Wind Power and Iowa Schools

Teresa Galluzzo
David Osterberg

March 2006

The Iowa Policy Project

AUTHORS AND ACKNOWLEDGEMENTS

The authors of this report are:

Teresa Galluzzo, M.S. (Environmental Studies), has been a Research Associate at the Iowa Policy Project since November 2004. Her research focuses on Iowa environmental issues.

David Osterberg, M.S. (Water Resource Management) and M.S. (Agricultural Economics), is founder and Executive Director of the Iowa Policy Project. He also is an associate clinical professor of Occupational and Environmental Health at the University of Iowa.

Photographs were taken and maps were created by Teresa Galluzzo.

The authors would like to thank everyone who participated in interviews for contributing their time and sharing their enthusiasm for wind energy. We would also like to thank staff at the Iowa Energy Center (especially Keith Kutz), Iowa Department of Natural Resources, and the Iowa Utilities Board for sharing their expertise and information. We would like to thank Jon Muller and the Iowa Association of School Boards for helping to print and distribute this report. We are also grateful to The Joyce Foundation for their support.

The Iowa Policy Project

Formed in 2001, the Iowa Policy Project is a nonpartisian, nonprofit research organization based in Mount Vernon, with its principal office at 120 N. Dubuque Street #208, Iowa City, IA 52245.

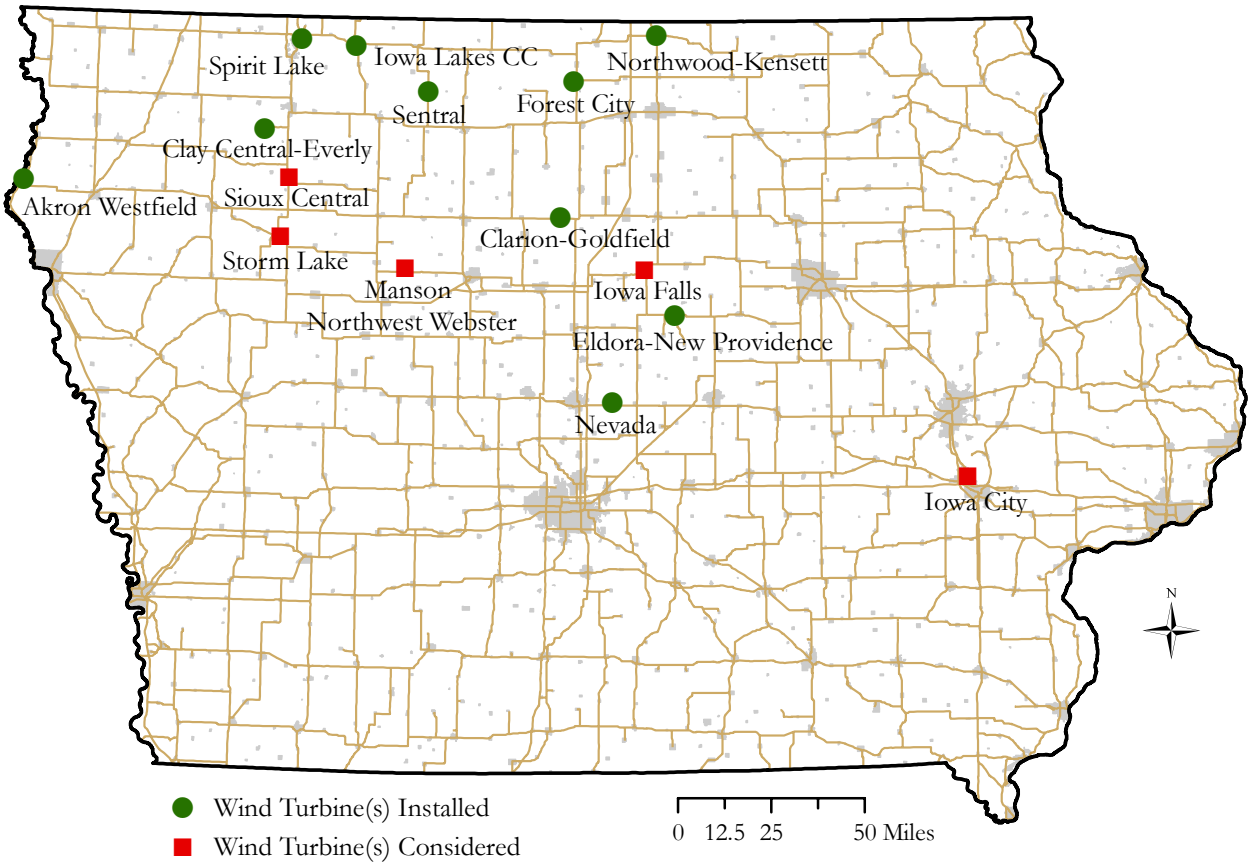
The Iowa Policy Project promotes public policy that fosters economic opportunity while safeguarding the health and well-being of Iowa's people and the environment. By providing a foundation of fact-based, objective research and engaging the public in an informed discussion of policy alternatives, the Iowa Policy Project advances accountable, effective and fair government.

All reports produced by the Iowa Policy Project are available to the public, free of charge, on the organization's website at www.iowapolicyproject.org

The Iowa Policy Project is a 501(c)3 organization. Contributions to support our work are tax deductible. We may be reached at the address above, by phone at (319) 338-0773, or by email at tgalluzzo@iowapolicyproject.org.

TABLE OF CONTENTS

IOWA SCHOOLS THAT HAVE INSTALLED OR CONSIDERED WIND TURBINES



GIS data from Iowa Geological Survey.
Available at http://www.igsb.uiowa.edu/nrgislibx/

INTRODUCTION

Harnessing the wind's energy is a modern but age old practice. Today the process often takes the form of three substantial yet sleek blades turning in the breeze, converting motion into electricity. It is a clean and relatively simple process compared to mining coal, drilling for gas or oil, or splitting atoms. There are currently enough wind turbines installed in the U.S. to power about 2.4 million homes.[1] Furthermore, wind power is poised to be a major player in our energy future as it is the fastest growing energy source in the world.[2]

Combine this with the fact that America's schools face a perennial struggle with tight budgets. Their financial difficulties are worsened by rising prices for fossil fuels. A small but growing number of schools have made this connection and have begun to produce their own electricity with wind turbines, helping them reduce costs while promoting energy independence and environmental responsibility and providing their students with the opportunity to understand this burgeoning technology.

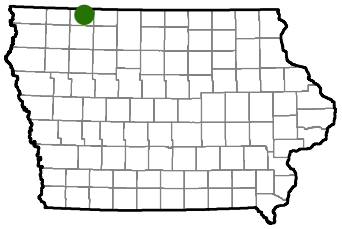
Iowa currently ranks third in the nation for megawatts installed, standing at more than 896 turbines producing 836 MW, and has long been a leader in educational achievement.[3,4] It is now also a leader in the number of schools using the wind's energy. Each of the 10 Iowa schools with wind turbines have lessons to share about their experience.

Each school came to install their turbines under a different set of circumstances: one started with two school officials noticing the wind's power while their sons played flag football; another with a student, assisted by his teacher, going above and beyond with a physics project; another from the desire of a retired banker to make a difference in his community; and yet another from a community college president who wanted to provide students with the opportunity to obtain good jobs in their own communities. As groundbreakers without a formula to follow, each school faced challenges from the beginning of the process continuing through everyday operation. Another group of schools interested in producing wind power found these challenges insurmountable, preventing them from installing turbines, at least for the time being.

This report provides a profile of the 10 schools that operate wind turbines as well as a look at 5 schools that have seriously considered, but decided against installing a turbine. In each section the schools are presented chronologically by date of installation or by date the project was researched. This information was collected through a series of interviews with personnel at each school (the interviewee's contact information is listed at the end of each profile).[5]

After the school profiles, a synopsis of wind power development in Iowa is presented and the benefits of wind power are reviewed. To conclude there is a summary of key lessons from the schools and policies are recommended that would help schools continue to become producers of wind power. Additionally there is a glossary, list of resources, and appendix with useful information for those interested in learning more.

SCHOOLS PRODUCING WIND POWER



1. SPIRIT LAKE COMMUNITY SCHOOL DISTRICT

DISTRICT FACTS

COUNTY – Dickinson
DISTRICT ENROLLMENT[6] – 1,317 students
POPULATION OF SPIRIT LAKE[7] – 4,493 people
APPROXIMATE ELEVATION OF SPIRIT LAKE[8] – 1,470 feet
AVERAGE ANNUAL WIND SPEED AT SPIRIT LAKE[9] – 16.39 mph

PLANNING THROUGH CONSTRUCTION

DATE PROJECTS STARTED – Turbine 1: September 1991; Turbine 2: 1995

KEY PEOPLE BEHIND PROJECTS – former Superintendent Harold Overmann, current Superintendent Tim Grieves, and Director of Buildings and Grounds Jim Tirevold

MOTIVATION – Superintendent Overmann and School Board Member Craig Newell were watching their sons play flag football when they exchanged comments about how it would be wonderful if they could harness the wind that frequently gusts across campus. Later, Overmann began to seriously consider whether wind power could be a solution to the students' challenge that the District become more environmentally friendly. The motivation for installing the turbines was to reduce the District's environmental impact, create an educational resource, and provide an economic boost.

MOST HELPFUL RESOURCE – Dan Juhl, owner and founder of wind energy consulting company DanMar & Associates, assisted the District with installing both turbines and according to Tirevold was extremely helpful because of his expertise.

LEGAL OR ZONING ISSUES – The District worked with the City and County to rezone the land to be within City boundaries.

INTERCONNECTION ISSUES – The District has contracts with Alliant Energy Corporation (formerly IES Utilities) to sell excess power. Turbine 1 is connected directly to the elementary building and the District has a 33 year contract for selling its excess electricity for $.0602 per kWh. Turbine 2 is connected to the grid and eight of the District's meters (all District buildings, except the elementary) are combined for net metering. The District has a 20 year agreement with Alliant to sell the excess power produced by Turbine 2 at $.02 per kWh. In comparison, the District purchases power from Alliant for $.085 per kWh.

MANUFACTURER ISSUES – The District had positive experiences with both turbine manufacturers.

FUNDING DETAILS – The District received a $119,000 grant from the U.S. Department of Energy to install Turbine 1. The remaining cost of the project, $120,500, was financed by a low-interest loan approved by the Department of Natural Resources' (DNR) Energy Bank Program. Turbine 2 was financed with a $250,000 no interest loan from the Iowa Energy Center's (IEC) Alternate Energy Revolving Loan Program (AERLP) and a $530,000 Energy Bank approved loan, financed at 5.1 percent interest.

CONSTRUCTION ISSUES – Turbine 1 was installed by Minnesota Wind Power of Marshal, Minnesota. Turbine 2 was installed by Micon. The District had good experiences with both companies.

OPERATION AND MAINTENANCE

DATE TURBINES OPERATIONAL – Turbine 1: July 20, 1993; Turbine 2: October 29, 2001

ELECTRICITY SUPPLIED – On average, over the last five years, the turbines have supplied enough electricity to provide 60 percent of the District's total use. As of January 2006, together the two turbines had produced more than 10,000,000 kWh of electricity since they began operation.

PAYBACK PROJECTIONS – Turbine 1 was paid for in 5.5 years. The District estimates it will take 6.5 to 7 years to pay for Turbine 2.

ENERGY DOLLARS PRODUCED – Since 1998, the District has offset $23,124 annually in electricity costs with the power produced by Turbine 1. Turbine 2 is offsetting $120,987 and generating $1,377 in revenue from surplus sold each year. In 2008 when both turbines are owned free and clear, the District will no longer need to pay back loans and will save over $144,100 annually.[10,11]

OPERATION ISSUES – Tirevold reported no significant operation concerns.

MAINTENANCE PROVIDERS – Most of the maintenance for Turbine 1 is provided by Energy Maintenance Service in Gary, SD. The District has a five year service agreement with Micon (from an office based in Garner, IA) for the maintenance of Turbine 2.

MAINTENANCE COSTS –Turbine 2's first five years of maintenance were included in the purchase price.

WARRANTY ISSUES – Turbine 1 was covered, but Windworld went out of business. Turbine 2 has a five year warranty which costs $5,000 a year.

INSURANCE ISSUES – The turbines are covered under the District's policy and not a significant cost.

* Turbine 1 on right and Turbine 2 on left.

TURBINE FACTS

MANUFACTURERS/MODELS –
Turbine 1: Windworld
Turbine 2: NEG Micon 750/48

CAPACITIES – Turbine 1: 250 kW
Turbine 2: 750 kW

PROJECT COSTS – Turbine 1: $239,500
Turbine 2: $780,000

TOWER HEIGHTS – Turbine 1: 140 feet
Turbine 2: 180 feet

BLADE LENGTHS – Turbine 1: 45 feet
Turbine 2: 77 feet

TURBINE LOCATIONS – Both about 800 feet behind elementary

ADDITIONAL INFORMATION

EDUCATIONAL USES – The turbines have been used in curricula at various grade levels and subjects.

COMMUNITY RESPONSE – Modern wind power was so new in Iowa when Turbine 1 was installed that many community members could not visualize the project. However, once operational, people were eager to install a second.

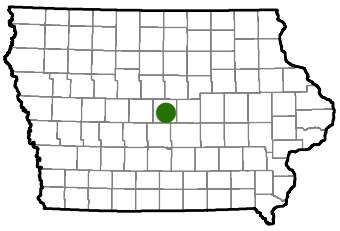
FUTURE WIND ENERGY PLANS – The District has considered installing another turbine in a few years. The District will be undertaking major construction and would like to produce enough power to compensate for their expansion.

OTHER RENEWABLE ENERGY/ENERGY EFFICIENCY PROJECTS – The District has converted its buildings to energy efficient lighting and uses geothermal heating and cooling in the high school.

NOTEWORTHY – The energy supplied by the District's turbines reduces their reliance on traditional energy. Since they began operating both turbines, the District annually emits 3,032,000 fewer pounds of carbon dioxide and 439,800 fewer pounds of sulfur dioxide.

CONTACT INFORMATION

NAME, TITLE – Jim Tirevold, Dir. of Blds & Grounds
ADDRESS – 900 20th St, Spirit Lake, IA 51360-1250
PHONE – 712.336.2820
EMAIL – jtirevold@spirit-lake.k12.ia.us
PROJECT WEBSITE – http://www.spirit-lake.k12.ia.us/~jtirevold/bg/building.htm



2. Nevada Community School District

District Facts

County – Story
District Enrollment[6] – 1,488 students
Population of Nevada[7] – 6,249 people
Approximate Elevation of Nevada[8] – 1,003 feet
Average Annual Wind Speed at Nevada[9] – 14.98 mph

Planning through Construction

Date Projects Started – Turbine 1 and 2: 1993

Key People Behind Projects – former Superintendent Ken Shaw, Director of Transportation Richard Scott, and a Nevada family including: retired banker Harold Fawcett, his wife Marjorie Fawcett, and his sister Josephine Fawcett Tope

Motivation – Harold Fawcett was inspired by the success at Spirit Lake and along with his family donated two wind turbines to the District.

Most Helpful Resource – The Fawcetts' gift was the key to Nevada's project.

Legal or Zoning Issues – The District worked with the City to meet the requirements for placing the turbines a certain distance from roads and electrical wires.

Interconnection Issues – Both turbines are connected to the grid. For the first year and half after instillation, Alliant refused to pay the District for surplus power. Now the District has a great relationship with Alliant which has subsequently allowed the District to consolidate all of its meters in the middle and high schools to offset consumption. Alliant purchases their surplus power for $.06 per kWh. The District purchases electricity from Alliant for $.10 to $.11 per kWh.

Manufacturer Issues – The District had a positive experience with Windworld, however, the company went out of business shortly after their turbines were installed and therefore was not available for assistance with problems.

Funding Details – The District did not have to pay for anything; all costs were covered by the Fawcetts.

Construction Issues – The construction process went smoothly, both turbines were installed by Windworld. Scott speculated that their two turbines and the one at Spirit Lake may be the only Windworld turbines still in operation in the U.S.

Operation and Maintenance

Date Turbines Operational – Turbine 1: Fall 1993; Turbine 2: Spring 1994

Electricity Supplied – Together the turbines generate about 414,000 kWh of electricity annually.[12]

Payback Projections – If the District had purchased the turbines, they would have been able to pay them off in 10 years.

Energy Dollars Produced – The District saves approximately $33,580 a year on electricity expenses.[12]

Operation Issues – It took a couple years for the turbines to operate smoothly, but now other than the concerns listed next, they run well. The biggest operation impediment was the failure of Turbine 2's gear box in 2003. There was only one gear box of this model ever built, so no replacements were available. It took the District a long time to decide how to proceed. When they choose to rebuild the gear box, the $80,000 cost was covered by the Fawcett Tope trust fund. Another operation issue has been working with the turbines' computer systems which were made in Sweden. When they rebuilt the gear box for Turbine 2 they also rewrote the program in English, allowing them to better maintain the turbine. Other incidental issues are that Turbine 2

has been hit by lightning twice and both turbines have to be turned off occasionally in the winter because of the risk of ice throw.

MAINTENANCE PROVIDERS – Most of the maintenance for the turbines is provided by Energy Maintenance Service, additionally Scott performs some troubleshooting.

MAINTENANCE COSTS – Fawcett Tope set up a trust fund for turbine maintenance so the District does not pay operation or maintenance expenses which average $3,000 a year.

WARRANTY ISSUES – The District does not have a warranty because Windworld went out of business.

INSURANCE ISSUES – The turbines are covered under the District's policy at no additional charge.

* Turbine 1 on left and Turbine 2 on right.

TURBINE FACTS

MANUFACTURERS – Turbine 1 & 2: Windworld
CAPACITIES – Turbine 1: 250 kW; Turbine 2: 200 kW
PROJECT COSTS – Turbine 1 & 2: $250,000 (donated)
TOWER HEIGHTS – Turbine 1 & 2: 140 feet
BLADE LENGTHS – Turbine 1 & 2: 35 feet
TURBINE LOCATIONS – Turbine 1 about 100 feet and Turbine 2 about 500 feet behind high school.

ADDITIONAL INFORMATION

EDUCATIONAL USES – The revenues from the turbines are invested in instructional materials, but the turbines are not often used directly in curricula.

COMMUNITY RESPONSE – Initially there were a lot of questions from community members, no resistance, but questions, for example about the noise the turbines would make. There have not been any complaints since instillation; rather the turbines are a source of community pride.

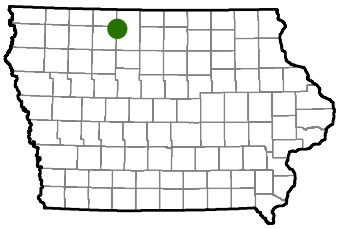
FUTURE WIND ENERGY PLANS – When Turbine 2 was broken, Scott researched installing a 750 kW machine to supply all the electricity the District uses, but the School Board rejected the proposal because they were in the process of building a new elementary. The District may consider it again in the future. If the District were to install a new turbine it would not be included in the existing contract and Alliant would purchase surplus power for only $.015 per kWh, meaning it would not be profitable for the District to install a turbine that produced a large surplus.

OTHER RENEWABLE ENERGY/ENERGY EFFICIENCY PROJECTS – The District is the only district in Iowa to run their vehicles on 100 percent soy biodiesel. The transportation department also uses soy grease.

NOTEWORTHY – The Fawcetts also donated a 225 kW Vestas V-29 to supply electricity for the Story County Medical Center in Nevada.

CONTACT INFORMATION

NAME, TITLE – Richard Scott, Director of Transportation
ADDRESS – 1035 15th St, Nevada, IA 50201
PHONE – 515.382.4067
EMAIL – rscott@mail.nevada.k12.ia.us



3. Sentral Community School District

District Facts

County – Kossuth
District Enrollment[6] – 195 students
Population of Fenton[7] – 293 people
Approximate Elevation of Fenton[8] – 1,240 feet
Average Annual Wind Speed at Fenton[9] – 16.57 mph

Planning through Construction

Date Project Started – 1993

Key People Behind Project – Three then teachers, Tammy Geitzenauer, Arlet Johnson, and Troy Bennet, took a science and technology in society course at the University of Iowa. The teachers fulfilled their required group project with a report on alternative energy. From this work they realized wind power might work at their school. With School Board approval, a committee comprised of teachers and local experts was formed and spent the next two years researching and planning.

Motivation – The District's primary motivation was to save money for their students' education.

Most Helpful Resources – The committee formed by the School Board did a lot of the work, assisted by a visit to Spirit Lake School and information shared by Monty Miller, a local owner of three turbines identical to the one the District installed.

Legal or Zoning Issues – Business Manager Joni Underwood did not recall any.

Interconnection Issues – The District has a contract with Alliant for net metering and the purchase of surplus power for $.06 per kWh.

Manufacturer Issues – The District did not have contact with the manufacturer because they purchased a turbine that had been previously used in California. It was reconditioned and sold to the District by Ecowind Development Corporation of California.

Funding Details – The District's Physical Plant and Equipment Levy Fund was used to finance $40,000 of the project's cost. The remaining $8,000 came from donations, partly raised by holding a community barbecue and auction of donated items.

Construction Issues – There were some glitches during the instillation period requiring the job to be finished by a different company.

Operation and Maintenance

Date Turbine Operational – October 1995

Electricity Supplied – Since November 2003 the turbine has produced about 36,800 kWh per year which supplements the electricity consumption of the K-12 building.[13]

Payback Projection – The turbine was paid for in five years.

Energy Dollars Produced – In the winter of 1995 the District reported saving $1,000 in single month on their electricity bills.[13] Underwood believes they are saving more now because of higher electricity rates; however, current data on their savings were not available.

Operation Issues – Initially, the District had problems with finding replacement parts and a qualified person to perform maintenance. Since then, they hired Energy Maintenance Service to maintain the turbine. The District also had a new computer system installed that connects the turbine directly with the building and with Energy Maintenance Service's office in South Dakota. This means that although located in South Dakota, Energy Maintenance Services knows as soon as the District when the turbine is not operating.

Maintenance Provider – Maintenance is performed by Energy Maintenance Service.

MAINTENANCE COSTS – The District spends $3,000 to $4,000 a year on maintenance; $2,600 is the fee for Energy Maintenance Service. Additionally, the school had a one time expense of $12,000 for the new computer system.
WARRANTY ISSUES – Underwood could not recall a warranty.
INSURANCE ISSUES – The turbine is covered by the District's policy.

ADDITIONAL INFORMATION

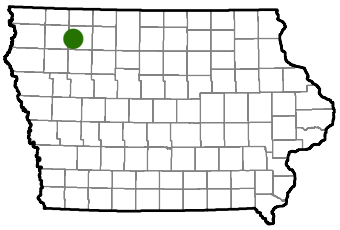
EDUCATIONAL USES – The turbine is not currently being used in class projects, but has in the past.
COMMUNITY RESPONSE – The community has supported the project from the beginning.
FUTURE WIND ENERGY PLANS – The District considered installing another turbine and hired Tom Wind, owner of Wind Utility Consulting based in Jefferson, Iowa, for analysis. They found the turbines currently being manufactured are too large for the District's electricity needs. However, the District remains open to the option.
OTHER RENEWABLE ENERGY/ENERGY EFFICIENCY PROJECTS – The District has installed energy efficient lighting.
NOTEWORTHY – One consideration for the District during the decision whether to install a turbine was that owning a turbine reduces electricity costs, giving the District an advantage in the face of school consolidations.

TURBINE FACTS

MANUFACTURER/MODEL – Windmatic 15 S
CAPACITY – 65 kW
PROJECT COST – $48,000
TOWER HEIGHT – 82 feet
BLADE LENGTH – 24.5 feet
TURBINE LOCATION – About 300 feet from buildings

CONTACT INFORMATION

NAME, TITLE – Joni Underwood, Business Manager
ADDRESS – 308 310th St, Fenton, IA 50539
PHONE – 515.889.2261
EMAIL – jlunder@sentral.k12.ia.us



4. Clay Central-Everly Community School District

District Facts

County – Clay
District Enrollment[6] – 462 students
Population of Royal[7] – 433 people
Approximate Elevation of Royal[8] – 1,412 feet
Average Annual Wind Speed at Royal[9] – 16.19 mph

Planning through Construction

Date Project Started – 1994
Key Person Behind Project – former Superintendent Dave Homqist
Motivation – Homqist was friends with Superintendent Harold Overmann of Spirit Lake and after discussions with Overmann thought it might be possible for his district to do what Spirit Lake had done.
Most Helpful Resource – According to Superintendent Monte Montgomery, Syverson Engineering, a firm based in Des Moines, was helpful during the planning phase.
Legal or Zoning Issues – The City required a building permit, but it was easy to obtain.
Interconnection Issues – Initially, Alliant did not want to provide net metering and wanted to purchase surplus power for only $.02 per kWh. However, the District negotiated a more favorable contract allowing them to net meter and sell surplus power for $.06 per kWh. The District purchases electricity from Alliant for $.085 per kWh. Additionally, the District receives a $.015 (in 1993 dollars, rises with inflation) per kWh incentive payment through the federal government's Renewable Energy Production Incentive (REPI) program.
Manufacturer Issues – The 20 year old turbine was purchased used from Lakota Power Group so the District had little interaction with Windmatic.
Funding Details – The project was financed with a loan approved by the Energy Bank Program for three percent interest.
Construction Issues – The turbine was installed by John Sayler, president of the former Lakota Power Group. Local labor was used for pad construction and crane operation and an electric company from Dickens, Iowa was employed.

Operation and Maintenance

Date Turbine Operational – October 1995
Electricity Supplied – Averaged since September 1998, the turbine's actual annual production has been 89,223 kWh. The Royal elementary building uses about 167,000 kWh of electricity annually.[14]
Payback Projection – The District projects it will take 12 years to pay for the turbine.
Energy Dollars Produced – On average, since 1998 the District has saved about $7,600 on electricity expenses.[14]
Operation Issues – The largest operation impediment is that the turbine's pinion gears are frequently stripped and previously the District was able to purchase replacements only from Holland. There is now a local business that can make them, but there are still often extended periods of down time before they are replaced.
Maintenance Provider – Most of the maintenance is done by the District's custodian. Major repairs are handled by Mark Crawmer of Des Moines. The custodian learned to fix many problems from watching Crawmer.

MAINTENANCE COSTS – Regular maintenance costs about $900 a year. The District has had years where this was greater, due to expenses from a lightning strike and replacing computer boards and pinion gears.

WARRANTY ISSUES – The District had a three year warranty with Lakota Power Group which was included in the cost of the turbine.

INSURANCE ISSUES – The turbine is covered under the District's overall insurance policy.

ADDITIONAL INFORMATION

EDUCATIONAL USES – The turbine has been used in science classes and students have created science fair projects involving the turbine.

COMMUNITY RESPONSE – The community supports the District's use of wind power. However, members did have questions about why this particular turbine was chosen, because the initial studies were done for a 125 kW machine. The District chose to install this 95 kW turbine because of the lower initial cost.

FUTURE WIND ENERGY PLANS – The District would be interested in installing another turbine, but currently has no plans to do so.

OTHER RENEWABLE ENERGY/ENERGY EFFICIENCY PROJECTS – Energy efficient lighting was installed in the school at the same time as the turbine. That retrofit actually saves the District more money than the turbine.

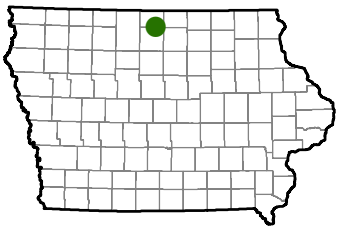
NOTEWORTHY – Lightning strikes were reported by many schools. When lightning struck the District's turbine, new computer boards had to be shipped from Holland causing a long period when the turbine was not operational.

TURBINE FACTS

MANUFACTURER/MODEL – Windmatic 17 S
CAPACITY – 95 kW
PROJECT COST – $130,800
TOWER HEIGHT – 90 feet
BLADE LENGTH – 30 feet
TURBINE LOCATION – About 80 feet from building

CONTACT INFORMATION

NAME, TITLE – Monte Montgomery, Superintendent
ADDRESS – 401 Church St, Royal, IA 51357
PHONE – 712.933.2242
EMAIL – mmontgomery@clay-royal.k12.ia.us



5. Forest City Community School District

District Facts

County – Winnebago
District Enrollment[6] – 1,359 students
Population of Forest City[7] – 4,248 people
Approximate Elevation of Forest City[8] – 1,250 feet
Average Annual Wind Speed at Forest City[9] – 15.69 mph

Planning through Construction

Date Project Started – 1996

Key People Behind Project – In 1996 junior Paul Smith began a physics project to assess Forest City's wind potential. With the help of his teacher he had an anemometer installed on top of the town's water tower. He shared the resulting data with the School Board and City Council. Subsequently the School Board formed a wind energy task force of which Smith was a member. After studying the possibility for eight months, the task force concluded the wind potential was large enough to make a turbine economically attractive. Superintendent Dwight Pierson was also very supportive of the project and completed much of the work.

Motivation – The primary motivation was the initiative taken by Smith and his teacher and the economic benefit of operating a turbine.

Most Helpful Resources – According to Pierson, the City of Forest City and the superintendent of the Forest City Municipal Utility were helpful during the planning phase.

Legal or Zoning Issues – The Federal Aviation Administration (FAA) required that the District install a red light on top of the turbine.

Interconnection Issues – The power produced by the turbine is fed directly to the grid and the Forest City Municipal Utility purchases the power at same price for which they currently sell power to the school. The District also receives REPI payments.

Manufacturer Issues – The District is satisfied with their experience with Nordex.

Funding Details – The District received a $250,000 no interest loan from the AERLP. The remaining cost was covered by a loan from a local bank at 4.1 percent interest.

Construction Issues – The turbine was constructed by Nordex using local labor for the cement work and tower instillation. The District had a longer than anticipated wait for the tower which delayed construction until January. The extremely cold temperatures required cables be heated foot by foot.

Operation and Maintenance

Date Turbine Operational – January 1999

Electricity Supplied – The turbine supplies 60 to 65 percent of the District's electricity consumption; an average of 887,104 kWh per year since January 2000.[15]

Payback Projection – The District plans to have paid off their loans in 11 to 13 years.

Energy Dollars Produced – Since 2000, the District has averaged $55,477 in revenue annually.[15] On a windy day (winds at 12 mph, which occurs approximately a 100 days a year in Forest City) the District can save $600 a day.

Operation Issues – It took about two years to work out the kinks, but the turbine now operates smoothly.

Maintenance Provider – Most of the maintenance is provided by the District's custodian. The District sent the custodian to Europe for three weeks so he could learn turbine maintenance. Since this training, the custodian has been able to manage 95 percent of the problems. Before,

there were extended periods of down time, but now the custodian, armed with a pager, can manage problems in seconds.

MAINTENANCE COSTS – The District estimates they spend $5,000 a year on maintenance. A major breakdown in 2001 cost an additional $70,000 and prolonged the District's payback period.

WARRANTY ISSUES – The turbine is under warranty for 10 years.

INSURANCE ISSUES – The turbine is covered under the District's overall policy; there was no increase in the premium because nothing justified charging more.

TURBINE FACTS

MANUFACTURER/MODEL – Nordex N43

CAPACITY – 600 kW

PROJECT COST – $673,000

TOWER HEIGHT – 160 feet

BLADE LENGTH – 75 feet

TURBINE LOCATION – About 900 feet from buildings

ADDITIONAL INFORMATION

EDUCATIONAL USES – Pierson said the opportunity for students to learn about a growing technology was a primary reason for installing it. The turbine is used in a physical science course.

COMMUNITY RESPONSE – The turbine is a source of community pride. The only calls the District receives from citizens about the turbine are when it is not operating, because people like to see it spinning.

FUTURE WIND ENERGY PLANS – The District does not have plans for installing another turbine.

OTHER RENEWABLE ENERGY/ENERGY EFFICIENCY PROJECTS – In 2004 the District installed a geothermal heating and cooling system in the elementary and middle school buildings.

NOTEWORTHY – 1) The turbine is lit at night by three lights that run from the turbine's power; it is visible several miles outside town. 2) The same grid the District's turbine power transmits on is used by Winnebago Industries, the world's largest RV manufacturer. During summer vacation, the District uses very little of the turbine's electricity allowing the Forest City power plant to reduce their peak production during Winnebago Industry's busy season.

CONTACT INFORMATION

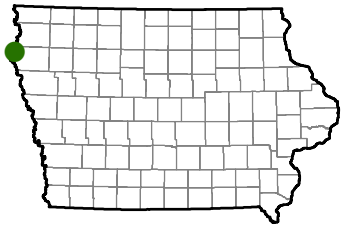
NAME, TITLE – Dwight Pierson, Superintendent

ADDRESS – 206 West School St, Forest City, IA 50436

PHONE – 641.585.2323

EMAIL – dpierson@forestcity.k12.ia.us

PROJECT WEBSITE – http://www.forestcity.k12.ia.us/Pages/windturbine/Wind%20site05/Forest_City_School%D5s_Wind_.html



6. AKRON-WESTFIELD COMMUNITY SCHOOL DISTRICT

DISTRICT FACTS

COUNTY – Plymouth
DISTRICT ENROLLMENT[6] – 626 students
POPULATION OF AKRON[7] – 1,478 people
APPROXIMATE ELEVATION OF AKRON[8] – 1,147 feet
AVERAGE ANNUAL WIND SPEED AT AKRON[9] – 14.98 mph

PLANNING THROUGH CONSTRUCTION

DATE PROJECT STARTED – 1996

KEY PEOPLE BEHIND PROJECT – A local business man donated a small turbine to the school for testing the wind potential. When they found there was not enough wind on campus, the District decided to lease nearby property from a willing landowner. A group of 20 students, led by Special Projects Coordinator Ronald Wilmot were involved from the beginning. They assisted in the analysis, design, and construction documentation and administration. These students learned first hand about wind power as well as how to give good presentations.

MOTIVATION – The primary motivation was to reduce the District's dependence on fossil fuels and thereby reduce their environmental impact.

MOST HELPFUL RESOURCE – Wilmot said Paul Ryan of Prochaska Energy Consulting in Omaha, Nebraska was very helpful during the planning phase. The students gathered and processed the data with assistance from Ryan.

LEGAL OR ZONING ISSUES – The city challenged the wind turbine on two counts. The mayor's first complaint was that the school was getting free power because turbine did not produce power continuously and city power had to fill the gap. Later, the mayor sued the District because he said the Akron Municipal Utility could not buy energy from anyone other than their existing sources. The case was resolved in the Iowa Supreme Court with the city and the school splitting the difference owed to the city.

INTERCONNECTION ISSUES – The District has a contract with the Akron Municipal Utility which purchases the turbine's power at the same rate they sell power to the school. The District also receives REPI payments.

MANUFACTURER ISSUES – The District has been very happy with Vestas.

FUNDING DETAILS – The District received a $250,000 no interest loan from the AERLP and financed the remaining $455,000 with an Energy Bank approved loan at 4.85 percent interest.

CONSTRUCTION ISSUES – The turbine was installed by Vestas. Wilmot was pleased they allowed students to participate in the process.

OPERATION AND MAINTENANCE

DATE TURBINE OPERATIONAL – February 1999

ELECTRICITY SUPPLIED – The turbine produces an average of 1,427,560 kWh a year.[16]

PAYBACK PROJECTION – The District anticipates a nine-year payback period.

ENERGY DOLLARS PRODUCED – On average, the electricity produced by the turbine is estimated to save the District $59,000 a year on electricity.[16]

OPERATION ISSUES – In general the operation of the turbine has been very smooth, however the turbine did get struck by lightning once, the transmission broke, and the turbine has to shut down occasionally for periods no longer than three or four days when the blades are icy.

MAINTENANCE PROVIDER – The maintenance is provided by Vestas, although Wilmot does minor repairs.

MAINTENANCE COSTS – The District spends $3,000 a year for their contract with Vestas.

WARRANTY ISSUES – The warranty cost $12,000 for the first three years and then $9,000 a year for the fourth and fifth year.

INSURANCE ISSUES – The turbine is covered under the District's general policy.

ADDITIONAL INFORMATION

EDUCATIONAL USES – The turbine is incorporated in a high school physical science course and every year the third grade class is taken on a fieldtrip to the turbine.

COMMUNITY RESPONSE – Overall the community appreciates the turbine. After the project was completed many people inquired why the District didn't install more turbines.

FUTURE WIND ENERGY PLANS – The District has a high interest in installing another turbine because of increasing energy prices, but is not pursuing anything at this time.

OTHER RENEWABLE ENERGY/ENERGY EFFICIENCY PROJECTS – The roofs of the District's buildings were redone with a cover of six-inch thick foam and a rubber seal to conserve energy. Additionally, the elementary building has high efficiency boilers and the high school has high efficiency hot water heaters.

NOTEWORTHY – During windy evenings when the school is not using much electricity, the entire town can be powered by the turbine.

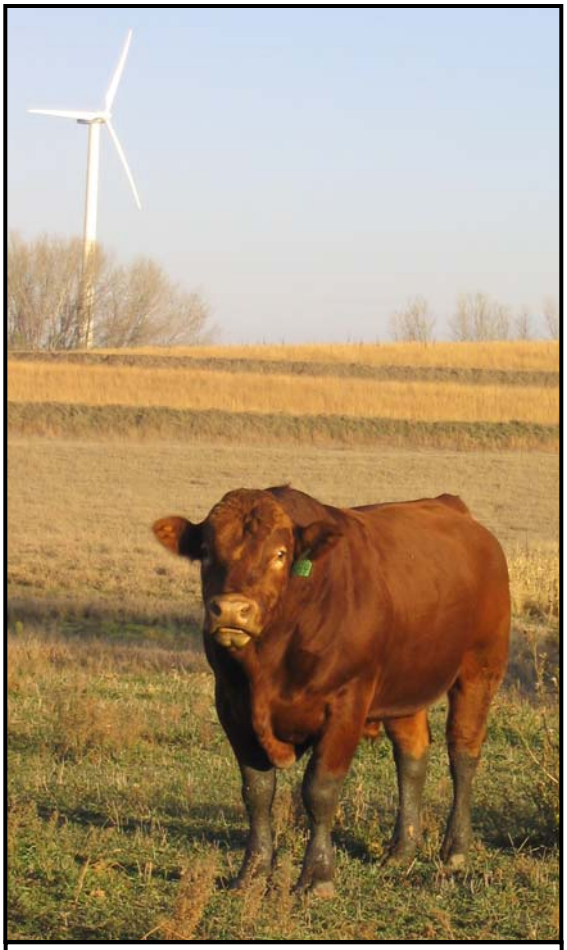
CONTACT INFORMATION

NAME, TITLE – Ronald Wilmot, retired Special Projects Coordinator

ADDRESS – 850 Kerr Dr, Akron, IA 51001

PHONE – 712.568.2020

EMAIL – rwjss504@yahoo.com



TURBINE FACTS

MANUFACTURER/MODEL – Vestas V44

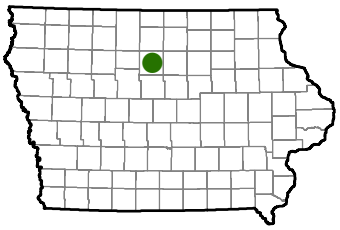
CAPACITY – 600 kW

PROJECT COST – $623,240

TOWER HEIGHT – 160 feet

BLADE LENGTH – 76 feet

TURBINE LOCATION – About 1,500 feet from buildings



7. CLARION-GOLDFIELD COMMUNITY SCHOOL DISTRICT

DISTRICT FACTS

COUNTY – Wright
DISTRICT ENROLLMENT[6] – 937 students
POPULATION OF CLARION[7] – 2,848 people
APPROXIMATE ELEVATION OF CLARION[8] – 1,168 feet
AVERAGE ANNUAL WIND SPEED AT CLARION[9] – 15.83 mph

PLANNING THROUGH CONSTRUCTION

DATE PROJECT STARTED – The District began thinking about installing a turbine in the early 1990s.
KEY PEOPLE BEHIND PROJECT – Superintendent Robert Olson had several information gathering phone calls with Superintendent Harold Overmann of Spirit Lake. When the DNR learned of the District's interest they offered assistance.
MOTIVATION – There was a combination of motivating factors including reduced dependence on purchased energy and the educational value.
MOST HELPFUL RESOURCE – Olson identified Tom Wind, who assisted the District during many phases of the project, as the most helpful resource
LEGAL OR ZONING ISSUES – The District had the project approved by the City.
INTERCONNECTION ISSUES – Establishing an agreement with MidAmerican Energy Company was a four year process, because MidAmerican did not want to provide net billing. MidAmerican argued their case at the Iowa Utilities Board, the Iowa District Court, the Iowa Supreme Court, and the Federal Energy Regulatory Commission. It was finally decided MidAmerican had to provide net metering for the District. However, MidAmerican did not permit them to consolidate meters; they were allowed to choose only one meter for net metering. This thwarted the District's plan of installing a larger turbine; they were considering a 750 kW machine.
MANUFACTURER ISSUES – Atlantic Orient declared bankruptcy while the District was working with them. This caused a nine month delay in the construction of the turbine and poor support and service.
FUNDING DETAILS – The District received a grant for $26,000 obtained by the DNR from the U.S. Department of Energy. The rest of the project was funded by loans; the District received a $55,000 no interest loan from AERLP and a $55,000 Energy Bank approved loan at 6 percent interest.
CONSTRUCTION ISSUES – Despite extensive delays, the construction process went smoothly; Atlantic Orient installed the turbine with help from local companies for crane operation, pad construction, and electric wiring.

OPERATION AND MAINTENANCE

DATE TURBINE OPERATIONAL – June 15, 2002
ELECTRICITY SUPPLIED – Between June 2002 and February 2004 the turbine has produced an average of 53,788 kWh of electricity a year, which supplies enough power for half the high school's lights.[17]
PAYBACK PROJECTION – The District estimates a seven year payback period.
ENERGY DOLLARS PRODUCED – Between June 2002 and February 2004 the District saved an average of $3,496 annually in electricity costs.[17]
OPERATION ISSUES – The turbine has had several performance problems; the tip brakes often break and the District is unable to find someone to help them establish a computer link between the turbine and the classroom.

MAINTENANCE PROVIDER – The District's custodian does some of the maintenance and is compensated with extra vacation days. The District frequently has problems with the turbine and has been unable to find a reliable service provider. Their current provider comes from a regional office of EnXco a company based in North Palm Springs, California.

MAINTENANCE COSTS – The District spends less than $1,000 per year on maintenance.

WARRANTY ISSUES – The District does not have a warranty because Atlantic Orient declared bankruptcy.

INSURANCE ISSUES – The insurance costs are negligible.

TURBINE FACTS

MANUFACTURER/MODEL – Atlantic Orient 15/50
CAPACITY – 50 kW
PROJECT COST – $142,000
TOWER HEIGHT – 100 feet
BLADE LENGTH – 24 feet
TURBINE LOCATION – About 400 feet from high school

ADDITIONAL INFORMATION

EDUCATIONAL USES – The turbine has not been used in curricula as much as the District planned, because they are unable to obtain the assistance needed to wire the information into classrooms.

COMMUNITY RESPONSE – When the turbine is operating properly it is an item of community pride.

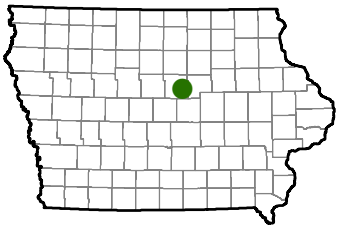
FUTURE WIND ENERGY PLANS – The District would be interested in installing another turbine, but Olson says before they pursue this they would require help from the Iowa Legislature to remove MidAmerican's connection barriers.

OTHER RENEWABLE ENERGY/ENERGY EFFICIENCY PROJECTS – The District installed geothermal heating and cooling in the high school.

NOTEWORTHY – By accepting the grant from the U.S. Department of Energy, the District agreed to purchase a turbine manufactured by an American company. However, Atlantic Orient was the only American manufacturer available at the time and their company was undercapitalized. The District would have been monetarily ahead to purchase a reconditioned 65 kW Windmatic turbine, without the grant.

CONTACT INFORMATION

NAME, TITLE – Robert Olson, Superintendent
ADDRESS – 319 3rd Ave, Clarion, IA 50525
PHONE – (515) 532-3423
EMAIL – rolson@clargold.k12.ia.us
PROJECT WEBSITE – http://www.clargold.k12.ia.us/high/staff/jwilson/Wind%20Turbine/Wind%20Turbine.htm



8. Eldora-New Providence Community School District

District Facts

County – Hardin
District Enrollment[6] – 674 students
Population of Eldora[7] – 2,892 people
Approximate Elevation of Eldora[8] – 1,088 feet
Average Annual Wind Speed at Eldora[9] – 15.02 mph

Planning through Construction

Date Project Started – Fall 1996
Key People Behind Project – Former Superintendent William Grove and representatives of Alliant Energy
Motivation – In 1995 a District principal attended a presentation about wind turbines. After the conference, he asked Grove and the School Board if they would like to pursue wind power. They agreed to investigate the option in order to save the District money and because they believed it was important as an educational institution to model green energy.
Most Helpful Resources – Grove felt the most helpful resources were Tom Wind and IEC.
Legal or Zoning Issues – The District had to place the turbine 200 yards from houses to avoid casting a shadow flicker when the blades rotating with the sun behind them.
Interconnection Issues – It took the District over three years to negotiate a contract with Alliant. Initially, Alliant would not agree to allow the District to net meter, but the District took their argument to the Iowa Utilities Board which required Alliant to do so. Despite this, the District had a good relationship with Alliant, established during their initial meeting when Grove expressed that the District was interested in working with Alliant, not as an adversary. Grove felt this set the tone and founded a good relationship. Although not required by law, Alliant allowed the District to consolidate all of their meters for net metering. Under their 10 year contract with Alliant, the District is paid $.021 per surplus kWh.
Manufacturer Issues – The District was happy with Micon.
Funding Details – The District borrowed $250,000 from AERLP at zero percent interest and $550,000 from the Hardin County Savings Bank of Eldora at 5.5 percent interest.
Construction Issues – The turbine was installed by Micon. One problem that arose during construction was when the crane lifted the tower onto the base the iron rods to secure the generator did not match the holes in the tower base because inches were used to measure one distance and meters the other. They company had to return the base to North Dakota for repair.

Operation and Maintenance

Date Turbine Operational – October 21, 2002
Electricity Supplied – As of January 2003, the turbine has produced an average of 1,293,120 kWh of electricity annually, equal to 90 percent of the District's consumption.[18] Since July 2003, the turbine has been available 95 percent of the time there was sufficient wind for operation.
Payback Projection – The District is on schedule to pay off their loans in 8.5 years.
Energy Dollars Produced – Once the District has paid back the loans it will save $84,308 (the average since 2003) in electricity costs a year and on average earn an additional $10,138 from selling excess power annually.[18] Additionally, Alliant has raised electric rates twice since the turbine has been installed, meaning that savings have also increased.
Operation Issues – The turbine had some glitches during its first three months but now operates smoothly. When the turbine is not operating, the District often receives phone calls almost

immediately from residents of a nearby retirement home who can see the turbine from their windows.

MAINTENANCE PROVIDER – Micon provides maintenance through an office located near Clear Lake, Iowa. They usually take care of problems within a day.

MAINTENANCE COSTS – The District pays $8,000 to Micon for service annually.

WARRANTY ISSUES – The turbine is covered by a two year warranty, to continue being covered by warranty for three additional years, the District paid $20,000, included in the total project cost.

INSURANCE ISSUES – The turbine is covered under the District's general policy.

TURBINE FACTS

MANUFACTURER – NEG Micon
CAPACITY – 750 kW
PROJECT COST – $800,000
TOWER HEIGHT – 160 feet
BLADE LENGTH – 80 feet
TURBINE LOCATION – About 200 feet from high school

ADDITIONAL INFORMATION

EDUCATIONAL USES – A computer records the turbine's production and up-to-date data is available in the main office. The turbine is used in a physics course.

COMMUNITY RESPONSE – The community is very happy with the project, and many people are proud of it. Grove said, "I wish I had a dollar for every community member who has told me, 'that generator is so neat.'"

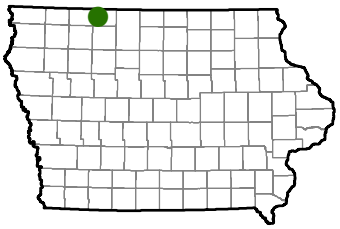
FUTURE WIND ENERGY PLANS – This turbine meets most of the District's needs so they are not considering another.

OTHER RENEWABLE ENERGY/ENERGY EFFICIENCY PROJECTS – The high school uses air-to-air heat pump system and the elementary uses high efficiency burners. All buildings had energy efficient lighting installed and the school buses run on a soy diesel mix.

NOTEWORTHY – Grove noted that in his 40 year educational career, the turbine project was the only thing he did that received 100 percent community approval.

CONTACT INFORMATION

NAME, TITLE – William Grove, former Superintendent
ADDRESS – 1800 24th St, Eldora, IA 50627-1558
PHONE – 641.939.5631
EMAIL – blgrove@netins.net
PROJECT WEBSITE – http://www.eldora-np.k12.ia.us/enpdistrict/index.html



9. Iowa Lakes Community College - Estherville

District Facts

County – Emmet
Campus Enrollment[6] – nearly 1,000 full- and part-time students
Population of Estherville[7] – 6,401 people
Approximate Elevation of Estherville[8] – 1,290 feet
Average Annual Wind Speed at Estherville[9] – 15.87 mph

Planning through Construction

Date Project Started – 2002
Key People Behind Project – President Michael Hupfer, Mary Mohni then Executive Dean at the Estherville Campus, and Rick Underbakke then Chief Academic Officer
Motivation – The turbine was pursued as a way to cut expenses; the Estherville campus was chosen because it had the highest electricity costs of Iowa Lakes Community College's five campuses. Part of the project was to establish the nation's first Wind Energy and Turbine Technology associate's degree program. Hupfer was interested in starting this program because he wanted students to have the opportunity to learn skills that would allow them to find good jobs available in their own communities.
Most Helpful Resource – Hupfer said Tom Wind was a valuable consultant.
Legal or Zoning Issues – The College had to file an application with the FAA.
Interconnection Issues – The College has a contract with Estherville Municipal Utility for the purchase of electricity for $.035 per kWh, whereas the College purchases electricity from the City for $.05 per kWh.
Manufacturer Issues – The College was very pleased with Vestas and according to Hupfer their dealings with them were "as smooth as silk."
Funding Details – Congress appropriated the College $500,000 for the turbine and $500,000 for a laboratory to train students enrolled in the wind energy program.
Construction Issues – The turbine was installed by Vestas and the process went well.

Operation and Maintenance

Date Turbine Operational – February 15, 2005
Electricity Supplied – It is believed the turbine will produce 6,000,000 kWh annually. All the power is sold directly to the utility and in fact, averaged over February through December 2005, the wind turbine supplied six percent of the power purchased by the Estherville Municipal Utility.[19]
Payback Projection – The College projects it will take 12 years to pay for the turbine.
Energy Dollars Produced – The College predicts it will make $560,000 in revenue, accounting for the $160,000 it spends on electricity plus an additional $400,000.
Operation Issues – There have not been any major operation problems.
Maintenance Provider – All maintenance is provided by Al Zeitz, coordinator of the Wind Energy and Turbine Technology program, and the students enrolled in the program.
Maintenance Costs – There is no direct cost.
Warranty Issues – A three year warranty was included in the turbine cost.
Insurance Issues – The College only pays a few hundred dollars for insurance.

Additional Information

Educational Uses – Students enrolled in the two year Wind Energy and Turbine Technology program learn about all aspects of wind power, including the exciting first day task of climbing

the tower. In the opening class entering Fall 2004, 15 students enrolled and 8 of them returned for a second year. The Fall 2005 class has 30 students. All students are required to complete a summer internship and several students receive job offers from this experience. Hupfer reported that many students in the class graduating in May 2006 already had job offers as of November 2005.

COMMUNITY RESPONSE – The community embraced the project, in fact many people sat in lawn chairs to watch construction. The College has held open houses allowing residents to climb inside the base of the tower.

FUTURE WIND ENERGY PLANS – The College was considering installing a turbine at its Emmetsburg Campus, but it currently seems doubtful it will be economically feasible.

OTHER RENEWABLE ENERGY/ENERGY EFFICIENCY PROJECTS – The College also started a Biomass Energy Processing program, which they hope will be another way to provide students with good jobs located in Iowa.

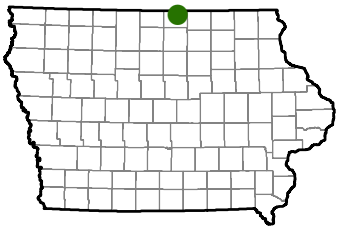
NOTEWORTHY – Hupfer said he was 100 percent satisfied with the turbine and the academic program because as a result College enrollment has grown and the program has attracted students from all over the nation.

TURBINE FACTS

MANUFACTURER/MODEL – Vestas V82
CAPACITY – 1.65 MW
Project Cost – $1,800,000
TOWER HEIGHT – 230 feet
BLADE LENGTH – 131 feet
TURBINE LOCATION – Turbine sits on the south edge of town on .25 acres purchased by the College.

CONTACT INFORMATION

NAME, TITLE – Michael Hupfer, President
ADDRESS – 300 S 18th St, Estherville, IA 51334
PHONE – 712.362.3505
PROJECT WEBSITE – http://www.iowalakes.edu/programs_study/industrial/wind_energy_turbine/index.htm



10. NORTHWOOD-KENSETT COMMUNITY SCHOOL DISTRICT

DISTRICT FACTS

COUNTY – Worth
DISTRICT ENROLLMENT[6] – 524 students
POPULATION OF NORTHWOOD[7] – 2,016 people
APPROXIMATE ELEVATION OF NORTHWOOD[8] – 1,232 feet
AVERAGE ANNUAL WIND SPEED AT NORTHWOOD[9] – 16.1 mph

PLANNING THROUGH CONSTRUCTION

DATE PROJECT STARTED – Spring 2001

KEY PEOPLE BEHIND PROJECT – Superintendent Thomas Nugent, Alliant Energy Account Manager Jim Collins, and Alliant Energy Technical Support provider Kevin Lehs

MOTIVATION – The first motivation was lower energy costs; the second was the educational opportunity.

MOST HELPFUL RESOURCES – Nugent reported the employees of Alliant mentioned above were the most helpful resources because they had been involved in many previous projects.

LEGAL OR ZONING ISSUES – The District originally wanted to move the turbine from its current location nine miles away near Joice, Iowa onto school property. The District made plans for disassembling, transport, road access, and reassembling, but the FAA ruled placement on campus illegal because of the nearby airport. Since they were unable to move the turbine to District property, they chose to leave it where it was and pay $1,850 annually for leasing the land.

INTERCONNECTION ISSUES – The District has a 30 year agreement with Alliant for the purchase of power for $.0602 per kWh. As of November 2005, the turbine was not yet producing power to be purchased by Alliant because the project was not entirely completed.

MANUFACTURER ISSUES – Two employees of Nordex traveled from Denmark to help the District begin to operate the turbine. Nugent said the officials were extremely competent, professional, and thorough.

FUNDING DETAILS – The District received a $135,000 no interest loan from AERLP and is approved for a 4.25 percent loan from Farmers State Bank in Northwood.

CONSTRUCTION ISSUES – The turbine was installed in 1998 before the District purchased it. After an inspection and tune-ups performed by the Nordex employees, they estimated the turbine has 25 years of operation remaining.

OPERATION AND MAINTENANCE

DATE TURBINE OPERATIONAL –The turbine was not in operation when the District purchased it in March 2004 and the project was not yet complete as of November 2005.

ELECTRICITY SUPPLIED – As of November 2005 the turbine had not yet started producing power for purchase by Alliant, but they estimate it will produce 408,000 kWh annually.[20]

PAYBACK PROJECTION – Depending on whether the District needs to take the Farmers State Bank loan, the payback period will either be four or eight years.

ENERGY DOLLARS PRODUCED – The District estimates they will make $40,000 from selling power to Alliant.[20]

OPERATION ISSUES – Work still needs to be done to install a turbine communication devise so data can be used in the classroom. One of the challenges is not having it outside the door, but the District hears by word of mouth when it is not running from families that live near the turbine.

MAINTENANCE PROVIDER – The District will contract with Alliant and Nordex for maintenance. Alliant will complete hands-on repairs and Nordex will solve computer issues.

MAINTENANCE COSTS – The District estimates it will spend $5,000 for maintenance plus $1,500 on operations annually.

WARRANTY ISSUES – The turbine is not under warranty.

INSURANCE ISSUES – The District purchased a $250,000 insurance policy for $261 annually.

*Top of Iowa wind farm pictured.

TURBINE FACTS

MANUFACTURER/MODEL – Nordex N27

CAPACITY – 250 kW

PROJECT COST – Still to be determined, $200,000 or above.

TOWER HEIGHT – 130 feet

BLADE LENGTH – 44 feet

TURBINE LOCATION – Amongst the turbines in the 80.1 MW Top of Iowa wind farm near Joice, nine miles from the school.

ADDITIONAL INFORMATION

EDUCATIONAL USES – The District plans to use the turbine in their curricula once they purchase a communication devise.

COMMUNITY RESPONSE – Nugent says people are happy the turbine is up and running and very pleased the School Board had the vision to start and complete the process.

FUTURE WIND ENERGY PLANS – The District does not have any.

OTHER RENEWABLE ENERGY/ENERGY EFFICIENCY PROJECTS – The District installed energy efficient windows, doors, and lights as well as efficient heating in the elementary school.

NOTEWORTHY – The District sees this as a tremendous economic, environmental, and educational opportunity that will allow them to spend more money for students and less for energy.

CONTACT INFORMATION

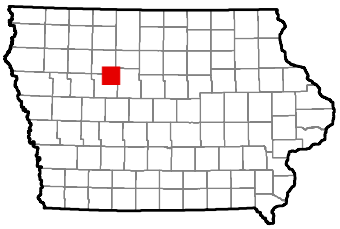
NAME, TITLE – Thomas Nugent, Superintendent

ADDRESS – 1200 1st Ave N, Northwood, IA 50459

PHONE – 641.324.2021

EMAIL – tnugent@nwood-kensett.k12.ia.us

SCHOOLS THAT HAVE CONSIDERED WIND POWER



1. MANSON NORTHWEST WEBSTER COMMUNITY SCHOOL DISTRICT

DISTRICT FACTS

COUNTY – Calhoun
DISTRICT ENROLLMENT[6] – 795 students
POPULATION OF MANSON[7] – 1,767 people
APPROXIMATE ELEVATION OF MANSON[8] – 1,221 feet
AVERAGE ANNUAL WIND SPEED AT MANSON[9] – 16.14 mph

PROJECT DETAILS

DATE PROJECT STARTED – 1995
KEY PERSON BEHIND PROJECT – Former Superintendent David Walkup
MOTIVATION – The District's primary motivation was to lower energy costs.
MOST HELPFUL RESOURCES – The District worked with Syverson Engineering, the Energy Bank Program, and Ahlers Law Firm.

EXTENT OF PLANNING

FEASIBILITY STUDIED – The District had completed a feasibility study and estimated they would save $60,000 per year on electricity expenses.
UTILITY AGREEMENTS – The District had discussed their plans with MidAmerican.
FUNDING SOUGHT – The District had worked with the Energy Bank Program.
TURBINE SELECTED – The District was planning to install two 250 kW turbines one for the Barnum middle school and one for the elementary and high school at Manson.

REASON FOR DECISION

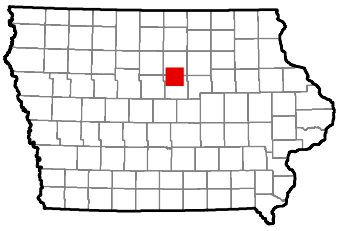
BIGGEST IMPEDIMENT – The biggest roadblock to installing the turbines was MidAmerican's proposed low purchase rates.
FINAL REASON – The final reason for not installing the turbines was the high upfront cost and MidAmerican's buy back rate was too low for it to be economically feasible for the District.

ADDITIONAL INFORMATION

FUTURE WIND ENERGY PLANS – The District does not have any at this time, but would consider a project if MidAmerican's purchase rates were increased.

CONTACT INFORMATION

NAME, TITLE – Karen Wallace, Secretary
ADDRESS – 1227 16th St, Manson, IA 50563
PHONE – 712.469.3598
EMAIL – wallacek@manson-nw.k12.ia.us



2. Iowa Falls Community School District

District Facts

County – Hardin
District Enrollment[6] – 1,107 students
Population of Iowa Falls[7] – 5,091 people
Approximate Elevation of Iowa Falls[8] – 1,113 feet
Average Annual Wind Speed at Iowa Falls[9] – 15.31 mph

Project Details

Date Project Started – 2002
Key People Behind Project – Members of the School Board and Superintendent John Robbins
Motivation – The District's primary motivation was to lower energy costs thereby saving general fund dollars to invest in students.
Most Helpful Resources – Robbins cited the Energy Bank Program and Alliant as helpful resources.

Extent of Planning

Feasibility Studied – The District had completed a feasibility study with help from Tom Wind and Iowa Winds, a company interested in developing a wind farm in the area.
Utility Agreements – The District tried to reach an agreement with Alliant.
Funding Sought – The District worked with the Energy Bank Program.
Turbine Selected – The District was considering installing a 650 kW turbine.

Reason for Decision

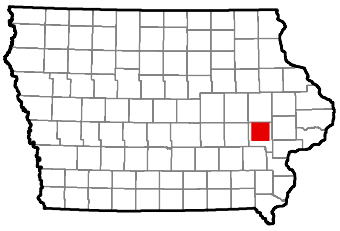
Biggest Impediment – The biggest roadblock to installing a turbine was Alliant's refusal to allow the District to consolidate its meters for net metering. They did not understand why Alliant would allow the nearby Eldora-New Providence School District to consolidate its meters, but not permit them.
Final Reason – Because they could not consolidate meters, a turbine was not economically feasible.

Additional Information

Future Wind Energy Plans – The District would like to install a turbine if the net metering rules were changed to allow them to consolidate their meters.
Recommendations – Robbins recommended schools visit with their utilities about allowing consolidation of meters.

Contact Information

Name, Title – John Robbins, Superintendent
Address – 710 North St, Iowa Falls, IA 50126
Phone – 641.648.6400
Email – jrobbins@po-1.iowa-falls.k12.ia.us



3. Iowa City Community School District

District Facts

County – Johnson
District Enrollment[6] – 10,637 students
Population of North Liberty[7] – 7,638 people
Approximate Elevation of North Liberty[8] – 765 feet
Average Annual Wind Speed at North Liberty[9] – 13.97 mph

Project Details

Date Project Started – 2002-2003
Key People Behind Project – Board of Education members, in particular, Dave Franker, and community members were interested in installing a turbine.
Motivation – The District was building a new elementary building in North Liberty and wanted it to be environmentally friendly so it could be certified under the Leadership in Energy and Environmental Design program. The District installed day lighting, permeable concrete, no flush urinals, and a geothermal heat pump; they were hoping a wind turbine could also be installed.
Most Helpful Resources – The District worked with Bill Haman of the IEC, the Linn County Rural Electric Cooperative (REC), Tom Wind, and The Energy Group. Superintendent Lane Plugge said Haman was very helpful because he helped the school plan for the near term, as well as the long term.

Extent of Planning

Feasibility Studied – The District installed an anemometer and measured the wind potential for several months and they hired Tom Wind to complete a feasibility study for them.
Utility Agreements – The District had discussed their plans with Linn County REC, which agreed to provide net metering. The District believed they would be able to save $65,000 annually on electricity costs.
Turbine Selected – The District was considering installing a Vestas 750 kW turbine.

Reason for Decision

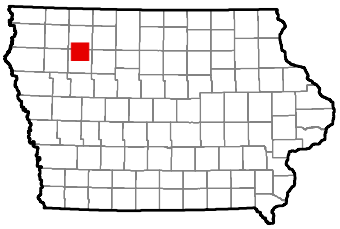
Biggest Impediment – The biggest problem was the poor economics of installing a turbine, they were worried they could not make it pay for itself, because of the marginal wind potential.
Final Reason – The District found the turbine would not generate enough power in the location studied to defer the costs.

Additional Information

Future Wind Energy Plans – The District would like to install a turbine if it became economical. In the future, they may look at a nearby higher elevation site where there is greater wind potential.
Recommendations – Plugge recommended wind power projects and suggested schools make sure they work with their neighbors; especially in cases like North Liberty were the community is developing rapidly.

Contact Information

Name, Title – Lane Plugge, Superintendent
Address – 170 Abigail Ave, North Liberty, IA 52317
Phone – 319.688.1000



4. Sioux Central Community School District

District Facts

County – Buena Vista
District Enrollment[6] – 579 students
Population of Sioux Rapids[7] – 703 people
Approximate Elevation of Sioux Rapids[8] – 1,261 feet
Average Annual Wind Speed at Sioux Rapids[9] – 15.87 mph

Project Details

Date Project Started – 2003
Key Person Behind Project – Former Superintendent Bonnie Meyer
Motivation – The District recognized that the wind always blows in their part of the state and thought they could save money for students.
Most Helpful Resources – Principal Jeff Scharn said Tom Wind and Alliant were good resources.

Extent of Planning

Feasibility Studied – Tom Wind completed a feasibility study for the school.
Utility Agreements – The District talked with Alliant.
Turbine Selected – The District was planning to install a 750 kW turbine.

Reason for Decision

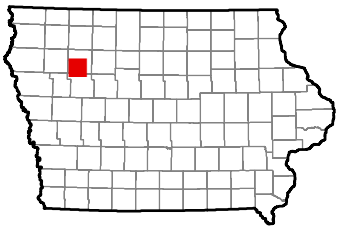
Biggest Impediment – Alliant would not fully reimburse the District for the power.
Final Reason – There was a combination of reasons a turbine was not pursued. The School Board was nervous about large initial investment, about ensuring repairs occurred in a timely fashion, about the monetary consequences if something happened to the turbine, and because Alliant's power purchase rate was not favorable.

Additional Information

Future Wind Energy Plans – There is still support in the community for installing a turbine. Scharn said the District would definitely pursue it if Alliant would purchase surplus power for its full value.
Recommendations – Scharn recommended other schools investigate wind power, because it looked like a win-win situation for saving money for education.

Contact Information

Name, Title – Jeff Scharn, High School Principal
Address – 4440 US Highway 71, Sioux Rapids, IA 50585
Phone – 712.283.2571
Email – jscharn@sioux-central.k12.ia.us



5. Storm Lake Community School District

District Facts

County – Buena Vista
District Enrollment[6] – 1,945 students
Population of Storm Lake[7] – 9,981 people
Approximate Elevation of Storm Lake[8] – 1,434 feet
Average Annual Wind Speed at Storm Lake[9] – 16.25 mph

Project Details

Date Project Started – August 2003
Key People Behind Project – District Technology Coordinator Steve Scarbrough, the Superintendent, and members of the School Board
Motivation – The primary motivation was the opportunity for the District to become more environmentally sound, but the anticipated savings were also a factor.
Most Helpful Resource – Scarbrough reported Les Wilson of The Energy Group was the most helpful resource.

Extent of Planning

Feasibility Studied – A feasibility study was done by Tom Wind.
Utility Agreements – The District had several conversations with MidAmerican.

Reason for Decision

Biggest Impediment – It was not feasible because MidAmerican would not allow them to group their meters for net metering and because the rate for which the District was purchasing electricity was low.
Final Reason – The project was not economically feasible.

Additional Information

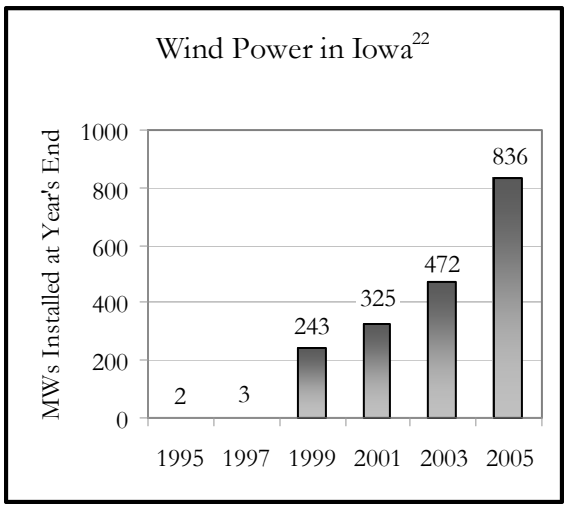
Future Wind Energy Plans – People in the community and the District were supportive of installing a turbine, particularly because several turbines are visible from District property. The District would like to install a turbine, but will not be able to do so unless MidAmerican allows them to consolidate meters.
Recommendations – Scarbrough suggested schools start a grassroots movement to change state utility policy.

Contact Information

Name, Title – Steve Scarbrough, District Technology Coordinator
Address – 419 Lake Ave, Storm Lake, IA 50588
Phone – 712.732.8100

WIND POWER DEVELOPMENT

The school turbines, summarized in the table on page 28, account for only a small share of the wind power installed in Iowa (5.5 out of 836 MW). Likewise, their stories only begin to foreshadow what is possible. The state has the 10th highest wind potential in the nation and has the potential to produce 4.8 times more electricity than Iowans consume.[21]



Wind power has grown rapidly in Iowa over recent years, see chart to left. Several state and federal policies and programs have promoted this development. Following is a brief description of those that apply to schools.

Since 1978, federal law has obligated utilities to interconnect with qualifying facilities, such as schools, and to purchase power from them at avoided cost. In 1983 the Iowa Legislature passed the nation's first renewable electricity standard, which defined a utility's avoided cost as the cost of a new generation plant and required investor owned utilities to buy renewable power at this rate. In 1990 Iowa limited the amount of renewable energy investor owned utilities must purchase at the avoided cost of a new generation plant to a combined total of 105 MW or about 2 percent of their total electricity generation at that time. Due to legal issues this mandate was delayed until 1997, but by 1999 the utilities had met the standard, with schools accounting for a small portion.

Also since 1983 Iowa law has required investor owned utilities to provide net metering to producers of alternative energy. Iowa is one of more than 30 states to do so. Iowa's rules established by the Iowa Utilities Board, allow for net billing for up to 500 kW, more generous than most states' rules. Under a net metering arrangement when the electricity generated exceeds the immediate demand, the electric meter runs backward and electricity is sent to the grid. This essentially banks the kilowatt hours so the producer can use them at a later time. This arrangement means the producer recieves the retail rate for power it contributes to the grid. See the table on the next page for a description of each school's utility agreement.

The Alternative Energy Revolving Loan Program, a $5.9 million fund created in 1996 and administered by the Iowa Energy Center, provides no interest loans for half a project's cost up to $250,000 and allows a 20 year repayment term. This program eases the large capital burden of a turbine project. The Energy Bank Program administered by the DNR assists public and nonprofit organizations with additional project financing.

In 2005, a state production credit was passed, making small producers eligible to receive and sell the tax credits to investors. This Renewable Energy Tax Credit specifically focuses on small-scale, locally owned projects. It provides a $.015 per kWh income tax credit for energy produced during the first 10 years of the project for projects less than 2.5 MW of which at least 51 percent is owned by a resident, farm corporation, school district, electric cooperative or small business in Iowa. While the 90 MW limit was quickly met, recognition of this issue by the Legislature means more funds could become available. In fact, a bill was introduced during this session (2006) to allow an additional 90

MWs of eligibility. There is also a federal production incentive available to public and nonprofit entities through the Renewable Energy Production Incentive program, which was reinstated in the Energy Policy Act of 2005. This combination of existing incentives has and will continue to help wind power develop in Iowa schools.

TABLE 1. SUMMARY OF IOWA SCHOOLS PRODUCING WIND POWER

	Date Operational	Turbine Capacity (kW)	Project Cost ($)	Est. Payback Period (years)	Average Annual Electricity Produced (kWh)	Net Metering	Purchase Agreement ($/kWh)	Average Annual Savings or Revenue ($)
Spirit Lake Turbine 1[10]	July 1993	250	239,500	5.5	282,921	Yes, for elementary building.	Alliant purchases surplus for .06	23,124 saved
Spirit Lake Turbine 2[11]	Oct 2001	750	780,000	6.5-7	1,554,444	Yes, consolidated for all other buildings.	Alliant purchases surplus for .02	120,987 saved, 1,377 revenue
Nevada Turbines 1& 2[12]	Fall 1993 & Spring 1994	250 & 200	500,000	10	≈414,000	Yes, for middle & high school meters.	Alliant purchases surplus for .06	≈33,580 saved
Sentral[13]	Oct 1995	65	48,000	5	≈36,800	Yes, for the meter for K-12 building.	Alliant purchases surplus for .06	
Clay Central-Everly[14]	Oct 1995	95	130,800	12	89,223	Yes, for elementary building meter.	Alliant purchases surplus for .06	≈7,600 saved, ≈1,300 from REPI
Forest City[15]	Jan 1999	600	673,000	11-13	887,104	No, directly to utility.	Forest City Municipal Utility purchases electricity at their current selling rate	55,477 revenue, ≈13,100 from REPI
Akron-Westfield[16]	Feb 1999	600	623,240	9	1,427,560	No, directly to utility.	Akron Municipal Utility purchases electricity at their current selling rate	≈59,000 revenue, ≈20,300 from REPI
Clarion-Goldfield[17]	June 2002	50	142,000	7	53,788	Yes, for one meter in high school.	MidAmerican purchases surplus for .06	3,496 saved
Eldora-New Providence[18]	Oct 2002	750	800,000	8.5	1,293,120	Yes, for all meters for elementary, middle, & high school.	Alliant purchases surplus for .021	84,308 saved, 5,602 revenue
Iowa Lakes[19]	Feb 2005	1650	1,800,000	12	≈6,000,000	No, directly to utility.	Estherville Municipal utility purchases electricity for .035	≈560,000 revenue
Northwood-Kensett[20]		250	200,000	4-8	≈408,000	No, directly to utility.	Alliant will purchase power for .06	≈40,000 revenue

BENEFITS OF WIND POWER

While the environmental and economic advantages of wind power are well known, the schools with turbines also reported educational and social impacts.

ENVIRONMENTAL AND ECONOMIC ADVANTAGES

Wind power is on the rise across the nation. As of December 2005 there were 9,149 MW installed in the U.S.[1] And for good reason: it has been repeatedly proven that wind power is beneficial to the environment and the economy. It is readily apparent wind power has a smaller environmental impact than the currently dominant energy sources. It is also obvious that developing wind power at home allows a state or nation to spend less money securing, obtaining, and transporting resources from across the globe. Further, wind power is becoming increasingly cost competitive to produce compared to nonrenewable energy sources.

Community based wind ventures in particular are growing and are uniquely beneficial to the local and state economy. They provide an opportunity for citizens to address climate change within their own communities. They keep the returns on energy investments at home, create jobs, and diversify local economies. The development of a wind project requires purchasing equipment and materials like turbines, towers, asphalt, concrete and electric cables from businesses both at home and abroad. Those involved spend dollars at local hotels, restaurants, gas stations, and hardware and grocery stores. In fact, a model created by the National Renewable Energy Laboratory (NREL) used Iowa data and found that several small-scale, locally owned wind projects generate significantly higher economic impacts within a county than one large project of equal capacity owned by out-of-the-area investors.[23] Further, having generation close to demand is more efficient and more secure because it is produced in a variety of locations and therefore less vulnerable to disruption, price volatility and attack.

WIND IN THE CLASSROOM

Many of the personnel at wind powered schools mentioned an additional benefit of their turbines: the educational value. They noted their turbines have been incorporated in curricula at various grade levels and in various subjects. The pioneering Wind Energy and Turbine Technology associates program at the Estherville Campus of Iowa Lakes Community Colleges is the premier example of the educational potential of a turbine. This program instructs students in every aspect of turbine technology, as well as economics, management, mathematics and computers using hands-on experience with the nearby turbine and the on-campus computer lab dedicated to the program.

But even in primary and secondary schools, turbines have been used as resources for student learning. Of particular note is a book written by Spirit Lake first graders about their turbines (this is available to view on the District's website). For teachers interested in incorporating wind power or renewable energy into their lessons, there are a variety of resources available. NREL has supported creating college programs to develop a "capable and diverse workforce" to work in the expanding renewable energy industry and has led in designing curricula for K-12 education.[24] The American Wind Energy Association has also developed a teacher's guide that offers curriculum ideas and a list of other resources for using wind energy in the classroom.[25]

COMMUNITY IMPACT

The influence of these schools' turbines has spread outside the classroom and has seemingly influenced the entire community. In every case, the personnel at wind powered schools reported

widespread community support for their projects and that having a turbine increased the cohesiveness of the community. These turbines are often visible throughout town and beyond, serving as a beacon for the school and the community. Several people noted that community members frequently called when their turbine was not operational.

KEY LESSONS

The circumstances surrounding each school's decision to install a turbine were different, as have been their experiences operating the machines. However, there are also similarities among their experiences, making it possible to define key lessons.

1. Perhaps the clearest lesson is that the process of installing a wind turbine is not fast or simple. It involves learning about things from ice throw and wind speed to net metering and state and federal programs and incentives. Because few wind turbines have been installed at the community scale, there is no clear path to follow. Therefore, in order to install a turbine a person or group of people with persistence, perseverance, and passion for making a difference in their community are necessary.

2. There can be a substantial monetary benefit from installing a turbine. Depending on the school's ability to negotiate a favorable power purchase agreement that allows the school to install a sizable turbine, the larger the turbine, the larger the eventual savings.

3. Nearly every person interviewed noted the key factor in determining if a project is viable is whether a favorable agreement can be reached with the utility company. Therefore many schools suggested this be one of the very first steps taken when researching a wind project.

4. Although few schools have turbines, there are many turbines installed across the state and the nation. Therefore there are experienced engineers, consultants, turbine manufacturers, and maintenance providers. Many schools with turbines recommended employing the service of these professionals to help the project proceed more quickly and the turbines operate more smoothly.

5. Many schools began their research by talking to schools with existing turbines. In particular, Spirit Lake personnel have provided information to many schools interested in wind power. In addition to schools, there are other wind energy enthusiasts, including individuals and organizations willing to share their hard earned knowledge. In short, much can be learned from those who have completed projects.

6. The primary motivation for installing a turbine is similar for many schools: to save money for students. However, many schools have realized benefits other than lasting monetary returns. In every case, the school's turbine(s) became a source of community pride. Further, they have presented an educational opportunity, provided security for schools threatened with consolidation, helped schools reduce their environmental impact thereby leading to a better future, and allowed schools to be model members of their community.

POLICY RECOMMENDATIONS

As previously discussed, Iowa has many outstanding policies and programs encouraging the development of wind power, yet there is more that could be done to promote the use of this nonpolluting, educational, and economical resource in Iowa schools. Many of the schools that were

interested, but not able to install turbines, stopped the process because they could not reach an economically favorable agreement with their utility. Therefore, many of the policy recommendations focus on making the interconnection process simpler and fairer.

1. Require all utilities to net meter and allow schools to consolidate their meters for net metering.

2. Require all utilities to purchase surplus power at a price that reflects the avoided cost of a new conventional, base-load power plant, plus an additional sum for the environmental benefits of wind power.

3. To avoid lengthy negotiations and court battles, the Iowa Utilities Board should set a standard contract for interconnecting schools and utilities.

4. Ensure the continuance of the Alternative Energy Revolving Loan Program and increase the dollars available.

5. Increase the number of MWs available for the state production tax credit and reserve a portion for schools: public and private K-12, community colleges, private colleges, and regents' institutions.

6. Many states have enacted their own renewable energy standards with percentages surpassing Iowa's. Iowa should boost its requirement to 10 percent of total production and require all Iowa utilities, not just investor owned companies, meet the standard.

7. Allow multiple schools to jointly purchase, operate and service turbines and aggregate all their meters for net metering.

8. Allow schools to own turbines outside their district boundaries so schools located in areas with insufficient wind can also reap the benefits of wind power for their students.

CONCLUSION

Combining the potential of wind power with educational institutions seems a beautiful idea and as represented in these profiles, it works. That is not to say that installing wind power is the only energy reform possible or beneficial for schools, advances are being made in other forms of renewable energy and energy efficiency measures in schools across the nation. Likewise that is not to discount the existing and potential role of wind power in other community institutions and private ownership models.

However, it is particularly intriguing to imagine the expansion of schools' skylines now only filled with the United States' flag constantly whipping in the wind to include a turbine harnessing this homegrown potential. As schools are the foundation of communities, this would be an ideal way to spread energy consciousness to children in classrooms and to all community members.

The possibilities for wind power are enormous in Iowa where there are 10 schools to learn from and there is potential for further development. There are 1,532 public schools in 367 school districts, 200 nonpublic schools, 28 community colleges, 62 public and private colleges, and 3 state universities in Iowa.[26] And, 40 percent of the state's land has adequate wind speeds.[27] These statistics highlight the great opportunity available for many Iowa schools.

GLOSSARY

ALTERNATE ENERGY REVOLVING LOAN PROGRAM (AERLP) – "was created by the Iowa Legislature in 1996 (1997 Iowa Code: Section 476.46) to promote the development of renewable energy production facilities in the state. The $5.9 million of AERLP funds were provided entirely through Iowa's investor-owned utilities. The Iowa Energy Center has developed the AERLP in such a way that loans are given based on both the technical merit of a project and the financial qualifications of the applicant. The [Iowa] Energy Center provides loan funds equal to 50% of the total financed cost of a project (up to $250,000) at 0% interest. Matching financing for the project must be obtained from an Iowa lender of the applicant's choice." See http://www.energy.iastate.edu/funding/aerlp-index.html (accessed Jan 23, 2006).

ENERGY BANK PROGRAM OF THE IOWA DEPARTMENT OF NATURAL RESOURCES – "The Iowa Energy Bank, an energy management program using energy cost savings to repay financing for energy management improvements, serves public and non-profit facilities. Since the program's inception in 1989, the Iowa Energy Bank has facilitated more than $130 million in energy improvements using private funds in combination with minimal state and federal support." See http://www.iowadnr.com/energy/ebank/index.html (accessed Jan 23, 2006).

KILOWATT (KW) AND MEGAWATT (MW) – "The ability to generate electricity is measured in watts. Watts are very small units, so the terms kilowatt (kW, 1,000 watts) and megawatt (MW, 1 million watts) are most commonly used to describe the capacity of generating units like wind turbines or other power plants." See http://www.awea.org/faq/tutorial/wwt_basics.html#How%20much%20electricity%20can%20one%20wind%20turbine%20generate (accessed Jan 23, 2006).

KILOWATT HOUR (KWH) – "A kilowatt-hour means one kilowatt (1,000 watts) of electricity produced or consumed for one hour. One 50-watt light bulb left on for 20 hours consumes one kilowatt-hour of electricity (50 watts x 20 hours = 1,000 watt-hours = 1 kilowatt-hour)." See http://www.awea.org/faq/tutorial/wwt_basics.html#How%20much%20electricity%20can%20one%20wind%20turbine%20generate (accessed Jan 23, 2006).

NET METERING – "Net metering or net billing is a term applied to laws and programs under which a utility allows the meter of a customer with a residential power system (such as a small wind turbine) to turn backward, thereby in effect allowing the customer to deliver any excess electricity he produces to the utility and be credited on a one-for-one basis against any electricity the utility supplies to him." See http://www.awea.org/faq/tutorial/wwt_policy.html#What%20is%20net%20metering%20(net%20billing)%20and%20how%20does%20it%20work (accessed Jan 23, 2006).

RENEWABLE ENERGY PRODUCTION INCENTIVE (REPI) – "This program, authorized under section 1212 of the Energy Policy Act of 1992, provides financial incentive payments for electricity produced and sold by new qualifying renewable energy generation facilities. Eligible electric production facilities are those owned by State and local government entities (such as municipal utilities) and not-for-profit electric cooperatives that started operations between October 1, 1993 and September 30, 2003. Qualifying facilities are eligible for annual incentive payments of 1.5 cents per kilowatt-hour (1993 dollars and indexed for inflation) for the first ten year period of their operation, subject to the availability of annual appropriations in each Federal fiscal year of operation." REPI was reenacted in the Energy Policy Act of 2005 and expanded "the types of entities and renewable energy technologies eligible for REPI incentive payments." See http://www.eere.energy.gov/wip/program/repi.html (accessed Jan 23, 2006).

RESOURCES

AMERICAN WIND ENERGY ASSOCIATION (AWEA) – www.awea.org
IOWA DEPARTMENT OF NATURAL RESOURCES (DNR) – www.iowadnr.com
IOWA ENERGY CENTER (IEC) – www.energy.iastate.edu
IOWA UTILITIES BOARD (IUB) – www.state.ia.us/government/com/util/util.html
WINDUSTRY – www.windustry.com

ENDNOTES

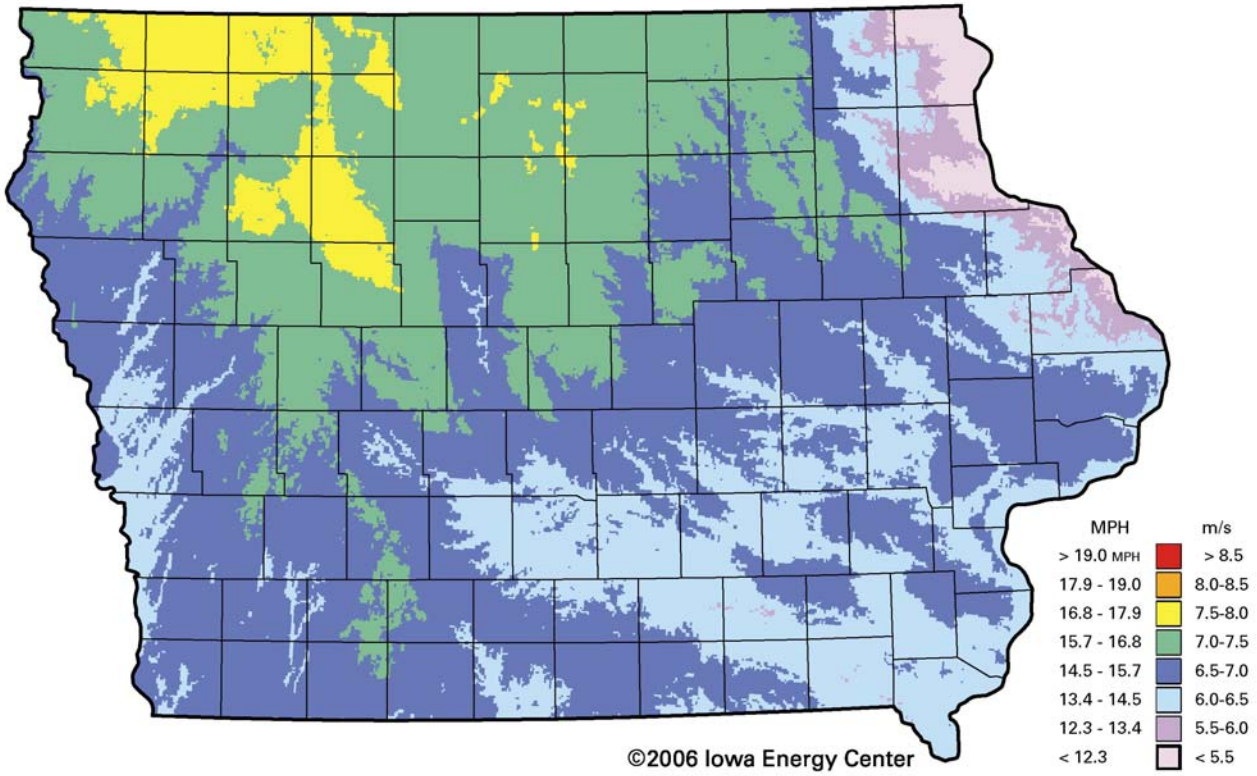
1. According to the American Wind Energy Association (AWEA) as of December 31, 2005 there were 9,149 MW installed in the U.S. See http://www.awea.org/projects/index.html (accessed Jan 23, 2006). According to AWEA 1MW of wind power can supply electricity for between 225 and 300 average homes depending on the turbine's size and the average wind speed. See http://www.awea.org/faq/tutorial/wwt_basics.html#How%20much%20electricity%20can%20one%20wind%20turbine%20generate (accessed Jan 23, 2006). According to the Energy Information Administration, in 2001 the average U.S. household consumed 10,656 kWh of electricity annually. See http://www.eia.doe.gov/emeu/recs/recs2001/enduse2001/enduse2001.html (accessed Jan 23, 2006).
2. Wind energy is the fastest growing energy resource according to the U.S. Department of Energy see http://www.eere.energy.gov/de/wind_power.html (accessed Jan 23, 2006).
3. Number and capacity of turbines installed in Iowa is from personal communication with Lee Vannoy, Environmental Engineer Senior at the DNR on Feb 1, 2006.
4. See a variety of indexes of Iowa schools performance at http://www.nea.org/goodnews/ia01.html (accessed Jan 23, 2006).
5. Unless otherwise noted, the information was collected through interviews with the contact person listed. Some of the people interviewed, although passionate about wind power were not experts on the subject. It is important to recognize the quality of data is based on what people, who are not wind power professionals, understand about a complicated subject.
6. District enrollment based on 2004-2005 enrollment figures from the Iowa Department of Education. Accessible at http://www.state.ia.us/educate/fis/pre/eddata/ied05/index.html (accessed Jan 23, 2006).
7. Town population estimates for July 2004. Data from the Population Division, U.S. Census Bureau available at www.census.gov/popest/cities/tables/SUB-EST2004-04-19.xls (accessed Jan 23, 2006_.
8. Elevation estimates from http://www.city-data.com/city/Iowa.html (accessed Jan 23, 2006).
9. Average annual wind speeds are from the Iowa Energy Center's Wind Assessment Study and Turbine Calculator. The Iowa Energy Center notes, "The wind speeds listed for 2,000 cities in Iowa are based on a mapping process estimated to be within ±7% accuracy. This is due to the margins of error of the instruments used, the mapping techniques and the corrections for long-term averages. National Weather Service data indicates that the measured period (June 1994 - May 1996) was as much as 4% below the long term averages for parts of Iowa." You can find your own town's average annual wind speed by going to http://www.energy.iastate.edu/renewable/wind/as-index.html (accessed Jan 23, 2006).
10. Spirit Lake's exact production and savings values for Turbine 1 averaged 11 year period from Jan 21, 1994 to Jan 16, 2006 with 4 fewer days compensated for. Data from District website, http://www.spirit-lake.k12.ia.us/~jtirevold/bg/wind%20chronological.htm (accessed Jan 24, 2006).
11. Spirit Lake's exact production, savings, and revenue values for Turbine 2 are averaged over four year period from Dec 10, 2001 to Dec 13, 2005 with four extra days compensated for. Data from District website, http://www.spirit-lake.k12.ia.us/~jtirevold/bg/Micon%20Data.htm (accessed Jan 24, 2006).
12. Nevada's production and savings data are based on estimates over a seven year period from Transportation Director Richard Scott.
13. Sentral's production estimates were directly from the computer; however, they have had problems with the computer and may not be accurate. Current saving estimates were not available. The $1,000 dollar savings was reported in a July 25, 1996 *Des Moines Register* article by Janet Harp titled Wind Energy at Work: Sentral's Wind Generator Saves School Money.
14. Clay Central-Everly's exact production values averaged over seven year period from Sept 1998 to Aug 2005, data directly from Superintendent Montgomery. Savings data based on average total consumption rate of 167, 360 kWh (the consumption for Oct 2004 to Oct 2005) and the District's electricity purchase rate of $.085 per kWh. REPI payment data from http://www.eere.energy.gov/wip/program/repi.html (accessed Jan 24, 2006).
15. Forest City's exact production and revenue values averaged over six year period from 2000 to 2005. Data from District website, http://www.forestcity.k12.ia.us/Pages/windturbine/Wind%20site05/Forest_City_School%D5s_Wind_.h

tml (accessed Jan 24, 2006). REPI data from http://www.eere.energy.gov/wip/program/repi.html (accessed Jan 24, 2006).

16. Akron-Westfield's exact production values averaged over five years from July 1999 to June 2004. Data for this and REPI income from http://www.eere.energy.gov/wip/program/repi.html (accessed Jan 24, 2006). Savings estimate from retired Special Projects Coordinator Ronald Wilmot.
17. Clarion-Goldfield's exact production and savings values averaged over one and half years from June 2002 to Feb 2004. Data from Final Report to the Department of Natural Resources by Superintendent Robert Olson, available online at http://www.clargold.k12.ia.us/high/staff/jwilson/Wind%20Turbine/Wind%20Turbine.htm (accessed Jan 24, 2006).
18. Eldora's exact production and savings values averaged over three years from Jan 2003 to Dec 2005. Data from District website, http://www.eldora-np.k12.ia.us/enpdistrict/index.html (accessed Jan 24, 2006).
19. Iowa Lakes production and savings figures are estimates from Al Zeitz. The information on the amount of electricity supplied to the Estherville Municipal Utility is from a personal conversation with employees of the utility.
20. Northwood-Kenesett's production from Jim Collins, the Districts Alliant Energy Account Manager. Their revenue estimate was from Superintendent Thomas Nugent.
21. Tenth place ranking according to the American Wind Energy Association, see http://www.awea.org/projects/iowa.html (accessed Feb 1, 2006). Wind power generation capacity according to the Iowa Department of Natural Resources, available at http://www.iowadnr.com/energy/renewable/wind.html (accessed Feb 1, 2006).
22. Sources for the MW installed in Iowa by year from Keith Kutz at the Iowa Energy Center, provided on March 1, 2006.
23. The 2004 National Renewable Energy Laboratory (NREL) research by Marshall Goldberg, Karin Sinclair, and Michael Milligan is available at http://www.eere.energy.gov/windandhydro/windpoweringamerica/pdfs/35953_jedi.pdf. A previous Iowa Policy Project report *Small Packages, Big Benefits: Economic Advantages of Local Wind Projects* available at http://www.iowapolicyproject.org/2005_reports_press_releases/050405-wind.pdf details NREL and others' analyses quantifying the economic benefits of locally owned wind projects.
24. Learn about NREL's education programs at http://www.nrel.gov/education/about.html (accessed Feb 13, 2006).
25. Download AWEA's Wind Energy Teacher's Guide at www.awea.org/pubs/documents/TeachersGuide.pdf (accessed Feb 13, 2006).
26. Number of public and private schools according to Iowa Department of Education, available at http://www.state.ia.us/educate/directory.html (accessed Feb 1, 2006). Number of colleges and universities according to Iowa Department of Economic Development, available at http://www.traveliowa.com/iowafacts/statistics.html (accessed Feb 1, 2006). Further, according to the National Center for Education Statistics there are over 129,000 educational institutions nationwide, available at http://nces.ed.gov/fastfacts/display.asp?id=84 (accessed Feb 1, 2006).
27. Iowa land area wind potential according to the Iowa Department of Natural Resources http://www.iowadnr.com/energy/renewable/files/windenergy.pdf (accessed Feb 1, 2006).

APPENDIX A

ESTIMATED AVERAGE ANNUAL WIND SPEEDS*
(on well exposed sites at 50 meters above ground)

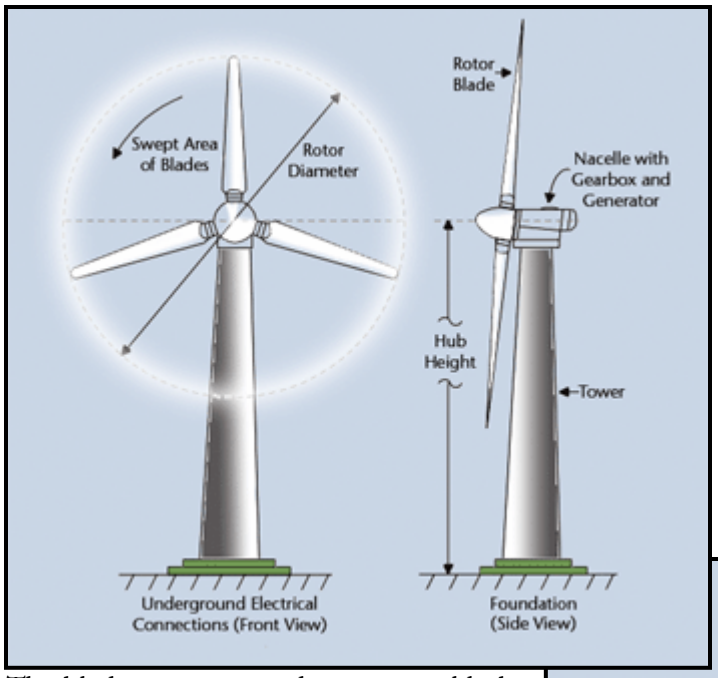


*Copyrighted map used with permission from the Iowa Energy Center.
See http: //www.energy.iastate.edu/renewable/wind/images/windmap-iowa_annual.gif.

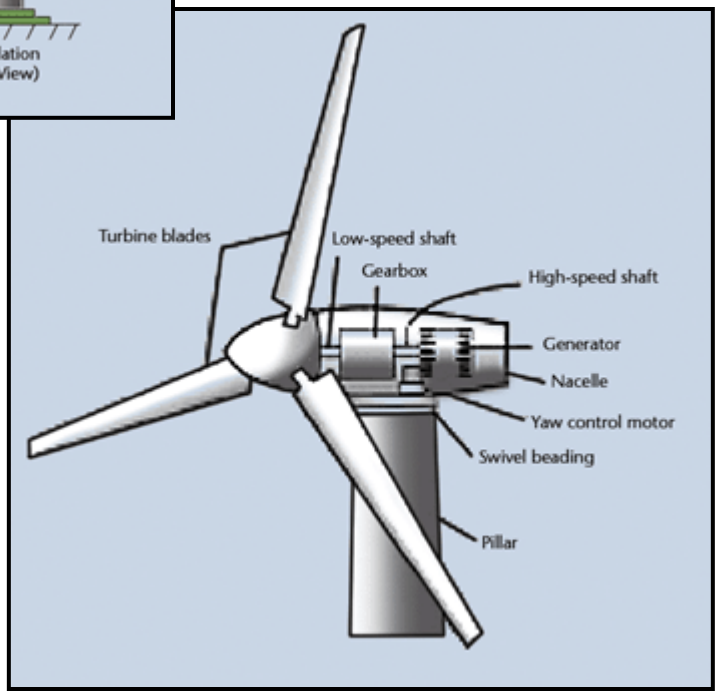
APPENDIX B

DIAGRAM OF A WIND TURBINE*

The rotor of a wind turbine is similar to the rotor of a helicopter. Horizontal rotation of the helicopter's rotor creates a downward air stream, which lifts the helicopter. In the case of the wind turbine a horizontal air stream (the wind) causes the rotor to turn around its horizontal axis. Wind turbines for electricity generation come in all sizes, and they include:



- A rotor with blades which convert the wind's energy into rotational movement
- A nacelle (machine house) containing the rotor shaft linked to a generator by a drive train, often including a gearbox
- A tower to support the nacelle and to put it at a sufficient height above ground to make use of the higher wind speeds usually available further above ground and to keep the rotor blades at a safe distance above the ground
- Electronic equipment for the general control of the turbine



The blades are mounted on a central hub connected to the generator. Typical rotor diameters range from 30 to 65 meters [98 to 213 feet], and the tower height is between 25 and 80 meters [82 to 262 feet]. Rotational mechanical energy is converted into electricity through the generator. Usually wind turbines start to operate at wind speeds of 4 to 5 meters per second [9 to 11 mph] and reach their maximum power at around 15 meters/second [33 mph]. At even higher wind speeds the turbines are shut down to avoid damage to the structure by excessive mechanical load.

As the technology is by now quite mature, wind turbines can be expected to function for a period of 20-25 years.

*Text and diagrams excerpted directly from the European Commission's Energy Research: What is a wind energy? See http://europa.eu.int/comm/research/energy/nn/nn_rt/nn_rt_wind/article_1101_en.htm.