

Renewable Energy for Historic Commercial Buildings



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High tech renewable energy projects may not seem like a good match for historic buildings, but if done properly, they can be a discreet but effective green feature of an energy retrofit.

Most people know that Iowa has great resources for turning wind energy into electricity. However, owning a wind farm isn't the only way to take advantage of renewable energy. Downtown commercial district buildings can make cost-effective use of solar, geothermal and other renewables to reduce their environmental footprint and sustain their business for the long haul.

Development of Renewable Energy in Iowa

Iowa has a long history of using renewable energy. Water-pumping windmills were once a common sight both in the country and in town. In the first half of the twentieth century before rural electrification, many Iowans used "windchargers" to provide electricity for radios, lighting and small appliances. In the mid 1970s, when the U.S. faced high energy costs due to the OPEC oil embargo, solar thermal panels began popping up on rooftops across Iowa, reducing heating demands for homeowners. More recently, geothermal heat pumps have become very popular, using the constant temperature underground to reduce heating and cooling costs. Now, in the beginning of the 21st century, Iowans are once again looking to renewable sources of environmentally friendly energy that provides protection against rising energy prices.

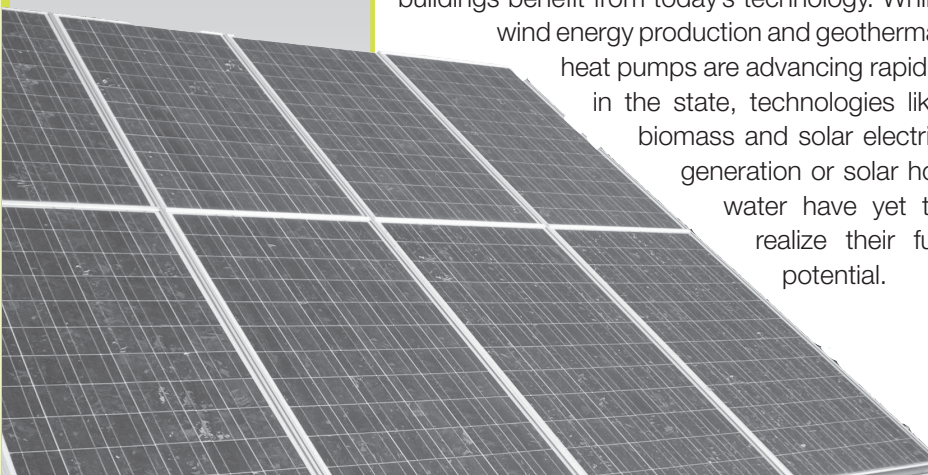
Renewable energy technologies today are superior to what Iowans used historically, which provides a great synergy for helping older buildings benefit from today's technology. While wind energy production and geothermal heat pumps are advancing rapidly in the state, technologies like biomass and solar electric generation or solar hot water have yet to realize their full potential.

Incentives and policies play a significant role in bringing these technologies within reach of small businesses and communities. Progress on such incentives, like for solar, could change the feasibility of installation virtually overnight. The rapidly changing marketplace for renewable energy services and products merits the consideration of business owners to look at how they can benefit from these technologies today and in the future.

Renewable Energy and Historic Properties

There are two important factors to consider before embarking on a renewable energy project at a historic property.

Energy Efficiency First: It is important to make sure that all possible energy efficiency upgrades have been made to the property before considering a renewable energy project. Reducing demand for electricity and gas is much cheaper than producing the same amount of energy by using wind or solar generation equipment. A common phrase in the energy business tells us that "the cheapest kilowatt hour is the one we don't use." Investments in lighting upgrades, insulation, sealing air leaks and even energy efficient appliances and heating and cooling equipment will pay back in just a few years — unlike renewable energy systems which often have paybacks of 15-20 years or more. Improving the efficiency of a building first can reduce the size and cost of a renewable energy system and create a better return on investment (ROI).



Visual Impact on Historic Property: One of the greatest setbacks to the fledgeling solar thermal industry in the 1970s was the impact that appearance had on older buildings. In many cases, the solar collectors looked out of place. Large, black boxes disrupted the rooflines of victorian homes and historic bungalows. Today's photovoltaic (PV) solar electric generating equipment and solar hot water heating panels can produce reliable energy with little or no visual or audio impact when a system is designed and installed properly. In regards to roof-mounted solar panels, systems should be installed behind roof parapets or to rear elevations. Geothermal heating and cooling systems can often be used with no impact on the historic appearance of a building. Wind turbines, however, need to be on tall towers at least 30 feet taller than any object within a 500 foot radius. This may cause zoning issues or problems with neighbors and an unwanted visual impact on a property.

Renewable Energy Technologies in Iowa

There are many sources of fossil-fuel free energy currently being used in Iowa. Some are more viable for use in downtown commercial districts than others.

Biomass: Biomass includes energy feedstocks derived from plants or other recently living organisms. Wood, perennial grasses, corn or even algae can be fermented into liquid fuel like ethanol or biodiesel, burned for direct heat or to run a steam turbine or turned into burnable methane gas through anaerobic digestion. Corn or biomass pellet stoves may be possible biomass options for commercial buildings. However, in general, biomass projects are high maintenance and may function best in rural or industrial environments. Biomass can be especially promising when there is a nearby source of woodchips or perennial grasses available. In this circumstance can support the local economy through procurement of available products.

Hydroelectric: Hydro was a major source of Iowa's energy in the past. There are still several historic hydroelectric dams functioning in Iowa, but because of the relatively flat landscape and

geographic limitations, hydro is not a viable option for Iowa property owners. Instead, it is more likely to be expanded by power companies and utilities seeking alternative energy sources.

Geothermal: A very popular technology for delivering high-efficiency heating and cooling, geothermal systems take advantage of the constant temperature below the earth's surface to provide warmth in the winter and cooling in the summer. Geothermal can be considered energy efficiency or renewable energy, depending on whose definition is used. Geothermal systems use either horizontal underground pipes called loops or vertical wells. Vertical wells are often used in areas with limited area for horizontal loops. In a downtown commercial district, alleys, parking lots and nearby green spaces could be viable locations for geothermal wells. Technology is in place to allow horizontal directional drilling under existing structures, parking lots and similar areas with minimal ground disturbance. A shared or district geothermal system, as is being implemented in West Union, can be implemented to benefit multiple properties at once. Having a thorough engineering analysis to determine the retrofit design and cost for an existing building is an important step when planning any type of geothermal project.

Solar Electrical Generation/ Photovoltaic (PV): Solar electrical generation using photovoltaic panels can provide stand-alone or back-up power by charging batteries, or it can be "grid-tied". A grid-tie PV system uses an inverter to synchronize the solar array with the existing utility service. In this way, the electricity produced offsets the building's electric usage while eliminating the need for expensive, high maintenance batteries. PV is often a good fit for commercial buildings because it produces the most power on sunny, summer days when demand for electricity is high. Excess generation can be credited toward future utility bills.

Solar Thermal: Producing heat with the power of the sun is one of the most efficient and cost effective ways to take advantage of solar energy. The sun's heat can be captured from warm air, water or "thermal mass"- brick or masonry that will hold heat after the sun goes down. "Active" solar thermal includes any system that uses mechanical means to pump water or air through panels and to distribute heat to the living space. For a restaurant in the downtown commercial district, using solar hot water has proven to be

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There are two key factors to producing power with a wind turbine: the swept area of the blades and the height of the tower.

a cost effective way to supply the large demand for hot water used for washing dishes and similar purposes. Businesses that utilizes a large quantity of hot water will often find that a solar hot water system pays for itself off within a few years. This practice has taken off in other states, but Iowa has yet to catch on to this business sustaining technology. "Passive" solar design does not include use of solar panels. Instead the design incorporates building designs that take advantage of the sun's heat with south facing windows, attached greenhouses or sun porches and move heat through natural air flow. Solar thermal technology (both passive and active) can be used effectively in retrofitting older buildings. Depending on the era, the technology may have been included in the buildings original design.

Small Wind Turbines: As mentioned earlier, wind energy has an important place in Iowa's history. The newer generation of small wind turbines, similar to PV, can supply stand-alone battery charging or grid-tied generation. Small-scale wind generators come in a wide range of sizes for many applications. However, tower height restrictions, noise ordinances and aesthetic considerations may limit the feasibility of wind power in downtown commercial districts.

Vertical Axis and Rooftop Wind Turbines

The small wind turbine industry is a dynamic and fast-changing environment where new products appear on the market, including vertical axis and rooftop wind turbines. These systems have yet to fully demonstrate their reliability for generating enough power to make them a good return on investment. Examples are tough to find of reliable operation of these technologies, and some installations have had disappointing outcomes and technological issues. Manufacturers of these products are creating turbines that do not need to be pointed into the wind to be effective. This is an advantage on sites where the wind direction is highly variable (i.e., when integrated with buildings).

The challenge with developing these systems is that they aren't inherently efficient since their design doesn't reflect the advantages of traditional wind turbines. It is common knowledge in the wind industry that making power efficiently with wind is a product of two key factors: swept area and tower height.

Swept area is determined by the length of the blades and the diameter of the area blades cover when spinning. Simply put, longer blades have the potential to capture more of the wind's energy.

Tower height is important because there is generally more air moving at higher altitudes. Air movement is less turbulent than wind closer to ground where obstructions like trees, buildings and topographical features impede air flow. For these reasons, most of the wind turbines on the market conform to common design criteria; they utilize blades mounted on a horizontal axis on a tall tower.

A number of manufacturers have tried to break with that horizontal axis model, claiming breakthroughs in efficiency or design. Unlike conventional horizontal axis wind turbines (HAWTs), vertical axis wind turbines (VAWTs) spin an "egg beater" shaped arrangement of blades with a generator in the base and a main shaft facing upward. It is thought that this design, since it is non-directional, should perform better in turbulent conditions and therefore not require a tall tower. These new turbines will not produce as much electricity as a larger wind turbine, but if successful, could contribute to a given building's energy needs.

Another design that has been heavily promoted is the roof-top wind turbine. Over the years, small HAWTs and VAWTs along with other experimental designs have been marketed on the premise that they can produce significant power without the expense, zoning or aesthetic issues of a tall tower.

Anyone considering a roof-top wind or vertical axis wind turbine would be wise to research warranties, performance history of products and give careful consideration before making a financial commitment. The Small Wind Certification Council seeks to provide consistent testing and certification of small wind turbines and is a good resource when choosing a small wind turbine.

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(www.smallwindcertification.org)

Barriers to Implementing a Renewable Energy Project

Renewable energy is an attractive feature for commercial buildings. Financing options are better for commercial than for residential systems. The use of renewables adds value to a property and promotion of green features can be good advertising for a business.

Before starting on a project, it is important to make sure to clear any potential roadblocks to success.

Zoning: Zoning ordinances and building codes are enacted to assure that structures are safe and consistent with the surrounding buildings. Because renewable energy systems are relatively new, they may fall into gray or undefined areas and will require some work with city officials to obtain a variance. In many areas, it may be difficult to obtain permission to erect a wind turbine tower or free-standing solar array.

Two options that communities may use to promote small renewable energy systems are the “Small Wind Innovation Zone Program” and “solar easements” as prescribed by Iowa Code.

Financing/Interconnection: In order for a business to consider a renewable energy project, it must make sense financially. Currently in Iowa, that can be difficult but it is not impossible. Federal and state tax credits, grants, accelerated depreciation, low interest loans and utility company rebates can all help a business or property owner shorten the payback on a project.

A geothermal project, pellet stove or solar water heating system may have a relatively quick return on investment (ROI). Wind or PV, on the other hand, may have a much longer payback period depending on the local utility’s interconnection policy. Iowa’s investor-owned utilities are required to provide net-metering (retail credit) for electricity produced. Many municipal utilities also offer net metering. The conditions of the agreement must be examined closely as the value of the electricity produced is key to successfully financing a renewable energy project.

Historic Restrictions: If the building that is to be retrofitted with a renewable energy system is of historic significance as defined by the the state of Iowa (a property that is listed or declared eligible by the State Historic Preservation Office for listing on the National Register of Historic Places, or a facility in which Iowa’s history or the heritage of Iowa’s people is interpreted) and federal or state grant money is to be used for work on the building, the State Historic Preservation Office should be consulted. In general, if a renewable energy project is on a flat-roofed building or other location that is out-of-site, it will not be a problem. More visible projects may be more difficult.

Finding a Qualified Installer: A local, licensed electrician or mechanical contractor has the basic skills needed to install a renewable energy system, but there are specific skills and knowledge required to design and implement a project to deliver peak performance. Iowa has an increasing number of trained and experienced installers, but the trick is to find them.

There are several organizations that provide lists of qualified contractors. For geothermal, the Iowa Geothermal Association is a good place to start. For solar or small wind turbines, ISETA (The Iowa Solar/Small Wind Energy Trade Association) or I-Renew (the Iowa Renewable Energy Association) can both be of help. Make sure that any contractor you choose is registered with Iowa Workforce Development and provides proof of insurance and references. Also ask if they are certified by NABCEP (North American Board of Certified Energy Professionals).

Incentives

As mentioned earlier, federal and state tax credits, grants, accelerated depreciation, low interest loans, and utility company rebates can all help a business or property owner shorten the payback on a project. In most cases, a combination of these financing mechanisms is used to bring the ROI on the project into a timespan that the owner of the system (or their lender) finds acceptable. Incentives are constantly changing, but here are some examples of programs available for renewable energy projects in Iowa’s Main Street districts as of 2011:

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Federal Income Tax Exemption: The Business Energy Investment Tax Credit (ITC) allows people investing in renewable energy systems to deduct 30% of the system cost for solar and small wind (and 10% for geothermal).

Accelerated Depreciation: The Modified Accelerated Cost-Recovery System (MACRS) allows a business to take 100% of depreciation in year one through the end of 2011, and 50% through the end of 2012.

USDA Renewable Energy Grants for Businesses: Rural Energy for America Program (REAP) grants are for farms and businesses in towns with a population of less than 50,000 residents. They provide up to 25% of the project cost, including feasibility studies.

State Sales Tax Exemption: All solar and wind equipment purchases made in Iowa are free of state sales tax.

State Loan Program: The Alternate Energy Revolving Loan Program (AERLP) is a low-interest loan program administered by the Iowa Energy Center at Iowa State University. AERLP provides 50% of the loan amount at zero percent interest while the other 50% comes from another lender at the market rate.

Utility Rebates: Currently in Iowa, only Alliant Energy offers utility rebates for renewable energy projects. Their "Efficiency First" rebates encourage customers to maximize their buildings efficiency by offering incentives based on meeting efficiency goals first.

Renewable energy projects hold great promise for Iowa's historic commercial buildings. As the price comes down on new, more efficient equipment and the price for electricity and natural gas continue to rise, small scale renewable energy projects will become more and more attractive. Iowa's downtown commercial district businesses have a tremendous opportunity to lead the way and help create a new market for clean, locally produced energy.

References and Resources

Small Wind Certification Council
smallwindcertification.org

Do Solar Systems Increase Property Values?
By Robert "Bob" Mitchell
www.renewableenergyworld.com/rea/blog/post/2011/02/do-solar-systems-increase-property-values

Database of State Incentives for Renewables and Efficiency
www.dsireusa.org/incentives/index.cfm?getRE=1?re=undefined&ee=1&spv=0&st=0&srp=1&state=IA

Iowa Code Chapter 564A: Access to solar energy
coolice.legis.state.ia.us/Cool-ICE/default.asp?category=billinfo&service=iowaCode&ga=83&input=564A

State Historical Society of Iowa - The Historic Site Preservation Grant Program (HSPG)
www.iowahistory.org/about/grants/hspg/eligibility-requirements.html

Iowa Geothermal Association
www.iowageothermal.org

Iowa Solar/Small Wind Trade Association
www.iowaseta.org

Iowa Renewable Energy Association
www.irenew.org

Iowa Workforce Development
www.iowaworkforce.org

North American Board of Certified Energy Professionals
www.nabcep.org

Iowa Energy Center - Alternative Energy Revolving Loan Program
www.energy.iastate.edu/AERLP/index.htm

HDC Guide for Historic Buildings - Clean Air-Cool Planet
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Titles include:

- Energy Efficiency Basics
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