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The Iowa Policy Project Policy Report

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Wind Power and the Iowa Economy

By David Osterberg and Elaine Ditsler

Introduction

Wind blowing across the Midwest has enormous potential for producing electricity and a "new economy." Iowa is the 10th windiest state in the nation and the third largest producer of wind power in the United States.[1,2] According to the Iowa Department of Natural Resources, Iowa wind has the potential to produce more than 4.8 times the state's own energy consumption annually, and about 5.2 percent of total U.S. energy consumption.[3]

There are over 400 wind turbines in Iowa with a total capacity of 425 megawatts (MW), and an additional 43 MW being installed this year.[4] These wind turbines provide enough power to generate electricity for 130,000 homes per year and reduce carbon dioxide emissions by more than 1.3 million tons of annually. Eight school districts in Iowa have saved thousands of dollars by constructing wind turbines to provide electricity to their school buildings.

Iowa has four large wind farms, the most recent of which was constructed in 2003 in Hancock County by FPL Energy. Construction of the 148 turbines, each about 213 feet tall, was completed in only 85 days and will provide renewable power to Alliant Energy. MidAmerican Energy, Iowa's largest electric utility, has pledged to build a $325 million, 310-MW wind farm with 200 turbines in northern Iowa.[5]

The Iowa Policy Project's Interest in Wind Power

The Iowa Policy Project (IPP) has reported on the potential for renewable energy to replace polluting coal, nuclear and natural gas plants and to provide a new source of jobs and income for Iowans. In 2002 and 2003, IPP published studies on energy efficiency and renewable energy in Iowa.[6] In the present report, we give special attention to the world's

[1] Iowa Department of Natural Resources. 2002.
[2] D.L. Elliott and M.N.Schwartz, *Wind-energy Potential in the United States*. Richland, WA: Pacific Northwest Laboratory; September 1993.
[3] Iowa Department of Natural Resources calculation from *Wind-energy Potential in the United States* (see previous footnote)
[4] Since wind blows variably and at different speeds in different areas, wind capacity is defined two ways: "nameplate capacity" and "effective capacity." Nameplate capacity is the energy that would be produced annually if the wind was always blowing at 28 mph. Effective capacity is the actual energy generated annually. Depending on the location of the turbine, effective capacity is usually about 30 percent of nameplate capacity.
[5] www.midamericanenergy.com/newsroom/asp/newsdetails.asp?id=196&nav=1.
[6] Mark Edelman, et al, *Renewable Power and Energy Efficiency: Policies in Iowa and other States,* Iowa Policy Project, April 2003 and David Swenson & Liesl Eathington, *Statewide Economic Values of Alternative Energy Sources and Energy Conservation*, Iowa Policy Project, March 2002.

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This study was conducted by The Iowa Policy Project and is not a University of Iowa study.

fastest growing energy industry, wind power. More specifically, we assess whether the real and potential economic impacts of the wind-power industry merit public policy changes. Should Iowa, as a matter of public policy, demand and/or support more investment in wind power? And if so, which types of policies are appropriate?

Two recent events provided the motivation for this report on wind energy in Iowa. One event was publication of the Iowa Policy Project's biennial report *The State of Working Iowa 2003,* which identified structural inadequacies in the Iowa economy as well as troubling economic indicators in Iowa's rural counties, including population loss and a decline in employment growth. The other event was the establishment of the Grow Iowa Values Fund, an economic development fund designed to stimulate Iowa's economy. In order to overcome the drag on growth resulting from the concentration of workers in slow-growth industries, Iowa needs to break into some high-growth industrial sectors. Not only is wind-produced electricity a high-growth sector and clean energy source, but it will generate jobs and income in rural counties that have fallen behind in economic expansion.

We find that wind-powered electricity adds slightly more jobs and economic output to the Iowa economy than coal and natural gas. Furthermore, this homegrown source of electricity offers a new cash crop to farmers, spurs the development of new industries (such as turbine manufacturers and maintenance companies) as well as existing industries, and provides stable energy prices. In conclusion, we believe that the vast economic potential of wind power in Iowa obliges public policy makers to make several policy changes. These changes include (1) increasing the amount of renewable electricity that all utilities are required to generate or procure in Iowa, (2) committing state government to purchase or produce 10 percent of all its electricity needs from renewable sources, (3) providing $100,000 grants from the Grow Iowa Values Fund for school districts to install wind turbines, and (4) setting aside a portion of the Grow Iowa Values Fund to provide grants for new, distributive wind-energy projects of less than 2 MW.

Worldwide Growth in Wind Power

According to the American Wind Energy Association (AWEA) and the European Wind Energy Association (EWEA), generating capacity from wind power increased by 28 percent worldwide during 2002. Nearly 7,000 MW of new wind capacity was installed last year, bringing the total to over 31,000 MW worldwide. This capacity is the equivalent of 31 average-sized nuclear power plants, and enough to supply 7.5 million average American homes. The high growth rate for 2002 was not unusual – the average annual growth in wind-energy capacity over the last five years has been 32 percent.[7]

Wind power is the first renewable energy source to become mainstream in the energy business. According to Worldwatch Institute President Christopher Flavin, renewable energy will dominate the market for new electricity generators within the next decade. In fact, the global power industry already adds more wind capacity each year than it does nuclear, and will soon be adding more wind than hydropower.[8] According to the EWEA, there are no technical, economic or resource barriers to prevent wind from providing 12 percent of the world's electricity by 2020. And with strong government policy, 22 percent of the world's energy could be produced from wind power by 2040.[9]

[7] American Wind Energy Association, www.awea.org/news/news030303gbl.html
[8] www.greenbiz.com/news/news_third.cfm?NewsID=25424
[9] *Wind Force 12*, European Wind-energy Association, www.ewea.org/doc/WF12.pdf

In the United States, wind capacity increased by only 10 percent in 2002. AWEA blames the relatively slower growth in this country on the instability of U.S. incentives. Since 1992, the U.S. government has offered commercial producers a 10-year Production Tax Credit (PTC) that is currently worth 1.8 cents per kilowatt-hour for the first 10 years the plant is operating.[10] This tax incentive program has twice expired and been subsequently extended for a short period. It is due to expire again at the end of 2003. However, both the recent House and Senate-passed energy bills include provisions to extend the PTC through 2006. AWEA predicts wind capacity in the U.S. will grow more like the rate in Europe during 2003 and reach 6,000 MW of capacity by year-end. Ironically, part of the reason for the higher growth projection is because the PTC is set to expire and firms want to get in under the wire.

Wind power is a domestic, sustainable, widely available and economical alternative to natural gas, coal and nuclear power. A new study from researchers at Stanford University found that 25 percent of the United States has sufficient winds to generate electricity as cheaply as natural gas or coal. According to that study, modern turbines, with tower heights of 80 meters (262 feet) or more, could reliably provide at least 30 percent of the power in the U.S.[11] Federal policy should facilitate the growth of this undersized industry by providing more generous and consistent incentives.

The U.S. is already far behind its much smaller European counterparts in developing its wind-energy industry. Table 1 identifies the countries that added the most wind-power capacity during 2002 and those countries with the most total capacity at the end of 2002. Germany is the world leader, yet Iowa has five times the wind-energy potential of that country.[12]

One effect of the slow U.S. growth is that European companies have captured greater market share of wind-energy equipment than U.S. companies. European firms dominate the market for manufactured turbines, towers, generators, blades and other components. Gearboxes, generators and controls were provided by German, Austrian and Danish

Table 1. Global Wind Energy Generating Capacity by Country

Country	2002 Additions (in MW)	2002 Year-End Total (in MW)
United States	410	4,685
Canada	40	238
North America	450	4,923
Germany	3,247	12,001
Spain	1,493	4,830
Denmark	497	2,880
Italy	103	785
Netherlands	217	688
United Kingdom	87	552
Sweden	35	328
Greece	4	276
Portugal	63	194
France	52	145
Austria	45	139
Ireland	13	137
Belgium	12	44
Finland	2	41
Luxembourg	1	16
EU Total	5,871	23,056
World Total	6,868	31,128

Source: American Wind Energy Association, www.awea.org/news/news030303gbl.html

[10] The U.S. government provides municipal utilities with Renewable Energy Production Incentive (REPI) payments of 1.8 cents per kilowatt-hour, based on actual production
[11] www.greenbiz.com/news/reviews_third.cfm?NewsID=25323
[12] American Wind Energy Association, www.awea.org/news/news030325.html

companies, respectively, for the Top of Iowa Wind Farm I & II.[13] Some European companies have located factories in the Midwest. LM Glasfiber, a Danish company that constructed the blades for the Top of Iowa Wind Farm, has located a manufacturing plant in North Dakota. NEG Micon, a Danish company that has supplied 369 turbines for wind farms in Iowa, located an assembly plant in Illinois. Gamesa, a Spanish manufacturer of wind-energy projects, recently acquired 75 percent of Navitas, a Minneapolis-based wind-energy developer.[14]

Progressive Public Policies Jump Start the Wind Industry

Progressive energy policy in Iowa dates back to the 1983 Iowa Alternative Energy Production (AEP) Statute (Iowa Code Sections 476.41-45). That law required investor-owned utilities to purchase electricity produced in its service territory by a facility that uses alternative power at a price equal to the utility's "avoided cost." This is the cost the utility would avoid if it were to build a *new conventional power plant.* Utilities fought the law for almost 15 years, even after more limited rules were passed in 1990 that required investor-owned utilities to purchase a combined total of 105 MW of effective capacity from renewable sources (about 2 percent of their electricity sales).[15] It was not until 1999 that the Iowa AEP law led to the building of two large wind farms with 240 MW of nameplate capacity in Storm Lake and Clear Lake.

Renewable Energy Requirements

The requirement that electricity sellers obtain a certain amount of renewable-produced electricity is known as a Renewable Portfolio Standard or Renewable Energy Standard (RES). Thirteen states, including Iowa, now have renewable energy requirements. Iowa's RES of 2 percent has helped make Iowa the third-largest producer of wind power, ranking it behind only California, the state where the new wind industry began in the 1980s, and Texas, a state with a stronger renewable energy standard.

Iowa needs to "raise the bar" to maintain its position as a national leader in wind power.

Iowa's 2 percent RES is low relative to other states. California requires 20 percent of all energy be produced from renewables by 2017, Texas requires 3 percent by 2009, Wisconsin requires 2.2 percent by 2011, Nevada requires 15 percent by 2013, and New Mexico requires 10 percent by 2011. In January of 2003, New York Governor George Pataki announced a goal of generating 25 percent – up from the current 18 percent – of New York's electricity from renewables by 2012. In total, 13 U.S. states have renewable energy standards, three states have renewable generation goals, and six states are considering adoption of standards.[16] In short, Iowa needs to "raise the bar" in order to maintain its position as a national leader in wind power.

[13] www.midwest-renewable.com/top-of-iowa-windfarm.html
[14] www.windpower.com/release_detail.cfm?ReleaseID=9
[15] The requirement for 105 MW of effective capacity was met with a nameplate capacity of approximately 240 MW.
[16] The recently passed energy bill in the United States Senate includes a 10 percent RES requirement. However, it is anticipated that similar to last year, the measure will not become law. Currently, about 2 percent of the country's electricity is produced from renewable sources, although it is primarily large, hydroelectric power.

Renewable Energy Policy in Midwestern States

Iowa's Midwest neighbors have some of the greatest wind-energy potential in the nation. Iowa's competitiveness depends heavily on public policies that demand and support wind-energy developments. In fact, Minnesota will soon surpass Iowa as the third-largest producer of wind power thanks to a number of Minnesota policy initiatives. Primarily it is the result of legislative actions that require Xcel Energy (the state's largest electricity generator) to acquire at least 10 percent of its electricity from renewable energy by 2015. Minnesota also passed legislation requiring Xcel Energy to acquire 825 MW of wind power by 2012 and legislation that requires Xcel to contribute $16 million per year to a Renewable Development Fund for as long as its Prairie Island nuclear plant is in operation. Funds in the account may only be used for the development of renewable energy sources. As mentioned earlier, Wisconsin has a 2.2 percent renewable energy requirement. Wisconsin Governor Jim Doyle recently recommended increasing Wisconsin's renewable energy standard from 2.2 percent to 10 percent.[17]

Legislative initiatives have helped to establish long-term markets for wind energy. Innovative energy policy has generated consumer interest in buying green power.

In addition to legislative requirements, states have established incentives to encourage the development of wind energy. Minnesota offers a payment of 1.5 cents per kilowatt-hour for electricity generated by new, small-scale (less than 2 MW in capacity) wind-energy projects for the first 10 years of operation. This incentive has led to 88.5 MW of capacity as of June 2003. Payments are made available on a first-come, first-served basis until new wind capacity statewide totals 200 MW. The cap of 2 MW was established with the goal of creating distributed generation and local ownership to complement large, centralized production. North Dakota provides property tax incentives for wind facilities of 100 kW or larger and has a sales tax exemption for these facilities. In Illinois, grants from the Renewable Energy Resources Program provide a single, large wind project with as much as $2.75 million in grants and a small wind project with as much as $1 million.[18] The program is funded by a 2.5-cent monthly per customer fee on gas and electric bills. Kansas, Minnesota and Illinois provide special property tax assessments and exemptions for renewable energy facilities. An Iowa loan program provides 0 percent loans for half of the financed project cost (up to $250,000) for wind-energy production facilities in Iowa. Also, Iowa provides some limited sales and property tax exemptions for wind-energy facilities.

Legislative initiatives are primarily responsible for establishing long-term markets to facilitate the development of wind energy. Innovative energy policy has also generated consumer interest in buying green energy from the marketplace and has persuaded utilities to use more renewable power sources to meet that demand. As a result, technology has advanced and wind power has become more cost competitive. Utilities continue to add to their renewable portfolio because of declining costs, customer demand, and as insurance against the possibility of more stringent policy requirements.

[17] Governor Jim Doyle remarks, Metropolitan Milwaukee Association of Commerce (MMAC) Sixth Annual Energy Symposium, April 11, 2003.
[18] Personal communication with Rex Buhrmester, Illinois Department of Commerce, July 24, 2003.

Conscientious Consumers Choose Renewable Power through "Green Pricing"

While most of the new wind development has been the result of requirements by state government, some regional electricity sellers have special tariffs so customers can purchase renewable power for a premium (above the normal price they pay for electricity). Alliant Energy's Green Pricing program named "Second Nature" enables customers to pay an extra one-cent per kilowatt-hour to be provided with 50 percent of their power from renewable sources or two cents per kilowatt-hour to be provided with 100 percent. Obviously, Alliant cannot deliver different electrons to one customer than they deliver to the neighborhood. However, the company promises to make investments in new renewable energy to supply the demand of Second Nature customers. An Iowa law passed in the 2002 legislative session will require all sellers of electricity in the state to have a green pricing program by 2004.

Customers around the nation have shown that they will pay more to encourage their electricity supplier to procure environmentally better power sources. Not only residential customers have shown this motivation. Companies that want to demonstrate a green image such as Fetzer Wines, New Belgium Brewery, Birkenstock and Toyota have paid higher rates to have cleaner electricity. Los Angeles World Airports, the City of Oakland and Santa Monica have done the same.[19]

Cost Competitiveness Spurs the Development of Wind Energy

The willingness of customers to pay a premium for clean energy has been important in the development of wind power in the United States. However, the industry has now matured enough that the cost of wind power is competitive with other energy sources. MidAmerican Energy recently announced plans to build the world's largest land-based wind farm in Iowa and to freeze electric rates through 2010. MidAmerican president Greg Abel told reporters that "this project will bring additional renewable energy to Iowans while extending rate stability for our customers."[20] The project will include 200 turbines producing 310 MW – enough to supply electricity to 85,000 Iowa homes. In a recent all-source bid, Xcel Energy in Minnesota selected 450 MW of wind power because of its cost-competitiveness with coal and natural gas plants.[21]

Since 1980, the cost of wind power has fallen by 80 percent to 90 percent, largely as a result of technological advances and economies of scale in manufacturing and installation. In the early 1990s, the Electric Power Research Institute predicted that wind would ultimately become the least expensive electricity generation source. Table 2 shows that wind power is already among the most economical forms of energy production. Wind production with the federal Production Tax Credit is cheaper than any new electricity production source. Experts predict that the cost of wind will decline by another 40 percent by 2006.[22]

[19] In one of the most interesting green marketing strategies, nine San Francisco Bay area Episcopal churches negotiated an arrangement with Green Mountain Energy Resources (GMER), which rewards the church group for finding customers who want to buy green power. Each church that signs up with GMER receives a $250 donation and another $20 for each parishioner that switches to the company's product. GMER will build a new wind turbine for every 3,800 parishioners that sign up for its Wind for the Future product.
[20] www.midamericanenergy.com/newsroom/asp/newsdetails.asp?id=196&nav=1
[21] Personal communication with Bret Eknes, Minnesota Public Utilities Commission, August 14, 2003.
[22] Jamie Chapman, et al, "Expanding Wind Power: Can Americans Afford It?" Research Report No.6, Washington D.C.: Renewable Energy Policy Project, 1998.

Since the cost of wind energy is largely determined by average wind speeds, Iowa can produce wind power at cheaper rates than most other areas of the nation. Iowa is the 10th windiest state in the nation, and the northwest and north central parts of Iowa have some of the best winds in the nation. Wind developers and utilities keep their costs under wraps, but industry experts have suggested costs in Iowa are usually less than 3 cents per kWh (with the Production Tax Credit), down from 35 cents per kWh in the 1980s.[23] Waverly Light and Power, a municipal utility, produces electricity from its wind turbines for only 1.5 cents per kWh.[24]

The declining cost of wind power stands in stark contrast to the volatility of natural gas prices.[25] The cost of natural gas has increased since 1996, so that Table 2 estimates for gas-fired power plants are understated.[26] In June 2003, natural gas prices in Iowa were double the average price of one year earlier. The Iowa Utilities Board and MidAmerican Energy have warned consumers that natural gas increases of over 100 percent are likely in the winter of 2004.[27] This is the third consecutive year that the Iowa Utilities Board has predicted increasing gas prices.

Table 2. Energy Production Costs*

Source	Cents per Kilowatt-Hour
Wind (with PTC**)	3.3-5.3
Natural Gas	3.9-4.4
Wind (without PTC**)	4.0-6.0
Coal	4.8-5.5
Hydro	5.1-11.3
Biomass	5.8-11.6
Nuclear	11.1-14.5

* Levelized costs; while costs may vary year to year, these are average rates over the life of a 20-year contract.
** Production Tax Credits
Source: California Energy Commission 1996

Wind power is inherently immune to fuel price risk and is always sold under fixed-price contracts. As a result, wind-power customers benefit from long-term price stability. On the other hand, stable natural gas prices can only be attained through the use of financial derivatives to hedge prices. A new report by Mark Bolinger and his colleagues at the Lawrence Berkeley National Laboratory found that the hedged cost of natural gas is considerably higher than natural gas spot price forecasts, which are often used for estimating natural gas prices.[28] In another study, the same researchers found that hedging natural gas in order to attain price stability costs customers an additional 50 cents per kWh.[29] The authors suggest that if this additional cost for natural gas is included in cost comparisons, wind generation would likely be the more favorable investment.

A new study shows that it is possible to add wind turbines to the existing utility system without significant system upgrades. The Utility Wind Interest Group (UWIG), an association of the largest investor-owned electric utilities in the country, has presented data to

[23] Office of Power Technologies, U.S. Department of Energy web site: www.eren.doe.gov/power/about.html
[24] Iowa Department of Natural Resources, "Focus on Energy: Renewable Energy Success Story," 2003.
[25] The Colorado Public Utilities Commission ordered one of their regulated utility companies (Xcel Energy) to engage in negotiations for a wind farm. The commission found that assuming foreseeable natural gas costs of more than $3.50 per million cubic feet, new wind would be a cheaper alternative than developing only gas-fired electricity capacity. www.dora.state.co.us/puc/new.htm#dated
[26] American Wind-energy Association, "Comparative Cost of Wind and Other Energy Sources," 2001.
[27] Iowa Utilities Board, "Natural Gas Price Volatility," June 2003, www.state.ia.us/government/com/util/Misc/2003WinterPrices.pdf
[28] Mark Bolinger, et al, *Accounting for Fuel Price Risk: Using Forward Natural Gas Prices Instead of Gas Price Forecasts to Compare Renewable to Natural Gas-Fired Generation*, Lawrence Berkeley National Laboratory, August 2003, http://eetd.lbl.gov/ea/emp/reports/53587.pdf
[29] Mark Bolinger, et al, *Quantifying the Value that Wind Power Provides as a Hedge against Volatile Natural Gas Prices*, Lawrence Berkeley National Laboratory, 2002, http://eetd.lbl.gov/ea/EMS/reports/50484.pdf

show that it is a common misconception that wind generation capacity needs to be backed up one-to-one with some other source of generation because wind blows only intermittently. An analyst speaking for UWIG found that costs to a system to back up wind turbines are moderate even when wind turbines are 15 percent of the total system.[30] Although this is not surprising (the state of Schleswig-Holstein in northern Germany was already generating 18 percent of its electricity from wind in 2002), it is noteworthy that the largest utilities performed this optimistic study on the potential of wind power.

Clearly, it would be good business for Iowa to advance new, wind generation facilities instead of natural gas plants so that Iowans and the Iowa economy are not held captive by soaring and unstable natural gas prices.

Advantages of Distributed Generation

Distributed generation (DG) refers to small-scale power generation technologies (typically less than 1 MW but can be as much as 20 MW) located close to where electricity is used (e.g., a home or business). DG provides an alternative to the traditional electric power system and is characterized by its high reliability, efficiency and cleanliness. Distributed generation lowers peak demand on the electric transmission system and reduces the risk of system failures. Wind turbines, photovoltaics, microturbines and fuel cells are all examples of DG technologies. The first two produce no greenhouse emissions.

The August 14, 2003, blackout in the Northeast has demonstrated the need for DG systems to be integrated into the energy grid. DG systems will improve the efficiency and reliability of the grid in order to meet the demands of a digital economy. A net metering law in Iowa is the first step toward encouraging distributed generation. Net metering enables a customer to exchange power with electric sellers by allowing the meter to run backward. When the generator produces more than the customer uses, the customer-producer is compensated for the generation (although at a lower rate than the retail sale price). Iowa lacks a standardized interconnection procedure that enables easy integration of DG with the energy grid. However, Iowa is moving forward on this issue. By April 2004, a study should be completed that will assess current interconnection standards in Iowa and make recommendations for standardizing regulations for DG.[31]

DG programs are supported by the Energy and Rural Development Titles of the latest farm bill that will provide $405 million in grants and loans for renewable energy systems in rural areas. Since these U.S. Department of Agriculture (USDA) funds can only be used to pay up to 25 percent of the cost of an eligible project, state programs that encourage DG would bring more federal funds to Iowa and more wind turbines to reality.[32]

Advantages of Wind Turbines for Iowa Schools

The Spirit Lake School District is 100 percent powered by two wind turbines. In just four years, the savings on electricity ($25,000 per year) paid for the first turbine, which was installed in 1993. When the second turbine, which was installed in 2001, is paid off in 2007,

[30] J. Charles Smith, “Wind Power Impacts on System Operation: A Summary of Results,” Presentation for the Utility Wind Interest Group at the NWCC Business Meeting Norman, OK. June 18, 2003.
[31] Personal communication with Jim Bodensteiner, Iowa Dept. of Natural Resources, August 26, 2003.
[32] In August 2003, the USDA awarded nine Iowa projects with over $1.2 million in grants.

the district projects tax-free profits of $120,000 each year to spend on educational programs instead of energy. The Akron-Westfield School District expects savings from its wind turbine to pay for itself within nine years. During the summer months, when school is not in session, the district will sell the excess power to the City of Akron. In just the first three months of operating its new turbine, the Eldora-New Providence School District saved over $25,000 on energy costs and earned almost $3,000 in extra income by selling excess energy. The school district expects an annual profit of $12,000 in the first 10 years of operation, and $109,000 in annual profits thereafter. Obviously, wind power for school districts creates major cost savings. School districts, governments and taxpayers can save money, protect the environment, and contribute to the state economy by investing in wind energy for our schools.

Currently, school districts can borrow up to $250,000 in low-interest loans from the Alternate Energy Revolving Loan Program (managed by the Iowa Energy Center) and borrow no-interest loans from the Iowa Energy Bank (a program run by the Iowa Department of Natural Resources Energy Bureau). Eight Iowa school districts already have wind turbines and at least two others are doing feasibility studies. There are hundreds of schools in Iowa, particularly in rural Iowa, that could save money by installing wind turbines, yet school districts have been to slow to take up the available loans because of a lack of information and technical know-how. The Energy Bureau of the Iowa Department of Natural Resources has only one full-time contractor who performs outreach and consulting for all the schools (and other public facilities) in Iowa.

Environmental Benefits of Wind Power

If the environmental costs of electricity generation were included in the calculation of costs in Table 2, then the competitiveness of wind power would increase substantially. Whereas coal and gas power plants damage public health and the environment by emitting sulfur dioxide, nitrogen oxide, mercury, carbon dioxide and other air pollutants, wind-energy produces no such emissions. Wind-energy also does not require extraction, such as drilling and mining, nor the processing or shipping of fuel, which are also harmful to the environment. All of Iowa's wind turbines help Iowans breathe better by reducing carbon dioxide emissions by more than 1.3 million tons annually.

Wind Power and Economic Development in Iowa

A 2002 report produced for IPP by Iowa State University economic researchers David Swenson and Liesl Eathington estimates economic values associated with Iowa's wind-energy industries. These values were calculated using an input-output model of the Iowa economy. One scenario developed in the Swenson/Eathington study demonstrates the economic impact of producing 3.6 percent of the state's electricity with wind power, somewhat more than will be produced this year. Table 3 shows the input-output model estimates of the direct, indirect and induced economic effects of producing 1,554,785 MWh.[33]

[33] Direct effects are the on-site or immediate effects created by the industry being studied. Indirect effects occur when a contractor or vendor receives payment for services delivered and is then able to pay suppliers and employees. Induced effects are the spending effects caused when workers in the direct and indirect industries spend their earnings.

Table 3. Wind Energy Production: Total Economic Values

	Direct	Indirect	Induced	Total
Total Industrial Output (sales)*	$ 116,526,782	$ 43,224,373	$ 16,082,438	$ 175,833,593
Labor Income	2,466,200	17,811,540	6,016,411	26,294,151
Value Added (inc. labor income)	65,509,831	28,973,576	10,158,833	104,642,240
Jobs	65	519	268	852

*Total Industrial Output: gross sales of electricity, plus subsidies.
Source: *Statewide Economic Values of Alternative Energy Sources and Energy Conservation,* Iowa Policy Project, March 2002.

The study found that 1,554,785 MWh of wind-generated electricity produces $116.5 million in *direct* industrial output (gross sales of electricity plus federal production subsidies). With those revenues, approximately $65.51 million is paid to workers, investors and governments (through taxes). About 65 jobs are directly created at an average salary of $38,000. The study estimates that the industry would purchase $43.2 million in inputs, which would sustain $17.8 million in labor income and employ 519 workers. The direct and indirect expenditures would stimulate additional rounds of spending and re-spending (the induced effects) that also impact the Iowa economy. In total, a wind industry producing 3.6 percent of the state's electricity would account for $175.8 million in total industrial output, support $26.3 million in labor incomes, and provide 852 jobs.

According to the study, the wind industry generates slightly more jobs and more sales per million dollars of production compared to traditional utilities. Swenson and Eathington also found that 1,554,785 megawatt-hours (MWh) of wind power will reduce coal imports into Iowa by 980,000 tons.

Jobs and Wages in the Wind-Energy Industry

Operation and Maintenance Jobs

Experts estimate that wind projects create about one permanent, local operation & maintenance (O&M) job for every 8 to 10 MW of installed capacity. Iowa's first wind farms created even greater numbers of O&M jobs: 240 MW of wind capacity in Buena Vista, Cerro Gordo and Cherokee counties sustains 40 long-term O&M jobs and $5.5 million per year in O&M income.[34] In Minnesota, a 107 MW wind farm in Lincoln County supports 31 O&M jobs.[35]

While wind farms do not generate large numbers of permanent jobs, research shows that they generate slightly more jobs compared to traditional utilities.[36, 37] And as Table 3 demonstrates, the total number of direct Iowa jobs is not the primary benefit of generating wind-produced electricity. Wind farms are more capital-intensive than coal and natural gas-fired plants, and require inputs and services from a wind range of Iowa industries. Whereas

[34] Union of Concerned Scientists, *Economic Development Benefits of Wind Power*, Cambridge, MA, 2002.
[35] The Minnesota Project, "The Facts on Wind: A Proven Economic Development Tool," 2003.
[36] Steve Clemmer, *Strong winds: Opportunities for Rural Economic Development Blow Across Nebraska*, Union of Concerned Scientists, February 2001.
[37] See Table 5 in *Statewide Economic Values of Alternative Energy Sources and Energy Conservation,* Iowa Policy Project, March 2002.

fossil fuel purchases for traditional utilities siphon money out of the state, purchases of inputs for wind energy support jobs in Iowa.

Another report produced for the IPP by three economists at Iowa State University and headed by Mark Edelman, found that O&M jobs in the renewable energy sector were high-wage jobs. Edelman's report confirmed that these jobs paid between $38,000 and $48,000 annually and that a standard benefits package is typically provided. At these wage rates, wind-energy jobs are in the 80th percentile of all jobs in Iowa (80 percent of jobs pay less, 20 percent pay more). These are the kind of jobs Iowa must add if it is to break out of its low-wage status. Some of these jobs will be created in rural counties where the wind turbines will be located.

Construction Jobs

Between one and two construction jobs are created per MW of installed wind capacity. Construction services, such as installing the concrete and building the towers, are usually provided by local businesses and provide local jobs. However, other parts of building the towers and attaching the turbines are likely to bring in outside specialists. The installation of 240 MW of wind capacity in three Iowa counties (Buena Vista, Cerro Gordo, and Cherokee) created 200 construction jobs. The 80 MW Top of Iowa I wind farm in Worth County created 200 construction jobs.[38] In Minnesota, 150 construction jobs were created when a 107 MW wind farm was installed in Lincoln County. These are not full-year jobs since wind farms are built so quickly. However, a study in Nebraska found that wind farms generate about 2.4 times more construction jobs per MW than do coal and natural gas plants.[39]

Other Jobs Supported by Wind Energy

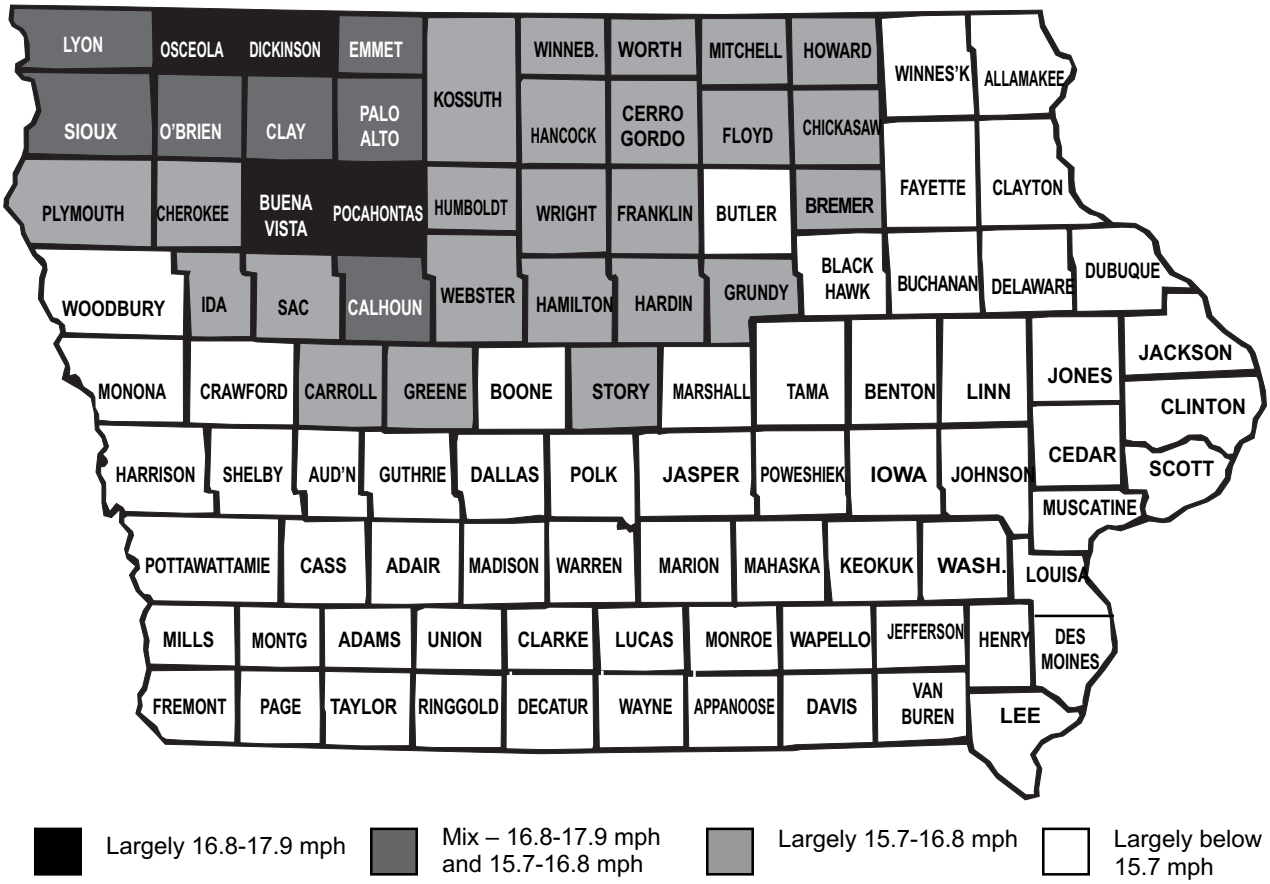
A recent publication by the Iowa Policy Project, *The State of Working Iowa 2003,* identifies two basic problems with Iowa's economy: Most industrial sectors in Iowa are growing slow compared to the nation and there is a concentration of workers in slow growth, "old economy" sectors. Wind power is a fast-growing industry that will support good jobs in a variety of other Iowa industries. Engineering, insurance, manufacturing, financial, and other companies will provide services and supplies to the wind industry. In fact, manufacturing firms that build wind turbine blades, towers, and other components already exist throughout the Midwest. DMI Industries of West Fargo, North Dakota, was previously a tool and die company before it became a manufacturer of wind towers. One study of Nebraska estimated that an additional 250 jobs, $15 million in earnings, and $44 million in gross state product would be generated if half of the wind turbine and related components and all of the towers that are needed to generate 800 MW of wind-produced electricity were manufactured in-state.[40]

[38] U.S. PIRG Education Fund*, Generating Solutions: How Clean, Renewable Energy is Boosting Local Economies and Saving Consumers Money*, April 2003.
[39] Steve Clemmer, *Strong winds: Opportunities for Rural Economic Development Blow Across Nebraska*, Union of Concerned Scientists, February 2001.
[40] Steve Clemmer, *Strong winds: Opportunities for Rural Economic Development Blow Across Nebraska,* Union of Concerned Scientists, February 2001.

The Impact of Wind Power on Iowa's Rural Economies

The State of Working Iowa 2003 identified troubling economic indicators in many of Iowa's windiest counties. Figures 1-4 show many of Iowa's windiest counties have experienced population decline, very slow employment growth, and moderate family incomes. Wind farms would provide badly needed jobs and an economic stimulus in these rural counties.

Figure 1: Average Annual Wind Speeds in Iowa, By County*



* Average Annual Wind Speeds at 50 Ft.
Source: Iowa Energy Center, http://www.energy.iastate.edu/renewable/wind/images/windmap-iowa_annual.gif.

A North Dakota study estimated the economic impacts of a 100 MW wind farm in two rural counties.[41] The study found that during construction, about 28 percent of expenditures (about $28 million) would accrue to firms and households in the local area. During operation, the wind farm would have annual direct impacts of about $1.5 million (primarily wages, but also expenditures for buildings, vehicles, insurance, and other materials and services) of which $1.4 million (about 93 percent) occur in the local area.[42] As this study demonstrates, wind-farm development means a tremendous boost for the rural economies where they are located.

[41] The two rural counties studied have a total population of 4,700. This is important to note since expenditures will have varying economic impacts depending on the size (and diversity of economic sectors) of the local economy. Iowa's windiest counties have larger populations (and therefore a larger economic base) than the counties in the N.D. study, so more inputs will likely come from the local economy.
[42] F. Larry Leistritz, *Potential Economic Impacts of Commercial Wind Power Development in North Dakota,* 2001.

Figure 1a. Population Growth in Windiest Iowa Counties, 1999

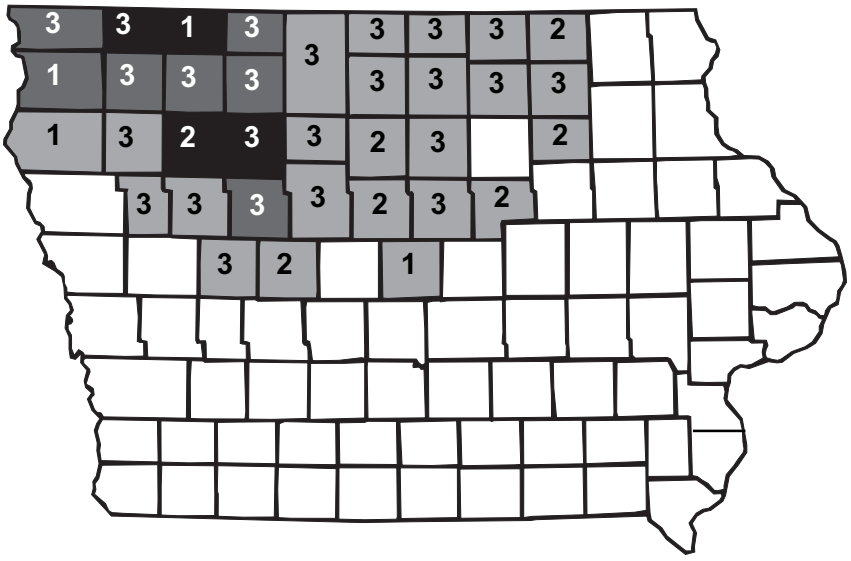
1 – 1,001 to 7,000

2 – 1 to 1,000

3 – (-1,428) to 0

Source: U.S. Census 2000, Summary File 3

Note: Shading on map corresponds to Figure 1, average wind speeds



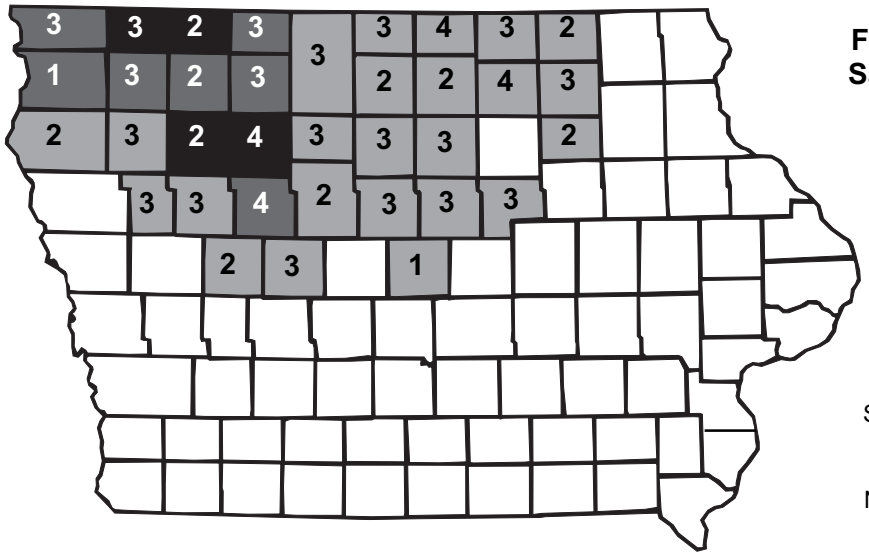


Figure 1b. Growth in Wage and Salary Employment in Windiest Iowa Counties, 1990-2001

1 – 3,501 to 10,000

2 – 1,001 to 3,500

3 – 1 to 1,000

4 – (-305) to 0

Source: Bureau of Economic Analysis, U.S. Department of Commerce

Note: Shading on map corresponds to Figure 1, average wind speeds

Figure 1c. Median Family Income in Windiest Iowa Counties, 1999

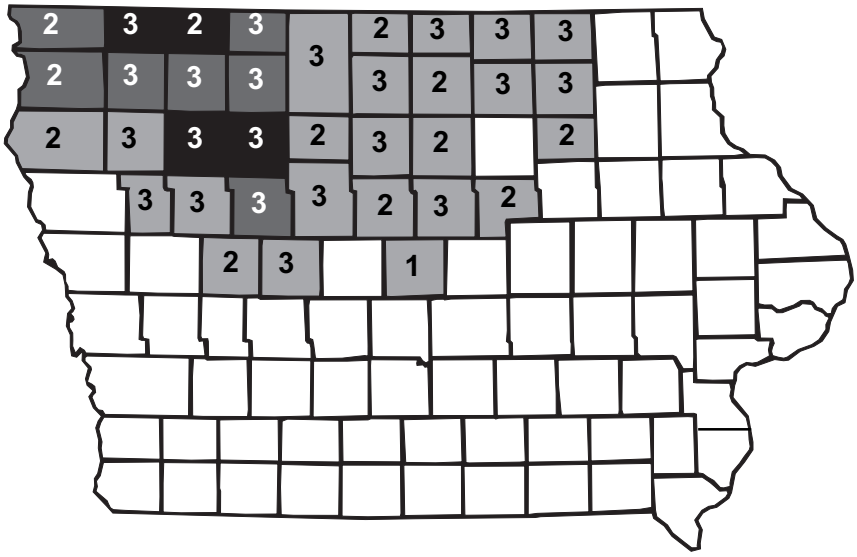
1 – $53,501 to $60,112

2 – $44,701 to $53,500

3 – $39,501 to $44,700

Source: U.S. Census 2000, Summary File 3

Note: Shading on map corresponds to Figure 1, average wind speeds



Iowa farmers and landowners also stand to gain substantially from wind-energy. An Iowa farmer receives an annual lease payment of between $2000 and $4,500 for each turbine.[43] Each turbine (and its access road) requires only about a half-acre of land and crops can be planted right up to the base of the turbine. Since an average Iowa corn yield on a quarter-acre would sell for $72, farmers can earn many times more income per acre by leasing the wind above their crop land.[44] About 115 landowners near Clear Lake and Storm Lake are paid $640,000 per year for turbines on their property.

Instead of receiving annual lease payments for wind turbines, landowners can negotiate a share of the revenues in order to capture future increases in the value of wind power. A more ambitious farmer, or group of farmers, could build a wind farm. According to one estimate, 200 MW of locally-owned wind projects increase owner income by $7.8 million in a 30-year period.[45] Two cooperative wind farms in Minnesota have 66 farmers as investors and produce about 4 MW of electricity. Another benefit of local ownership is that it creates more jobs – about 300 more jobs per 200 MW of electricity over a 30-year period according to one estimate.[46]

Wind farms also generate property taxes for the local economy. The 312 wind turbines in Storm Lake and Clear Lake (240 MW) generate $2 million in annual property tax revenues. In Iowa, the county board of supervisors can elect to cap the property tax at 30 percent of the construction cost. Thus, the property taxes generated by wind farms will vary by county.

The Aggregate Economic Impact of Wind Power for Iowa and the Midwest

Because wind power is a capital intensive industry, the largest benefits are likely to accrue through linkages to other industries in Iowa. Wind power is an import substitution strategy that helps keep energy dollars and jobs local. Whereas nearly all of the money spent by Iowans on electricity now leaves the state in the form of payments for natural gas and coal imports, many of the inputs for operating wind farms can be purchased in the state. Wind power projects can spur the development of new industries as well as existing industries such as in engineering, manufacturing, insurance, finance and construction. Germany's wind industry produces 12,000 MW of electricity and employs 45,000 people.[47] With Iowa having five times the wind energy the potential of Germany, one can easily see the job growth potential of wind in Iowa. As transmission lines are upgraded and regional transmission organizations are developed, Iowa will also be able to export wind-produced electricity across state borders.

Due to technological advances, economies of scale and the fact that wind farms do not require purchases of imported fuels, wind-energy prices are likely to continue decreasing over time and then flatten out. According to a new study, wind energy not only provides long-term price stability, it also reduces natural gas prices by decreasing its demand.[48] As a

[43] Farmers receive the largest payments for the newest turbines that have as much as 1.5 MW of capacity
[44] Environmental and Energy Study Institute, *The 2002 Farm Bill: Revitalizing the Economy through Renewable Energy Development*, September 2001.
[45] Union of Concerned Scientists, *Economic Development Benefits of Wind Power*, Cambridge, MA, 2002.
[46] www.windustry.com/opportunities/Long%20Term%20Eco%20Dev%20Fact%20Sheet.pdf
[47] American Wind Energy Association, www.awea.org/news/news030325.html
[48] American Council for An Energy-Efficient Economy, Impacts of Energy Efficiency and Renewable Energy on Natural Gas Markets, Sept. 7, 2003, www.aceee.org/energy/natgassummaryreport.pdf.

result, wind power helps preserve U.S.-based manufacturing jobs that may otherwise move production to other countries because of rising natural gas prices. And by reducing the use of polluting fossil fuels, wind power will save lives and health care costs and make Iowa a more attractive place to live.

In addition to property taxes, wind farms generate sales, use, excise and income taxes. The Swenson/Eathington study estimates that 507 MW of wind capacity generates approximately $1.75 million in these indirect taxes.

A study by the Environmental Law & Policy Center (ELPC) projects an important role for Iowa's wind resources in meeting future energy needs.[49] That study anticipates that Iowa will have installed 1,021 MW of capacity by 2010 and 3,817 MW by 2020. A second study by the ELPC used regional econometric input-output models to forecast the economic impact in the Midwest if renewable energy develops as anticipated.[50] According to that report, if 8 percent of electricity is generated by renewable energy (including wind, solar, biomass, and Combined Heat and Power) by 2010, then the region would experience net job growth of 36,800 and increased annual economic output of $3.7 billion. Construction and operation of wind turbines would make up 28 percent of the new jobs.

[49] Environmental Law & Policy Center, *Repowering the Midwest*, Februrary 2001.
[50] Regional Economics Application Laboratory and Environmental Law & Policy Center, *Job Jolt*, 2003.

Policies for Expanding Wind Power in Iowa

The energy choices facing Iowa have never been clearer. Wind-produced electricity is good for the environment and for Iowa's economy. Iowa is already a national leader in wind-energy production, but is falling behind because of outdated public policy. Taxpayers can rest assured that any financial investment in capturing Iowa's natural energy resource will yield positive returns – both for the economy and the environment. Governor Vilsack's 2003 Iowa Values Fund included initiatives to expand wind-energy in the state until the plan was changed by the Legislature. It is still possible to include many of the ideas in the modified Values Fund that was recently signed into law by the Governor (HF 692 and HF 683).

In 2001, the Governor's Energy Policy Task Force recommended, and Governor Vilsack supported, establishing a state goal of generating 1,000 MW of electricity from renewable sources by 2010. Keeping that goal in mind, we recommend the following policies to stimulate the growth of a new economic sector in Iowa: wind-produced electricity.

■ *Increase the Renewable Energy Standard (RES) in Iowa*

Iowa should increase the RES (Iowa Code 476.42) and make it apply to all utilities (not just investor-owned utilities). Every utility should be required to increase the percentage of renewable energy in its generation mix by an amount equal to 1 percent of its total Iowa retail sales each year until the standard reaches 15 percent. Electricity produced or purchased under this law could not also be credited toward a similar requirement in any other state. The 15 percent requirement is reasonable (and easily attainable) given Iowa's tremendous renewable energy potential and the benefits that all Iowans stand to gain from the development of this new industry.

■ *Tie State Purchases to the RES*

Starting in 2004, the state government should commit to purchase 10 percent of all electricity used from renewable sources or to produce this amount of renewable energy. In 2010, this commitment should increase to 15 percent. By purchasing the energy, the state government provides a market for renewable energy produced as a result of the higher RES. If state government decides to produce its own power, all kilowatt-hours shall count toward the renewable requirement of the seller normally providing electricity to the state facility.[51]

■ *Help Community School Districts Produce Wind Energy*

An excellent way to spur the development of a market for wind energy would be to help Iowa community school districts to purchase and install wind generators. We recommend

[51] Many state governments, local governments, federal agencies and private entities have committed to buying renewable power. In New Jersey, the McGreevey administration says it is practicing what it preaches. In May 2002, the state signed a contract with electricity seller Green Mountain Energy to receive 12 percent of state government-consumed energy from renewable sources ("Renewable Energy Gets a Boost in New Jersey," Akweli Parker, The Philadelphia Inquirer, Dec 18, 2002). The city of Chicago will obtain one-fifth of its electricity from green power sources. Other public entities that have recently invested in renewable electricity are Austin, Texas, Pennsylvania State University, and the Santa Rita Jail in Alameda, CA (Wind-energy Weekly # 1014). Wind power will now supply part of the electricity needs for U.S. Army facilities at the Walter Reed Army Medical Center campuses in D.C. and Maryland, Fort McNair in D.C., and Adelphi Labs in Maryland (Wind-energy Weekly #1008).

that a portion of the Iowa Values Fund be used for $100,000 grants to school districts that install wind turbines of at least 500 kilowatts in size. We further recommend that the Legislature increase the number of staff at the Iowa DNR who advise school districts on renewable energy.

- ***Provide State Funds for Small Wind-Power Projects (Distributed Generation)***

We recommend using money from the Iowa Values Fund to establish a seed grant program for small-scale wind projects of 2 MW or less. We emphasize that the size of each project be limited to 2 MW in order to promote distributed renewable energy systems. Distributed generation fosters local ownership of wind resources and increases the reliability and efficiency of the energy grid. Applicants could receive 25 percent of the cost of constructing a renewable energy system up to a limit of $100,000. The Iowa Energy Center could manage the grant program, which also may provide matching funds for new federal grants and loans available in the latest farm bill.[52]

Conclusion

Wind energy is economically viable, technically feasible and environmentally friendly. Windpower costs should continue to decline over time and then flatten out, thus providing insulation against the volatility of fossil fuel prices. Wind power can strengthen our rural and agricultural economies by creating jobs in the slow growing parts of Iowa and by increasing farmer income. Wind energy also spurs the development of new and existing industries, helps preserve manufacturing jobs, and keeps money in the Iowa economy. Wind power also reduces the amount of carbon dioxide emissions and particulate emissions that harm the environment and public health. In conclusion, we recommend that the Legislature adopt the policies listed above in order to harness Iowa's wind toward a better economic future for all Iowans.

[52] Because the Iowa Energy Center already manages the Alternate Energy Loan Program, it may make sense for the Center to also manage funds for distributed power projects.