Historic Places - Leaders of Built Environment Stewardship:

Responsible Rehabilitation

BRITISH COLUMBIA | Heritage Branch

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CityGreen Solutions

CASCADIA GREEN BUILDING COUNCIL

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This presentation is jointly-funded by the Real Estate Foundation of British Columbia and the BC Government Heritage Branch

The Real Estate Foundation works to advance knowledge and practices leading to more sustainable use of land and real estate in BC.

The Heritage Branch works to encourage and facilitate heritage conservation in British Columbia

City Green Solutions is an enterprising non-profit with a mission to improve the energy efficiency of homes and buildings in BC.

Cascadia is a non-profit, charitable organization whose mission is to lead a transformation toward a built environment that is socially just, culturally rich and ecologically restorative.

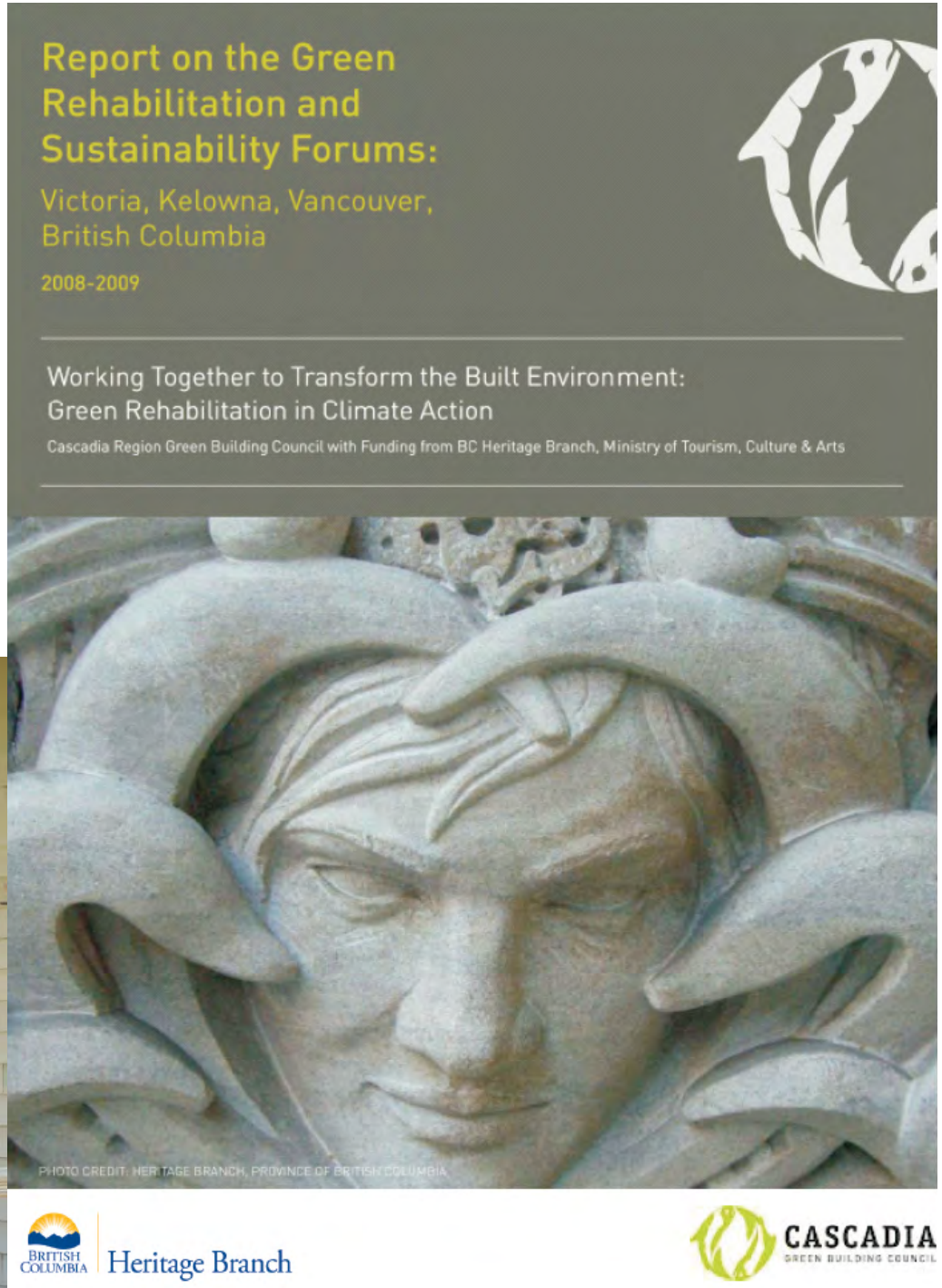
AGENDA

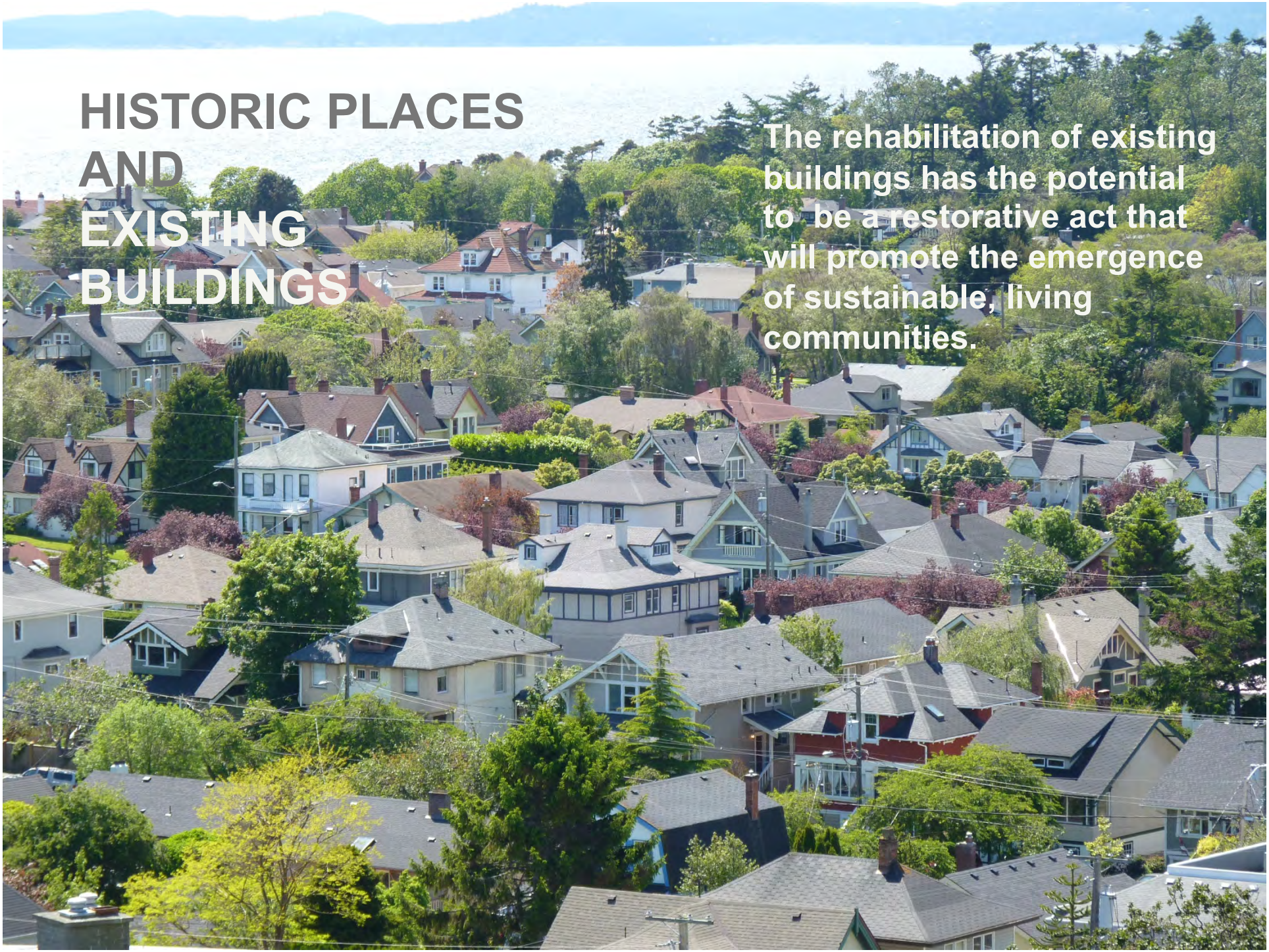
Nexus of Historic Places and Sustainability

Energy Efficiency Opportunities and Challenges

Resources and Technologies

I. Introduction to Historic Places as Leaders in Built-Environment Stewardship



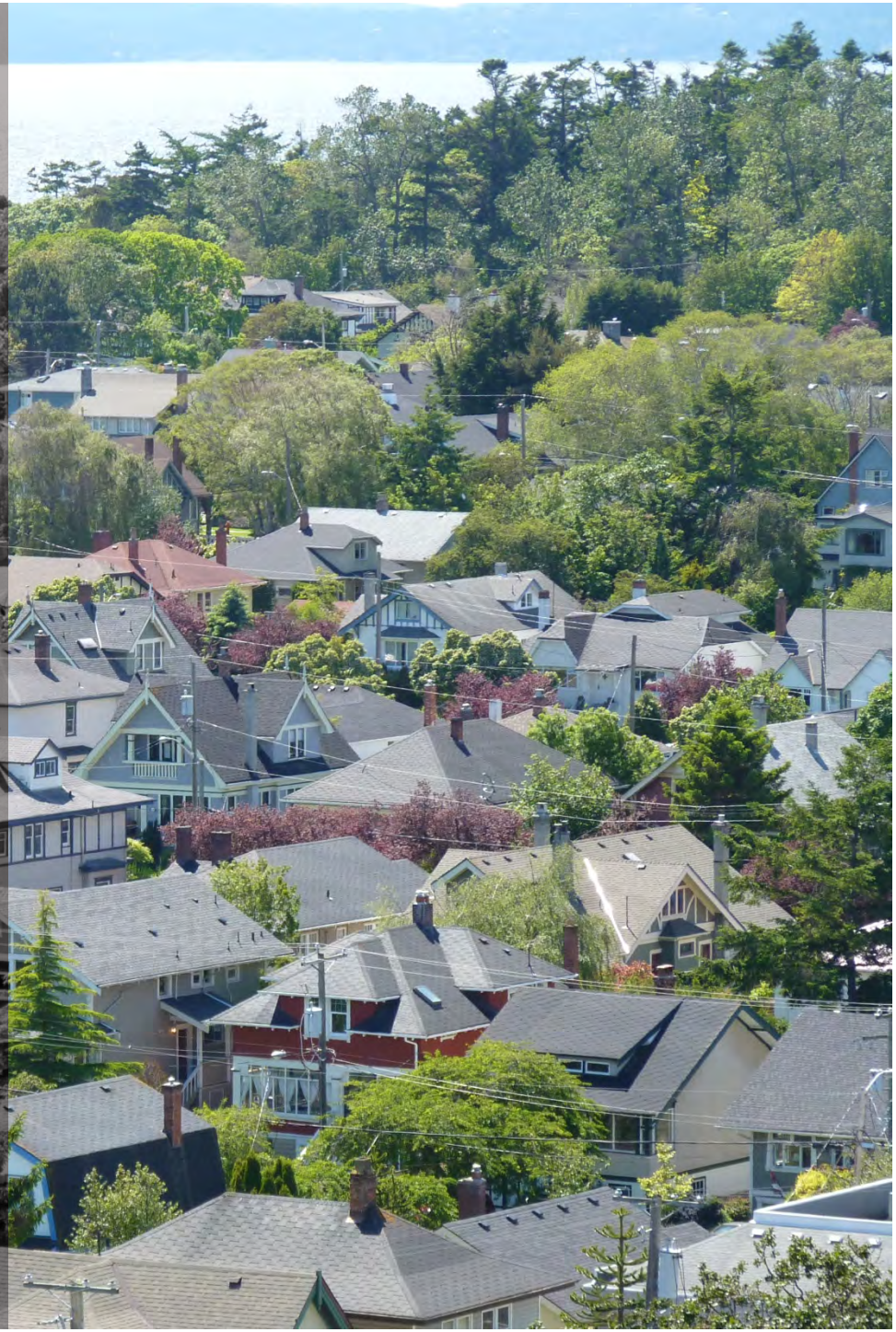


HISTORIC PLACES AND EXISTING BUILDINGS

The rehabilitation of existing buildings has the potential to be a restorative act that will promote the emergence of sustainable, living communities.

Traditionally constructed dwelling units targeted for retrofits:

- 200,000 pre-1950 dwelling units in BC (about 14% of the total housing stock in BC)
- Of these only 1400 (0.7%) are formally recognised for their heritage value.
- Unregulated 99% of pre - 1950s residential building stock vulnerable to climate action through low awareness of alternatives to meeting contemporary energy efficiency standards.



HISTORIC PLACES AND EXISTING BUILDINGS

In British Columbia, rehabilitation and upgrading work on historic places can access a variety of legislative and regulatory provisions not available to existing buildings generally.

These provisions allow an economic, social and environmental balance to the way we work with heritage building stock.

HISTORIC PLACES AND EXISTING BUILDINGS

Because of this, historic places are becoming models of stewardship for existing buildings.

And as the sustainability benefits of an historic places approach begin to be recognized more widely, it is anticipated that building legislation and regulation will follow a similar course.

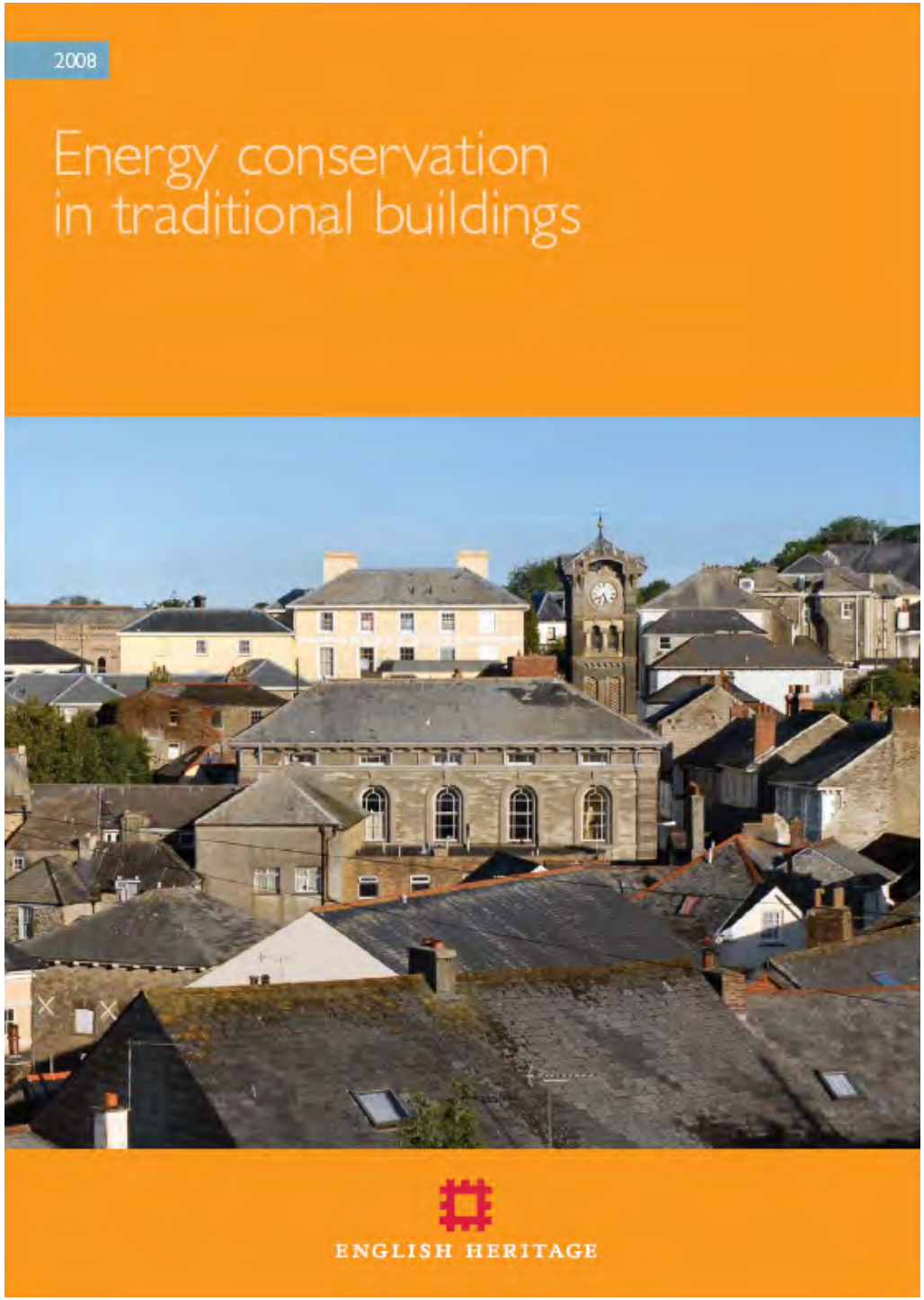
EXISTING BUILDINGS AND ENERGY EFFICIENCY

- Government Commitments
- Utilities Mandates
- Financial Incentives
- Retrofit Advice

BRITISH COLUMBIA
The Best Place on Earth

The energy efficiency of historic buildings can be increased in ways sympathetic to their historic character, for example through draught-proofing, improved insulation or bringing internal shutters back into use. Changing to a condensing flue gas boiler and improving heating controls or the introduction of secondary glazing can significantly improve energy performance.

English Heritage



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HEATING, VENTILATING AND AIR CONDITIONING (HVAC) AND AIR CIRCULATION

RECOMMENDED	NOT RECOMMENDED
Installing new mechanical ductwork sensitively or using a mini-duct system, so that ducts are not visible from the exterior and do not adversely impact the historic character of the interior space.	Installing new mechanical ductwork that is visible from the exterior or adversely impacts the historic character of the interior space.
Leaving interior ductwork exposed where appropriate, such as in industrial spaces, or when concealing the ductwork would destroy historic fabric.	Leaving interior ductwork exposed in highly-finished spaces where it would negatively impact the historic character of the space.
Leaving interior ductwork exposed and painting it, when concealing it would negatively impact historic fabric, such as a historic pressed metal ceiling.	Leaving exposed ductwork unpainted in finished interior spaces, such as those with a pressed metal ceiling.
Placing HVAC equipment where it will operate effectively and efficiently and be minimally visible and will not negatively impact the historic character of the building or its site.	Placing HVAC equipment in highly-visible locations on the roof or on the site where it will negatively impact the historic character of the building or its site.

63

64

65

Recommended: [62-63] Carefully installed new mechanical ductwork is barely visible in the elaborately decorated ceiling of this historic theater.
[64] The ductwork has been left unpainted which is compatible with this historic industrial interior.
[65] To avoid damaging the metal ceiling, the ductwork was left exposed and it was painted to minimize its impact, thus preserving the historic character of this former bank.

66

Not Recommended: [66] Interior ductwork has been inappropriately left exposed and unpainted here in this traditionally-finished school entrance hall.

Because it necessarily involves the conservation of energy and natural resources, historic preservation has always been the greenest of the building arts… preservation is the ultimate recycling.

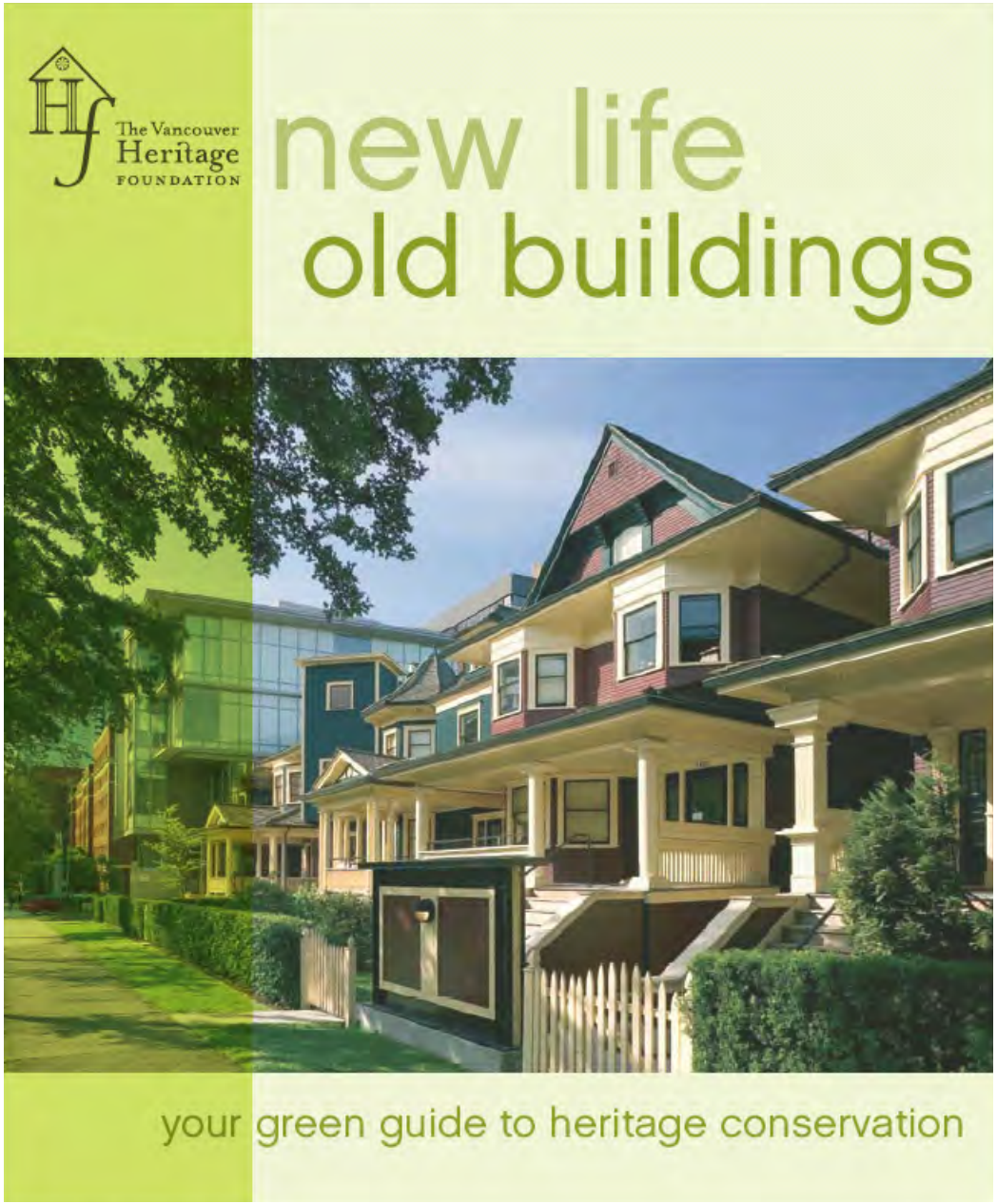
Richard Moe,
President
U.S. National Trust for
Historic Preservation

Both heritage conservation and sustainability aim to conserve. In the case of historic places, this includes considering the inherent performance and durability of their character-defining assemblies, systems and materials, and the minimal interventions required to achieve the most effective sustainability improvements.

Parks Canada

Standards and Guidelines for the Conservation of Historic Places in Canada

	Recommended	Not Recommended
SUSTAINABILITY CONSIDERATIONS		
25	**Complying** with energy efficiency objectives in upgrades to the roof assembly in a manner that respects the building's character-defining elements, and considers the energy efficiency of the building envelope and systems as a whole.	Damaging or destroying character-defining elements while making modifications to comply with energy efficiency requirements.
26	**Working** with energy efficiency and sustainability specialists to determine the most appropriate solution to energy efficiency and sustainability requirements with the least impact on the character-defining elements and overall heritage value of the historic building.	Making changes to the roof assembly, without first exploring alternative sustainability solutions that may be less damaging to the character-defining elements and overall heritage value of the historic building.
27	**Exercising** caution and foreseeing the potential effects of insulating the roof on the building envelope to avoid damaging changes, such as displacing the *dew point* and creating *thermal bridges*, or increasing the snow load.	Installing insulation without anticipating its potential impact on the building envelope. Inserting thermal insulation in roof assemblies, without providing appropriate vapour barriers or ventilation.
28	**Installing** thermal insulation in non-character-defining roof spaces, such as attics, without adversely affecting the building envelope.	Installing insulation in habitable attic spaces without considering its effect on character-defining interior features such as mouldings.
29	**Ensuring** that structural, drainage and access requirements to improve the roof's energy efficiency can be met without damaging character-defining elements.	
30	**Assessing** the addition of vegetated roof systems (green roofs) or storm water cisterns to flat-roof assemblies, and their impact on the building's heritage value and structural integrity, before work begins.	Adding a vegetated or reflective membrane roof system that might compromise the building's heritage value or its structural integrity.



The three pillars of sustainable development: social, economic and environmental are all integral to the rehabilitation of old buildings. Old buildings preserve our culture by paying tribute to the people and events that built our communities. They attract tourists, and their rehabilitation creates opportunities for highly skilled jobs and job training thereby contribution to our economy. In addition, their conservation saves tonnes of debris from the landfill - the ultimate form of recycling.

Vancouver Heritage Foundation

SO IS THE GREENEST BUILDING THE ONE THAT IS ALREADY BUILT?

- No matter how efficient, each new building increases energy demand
- Buildings must stand for many decades before their operational energy savings offset the embodied energy of construction
- So where is the scientific proof that supports that oft quoted statement of Richard Moe?

The Greenest Building: Quantifying the Environmental Value of Building Reuse

A REPORT BY: Preservation Green Lab, National Trust for Historic Preservation

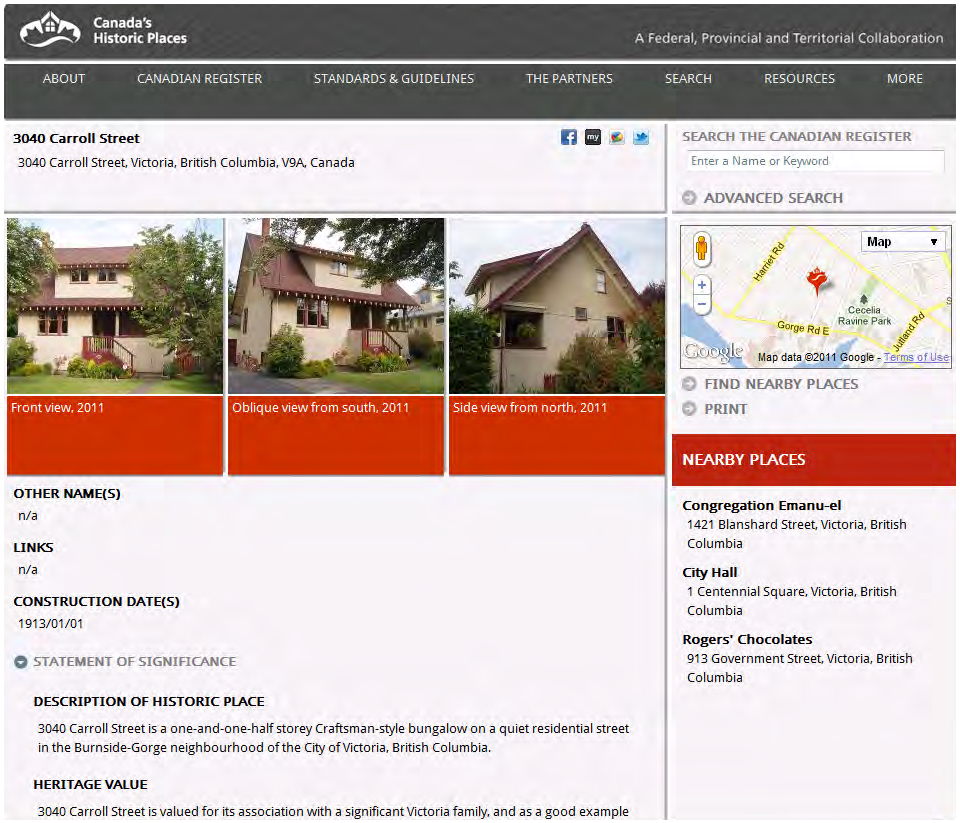
WITH SUPPORT FROM: The Summit Foundation

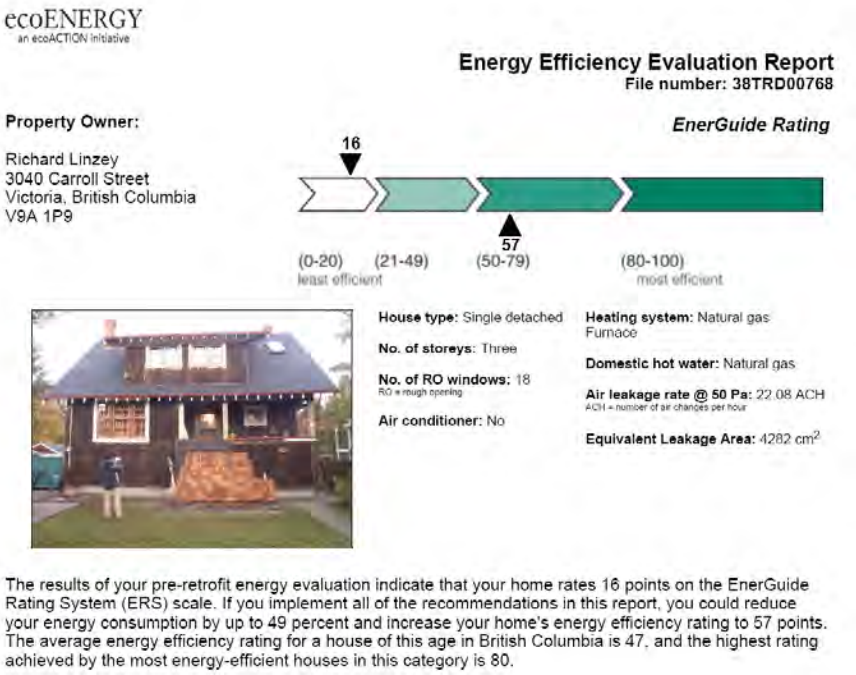
IN PARTNERSHIP WITH: Cascadia Green Building Council, Skanska, Green Building Services, Quantis Sustainability counts

II. Energy Efficiency Opportunities

Where are the opportunities for energy efficiency in historic places?

What are the unique challenges of working with historic places?





NEXUS OF HERITAGE AND ENERGY EFFICIENCY

House as a System Approach

Part 10 – Energy and Water Efficiency

Section 10.1. General

10.1.1.Application

10.1.1.1.Scope

1) The scope of this Part shall be as described in Subsection 1.3.3. of Division A.

10.1.2.Definitions

10.1.2.1.Defined Terms

1) Words that appear in italics are defined in Article 1.4.1.2. of Division A.

Section 10.2. Energy Efficiency

10.2.1.Design and Installation

10.2.1.1.Design

1) Except as provided for in Sentences (2) or (4), all *buildings* shall be designed to conform with ANSI/ASHRAE/IESNA 90.1, "Energy Standard for Buildings Except Low-Rise Residential Buildings".

2) Except as permitted in Sentence (3), those parts of *buildings* of *residential major occupancy* in *buildings* of less than 5 *storeys* in *building height* shall be provided with thermal insulation between heated and unheated space, the exterior air or the exterior *soil*, and heating floor assemblies and heated areas below in conformance to Table 10.2.1.1. A.

3) Alternatives to the requirements of Table 10.2.1.1.A may be determined through

a) the use of energy computer modeling resulting in an equivalent performance to the prescribed requirements in Table 10.2.1.1.A, (See Appendix A), or

b) achieving an EnerGuide Rating System rating of 77, verified by an EnerGuide Rating System energy advisor licensed by Natural Resources Canada to evaluate the energy efficiency of new houses.

4) *Buildings* or parts of *buildings* described in Sentence 1.3.3.3.(1), Division A, of other than *residential major occupancy*, shall be provided with thermal insulation between heated and unheated space, the exterior air or the exterior *soil* in conformance to Table 10.2.1.1.B.

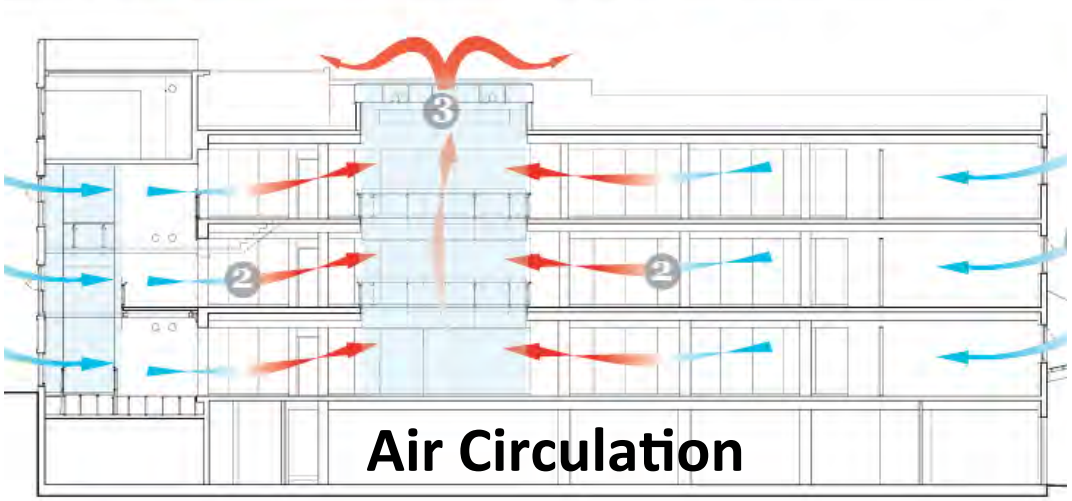
5) Insulation and the installation of insulation shall conform to

a) Subsection 9.25.2., or

b) Part 5

NEXUS OF HERITAGE AND ENERGY EFFICIENCY

Passive Design



ENERGY EFFICIENCY OPPORTUNITIES & CHALLENGES

Thermal Imaging

All building components emit infrared energy (heat).

Thermal imaging cameras make this infrared energy visible. Differences in thermal properties indicate differences in material or condition.

ENERGY EFFICIENCY OPPORTUNITIES & CHALLENGES

Space Conditioning and Water Heating

- Source of energy efficiency gains
- Pre-war and modernist era systems both low-efficiency
- Space conditioning and water heating account for 62% of energy use

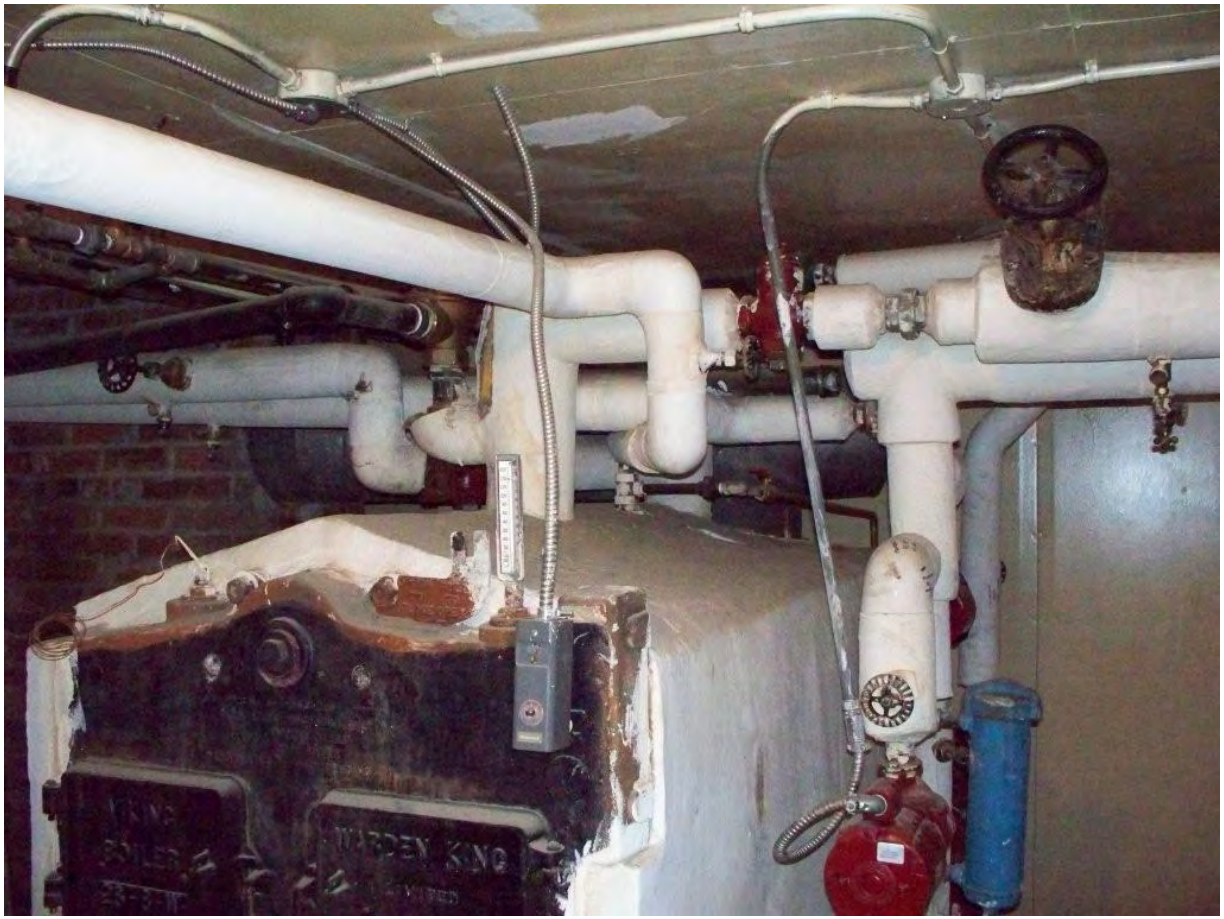
2008 BC Commercial/Institutional Sector Energy Consumption

End use	%
Space Heating	51.9
Water Heating	8.0
Space Cooling	2.4
Lighting	12.0
Auxiliary Equipment	15.2
Auxiliary Motors	9.9
Street Lighting	0.6

From NRCan's OEE's Comprehensive Energy Use Database, 1990 to 2008

ENERGY EFFICIENCY OPPORTUNITIES & CHALLENGES

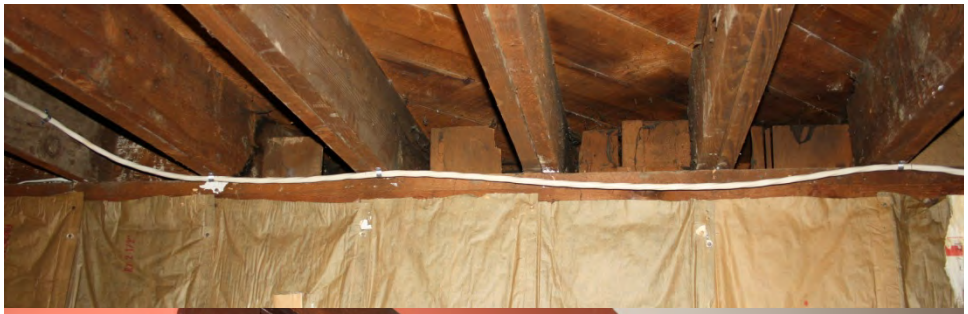
Space Conditioning and Water Heating



- Low efficiency, not direct-vented
- Replacement often appropriate for historic places
- A character-defining heating system can be adapted and retained alongside a new high-efficiency installation

ENERGY EFFICIENCY OPPORTUNITIES & CHALLENGES

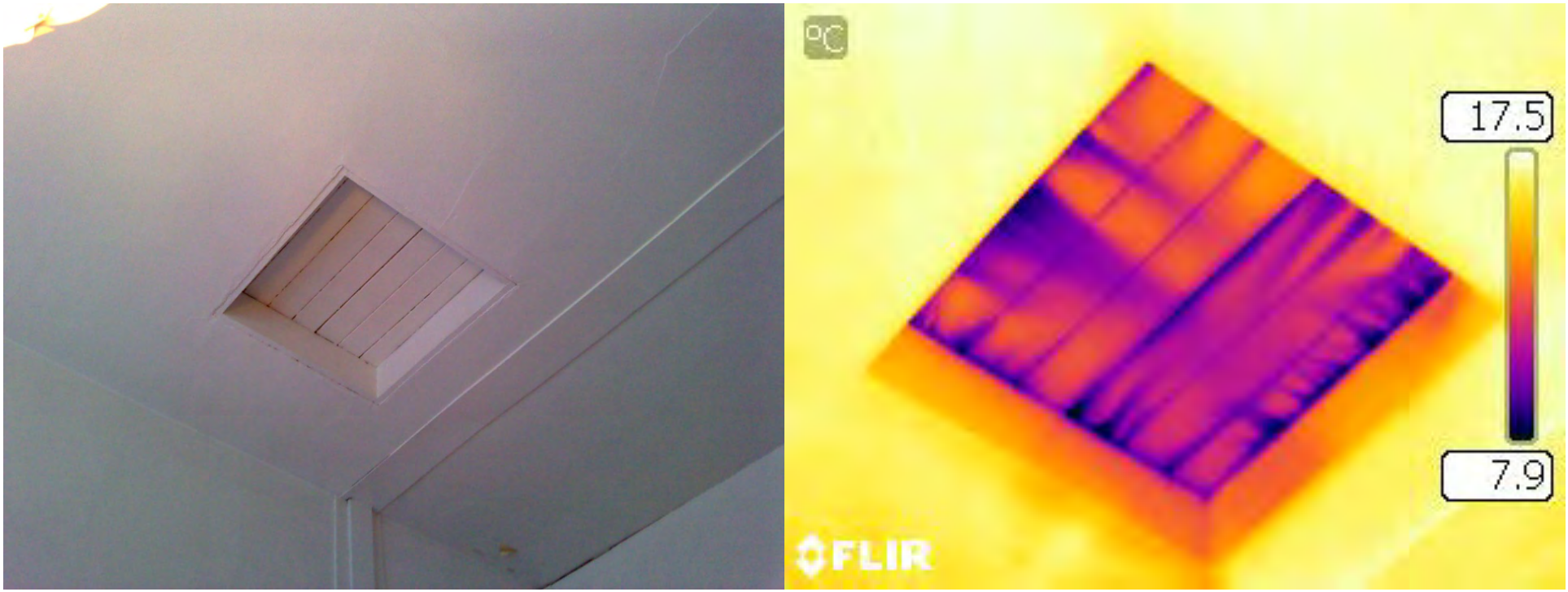
Air Leakage



- Drafts, heat loss, cold spots and noise
- Air sealing can be improved through general maintenance and repair
- Advanced weatherproofing with assistance of blower door and thermal imaging
- Removable/reversible methods are best practice

ENERGY EFFICIENCY OPPORTUNITIES & CHALLENGES

Air Leakage



ENERGY EFFICIENCY OPPORTUNITIES & CHALLENGES

Air Leakage

ENERGY EFFICIENCY OPPORTUNITIES & CHALLENGES

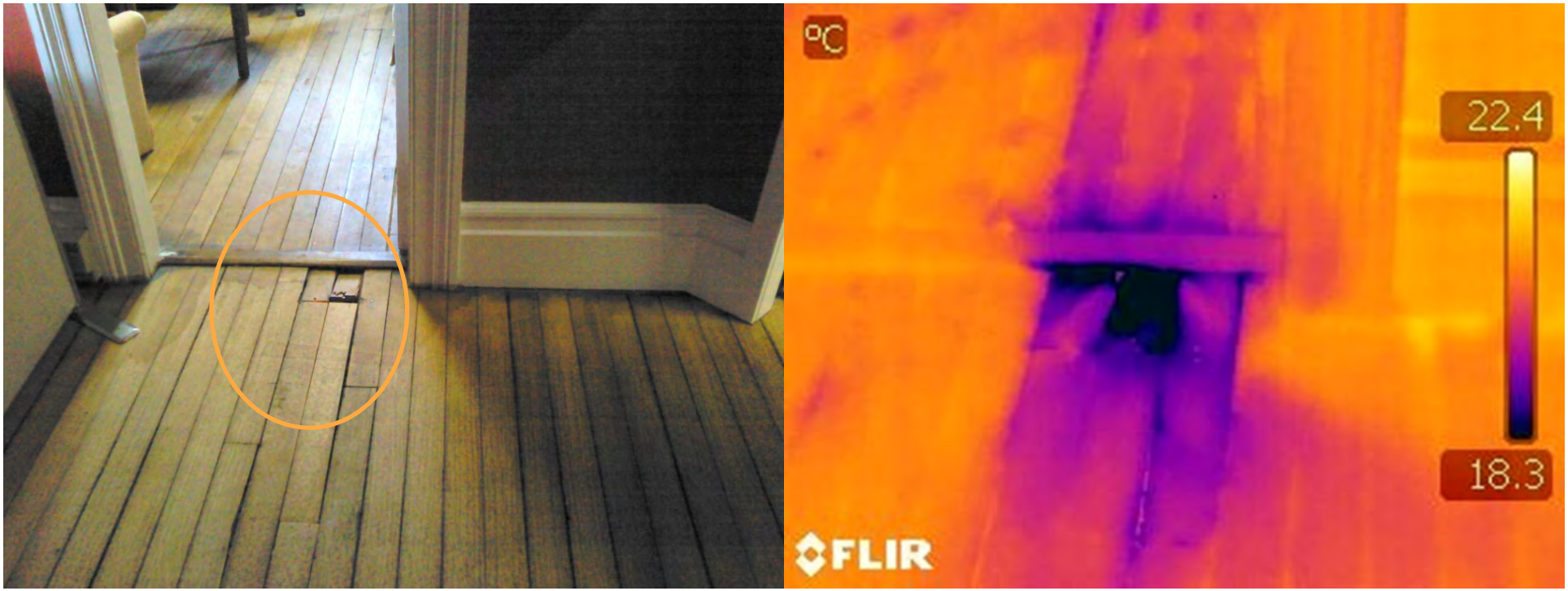
Maintenance and Repair

Regular maintenance also helps the building to perform in the way that was originally intended. Damp and significant draughts are more often the result of inadequate maintenance or ill-considered changes, rather than original defects in the design and construction of the building.

English Heritage

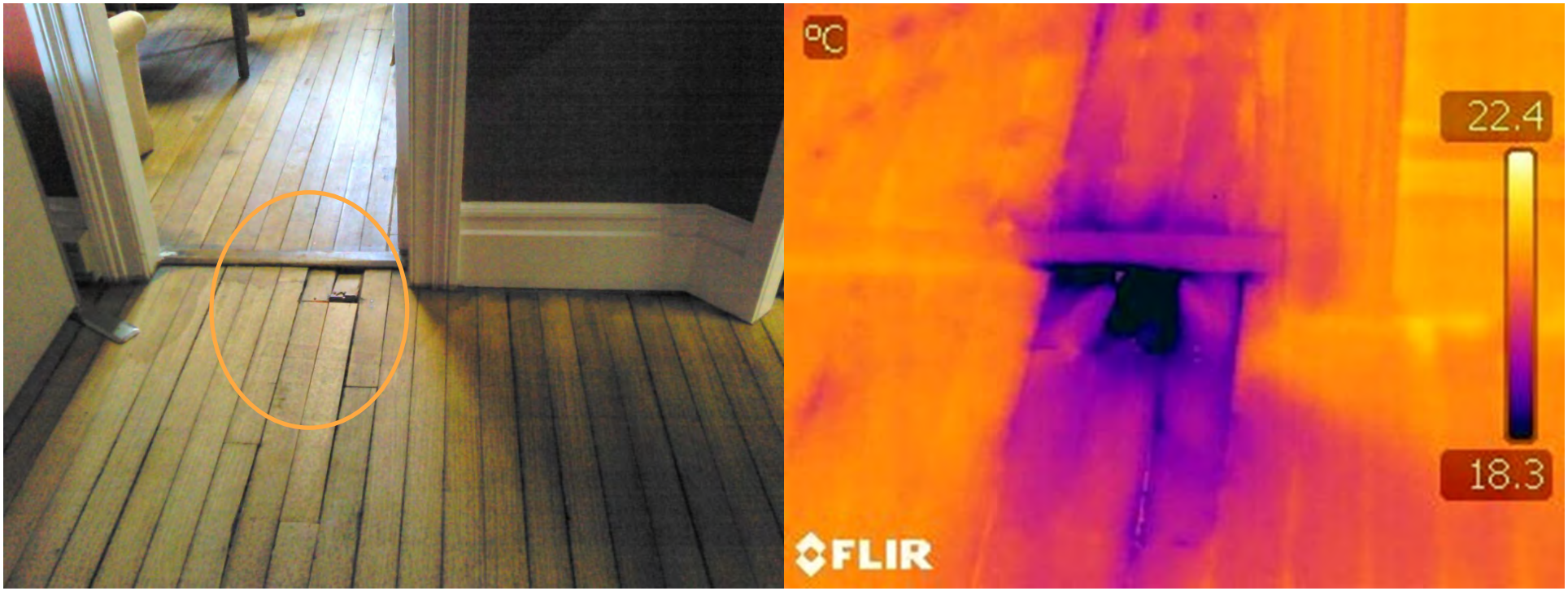
ENERGY EFFICIENCY OPPORTUNITIES & CHALLENGES

Maintenance and Repair



ENERGY EFFICIENCY OPPORTUNITIES & CHALLENGES

Maintenance and Repair



ENERGY EFFICIENCY OPPORTUNITIES & CHALLENGES

Insulation - Opportunities

- In order of best return on investment, upgrade insulation in
- Attics
- Basements
- These areas are usually more capable of adaptation without damaging the special character of historic place

ENERGY EFFICIENCY OPPORTUNITIES & CHALLENGES

Insulation

ENERGY EFFICIENCY OPPORTUNITIES & CHALLENGES

Insulation - Opportunities

- Insulate attics and knee wall voids.
- Avoid insulating cathedral ceilings unless a continuous air gap on the cold side can be built in as these surfaces are prone to extremes of temperature and exposure and are more likely to experience interstitial condensation

ENERGY EFFICIENCY OPPORTUNITIES & CHALLENGES

Insulation - Opportunities

- 3 ½ in stud wall cavities may be insulated
- Chances of interstitial condensation are minimised due to interior paint acting as a vapour barrier in coastal BC.
- In some areas of interior BC that experience extreme cold, the likelihood of interstitial condensation in such thin cavity fill is higher.

ENERGY EFFICIENCY OPPORTUNITIES & CHALLENGES

Restoring Original Features

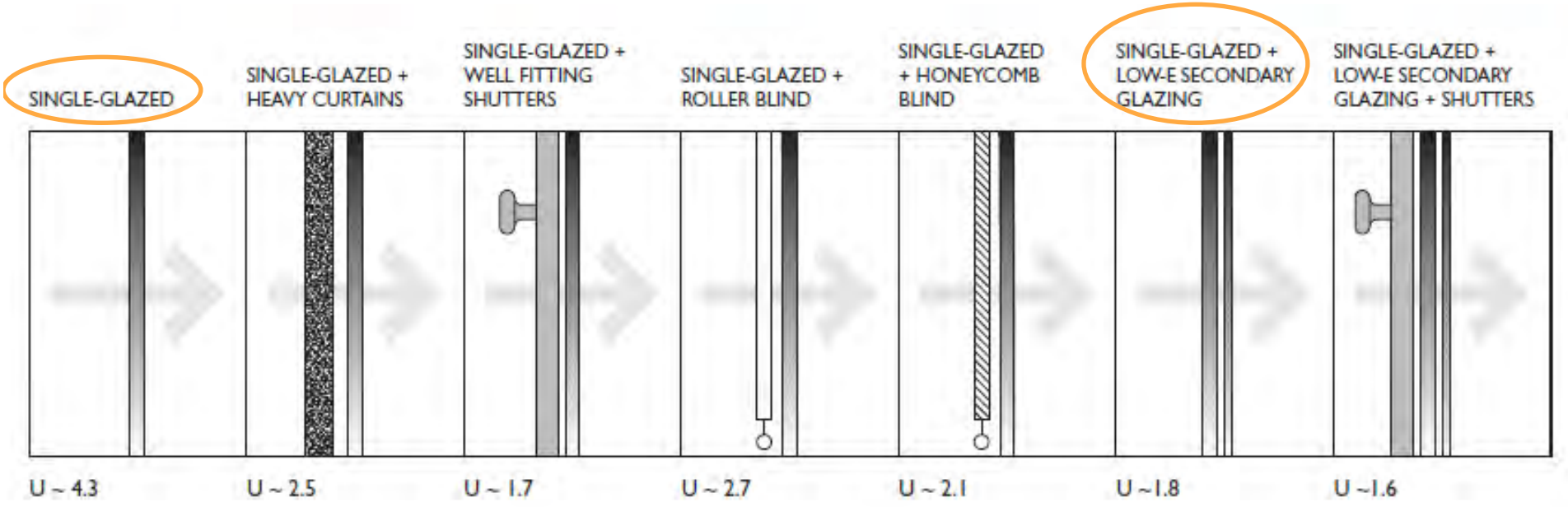
- Shutters, storms, and vestibules (heat loss)
- Awnings, deep eaves, shade plantings (solar gains)
- Interior windows, skylights (day lighting)
- Operable windows
- Well maintained windows can last indefinitely

Vinyl windows cannot be repaired by a building owner and must be thrown away, rather than repaired, when they fail.

ENERGY EFFICIENCY OPPORTUNITIES & CHALLENGES

Windows and Doors

- High air leakage, low R value, high heritage value
- Moderate potential energy savings
- Performance can be improved



ENERGY EFFICIENCY OPPORTUNITIES & CHALLENGES

Windows and Doors

- New windows and doors in historic places can be traditionally constructed

ENERGY EFFICIENCY OPPORTUNITIES & CHALLENGES

Windows and Doors

ENERGY EFFICIENCY OPPORTUNITIES & CHALLENGES

http://www.for.gov.bc.ca/heritage/

Secondary Glazing

Upgrade windows by installing secondary glazing.

This increases the R value and the thermal comfort for occupants

Fact Sheet

LiveSmart – Grants for Wood Storm Windows in Heritage Homes

Why a Wood Storm Window?

A traditionally made wood storm window is a removable wood window that is mounted outside or inside of the existing windows of a house to improve their energy efficiency and life-expectancy. It is a tried and tested traditional solution and serves as a seasonal (or sometimes permanent) retrofit for existing windows.

Wood storms are found throughout British Columbia and are gaining in popularity as a way of improving thermal efficiency in traditionally-constructed wood homes and heritage homes while retaining their special character. Wood storm windows are also very compatible with traditional wood-frame house construction exhibiting similar good physical characteristics of thermal performance and moisture transfer.

Other Benefits:

In addition to lowering heating bills, traditionally-made wood storm windows help to protect windows during inclement weather, reduce long-term maintenance costs, and prevent draughts to significantly improve the thermal comfort of the occupants.

As a wood product, they can be maintained by an owner with basic skills, and may be repaired in a cost-effective way when the need arises. Storm windows can also incorporate coatings to reduce the 'greenhouse effect' that can cause summer overheating.

Energy Efficient Heritage Homes:

Heritage homes constitute approximately half of the officially recognised historic places in British Columbia. Improving the energy efficiency of these valuable community assets requires a sensitive approach if they are to continue to contribute to the special character of the built environment. In recognition of this contribution, LiveSmart offers assistance with the purchase of wood storm windows for heritage homes.

Eligibility:

Eligible homes must be formally recognized (through designation or inclusion on a heritage register) by a local or regional government. To access these special LiveSmart provisions, please contact your local government office to find out whether your home has formal heritage recognition.

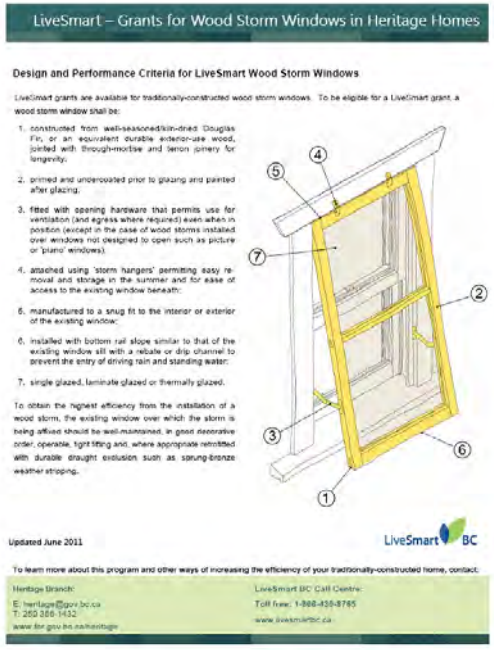
Technical Aspects:

Installation of a wood storm window decreases the rate that the window assembly transmits heat to the outside and cold to the inside of a home. The following ranges of thermal transmittance for wood windows have been calculated by the American Society of Heating, Refrigerating and Air-conditioning Engineers (ASHRAE).

- A single-glazed wood window achieves a U value in the range 5.82W/m²K to 4.99W/m²K
- A single-glazed wood storm window affixed over an existing single glazed wood window achieves a U value in the range 2.78W/m²K to

Heritage Branch

www.for.gov.bc.ca/heritage



LiveSmart – Grants for Wood Storm Windows in Heritage Homes

Design and Performance Criteria for LiveSmart Wood Storm Windows

LiveSmart grants are available for traditionally-constructed wood storm windows. To be eligible for a LiveSmart grant, a wood storm window shall be:

1. constructed from well-seasoned/kiln-dried Douglas Fir, or an equivalent durable exterior-use wood, jointed with through-mortise and tenon joinery for longevity;
2. primed and undercoated prior to glazing and painted after glazing;
3. fitted with opening hardware that permits use for ventilation (and egress where required) even when in position (except in the case of wood storms installed over windows not designed to open such as picture or 'plano' windows);
4. attached using 'storm hangers' permitting easy removal and storage in the summer and for ease of access to the existing window beneath;
6. manufactured to a snug fit to the interior or exterior of the existing window;
6. installed with bottom rail slope similar to that of the existing window sill with a rebate or drip channel to prevent the entry of driving rain and standing water;
7. single glazed, laminate glazed or thermally glazed.

To obtain the highest efficiency from the installation of a wood storm, the existing window over which the storm is being affixed should be well-maintained, in good decorative order, operable, tight fitting and, where appropriate retrofitted with durable draught exclusion such as sprung-bronze weather stripping.

Updated June 2011

LiveSmart BC

To learn more about this program and other ways of increasing the efficiency of your traditionally-constructed home, contact:

Heritage Branch
E: heritage@gov.bc.ca
T: 250 356-1432
www.for.gov.bc.ca/heritage

LiveSmart BC Call Centre
Toll free: 1-866-456-8765
www.livesmartbc.ca

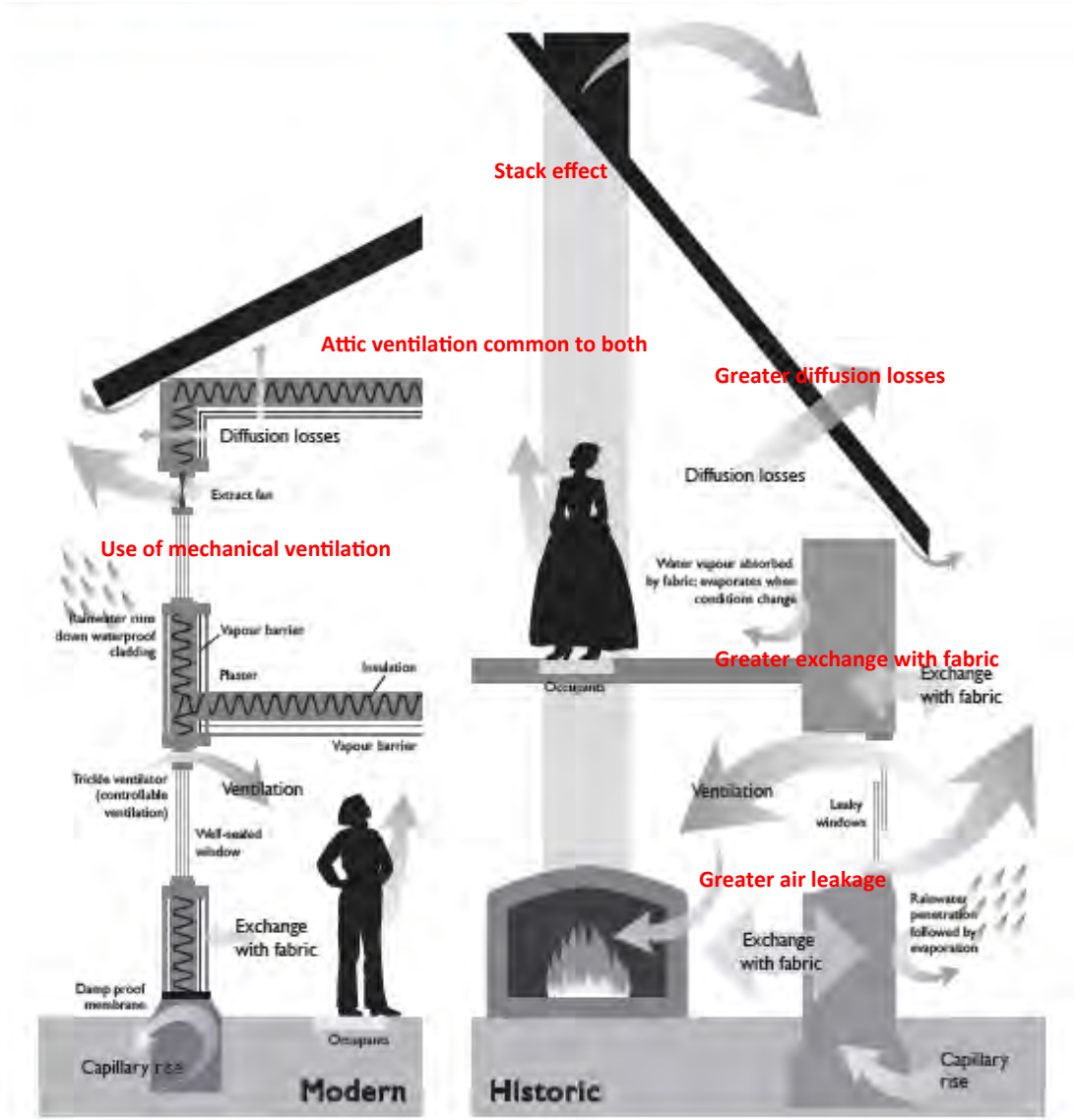
WINDOWS, DOORS AND SKYLIGHTS – *Heated space only*			
ENERGY STAR Windows, Doors and Skylights Replacement	Rated one ENERGY STAR zone better ★ (must upgrade a minimum of 75% of windows to achieve Champion Level)	$70	$60
	Rated for your ENERGY STAR zone	$35	$30
	LiveSmart qualified storm windows. Only available for formally recognized heritage homes. For qualification requirements and a list of eligible, formally-recognized heritage homes, speak to your energy advisor.	$25	$20

ENERGY EFFICIENCY OPPORTUNITIES & CHALLENGES

House as a System

The various parts of a house/ building work together as a system to create a comfortable, durable and energy efficient buildings. The house system itself interacts with both its surrounding environment and with its occupants.

Goal: Consider the impact of single retrofits on the whole system.



ENERGY EFFICIENCY OPPORTUNITIES & CHALLENGES

Ventilation

- Traditional construction relies on natural ventilation
- Air leakage often sufficient to remove moisture
- Air sealing and insulation can disrupt this balance
- Must balance heating system upgrades, air sealing and insulation with ventilation to avoid moisture, mold and air quality issues

ENERGY EFFICIENCY OPPORTUNITIES & CHALLENGES

Compatible Materials

- Many historic buildings include soft, weak or permeable materials
- Best practice to match the original fabric as closely as possible
- Modern substitutes and introducing impermeable materials or membranes is usually not good practice
- Preserving breathability is key to ensuring the optimum performance and durability of traditional buildings
- Introducing impermeable insulation or moisture barriers causes unpredictable redirection of moisture

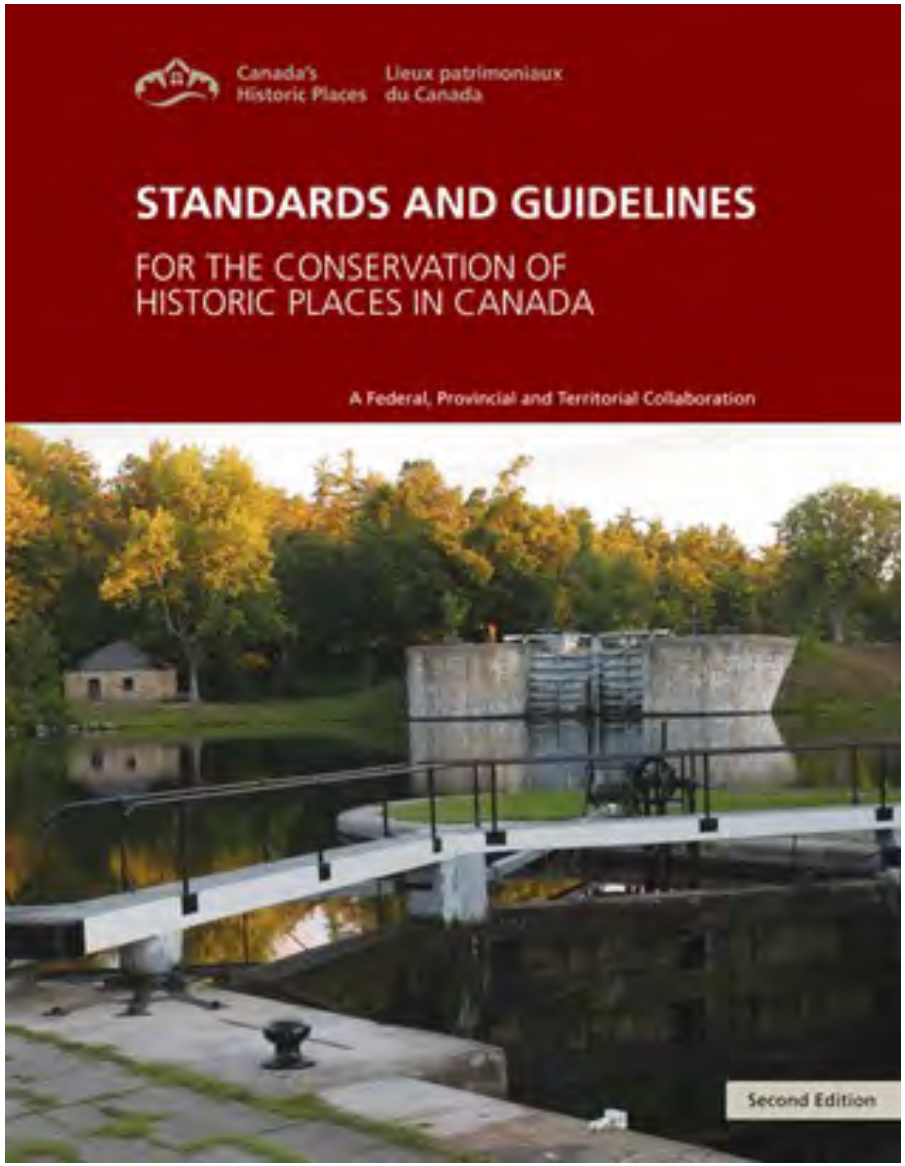
III. Resources & Technologies

What resources exist to support energy efficiency in historic places?

RESOURCES & TECHNOLOGIES

Publications and Websites

- Technical Guidance
  - Standards and Guidelines
  - CMHC
  - English Heritage
  - Technical Preservation Services
- General Information
  - BC Heritage Branch
  - Vancouver Heritage Foundation
  - National Trust



RESOURCES & TECHNOLOGIES

Advice

- Municipal planning departments

- Qualified consultants
  - Heritage Resource Managers
  - Energy Efficiency Consultants
  - Architects
  - Trades

RESOURCES & TECHNOLOGIES

Funding

- Heritage BC
  - Heritage Legacy Fund
  - Workshop Program
- Vancouver Heritage Foundation
  - Restore It!
  - House Call
  - Get on the Register
  - True Colours
- Local Foundations
  - Repairs and maintenance
  - Designation/ registration
  - Larger rehabilitation projects
- Provincial Government
  - LiveSmart BC Efficiency Incentive Program
  - Towns for Tomorrow
- Parks Canada
  - National Historic Sites Cost-Sharing Program
- Other
  - Local Governments
  - Real Estate Foundation
  - CMHC

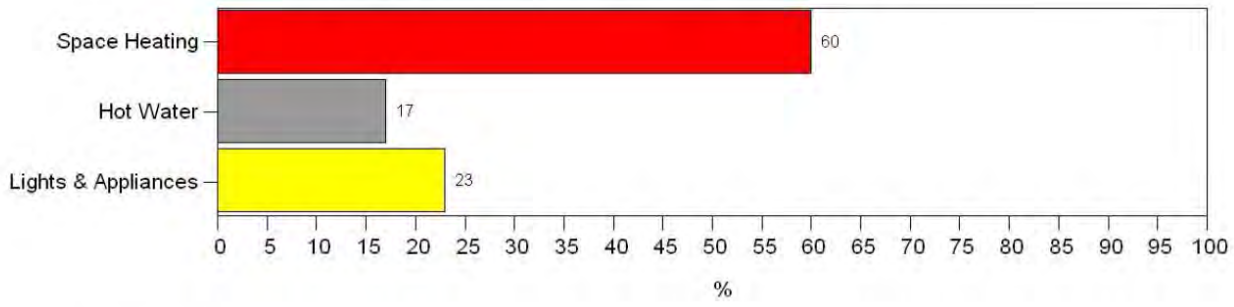
NOTE: Eligibility often restricted

RESOURCES & TECHNOLOGIES

Energy Modeling

- Detailed model based on building specifications collected during an energy assessment
- Quantify and analyze energy consumption
- Produce reports and graphical representations
- Estimate energy savings and simple payback for proposed retrofits
- For example, HOT2000, RETScreen, and eQUEST

Figure 1. Estimated Breakdown of Energy Consumption



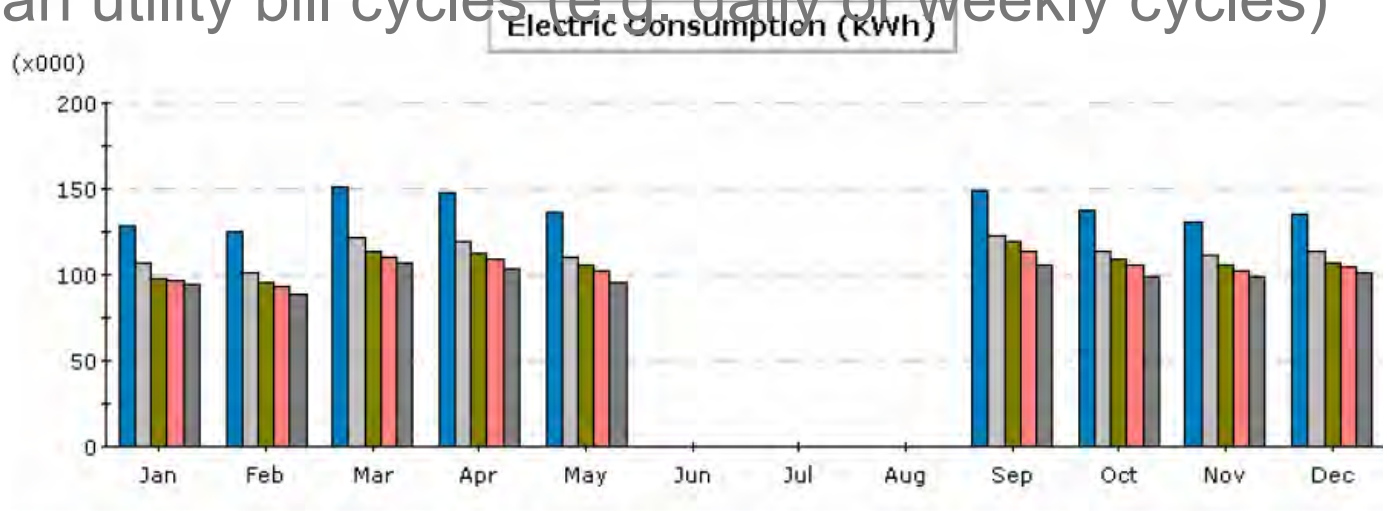
RESOURCES & TECHNOLOGIES

Utility Bill Analysis

- Analyze energy use patterns on a long time scale
- Data can be difficult to collect

Sub Meters and Smart Meters

- Analyze energy consumption of specific systems
- Required for analysis of consumption patterns shorter than utility bill cycles (e.g. daily or weekly cycles)



RESOURCES & TECHNOLOGIES

Blower Door Testing

- Quantify air leakage
- Facilitate the identification of air leakages

RESOURCES & TECHNOLOGIES

Dampness Meters

- Seek qualified contractor
- Soluble salts in masonry and plaster effect the accuracy of electrical meters

Borescopes

- Non-invasive visual inspection
- Use in small voids, flues and voids

RESOURCES & TECHNOLOGIES

Thermal Imaging

- All building components emit infrared energy.
- Thermal imaging cameras make this infrared energy visible.
- Visualizing a building's thermal properties aids in the identification of previously undetectable faults, often avoiding costly repairs and enhancing the energy efficiency of the home or building.

CONCLUSION

This presentation has illustrated:

- the concept that historic places are demonstrating leadership in environmental stewardship for existing buildings
- that there is an international move toward protecting the character of our towns and cities as we address climate change in the built environment.
- that the greenest building has been shown by science to be the one that is already built
- how we can understand the performance of the traditional building envelope and how that helps us to make better decisions about suitable upgrades
- some of the special legislative provisions that provide opportunities for creativity in upgrading historic places that are not available to ‘normal’ existing buildings
- some cautions over mixing traditional and sealed building technologies
- and some resources to support these observations

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