IT'S EASY BEING GREEN:

Sustainability in Bayfield From a Historic Preservation Perspective

EXECUTIVE SUMMARY

The City of Bayfield recently adopted a resolution to incorporate sustainable practices based on the Natural Step Framework into their decision making and operations, becoming the latest in a series of eco-municipalities in the Chequamegon Bay region. Bayfield has shown a commitment to sustainability through the incorporation of that theme in its *Comprehensive Plan 2002-2022.* Its sustainability commitment is also evident in its early efforts to preserve its built environment, which began over twenty-five years ago with the nomination of the Bayfield Historic District to the National Register of Historic Places. It has continued with the subsequent adoption of a Historic Preservation Ordinance, local Historic District, and Design Guidelines.

Historic preservation and sustainability go hand-in-hand. Historic preservation serves to promote sustainability environmentally, economically, and socially. Preserving existing buildings and adapting them for new uses over time makes the best use of the resources and energy used in their initial construction, known as *embodied energy*, as well as saving open land and keeping demolition materials out of landfills. Rehabilitation of old buildings can generate more local dollars that stay in the community rather than being exported elsewhere. Financial incentives for historic preservation can also help to meet the social needs of the community by facilitating the creation of affordable housing.

Bayfield has many characteristics inherent in its design that incorporate sustainability concepts. It was designed before the advent of the automobile, making it pedestrian friendly. It was built from materials that were derived locally. Much of its building stock dates to before 1920, when buildings were routinely designed to work with nature to take advantage of ways to be comfortable without mechanized methods of climate control. Natural ventilation, passive solar design, and natural daylighting are three areas of the green building movement that were routinely incorporated into historic buildings. Such buildings in Bayfield often featured large windows; prism glass; operable transoms; south-facing windows; the incorporation of thermal mass with stone walls and exposed foundations; storm windows; and the use of window awnings. By learning about these features and making them work to their advantage, property owners can increase their comfort while saving energy.

In addition, historic buildings can be retrofitted with measures to increase their energy efficiency and water conservation. These measures should be undertaken very thoughtfully and with care so as not to damage or destroy the historic fabric and cultural value of the property. Sealing air leaks, increasing the level of insulation, monitoring your energy and water usage, adding storm windows, and thoughtfully designing your landscape are all ways to approach sustainability.

Renewable energy use has been incorporated into Bayfield's Historic District on a limited basis, and the desire for these technologies is likely to increase with time. It is very important to make sure that steps have been taken to make a property as energy efficient as it can be *before* considering renewable energy technologies, as they are currently very expensive with long payback periods. In addition, there are aesthetic concerns associated with some of these technologies that conflicts directly with the goals of maintaining the historic authenticity of the community. Building technologies are rapidly changing, and with time more products will become available that balance these concerns. Property owners should work with existing roof planes and color to make the solar installations as unobtrusive as possible. **Panels and collectors that are sharply angled off the roof are generally not considered appropriate in any historic district in the country.** Other renewable energy technologies include wind power, geothermal systems, and combustion of biomass fuel for heating. Each of these has advantages and disadvantages for consideration.

A green rehabilitation or addition to a historic property involves thoughtful planning, and first steps should be to consult the City of Bayfield's Historic Preservation Ordinance and the Historic District Design guidelines. Choose an architect that is familiar with historic preservation practice, including the Secretary of the Interior's Standards for Rehabilitation. There are also many building professionals now that are also well versed in sustainable design concepts. Preserving the existing integrity of the structure, deconstruction and recycling of existing materials, and careful consideration of the environmental impacts of new materials are important aspects to a successful green rehabilitation project. Financial incentives for rehabilitation of historic properties, including tax credits and income-tax deductions for façade easement donations, as well as incentives for energy conservation, can be part of a successful green rehabilitation.

Bayfield was designed to be beautiful, which may explain in part why many of its historic buildings remain. Typically, things that were designed with beauty in mind are well cared for. Our architectural beauty and authenticity are assets to be cherished and protected, just as our other precious resources. By preserving our built environment, we are performing an act of sustainability that, in turn, helps to preserve the planet.

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Bayfield is a leader, not a follower. As outlined in our *Comprehensive Plan 2002-2022* for the community, we are proactively setting the course for our future. Sustainability was one of the many themes incorporated into that planning document, and it is a theme that has become even more relevant as we go forward with the eco-municipality model we have adopted in the community.

Protection of our cultural resources was another theme addressed by the Comprehensive Plan. One of the goals presented was to preserve and protect our community cultural resources, including those of historical and archaeological importance.[1] Our Historic Preservation Ordinance, along with our Design Guidelines for the Bayfield Historic District, are tools to help the community accomplish the goal of preserving our unique architectural identity.

But design guidelines, while providing a roadmap for the community, do not by themselves provide for the preservation and authenticity of the community's historic fabric. In order to be the most successful in maintaining Bayfield's architectural heritage for the future, the impetus must come from the bottom up, much like the incorporation of sustainable practices outlined in the Natural Step Framework, which is the basis for Bayfield's eco-municipality model.[2]

"And then it hit me. The more I inquired into the forces that make preservationists do the things we do, the more I realized that preservation is really un-American…the fact is that preservation goes against the basic historical thrust that built America into a world power. America was built on the concept of the frontier. Land was limitless. Resources were never ending. The pioneer way was to use it up, throw it away, and move west…. [Preservationists] are not making futile, reactionary gestures. Rather, we represent the cutting edge of a true cultural revolution, a revolution generating new perceptions that will have a dramatic impact on America's way of thinking in the next 50 years. That is why we are un-American. Preservationists oppose the conventional American idea of consuming ever more. We are actually the new wave of pioneer. We are struggling to reverse the "use it up and move on" mentality…We are cleaning up after society's litterbugs."

Labine, Clem. "Preservationists Are Un-American," *Historic Preservation* (March 1979): 18.

And in many ways it has. Our history shows that Bayfield's identification of our historic and architectural resources, as well as the creation of the comprehensive plan to protect them, has been aided by a grassroots endeavor, which recognized the importance of the groundwork laid by William Tishler and his team of students of the University of Wisconsin in the 1970s and the subsequent designation of the 50-block National Register Historic District in 1980. The large degree of participation by members of the community in the designation of Bayfield's local Historic District and the development of design guidelines for the district shares much in common with the bottoms up approach to sustainability that the City has adopted. What may not be apparent to everyone, however, and what this document will attempt to do, is show that the two goals of sustainability and historic preservation are not mutually exclusive goals. In fact, they are goals that are very much aligned with each other. "Green" advocates and preservation advocates truly are on the same team, with philosophies that oftentimes overlap. This is to Bayfield's advantage as we move into the future and as other communities look to us to lead the way (and they do!) in demonstrating how to reconcile efforts in both areas.

This document will serve two purposes. First, it will attempt to provide information as to best practices in sustainability from a historic preservation perspective. That means it will reconcile the information out there on being green with the sustainability and preservation goals set forth by the community. The second thing it will do will attempt to provide property owners with resources to research the topics further and find relevant products and additional information.

Bayfield: An Eco-Municipality

The City of Bayfield has recently voted to become an eco-municipality, along with other communities in the Chequamegon Bay region. After their introduction in Sweden, where there are over 60 such communities, to great success, many other local governments in the state of Wisconsin and around the country are following suit.[3] The eco-municipality model uses the Natural Step Framework to incorporate the idea of sustainability into all decision-making with a bottoms-up, systems approach, analogous to a tree with sustainability objectives at the roots and the different branches of government utilizing those objectives in all planning and procedures.[4] Historic preservation is one branch of the City of Bayfield tree, and this manual is meant to help property owners to think about sustainability and offer guidance as they live in and use their historic buildings.

The Natural Step Framework was developed in Sweden in the 1980s by scientists and other professionals concerned with the idea of sustainability under

the direction of Karl-Henrik Robert, a doctor and cancer-treatment specialist. It uses the laws of science in conjunction with simplified, easily understandable language to create a set of conditions for sustainability as well as a way to measure the progress of incorporation of sustainable practices.[5] It is a planning tool for all types of organizations - businesses, governments, and households alike.

What does Historic Preservation have to do with being an Eco-municipality?

Carl Elefante, director of Sustainable Design at Quinn/Evans Architects, has coined a mantra that bears repeating to anyone not familiar with the inter-relationship between historic preservation and sustainability: "The greenest building is… one that is already built."[6] But what does he mean by this? He is referring to the huge investment in terms of energy and natural resources that has already been made in existing buildings. While most of the discussion on sustainable development concerns itself with building new, "green" buildings, this mindset ignores the fact that new buildings require the use of new land, new materials, or, in the case where the building replaces an existing structure, the demolition and disposal of that building – not the best resource management practices. This is an accepted mindset because it is the way Americans have done things since the beginning of the industrial era – use it up, throw it away, and replace it with something new.

A study completed by the Brookings Institution in 2004 predicts that by 2030 the United States will have demolished and rebuilt 82 billion square feet of our existing building stock, which is about one-third of the total.[7] The energy required to fulfill that prediction is the same amount required to power the entire state of California for 10 years, and the resulting construction debris will fill the equivalent of 2500 NFL stadiums.[8]

Contrast that way of thinking with the environmental mantra of "reduce, reuse, and recycle." Historic preservation fits with this philosophy very well. By living in and running our businesses in existing buildings, we reduce the amount of materials we consume in new construction, we reuse what already exists, and those buildings can be recycled into new uses, using construction materials that have been recycled (i.e., "salvage") when the time comes for them to be repurposed. Buildings can be looked upon as a renewable resource. The National Trust for Historic Preservation estimates that if just 10 percent of the 82 billion square feet predicted to be demolished and rebuilt were instead rehabilitated, the energy savings would power the state of New York for well over one year. [9] In addition to resource and energy savings, rehabilitation will protect our cultural resources, which give Bayfield its unique sense of place,

sustaining them for the enjoyment and identity they provide for generations to come.

We can look to our Swedish leaders in the eco-municipality movement for examples of how historic preservation and sustainability go hand in hand. For example, the eco-municipality of Eksjö has formed a nonprofit organization concerned with safeguarding the knowledge of traditional Swedish building techniques and have started an educational endeavor to promote their continued use as a means of preserving their cultural heritage as it pertains to their built environment.[10] The Center for Building Preservation was formed in 1995, and it trains craftspeople in the traditional building methods along with ways to incorporate those practices into new construction.[11] In this way, preservation and sustainability thought merge to provide skilled labor that benefits the community culturally and economically.

Defining Sustainability

This brings up another point. Most people perceive the concept of sustainability as being only about the environment. How is sustainability defined? There are broad definitions as they relate to the built environment, as well as more specific ones. The Natural Step identifies four conditions that a sustainable society must meet.

The Natural Step Conditions for a Sustainable Society

1. **Extracted substances from the Earth's crust must not systematically increase in the biosphere.**
2. **Substances produced by human society must not systematically increase in the biosphere.**
3. **The productivity and biodiversity of the Earth itself must not systematically be physically deteriorated.**
4. **Human needs must be met with a fair and efficient use of energy and other natural resources.**

Robert, Karl-Henrik. *The Natural Step: A Framework for Achieving Sustainability in Our Organizations*. Cambridge: Pegasus, 1997.

Another definition comes from the 1987 *Brundtland Report,* published by The World Commission on Environment and Development, which focuses more specifically on the concept of *sustainable development*, which is "development that meets the needs of the present without compromising the ability of future generations to meet their own needs."[12] The *Brundtland Report* set out the three fundamental components of sustainability: environmental protection, economic growth, and social equity.

Somewhat more specific than this is the concept of *sustainable design.* The architect Jason F. McLennan in his book *The Philosophy of Sustainable Design* defines this as "a design philosophy that seeks to maximize the quality of the built environment, while minimizing or eliminating negative impact to the natural environment."[13] He argues that because it is a design philosophy it is not an aesthetic exercise or fad that will quickly go out of style. It helps to instill a sense of responsibility and higher purpose into design,[14] and he makes the point that part of that responsibility is building things of quality that are meant to last for future generations, much in the manner that things used to be built before we became a culture of disposability.

Historic preservation has the attributes to make a positive contribution to sustainability on all fronts – environmentally, economically, and socially. It is environmentally friendly because it uses fewer new resources, and the materials involved are often natural materials, not synthetic substitutes that increase the levels of toxic compounds in the atmosphere. Historic buildings are built from materials that require less energy to produce than many materials used in new construction.[15] In addition, preserving existing buildings helps to curb the need to build on undeveloped land.

Historic preservation can also contribute to economic sustainability. Historic buildings are generally more affordable, which make them particularly well-suited for use by small businesses.[16] Rehabilitation for properties on the National Register of Historic Places, which includes nearly all of the properties in Bayfield's Historic District, often qualifies for government financial incentives, which can be used to decrease the costs of rehabilitation work. Rehabilitation of historic buildings creates job opportunities. A general rule of thumb is that new construction costs break down into half for new materials and half for labor.[17] Rehabilitation is much more reliant on labor than materials, with the result being that more money is kept in the local economy and spread around, instead of being sent outside of the community.[18] Another benefit is that rehabilitation work requires more skill, which ostensibly translates into higher wages for the laborers. Another economic benefit is that heritage tourism, and yes – visitors come to Bayfield to enjoy the architecture in addition to the natural beauty – helps the local economy.

The State of Wisconsin's Main Street Program, administered by the Division of Historic Preservation of the Wisconsin Historical Society, has made a very real contribution to the economic sustainability of Wisconsin's historic downtown areas. Between the years of 1988-2000, this program was responsible for creating over 1,775 new businesses, over 9,500 new jobs, and stimulated a total private investment of over $257 million dollars.

Wisconsin Historical Society, Division of Historic Preservation. *A Guide to Smart Growth and Cultural Resource Planning,* Richard A. Bernstein, ed.

Social sustainability is also positively impacted by historic preservation. Protecting our cultural resources serves to protect our identity and what makes Bayfield special. It will serve to keep our community vibrant, welcoming, and desirable as a place to live, work, and visit. Historic preservation can even be used to achieve goals in the creation of affordable housing, as government financial incentives for low-income housing development can often be combined with historic tax credits for qualifying properties in historic districts. A good example of this approach can be found in Mineral Point with the conversion of its historic high school building into an apartment house.[19] This option has not been pursued in Bayfield to date, but perhaps will be explored in the future.

Historic preservation also illuminates that sustainable design is a philosophy for the ages, and it is only recently, in the twentieth century, that we have gotten away from it. Buildings constructed in the nineteenth and early twentieth centuries incorporated many features of sustainability that we consider innovatively "green" today – features that somewhere along the way were rejected with an embrace of modernistic design and technological (but not necessarily environmental) advances in the types of materials and features used in construction.

Mineral Point High School Apartments/Photo by Stone House Development[20]

Along my own journey, I have come to understand several key things:

- **That we, as a society, cannot continue for long down the current path we are on, each year breaking records for the amount of energy, water, and materials used and the pollution and waste created, without seeing widespread social, economic and environmental upheaval.**

- **That we in the building professions must bear a large share of the responsibility in redesigning the places and systems that we use to live sustainably, because many of the solutions to our environmental problems are design problems.**

- **That a sustainable future is possible and achievable within this century if we continue to remove the barriers to sustainability and apply appropriate technologies and the knowledge we continue to acquire.**

- **That most of the barriers to a sustainable future are not technological but fear and ignorance based.**

- **That each of us must begin now so that the treasures of today remain for future generations to enjoy. Each of us has a role to play.**

McLennan, Jason. *The Philosophy of Sustainable Design,* Bainbridge Island: Ecotone, 2004, p. xxvi.

Bayfield's Environmental Capital

The term "environmental capital" has been used by one source to describe a city's stock of natural resources and environmental assets.[21] In Bayfield, it includes not only the abundant natural resources and beauty in the area, but also the embodied materials and energy that have been invested in the creation of the built environment.[22] *Embodied energy* is defined as the energy required to extract, process, manufacture, transport, and install building materials.[23] There are two types: initial, which relates the actual materials and energy that go into the construction of a building, and recurring, which is the energy required for building operations and renovations.[24] It is estimated that the initial embodied energy per square foot in the construction of a typical mid-century building is equal to the amount of energy created by 5-15 gallons of gasoline.[25]

Of course the operating energy over the life of the building is much greater than the energy used in its initial construction. Most people assume that older buildings are "energy hogs," and that replacing them with new, energy-efficient structures is the best use of resources. But surprisingly to many, this is not the case. Recent calculations estimate that it takes about 65 years for an energy-efficient new building to save the amount of energy lost in an existing building that is demolished.[26] But what's even more surprising is that it has been determined that buildings built before 1920 are actually more energy efficient than any other buildings of the 20th century.[27] This is because older buildings have design features that make them "greener" than most buildings except for new "green" construction of the 21st century. Understanding what these design features are, preserving them, and utilizing them to their best advantage will help all historic property owners to live or work in their properties in a more environmentally conscious manner.

Many Features of Bayfield and its Historic Properties Were Originally "Green"

Bayfield as a community was planned before the advent of the automobile. As a result, it was designed to be walkable. That feature gives Bayfield an advantage as an eco-municipality relative to other communities that developed primarily *after* the car became the primary consideration in all community planning efforts. Neighborhoods that were planned after automobile ownership was widespread were designed without amenities such as sidewalks, and much of their open space was converted to the likes of strip malls and parking lots. We are very lucky to have avoided that here. If you live in Bayfield you will likely put less miles on your car, and more miles on yourself! That's good for the environment, not to mention personal health.

The shift in community design from pedestrian-friendly to car-friendly has come full circle and is turning back again. The results of sprawl have got everyone thinking about what kinds of neighborhoods work best from a livability standpoint, as sprawl makes everyone, young and old alike, slaves to their automobiles. If the goal is to limit consumption of fossil fuels, then different neighborhood designs are of a top concern to architects and city planners alike. And what kinds of designs are they coming up with? New neighborhoods based on historic precedents.[28] It turns out that the old way is the better way, as well as the greener way.

The American Planning Association (APA) has developed a sustainability policy, also based on the Natural Step Framework, that will help them attain their goal of community development planning to reverse the trend of environmentally and socially destructive development patterns that came with the advent of the automobile.[28] This policy includes promotion of compact

development that reduces the need to drive, local food production and agriculture, home-based occupations that reduce the need to commute, a mix of integrated community uses, and human scale development that is pedestrian friendly. All of these things are in Bayfield already in part because of its historic town plan. Historic neighborhoods are on the cutting edge of sustainable community design.

But beyond Bayfield's green community design, there are also features within its historic buildings that are also on the cutting edge of green design. Because so many of these buildings were built before electricity and mechanical climate control, they were often designed to maximize natural sources of heating, lighting, and ventilation. In many cases, we as property owners have forgotten how to use these things to our advantage to increase our comfort without using energy. As they are doing again today, in earlier times architects and builders paid close attention to the attributes of the site of the building and then incorporated features to take get the most climate-control advantage.

Take a look at your property and see if it contains any of these design features:

Large windows and/or transoms containing prism glass - allow more natural light to enter, reducing the need for artificial light.

South facing bands of windows – allow the use of passive solar gain to warm interiors in winter.

High ceilings – allow hot air to rise above living space.

South- and west-facing porches – keep the heat of the late afternoon sun away from the interior of the house during the summer months; can be used to gain heat in the winter months.

Operable windows with transoms – allow natural ventilation, as well as the escape of warm air that rises. For double-hung windows, often both top and lower sashes could be opened to get the best ventilation.

Thick masonry walls – high thermal inertia lengthens the time it takes heat from the summer sun to penetrate – this is one reason why masonry buildings feel cool even when it is very warm outside. The opposite is true in the winter, as it takes longer for warmed air to move through the masonry walls.

Original storm windows- greatly increase the thermal efficiency of single-pane windows.

Awnings – historically used in the summer to control the amount of heat that entered through the windows. Awnings could be removed at the end of the summer to allow passive solar gain in the winter.

Use of local building materials – while not directly related to climate control, it is definitely related to greenhouse emissions. A key tenet of sustainability in design is to build with local materials that do not travel far. Historically, that was the way it was done, and Bayfield is no exception, with its sandstone foundations, retaining walls, and wood clapboard-sided buildings, all materials derived locally as the city was being built.

Three technologies that are being incorporated into green building design today are the use of natural ventilation, passive solar design, and natural daylighting. These are three big areas where older buildings have an advantage relative to many built in the mid-to-later part of the 20th century. In many cases, pre-WWII buildings already address these features to some degree. As our technologies advanced and we increasingly turned to mechanized means (i.e., fossil fuel dependence) to provide thermal comfort and light, the old ways of designing to work with nature were lost. We are entering a new era, however, and the award-winning green buildings of today are once again incorporating these features.

Natural Ventilation

Natural ventilation used to be a primary consideration in the delivery of comfort to our living and working spaces during the summer months. Somewhere along the way, however, ventilation became equated with energy inefficiency, or maybe it was that we became to lazy to monitor the opening and closing of our windows to our advantage – we decided it was easier to work with the thermostat. As we gradually stopped using our windows and began relying on our air conditioners, we also stopped our window maintenance, allowing many of them to be painted shut so they are no longer operable.

There has been a tendency in the latter part of the 20th century to tightly seal the interior of our buildings in order to make them more energy efficient. While it is certainly good practice to insulate your home, especially in the attic, and attempt to mitigate drafts with weatherstripping and other sealing techniques, sealing our buildings too tightly has led to a serious problem with indoor air pollution. This is an example where good intentions led to unintended consequences, and has even been responsible for a recently identified phenomenon called "sick building syndrome." Buildings that cannot breathe can contribute to the build-up of carbon monoxide and the off-gassing of interior finishes and furnishings, not to mention the accumulation of mold and mildew. [30] The American Lung Association has found the indoor air quality in the average American home to be much worse than outdoor air, even in industrial areas.[31] That is a very sobering finding, given how much time we spend indoors.

Since we live where the air is good – clean and fresh – it is to our advantage to let it indoors in the summer months. Many of our historic properties in Bayfield were designed to do this. Historic windows were often designed with moveable top and bottom sashes, and opening both gives greater ventilation efficiency. Windows often align with each other on opposite sides of

the structure, allowing cross ventilation. Sometimes even interior windows were incorporated into the design in hallways and between rooms, to aid in both ventilation and capturing natural daylight. Operable transom windows allowed excess heat to escape. In many cases the transom windows have been replaced with fixed panes, and making them operable again is a way to increase your comfort while lowering your energy costs.

Passive Solar Design

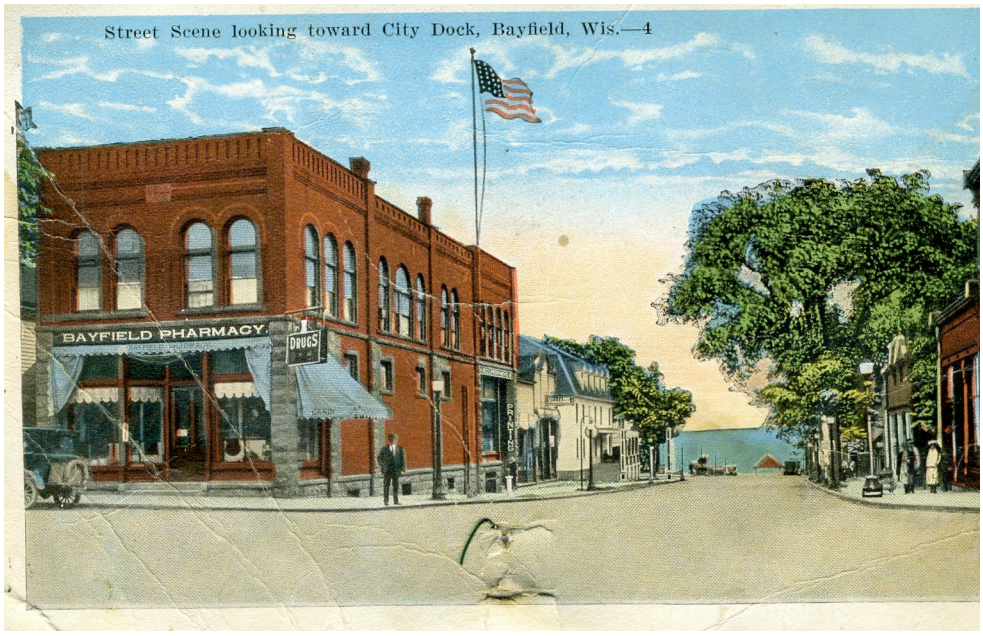
Natural sunlight has the ability to lower your heating bills in the winter, if you take advantage of it to the extent that you can. Many new green buildings today incorporate the maximum use of passive solar heating by carefully orienting the building to take advantage of south-facing rays and incorporating the use of thermal mass, such as brick or stone, to capture the heat and slowly transfer it to the interior. During the summer months, heat from the sun can be blocked through the use of shading devices. South-facing rays are easier to control in this way than east- or west-facing sunlight, which is always at a lower angle, and it is recommended that a new green building be elongated in an east-west orientation to best take advantage of the sun's free heat.[32]

Luckily for Bayfield, our lots are already laid out in an east-west configuration, and many of the existing building forms follow this shape. Because so many of our lots are not level, generally our stone foundations are exposed to the sun to some degree. Benefits are maximized on the south side, but even east- and west- side exposures will absorb some of the sun's rays during the day. If you have a south-facing enclosed porch with windows that includes an interior masonry wall, the heat collected in the sunspace and transferred to the thermal mass of the masonry can be used to warm the interior of your home at night, provided you add some ventilation measures.[33] But even without the thermal mass, solar heat gained through windows during the day can be used to help heat the interior during the daylight hours.

The use of dark paint schemes on Victorian-era buildings maximized solar heat gains in the winter in cold climates. Photo courtesy of Neal Vogel.

To minimize passive solar gain in the summer, use shading devices to reduce your property's heat capture. Awnings are particularly effective, and canvas awnings were common on historic buildings, providing visual character for a very long period in most of America's commercial and residential neighborhoods.[34] With the advent of air-conditioning, we seem to have gotten away from this visually pleasing way to minimize heat gain, which saves the amount of energy required to cool an interior space. Awnings can be stored during the winter months, when solar gain is appreciated.

Image: Otis Awning Fabrics Company Brochure c. 1920s. From National Park Service Technical Preservation Brief No. 44., *The Use of Awnings on Historic Buildings*, 2005. http://www.nps.gov/history/nps/tps/briefs/brief44.htm



Historic Postcard of Bayfield showing the Currie Bell Building with awnings. Courtesy of Roxanne Frizzell

Natural Daylighting

Before the advent of electricity, buildings were often designed with features that would maximize the indoor light. Gas lighting and early electric lighting was very dim, and didn't provide the intensity of light that we have grown accustomed to today. This is in part why many of Bayfield's older properties have a large number of windows, and the sizes of the windows in many of the Queen Anne and Italianate structures are quite large. It is another reason why building designs, in addition to their natural ventilation features, often featured transom windows above double hung sashes and doorways.

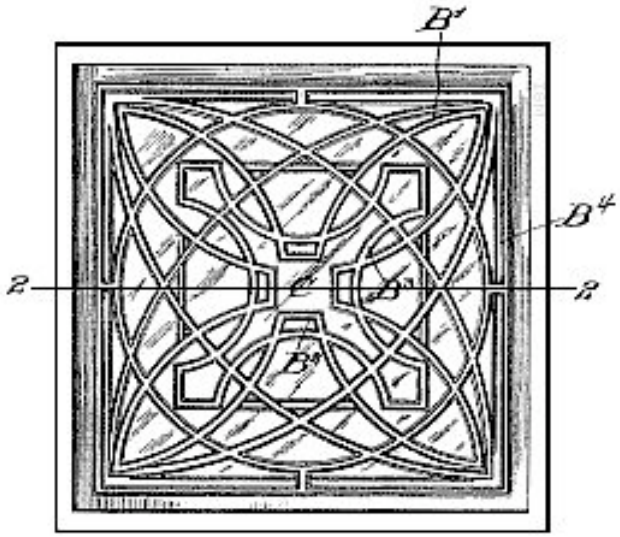
A number of Bayfield's early commercial storefront windows had another feature to enhance the interior lighting levels. If you look closely at some of the commercial buildings, you will see small fixed panes of prismatic glass in the transoms above the main storefront areas. The Bate's Art Barn building (14 S. Broad St.) is one example where these transoms remain, as well as the building on the southeast corner of Rittenhouse and 2nd Street, which houses the clothing store, Xanadu. Even the IGA still has one remaining transom with prismatic glass on the east side of the front elevation.

These prismatic tiles of glass were designed with ridges or raised patterns on their surface, allowing sunlight to be refracted toward the rear of the interior of the building, and they were typically held together in a manner similar to that used for stained glass.[35] These transoms went out of fashion as artificial lighting improved and commercial aesthetics became more modern, but in their heyday there were many companies that manufactured these glass tiles.[36] The first company to have a patent on the technology and quickly became the industry leader was the Luxfer Prism Companies, which originated in Chicago in the 1890s.[37]

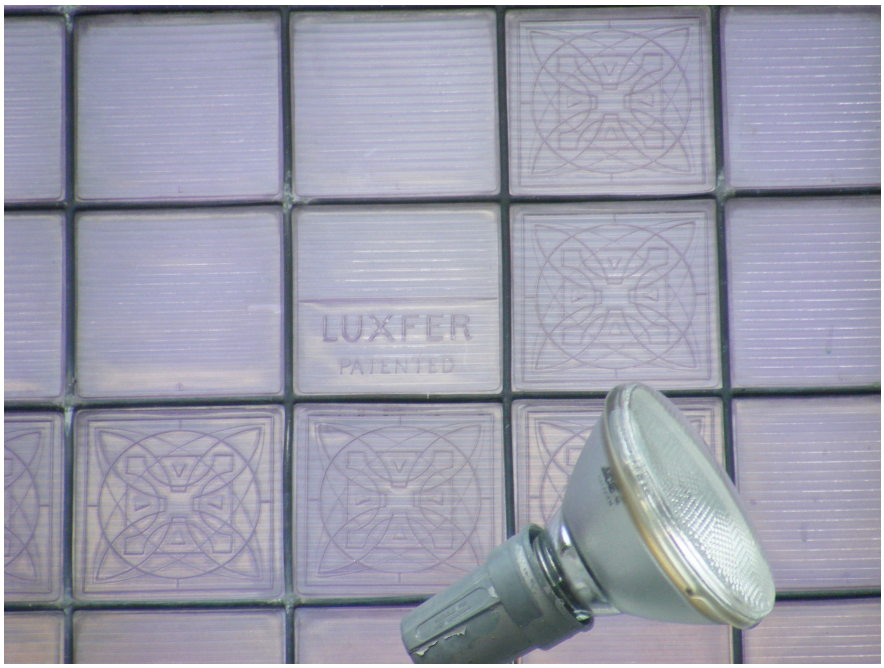
The prismatic glass was very popular because it worked so well. Luxfer Prism Companies boasted after its first year of operations that nearly 200 buildings incorporated the use of the prisms in Chicago to great success, and that the building owners for the most part recouped their costs associated with installing the technology in just a year's time with reduced gas and electric bills.[38] While there is really no way to verify this claim, it is known that the performance of the glass was such that after its introduction some of the major architects in Chicago were able to design their buildings without the use of light wells, the common practice before the availability of prism glass.[39] This was important to building owners, as the space previously allotted for the light well could now be utilized as rent-producing space.

The Bates Art Barn building on South Broad Street contains Luxfer Prism glass, as indicated by the company logo found in some of the glass tiles, which is

visible from the sidewalk. It also has the distinction of containing patterned prism glass tiles that were designed by Frank Lloyd Wright in 1897, as he worked for the Luxfer Prism Companies as a designer early in his architectural career.[40] While he obtained patents on over 40 designs for the company, the one found on the Bates Art Barn building, pictured below, was the only one known to have been put in mass production.[41]



Frank Lloyd Wright patented design for Luxfer Prism glass, No. 27,977
http://glassian.org/Prism/FLW/index.html



Luxfer Prism glass from the Bates Art Barn building, showing tiles designed by Frank Lloyd Wright. Photo: V. Birenberg

Some of Bayfield's commercial storefronts have lost their original prism glass transom windows, but with archival research and photo documentation, building owners should be able to determine if their building originally had it. Restoration would not only enhance the historic character of the community, but would have the additional benefit of increasing natural daylight in these buildings, which may allow for decreased use of artificial light and subsequent energy savings. Salvaged glass tiles are sometimes available, but there are manufacturers today who are making them again.[42]

Reproduction of historic postcard showing Bayfield streetscape circa 1900. Note the prism glass transoms in the building that now houses Andy's IGA. There is also prism glass in the (now demolished) building across the street. Postcard courtesy of V. Birenberg

New Measures For Making Your Historic Property Greener

We have discussed the concept of *environmental capital*, which for Bayfield as anywhere else includes both its natural resources and built environment. The impact of any action taken upon a community's environmental capital is known as an *environmental impact.* The idea in sustainability is to impact the environmental capital as little as possible. Existing buildings that are maintained using renewable, indigenous materials have a low environmental impact, especially if they are made as energy efficient as they can be.[43]

Environmental performance is a measure of how well an existing building performs in relation to its environmental conditions.[44] Traditionally constructed

buildings often have features that utilize these conditions to their advantage, as has been pointed out. But it also makes sense to improve this performance when possible, further reducing environmental impact of the building without the associated damaging impact of reconstruction or major alterations. Low-tech, low-impact upgrades can have real returns in terms of resource conservation and cost savings**. But it is important to keep in mind that historic buildings have cultural value, and therefore alterations that affect the integrity of important architectural features, or remove historic fabric, or introduce unwanted chemical reactions or moisture-related deterioration should be avoided at all costs.**

Before discussion of active measures that can be taken to increase the thermal performance of an historic building, it should be pointed out that passive, common sense measures should be looked at first. In addition to taking advantage of the inherently green design of your property through natural ventilation, solar gain/avoidance, and natural daylighting, simple measures to conserve energy should include lowering the thermostat in the winter and raising it in the warm months (a programmable thermostat is a good way to control day/evening temperatures), closing off those rooms that are used infrequently, turning off lights, and having your furnace, boiler, and air-conditioning unit serviced regularly to make sure they are operating at their most efficient levels, which includes cleaning the radiators and forced air registers to ensure proper operation (don't forget to change that furnace filter on a regular basis!)[45] Beyond this, active measures should be taken very carefully and thoughtfully, so as not to damage the historic fabric of the building. **Once authentic historic materials are lost, they are gone forever, and the overall architectural integrity of the historic property is decreased.**

Paint layers on radiators can reduce their efficiency. Paint removal has its own environmental considerations, and can be a very messy and tedious process for the do-it-yourselfer. The best approach may be to disconnect them during the warm months and take them to a professional sandblaster.[46] Victorian radiators are often very decorative, and eliminating the layers of paint will really bring out the detail, in addition to making them operate more efficiently. When choosing a new color to paint them, remember that darker colors will generate greater heat, but it is very important to use a paint specially formulated for heated surfaces. Their efficiency can be further improved by placing a metal shield behind them on the wall side. Radiators are not only a heat source, but one that can be utilized creatively to maximum benefit – like warming your towel for you in the bathroom, or drying your mittens when you come in from the snow!

Sealing Air Leaks

While natural ventilation is important for a building to breathe and avoid problems with moisture and indoor air pollution, it is beneficial to address areas where excess amounts of air infiltrate. Weatherstrip around door and window openings, and add caulk around other cracks and crevices, like underneath the windowsills. Another source of drafts can be at junctures where surfaces meet, such as where walls meet ceilings, or at baseboards where shifting or shrinkage has allowed gaps to become exposed.[47] Gaps larger than 1/4 " will require the insertion of a piece of foam backer before caulking. It is also good to inspect your property on the exterior to look for gaps where electrical, cable, telephone, and gas lines enter the building, as well as where water pipes lead to the exterior, and caulk around these entry points. On your interior, foam gaskets can be placed behind outlet and switch plates to minimize drafts. Stuffed, weighted draft-stoppers placed at the base of exterior doors are a low-tech, very green way to stop air infiltration.

Weatherstripping and caulk can be used to fill most cracks and gaps of up to 1/4" in the building envelope. A common way to deal with some of these cracks is by using expanding foam insulation that comes in a spray can; however, if you go this route, do some research to find a product that has the least environmental impact. Many of these products use HCFC and CFC as propellants, which can damage the ozone layer. HFC or propane-based propellants avoid this, but they are flammable during installation and require ventilation. It is uncertain if there is a product of this type out there that would meet the guidelines of the Natural Step Framework.

Another area where leaks can occur is at the foundation, and at the juncture where it meets the walls. Caulk cracks and crevices with a caulk designed to work with masonry. Also, any gaps that show daylight in your foundation need to be repaired. Repoint masonry where mortar has failed, taking care to use the appropriate type of mortar. It is very important not to use mortar when repointing that is harder than the masonry material itself. The mortar was designed to be the sacrificial element of the masonry wall system, and will need periodic replacement. If you repoint with a material that is harder than the masonry (e.g., such as Portland Cement in a sandstone wall) then the stones or bricks will deteriorate, rather than the mortar.[48]

Another big source of drafts is the chimney. Fireplaces can be a major source of heat loss in the winter. Turn the thermostat down when you burn in it. Keep the damper closed when not in use. You may consider a new damper that is added to the top of the chimney, which creates a tight seal without visual disruption to your historic fireplace. If you have a new or remodeled fireplace in your historic home, the addition of glass doors can enhance combustion

efficiency and reduce air leaks. If you have an authentic, historic fireplace; however, glass doors would probably not be a good aesthetic choice. In that case, a hearth cover made of sheet metal or wood to fit over the fireplace when not in use would at least inhibit drafts and heat loss.

Insulation

The active measure you can take to improve the energy efficiency of your property that will have the most impact is to insulate your attic. Heat rises, and while there is much marketing hype out there by window replacement manufacturers about money you can save by replacing your windows, the bottom line is that most of the heat loss in a building is through the roof and the chimney. In cold climates such as Bayfield's condensation can collect in whatever insulation material you use, so it is important to use a vapor barrier facing in (which means face-down between joists in an unheated attic, or between the roof rafters face-in in a heated attic space), and to ensure that the attic is well ventilated. This will prevent the insulation from becoming saturated with moisture, which inhibits its thermal effectiveness.[49]

What kind of material is the best to use for insulation? There are a number of alternatives to the "pink' fiberglass insulation, which seems to be the industry standard. While it is generally inexpensive, there are health concerns associated with its use, particularly as a lung and skin irritant. Likewise, rigid polystyrene panels are not kind to the environment in their production process. There are alternatives out there, all of which deserve consideration and investigation. Fiberglass insulation is not necessarily the worst choice – it is important to look at each product and its environmental impacts over an entire life cycle, meaning from pre-production to the point where it will eventually be disposed of. Do your homework, but here are some ideas for beginning your research:

- **Cellulose** – blown-in cellulose insulation is made primarily of recycled newspaper. Make sure it is treated with boric acid instead of ammonium or aluminum sulfate as a fire retardant, as these later chemicals can react with certain building materials, such as metals, and cause deterioration.[50]
- **Wool or Cotton** – these materials have been used throughout history as insulation materials, but they are now being rediscovered for their organic qualities. Cotton insulation is often made from recycled denim bluejeans!
- **Spray foam** –Icynene is a type of spray-in foam that is water blown and does not produce any off-gassing. It is, however, produced from petroleum. There are also soy-based foam insulation products on the market. They are naturally produced, but are processed with the help of chemicals. They do not, however, off-gas any volatile chemicals.

Other areas, besides the attic, where insulation may increase the thermal performance of your property include basements and crawlspaces and around ductwork and pipes. Moisture from condensation is a consideration in these applications and it is important to give thought to making sure there is enough ventilation in unheated spaces, as well as making sure vapor barriers are installed in the appropriate manner.[51]

Insulating in wall cavities as a retrofitting measure is generally not a recommended procedure for a historic property. Again, heat rises, and most heat is lost through the roof. Blowing insulation into the walls is expensive, the walls must be ventilated, which means the exterior walls must be altered with vents, and unless a proper vapor barrier is installed on the interior walls, moisture will infiltrate the insulation and render it ineffective, not to mention increasing the likelihood of mold and mildew, rot, insects, etc. Also, cellulose blown into wall cavities has a tendency to settle with time, leaving the tops of walls uninsulated.[52]

Read This Before Deciding to Replace Your Historic Windows!

While most of the heat loss or cooling gain in a building can be mitigated by appropriate sealing and insulation measures, the first thing many property owners do when trying to improve the energy efficiency of their building is replace the windows, often at great cost. There are many reasons for this, but the primary one is the slick marketing strategies of the many window manufacturers, who often distort the information on all fronts - the thermal effectiveness and life of their products, the unrealistic savings, and the pay-back periods involved - and never discuss issues that can be very problematic to property owners, like replacement parts. Rather than spend the money on replacement windows, most property owners would do better to spend the money to do a bit of restoration work on their historic wood windows, add weatherstripping, and add a storm window if none currently exists.

Simply adding a storm window to a single-pane window where none currently exists will result in a 75 percent reduction in heat transmission through the window.[53] Likewise, a little bit of restoration/weatherization (squaring up the frame to make the sashes fit more tightly, fixing rot in the frame, reglazing the panes, caulking cracks in the frame, putting a sweep at the bottom of the lower sash, and installing a new window lock to improve closure) to a single-pane window will make it as perform as well as a typical dual-pane window, even **without** the addition of a storm.[54]

Window manufacturers have all kinds of tactics to make a property owner feel like old windows are inferior products. But they have many attributes that give an advantage over replacement windows. One big one is their long life and ease of repair. Historic windows typically have life spans of 60-100 years[55] (which can be renewed), and the system involved in their operation involves few parts that are easily replaced. They are often made from old-growth wood,

> "…Only 20 percent of the heating loss (or cooling gain) in a building is through the windows. The other 80 percent is lost through roofs, walls, floors, and chimneys, with most of it going out the roof. And most of the cold air is sucked in through the floor from the basement or crawl space. Reducing the heat loss through the windows by fifty percent (double-glazing) will only result in a ten percent reduction in the overall heat loss. The average cost to replace ten windows with double-glazed units is approximately $9,500 for vinyl and $16,000 for aluminum-clad wood. And that's only ten windows – the smallest bungalow I ever owned had twenty windows. Misleading the public about actual costs is one of the sleazy tactics employed. But let's say some mythical person, obviously not me, decides to replace their twenty windows with vinyl. They pay $19,000 for them. Let's also say that their utility bill averages…$200 a month….a ten percent reduction on their heating bill amounts to $20 a month, or $240 a year. At that rate it would take just over 79 years to recoup the $19,000 investment…But wait – according to the Environmental Protection Agency, 40 percent of the average household energy budget goes to heating and cooling. So at $200 per month, only $80 goes to heating and cooling. Saving 10 percent on that would only be $8 a month, putting the payback time at 197.9 years. For the same amount of money (or less!) that replacement windows would cost, you could insulate the attic and the walls and install a damper on the chimney and get an 80% reduction in heat loss. And probably vacation in Tahiti on the money you'd have left."
>
> -Jane Powell, author and old-house renovator, excerpted from her book *Bungalow Details: Exterior*, Salt Lake City: Gibbs Smith, 2004, p.107.

which is denser, has a tighter grain, and is of a superior quality than anything you can buy today, even in new, all-wood windows.[56] New wood windows are made from lumber derived from tree farms, where the trees are selected for their fast growth. Because of this they are subject to greater dimensional change, which can affect their overall performance.[57]

The traditional joinery used in historic wood windows is far superior to the methods of joinery employed in replacements, which can include such things as staples and glue.[58] Furthermore, the cast hardware and pulley mechanisms of traditional windows have a much longer, renewable, life than the spring-loaded suspension systems and plastic parts of newer windows. [59] Window

manufacturers tend to focus on the idea of "maintenance-free" in their marketing efforts, but the reality is that replacements are not easy to maintain when parts break or components degrade, which is, of course, what happens. Vinyl in particular expands and shrinks at twice the rate of wood and expands at seven times the rate of glass.[60] Thermal expansion and contraction of the window has the potential to affect the thermal performance of the window over time, not to mention having an impact on the longevity of the other window components. Manufacturer's warranties on replacement windows range from two to ten years, and after that, replacement parts, assuming you can figure out how to install them yourself, can be very difficult to come by.[61] And what about broken panes? Single pane glass is easy and inexpensive to replace – a do-it-yourself endeavor. That is not the case at all with double-glazed windows.

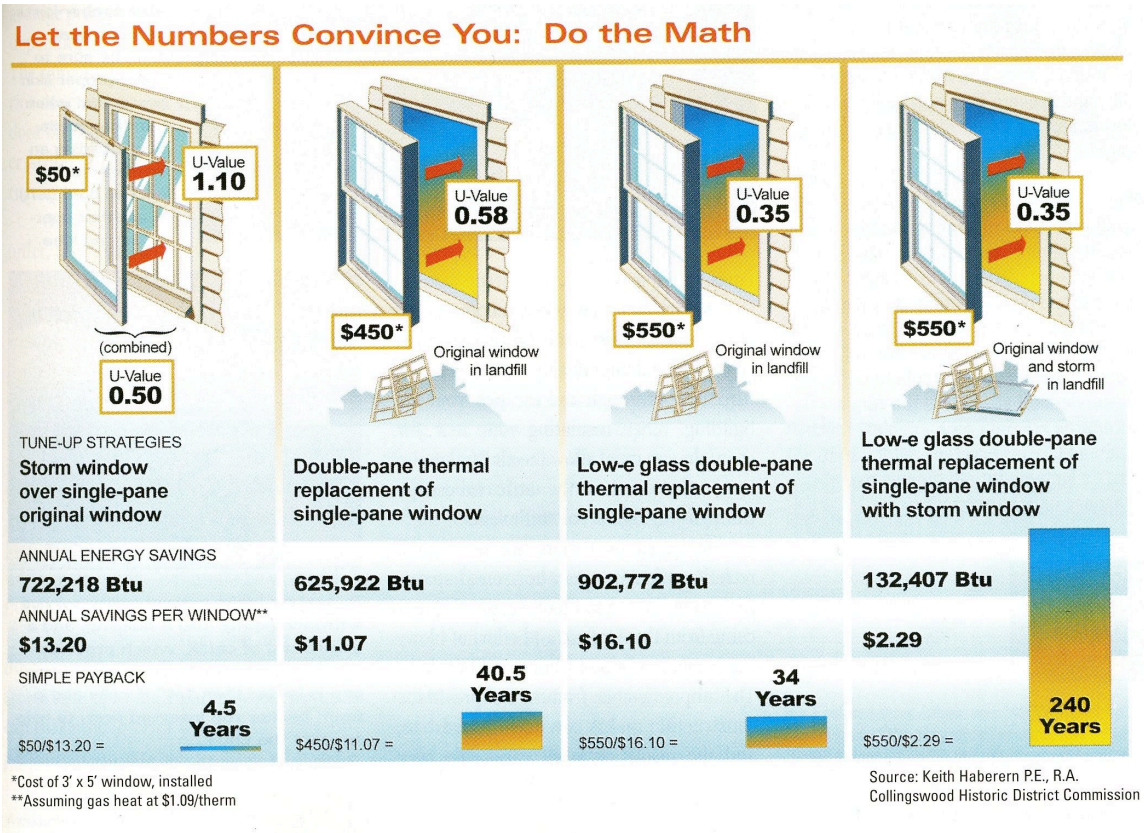
A key component of sustainability is the concept of longevity, which implies the ability to renew with repairs and conservation. Some of the material choices used in replacement windows, such as PVC, cannot be conserved, and after they have degraded, they require complete replacement. There is nothing sustainable about that, as there are environmental impacts in the production and transportation of replacement units. In addition, the old windows end up being carted off to a landfill.

So replacing your historic wood windows is not really a very green decision. But there are also important authenticity and aesthetic concerns when you live in a historic property. Windows are one of the most prominent features on a building. There are subtle details in the molding profiles, shadow, line, and color of the windows as well as the appearance of the glass ("wavy glass") that add to the overall character of the historic building.[62] Often times changing the windows has far-reaching aesthetic consequences. Actual divided-light windows are sometimes replaced with insulated glass units that attempt to simulate the look of divided lights. In marketing lingo, these replacements are sometimes referred to as "true divided lights." The profiles are never the same. Insulated glass units are bulkier; replacing historic windows with them can interrupt views and reduce interior daylight levels by up to fifteen percent or more.[63] Worse offenders include the "snap-in" muntins, or tape between the panes designed to simulate muntins, which bear no relationship whatsoever to the original window design.

The bottom line is that the best green approach to increase the efficiency of your historic windows is to simply add a storm window where none exists. Historically, wood storms are the most appropriate, and if you still have yours, give them a tune-up and they will be the best aesthetic choice. Typically, they were interchanged with full-sized screens in the warmer months to allow the best ventilation with the double-hung sashes that opened at the top and bottom.

Adding a storm window improves efficiency, has a short payback time, and conserves historic fabric.

Alternatively, you could invest in window restoration and get nearly the same benefit in increased energy efficiency as you would with replacement windows. If you do both things, you will likely have a window system that will perform as good or better than most all replacement windows on the market. **And** you will have conserved the historic character of your property. **And** you will have prevented your original windows from ending up in a landfill. **And** you will not have participated in the negative environmental impacts of replacement window production. Score another point for the green attributes of historic preservation!



Lord, Noelle. "Embracing Energy Efficiency,"*Old House Journal*, Oct. 2007, 43.

Additional Energy Conservation Considerations

Beyond common-sense measures that are within all of our reach, there are additional energy conservation actions worth mentioning that you may not have considered previously. Outside of turning down the thermostat in the winter (or up in the summer), using passive solar and natural ventilation to your benefit,

sealing against excess air infiltration, insulating, servicing your climate control system for maximum efficiency, and adding storm windows, there are other ways to reduce your energy usage. Many are habit-changing measures, like turning off the lights when you leave a room, only washing full loads, and drying clothes on a line on sunny days.

One thing to consider is your choice of appliances. When shopping for new appliances, look for the Energy Star label. The Energy Star program was developed by the Environmental Protection Agency and the Department of Energy to help consumers identify appliances and other devices that are the most energy efficient. They also have tips for making existing appliances more energy efficient, such as lowering the thermostat of and insulating hot water heaters. You can learn more by visiting the Energy Star website: http://www.energystar.gov.

Another energy-related item worth mentioning is the indirect consumption of energy through standby power, also known as *phantom loads,* which is a wasteful type of electrical consumption that happens when you aren't even using the electronic device, similar to a leaky faucet. There are probably many devices in your household and work space that are worth analyzing as to whether it is worth it to keep them plugged in all the time simply for convenience. While each device is only responsible for a small amount of energy consumption when not in use, the aggregate consumption on a national scale is huge.

> "Many appliances continue to draw a small amount of power when they are switched off. These "phantom" loads occur in most appliances that use electricity, such as VCRs, televisions, stereos, computers, and kitchen appliances. In the average home, 75% of the electricity used to power home electronics is consumed while the products are turned off. This can be avoided by unplugging the appliance or using a power strip and using the switch on the power strip to cut all power to the appliance."
>
> U. S. Department of Energy, *Energy Efficiency and Renewable Energy,* http://www1.eere.energy.gov/consumer/tips/home_office.html

Your choice in light bulbs also affects your energy use. Many green advocates recommend switching your use of incandescent bulbs to compact fluorescents, which have a longer life and use considerably less energy to produce light. They do, however, require more energy in their manufacture than incandescent bulbs. They have other drawbacks, too. They put out a different

quality of light than incandescent bulbs, although the technology seems to be improving in this area. They may not be appropriate in historic light fixtures because of their shape and the quality of the light. There is less accurate color rendition under fluorescent lighting. Only special versions of the bulbs can be used with dimmer switches or in ceiling fans. Using them in applications that require switching the bulb on and off frequently can shorten their life. In addition to these considerations, they contain mercury, have special clean-up requirements if you should break one, and special disposal requirements similar to other hazardous waste.[64]

However, despite the small personal risk of mercury exposure, it is important to keep in mind that reducing energy consumption with the use of these bulbs ostensibly reduces mercury emissions of coal-fired power plants, which are a far greater source of mercury contamination in the environment. They are more energy efficient than incandescent bulbs because all of the energy used goes to produce light, and with incandescents, some of the energy is wasted as heat. But in a cold climate in the winter, heat generation from incandescent bulbs may not be a bad thing. As with any other product, it is important to analyze the product **over its entire life cycle, from production to disposal**, and make an informed decision as to its overall impact on the environment. There is no doubt that compact fluorescent bulbs save energy while they are in use. Getting good information about the impact they have relative to incandescent bulbs over their entire life cycle is more difficult to come by.

Renewable Energy Options in Historic Districts

With the recent meteoric rise in energy costs, it is all but certain that renewable energy is going to become more important to all of us in the future. The Natural Step Framework advocates for a reduction in the use of fossil fuels, whose extraction and consumption have a detrimental impacts on our planet. The sun and the wind are clean sources of energy that are renewable, and a logical direction in which to move if the goal is to decrease our negative impact on our natural environment. At the same time, however, it should be remembered that sometimes reducing a negative impact on the natural environment has a detrimental impact on the built environment (the "other" part of our environmental capital), especially where historic resources are concerned. The key is to balance the impacts between the two.

The way to start is by taking every energy conservation measure possible before considering the use of renewable energy in your historic property. No matter what the source of the energy, it makes no sense to waste it, even if it is renewable. Renewable energy technologies are currently expensive and have long payback periods, which are even longer if all steps have not been taken to

make your property the most energy efficient it can be. In addition, the equipment, including the size of solar photovoltaic panels, is increased if the building's energy efficiency has not been maximized. This is a very big consideration when trying to mitigate the aesthetic impacts of renewable energy technologies in places where preservation of cultural resources and community character are important, such as in Bayfield's Historic District. There are preservation commissions around the country, such as in Ypsilanti, Michigan, where approval for renewable energy technologies such as solar panels is only granted *after* a property owner has demonstrated that he/she has taken all necessary measures to increase energy efficiency first.[65] This is to ensure that the character of the community is balanced with goals to reduce consumption of fossil fuels.

Solar Energy

Two types of renewable energy technologies that involve the use of solar power are *photovoltaics* and *solar thermal systems*. They can be installed on a building, typically on the roof, or on the ground nearby. Photovoltaics, or PV systems, (commonly just referred to as "solar panels") generate electricity from sunlight without creating pollution. Solar *cells* are the basic building block of these panels, and each cell typically produces one or two watts of electricity from sunlight. The cells are combined into *modules* for larger power generation, and the modules can be combined into even larger configurations known as *arrays*.

The typical size of a PV module, or panel, is two-to-four feet wide and four-to-six feet long. Their ability to generate power is greatly influenced by their location - unobstructed sunlight in a position perpendicular to the sun facing south is optimum. They can only generate electricity while under the influence of the sun, so any power generated during the daylight must either be stored for nighttime use or exported to the local power company via net metering (in Wisconsin, net metering is available for a variety of renewable energy technologies[66]). Storage of power without net metering requires the use of batteries, which compromises the overall environmental integrity of the PV system: creation of the batteries is not environmentally kind, they have a short-to-moderate lifespan, they are expensive, and they must be disposed of as toxic waste.[67]

There are different types of PV cells to choose from, but the one considered the most efficient at converting the sun's rays to electricity is made of monocrystalline silicon.[68] This type of cell also has the longest life span, but it is more expensive than the other types of cells. Prices for this technology will likely decrease over time as increased demand stimulates more production.

Most solar modules consist of rigid crystalline wafers enclosed in aluminum frames and covered with glass on the top.[69] Modules are typically rectangular, but are now available in triangular and custom shapes in order to best match the shape of a roofline.[70] This can greatly enhance the aesthetic appearance of the overall installation.

Another type of photovoltaic module is made of amorphous (flexible) silicon, which is applied in a very thin layer to hard surfaces such as metal, glass, or plastic.[71] These thin films allow greater flexibility in applications, but they are less available commercially and require more surface area to produce the same amount of electricity.[72]

One of the more exciting developments in solar technologies is building-integrated photovoltaic systems, or BIPVs. Rather than mounting panels on the roof of a structure, or on the ground nearby, BIPVs integrate the PV material directly into the building's materials, such as the roofing shingles.[73] Sometimes referred to as solar shingles or solar tiles, they perform both an aesthetic and weatherproofing function for the building in addition to generating electricity. They have a look that is very similar to standard roofs, especially as dust accumulates on them.[74]

The type of cell used and the delivery (whether panels, laminates/glazing, or BIPVs), the amount of roof space available in an optimal configuration, and your power needs will all influence the cost of the system, which will, in turn, affect your payback time. The cost of electricity from a PV system ranges from 25 to 50 cents per kilowatt-hour (kWh), which compares to 9.53 cents per kWh for utility-supplied electricity.[75] This figure includes the initial cost of the system and maintenance spread over its entire life, which is approximately 20 years. For rooftop systems, coordinating installation with the replacement of the roof is the most economic, as it avoids having to disassemble and reinstall the system before and after a roof is replaced.

Solar thermal systems use the energy from the sun to produce heat, which is then applied to a building's air or water.[76] These systems do not produce electricity, but they can reduce the consumption of electricity and natural gas. The most common type of system is used to heat water, and it consists of collectors, heat transfer fluid, circulating pump, heat exchanger, and a storage tank. The collectors are thicker than panels used to generate electricity, typically 2-4 feet wide and 5-12 feet long, with a glazed surface to let in the sun's heat, which heats the transfer fluid used to heat the water. [77]

Solar thermal systems can also be integrated into the building's roof in a manner similar to BIPVs. Rather than using a collector box, the heat is absorbed directly from the roof through metal or cement tile roofs, which allow enough

heat to be transferred to the remaining elements of the system, which are located directly below the roof surface.[78] These systems have a higher up-front cost because generally a new roof is required as part of the installation. However, they can have a life expectancy of 50 years instead of the 15-20 years of a more typical solar thermal system.[79]

Solar Aesthetics

Bayfield's Historic Preservation Ordinance regulates any alteration in the district that would potentially "adversely affect the exterior appearance of the structure"or "adversely affect the external appearance of other neighboring improvements."[80] Certificates of Appropriateness for alterations to existing structures are granted based on specific standards, which include:[81]

a) The historic character of a property shall be retained and preserved.
b) Each property shall be recognized as a physical record of its time, place and use. Changes that nullify historical developments, such as adding conjectural features or architectural elements, shall be carefully undertaken making sure new construction complements current architectural design.
c) Most properties change over time; those changes that have historical significance in their own right shall be retained and preserved.
d) The surface cleaning of historic structures, if appropriate, shall be undertaken using the gentlest means possible. The State Historical Society may be consulted to determine the gentlest means.
e) New work shall be compatible with the massing, size, and architectural features to protect the historical integrity of the property and its environment.
f) Significant archeological resources affected by a project shall be protected and preserved. If such resources must be disturbed, mitigation measures shall be undertaken.

While there are limits on the regulation of renewable energy technologies in the state of Wisconsin, all property owners in the historic district should take into consideration the cultural value of the community when planning to incorporate them into their sustainability plans and attempt to mitigate the adverse aesthetic impact to the extent that they can. It is important to note that as these technologies become more widely available, the designs for them will begin to accommodate this desire. Indeed, there are products currently available that incorporate the renewable-energy technologies right into the building materials, such as roofing shingles, and there are definitely more on the horizon.

These technologies will surely be refined and adapted to address historic preservation concerns more specifically in the future.

One important thing to remember when doing rehabilitation work is that the criteria for approving alterations and new construction in Bayfield's Historic District is slightly different than that employed by the State of Wisconsin for approval of changes to properties that are trying to take advantage of state and Federal tax incentives for rehabilitation of historic properties. For example, income-producing properties that are contributing resources to the National Register Historic District would be required to adhere to the Secretary of the Interior's Standards for Rehabilitation when incorporating renewable energy technologies as part of an overall rehabilitation plan that would qualify for the Federal Historic Rehabilitation Tax Credit. Contact the State of Wisconsin Historic Preservation Office (608.264.6464) for more information.

The Secretary of the Interior's Standards for Rehabilitation of Historic Properties

1. A property shall be used for its historic purpose or be placed in a new use that requires minimal change to the defining characteristics of the building and its site and environment.

2. The historic character of a property shall be retained and preserved. The removal of historic materials or alteration of features and spaces that characterize a property shall be avoided.

3. Each property shall be recognized as a physical record of its time, place, and use. Changes that create a false sense of historical development, such as adding conjectural features or architectural elements from other buildings, shall not be undertaken.

4. Most properties change over time; those changes that have acquired historic significance in their own right shall be retained and preserved.

5. Distinctive features, finishes, and construction techniques or examples of craftsmanship that characterize a historic property shall be preserved.

6. Deteriorated historic features shall be repaired rather than replaced. Where the severity of deterioration requires replacement of a distinctive feature, the new feature shall match the old in design, color, texture, and other visual qualities and, where possible, materials. Replacement of missing features shall be substantiated by documentary, physical, or pictorial evidence.

7. Chemical or physical treatments, such as sandblasting, that cause damage to historic materials shall not be used. The surface cleaning of structures, if appropriate, shall be undertaken using the gentlest means possible.

The Secretary of the Interior's Standards for Rehabilitation of Historic Properties, cont'd.

8. Significant archeological resources affected by a project shall be protected and preserved. If such resources must be disturbed, mitigation measures shall be undertaken.

9. New additions, exterior alterations, or related new construction shall not destroy historic materials that characterize the property. The new work shall be differentiated from the old and shall be compatible with the massing, size, scale, and architectural features to protect the historic integrity of the property and its environment.

10. New additions and adjacent or related new construction shall be undertaken in such a manner that if removed in the future, the essential form and integrity of the historic property and its environment would be unimpaired.

The State of Wisconsin has a special statue that limits the regulation of renewable energy technologies, even in historic districts.[82] The State of California has similar legislation in place, and some communities in that state, such as Santa Barbara, have responded by developing voluntary guidelines for following good solar design practices in their communities, with awards bestowed upon the best installations. The guidelines are more stringent in their historic district that for the rest of the community, but in all cases they attempt to encourage property owners to follow the best aesthetic practices and technologies available. Santa Barbara does not recommend photovoltaic roof laminates or ground-mounted panel systems in their historic districts, as they are not compatible with the character of their district, but they do feel that photovoltaic shingles and glazing may be appropriate on a case-by-case basis in locations that are not publicly visible.[83]

There are many communities around the country that are attempting to reconcile their desire to be green with their goal of preserving the existing character of the community. The State of Massachusetts directs their preservation commissions to encourage the use of solar energy, and Paul Trudeau, Preservation Administrator for the City of Cambridge, says his community is very pro-active in their efforts to be green. They have had applications for solar panels in their Neighborhood Conservation Districts, which have less stringent design guidelines than their historic districts. Approval has been granted in cases where panels are installed at the same plane as the roof, and if possible, toward the rear of the building. In addition to trying to maintain the same slope as the existing roof, the reflection of light, the color of

the panels (close to the roof color is desirable), and the amount of roof area covered are all considerations.[85]

In general, for historic properties, a "best practices" approach to solar panels and collectors is to install them so they are not visible from the public right of way, and in such a way that they do not damage the historic fabric of the building. This can most easily be accomplished in situations where the roof is flat, especially if the roof is surrounded by a parapet wall. There are many buildings in Bayfield's commercial area that have flat roofs. In situations where the roof is sloped, it would be best to choose a location with the least aesthetic impact. That may mean considering placing the system on the east or west side of the building, rather than on the optimum south-facing location. **Panels that are sharply angled off the roof with framing and highly visible from the street are not considered appropriate in a historic district.**

The City of Santa Barbara, California, makes these suggestions in regards to panel arrangement and design for solar energy systems on sloped roofs (these are general aesthetic guidelines not specific to Historic Districts, where no visibility is recommended):

- Consider the panels as part of the overall design composition. Match the shape and proportions of the array with the shape and proportions of the roof.
- Installations on single-plane roofs are preferable because arrays can create a disjointed appearance on multi-plane roofs.
- Consistently cover the entire roof face with the array if possible. If not possible, either:
    - aim for a regularly shaped panel of rectangles; or
    - use custom panel shapes to match the shape of the roof. Some manufacturers will create custom panel shapes such as triangles. If the roof is not entirely covered with panels, avoid leaving small or thin portions of the roof surrounding the array. Allow roof elements to remain which have enough size to appear intentional and hold their visual "weight" in the overall design composition.
- Avoid interrupting arrays with rooftop projections such as vents and skylights.
- Avoid breaking up systems into multiple panel areas. Try to limit the array to one rectangular panel section on each side of the structure.
- In some cases, placing an array along the lowest edge of the roof may make it less visible from a distance.
- Coordinate roof and building color and pattern as much as feasible with color and pattern of the collection array. Darker roofing colors can better compliment mounted solar energy systems.

-City of Santa Barbara Community Development Department, *Solar Energy Design Guidelines and Solar Recognition Program,* 2006.

Even BIPV roofing products can give a less than ideal aesthetic result if they are not thoughtfully installed.

City of Santa Barbara, *Solar Energy System Design Guidelines* (2006) pg. 21

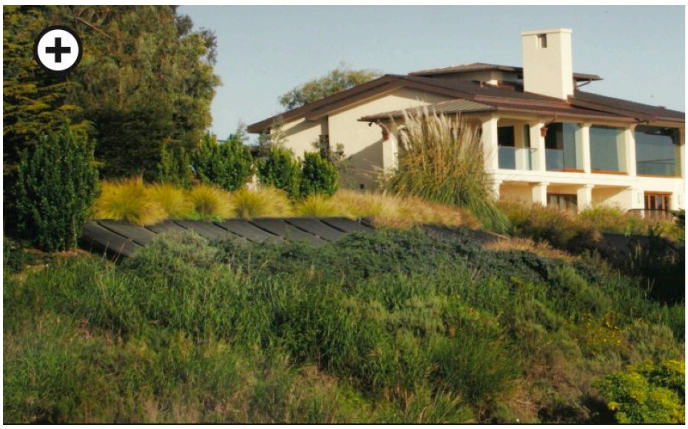
This photo, taken from the Santa Barbara guidelines, shows solar roofing tiles that have been installed in a way that create an irregular disjointed pattern.

Consider the following photo examples of installations of PV panels, also taken from the Santa Barbara guidelines, which would not qualify for their solar recognition awards because of their negative aesthetic impact:

All photos from City of Santa Barbara, *Solar Energy System Design Guidelines* (2006), p. 25.

These examples are less than ideal from an aesthetic standpoint because of the irregular shapes of the panels that do not correspond to all of the lines of the roof, they are installed on multiple roof planes, and they are disjointed and interrupted by protrusions such as skylights and vents. Another aesthetic consideration is glare from the panels. It is best to use panels with non-reflective coatings and to be considerate of neighboring properties and public areas that may be affected negatively by glare. Panels should also not project higher than the ridge of the roof.

Ground-mounted panels also have aesthetic considerations. The City of Pasadena, California recommends in their Historic District Design Guidelines that all solar collectors not attached to a building should be located only in rear or side yards; all exposed hardware, frames, and piping should have a non-reflective finish; and they should be screened by landscaping.[86] Sometimes other screening methods may be appropriate.



This ground-mounted array is well integrated into its site with native landscaping, making it less visible. From the City of Santa Barbara, *Solar Energy System Design Guidelines* (2006), p. 30.

Solar thermal installation in West Sussex, England on a National Trust cottage dating to the 17th century. The small willow fence next to the cottage screens the collector. Photos by Robert Williams. English Heritage, *Small-Scale Solar Thermal Energy and Traditional Buildings,* (2008), p.7.

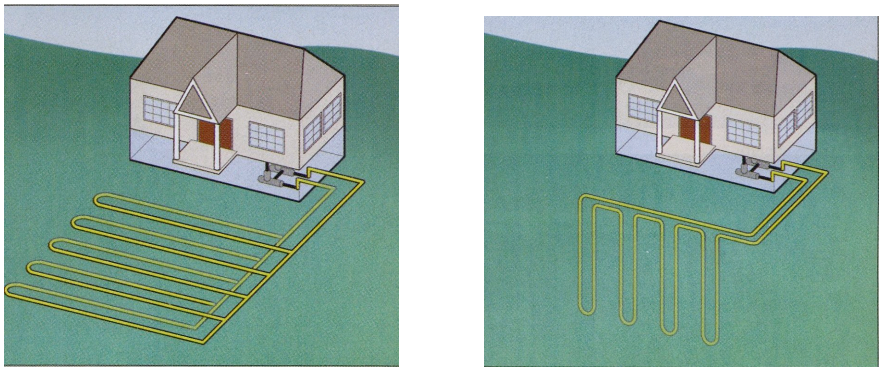
Wind Power

Residential wind turbines to generate electricity are relatively large devices. The American Wind Energy Association states that they are generally not suitable in small-lot neighborhoods – they recommend a lot size of one acre or more.[87] Typically they require installation on the top of an 80-120 foot tower for optimum efficiency, and they cost from $6000-$22,000.[88] The payback period (generally between 6-15 years) is affected by the current cost of electricity and the amount of wind generated in your particular location. Wind turbines also have the negative effect of generating noise. The negative aesthetic impact and the noise issue are both considerations that would impact the character of the Bayfield Historic District, and as such, wind turbines would not be a recommended approach to renewable energy generation.

Geothermal Systems

Geothermal is a broad-based term that has to do with gathering the natural heat generated by the earth.[89] Geothermal heating and cooling systems can be a natural fit for historic properties, as there are decreased aesthetic issues having to do with visible equipment. In addition, the technology is considered highly efficient relative to conventional systems.[90] Geothermal works by gathering the heat available below the frost line with a system of liquid-filled pipes that carry the heat back to the building, where it is released. In warm weather the system is reversed, and heat from the building is removed and carried to the earth. The technology can also be used for domestic water heating.

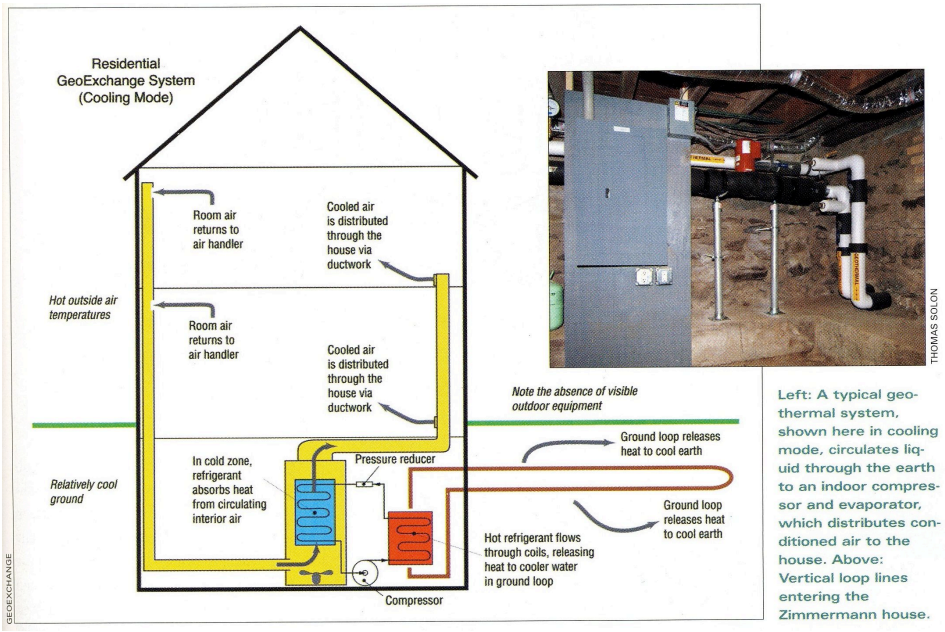
There are two types of ground installations. Where there is abundant yard space, it is usually more cost-effective to use a horizontal ground loop, which requires digging to a lesser depth in the earth. On small lots or places where conditions do not favor the use of a horizontal loop, vertical ground loops are an alternative. They require the use of well-digging equipment, however, as the pipes must be placed at least 200 feet deep.[91]



Bock, Gordon. "Notes From the Underground," *Old House Journal,* October 2007, p.53

Geothermal systems are more expensive to install than conventional heating systems, with prices averaging $10,000-$15,000 in the Northeast; however, an average system has a 20-plus year life and saves $1,500 or more in energy bills.[92] What makes them so appealing for historic properties is the combination of energy savings with the lack of visibility of equipment. Most of the system is buried in the earth, with the remainder of the equipment not taking up much space indoors, either. The system has reduced maintenance costs due to weather, vandalism, etc.

Note the lack of visible equipment outside the 1912 Marie Zimmerman House in Bushkill, PA. Use of geothermal eliminated aesthetic intrusions on the facades of this historic house.



Left: A typical geothermal system, shown here in cooling mode, circulates liquid through the earth to an indoor compressor and evaporator, which distributes conditioned air to the house. Above: Vertical loop lines entering the Zimmermann house.

This image shows how geothermal cooling works. Both images taken from Gordon Bock's article "Notes From the Underground," *Old House Journal*, October 2007, pp. 52-55.

Geothermal technology has been installed in Bayfield. Thomas Hirsch, AIA, of the Hirsch Group, LLC has worked with the Housing Authority of Bayfield County to install geothermal at Rittenhouse Commons apartments.[93] Tom chose to use geothermal because it would save operating costs for both the owner and renters. A vertical loop system was used because of the lot size and lack of space due to the buildings and mature trees on the lot, but he did indicate it was costly to dig the required wells because there was a lot of hard rock in with the sand and clay soil. There is an auxiliary boiler in place to provide additional heat to the system as needed. A local contractor provided the installation, and most of the equipment was located in the attic because of the limited floor area in the apartments. Tom said that for a single-family home, the basement, which is common in Bayfield's Historic District, would be the preferred location for the equipment.

One drawback from a historic preservation perspective is that geothermal cannot be used with existing radiators, which are sometimes an important authentic decorative element of a historic interior. This is particularly true for buildings from the Victorian era, which is included in Bayfield's period of significance.

One environmental issue to note is that systems in cold climates typically use antifreeze to protect from freezing in very cold temperatures (this is also true of solar thermal systems). Also, closed–loop geothermal systems typically make use of a refrigerant as part of the system's operation. There are environment concerns associated with both antifreeze and refrigerants in their use and disposal. Corrosion and leakage of toxins are a possibility at some point over the life of the system, and should be a consideration as you gauge the overall advantages and disadvantages.

Biomass Energy

Biomass is a term for plant or animal material, and it has been used as an energy source since the beginning of life on earth. Initially biomass energy was accessed through digestion. Since the arrival of man to the planet and the subsequent discovery of fire, combustion has been used to gain access to the energy stored in biological materials from the process of photosynthesis.[94] Man has been burning wood to keep warm for centuries, and wood is likely the most widely known biomass fuel for heating. Heating a building with the burning of wood in a fireplace, however, is very inefficient. The use of wood stoves and special furnaces to burn biomass fuels more efficiently can be part of a renewable energy strategy for a historic property.

Biomass can be suitable for either spot heating (as with a fireplace or freestanding stove) or used in a central heating system that also provides hot water.[95] In the latter situation, you will require a boiler in addition to a stove, and in the summer months, it may be best to find an alternative heating system for water, such as solar thermal.[96]

Burning biomass fuel still produces greenhouse gasses. The difference between burning them and fossil fuels, however, is that those gases are offset by the consumption of carbon dioxide made by the plant material over its life. In this way, biomass energy can be considered *carbon neutral.*[97] There are also other advantages to using biomass. Fuel "crops" require fewer nutrients from the soil than food crops, and the crops' root structure can absorb soil contamination.[98] On the downside, there is the possibility of the creation of pollution from the combustion of herbicides and pesticides used on the crop, focusing on single crops for energy production can undermine biodiversity, and fossil fuel is consumed in the transport of these crops to their place of consumption.[99] The latter disadvantage can be reduced by checking with the local farm bureau to see what types of fuels are available locally.[100] Biomass can only be considered renewable energy if it comes from a sustainable source. In the Midwest corn is often used as a biomass fuel as well as wood and wood pellets.[101]

There is more maintenance involved with a biomass heating system than a conventional one that burns fossil fuels. The biomass fuel has to be carried to the stove and loaded periodically, and the resulting ash has to be removed. Burning corn or wood pellets, however, does not create a large amount of ash.[102] Pellet-burning stoves are considered efficient, with a greater than 55 percent efficiency at delivering heat – a fireplace only delivers 10 percent.[103] In addition, pellet stoves burn cleaner than wood stoves, with particulate matter emissions 90 percent less than that of conventional wood stoves.[104]

Water Conservation

Some sources say that water resource issues are likely to be one of the most important problems facing the world in the decades to come, perhaps even leading to conflicts between nations.[105] It's not there isn't enough water on the earth, it's the quality and distribution of the water that is the issue.[106] The planet is comprised of about 70 percent water, but 97 percent of that total is saltwater, and 90 percent of what remains is locked up in the glaciers.[107] That leaves a very paltry amount for human consumption, and most of that is found in Canada, the U. S., and Russia.[108]

Because water seems abundant to us in this country, we lack a water conservation ethic here. The U. S. uses 124 trillion gallons of water each year,

and 13 percent of that goes to domestic use.[109] The way we use that water deserves some consideration. For example, we flush our toilets with the same quality of water as comes out of the tap for drinking.

New green buildings focus on water conservation by way of designs that collect gray-water, which is water not suitable for consumption but perfectly acceptable for other uses, such as watering plants or flushing the toilet.[110] Historic property owners can be more thoughtful about their own opportunities for recapturing water for other uses, as well as being thoughtful about how water is used each day and how to use less of it.

Top-Ten Water-Saving Tips

1. Water your lawn only when it needs it
2. Fix leaky faucets and plumbing joints
3. Don't run the hose while washing your car
4. Install water-saving showerheads and flow restrictors
5. Run only full loads in dishwasher/washing machine
6. Shorten your showers by 1-2 minutes
7. Use a broom instead of hose to clean driveway
8. Don't use your toilet as an ashtray/wastebasket
9. Capture tap water for other uses while you wait for the hot water to emerge
10. Adjust your sprinklers so you are not watering the sidewalks/driveway

From the City of Mono Lake, CA. http://www.monolake.org/waterconservation/

When remodeling your bathroom, consider the use of new fixtures designed to conserve water usage. Low-flow toilets are available, and while early models were met with some derision for their performance, newer models are considered much better. If you have an original historic water-hogging toilet (typically 5-7 gallons a flush), you can decrease water usage by the insertion of a brick, or a plastic bottle filled with pebbles, into the tank.

On the exterior of your property, there are several steps you can make that will help to conserve water. One is to limit your use of impervious surface materials, such as asphalt or concrete, for areas such as parking, walkways, and patios when making those types of improvements to your property. Impervious surface materials cause storm water run-off and can contribute to water pollution problems. In addition, their production is not kind to the environment. The production of cement for concrete, for example, releases carbon dioxide into the atmosphere on a pound-for-pound basis.[111] It is much more environmentally sound to choose pervious materials, which allow rainwater to soak into the

ground. Historically appropriate materials for paving include gravel, recycled brick, and stone. The widely available interlocking concrete paving stones, while they do allow rainwater to seep in between, are not the best choice for compatibility with the historic built environment, as they are a new product that was not used during Bayfield's period of significance.

Another thing you can do is to collect the rainwater from your roof in the warmer months with the use of rain barrels positioned beneath your downspouts. Water collected in the rain barrels can be used for watering outdoor plants. If you must water from the hose or sprinkler, be sure *not* to do it during the hottest part of the day – early morning or evening is best. The use of mulch around plantings will help to hold moisture in place and decrease their need for constant watering.

Green Landscaping for Historic Properties

As discussed previously, buildings used to be constructed with a design philosophy that worked with nature to the extent that it could. A building's orientation to its site and the incorporation of design features to maximize comfort for the inhabitants was an exercise that had architects thinking about the exterior of the property before the interior. Over the course of the twentieth century this was abandoned in favor of tract-type housing with mechanized climate controls, and the exterior of the building became a secondary consideration.

Because in earlier times buildings had a stronger connection to the environment to begin with, they were often designed to maximize views and with extra consideration given to things such as balconies, access points to the outside, pathways, and outdoor structures that would allow the inhabitants to enjoy their surroundings.[112]

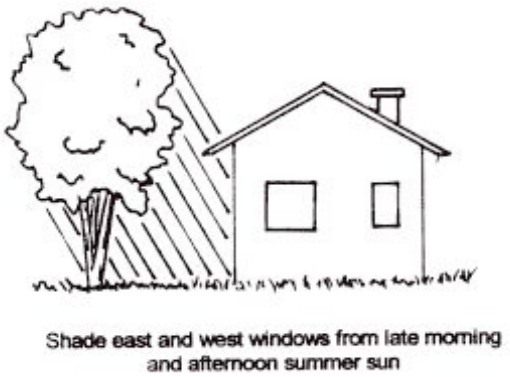
While existing trees and natural vegetation would be major consideration in the site location of the building, landscape design was planned in conjunction with the design of the house, typically with shrubs and flowers native to the area.[113] The combination of local materials used in construction of the building with plant materials native to the area created a cohesiveness in design that added to the building's overall character and sense of place.

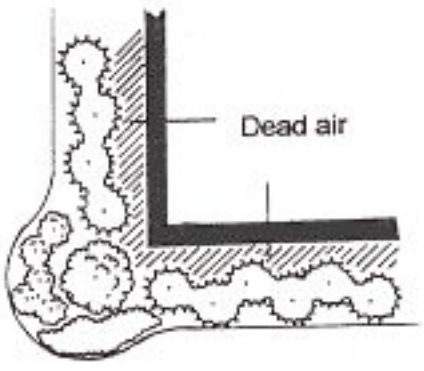
Using native plants in your historic landscape design has benefits that go beyond complementing your building's historic character, however. Local and regional plantings have evolved and adapted to local climate and conditions. They often perform much better with less water than plantings that have been transported from other locales.

There is a term for this approach to landscape design, and it is called xeriscaping. It is the landscape equivalent of the philosophy of sustainable design for buildings.[114] The idea is that in typical conditions the only water these plants should require, after propagation, is that which is supplied by rainfall, and that they are adapted well enough to their environment not to require chemical inputs.[115] Using native plantings has the benefit of helping to maintain the genetic diversity against invasive species, and it also helps to maintain appropriate levels of birds and insects that have evolved in conjunction with the plants.[116] It can also have an added economic benefit for the property owner, as ostensibly there are lower maintenance costs.[117]

Landscaping can also influence energy usage. Correctly placed shade trees, windbreaks, and foundation plantings can reduce heating and cooling costs by 25 percent or more.[118] Large trees that shade the house from the afternoon sun can lower indoor air temperatures by as much as 10 degrees.[119] If they are deciduous trees, they will lose their leaves in the winter, allowing the sun to provide winter warmth. Large trees are required to shade the roof. Smaller deciduous trees and shrubs can provide the same benefit by minimizing solar gain through windows in the summertime, while allowing it in the wintertime. Because the summer sun is so high in the sky, in the summer most of the passive solar gain is on the east and west sides of the house, and planting trees on those sides give the most benefit.[120]

Climbing vines can provide an insulating effect for your historic property, provided you give them a proper support on which to grow. It is not a good idea to allow vines to grow directly on the building. It will contribute to rot in the case of wood and spalling in the case of masonry. It is a better practice to provide a trellis or other support that stands a few inches away from the structure. Evergreen shrubs planted near the foundation will also have an insulating effect. It is recommended that you plant approximately one foot away from the building wall.[121] Foundation plantings were just becoming popular





Insulating effects of shrubs

Both images from the University of Minnesota, "Energy Saving Landscapes," *Sustainable Urban Landscape Information Series,* http://www.sustland.umn.edu/design/energysaving.html

at the turn of the twentieth century, which is included in Bayfield's period of significance (1800s through 1920s). [122] The mid-1800s saw little in the way of foundation plantings due to the belief that it would result in stale air that harbored disease, and the Victorian era favored large flower beds that were created away from the house.[123] But it is likely that many of Bayfield's Victorian –era houses were beginning to use foundation plantings by 1900, and you can make the case that their use is considered historically appropriate.[124]

In addition, trees and shrubs that shade the outdoor portion of a split system air conditioner can make it operate more efficiently. A study by the American Refrigeration Institute shows that this type of shading can lower indoor air temperatures as much as 3 degrees.[125] While you don't want to obstruct the unit's air flow or service access, screening with landscaping also has an aesthetic benefit for the property, as views of mechanical equipment are rarely pleasing.

A traditional use of trees is to create a windbreak from the harsh winter winds. Windbreaks with several rows of evergreen trees are not practical on small city lots, but a canopy of tall deciduous trees can provide a great deal of shelter from winds in addition to the other benefits mentioned previously. Trees, particularly evergreens, also have the effect of insulating against noise. For the greatest effect, mature trees should cover at least half of the canopy space.[126]

Another historically appropriate approach to providing shade for both your residential building and yard is by use of a pergola with the addition of climbing plants.[127] Pergolas have the additional benefit of providing an outdoor "room" to enjoy during the warm months, much like an open porch. Pergolas were a popular landscape feature in many parts of the country during Bayfield's period of significance, and it is likely that they were found here, too. Architectural styles and materials used should complement the house. Before beginning construction, look for archival documentation, such as historic photos, to see if you can find a history of such a structure on your property and what the original design may have been.


Pergola adjacent to Le Chateau Boutin in Bayfield. Notice the Ionic columns used on the structure are the same design as found on the porch. Photos: V. Birenberg

Sustainable Rehabilitation and Additions to Your Historic Property

Remodeling existing buildings has contributed significantly to economic activity in recent years. Expenditures on remodeling increased by $64 billion dollars between 1995 and 2001.[128] In 2000 and 2001, 41 million homeowners undertook 100 million improvement projects, nearly two-thirds of which involved replacing structural elements or major components on both the exterior or interior.[129] As previously discussed, the adaptation of an existing building for continued use is already a first step toward sustainability. When dealing with historic properties, however, special consideration is given when approaching the concept that most Americans refer to as "remodeling." Bayfield has developed special design guidelines for the historic district to address many of these considerations. Historic preservation employs a special vocabulary to define the types of interventions/alterations that historic buildings undergo over time:

Preservation: This term refers to the maintaining a historic property as is. When preservation is employed as a strategy, the only interventions undertaken are for normal routine maintenance or special work needed to protect against further damage.[130]

Restoration: This is a term that is widely misused. It refers to returning a building to its condition at a very specific point in time.[131] It ignores the natural evolution of a building over time, and removes elements that were added after the restoration date. This may be an appropriate strategy if the building's significance is tied to a very specific point in time or where the structure's historic integrity has been lost.[132] Historic evidence to support the restoration is important – elements should not be added for conjectural reasons. A good guiding principal is that original fabric, even if in poor condition, is preferable to a replaced element.[133] The Secretary of Interior's Standards for Restoration state that deteriorated features should be repaired rather than replaced, but where the severity of the deterioration requires replacement the new feature will match the old as closely as possible, and replacement of missing features will be substantiated by documentary and physical evidence.[134] In other words, the alteration of an existing exterior of a historic building based on an "idea" of what it "might have" looked like is **not** a restoration. Likewise, adding new features that were never there originally is **not** a restoration.

Rehabilitation (Adaptive Use): This is the preservation term that comes closest to meeting what most people think of as "remodeling." But for historic properties, rehabilitation is still a very specific approach to making changes to a building. Preserving the existing architectural integrity, especially on the exterior, is a primary consideration. Original exterior features are preserved to

the extent that they can be with the emphasis on repair over replacement. When an element is so deteriorated that replacement is warranted, again, matching the original as closely as possible is the goal. Alterations and additions can take place, but they should not be on the primary facades and they should strive not to confuse the historical record, which requires that new construction be differentiated from the old. Two approaches to this are to make the new design *compatible* or *contrasting*. Bayfield's Design Guidelines specify that all new construction be compatible with neighboring structures.[135] Compatible design is a new design that maintains some existing elements, such as scale, color, massing, proportions, and materials.[136] Typically the new portion of the building has ties to the original structure while remaining subservient. The addition does not "compete" with the original structure, and in the best practice, it could theoretically be removed in the future without significantly impacting the original building.

Rehabilitation also encompasses such things as mechanical upgrades, kitchen and bath remodeling, and the like. It often allows a building to be reused over time for different purposes. A local example of an adaptive re-use rehabilitation in Bayfield is the Apostle Islands National Lakeshore Headquarters and Visitors' Center operated by the National Park Service. It was initially constructed as the Bayfield County Courthouse.

The original Bayfield County Courthouse has been rehabilitated to provide a Headquarters and Visitors' Center for the Apostle Islands National Lakeshore. Photo: V. Birenberg

Preservation, restoration, and rehabilitation can all be approached with a green mindset. For the most part, it's about the materials used and the way what the building industry refers to as "demolition" is handled. Salvage and recycling are major components of the process, but taking a green approach is also about treading thoughtfully and lightly around the site of the building as the work commences.

Do You Really Need More Space?

Special consideration should be given to a rehabilitation project that will include an addition to the building. Before even getting to the design and construction phase, spend time thinking about whether you really need the additional space. In the last thirty years, the average single-family home size has increased by 42%[137] Increases in the size of our living spaces directly correlates to increases in the consumption of fossil fuels. Perhaps you are considering an addition because conventional wisdom about real-estate returns makes you think you need more living space. But from a sustainability standpoint it might make more sense to re-think your existing space. How often do you use your formal dining room? Perhaps it would be better used as a family area, with a drop-leaf dining table that could be pulled out for the times of the year when it is utilized for dining. Likewise, many living rooms are not currently lived in at all. And there are many ways that creative thinking and a little carpentry work, like adding built-ins and shelving, can help to more intensively use underutilized space for both living and storage.[138]

After taking the time to analyze whether an addition really makes the most sense, if you still need to proceed, take time to do some research and planning. When working with a historic property, one of the best things you can do **before** you pay an architect to do any design work is to familiarize yourself with the Historic Preservation Ordinance and Design Guidelines written for the City of Bayfield Historic District – both are available at the City website (www.cityofbayfield.com). It is also recommended that you familiarize yourself with the Secretary of the Interiors' Standards for Rehabilitation (pages 28 and 29), as they are the standards applied to any rehabilitation work qualifying for government preservation financial incentives.

Take the time to find an architect who is familiar with these guidelines and standards and has a track record of success on historic preservation projects as well as green building practices. That way you will ensure that the historic integrity of your home is handled with care and sensitivity while incorporating environmentally preferable materials into the rehabilitation. In the same vein, it makes sense to find a contractor who has the same mindset about the importance

of preserving the historic integrity of the building and will proceed with sensitivity.

Preservation and LEED

The U. S. Green Building Council, a nonprofit organization, has taken the environmental building movement by storm with its LEED (Leadership in Energy and Environmental Design) rating system. LEED ratings, including platinum, gold, and silver, are awarded to creatively designed buildings who meet the architectural and engineering criteria to maximize energy efficiency, minimize wear and tear on the environment, generate clean power, decrease water usage, keep storm water onsite, and integrate recycled materials.[139] Ironically, LEED standards were developed with new buildings in mind, despite the fact that recycling existing buildings is a better practice from a sustainability standpoint. The U. S. Green Building Council has acknowledged this as an oversight, and they have responded by revamping their rating system, which is due to be unveiled in January 2009, to give greater weight to the reuse of existing buildings.[140] These changes are taking place with input from the National Trust of Historic Preservation, the American Institute of Architects, and the Association for Preservation Technology International, among other national organizations.

The U. S. Green Building Council also has an accreditation program for building professionals.[141] In order to receive LEED accreditation, professionals must pass an exam that demonstrates their knowledge of sustainable design practices. Looking for LEED accreditations along with a historic preservation background is one approach to finding the right team to carry out your rehabilitation plans.

Mitigate the Potential for Landscape Damage

Before beginning your rehabilitation project, take the time to thoughtfully prepare your property before the invasion of equipment, debris, materials, and manpower begins. Again, discussions with your architect and contractor can go a long way toward mitigating damage to the site and preserving its features. Many contractors have a thought process toward construction that gives little consideration to damage incurred in the landscape because the intent is to repair and replace by the end of the project. This falls in line with the "throw it away and replace it" mentality that has lead to so many unsustainable practices. A better approach is to protect plant materials that are at risk before the project begins. Transplant shrubs and perennials to other parts of the yard. Placing barricades around the canopies of existing trees on the site can help to prevent

root damage. Likewise, making sure that your project is not negatively impacting your neighbor's landscape is also very important.

Deconstruction, Not Demolition

Construction and demolition debris accounts for 25 percent of our landfill waste.[142] Contractors refer to the stage of a remodeling project where the old stuff is "ripped out" as demolition, and for the most part, it goes off to the dumpster. A better approach is to change that vocabulary from *demolition* to *deconstruction*. Carefully taking apart what exists, with an eye toward reuse and recycling, is a much better management of existing resources. Metal and wood have long been known as recyclable materials, but even materials such as concrete and asphalt shingles can be recycled into the base for paving roads, for example. Likewise, salvaged brick and reclaimed wood can be key components of a historic rehabilitation project. The key to making recycling a larger part of construction is to develop processes regionally in this area of eco-municipalities with the input from local building professionals that will address this needed aspect of the building industry. The Materials Reuse Association has a website (http://www.buildingreuse.org/directory/) to help property owners find sources for recycling and salvaged materials, but there are few in the state with addresses in this area.

Buy Green Materials Close to Home, if Possible

Buying local is one of the key tenets of sustainability. Buying products that are shipped from far-flung locales creates pollution as it increases the consumption of fossil fuels. Like the issue with recycling building products, however, it would be ideal in this area of eco-municipalities to develop regional sources for green building materials. Businesses and corporations are key components of sustainable development, and attraction of these types of businesses to the area would serve to provide jobs, raise local consumer awareness of green materials for construction, and provide locally based materials for rehabilitation.

What Types of Building Materials are Green?

Salvaged materials, if you can find a source for them, are inherently green because of the embodied energy they contain. But beyond reusing materials to the extent that you can, what types of new materials are considered green? There are many good resources for information in this area, and some of those

will be listed in the **Resources** section of this document. One thing you should be aware of as a consumer is the potential for *greenwashing* when evaluating

CHECKLIST FOR BUILDING PRODUCTS: IS IT GREEN?

- Does the manufacturer have an environmental policy?
- Is the raw material renewable/recyclable?
- Does the harvesting/extraction process cause environmental degradation?
- What happens to waste/ pollution in the manufacturing process?
- Is it an energy intensive process?
- Is the finished product tested/certified by any environmental agency?
- (If it saves energy) What is the payback period (the time in which initial costs are recouped through lower long-term operating and maintenance costs)?
- (If it conserves resources) What is the recycled percentage?
- Is it more durable than its competitors?
- Does it off-gas carcinogens, VOCs (volatile organic compounds), or other toxins? For how long?
- (Remember that "right-to-know" regulations entitle you to request a Material Safety Data Sheet (MSDS) from the manufacturer or supplier).
- Has the minimum amount of packaging been used? Is it recyclable?
- How is the product disposed?
- Is it designed to be easily recyclable? Into what?
- What are its maintenance requirements?
- Are any of the maintenance requirements hazardous?

Rodwin and Okura, Denver AIA Committee on the Environment, *Sustainable Design Resource Guide,* http://www.aiasdrg.org/sdrg.aspx

choices of building products. Greenwashing is the use of language or marketing to promote attributes of a product as being environmentally friendly when the product itself may not be green at all. As with all purchasing decisions, it is best to do your homework to evaluate all aspects of a product over its entire life cycle, from production to disposal, to determine its overall environmental impact. Many building materials contain toxic chemicals. Since 1983, Material Safety Data Sheets have been required for all building products and can be requested from the product supplier or manufacturer to aid in your determination of what the components of the particular material are.[1]

Financial Incentives for Historic Preservation

Since 1976 federal tax law has offered incentives to rehabilitate our nation's older building stock. The *Historic Rehabilitation Tax Credit* is equal to 20 percent of the cost of rehabilitating historic buildings or 10 percent of the cost of rehabilitating nonhistoric buildings constructed before 1936. Because it is a credit rather than a deduction, it provides a dollar-for-dollar reduction in income taxes owed. It is eligible for **income-producing properties not occupied by their owners**. All such properties in the Bayfield National Register Historic District built before 1936 undergoing "substantial rehabilitation" could qualify for one credit or the other. Substantial rehabilitation means the expenditures must exceed the greater of the "adjusted basis" of the building, or $5000, during any 24-month period (or 60-months for phased projects). The adjusted basis in a building is determined by the purchase price plus the amount of any previous capital improvements, minus depreciation and cost of the land. Contributing structures in the National Register District that wanted to take advantage of the 20 percent credit would be required to submit plans to the State Historic Preservation Officer (SHPO) to certify that the rehabilitation is consistent with the historic character of the building and the Bayfield Historic District. Contributing structures are only eligible for the 20 percent credit. Noncontributing structures taking advantage of the 10 percent credit must be substantially rehabilitated, but do not require certification. These credits are sometimes used in conjunction with Low-Income Rental Housing credits to provide affordable housing in communities.

Property owners in Wisconsin who qualify for the 20 percent Historic Rehabilitation Tax Credit will also qualify for the Wisconsin Supplemental Historic Preservation Credit, which returns an additional 5 percent of the cost of rehabilitation to owners as a credit on their Wisconsin state income taxes. For more information on both of these programs, see the Wisconsin Historical Society's webpage:

http://www.wisconsinhistory.org/hp/architecture/iptax_credit.asp

The State of Wisconsin also offers a 25 percent state income tax credit for repair and rehabilitation of historic homes. **The structure must be your personal residence** and be a contributing structure in the Bayfield National Register Historic District. You must spend a minimum of $10,000 on qualified expenditures over a two-year period, although you may request a five-year period. For more information, see the Wisconsin Historical Society's webpage on the program:

http://www.wisconsinhistory.org/hp/architecture/tax_credit.asp

Contributing properties in Bayfield's National Register Historic District are eligible to make a façade easement donation in return for a one-time charitable Federal income-tax deduction equal to the appraised value of the easement. A preservation easement is a legal agreement that assigns the rights to review and approve alterations to a qualified non-profit organization for the purpose of preserving the property into perpetuity. The easement applies to all future owners of the property. The deduction applies to both commercial property and owner-occupied housing.

Financial Incentives for Energy Conservation

There are many different incentives, both Federal and specific to the state of Wisconsin, that provide financial incentives for energy conservation. A good place to get summaries of these incentives is at the Database of State Incentives for Renewables & Efficiency (DSIRE) on the web: http://www.dsireusa.org/

As part of their *Clean It Green It* campaign, the City of Bayfield is offering homeowners an opportunity to apply for a grant of up to $250 during the remainder of 2008 or until funds are depleted. The grants are for the purpose of making home improvements that reduce energy or water usage or demonstrate other beneficial environmental impacts. Contact the Bayfield City Hall at 715-779-5712.

The Goal of Sustainability

The Natural Step Framework encourages the use of "systems thinking" to meet sustainability goals. Because human beings have the ability to filter, categorize, and prioritize information, the Natural Step concludes that once the overarching principles of sustainability are defined, we will find it natural to make our decisions in ways that adhere to those principles and will carry that decision-making process into all areas of our life.[144] The Framework focuses on

teamwork and collaboration, and to meet sustainability goals uses a tool called *back-casting*. Back-casting is a process by which future sustainability goals are met by making short-term decisions and investments that lead you where you want to go.[145]

In Bayfield, preserving our heritage and built environment is an act of sustainability. Reconciling preservation with the other sustainability goals of the community will require teamwork and collaboration. We want to encourage sustainability in the environmental arena that also promotes the sustainability of our historic built environment. In all decisions that we make regarding our actions that impact the environmental capital that surrounds us, we should systematically keep in mind that preserving what was created here so long ago will help to sustain Bayfield into the future. Jason F. McLennan reminds us that throughout time beautifully designed things – whether a teapot or cathedral - have always been taken better care of and last longer than counterparts with less aesthetic value.[146] Bayfield is a beautiful place, but not just because of its location on Lake Superior and its views of the islands. It is a beautiful place because it was *designed* with beauty in mind, to be enjoyed on foot, and it escaped the misguided "renewal" that so many communities undertook during the middle of the last century. It is an asset to be cherished and protected, just as our other precious resources.

"Taking care of a building and respecting the resources and energy that went into creating it is one of the most important tenets of sustainability. Beautifully designed buildings that elicit an emotional response are likely to be respected in their use, and be maintained and repaired as necessary. It is the most beautiful of buildings that typically gets saved from the wrecking ball. While this is not always the case, as we know, it tends to help in sometimes significant ways. The Historic Preservation movement arose as a reaction to the wholesale destruction of beautiful historic works of architecture that was occurring around the country. The preservation movement has done wonders to preserve a cultural and artistic legacy as well as preserving the embodied energy inherent in the structures while preventing the need for new buildings to be built in their place. Something that has been carefully designed and built is also more likely to be re-used when its original functional life is over, even if it does not have historical value. The thousands of brick warehouses and factories all over America are prime examples. As opposed to many of the warehouses that are being built today, these buildings were built at a time when beauty, form and attention to detail were important even in a warehouse. Beauty does not always have to be expensive, but it does require care. Just about every family can point to things that have been handed down from previous generations either for their beauty, their utility, a family story or some combination of the three. As the utility and family significance fades, it is often only the beauty of the object that keeps it cherished and passed on."

Jason McLennan, excerpted from his book *The Philosophy of Sustainable Design,* Bainbridge Island: Ecotone, 2004, p. 235-236.

This information was compiled and written by Vicki Birenberg, a graduate student at The School of the Art Institute of Chicago. Vicki is working toward her Master's of Science degree in Historic Preservation. She spent the summer of 2008 completing the internship requirements of that program by working for the City of Bayfield.

Notes

1. City of Bayfield, WI, *Comprehensive Plan 2002-2022,* 92.
2. Detail on this topic can be found throughout the book *The Natural Step for Communities: How Cities and Towns Can Change to Sustainable Practices,* by Sarah James and Torbjörn Lahti, 2004.
3. Sustain Dane, "Eco-municipalities: Where Are They?," http://www.sustaindane.org/Pages/ecomunicipality_where.htm
4. James and Lahti, *The Natural Step for Communities:,* 24.
5. For additional information, refer to *The Natural Step: A Framework for Achieving Sustainability in or Organizations,* by Karl-Henrik Robert, 1997.
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7. The National Trust for Historic Preservation, *The Facts: Why Our Existing Buildings and Neighborhoods Matter,* http://www.preservationnation.org/issues/sustainability/additional-resources/the-facts-about-preservation-a.html.
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9. Ibid.
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11. Ibid.
12. Frey, *Making the Case: Historic Preservation as Sustainable Development,* http://www.preservationnation.org/issues/sustainability/additional-resources/DiscussionDraft_10_15.pdf, 4.
13. McLennan, *The Philosophy of Sustainable Design,* 4.
14. Ibid.
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21. Rodwell, *Conservation and Sustainability in Historic Cities,* 185.
22. Ibid.
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24. Ibid., slide 13.
25. Ibid., slide 20.

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31. Ibid., 153.
32. Ibid., 121.
33. Poore, ed., *The Old House Journal Guide to Restoration,* 205.
34. For more information on awnings for historic buildings, see The National Park Service Technical Preservation Services Brief No. 44: "The Use of Awnings on Historic Buildings: Repair, Replacement, & New Design, " http://www.nps.gov/history/hps/tps/briefs/brief44.htm.
35. Randl, "Repair and Reproduction of Prismatic Glass Transoms," http://www.nps.gov/history/hps/tps/technotes/PTN44/intro.htm.
36. Ibid.
37. Neumann, "The Century's Triumph in Lighting," 25-26.
38. Ibid., 35.
39. Ibid, 37-38.
40. Ibid,, 27.
41. Ibid., 28.
42. For information on current prism glass manufacturers, see http://glassian.org/Prism/current.html.
43. Rodwell, 185.
44. Ibid.
45. Smith, "Conserving Energy in Historic Buildings," http://www.nps.gov/history/hps/tps/briefs/brief03.htm, 3.
46. One local source for sandblasting is Fastlane Motorsports in Ashland. http://www.fastlanemotorsports.org/sandblasting.html.
47. Lord, "Embracing Energy Efficiency," 40.
48. For more detailed discussion of mortar and repointing of historic buildings, see the National Park Service Technical Preservation Services Brief No. 2: "Repointing Mortar Joints in Historic Masonry Buildings," http://www.nps.gov/history/hps/TPS/briefs/brief02.htm.
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50. Ibid., 4.

51. For more information on insulating your historic property and other retrofitting techniques, see The National Park Service Technical Preservation Services Brief No. 3: "Conserving Energy in Historic Buildings," http://www.nps.gov/history/hps/tps/briefs/brief03.htm.
52. Lord, 44-45.
53. Powell, *Bungalow Details: Exterior,* 107-108.
54. Ibid.
55. Sedovic and Gotthelf, "What Replacement Windows Can't Replace: The Real Cost of Removing Historic Windows,"27.
56. Powell, 108-109.
57. Sedovic and Gotthlef, 28.
58. Ibid.
59. Powell, 110.
60. Ibid., 111
61. Ibid.
62. Sedovic and Gotthelf, 28.
63. Ibid., 29.
64. For proper disposal of Compact Fluorescent Bulbs, see the detailed document on the Energy Star website at http://www.energystar.gov/ia/partners/promotions/change_light/downloads/Fact_Sheet_Mercury.pdf.
65. Kooles, "Going Green: Solar Panels in Historic Districts," 18-19.
66. For an explanation of net metering in Wisconsin and incentives for using renewable energy technologies, visit http://www.dsireusa.org/library/includes/seeallincentivetype.cfm?type=Net&currentpageid=7&back=regtab&EE=0&RE=1.
67. McLennan, 108-109.
68. English Heritage, *Small Scale Solar Electric (Photovoltaics) Energy and Traditional Buildings*, http://www.english-heritage.org.uk/upload/pdf/49357-SolarElectric.pdf, 2.
69. City of Santa Barbara, California, *Solar Energy System Design Guidelines & Solar Recognition Program*, http://www.santabarbaraca.gov/NR/rdonlyres/D47E4961-32DA-4E19-9690-7F11ED0562E2/0/Exhibit_A_Solar_Guidelines_Recognition_Program.pdf, 7.
70. Ibid.
71. Ibid., 8.
72. Ibid.
73. Ibid.
74. Ibid., 9.
75. Toolbase Services, *Photovoltaics – Building-Integrated Photovoltaics (BIPV),* http://www.toolbase.org/Technology-Inventory/Roofs/photovoltaic-building-integrated
76. Ibid., 11.
77. Ibid.
78. Ibid., 12.

79. Ibid.
80. City of Bayfield, *Historic Preservation Ordinance,* 423 – 4, B 1,2.
81. Ibid., 4 a-f.
82. Statute 66.0401 regarding restrictions on the regulation of solar technologies can be found online at http://www.renewwisconsin.org/wind/Toolbox-Legal/66.0401.pdf
83. City of Santa Barbara, California, 19.
84. Ibid., 16.
85. Taken from email correspondence with the author dated June 4, 2008.
86. City of Pasadena, California, *Design Guidelines for Historic Districts in the City of Pasadena, California,* http://www.ci.pasadena.ca.us/planning/deptorg/dhp/pdfs/Pasadena_DGs.pdf, 90.
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88. Ibid.
89. Bock, "Notes From the Underground," 52.
90. Ibid., 54.
91. Ibid., 53.
92. Ibid., 55.
93. Taken from email correspondence with author dated July 24, 2008.
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95. Green Energy Centre, *Renewable Energy Technologies: Biomass*, http://www.greenenergycentre.org.uk/bio.asp
96. Ibid.
97. Ibid.
98. Ibid.
99. Ibid.
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101. Ibid.
102. Ibid.
103. State of Oregon, *Biomass Energy Home Page,* http://www.oregon.gov/ENERGY/RENEW/Biomass/bioenergy.shtml
104. Ibid.
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109. Ibid., 82.
110. Ibid., 106.

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113. Ibid.
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119. Welch, "Landscaping for Energy Conservation," http://aggie-horticulture.tamu.edu/extension/homelandscape/energy/energy.html
120. University of Minnesota, http://www.sustland.umn.edu/design/energysaving.html
121. Ibid.
122. McMillan, *National Register of Historic Places Inventory – Nomination Form,* Sec. 8 p. 3.
123. Missouri State University – Mountain Grove, "Centennial Garden Concept and Historical Perspective," http://mtngrv.missouristate.edu/CentGarden/CentConcept.htm
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IT'S EASY BEING GREEN:

Sustainability in Bayfield from a Historic Preservation Perspective

Resource List for Additional Information

-The City of Bayfield's Historic Preservation Ordinance and Design Guidelines for the Historic District are available for review on the City's website:

http://www.cityofbayfield.com/

http://www.cityofbayfield.com/CodeOrdinances/chapter423.htm

http://www.cityofbayfield.com/HistoricDistricGuidelines.pdf

-To learn more about eco-municipalities and The Natural Step:

The Natural Step: A Framework for Achieving Sustainability in Our Organizations by Karl-Henrik Robert. (Cambridge: Pegasus Communications) 1997.

The Natural Step for Communities: How Cities and Towns Can Change to Sustainable Practices by Sarah James and Torbjörn Lahti. (Gabriola Island, BC: New Society) 2004. This book is available at the Bayfield Public Library.

-To learn more about the relationship between sustainability and historic preservation:

http://www.preservationnation.org/issues/sustainability/

http://www.illinoishistory.gov/ps/green_preservation.htm

-A recommended resource on the subject of sustainable design:

The Philosophy of Sustainable Design by Jason F. McLennan. (Bainbridge Island: Ecotone Publishing) 2004.

-The National Park Service Technical Preservation Services Division has a wealth of information on many different topics related to the rehabilitation of historic buildings. View a .PDF file of the various publications and online materials at:

http://www.nps.gov/history/hps/tps/tax/download/tax_tech_index.pdf

Their *Preservation Briefs* series is particularly informative for historic property owners and cover over 40 different topics related to restoration and rehabilitation. Access to the series can be found online at:

http://www.nps.gov/history/hps/tps/briefs/presbhom.htm

The *Briefs* most relevant to the topics in this manual include:

No 2: *Repointing Mortar Joints in Historic Masonry Buildings*
http://www.nps.gov/history/hps/tps/briefs/brief02.htm

No. 3: *Conserving Energy in Historic Buildings*
http://www.nps.gov/history/hps/tps/briefs/brief03.htm

No. 9: *The Repair of Historic Wooden Windows*
http://www.nps.gov/history/hps/tps/briefs/brief09.htm

No. 11: *Rehabilitating Historic Storefronts*
http://www.nps.gov/history/hps/tps/briefs/brief11.htm

No. 14: *New Exterior Additions to Historic Buildings: Preservation Concerns*
http://www.nps.gov/history/hps/tps/briefs/brief14.htm

No 16: *The Use of Substitute Materials on Historic Building Exteriors*
http://www.nps.gov/history/hps/tps/briefs/brief16.htm

No 24: *Heating, Ventilating, and Cooling Historic Buildings*
http://www.nps.gov/history/hps/tps/briefs/brief24.htm

No 44: *The Use of Awnings on Historic Buildings*
http://www.nps.gov/history/hps/tps/briefs/brief44.htm

-For another National Park Service TPS document with information on historic prism glass and another website with sources for replacement prism glass:

http://www.nps.gov/history/hps/tps/technotes/PTN44/print_version.html

http://glassian.org/Prism/current.html

-For additional information on historic wood windows, including a tip sheet for property owners:

http://blogs.nationaltrust.org/preservationnation/?p=717

-The National Institute of Building Sciences addresses the importance of aesthetics and building design on their website -

http://www.wbdg.org/resources/aestheticchallenges.php
http://www.wbdg.org/resources/aestheticopportunities.php

as well as a page on sustainable historic preservation, including resources of where to find design professionals:

http://www.wbdg.org/resources/sustainable_hp.php

as well as a general overview of the topic of historic preservation:

http://www.wbdg.org/design/historic_pres.php

-Visit the U. S. Environmental Protection Agency/U. S. Department of Energy website for information on saving energy:

http://www.energystar.gov

-For information on solar systems, how they work, and financial incentives:

http://www.state.mn.us/mn/externalDocs/Commerce/Consumer_Guide_to_Solar_Systems_123002022801_pvguide3.pdf

http://www.the-mrea.org/download/SolarHotWaterFactSheet.pdf
http://www.wbdg.org/resources/swheating.php

-The U. S. Department of Energy: Energy Efficiency and Renewable Energy website has information available on all types of energy technologies, including solar, geothermal, and wind, as well as specific information on energy savings with landscaping:

http://www.eere.energy.gov/

http://www.eere.energy.gov/consumer/your_home/landscaping/index.cfm/mytopic=11910

-The U. S. Environmental Protection Agency (EPA), in conjunction with Purdue University, has put together information on residential water conservation:

http://www.purdue.edu/dp/envirosoft/watcon/src/title.htm

-The EPA also has a website on green landscaping that includes a plant lists with native plants suitable for the Great Lakes region:

http://www.epa.gov/greenacres/

-Background on the Secretary of the Interior's Standards for the Treatment of Historic Properties, including preservation, restoration, rehabilitation, and reconstruction can be found at:

http://www.nps.gov/history/hps/tps/standards_guidelines.htm

-The U. S. Green Building Council has background on building "green" and their Leadership in Energy and Environmental Design (LEED) rating system at:

http://www.usgbc.org/

The Materials Reuse Association website can help you to find sources for recycling building materials and finding salvaged materials:

http://www.buildingreuse.org/directory/

-The City of Boston, MA has put together a comprehensive list of sustainable design guidelines, including sources for building products:

http://www.cityofboston.gov/environment/pdfs/hpb_guidelines.pdf

-The Wisconsin Green Building Alliance has a website with links to sources of green building rating systems and green guidelines:

http://www.wgba.org/artman/publish/article_359.s

- For detailed information on the Federal Rehabilitation Tax Credit:

http://www.nps.gov/history/hps/tps/tax/incentives/index.htm

-For information on the preservation incentives available in the State of Wisconsin:

http://www.wisconsinhistory.org/hp/architecture/iptax_credit.asp
http://www.wisconsinhistory.org/hp/architecture/tax_credit.asp

-For information on incentives for energy conservation, see the Database of State Incentives for Renewables and Efficiency (DSIRE)

http://www.dsireusa.org/index.cfm?&CurrentPageID=7&EE=0&RE=1