Repair or Replace in Historic Buildings: Arriving at a Sustainable Solution
by Craig Sims and Andrew Powter

We tend to take windows for granted. Yet we recognize that heritage buildings whose windows have been replaced have been diminished. The depth and thickness of frames and sills, the width and visual weight of sash components, the materials, the colour and the pattern of light reflecting off the glass—all complement and elaborate the architectural style, texture and age of a building. Much of this character is lost when windows are replaced with modern versions that lack these features.

Replacement of historic windows is often driven by a number of concerns. Peeling paint, broken glass or missing glazing putty can make them look unsightly. Some may be draughty because of a sloppy fit or difficult to operate due to deteriorating sash cords. Any exposed weathered wood is often described as "rot." One often-stated argument for replacing windows is the "desire" to improve energy performance and an "assumption" that this will be achieved by replacing the windows.

Despite the irreversible impact on the character and authenticity of the building, anticipated energy savings are rarely achieved over the long term. Removing historic windows should be a solution of last resort, not of first resort. In the residential sector the decision to replace is rarely preceded by analysis and serious investigation of the range of alternatives.

Fortunately, it is not necessary to sacrifice our non-renewable cultural resources in order to preserve our non-renewable energy resources. Usually, the most effective ways of improving energy performance in a historic building are controlling all sources of air leakage and having an efficient heat source (furnace, boiler or other). Replacing historic windows with modern sealed glazing units is one of the most expensive, short-lived, least effective, yet most popular home improvements for reducing energy consumption in heritage houses.

There are no publicly available life-cycle studies or data in Canada which assess and compare the energy performance of rehabilitated historic windows versus retrofit new windows in historic buildings. Those studies carried out in the U.K. and Norway indicate that over an appropriate life cycle, window retention and rehabilitation might even be the greenest overall solution. Despite many years of debate, publicity and numerous articles on the subject, retention and upgrade versus replacement continues to be a conservation battle.

Detailing and Durability
Historic window systems are usually built with good attention to detail (such as weather shedding) and with good quality materials (such as old-growth timber). Problems related to wear over time— peeling paint, broken glass and missing putty—can look unsightly but are easily put right. Residential wood windows can be in service for 100 years before requiring a major retrofit to remain in service for a second 100 years. Similarly, it is not unusual for modern windows to experience major, non-repairable failures to sealed units, vinyl welds, caulk joints and wood joints within 10 to 25 years. Today, most sealed units carry warranties of only 8 to 10 years.

Does Replacement Reduce Heating Costs?
Life-cycle cost analysis has shown that replacing historic windows in order to reduce heating costs is largely a myth. This notion dates back to the energy crisis of the 1970s. Unfortunately, the message was repeated by every government agency involved in helping homeowners save energy. The window replacement industry was soon born. For homeowners seeking advice on how to deal with their old window problems, a trip to the yellow pages will still result in sales pitches for replacement windows and little else. Yet, life-cycle cost analysis has demonstrated that other means are more effective for improving building envelope performance.

Many aspects of the construction industry, including those related to heat loss, are measured and regulated by the Canadian Standards Association (CSA). Some years ago CSA, in tandem with the

window industry, actually developed a Canadian standard to measure window performance known as CSA A440 (see sidebar).

The most significant factor relating to heating costs and human comfort is air infiltration, that is, cold air leaking in and warm air leaking out. Fortunately, it is also the easiest and cheapest problem to solve when retrofitting old windows. The use of sealants on fixed joints in combination with weather stripping on operable joints results in significant improvements, and usually the CSA standard can be met.

CSA A440 also rates weather shedding performance. Because the construction and detailing of traditional windows has evolved to include drip designs and angled sill slopes that ensure water sheds effectively, they tend to perform very well under these two parts of the standard. (Anyone who bought condominiums in British Columbia a decade ago will be aware of the importance of designed-in weather shedding.)

Does Replacement Reduce Maintenance?

There is no question that historic wood window systems require maintenance. Windows have to be washed and painted on a regular basis. If painting is neglected for too long, then glazing putty may need touching up or replacing. Sometimes broken sash cords on double-hung windows have to be replaced—especially if they are brittle from being painted. The good news, however, is that historic windows are maintainable.

Modern window systems, by comparison, are usually touted as maintenance-free. Although they may not require painting or glazing putty touch ups, they still need to be washed and cleaned. A host of maintenance issues unique to modern windows arise. For instance, most modern window systems incorporate double glazing in the form of a sealed insulated glass (IG) unit. The integrity of the wet seals, i.e., small caulking beads around the perimeter of the glass inside and out, must be maintained to protect the edge seals of the IG units from light and moisture. When the seal fails, condensation and eventually scum and mildew within the interstitial space will result (see sidebar).

Because IG units are commonly installed as part of the window manufacturing process, their replacement often means replacing the entire sash. If the manufacturer still exists—and still makes that same window model—it may be possible to replace the sash; but if the models have changed, the entire unit has to be replaced. Finding the proprietary hardware can also be a problem.

“Maintenance-free” is often industry double-speak for un-maintainable or disposable. Vinyl- or aluminium-clad windows do not require the cyclical painting that wood does, but they scratch and fade, factory applied sealants fail, and joints may separate. These forms of deterioration cannot be halted by maintenance.

In the last few years the advice to homeowners from the window replacement sector has been that responsible homeowners should replace their windows about every 25 years. So much for payback!

Issues of Sustainability

What makes a “green” window? Green building is about using fewer non-renewable resources. It is not only about reducing your personal, government-subsidized monthly heating bill. It is about the overall impact on the environment. Wasting a window’s embodied energy—the energy used to extract raw materials, manufacture, transport, install and maintain—is wasting a previous energy investment. When traditional windows are stacked on the curb for disposal, energy resources must still be expended. Fuel is required to take them to the landfill and to bulldoze them in when they get there.

The most energy-efficient window is one which is responsible for less consumption of energy across its entire life cycle, including its manufacture, shipping, time in service and its eventual disposal or recycling—not just its performance rating on the day it was installed, which is how CSA A440 rates windows.

Remember, glass and aluminium are two of the most energy-dense building materials requiring the highest use of energy in their manufacture and recycling. Vinyl is a non-renewable petroleum product and is not bio-degradable.

What do we hear about payback? Payback is the time it takes for the money you save on heating fuel to equal the money you invested in your retrofit. Payback on replacement residential windows, if it can be determined at all, usually falls within 40 to 100 years. That is commonly two to four times the service life of the window you have just installed.

Window replacement is now a major industry that is supported by utilities, lenders and insurers (think of the inserts in your last electricity bill). Surprisingly, there is very little data which allows the homeowner to make a "business" comparison between various upgrade options and full replacement. Perhaps that is because what data does exist indicates that over a 25-year period, upgrading is a more affordable energy-saving alternative to full replacement. To make an informed decision, homeowners need to be able to assess the performance of their existing windows, to be aware of the various retrofit options available to them and to estimate how much difference various improvements are likely to make.

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Editor's Note: *Two more articles in the historic windows series will follow in upcoming issues. The first will address the most common maintenance and repair questions facing homeowners with wood windows; the second will look at the issues surrounding thermal upgrades such as additional layers of glass and weather stripping.*