Conserve~Preserve
Guidebook
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Introduction

In this fast paced world of the early 21st century, it is easy to be swept away with ‘new and improved’. As our world continues to spiral on all fronts, we are beginning to wake up to the need to ‘get back to basics. This requires us to reach into the past while we build the future. To do this we have to hold different times and perspectives that on the surface conflict with each other, but who together hold key solutions to building a sustainable future.

One place where this conflict and convergence is clearly evident is in the role our heritage buildings play in our sustainable future. Not only do these buildings hold our history and untold knowledge, they also embody significant environmental value, and a meeting place where the past, present and future centuries can meet and collaborate.

The purpose of the Conserve~Preserve Guide is to provide an initial framework and guidance as to why and how our heritage buildings can conserve energy, and play their role in climate change mitigation; while preserving our culture and history. Conserving and preserving are vital tools for a sustainable future.

The contents of this Guide originated from a series of ‘design studios’ held by the Windfall Ecology Centre to harmonize modern energy and environmental technology while maintaining the historic integrity and embodied energy of the heritage buildings. A wonderful cross section of architects, engineers, heritage home/building owners and managers, and environmental, and energy specialists were brought together to create a new Model and Guidebook for heritage retrofits. These studios were hosted by prominent heritage buildings to discover firsthand the theory and practice of sustainable heritage.

This Guidebook is a living document that will be changed and amended over time to reflect new knowledge and advice by those who are working in the conserve~preserve fields, as well as heritage building and home owners who are stewards of these great buildings that hold social and cultural values and assets that are non-renewable.

The Contents of this Guidebook are as follows:

- **Where Centuries Meet:**
  Making the case for conserving and preserving heritage buildings and homes.

- **A Framework for Sustainable Heritage:**
  A model to help guide the conserving and preserving of our heritage buildings and homes.

- **Where to Start**
  A process to follow when undertaking this important work

**Editor**

**Hilary Van Welter**
Where Centuries Meet – The Business Case for Sustainable Heritage

This section will explore the heritage assets, the drivers of sustainable heritage, and the benefits of conserving and preserving.

**Heritage Assets**

Let’s begin with the buildings themselves. When we reflect on the value of our heritage homes - we have to consider both the tangible and intangible. The tangible or physical assets are visible to the eye – the structures, architectural beauty and interior design, the rich materials themselves, all reflect the cultural history of the time. Heritage buildings also record the often lost human craft of their builders as the masters of their era. The uniqueness of each structure, unlike the cookie cutter of the modern day, and the antique woodwork is itself a testament to another time and sense of individuality and authenticity.

While these are key assets, the intangible value of these buildings and homes is hard to quantify, but is very real such as the energetic knowledge and experience the buildings hold and share. They have a feel and presence of quiet, solid majesty that is very tangible. These homes and buildings hold stories that reconnect us to the lives, struggles and triumphs of those who inhabited them. Our connection to the personal histories of the past helps us understand the present. Heritage buildings help us become more aware of ourselves, our humanity and nature (through the materials with which they were built). Heritage homes are landscape icons, as well as important cultural and social identity. They help us orient ourselves through our cities, towns, villages and countrysides – describing through their presence how this country evolved – through its people and the structures they built – with the natural resources available to them.

**The Drivers of Sustainable Heritage**

As outlined above, our heritage buildings are precious resources that need to be preserved. At the same time there are real challenges that must be addressed such as the role these buildings are playing in our current climate crisis. The core issue is with the dependency on fossil fuels, and the lack of energy efficiency. When climate crisis is spoken about in terms of heritage buildings, it is often dealing with the impact of the weather on these buildings. The tables are now turning and these buildings are now contributors to the increasing footprint.

There is also the issue that many home owners and not for profits who inhabit these buildings are facing fuel poverty. If they are not able to keep these buildings running, then the homes and buildings will be abandoned and left derelict. The impact of the demolition and loss of an important heritage assets is also a significant consideration.

The issue around energy efficiency also plays out with respect to health. Hard to heat homes and buildings are prone to mould or fungal growth from condensation dampness; this can cause respiratory problems as well as other health concerns for immune systems.
THE BENEFITS OF CONSERVING AND PRESERVING

On one hand, the preservation of heritage buildings reduces waste and conserves energy. The energy used in the life-cycle of a building, called the embodied energy, includes all the non-renewable energy consumed:

- Initial energy – to acquire, process, manufacture, and transport building materials, and construct the building. According to Statistics Canada, in 2000, 12% of Canada’s waste disposal was from construction and demolition sources. However, Heritage Canada Foundation states that estimates of construction and demolition waste in Canada range from 10-33% with a conservative estimate of about 20%.
- Recurring energy – to maintain and repair the building,
- Operating energy – to heat, cool, ventilate, and light the building,
- Energy to demolish and dispose of the building

Also – just like many natural resources, the social and cultural values of heritage buildings are non-renewable.

On the other hand, we are facing significant challenges to 1) making these buildings energy efficient, and 2) ensuring that the heating systems are mitigating against climate change, not contributing to it.

Undertaking a project to preserve and conserve a heritage building can feel like walking into a world of two solitudes. There is a need to preserve the heritage features, and yet in some cases those very features are the major issue of significant energy loss, which are in turn making the building a contributor to the climate crisis.

There are solutions however - as this Guidebook will demonstrate. Our heritage buildings once housed our pioneers. Well – we have to pioneer again – to find solutions that will both preserve the heritage AND mitigate against climate change. The use of renewable energy is certainly a start, but we need to be continually seek out innovative alternatives. This Guidebook represents an initial step in that direction.

Figure 2: Hilary House Aurora Ontario – site of Design Cafe.
As noted in the previous section, sustainability in all its forms – economic, environmental, social and cultural, plays a major role in the conserving and preserving of our heritage buildings. A framework was therefore developed that has many of the features of community sustainability planning, as outlined below:
1. Forces of Change

The next place we need to go when considering how to preserve these heritage buildings while conserving our energy and resources is to look at the challenges and forces of change that these buildings will be facing in the future.

Climate Change
One of the forces of change that we can’t avoid is climate change. At this point, heritage buildings can be contributing to climate change with the high use of fossil fuels for heating. Energy retrofitting is often difficult because of the need to preserve the heritage features. These buildings offer a great challenge to develop technologies that can be utilized to preserve the embodied energy while conserving operating energy.

Increasing Population~Shifting Economy
As the economy continues to downturn, we are seeing declining affluence, at the same time natural resources are depleting, along with population increases – all of which will put increased pressure on our current building stock. We will need to put existing buildings – including heritage buildings, to better use.

Renewable Energy
Renewable energy is becoming a major focus of attention as we begin to move away from fossil fuels to energy sources that are generated from natural resources such as the sun, wind, rain, tides and geothermal heat. Renewable energy isn’t only about the physical resource – it is also about redistribution of decision making power, and the renewing of our very precious resource – human creativity. Heritage homes are asking that we call on both forms of renewable energy – one for heating and lighting, the other for figuring out how to apply that energy in ways that honour heritage homes.

2. Holistic Sustainability Lenses

Often the discussion concerning heritage buildings and energy efficiency ends up in a debate of either/or. When we look at the issues impacting heritage buildings with different lenses – new opportunities arise. Seeing Heritage Buildings through the holistic lenses of sustainability: social/cultural/economic and environmental lenses offer the following new possibilities:

- Heritage buildings offer the opportunity to bring forward invaluable sustainability knowhow and practices – for example how these structures worked ‘back in the day’ with natural ventilation, light, and natural materials into our current construction mode. We are looking for ways to reignite an age of quality and craftsmanship, as well as ways to use our natural resources in a sustainable fashion. (For more information, check out: http://www.nps.gov/history/hps/tps/briefs/brief03.htm#InherentEnergySavingCharacteristicsOfHistoricBuildings

- As we move into the green age we are searching for new definitions and vocabulary. It has been difficult to leave the industrial era that influences most of our language.
Heritage buildings and their challenges are fertile ground for merging traditional language with 21st thinking to come up with new definitions and vocabulary.

- We are in the early days of a rush in which everything is green. What was once purely an environmental domain is being redefined to incorporate a new mindset that addresses every aspect of the way we live. There is a need to call out the ‘fake’ green initiatives that are merely riding the coattails of a movement, and define what is truly green, as well as take a holistic approach to conservation. Heritage buildings demand authenticity and this applies to green as well.

- The concept of embodied energy holds fascinating potential for demonstrating 21st century sustainable practices. Retaining the original materials avoids the environmental impact, and is in fact an environmentally sustainable practice as well as a cultural one. The idea of embodied energy is one which provides great insights in how to define ‘intangible assets’ and lends itself to the development of an ‘embodied energy standard’.

- Our heritage buildings provide hands on opportunities for awareness and learning, not only about the past but also about 21st century sustainability practices. Conserving heritage means jobs for local trades and the development of unique skills that blend heritage and energy conservation and renewable energy.

3. SUSTAINABILITY PRINCIPLES

As mentioned numerous times throughout this Guide, heritage homes actually naturally lend themselves to the holistic view of sustainability. The preservation of heritage homes began with Built Heritage Principles. These were evolved and expanded to reflect practices that sustained the architecture. Add to these Green Build Principles that, while geared to new builds, have relevance to the energy conservation requirements for heritage homes and we end up with the beginning of a set of Sustainability Principles.
Let’s begin my reviewing the various sets of principles. Below is a chart that outlines the Built Heritage Principles and how they were evolved by the Ontario Heritage Trust to reflect Architectural Sustainability.

<table>
<thead>
<tr>
<th>Built Heritage Principles</th>
<th>Architectural Sustainability Principles</th>
</tr>
</thead>
<tbody>
<tr>
<td>• <strong>Respect for documentary evidence</strong></td>
<td>• <strong>Respect for documentary evidence</strong></td>
</tr>
<tr>
<td>○ Do not base restoration on conjecture. Conservation work</td>
<td>○ Sustainable design should be based on accurate and detailed</td>
</tr>
<tr>
<td>should be based on historical documentation, such as</td>
<td>understanding of the property, the existing and historical systems</td>
</tr>
<tr>
<td>photographs, drawings and physical evidence.</td>
<td>and conditions.</td>
</tr>
<tr>
<td>• <strong>Respect for the original location</strong></td>
<td>• <strong>Respect for the site</strong></td>
</tr>
<tr>
<td>○ Do not move buildings unless there is no other means to</td>
<td>○ The energy required to alter a site should be part of the overall</td>
</tr>
<tr>
<td>save them. Site is an integral component of a building.</td>
<td>energy calculation. Major changes in topography, excavation and</td>
</tr>
<tr>
<td>Change in site diminishes heritage value considerably.</td>
<td>vegetation should be avoided.</td>
</tr>
<tr>
<td>• <strong>Respect for historical material</strong></td>
<td>• <strong>Respect for existing material</strong></td>
</tr>
<tr>
<td>○ Repair/conserve rather than replace building materials</td>
<td>○ Keep and re-use as much material as possible. Minimize removal of</td>
</tr>
<tr>
<td>and finishes, except when absolutely necessary. Minimal</td>
<td>building fabric and debris.</td>
</tr>
<tr>
<td>intervention maintains the resource’s historical content.</td>
<td>• **Respect for local materials, vernacular design, and proven building</td>
</tr>
<tr>
<td>• <strong>Respect for original fabric</strong></td>
<td>○ Historical building traditions were labour intensive, used local</td>
</tr>
<tr>
<td>○ Repair with like fabrics to return the resource to its</td>
<td>materials and responded self-consciously to the environment through</td>
</tr>
<tr>
<td>prior condition, without altering its integrity.</td>
<td>good design.</td>
</tr>
<tr>
<td>• <strong>Respect for building history</strong></td>
<td>• <strong>Respect for building and site evolution</strong></td>
</tr>
<tr>
<td>○ Do not restore to one period at the expense of another.</td>
<td>○ Utilize an incremental approach to site design. That contributes to</td>
</tr>
<tr>
<td>Do not destroy later additions to a house solely to</td>
<td>the architectural collage rather than carting everything to landfill</td>
</tr>
<tr>
<td>restore to a single time period.</td>
<td>and starting over.</td>
</tr>
<tr>
<td>• <strong>Reversibility</strong></td>
<td>• <strong>Recycle</strong></td>
</tr>
<tr>
<td>○ Alterations should be reversible to original conditions.</td>
<td>○ Will the new work be useful, adaptable, and/or demountable to future</td>
</tr>
<tr>
<td>This conserves earlier building design and technique.</td>
<td>designs?</td>
</tr>
<tr>
<td>• <strong>Legibility</strong></td>
<td>• <strong>Legibility</strong></td>
</tr>
<tr>
<td>○ New work must be distinguishable from old. Buildings</td>
<td>○ The site should read as a testimony to its evolution. Does the design</td>
</tr>
<tr>
<td>should be recognized as products of their own time: new</td>
<td>of the new building waste resources trying to dress up or disguise</td>
</tr>
<tr>
<td>additions should not blur the distinction between old and</td>
<td>existing forms?</td>
</tr>
<tr>
<td>new.</td>
<td>• <strong>Maintenance</strong></td>
</tr>
<tr>
<td>• <strong>Maintenance</strong></td>
<td>○ Since the mid-20th century, attempts to minimize/eliminate ongoing</td>
</tr>
<tr>
<td>○ With continuous care, future restoration will not be</td>
<td>building maintenance have only proven its importance. We must design</td>
</tr>
<tr>
<td>necessary. With regular upkeep, major conservation</td>
<td>for maintenance.</td>
</tr>
<tr>
<td>projects – and their high costs – can be avoided.</td>
<td></td>
</tr>
</tbody>
</table>
In order to bring our heritage buildings into the realms of energy conservation we have introduced the Green Build Principles. There are significant opportunities to adapt these principles for heritage buildings.

<table>
<thead>
<tr>
<th>Green Build Principles</th>
<th>Application for Heritage Buildings</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Energy Efficiency and Renewable Energy Resources</strong></td>
<td>• Buildings with boiler systems work very well with geothermal energy.</td>
</tr>
<tr>
<td>Commerially available, cost-effective energy technologies could reduce overall energy consumption in the United States by as much as one-third--worth some $343 billion. Proper siting and airtight construction, as well as installing energy-efficient equipment and appliances and renewable energy systems can reduce the amount of energy your building needs to operate and to keep its occupants comfortable.</td>
<td>• Proper insulation of attics and walls and walls will help conserve energy.</td>
</tr>
<tr>
<td>• Maintaining the building on a regular schedule is imperative.</td>
<td>• Replacing the heating systems to energy efficient ones is very important to energy conservation.</td>
</tr>
<tr>
<td>• Replacing the heating systems to energy efficient ones is very important to energy conservation.</td>
<td></td>
</tr>
<tr>
<td><strong>Environmental Impact</strong></td>
<td></td>
</tr>
<tr>
<td>The built environment has had a tremendous impact on the environment. However, your building can interact more positively with the environment if you pay special attention to preserving the site’s integrity and natural characteristics, landscaping appropriately, and selecting materials that have lower embodied energy and those that are produced locally.</td>
<td>• The more efficient the building is, the less stress on the environment.</td>
</tr>
<tr>
<td>• By saving the building you save resources that would otherwise be used to build new homes, plus you save landfill space by not demolishing the building.</td>
<td></td>
</tr>
<tr>
<td><strong>Resource Conservation</strong></td>
<td></td>
</tr>
<tr>
<td>Conserving resources is a cornerstone of green building techniques. There are many ways to conserve resources during the building process. For example, selecting materials that have at least some recycled content can conserve natural resources and virgin materials. Minimizing construction waste can ease the impact on landfills and resources. Installing water- and energy-efficient products can conserve resources while reducing operating costs. Choosing a green (plant-covered) roof can reduce energy use, cool urban heat islands, and prevent stormwater runoff, as well as contributing to wildlife habitat and air quality.</td>
<td>• Replace appliances with energy star.</td>
</tr>
<tr>
<td>• Replace lightbulbs with incandescent.</td>
<td>• Draft proofing, especially windows, caulking, baseboards of outside walls, are key and can reduce costs by 50%.</td>
</tr>
<tr>
<td>• Adding low flow water devises will reduce water consumption.</td>
<td>• Adding indigenous trees helps (in areas that won’t shade solar panels).</td>
</tr>
<tr>
<td>• Adding indigenous trees helps (in areas that won’t shade solar panels).</td>
<td></td>
</tr>
<tr>
<td><strong>Indoor Air Quality</strong></td>
<td></td>
</tr>
<tr>
<td>Energy-efficient buildings are more airtight and therefore hold greater potential for indoor air quality problems, especially if not properly ventilated. Building products can contribute to poor air quality, but these potential problems can be reduced by selecting materials lower in chemicals and toxins, and installing mechanical ventilation systems to ensure an adequate fresh air supply.</td>
<td>• Proper use of windows will allow for good air quality.</td>
</tr>
<tr>
<td>• Removing carpets improves air quality.</td>
<td>• There is no such thing as a too tight building, only under ventilated.</td>
</tr>
<tr>
<td>• Add plants in the building to improve air quality as they are natural filters.</td>
<td></td>
</tr>
</tbody>
</table>
Community Issues

Placing green building projects within easy access of public transportation, medical facilities, shopping areas, and recreational facilities decreases the need for automobiles and encourages bicycling and walking. In addition, successful green buildings blend into the community, preserving natural and historical characteristics, and will utilize existing infrastructure in order to reduce sprawl. Cohousing represents one approach to creating a community of green buildings.

While all these principles will contribute significantly to the conserving and preserving of our heritage buildings, they may not be sufficient to ensure that these buildings are still vital in the next 100 years given the challenges and forces of change. We have therefore added the holistic or comprehensive version of sustainability that incorporates economic vitality, environmental health, social well being and culture to the mix. These principles contribute to the awareness of the significant importance of these buildings and the role they will play in the evolution of our economy, society, culture and environmental health. The sustainability principles are further defined in Appendix A.

<table>
<thead>
<tr>
<th>Sustainability Principles</th>
<th>Application for Heritage Buildings</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Stewardship .....</td>
<td>• Preserving Heritage buildings add value to the community.</td>
</tr>
<tr>
<td>2. Respect for limits...</td>
<td>• Heritage buildings are usually located in centre of towns which reduces transportation.</td>
</tr>
<tr>
<td>3. Interdependence....</td>
<td>• Communities gain a sense of pride in having their heritage buildings in good standing. Heritage Buildings can be a vehicle of innovation.</td>
</tr>
<tr>
<td>4. Economic restructuring...</td>
<td>• Heritage buildings provide an opportunity to apply nature’s intelligence – i.e Biomimicry.</td>
</tr>
<tr>
<td>5. Fair distribution.....</td>
<td>• Heritage buildings stimulate sustainable economy – local trades, labour rather than material intensive, plus use of natural materials.</td>
</tr>
<tr>
<td>6. Intergenerational perspective...</td>
<td>• Sustainable Heritage is a vehicle for innovation.</td>
</tr>
</tbody>
</table>

The principles that are the foundation of our Framework for Sustainable Heritage are ALL of these principles: Built Heritage; Sustainable Architecture; Green Build, and Sustainability. Each of these hold unique advice and perspective that contribute to the conserving and preserving of our heritage buildings.
4. THE 100 YEAR VISION

The types of challenges and changes that these buildings have witnessed in their lives to date are extensive. These buildings also have a significant contribution to play in the future. In order to make sure that they continue to carry our history forward for many years to come, it was decided that this Framework would be sheltered by a 100 year Vision. This is an attempt to get us out of short term and knee jerk problem solving, and take the longer term view. This allows us to get a bigger picture of the role that heritage buildings can play in our own evolution. The following elements of the 100 Year Vision for Heritage Homes is very much about the type of society we wish to create, and the role that heritage buildings can play in guiding us there.

Heritage Buildings – Beacons of Sustainable Living

In 100 Years….Our heritage buildings are focal points in our neighbourhood communities that remind us of the historic sense of community and connectedness.

They are beacons that called us to localize our social, cultural and economic activities. This ‘localization’ is fuelled however by a renewed understanding and awareness of our finite resources and a rehabilitated respect for our natural world and our relationship to it. At the same time our local economies are driven by unleashed creativity and innovation that has brought back the artists and craftspeople into every realm of enterprise with a revitalized sense of quality. Innovation is shared and enabled through technology therefore connecting these communities around the world for unique collaborations. These collaborations are enabled because the heritage buildings have helped the communities restore their identity and their intangible resources such as reputation and sense of community. This includes the feeling among the community (cohesiveness, or high social capital), a strong feeling that “this community is ours” (sense of ownership), strong commitment (the motivational aspect of human capital) and the intangible quality of “social trust”.

These intangible assets, along with vibrant ‘old and new world skills’, and inspired education, have also aided our local communities to become self sustaining. The unique needs of heritage buildings acted as a lever to develop innovative solutions so that the energy costs have been minimized and fossil fuels are no longer used in the heating of the buildings or for electricity. The addiction to disposable has been converted to the power of renewable which has been replaced by the next evolution of the human/nature partnership. The heritage buildings are grand reminders of the transformation to a post consumer society and economy through the use of human creativity, craftsmanship, indigenous use of natural resources and the evolution of technology.
5. ENERGY EFFICIENCY

The 100 Year Vision focused on the unique contribution heritage homes will make in the future. In order to make sure that they are in healthy form. Below are a series of steps to be taken to ensure the energy efficiency in a heritage home/building.

Energy Assessment

One of the first steps in this process is the conducting of an energy audit or assessment. An Energy Assessment provides an objective review of the energy use in the home or building and determines a rating for the house based on scientific assessment. An energy advisor can then demonstrate how to improve the comfort of the home or buildings, cut heating and cooling costs, and ensure that there is adequate, healthy ventilation. These assessments provide building and home owners with the knowledge on how the building/ home uses energy and where it is being wasted.

From Basement to Attic

A Certified Energy Advisor will perform a detailed on-site assessment of the building or home's energy use. The advisor will then provide a customized written report which includes a checklist of recommended retrofits to improve the energy efficiency of the home/building and, in some cases, to reduce water consumption. The report will also show the ecoENERGY grant amount for each eligible upgrade you can receive by carrying out these energy saving improvements.

The Energy Assessment includes:

- Checking the efficiency of the insulation, windows, furnace, and hot water tank.
- Conducting a sophisticated blower door test to identify leaks in the outer shell of the building/home.
- Getting to the root of the home/building performance problem and coming up with the best overall plan for improvement.
- A customized report, a plan that includes recommendations for improvement.
- Calculation of money savings by completing the recommended improvements and how much money could be forthcoming as a grant from the federal and provincial governments.


The Heritage Dynamic

Energy Efficiency Ratings are great starting points to understand where the best value for time, energy and money would be for improvements. Heritage buildings however have very unique features that require further exploration. An energy efficiency audit may suggest that the only major way of saving energy and the inherent costs is to wrap the building with insulation from the outside so as not to damage internal heritage features. This would however cause irreversible damage as the heritage features on the exterior would be compromised.
An energy efficiency audit may suggest that windows be replaced to save money and energy, however these are heritage features and therefore weather-stripping may be the best solution.

This is where common sense is needed – and by common we mean the heritage perspective and the energy efficiency view finding some common ground on which they can agree. This is also the place where innovation has to step in to find a new alternative that would preserve the heritage but litigate against climate change.

Below is a check list of the most critical heat loss concerns for heritage buildings:

<table>
<thead>
<tr>
<th>Critical Heat loss Concerns</th>
<th>Yes</th>
</tr>
</thead>
<tbody>
<tr>
<td>Knee walls</td>
<td></td>
</tr>
<tr>
<td>Attics</td>
<td></td>
</tr>
<tr>
<td>Stranded attics</td>
<td></td>
</tr>
<tr>
<td>Bulkheads/Drop Ceilings</td>
<td></td>
</tr>
<tr>
<td>Different heights of ceilings</td>
<td></td>
</tr>
<tr>
<td>Slope ceilings</td>
<td></td>
</tr>
<tr>
<td>Open top-plates</td>
<td></td>
</tr>
<tr>
<td>Overhang/Bay windows</td>
<td></td>
</tr>
<tr>
<td>Single Pane Windows – No Storms, No Weather-stripping</td>
<td></td>
</tr>
<tr>
<td>Attic hatches/crawlspace/doors</td>
<td></td>
</tr>
<tr>
<td>External doors</td>
<td></td>
</tr>
<tr>
<td>Basement/headers</td>
<td></td>
</tr>
<tr>
<td>Hidden cavities (connected to cold spaces)e.g. coal shoots</td>
<td></td>
</tr>
<tr>
<td>Connecting roof lines</td>
<td></td>
</tr>
<tr>
<td>Protruding dormers</td>
<td></td>
</tr>
<tr>
<td>Open top plates on inside/outside walls</td>
<td></td>
</tr>
<tr>
<td>Crawl spaces</td>
<td></td>
</tr>
<tr>
<td>Contaminants i.e. vermiculate</td>
<td></td>
</tr>
</tbody>
</table>
As one can see from above some of the most distinct features of heritage buildings are also the places which are causing the most significant heat loss. There are certainly steps that can be taken that will not impact the heritage integrity such as draft proofing, caulking, weather-stripping, and insulating wherever possible such as in attics.

There are excellent resources that provide heritage specific guidance in this regard:

- **Windows in Historic Buildings: Sustainable, Repairable** by Susan Turner, presents an overview on maintaining and upgrading wood windows

- **Repair or Replace: Arriving at a Sustainable Solution** by Craig Sims and Andrew Powter, examines the myths associated with window replacement, the durability of traditional window systems and the standards by which window performance is measured in Canada.

- **Improving Thermal Performance of Historic Windows** by Craig Sims and Andrew Powter, describes the common maintenance and repair techniques for typical traditional wood window problems.

- **Keeping Wood Siding on Historic Buildings** by Andrew Powter, describes the advantages of retaining historic siding materials and identifies some of the disadvantages of installing modern materials like aluminium or vinyl over the original siding. It also describes the repair and refinishing of wood siding.

- **Repairing Wood Siding on Historic Buildings: Runciman House** by Andrew Powter, is a case study of siding repair methods used in the restoration of the 200-year-old Runciman House in Annapolis Royal.

Changeworks: Energy Heritage which is a download:

English Heritage has a series of excellent guides that can be found on:

In particular this tool is excellent for the details of conserving energy in the heritage context:

The Heritage Matters Magazine by the Ontario Heritage Trust – specifically Volume 5
[http://www.heritagefdn.on.ca/userfiles/HTML/nts_1_8524_1.html](http://www.heritagefdn.on.ca/userfiles/HTML/nts_1_8524_1.html)

Windows - Repair or Replace
In looking to the future, one the possible aids might be in a new rating system for heritage buildings. Work is beginning on a heritage scale as well as a ‘best in class’ for heritage buildings for a more realistic gauge. There are 20,000 heritage buildings in Ontario which fall within a range of types (Colonial, Mid 18th to mid 19th century, Mid 19th to end of 19th century, late 19th century to World War I, World War I to World War II, Post War) It has been recommended that an optimal set of guidelines be developed for each type. Also ask for a heritage pretest energy audit to get a sense of the issues, before entering into the ecoEnergy program.

But this is just the beginning. Our heritage homes and buildings are asking us to go back in time to understand how these buildings were originally constructed, and to use that knowledge – which was actually a lot of common sense, and mix it with 21st century technology to find some innovative solutions to energy conservation while preserving our heritage.

6. RENEWABLE ENERGY

The initial goal of energy conservation is to make the building as efficient as possible, and in the case of heritage buildings, not compromising, but preserving the heritage features. As the previous section outlined, the building or home may not be as efficient as the more modern structures, therefore other measures need to be taken to make sure that both the operating costs are reduced, as well as the use of fossil fuels. As we have said – our heritage buildings have an important role to play in climate change mitigation. This section will look at two possible solutions in the form of renewable energies: Solar and Geothermal.

SOLAR ENERGY

Solar energy is the radiant light and heat from the Sun that has been harnessed by humans since ancient times using a range of ever-evolving technologies. Solar radiation along with secondary solar resources such as wind and wave power, hydro electricity and biomass account for most of the available renewable energy on Earth. Only a minuscule fraction of the available solar energy is used.

Solar power technologies provide electrical generation by means of heat engines or photovoltaics. Once converted its uses are only limited by human ingenuity. A partial list of solar applications includes space heating and cooling through solar architecture, potable water via distillation and disinfection, daylighting, hot water, thermal energy for cooking, and high temperature process heat for industrial purposes.

When it comes to the use of solar energy in heritage homes, one thing we need to remember is that these buildings were normally built with the best use of natural lighting from the sun. Now we are in an age where the electricity and water heating can also benefit from the sun.
There are some simple considerations for heritage buildings:

- Determine your solar resources – assess your sun availability and the angle of orientation
- Assess the impact solar panels will have on the roof – many heritage roofs are not conducive to these.
- Consider the use of solar shingles or ground pole mounting system so as to retain the heritage features of the building.
- Consider the need for reversibility for any changes made to the heritage building and property.
- It is important that no trees or other structures – or parts of the same building such as chimneys or dormer windows – cast shadows on a collector, as this would reduce its energy output.
- Consider the wildlife: bat and birds use buildings for roosting and nesting. Bats can roost under very small spaces in roof coverings or inside roof spaces.

There are excellent detailed resources available on the details on solar and heritage home:

- [Small-scale solar thermal energy and traditional buildings](#) (1212 Kb)
- [Small scale solar electric (photovoltaics) energy and traditional buildings](#) (1511 Kb)

Here is a sample of advice from these guides:

If one does proceed with roof panels, it is best to have an area of 2-4m2 of south-east- to south-west-facing roof, receiving direct sunlight during the main part of the day, would generate a significant annual yield of energy.

It is generally not considered sympathetic to a building’s appearance to have a solar collector or other equipment fixed to any of its main elevations, ie the face or faces seen from the principle view point, towards which it is mainly viewed. Thus buildings with main elevations aligned in the direction of optimal solar radiation may present special installation problems with regards visual impact.

Collectors can still be effective on the east and west faces but the annual yield would be lower. Where a collector cannot be mounted on a building in an optimal direction for solar irradiation, it may be possible to mount it away from the building. In such cases it is advisable to speak to your local heritage inspector or planning officer.

![Figure 7 Solar hot water heating in Traditional Buildings from the English Heritage](#)
Solar energy is certainly a viable alternative to fossil fuels, and with care and innovation, it can enhance the building rather than detract. Many churches and schools are experimenting with the attractive use of solar panels. Again reversibility is key when dealing with this energy source.

Now comes the real advantage: In Ontario, with the new Green Energy Act, building owners will be able to feed their solar energy onto the grid and once a contract is signed, will be paid a set price per unit delivered to the grid. This revenue could certainly contribute to the costs of upkeep and well as to ongoing innovation when it comes to conserving and preserving. For more information go to: http://www.greenenergyact.ca/

**Geothermal**

*Geothermal power* (from the Greek roots *geo*, meaning earth, and *thermos*, meaning heat) is energy generated from heat stored in the earth, or the collection of absorbed heat derived from underground. Below is an excerpt from Residential Earth Energy Systems: A Buyers Guide published by Natural Resources Canada that describes the way this energy works:

> The sun has always provided heat for the earth. Its energy warms the earth directly, but also indirectly. Its heat evaporates water from the lakes and streams, which eventually falls back to earth and filters into the ground. A few metres of surface soil insulate the earth and ground water below. The warm earth and ground water below the surface provide a free, renewable source of energy for as long as the sun continues to shine. The earth under an average suburban residential lot can easily provide enough free energy to heat and cool the home built on it.

*The free energy has only to be moved from the ground into your home. This is done by drawing ground water directly from a well and using a heat pump to extract heat from it. As well, a circuit of underground piping called a loop can be buried in the soil outside the home through which fluid – water or antifreeze – is pumped. The fluid, called the heat transfer fluid, absorbs the heat in the ground water or soil and transfers it to the heat pump. The heat absorbed by the fluid from the solar-heated ground is extracted from it by the heat pump, and the now-chilled fluid is circulated through a heat exchanger over and over again to extract more heat from the earth.

If your home is located near a suitable pond or lake, you can use an Earth Energy System (EES) to draw on this excellent source of free energy. Burying a loop in the ground around your home is like owning your own oil well, but instead of pumping oil from an underground pool and burning it to create heat (and greenhouse gases), you tap into clean energy that will be there for as long as there is a sun.

A well-designed ground loop will not hurt the earth or plants growing above it. There is no visible part to show that it is buried in your yard. If your system uses ground water, it has no effect on the water other than changing its temperature by a few degrees. Finally, a well designed ground water system will not waste the water, but put it back into the ground by means of a return well.

*Figure 8: Geothermal Heat for Homes Climate Progress.org*
Application to Heritage Buildings

As identified above, installing a geothermal or earth energy heating system can be done without impacting the structure of the building other than a couple of drill holes for the pipes. Also this system can be hooked up to the radiator system in most heritage homes which is a real bonus. An example of progress that is being made with geothermal and heritage buildings can be found in the following newspaper article:

<table>
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<tr>
<th>Heritage building has high-tech factor</th>
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<tr>
<td><strong>BY JOANNE HATHERLY, TIMES COLONIST</strong></td>
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<tr>
<td><strong>JANUARY 20, 2009</strong></td>
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A heritage renovation project in downtown Victoria is the first of its kind to utilize geothermal technology. It's also the first building where the geothermal piping feeds directly beneath the building. Barry Milner, marketing director at GeoTility Geothermal Installations Corp., said geothermal systems are typically drilled outside the building footprint -- either into an adjacent greenspace or beneath a parking lot. That restricts the use of geothermal heating, cooling and ventilation systems in urban cores, where building footprints typically encompass the whole lot. Victoria's heritage planners are excited about the project at 1005 Langley St., a 1909 building where heritage aesthetics are being married to green technologies. "It's something we support and encourage. It's consistent with the city's other goals," said Steve Barber, senior heritage planner for Victoria.

Developer Richard Holmes of Hobo Properties purchased the commercial heritage building at the northeast corner of Langley and Broughton streets in 2006.

Designed by Francis Rattenbury, the simple brick building with diamond brick insets, cloverleaf detailing and plain granite window sills is a departure from Victoria's storied architect's more famous and ornate works, such as the Fairmont Empress Hotel and the legislature building. Architect Phillip Chang designed the 12,000-square-foot space in the building with an added fourth storey. The building will be leased as office and retail space. "We're taking a building that has served the city for 100 years and refitting it so that it can serve for another 200 years," said Holmes, who estimates the added cost at $70,000 to $80,000, which he hopes will be recouped within a decade.

Heating, ventilation and air conditioning for a building that size usually costs $18,000 a year, Holmes said, estimating that when it's complete, those costs will fall to about $8,000 a year. Holmes has revived several Victoria heritage buildings, including the Temple Building and the Thomas Hooper Building.

City heritage planner Helen Cain called the blending of conservation and environmental goals a "win-win," in what she described as rehabilitation rather than a restoration. As to whether there will be future examples, Cain said, "We'll take it on a case-by-case basis."

jhatherly@tc.canwest.com
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There is much to be excited about with this type of innovation. It is not something that is rushed into, but rather with careful research and an open mind – our heritage buildings can benefit not only from the technologies of the past, but also the future.

7 TIPS FOR ENERGY EFFICIENCY AND RENEWABLE ENERGY

1. The energy lens needs to be complemented by the social/cultural one. Together these two lenses provide a much more comprehensive set of solutions to ensure the longevity of both the heritage structures and the culture.

2. One needs to consider the life cycle of the building and come at the issues with a whole vision. There is a need to look at initial energy costs of technology solutions and factor them in at the beginning.

3. Reversibility is key to success with moving forward with decisions regarding heritage retrofits.

4. By adding renewable energies, it will allow for future funding to focus on upkeep and preservation rather than heavy energy bills.

5. Ensure new technologies are ‘unseen’ in the building e.g. – wireless internet, geothermal and energy efficiency.

6. Retrofitting does not have to mean drastic change: retrofitting windows can include the following: a) it makes an operable artefact, b) weather stripping and c) refurbishing.

7. It is important to keep a strict eye on maintenance – yearly, monthly and daily. This will help ensure that the building is here for another 100 years as well as help the local economy.
III Where to Start

As this Guidebook outlines, there is much to be taken into consideration when beginning a heritage retrofit. Below is an initial start up process for engaging in a project for preserving and conserving heritage buildings. We are suggesting the same process be adopted by both home and building owners, even though the scale might differ.

STEP ONE: RESEARCH

This research is primarily twofold. One involves the Preserve including the history of the building; the other is the Conserve which is the functional research.

Preserve - Heritage

The History
Every building has a story. It is vitally important that everyone who becomes involved in assessing and retrofitting the building understand the building's history. This includes learning as much as you can about the original inhabitants, as well as the subsequent owners and the changes they made which reflected their times. These buildings are living history, and the embodied energy isn’t only from the natural materials used, but the stories the building tells. Buildings do talk, we have to listen.

Gather as may photographs as you can and make up a PowerPoint or scrapbook which others can review so they can get in touch with the essence of the building and its inhabitants.

The Heritage Features
The next step is to learn about and document the heritage features in the room, home or building you wish to retrofit. This will help in the decision making stage as to the nature of the changes you wish to make.

You also need to become aware of other interventions that may have causes decay, moisture build up. Certain restorations conducted according to heritage guidelines that have failed offer important information.

The Building Use
The next thing you need to do is to explore how you wish to use the building. It is important to adjust the lifestyle or program to fit the building rather than the other way round. If the building houses a number of organizations, they should all be involved in the very beginning.

Conserve - Energy

The Energy Audit
Do an energy audit – look at Energy Efficiency implications and understand the peculiarities of individual buildings. The Energy Efficiency goals may not be the best they can be when compared to modern buildings.

It is also important in this stage to identify things that are going right. Understand the systems in your house/building. Look at what your house is accomplishing - what is working.
**Improvement Recommendations**
Help the energy advisor understand the history, character and heritage features of your building as you review the recommendations. Explore options as how to deal with heat loss issues that would retain the heritage integrity.

**S T E P 2  A S S E S S M E N T**

**Design Team**
Now that you have the key information, you can begin to look at your options, and to do this you need to assemble your team. If this is a family, then all members would be brought in for this process. If this is a building which organizations use – then a number of players should be brought onto the team. See the following graphic as an example of who should be at the table, depending on the extent of the retrofitting. There are also others such as a heritage inspector and renewable energy experts would should also be on the team.

**Determine Goals and Objectives**
Next you need to confirm why you want to engage in this work. For some it is because they love their home and want to take care of it. For others it is an opportunity to improve the home for resale value – there is a market as humans have an inherent need to have something different.

Now you need to determine what want to do you want to do with the house/building including budget. It is important to start with what you have and also have realistic expectations. It is also key to consider that for every dollar you save in energy costs, you can put back into the home or building. This can mean taking little steps such as draft proofing, using lime to repair glass, or finding the right mortar to point the bricks. The Do It Yourself movement is alive and growing. There is also access to invaluable resources on the internet to research original materials. You can also look at the heritage features as working artefacts, and explore how you can preserve this piece of history, while saving energy.

On larger scale buildings this process is an extensive undertaking and requires the fullness of project management practices to do it well.

**S T E P 3  –  T A K E  A C T I O N**

Now that you are armed with the right knowledge and information, and have made both an emotional and rational connection to why you are engaging in this work, it is time to do it. There are two guidelines for this stage:

1. **Simplicity** – There is simplicity about the right thing to do.
2. **Common Sense** – This means making sure things are tested and that it is responsible action – for our past heritage and for the future of our planet.
Final Thoughts

This Guidebook has attempted to blend a philosophy about our heritage buildings along with practical advice. Below are some final thoughts that are offered as a summary of the learning of the design studios that contributed to this Guidebook.

- We are at a defining moment for our heritage buildings – the changes we are contemplating could be greater than any other time – for example adding renewable energy which will help maintain the building.

- We have to reduce our footprints. Severe weather events are increasing. Our heritage homes need to do their part.

- Heritage homes need all the systems working together – old and alternative. There is interconnection and interdependence – adding renewable energy to help maintain the building will make it habitable – making it habitable will ensure it is occupied - when it is occupied, the inhabitants learn to care about the building – this increases the odds of them maintaining the building so that it doesn’t deteriorate.

- Each heritage house is unique and therefore requires different strategies. Renewable energies may be appropriate in one but not another. Demonstration houses are key to helping people understand the possibilities for sustainable heritage.

- Each heritage building that is cared for using the sustainability principles will create a wave that will have a ripple effect. This ripple can help others outside of the ‘heritage circle’ to get excited about the blend of the ‘old and new’ to retrofit the enormous amount of post war buildings that need help.

- Storms and weather have been impacting the heritage homes for many years, and now these storms and weather can be the solution through renewable energy.

- The solutions for our heritage buildings will require mixing the old and new. We are at a place in conserving-preserving in which we are sowing seeds for new approaches and technologies that will mature over time.

- There is cyclicity to our heritage buildings – the old slums are now the most important part of our cities. Also some of the values we hold shift in time – for example humbleness. These values are returning as we try to find solid ground in rapid change.

- The process of conserving-preserving of a heritage building isn’t just a project – it is a journey with ups and downs. The context and fabric of what we’re trying to do must be taken into consideration as much as the building science - old and new. This context and fabric provide the highly important ‘why’ and emotional connection to the work.
We would like to send our sincere gratitude to the following contributors who shared their insights, experience, wisdom, time and energy:

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Resources


