wind power industry.

The overall conclusion to be drawn from this analysis is that although wind power has been a relatively small contributor to American electricity generation in the past, with supportive government policies attracting large private market capital investments, it could produce, in conjunction with other renewable sources, significant amounts of electrical power in the next 10 to 15 years. If this were to occur, significant environmental and economic benefits that would accrue to the nation. Recent polling data has suggested that American public opinion strongly support non-polluting renewable energy technologies[6] and would likely accept increased reliance on these new forms of electricity supply. The evidence suggests that this process of energy diversification is already taking place and the main question is whether this pattern will accelerate to achieve the significant electricity generation goals set out by government policymakers.

B. Introduction to Patterns of World Energy Production and Consumption.

1. Global Energy: Large and Growing Demand.

Global primary energy consumption has steadily risen over the last decade and in 2005 it totaled 10,537 million tons of oil equivalents (Mtoe).[7] World primary energy consumption

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[5]California was the first state to have operating wind power plants. In 1978, it initiated the Wind Energy Program with a goal of securing 500 MW of wind power electricity installed and operating by the mid-1980s. Initially in the early 1980s, more than 1000 55 kW wind turbines were installed in a large wind energy park in Palm Springs, California. The State of California had encouraged wind energy by funding research and development in wind energy projects and later by offering generous investment tax credits. In fact, by 1985 California had installed 1,000 MW of wind capacity. Energy Information Administration, Office of Coal, Nuclear, Electric and Alternate Fuels, U.S. Dept. of Energy, Policies to Promote Non-Hydro Renewable Energy in the United States and Selected Countries at 9-10 (February, 2005). When the state government withdrew the preferential tax policy in the mid-1980s, the development of wind energy in California stalled.

[6]A survey conducted by Yale Center for Environmental Law and Policy found that an overwhelmingly large percentage of Americans polled wished to reduce dependence on imported petroleum products. They also strongly supported the building of more solar power facilities (90%) and more wind turbine farms (88%) as ways of reducing that dependence. Survey on American Attitudes on the Environment- Key Findings 6 (May, 2005). Found at http://www.yale.edu/envirocenter/poll2key.prn.pdf

[7]Million tonnes of oil equivalent or mtoe has a heat equivalency of approximately 40 million British thermal units or Btus per mtoe.

increased by 2.7% in 2005 alone, below the previous year's strong growth of 4.4% but still above the 10-year annual average of approximately 1.9%. The strongest increase in consumption was in the Asia Pacific region, which rose by 5.8%, while North America once more recorded the weakest growth at 0.3%.8 American consumption fell slightly, while China accounted for more than half of global energy consumption growth.9 In 2005, China consumed 1554 mtoes of energy second only to the United States at 2336 mtoes.10

The future appears to portend even more energy use. Current baseline projections of the International Energy Agency (IEA) indicate that worldwide demand will increase at the rate of 1.6% annually reaching a total of 16,300 (Mtoe) by 2030.11 In this scenario, oil, natural gas and coal will account for 83% of this increase and ultimately comprise 81% of global energy demand by 2030.12 If this view is correct, oil will be the single largest fuel in the global energy mix while natural gas will exceed coal to be the second most common fuel source. This estimate also assumes that renewable energy, other than hydro-electric and biomass, are likely to increase at the largest annual rate of any fuel source- 6.2%. However, this rapid increase springs from a small initial share of global energy demand. While the dominance of fossil fuels as the world's most significant fuel source appears certain, government policy changes could alter the energy mix to some degree. It is possible that by advancing goals to reduce air pollution and greenhouse gas emissions13 as

[8]In 2005 primary energy consumption rose worldwide by 2.7% with the following distribution across the regions of the world: 1) Asia/Pacific- 32.5%, 2) Europe and Eurasia- 28.3, 3) North America- 26.6%, 4) South and Central America- 4.8%, 5) Middle East- 4.8% and 6) Africa- 3%. See BP Statistical Review of World Energy, June 2006: Primary Energy Consumption (http://www.bp.com/statisticalreview).

[9]In 2005, the top ten world consumers of energy expressed in million tons of oil equivalent (mtoe) and in percentages of total consumption were: 1) United States- 2336 or 22.2%, 2) China- 1554 or 14.7%, 3) Russian Federation- 679 or 6.4%, 4) Japan- 524 or 5%, 5) India- 387 or 3.7%, 6) Germany- 324 or 3.1%, 7) Canada- 317 or 3.0%, 8) France- 262 or 2.5%, 9) United Kingdom- 227 or 2.2%, and 10) South Korea- 224.6 or 2.1%. BP Statistical Review of World Energy- June 2006 Primary Energy Consumption by Fuel.

[10]In the last 40 years, China's energy consumption has risen 8.5 times from 182.4 to 1554 mtoes. By comparison, the United States has increased its energy use by less than 1 time from 1324 to 2336 mtoes. This reflects the significant change in industrial, residential and commercial energy use that has occurred over that important period. BP Statistical Review of World Energy June 2006 (Primary Energy Consumption by Fuel).

[11]International Energy Agency, World Energy Outlook 2005 at 80. These estimates spring from the IEA's Reference Scenario that takes into account governmental policies and actions that have already been adopted even if not currently in place. This "baseline vision" does not include possible, potential or even likely future policy initiatives even though it is quite possible or desirable that new energy policies will be adopted in the next two decades. *Id*. at 59.

[12]Id. Under this appraisal, nuclear power will fall from supplying 6.4% to 4.7% of energy demand while the share of renewable resources, including biomass, will increase from 13% to 14% of the total. Id.

[13]Maintaining the status quo of heavy reliance on fossil fuel energy sources will result in a substantial increase in the emission of energy related CO_2 over the period ending in 2030. Under the IEA's Reference Scenario, emissions of this gas will increase from 24 gigatonness to 37 gigatonnes an increase of 52% over the 2003 level. Electrical power generation is expected to contribute approximately have of this increase while transportation-related

well as enhancing energy security, world governments could adopt an alternative set of policies that would reduce world energy demand. These policy changes could stimulate the demand for renewable energy technologies even beyond the projected level of growth.14

In terms of world electricity generation growth during the 2003-2030 period, estimates of the Energy Information Administration set the rate of annual growth in installed generating capacity to average 2% per year. While this might sound modest, it results in an increase in electrical generation from 3,710 gigawatts in 2003 to 6,349 gigawatts in 2030.15 How will this large increase in generating capacity be met? The fuels and generating technologies to be used in meeting this sizable capacity expansion will vary from country to country depending upon available fuels, national security concerns, market competition and governmental policies. Considering the existing fuel mix used to generate electricity, it seems likely that a large percentage of the needed, new capacity will be fossil fuel powered. Currently, approximately 70% of American electricity comes from fossil fuels while in China even a greater share is fueled by coal, natural gas and oil.16 Certainly, the dramatic increase in world energy generation capacity burning fossil fuels will only worsen the loading of global warming gases and air pollutants into the environment.17 This raises the question of whether other generating technologies- such as renewable energy- should be advanced to fill the needed vacuum.

2. American Energy Production and Consumption Patterns.

To understand the scope of energy policy issues in the United States, it is necessary to comprehend the trends of American energy production and consumption. As a measure of overall consumption, in 1978 America used 79.99 quadrillion Btus from fossil fuels, nuclear electric

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energy use will add another quarter. IEA World Energy Outlook 2005 at 92.

[14]The IEA's World Alternative Policy Scenario assumes the enactment of several energy saving and fuel diversification policies which would lower all fossil fuel demand (by more than 10%) and higher carbon-free fuels in the energy mix by 2030. This would undoubtedly increase the share of renewable energy sources, including wind power, to an even higher level than that projected in the IEA's Reference Scenario.

[15]U.S. Department of Energy, Energy Information Administration, International Energy Outlook 2006 at 65.

[16]U. S. Department of Energy, Energy Information Administration, Net Generation by Energy Sources by Type of Producer, November, 2005. (Found at www.eia.doe.gov.cneaf/electricity/epa/epat1p1.html). China already provides over 70% of its electrical generation with coal and that is expected to rise to at least 72% by 2030. Natural gas and oil electrical production will only add to the fossil fuel component of their electricity. See Energy Information Agency, International Energy Outlook 2006 at 68.

[17]In 2004, it was estimated that the United States discharged 5.9 billion metric tons of CO_2 into the environment with 2.4 billion of these metric tons originating in electricity production. This same data indicates that China added 4.7 billion metric tons of CO_2 into the air in the same year with no breakdown available for the electrical generating industry. U.S. Dept. of Energy, Energy Information Administration, Emissions from Energy Consumption for Electricity Production and Useful Thermal Output at Combined Plants (found at: www.eia.doe.gov.cneaf/electricity/epa/epat5p1.html) and Energy Information Administration, International Energy Annual 2004, Table H.1 CO_2.

power and renewable energy.18 By 2005, this number had grown to 99.89 quadrillion Btus, an increase of 24.9% over 27 years for an average increase of .92% per year.19 However by comparison, the population growth over this same period was 35.4% suggesting that per capita energy use had been reduced perhaps through the introduction of energy conservation methods.20 The largest increases in electricity use comes from the residential and commercial sectors of the economy. Electricity has been used in these sectors for heating and cooling, lighting and the operation of small appliances such as computers and refrigerators. In this period, industrial use of electricity actually declined slightly indicating a contraction in large electricity consuming industries such as iron, steel and aluminum manufacturing.

During this time, the distribution of energy sources (fossil/nuclear/renewable) has moved from 89.8%/3.8%/6.3% to 86%/8.1%/6.1% revealing a small shift away from fossil fuels into nuclear energy. Over this period of time, renewable sources of energy have stayed remarkably static at slightly more than 6% of the energy mix with wind power representing a small fragment of that total.21

Looking forward into the future, American energy consumption is expected to rise by approximately 1% per year from 2003-2030 to reach a total of 133.88 quadrillion Btus in 2030.22 Under this prediction, domestic energy production would grow by .9% per year with any shortfall being made up with imported energy materials. Using this assessment, by 2030, energy imports would represent nearly 50% of American energy production. Under this estimate, all renewable sources of energy would increase by an annual rate of 1.8% and by 2030 renewable energy would constitute approximately 10% of the domestic energy production. This definition of renewable energy includes hydroelectric, biomass wind, geothermal and solar energy. It is notable that this projected rate of increase for renewable energy production would be double the overall rate of energy production. This bullish view of American renewable energy is further reinforced by the International Energy Agency's estimate of world-wide energy trends indicating that renewable energy would increase globally by 14%.23 While such energy assessments represent attempts at modeling complex systems of supply and demand, they do present an "educated guess"

[18]U.S. Dept. Of Energy, Energy Information Administration, Annual Energy Review 2005 Table 1.1 (Energy Overview, Selected Years, 1949-2005).

[19]Id.

[20]Statistical Abstract of the United States: 2006, Population 8-9 Table 2 & 3.

[21]Also, hydro-electric power and biomass sources represented the overwhelming majority of renewable energy with geothermal, solar and wind energy combined constituted only 9.3% in 2005. U.S. Dept. of Energy, Energy Information Administration, Annual Energy Review 2005 7, Table 1.2.

[22]International Energy Agency, Annual Energy Outlook 2006 (February, 2006).

[23]2005 International Energy Agency, World Energy Outlook, Annex B at page 607.

concerning future energy trends.

With regards to electricity generation, the United States leads the world in electrical generation with 3,892 billion kWh followed by China with 2,191 billion kWh in 2005.24 As a percentage of world electricity, the United States generates 23.6% while China provides 13.3.%25 Although the growth of both nations has been rising, the rate of American electrical generation growth at 2% from 2004 to 2005 is dwarfed by that in China at 12.6%, which is the highest in the world. Focusing on the accelerating growth in electrical generation and demand, it is significant to note that the overwhelming fuel source for this increase are fossil fuels. In both the United States and China, least 70% of the electricity is currently produced through the combustion of coal, natural gas and oil.26 New power plant construction in the United States during the last few years has emphasized natural gas as the fuel source.27 In America, policy makers must consider the implications of selecting appropriate technologies for meeting the increased electrical demand over the next two and a half decades.

C. Forcing Change in Patterns of American Energy Supply and Use.

1. Making Technological Choices for Electricity Generation.

Most American consumers and industrial/commercial users of electricity purchase it from an electric utility company that generates and distributes the energy product. The majority of these

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[24]CIA World Fact Book, 22 August 2006. National electricity statistics have a small amount of variation. The U.S. Energy Information Administration's Monthly Energy Review listed American electrical generation for 2005 at 4,038 billion kWh while the British Petroleum's Statistical Review of World Energy, June 2006 listed U.S. 2005 generation at 4239 billion kWh. See Monthly Energy Review, http://www.eia.doe.gov/emeu/mer/elect.html, August, 2006, posted 8/26/06 and BP Statistical Review of World Energy- June 2006, http://www.bp.com/statisticalreview.

[25]Id. If Taiwan, Macau and Hong Kong are added to the electricity generated by China, the total rises to 14.8% of the world total.

[26]For the first six months of 2006, American electrical power was generated by coal (49.3%), petroleum (1.5%), and natural gas (18.2%). Hydroelectric and other renewable sources of electricity comprised 11% with nuclear electricity providing nearly 20%. U.S. Dept. of Energy, Energy Information Administration, Electric Power Monthly, September 2006 Edition Table ES1.B Total Electric Power Industry Summary Statistics (found at http://www.eia.doe.gov/cneaf/electricity/epm/tablees1b.html).

[27]In Congressional testimony in 2005, Jim Wells, Director of the Natural Resources and Environment Section of the General Accounting Office stated that,

> In 2003, over 70 percent of electricity [in the United States] was generated using fossil fuels, with over 50 percent coming from coal-fired power plants, about 16 percent from natural gas, and small amounts from petroleum and other fossil fuels. In recent years, new power plants have predominantly relied on natural gas. Nuclear energy provides about 20 percent of electricity generation, hydroelectric energy provides about 7 percent, and a variety of renewable resources, such as wind turbines, provide the remainder.

Jim Wells, GAO Director of Natural Resources and Environment, "Meeting Energy Demand in the 21st Century-Many Challenges and Key Questions at 21, March 16, 2005 (GAO-05-414T) firms are investor-owned utility corporations who responsible to their shareholders and their consumers as well as government utility regulators.28 Since energy generation is an extremely capital-intensive activity, a shift to a new technology can only follow a careful cost/benefit analysis of modifying technical approaches to electricity generation. Investment in new generating capacity represents a major, long-term capital commitment and one that cannot be easily replaced if it fails to provide the expected generating results. As a result, utilities often make incremental improvements to their existing generating technologies and major changes in their basic generating equipment only when significant benefits have been established.

The choice of appropriate technology for energy production is driven by multiple factors. First, the technology must be established as technologically feasible and reliable in large scale, real-world applications. In this area, theoretically appealing yet untried energy production concepts are not ready for actual application. The utility company or the Independent Power Producer must be assured of the performance characteristics and reliability before the major investments can be made. Second, economic cost in the construction and operation of the technology are usually of central and primary importance. A number of costly energy technologies have failed to be widely adopted due to their high relative expense per unit of energy delivered. Consequently, the energy produced must be economically competitive with substitutes and, generally, be within the budget limits of most energy consumers. Third, environmental implications are also important and if a particular energy technology imposes excessive environmental harm, it must be subordinated to other less damaging technologies all other things being equal. Most prominently, greenhouse gas and conventional air pollutants such as sulphur dioxide, mercury, nitrogen oxides are the result of existing fossil fuel combustion technology. Fourth, raw material supply concerns are also significant aspects of technology choices. This is true about the fuel used or the underlying technology itself. If the use of a particular fuel or other necessary components may be difficult or impossible to obtain, have global political consequences or may have wildly erratic prices, the energy technology will be considered less desirable for future installation.

2. Increasing the Emphasis on Renewable Energy Technologies.

[28] American electrical generation is provided by electrical utility companies (Utilities) that generate, purchase and distribute electricity and independent power producers (IPPs) which generate electricity and sell it to distribution companies. Currently, utilities generate about 63% of American power while IPPs provide 33%. U.S. Dept. of Energy, Energy Information Administration, Electric Power Monthly, September, 2006 Edition. (Found at http://www.eia.doe.gov/cneaf/electricity/epm/epm_sum.html)

Recent estimates have increased the emphasis on renewable energy technology as a future source of American energy production. Renewable sources of energy are abundant and, when they are combined, have the potential to change the American energy mix. Although there is no authoritative definition of "renewable energy" sources, the U.S. Department of Energy includes hydroelectric power, geothermal, solar and wind energy, wood waste and alcohol fuels, geothermal heat pumps and solar thermal direct uses.29 In fact, over the last twenty-five years, in absolute terms these renewable source production has generally fluctuated between 6 and 7 quadrillion btus per year.30 As a percentage of total energy production, the renewable component has varied within a tight range between 8% and 10% of total American energy production. In 2006, renewable sources have contributed to electricity generation in the a rising proportion with 11% of total electric power generation.31 The rise in renewable electricity is attributable to significant increases in hydroelectric generation and wind power.32 While 11% of electricity generation is still a relatively small component of overall supply, it does some evidence that a shift in generation can occur in the world's largest electrical market.33 If this recent trend can continue, America could begin to incrementally reduce its overwhelming reliance on fossil fuels. Continued high fossil fuel prices would support the development and installation of larger amounts of electric power substitutes such as renewable energy. Should this occur, we would witness the emergence of renewable energy as a larger part of the energy mix.

D. The Potential of Wind Power to Bolster Renewable Electricity Supplies in the Future.

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[29]U.S. Dept. of Energy, Energy Information Administration, Annual Energy Review 2005, Table 1.2 Energy Production by Source, Selected Years, 1949-2005 footnote 1.

[30]U.S. Dept. Of Energy, Energy Information Administration, Annual Energy Review 2005 Table 1.2 Energy Production by Source, 1949-2005. Curiously, the highest absolute amount of renewable energy production occurred in 1996 & 1997 when the total topped 7.1 quadrillion btus.

[31]U.S. Dept. of Energy, Energy Information Administration, Electric Power Monthly- Table ES1.B Total Electric Power Industry Summary Statistics, Year-to-Date 2006 and 2005. (Found at http://www.eia.doe.gov/cneaf/electricity/epm/tablees1b.html)

[32]Hydroelectric generation has continued to increase in 2006. Electricity generation in June, 2006 was 10% higher than in June 2005, and the year-to-date total was 13.7 percent higher than it was in 2005. Due to heavy precipitation, water supplies have been at or above normal in the northwestern states, the largest hydroelectric production region. However, the fastest growing source of electrical generation has been wind power. In June, 2006, wind generation increased by 17.8 percent compared to June 2005. Year-to-date net generation from wind was up 49.5 percent. However, wind still constitutes a small share of total electrical generation providing only 0.6 percent of the total, year-to-date. Id.

[33]Recent estimates of renewable electricity as a percentage of total installed generating capacity has placed the figure of 23% on renewable power. Much of the increase in this category of electrical power comes from large hydroelectric plants being constructed in many parts of the world, including China with the Longtan and the Three Gorges dam projects. Energy Information Administration, International Energy Outlook 2006 at page 69-70 (found at http://www.eia.doe.gov/oiaf/ieo/pdf/electricity.pdf)

1. Renewable Energy Worldwide.

Across the globe, nations are beginning to diversify their electrical generation mix by emphasizing new energy technologies. Overall, in 2003 the world acquired 18% of its electricity from renewable sources.34 Different countries lead the world with different kinds of renewable sources of energy: the United States leads with geothermal power, Japan is in front with photovoltaic power, Germany is world champion with wind turbines and the United States and Brazil share the spotlight with ethanol. Also, renewable energy serves as a significant electrical energy source in different countries around the world. For instance, wind power generation has a substantial share of total electricity generation in Denmark (16%), Spain (8%) and Germany (5%); geothermal sources account for approximately 25% of the total electricity generated in El Salvador, 20% of all electricity in the Philippines and in Kenya, and 17% in Iceland.35 Even in the United States, there will be one million solar energy systems installed on rooftops across the country by 2010 under a U.S. Department of Energy program and the installation of these systems could eliminate CO2 emissions equal to those produced by 850,000 automobiles.36 In all of these locations, renewable energy is a reality and a major contributor to the national energy mix. While each nation has its own reasons for setting its energy profile, it is clear that renewable forms of energy are not exotic, rare phenomena. Rather, they serve important purposes in diversifying the mixture and achieving a range of societal objectives.

2. Wind Power as a Larger Component of the American Renewable Energy Mix.

A. Is Wind Power a Modern High Tech Innovation?

[34] The bulk of this electricity production was from hydroelectric energy providing 16% of the world's need while all other renewable forms of electricity combined for another 2%. CIA World Fact Book 2006, 22 August 2006. Much of the growth in renewable electricity production comes from extremely large hydroelectric projects that have been undertaken in non-OECD countries like China over the last decade. These additions to generating will be substantial and will lessen, to some degree, the demand for fossil fuel generated electricity in those places.

[35] British Petroleum, Statistical Review of World Energy 2006- Renewable Energy (found at (www.bp.com/statisticalreview).

[36] Solar photovoltaic electricity production has begun in earnest in the southwest United States with 9 commercial concentrated solar power plants producing approximately 354 megawatts of electricity- enough energy to power 85,500 homes per year. The cost of solar energy has been declining over the past two decades (although still not competitive with coal or natural gas generation) with the Sandia National Laboratories predicting price-competitive 5 cent per kWh electricity by 2020. NRDC: Solar Power (found at www.nrdc.org/air/energy/renewables/solar.asp).

Nature's wind movement has been used for centuries throughout the world with records indicating earlier use of the wind as an energy source in China and Persia for grinding grain and pumping water at least since 200 B.C. The use of the wind's force into ship sails have powered vessels for even longer.37 Over the last two thousand years the power of the wind has assisted ingenious humans with land drainage, industrial activities such as wood sawing, pulping and papermaking, mining, textiles and agriculture.38 While the technology has changed from vertical to horizontal designs, it has proven to be extremely useful for solving important social needs. In Holland for example, as early as the 14th century wind energy drove pumps to remove water from the polders, to create dry land and to expand the Dutch land mass.39 More recently, it has been used for pumping and supplying water and, for the last century, providing electrical energy.40 Current research and development has suggested other innovative and useful applications for wind power including the production of hydrogen, the cleaning and moving of water in combination with hydro power plants, powering municipal drinking water and waste water operations, desalination, and irrigation.

In the twentieth century, the widespread availability of inexpensive, utility-generated electricity has put pressure on wind power as an alternative electrical source. For much of the twentieth century there has been scant interest in wind produced electricity other than for charging batteries in remote and inaccessible locations. Federal policies enacted in the early 20th century which encouraged rural electrification through the subsidy of rural electrical cooperatives and the

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[37]See, generally, Richard L. Hills, Power from the Wind: A History of Windmill Technology at xx (Cambridge University Press, 2002); Peter Ausmus, Reaping the Wind: How Mechanical Wizards, Visionaries and Profiteers Helped Shape Our Energy Picture, at 9 (Island Press, 2001); Robert Gasch & Jochen Twele (editors), Wind Power Plants: Fundamentals, Design, Construction and Operation at 17 (Solarpraxis, Berlin & James and James Publishers, London, 2002); J.F. Manwell, J.G. McGowan & A.L. Rogers, Wind Energy Explained: Theory, Design and Application at 11 (John Wiley Publishers, 2002); Tony Burton, David Sharpe, Nick Jenkins & Ervin Bossanyi, Wind Energy Handbook at 1 (Wiley Publishers, 2001).

[38]As early as 1700 B.C., Hammurabi is said to have used windmills to water the plains of Mesopotamia. See Robert Gasch & Jochen Twele, Wind Power Plants- Fundamentals, Design, Construction and Operation 17 (Solarpraxis AG, Berlin,Germany, 2002) citing E.W. Golding, The Generation of Electricity by Windpower, 1955 edition; reprint with additional material E. & F. Spon Ltd., London, 1976.

[39]Id. at 21.

[40]Using windmills or wind turbines to generate electricity can be traced back to an ingenious and highly successful American inventor, Charles F. Brush, who in 1888 devised the first large windmill generating electricity. Brush, a successful inventor of the arc lamp and the dynamo, built a turbine with a 51 foot diameter wooden blades next to his mansion at Euclid Avenue and 37th Street in Cleveland, Ohio. This was the first automatic operating electricity turbine and it provided sufficient direct current to power 350 incandescent lights plus several motors within the large mansion. The successful electricity-generating project was even profiled in an article in the Scientific American magazine of December 20, 1890. The electricity generated by the windmill was stored in batteries located in the basement of the house. This system supplied the large residence for 20 years when in 1908, Brush chose to use inexpensive electricity supplied by Cleveland's municipal light company. See further information at http://www.greenenergyohio.org/page.cfm.

installation of electric transmission lines largely eradicated the more than 8 million mechanical windmills that had been installed throughout the west and mid-western parts of the United States. Following these policies, utility electrical lines were extended and ultimately connected to fossil fuel powered generating plants.

B. What Is Wind Power?

Wind power is a converted form of solar energy. When solar radiation reaches the Earth it heats different areas at uneven rates due to differing land surfaces and the day/night alternation. The atmosphere warms evenly and warm air rises causing a reduction in the atmospheric pressure at the Earth's surface and cooler air is drawn to fill in the low pressure area. This we call wind. Air has mass and when it is moving it contains kinetic energy which can be directly or indirectly converted into mechanical force or electricity. Using wind's mechanical force directly can power ships or grind grain while the same mechanical force can also turn wind generators and create electricity. The kinetic energy of the wind continues as long as the winds blow and this fact has lead some wind power advocates to announce that wind energy is both clean and inexhaustible.

C. How is Wind Power Electricity Produced?

The generation of electricity or the capture of motive energy requires a structure to convert the force in the wind into rotating motion. Most modern wind power devices employ turbines using the horizontal axis configuration that resembles the propeller of a boat or an airplane. Most wind turbines generally have the following components: a) a rotor or blades (usually three per tower) which convert the wind's energy into a rotating shaft energy, b) a nacelle or enclosure containing a drive train usually having a gearbox and a generator, c) a tower which supports the rotor and the drive train, and d) electronic equipment such as controls, ground support equipment and grid interconnection equipment.

The wind turbine towers are usually composed of tubular steel while the rotors or blades are made of fiberglass reinforced polyester or wood epoxy. For small farm or home applications, relatively small-sized wind turbines having a diameter of eight meters or less placed on towers of forty meters or less in height would be sufficient. There are a surprisingly large range of these small scale users of wind power.41 However, significantly larger machines are needed to generate

[41] There are small scale, individual or community, users of wind energy in both motive and electrical forms. With regard to electricity, distributed wind systems provide between 1 kW to 5 MW of electricity and are used by small industry, water districts, schools, rural homes, farms and other remote power users. A good example of a successful small wind power system can be found in Spirit Lake, Iowa, a small town with a population of 4,000. In 1993, the school district installed a 250-kW wind turbine near the local elementary school providing an average of 350,000 kWh of electricity per year. This amount of electricity was more than necessary for needs of the elementary school and the excess electricity was sold to the local utility system. These power sales netted the school $25,000 in its first five years of operation which were used to supplement the school's budget. The success of this initial project has led the school district to build a second turbine with a capacity of 750 kW solely for electricity sales. (For further information on this project, see http://www.greenpowergovs.org/wind/Spirit%20Lake%20case%20study.html.)

utility-quantity electricity that would be interconnected into the nation's electrical grid system. Currently, wind turbines for land-based wind farms42 come in various sizes, with rotor diameters ranging from about 50 meters to about 90 meters, and with towers of roughly the same size. A 90-meter machine with a 90-meter tower would have a total height from the tower base to the tip of the rotor of approximately 135 meters (442 feet). This is longer than football field by nearly 50%. Offshore turbine designs now under development would have even larger rotors under present designs some as large as 110 meters in diameter.

D. Where Can Wind Power Be Found in the United States?

There are many parts of the United States that hold the potential for providing wind generated electricity. It has been suggested by wind power advocates that the nation has only tapped a fraction of its wind power development potential. According to the Department of Energy, thirty-seven states have wind resources that would support utility-scale wind power projects.43 One estimate prepared by the Battelle Pacific Northwest Laboratory in 1991 suggested that wind power could supply 10.8 billion kWh annually or 20% of American electricity.44 The Department of Energy has studied the wind power potential and concluded that, in theory, the Midwest including the Great Plains has more than enough wind energy to fulfill the entire nation's electricity needs.45 However, the U.S. Government plans have established an optimistic, yet more modest, goal of 6% of the American electrical supply by 2020. The U. S. Department of Energy has estimated that good wind areas, which cover 6% of the U.S. land area, are widely distributed across the nation and have the potential to supply more than two and a half times the current electricity consumption of the United States.46

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[42] The most economical use of wind-generating electric turbines is in groups of large groups of large turbines, called "wind power plants" or "wind farms." Wind farms can range in size from a few megawatts to hundreds of megawatts in capacity. Currently, most utility sized turbines that are being manufactured range from 700 kW to 3 MW in rated capacity. Some wind farms combine 40 or more turbines to produce over 100 MW of electricity per year. Since the turbines are built in modular components off-site and assembled in large sections, a 50-MW wind farm can be completed in less than six months. Other time- from a year to three or more years is occasionally required for doing preparatory wind measurements and for obtaining the necessary construction approval.

[43] U.S. Government Accountability Office, Renewable Energy- Wind Power's Contribution to Electric Power Generation and Impact on Farms and Rural Communities at 17 (September, 2004)(GAO-04-756).

[44] Battelle Pacific Northwest Laboratory, An Assessment of the Availability of the Windy Land Area and Wind Energy Potential in the Contiguous United States. This estimate also concluded, factoring in environmental and land use exclusions for wind class 3 or higher areas that North Dakota, Texas, Kansas, South Dakota and Montana each held the potential of over 1000 billion kWh of electricity

[45] The U.S. General Accountability Office study, Renewable Energy- Wind Power's Contribution to Electric Power Generation and Impact on Farms and Rural Communities (GAO-04-756), made this statement and added that "just three wind-rich states– North Dakota, Texas, and Kansas– could accomplish this [production]." Id. at 17.

[46] See http://www1.eere.energy.gov/windandhydro/wind_potential.html. The land base of the continental United States has been classified into seven wind potential categories. Estimates of the wind resource are expressed in

With wind power, location really matters. Generating electricity from the wind depends on the wind's speed since large-scale, commercial wind farms require consistent, high velocity winds. The land area of the United States has been mapped and classified by the U.S. Department of Energy in terms its Wind Power Resource Potential in a U.S. Wind Atlas.47 Small wind systems, known as distributed wind systems, are more flexibly sited with the estimate that as much as 60% of America is suitable for small turbine use.48 Native American tribal land encompass 96 million acres much of which possessing excellent wind resources as do federally-owned lands under the control of the Bureau of Land Management (BLM). Other potential wind power regions exist in off-shore locations. Off-shore electrical potential between 5 and 50 nautical miles away from the coasts could provide 900 GW of wind energy. The higher construction costs have been offset by higher and more consistent wind speeds which can produce more electricity at a lower cost. However, only a small amount of this potential has been currently been tapped in the U.S. although there are at least 600 MW of new offshore wind projects, some extremely controversial, currently in the permitting process in the United States.

E. What Has Been the Rate of Growth of Installed Wind Power Generating Capacity?

Wind power is increasingly considered to be part of the mix of renewable energy sources. Significant growth in wind power generating electricity has occurred over the last 10 years

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wind power classes ranging from class 1 to class 7, with each class representing a range of mean wind power density or equivalent mean speed at specified heights above the ground. Areas designated class 4 or greater are suitable with advanced wind turbine technology under development today. Power class 3 areas may be suitable for future technology. Class 2 areas are marginal and class 1 areas are unsuitable for wind energy development. These areas have been carefully mapped in the Wind Energy Resource Atlas of the United States which summarized its findings as:

> Areas that are potentially suitable for wind energy applications (wind power class 3 and above) are dispersed throughout much of the United States. Major areas of the United States that have a potentially suitable wind energy resource include: much of the Great Plains from northwestern Texas and eastern New Mexico northward to Montana, North Dakota, and western Minnesota; the Atlantic coast from North Carolina to Maine; the Pacific coast from Point Conception, California to Washington; the Texas Gulf coast; the Great Lakes; portions of Alaska, Hawaii, Puerto Rico, the Virgin Islands, and the Pacific Islands; exposed ridge crests and mountain summits throughout the Appalachians and the western United States; and specific wind corridors throughout the mountainous western states.

[47]See U.S. Wind Atlas (found at http://www1.eere.energy.gov/windandhydro/wind_potential.html).

A new class of small wind turbines, dubbed micro turbines, has come into existence. These micro turbines are so small that they can be purchased for less than $1000 and carried in your hands.

The debut of micro wind turbines brings the technology within reach of many consumers. These inexpensive machines, when coupled with readily available photovoltaic solar panels, have revolutionized living in remote homes away from utility-supplied electricity. And the increasing popularity of micro wind turbines has opened up new applications previously once considered off-limits to wind energy, such as charging electric fences and powering remote telephone call boxes, which were once the sole domain of solar cells. Micro wind turbines have been around for decades for use on sailboats, but they have gained increasing prominence in the 1990s as their broader potential for off-the-grid applications on land has become more widely known. See generally, Paul Gipe, Wind Energy Basics- A Guide to Small and Micro Wind Systems (Chelsea Green Publishing Co., White River Junction, Vermont, 1999).

although growth had been slow at first. The first 1000 MW of wind power generating capacity was in place by 1985; however, it took until 1999 for the total capacity to reach 2000MW. After that, things sped up considerably with 5,000 MW in place by 2003 and 10,000 MW by the end of July, 2006.49 This acceleration in wind power investment has been spurred on by increasing fossil fuel prices and declining wind generation costs supplemented with crucial federal tax subsidies.50 The result has been an annual wind power growth rate over the last several years of about 30% with the result that the amount of installed capacity doubling in approximately 2.6 years.51 A predictable continuation of supportive governmental subsidy policy as well as research and development funding will be necessary if the federal goal of 100,000 MW of wind power by 2020 will be met.

It is also worth noting that large and small industrial firms as well as well-funded venture capital investors have been attracted to the prospects of wind generated electricity and now are actively involved in the promotion and expansion of the new industry.52 In 2005, $17 billion was invested in clean energy projects in the U.S. (about 25% in wind projects) and $49 billion was invested worldwide.53 This substantial flow of capital into the American wind power industry has

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[49]Put into a global perspective, in 2006 there were estimates of 63,000 MW of wind generated worldwide. The American component was 10,000 MW or approximately 16% of the world total. Wind power is now a global industry employing about 100,000 people in the design, manufacture, installation and operation of wind turbines. The top five countries using wind generated electricity are Germany, Spain, the United States, India and Denmark.

[50]The federal production tax credit or PTC of 1.9 cents per kWh was first adopted in 1992, extended in 1999 and 2004. It is currently set to expire once again on December 31, 2007. This inconsistent federal tax incentive policy has had dramatic adverse affects on wind power developments. The uncertainty about whether Congress will once again extend this tax subsidy increases project costs as orders are hurried to meet phase-out deadlines or as planning and construction ceases as the industry waits for congressional action. A proposal currently exists to further extend the PTC until December 31, 2010.

[51]From 2000 to 2005 it has been estimated that the wind power industry growth rate has averaged 29%. See Wind Energy Fast Facts at www.awea.org.

[52]The list of wind turbine manufacturers and investors in wind power projects continues to grow and to include a multi-national array of well funded companies including: 1) General Electric's GE Wind, the biggest American manufacturer of wind turbines with 2005 revenues of more than $2 billion, 2) Vestas, a Danish wind turbine manufacturer with 34% of the world wind turbine market, 3) Gamesa, a Spanish wind turbine manufacturer and a worldwide wind farm developer with 15% of the 2006 U.S. wind power market, 4) FPL Energy (Florida Power & Light affiliate), currently the largest owner of wind generating capacity in the U.S., 5) MidAmerica Energy, large developer of mid-western wind farms, 6) PPM Energy (U.S. subsidiary of Scottish Power), wind generator in 7 states with a goal of tripling its output by 2010, 7) J.P. Morgan, owner of 17 wind farms nationwide and financier of Noble Environmental Power LLC, a wind power developer in New York, Connecticut and Michigan, 8) Goldman Sachs, acquirer of Zilkha Renewable Energy in 2005 with a portfolio of approximately 4,000 MW of U.S. wind farms. See Kevin Kelleher, Wind Power Generating a Higher Profile, TheStreet.com, 7/5/06, URL- http://www.thestreet.com/markets/energy/10294781.html.

[53]Emily Thornton & Adam Aston, Business Week online, Special Report- Wall Street's New Love Affair- Why Some of the World's Smartest Investors Are Betting Billions on Clean Energy, August 14, 2006. Http://www.businessweek.com/print/magazine/content/06_33/b3997073.html In Texas alone,it has been estimated that about $2 billion was invested in windpower projects in 2006. Steve Quinn, Texas is Top Producer of Wind Energy, Associated Press posted July 25, 2006. See http://www.livescience.com/environment/ap_060725_wind_texas.html

undoubtedly been influenced by the rise in fossil fuel prices and the availability of various federal tax incentives. It also reflects a substantial commitment to a rapidly growing industry that has financial viability, at least with the current subsidy structure.

F. Where Is Wind Power Currently Being Used in the United States?

In the summer of 2006, two significant developments took place: 1) the total amount of installed utility scale wind power electricity exceeded 10,000 MW for the first time and 2) Texas surpasses California as the state having the greatest installed capacity in the United States. These two states lead the nation, by far, in terms of current wind generated electricity. In fact, the top ten states in terms of installed electrical capacity were Texas (2370), California (2324), Iowa (826), Oklahoma (475), New Mexico (407), Washington (390), Oregon (338), Colorado (291), Wyoming (288), and New York (281).54 The optimistic goal of the federal government's Wind Powering America initiative is to have at least 30 states with at least 100 MW of installed wind power capacity by 2010.55 In 2006, there were only 15 states that already meet that goal but an 7 additional states currently have between 29 and 75 MW of generating capacity and they could meet the goal in the next few years. While achieving the 10,000 MW milestone in 2006 represents a ten-fold growth in 20 years, it must be kept in mind that American wind power still accounts for less than 1% of existing, domestic electricity generation.56 This total may be small but it is still 24 billion kWh of electricity which is sufficient to power 2.5 million American homes. The proclaimed national goal of reaching the 6% level by 2020 will require substantial expansion of the large American wind farms that are being sited across the country and in offshore locations.

3. The Pros and Cons of Wind Power as an American Energy Choice.

A. What Are the Advantages or Benefits of Wind Power Electricity Generation?

Proponents of wind power technology emphasize a range of reasons to support the rapid expansion of wind generated electricity and motive power in the United States. These arguments will be set forth in order. First, wind power is a renewable and indigenous form of non-fossil fuel electrical generation. Once a wind turbine is installed there is no fuel cost for the generation of

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[54] www.eere.energy.gov/windandhydro/windpoweringamerica/wind_installed_capacity.asp.

[55] Wind Powering America (WPA) is a commitment of the United States Department of Energy to dramatically increase the use of wind energy in the United States. This initiative is intended to establish new sources of income for American farmers, Native Americans, and other rural landowners and meet the growing demand for clean sources of electricity. See http://www.eere.energy.gov/windandhydro/windpoweringamerica/wpa_about.asp.

[56] U.S. Department of Energy total electric power statistics reveal that in 2006, wind generated electricity represented .57% of American electricity. Wind did significantly increase its productivity over 2005 levels by more than 49%. The vast majority (91%) of wind generated electricity in America is provided by Independent Power Producers and not Electric Utilities. As a component of renewable electrical generation sources, in 2006 wind constituted about 20%; however, all renewable electricity was about 2.5% of total domestic electric generation. See Table ES1.B Total Electric Power Industry Summary Statistics, Year-to-Date 2006 and 2005 (found at http://www.eia.doe.gov/cneaf/electricity/epm/tablees1b.html).

power and as a result there is no fuel cost volatility. The wind follows predictable patterns yet its kinetic energy is available without cost to the turbine owner solely because of the siting location of the turbine. This is an inexhaustible supply without raw material or fuel costs thereby making the inflationary characteristics of coal, natural gas and oil irrelevant to the economic calculous of the project. As a result, the geopolitical complications of fossil fuels supplied from non-domestic sources cease to be a concern for the wind power electricity generator.

Second, wind power generation does not burn any fuel so that it does not result in the emission of any air pollutants. Conventional fossil fuel combustion results in sulfur dioxide, nitrogen oxides, carbon dioxide, mercury and other emissions and these substances are air pollutants of concern to public health and safety. Furthermore, the absence of carbon dioxide makes a contribution towards the reduction of global warming gases.

Third, wind power does not use any water as do conventional thermoelectric, fossil fuel plants. The thermoelectric fuel cycle and the nuclear fuel cycle both heat water in order to create steam needed to turn turbine blades for the generation of electricity. As a result, thermal electric power plants are the second largest user of freshwater in the United States after agricultural irrigation. To put water use in perspective, fossil fuel plants require 60 million gallons of water per year of which nearly 1 million gallons are lost to evaporation. This intensive water use is often the most serious limiting factor in the permitting of these plants. Wind power does not use water because it employs kinetic not thermal energy to spin the turbines in its generators.

Fourth, there is no solid or hazardous waste needing disposal as the aftermath of wind power electricity generation. Flue gas de-sulfurization in fossil fuel plants results in a large volume of sulfur laden solids that must be disposed of or recycled. Since there is nothing to extract from the non-existent wind power emissions, there is no solid waste disposal issue either. This is a significant environmental advantage of wind power since the left-over residue of coal combustion must often be disposed of in land fills.

Fifth, the development of wind farms usually occurs in rural communities experiencing depressed or subdued economic conditions. The construction of the wind turbines and towers employs construction workers at an estimated rate of 4.8 job years (direct and indirect employment) per 1 MW of wind power construction. Using this ratio, a 50 MW wind farm would produce 240 job years of employment for those workers who constructed the facility. After the construction phase of the wind farm project a smaller number of permanent jobs would be added to local economies having little job growth.

Sixth, wind farms use leased land or land upon which royalties must be paid to the landowner. In these rural areas, there are often few leasing alternatives and none that pay the high level of lease or royalty payments on $3,000 per turbine per year. In addition, local governments are benefitted by increasing their real estate tax bases due to the new wind farm land use. Finally, these economically-beneficial aspects of wind power projects can co-exist with pre-existing grazing and farming activities undertaken by the land owners.

B. What Are the Disadvantages or Harms Caused by Wind Power Generation?

While there are many advantages to electricity and motive power produced using the wind, disadvantages exist as well. Every energy producing technology contains pros and cons which must be evaluated both by government policymakers as well as private investors. With regard to wind energy, some of the associated adverse effects or disadvantages are inherent in the nature of wind power itself while others relate to the use of the technology in particular sites.

First, a major issue relates to the nature of the wind resource itself. The blowing of wind is intermittent and occurs according to atmospheric conditions not human energy needs. As a result, wind does not always blow when energy is required and, in general, it cannot be stored for use later. Wind speed and availability can vary from day to day and, as a result, the amount of electricity produced can vary. It has been feared that utilities relying on wind power will have to develop or purchase costly reserve capacity to fill in if wind power is not available when it is expected. This question of intermittent supply has been much debated and, as yet, has no definitive answer. The U.S. Department of Energy has reported that additional operating costs of integrating wind power into utility systems would be small. Further research will undoubtedly address this important question.57

Second, good wind sites having a high wind power classification are often located in remote places far from the high density metropolitan areas that have high energy demands. An examination of the U.S. Wind Atlas reveals that many of the highest potential Class 6 & 7 wind areas are located in the Upper Midwest which are hundreds of miles from the closest population source. These remote places are frequently not located close to high capacity utility transmission lines so that power connections must be built to link the wind electrical generators with the utility power grid. The high costs of building this necessary connective infrastructure can create serious obstacles for wind power projects. Even if they are able to connect, remotely located wind power sources may be charged high access fees to use the transmission lines. Furthermore, these lines may have limited transmission capacity which may have been allocated on a first-in-time principle having a discriminatory effect on new power generators like wind farms.58

[57] U.S. General Accountability Office, Renewable Energy- Wind Power's Contribution to Electric Power Generation and Impact on Farms and Rural Communities at 21-22 (September, 2004)(GAO-040756). See also Paul Gipe, Grid Integration of Wind Energy, April 20, 2006 found at http://www.wid-works.org/articles/GridIntegrationofWindEnergy.html.

[58]The National Energy Policy Act of 2005 provides incentives to encourage the construction of new and expanded power transmission lines. This should make transmission capacity to be more available to new market entrants like wind electricity plants. It also directs the Department of Energy to study the problem of transmission congestion and designate "national interest electric transmission corridors." The Act also requires that new utility system rules be "non-discriminatory" and provide for fair access to new electrical technologies such as wind.

Third, the cost of producing wind power must be taken into account in the development of the energy technology. The economics of wind generated electricity have changed enormously over the last quarter century with costs being drastically reduced. Improvements in turbine design and electronic controls have led to significant reductions in costs. For instance, the taller the tower and the larger the area swept by the rotor's blades, the more energy that can be produced by the wind turbine. Over the last two decades design improvements have significantly expanded the size of the rotors and their aerodynamic features leading to huge increases in electricity generated and greatly lowered kWh costs.

However, even with these improvements the cost of wind energy varies greatly depending upon the wind speed at the site.59 Most of the existing wind projects have attempted to harness the winds at the best sites (Class 6 & 7) with the lowest generation costs. The Department of Energy has estimated that wind power electricity costs between 3 and 6 cents per kWh making wind power cost competitive to fossil fuel plants. This would be especially true if fuel costs continue to rise. However, sites with lower wind speeds have higher generating costs making them less economically competitive. It is believed that subsidies are needed to make the Class 4 & 5 site electricity competitive. Federal research is being funded to advance technological improvements in order to bring down the costs at these more common sites with lower wind speeds.60 Also, larger wind farms can produce electricity more economically than smaller facilities due to economies of scale with operation and maintenance costs. Financing costs also play a role in making wind power more expensive per kWh. All of these factors makes it necessary, at present, for wind projects to receive federal tax credits to make their costs competitive with conventional utility generated electricity.

Fourth, wind power development must compete with other land use activities for particular locations and those alternative uses might be more highly prized or valued than electrical generation. This kind of competition is not unusual but it pits wind power energy goals against conservation or preservation objectives of states and local communities. Land use considerations are often the heart of objections to large wind power projects and require that project siting be undertaken with multiple considerations in mind.61

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[59]Energy that can be taken from the wind follows a common formula: wind energy is proportional to the cube of the wind speed at the site. As a result, small variations in wind speed translate into significant differences in electricity generation. For example, the difference between the power produced at a site with an average wind speed of 16 miles per hour and one with 14 miles per hour in nearly 50%. See American Wind Energy Association, The Economics of Wind Energy.

[60]For instance, America's prime wind sites (Class 6) are those with wind speeds of 6.7 meters per second at a 10 meter height that are located near utility transmission lines. Sites with lower wind speeds of only 5.8 meters per second (Class 4) can only operate economically with the assistance of the 1.9 cent per kWh federal Production Tax Credit. See Wind Power Today, U.S. Department of Energy, May, 2006 page 3.

[61]However, local communities do not always object to wind energy projects. If properly present, community support can be found. For example, a 40,000 acre 200 to 300 MW windfarm has been proposed by Iowa Winds LLC

Fifth, although wind power plants have a relatively small environmental "footprint" in comparison with conventional fossil fuel generating facilities, there some negative effects that impact the environment. Some questions have arisen about the noise produced by rotating blades,62 the aesthetic or visual impact of a large number of wind turbines,63 the effect on resident or migrating bird and bat populations,64 interference with communications and aircraft navigation,65 ice throws from the blades of turbines.66 In addition, some have criticized wind

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for an area in Franklin County, Iowa which, if constructed, would be the largest wind farm in the United States. The Iowa Winds project involves 193 landowners and has community support. 40,000 Acre Wind Farm Proposed for Iowa, Associated Press posted: August 31, 2006. In addition, Community Energy, Inc. built and now operates five 380 foot tall wind turbines on municipal land in the midst of Atlantic City, New Jersey- a site not to be missed by the city's 35 million annual visitors. Heather Green & Mark Scott, Wind Power's Gusty Forecast, BusinessWeek online, August 21, 2006. Http://www.businessweek.com/print/technology/content/aug2006/tc20060818_160729.html

[62]Susan Squires, Worries in the Wind for Calumet, The Post-Crescent (Appleton, Wis.), Aug. 4, 2006 at 1A; Editorial, Fear of the Unknown Greatest Obstacle for Wind Turbines, The Sheboygan (Wis.), Aug. 16, 2006 at B1; Richard S. Porter, Reasons to Reject Ogle Proposal, Rockford Register Star (Rockford, Illinois), Nov. 27, 2005 at 3; Neil Rhines, Debate Rages Over Wind Energy Farms, Issue Divides Community, Herald Times Reporter (Manitowoc, Wis.), Mar. 6, 2005 at 1A; and Lee Bergquist, Fanning Neighbors' Ire, Some Think the Wind Farms Across Wisconsin Blow an Ill Wind of Noise, Milwaukee Journal Sentinel (Wis.), Sept. 26, 1999 at Business page 1.

[63]A Mighty Wind, N.Y. Times, July 16, 2005 at 14LI; Leigh Hornbeck, Gore Wind Farm Plan Advances, The Times Union (Albany, N.Y.), May 12, 2006 at B9;Wind Towers Would Mar "Million Dollar" View, The Pantagraph (Bloomington, Ill.), June 2, 2005 at A8; Neil Rhines, Debate Rages Over Wind Energy Farms, Issue Divides Community, Herald Times Reporter (Manitowoc, Wis.), Mar. 6, 2005 at 1A; Katharine Q. Seelye, Windmills Sow Dissent for Environmentalists, N.Y. Times, June 5, 2003 at A1; Meredith Goad, Debate Over Wind Turbines Heats Up; Two Proposed Maine Wind Farms are Hailed as Clean Energy Sources- and Criticized as Potential Environmental Eyesores, Portland Press Herald (Me.), Sept. 28, 2003 at 1A; and Lisa Stiffler, Farms Produce Power from Thin Air: Keeping an Eye on the Windmill in the Sky Proponents See Clean Energy; Foes See Marred Hills, High Utility Rates, The Seattle Post-Intelligencer, Sept. 19, 2003 at B1.

[64]Peter Marren, Is this the Price of Clean Fuel?, The Independent (London), Aug. 10, 2006; Wind Farm Cuts Eagle Population, PhysOrg.com, Aug. 21, 2006, http://www.physorg.com/printnews.php?newsid=68373280;A Mighty Wind, N.Y. Times, July 16, 2005 at 14LI, Despite Objections, Turbines are the Winds of Change, Austin American-Statesman (Tex.), May 10, 2006 at A10; Patty Brandl, Both Sides of Wind Farm Debate Agree: No Federal Government Assistance, The Reporter (Fond du Lac, Wis.), Sept. 22, 2005 at 1A; Calvin R. Trice, Turbines Would Set Off Lawsuit: Highland Landowners File an Intent to Sue if Wind Farms are Approved, Richmond Times Dispatch (Richmond, Va.), July 7, 2005 at B-1; and Wind Farm: It Seems Ironic that Environmentalists Object, Milwaukee Journal Sentinel (Milwaukee, Wis.), July 1, 2004 at 16A.

[65]Susan Squires, Worries in the Wind for Calumet, The Post-Crescent (Appleton, Wis.), Aug. 4, 2006 at 1A; Editorial, Fear of the Unknown Greatest Obstacle for Wind Turbines, The Sheboygan (Wis.), Aug. 16, 2006 at 5A; Wind Power: Air Force Joins Enviros in Opposition to Proposed Wis. Wind Farm, Environment and Energy Publishing, LLC, Greenwire, March 23, 2006- Vol. 10 No.9; Keith Rogers, Project Cancellation Draws Speculation, Las Vegas Review (Nev.), July 17, 2002 at 1B and M.K. Guetersloh, Residents: Wind Farm to Cast Shadow: Zoning Board Hears Testimony on Project Plans, The Pantagraph (Bloomington, Ill.), July 6, 2005 at A1.

[66]Susan Squires, Worries in the Wind for Calumet, The Post-Crescent (Appleton, Wis.), Aug. 4, 2006 at 1A; Neil Rhines, Debate Rages Over Wind Energy Farms, Issue Divides Community, Herald Times Reporter (Manitowoc, Wis.), Mar. 6, 2005 at 1A;

power for its economic adverse effect on adjacent property values.67 These concerns reflect the fact that energy development projects having environmentally "green" characteristics can also adversely affect other environmental and health and safety values. This should be no surprise since all new technologies impose costs and benefits upon the society adopting it. It is up to the societal decision makers to determine whether or not to pursue the policy in light of its likely consequences.

4. Government Policy Towards Wind Power.

A. Federal Policy on Wind Power.

Since electricity production is largely a privately-financed and operated activity, there is no national control over investments in this industry. Private, market decisions are influenced by governmental policies that make investing in a particular energy production technology operationally and financially sound. At the national level, there have been a number of executive pronouncements encouraging renewable wind energy supply68 but there has been no comprehensive, high priority strategy set forth. Federal policy on wind power can be pieced together from a series of separate federal initiatives.

i. Financial or Economic Subsidy.

Congress has enacted laws creating direct forms of federal financial support affecting the financial bottom line of wind power production. Federal subsidies to the energy industry have been longstanding and have overwhelmingly favored the conventional energy sources.69 Most notably,

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[67] In 2003, the Renewable Energy Policy Project, a federally-supported, non-profit organization, undertook an economic analysis of the impact of wind power development from 1998-2002 on surrounding property values in the "viewshed" of the wind projects. The study considered ten sites in 7 states where property sales data was available and statistically significant. It focused on the impact of wind power projects 10 MW or larger on property sales within a 5 mile radius and it compared the sales data with information from sales occurring in comparable communities during the same time. After performing a standard regression analysis of over 24,000 sales the study concluded:

> the statistical evidence does not support a contention that property values within the view shed of wind developments suffer or perform poorer than in a comparable region. For the great majority of projects in the three Cases studied, the property values in the view shed actually go up faster than the values in the comparable region.

George Sterzinger, Fredric Beck & Damian Kostiuk, The Effect of Wind Development on Local Property Values at 4 (Renewable Energy Policy Project, 2003). Notwithstanding these results , the reports in the popular media have raised the property value impact issue. See Susan Squires, Worries in the Wind for Calumet, The Post-Crescent (Appleton, Wis.), Aug. 4. 2006 at 1A and Neil Rhines, Debate Rages Over Wind Energy Farms, Issue Divides Community, Herald Times Reporter (Manitowoc, Wis.), Mar. 6, 2005 at 1A.

[68] Most prominent is the U.S. Department of Energy's "Wind Powering America" (WPA) program that has set the 6% of American electricity by 2020 goal. See L.T. Flowers & P.J. Dougherty, Wind Powering America: Goals, Approach, Perspectives and Prospects, March, 2002 (NREL/CP-500-32097). WPA's stated goals were set out to increase rural economic development , protect the environment, and increase energy security.

[69] According to a study of the National Commission on Energy Policy, in 2003 federal subsidies ranged from $37 to $64 billion to various energy sources with wind receiving less than 1% of the total. National Commission on Energy Policy, Ending the Energy Stalemate, Technical Appendix, Chapter 6.

the federal production tax credit (PTC), established by the Energy Policy Act of 1992, as amended, currently provides a 1.9 cent per kWh tax credit for electricity from wind plants for 10 years from initial plant operation.70 It has been estimated that this incentive could provide a moderate sized 30 MW wind farm with up to $1.6 million in annual federal subsidy.71 This tax credit has expired three times since its initial enactment and has been extended each time after a period of uncertainty.72 In addition, the PTC may be combined with a five-year accelerated depreciation schedule allowed for renewable energy system investments further offsetting the high initial capital costs.73 This financial subsidy has allowed for marginal wind farm projects to become viable in economic terms.

ii. Research and Development Funding.

The federal government has also supported wind power development through the Department of Energy's funding of research activities into technological improvements. This financial support is part of the President's State of the Union announced Advanced Energy Initiative74 and which would supply $44 million during the 2007 fiscal year. This funding apparently will be targeted to small wind applications and improvements in the efficiency of wind turbines in low speed wind environments. Other federal funds have been made available through sources such as the 2002 Farm Bill or the Farm Security and Rural Investment Act of 2002. Under Title IX, this program provides grants and loan guarantees to farmers and rural business owners for assistance for purchasing renewable energy systems including wind power.75

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http://www.energycommission.org/site/page.php?node=48
This large tax and direct subsidy has attracted the ire of several taxpayer rights groups including Taxpayers for Common Sense. See http://www.taxpayer.net/energy/index.htm

[70]Pub. L. No. 102-486, 106 Stat. 2776, 3020 (1992), codified at 26 U.S.C. section 45.

[71]U.S. Government Accountability Office, Report to the Ranking Democratic Member, Committee on Agriculture, Nutrition, and Forestry, U.S. Senate, Renewable Energy, Wind Power's Contribution to Electric Power Generation and Impact on Farms and Rural Communities, at 23 (September, 2004)(GAO-04-756)(hereinafter GAO 2004 Farm Impact Study).

[72]New wind power installations appear to be directly correlated to the availability of the production tax credit. See GAO 2004 Farm Impact Study, Figure 8 at 32.

[73]Economic Recovery Tax Act of 1981, as amended, Pub. L. No. 97034, 95 Stat. 230 (1981), codified at 26 U.S.C. section 168(e)(3)(B)(vi).

[74]This initiative announced by President Bush in February, 2006 called for a 22% increase in Department of Energy funding clean energy technology research in the fiscal 2007 budget. Funding for wind energy increases over FY2006 levels to $44 million with the addition of $5 million. This increase pales by comparison to the Solar America Initiative that increases federal solar research funding by $65 million to a total of $148 million in FY07. See http://www.whitehouse.gov/stateoftheunion/2006/ energy/index.html.

[75]Section 906 of the 2002 Farm Bill established the Renewal Energy and Energy Efficiency loan and grant program. The Renewable Energy and Energy Efficiency loan and grant program was established under Section 9006 of the 2002 Farm Bill to encourage agricultural producers and small rural businesses to create renewable and energy

iii. Wind Power on Federal Lands.

Third, the federal government is working to make high wind quality federal lands available for the development of wind energy projects under "right-of-way authorizations." Up to now, the Department of the Interior's Bureau of Land Management (BLM) has been the only federal agency granting permission for these kinds of private activities and it has permitted approximately 500 MW of installed capacity or 5% of the national total.76 Due to their prime locations, BLM lands will continue to be the focus of wind energy development.77 The agency has recently established comprehensive policies and best management practices (BMPs) for analyzing wind energy developments through a Programmatic Environmental Impact Statement (PEIS). This proposed Wind Energy Development Program would affect all BLM-administered lands in 11 western states and would set general mitigation standards.78 The comprehensive approach taken in the BLM policy suggests that federal lands will increasingly be available to private firms wishing to develop wind energy resources. The U.S. Forest Service has recently begun to develop national guidance to evaluate wind energy proposals on national forest system lands.

iv. Federal Environmental and Other Regulation.

Fourth, the federal government's role in regulating wind power projects is limited. Generally, federal project control is restricted to79 those projects taking place on federal lands or

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efficient systems. A total of 435 grants totaling $66.7 million have been awarded in 36 states since the program began and in 2005, for the first time, renewable energy loan guarantees were made under the program. Grants have been awarded to fund a wide range of wind, solar, biomass, geothermal and conservation technologies. For the 2003-2005 fiscal years, the Farm Bill has made wind awards totaling $25.1 million. Another section of the Farm Bill- section 6401- designates wind power as a "value added agricultural product" and makes grants available for rural projects. See http://www.eere.energy.gov/windandhydro/windpoweringamerica/ag_farm_bill.asp

[76]This wind energy capacity is located in the San Gorgonio Pass and the Tehachapi Pass areas of Southern California and in the Foote Creek Rim and Simpson Ridge areas of Wyoming. GAO Report to Congressional Requesters, Wind Power- Impacts on Wildlife and Government Responsibilities for Regulating Development and Protecting Wildlife at 32.(September, 2005)(GAO-05-906).

[77]As of September, 2005 the BLM had approved 88 applications for new projects and had 68 pending applications to review. Id.

[78]Programmatic Environmental Impact Statement, Department of the Interior, Bureau of Land Management, June, 2005. The PEIS included an assessment of the environmental, social and economic impacts; discussion of the relevant mitigation measures to address these impacts and an identification of appropriate program policies and BMPs to be included in the BLM's Wind Energy Development Program. The geographic scope of the Program includes BLM lands in Arizona, California, Colorado, Idaho, Montana, Nevada, New Mexico, Oregon, Utah, Washington and Wyoming. *Id.* at 1-3. The PEIS simultaneously proposed amendments to the BLM's specific land use plans for 52 areas under its administration. *Id.* at ES-3.

[79]The Federal Aviation Administration (FAA) has the authority to issue "notices of presumed hazard" to the developers of structures that might present risks to civilian aircraft operations in the United States. This evaluation of obstructions to aircraft operations or navigation is conducted pursuant to FAA regulations found in U.S. Code Title 14, Part 77. Recently, the FAA's reviews of wind power projects has been a controversial issue but one which has been handled by the FAA on a case-by-case basis. According to press release in June, 2006 from U.S. Senator Byron

having some other form of federal involvement. While the Federal Energy Regulatory Commission or FERC regulates the interstate energy transmission, it has no authority to regulate the actual construction of electric generation and transmission facilities which is reserved for state and local governments. There are other general federal regulations that could affect wind power developments including environmental rules,80 aircraft obstruction regulations, civilian and military radar interference controls.81 Some of these restrictions have slowed wind power developments in some areas of the nation but in general, the federal government has established a case-by-case approach to the evaluation of each project.

B. State Policies on Wind Power.

The state and local governments have enacted a broad array of policies and programs which encourage renewable energy and wind power within their jurisdictions. These policies fall into two general categories of 1) regulatory techniques and 2) economic subsidy devices. The initiative taken in some states reflects a deep belief in the potential for renewable power as important, non-polluting contributor to the electrical supply and as a force for local economic development.

1. Regulatory Techniques. States have taken the lead with wind power development by providing for the legal regulatory mechanisms facilitating wind power facility siting and for

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Dorgan, the Department of Defense and Federal Aviation Administration withdrew their objections to a North Dakota wind generation project. See http://www.zmetro.com/community/us/wi/madison/renew/archives/2006/06/defense_dept_re.html.

[80]A general environmental statute such as the National Environmental Policy Act or NEPA would apply to any wind power development if it constituted "a major federal action significantly affecting the quality of the human environment." Section 102(2) (C). Other federal environmental wildlife laws such as the Migratory Bird Treaty Act, the Bald and Golden Eagle Protection Act and the Endangered Species Act generally forbid harm to various species of wildlife. Apparently, there have been no recorded incidents of federal or state wildlife enforcement actions being taken against wind power companies. *Id.* at 33.

[81]In January, 2006, The National Defense Authorization Act for Fiscal Year 2006 was signed into law. This statute-- P.L. 109-163-- contain a provision requiring the Department of Defense to study and to report to Congress on the effects of wind projects on military readiness, specifically investigating whether windmill facilities interfere with military radar. While the report is being completed, the Federal Aviation Administration has issued "Notice of Presumed Hazard" letters to more than a dozen wind farms and facilities in Illinois, Wisconsin, North Dakota and South Dakota, thereby preventing these projects from moving forward. This issue has caused major concern in the wind power industry that projects near completion will not be allowed to operate.

In September, 2006, the DOD issued its report to Congress. See Department of Defense, Office of the Director of Defense Research and Engineering, Report to the Congressional Defense Committees, The Effect of Windmill Farms on Military Readiness (2006). It concluded that air defense radars could be adversely affected by wind power projects but that mitigation practices did exist to completely preclude these effects. It left to the FAA and to the National Weather Service the primary responsibility for determining effects on Air Traffic Control radar and weather forecasting radars. Id. at 4.

electrical utility policies supporting the growth of renewable energy projects. State policy in these areas possesses similarities but there is no template that all states follow.

A. Wind Power Siting Procedures. Since most wind power development takes place on non-federal land, the states and local governments largely have the responsibility for siting regulation. This permitting or approval control is undertaken in a variety of ways including procedures directed by the local government, the state government or a hybrid of state and local government. The states have not settled on one dominant method of dealing with the wind power siting issues.

A number of approaches have been adopted. Some states maintain the exclusive control over energy facility siting at the state level of government with a state board having responsibility over these plants, including wind facilities. In Connecticut, Massachusetts and Oregon, state statutes grant approval authority to specialized siting boards.82 Other states such as Minnesota and Vermont allot permitting authority to general utility commissions rather than siting panels.83State agencies in Kansas, Montana and Wisconsin have developed voluntary guidelines or model local government ordinances to deal with wind power siting regulation.84 In these states, state guidance is intended to provide local governments with a frame of reference that will enable them to carefully evaluate wind proposals in terms of their likely land use impacts. Finally, in the last group of jurisdictions, the primary permitting authority is the local planning commission, zoning board or panel of elected officials who possess the general power under state law of implementing zoning and building regulation.85 Although general zoning control might be adequate to deal with a few small turbines, it would seem to be overmatched by the complexity of the large wind farm proposal. The regulatory regimes adopted by states have varying levels of sophistication and have

[82]The Connecticut Siting Council regulates the siting of renewable energy projects of more than 1 MW. See Connecticut General Statutes § 16-50g through 16-50aa and Sections 16-50j-1 through 16-50z-4 of the Regulations of Connecticut State Agencies. In Massachusetts, the Massachusetts Energy Facilities Siting Board considers applications for generating facilities of 100 MW or greater.
See http://www.mass.gov/dte/siting/shandbook.pdf . Oregon law requires that energy facilities with generating capacities of 105 MW or more must be approved by the Oregon Energy Facility Siting Council. See Or. Rev. Stat. Sections 469.300-469.560 and Or. Admin. Rules Chapter 345.

[83]See Minn. Stat. Sections 116C.691-116.C.697 (Minnesota Public Utilities Commission); Vt. Stat. Ann. tit. 30, section 248 (Vermont Public Service Board).

[84]The Kansas Energy Council has issued a Wind Energy Siting Handbook in 2005 that provide cities and counties non-binding advice based on the experience of four Kansas counties. See http://kec.kansas.gov/reports/wind_siting_handbook.pdf. In Wisconsin, the Public Service Commission and the Department of Administration have developed a model wind ordinance to guide towns and counties. See http://www.doa.state.wi.us/docs_view2.asp?docid=2869

[85]California, New York and West Virginia are in this category although in California and New York approvals are subject to the state's environmental quality act which requires assessment of environmental impacts of proposed actions.

been described as "evolving" in one federal study.86 Some state and local regulators have little experience in assessing and mitigating the environmental and other impacts of wind power development. These jurisdictions should draw on th experience and regulations developed by those states having substantial experience with siting issues. Perhaps with time, wind power projects will be assessed in a fashion that carefully considers specific site characteristics so as to minimize adverse impacts.87

B. Renewable Energy Portfolio Standards (RPS).

Nearly half of the states have imposed electricity supply requirements upon utility companies in the form of renewable portfolio standards. A renewable portfolio standard or RPS is state utility regulation requiring these firms to supply a minimum percentage of their electrical load with eligible sources of renewable energy. The policy premise behind the RPS technique is to use a state-mandated supply mechanism to provide a predictable and competitive demand for renewable energy, ensuring these renewable producers of a steady market for their power. As of 2005, twenty-one states and the District of Columbia have adopted RPS requirements in some form.88 Some states require achievement of target percentages in the near term (by 2006 in New Mexico) while others set their standards farther out (2025 in Arizona). Not surprisingly, the more distant attainment dates have the highest required percentages of renewable energy.89 California, Colorado, Illinois, Massachusetts, Montana, New Mexico, Nevada have all adopted RPS targets from 10% to 20% to be achieved by 2017.90 While the elements of a particular RPS system may differ, wind energy is always included within the definition of renewable energy.

C. State Utility Regulatory Policies. A range of regulatory policies have been adopted across the nation to provide information for energy consumers and to encourage renewable power.

i. Generation Disclosure Rules. Twenty-four states and the District of Columbia require that electrical utilities disclose to their customers information about the electrical energy they purchase. In particular, utilities must provide consumers with their fuel mix data plus emissions

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[86]GAO Report to Congressional Requesters, Wind Power- Impacts on Wildlife and Government Responsibilities for Regulating Development and Protecting Wildlife at 22, September, 2005 (GAO-05-906).

[87]The Sierra Club has issued a Wind Siting Advisory Document in 2002 that identifies the relevant issues to consider in a wind power siting application. In addition, it creates a useful 4-level hierarchy of development preferences for particular lands ranking them most appropriate, more appropriate, less appropriate and not appropriate. See http://wind-works.org/articles/scsitingadvisory.html

[88]These policies often contain features establishing renewable energy targets, eligible renewable energy sources, treatment of existing plants, application requirements, enforcement mechanisms, flexibility devices and even tradable permits.

[89]See State-Level Renewable Energy Portfolio Standards (RPS), American Wind Energy Association (2005).

[90]Id.

information in order to educate them about the source of their electricity. Some states go one step farther by requiring that the electrical utilities certify the actual sources of their power and assure their customers that the firm actually uses them.

ii. Green Power Purchasing and Aggregation Policies. Ten states and twenty localities allow individuals and government units to purchase “green power” generated by renewable sources. Municipalities, state governments, businesses, and other non-residential customers like universities can play a critical role in supporting renewable energy technologies by purchasing electricity from renewable sources. At the local level, green power purchasing can buying this kind of electrical power for municipal facilities, streetlights, water pumping stations among other uses. Several states require that a certain percentage of green power be purchased for use in state government buildings. A few states allow local governments to aggregate the electricity loads of the entire community to purchase green power while others allow localities to join with other communities to form a large purchasing block often called "Community Choice."

iii. Interconnection. Thirty-four states and the District of Columbia have developed or are developing interconnection rules that establish technical standards for independent electrical generation sources to use when they wish to sell their power to the utility grid. These sources, known as distributed power sources, must meet engineering standards so that their power can safely and efficiently flow into the utilities lines.

2. Economic Subsidies and other Incentives.91

[91] The Database State Incentives for Renewable Energy or DSIRE provides the most up-to-date, state-by-state listing of policies and practices adopted in the United States for the support and encouragement of renewable energy production. See http://www.dsireusa.org/. The database has provided the information in this section of the paper and is accurate as of October 7, 2006.

A significant number of states have adopted a wide range of state policies with the overall intention of encouraging both the development of renewable energy supply and the consumption of renewable power within the state. The states have been remarkably creative in fashioning a broad scope of approaches encompassing techniques including tax rules, financial support, and regulatory policies.

A. Net Metering Laws. Thirty-five states and the District of Columbia have adopted net metering laws. For those consumers who have their own electricity generating units, net metering allows for the flow of electricity both to and from the customer through a single, bi-directional meter. With net metering, during times when the customer's generation exceeds use, electricity from the customer moves to the utility and is credited to the customer’s account. At least, the consumer offsets costs of utility supplied electricity with the possibility of having the utility pay the small generator. Net metering laws is often beneficial for small wind turbine owners such as farmers, ranchers and community facilities.

B. State Tax Incentives. States offer at least four kinds of tax incentives to assist and attract renewable energy production.

i. Property Taxes. Twenty-seven states offer property tax exemptions, exclusions and credits for renewable power including wind energy. These policies take many forms but the net result is to reduce state or local government property taxes on renewable energy equipment.

ii. Personal and Corporate Income Taxes. Seventeen states make personal income tax incentives available and twenty allow corporate income tax payers benefits for the expense of purchasing and installing renewable energy equipment. In some instances, tax credits are provided for between 10%-35% of the costs.

iii. Sales Taxes. Eighteen states permit sales tax exemptions on the purchase of renewable energy equipment including wind turbines.

C. State Financial Support. A relatively large number of states provide grants (20 states), loans (22 states), rebates (19 states), bonds (3 states), and production incentives (6 states) which seek to promote renewable energy production. In addition to state and local government support, utilities and non-profit organizations may also offer these kinds of financial incentives as well. Eighteen states and the District of Columbia have public benefit funds that charge customers utility bills to create a fund to be used for renewable energy research, development and education.

D. State Regulatory Policies. A range of regulatory policies have been adopted across the nation to provide information for energy consumers and to encourage renewable power.

i. Generation Disclosure Rules. Twenty-four states and the District of Columbia require that electrical utilities disclose to their customers their fuel mix data plus emissions information to educate the consumers within their jurisdictions.

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5. Conclusions.

America is a nation that runs on electricity. It is currently the world’s largest consumer of electric power and it is projected to maintain that position for at least the next two decades. For the reasons discussed in this article, the United States should continue to diversify its energy supply for economic and environmental reasons. Encouraging the development of an increasing-larger wind power industry can make an important contribution to American energy supply in a sustainable and environmentally responsible manner. This is not to say that the expansion of wind-generated electricity is free of costs. No energy source is costless. It does mean that wind power has clear benefits that deserve serious consideration as the nation moves to choose its energy future.

The transformation of American energy policy towards a greater reliance upon wind power will be achieved, if at all, by private market investment in the technology. The role of public policy should be the establishment of a mix of incentives and supportive policies that reinforce market decisions. Energy policy should seek to reinforce the technologies and practices that advance our larger societal goals. If wind power is to become an important contributor to American energy supply in the future, at least six steps must be taken.

First, favorable local, state and federal governmental policy must be established to provide the wind power industry with a stable and predictable regulatory environment. Policy predictability is necessary to assure those taking capital and other risks of a consistent policy landscape upon which to base their decisions.

Second, some form of financial incentive should be utilized that will subsidize this form of renewable energy through higher payments or through favorable tax policy. Such payments could combined with a tax on fossil fuels (often known as a carbon tax) to remove their hidden subsidy.

This program of financial assistance must remain stable for at least ten years so that developers, investors and consumers have a predictable stream of costs and benefits. Over time as wind technology becomes more cost effective, financial policies can be scaled back or dropped altogether.

Third, it should also include comprehensive, non-financial government assistance to the emerging industry. This form of assistance could be a mixture of federal and state policy. This policy could include greater support for research and development of generating technology, product testing and certification, wind resource mapping, site leasing, and encouraging small community ownership and operation. Some states have already developed an array of supportive and effective policy instruments which should be generally promoted.

Fourth, the "problems" associated with wind power should be identified and seriously analyzed so that the negative aspects of the energy technology can be accurately understood and minimized. All generating technologies have impacts on the surrounding environment. Through analysis and proper design, many of these questions can be addressed. As for wind power, certain technical questions such as wildlife and, lighting and radar effects, transmission connectivity, and turbine safety must be studied and resolved with optimal solutions for the industry and surrounding communities.

Fifth, wind generation of electricity is the use of land. All energy generation technologies affect the land base comprising their facilities as well as surrounding property. By comparison, consider the land use impacts of a conventional coal-fire electrical generating plant. Wind power also raises siting and operational considerations. This might call for the involvement of state-level agencies in the assessment and permitting of large wind farm projects while smaller undertakings could be effectively handled by local governments following state developed guidance. Important land use policies and procedures must be developed to insure that wind power projects are sited in ways to maximize energy yields while minimizing negative side-effects.

Sixth and finally, the public must be informed about the costs and benefits of wind power so that they will better understand the implications of embracing the new technology. There are undoubtedly objective aspects to the promotion of wind generated electricity. However, subjective factors also have an effect in public perceptions about the desirability of wind generation. Perhaps public attitudes will increasingly view wind turbines as benign, non-polluting generators of electrical power generally benefitting American society. This positive view and increased public acceptance would greatly assist the shift towards wind power as an important future source of American electricity.