New study shows that restored 200 year old windows are as airtight as brand new replacements

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Design / Green Architecture
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© Shannon Kyles and Walter Furlan with 200 year old window, before restoration

Tell those replacement window salesmen to go away; fix your old window instead.

One of the first things many people do in a renovation is change the windows. For years, historic preservation groups like the National Trust for Historic Preservation have tried to show that this was an aesthetic and environment crime. I have railed on against the lying replacement window manufacturers with posts like If I See Another Full Page Pella Window Ad I Am Gonna Scream. We have discussed studies that showed that the payback period for replacement windows can be as much as 250 years.

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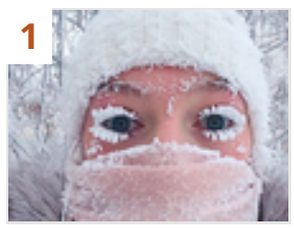
1 
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But now a new study headed by Shannon Kyles, Instructor at Mohawk College in Hamilton, Ontario, settles the question once and for all. Her team built a tiny house, 12 feet by 8 feet, with two new windows and two restored 200-year-old windows and tested them for air infiltration (the biggest source of heat loss with windows). “The test results demonstrate that there is no difference in air infiltration between new windows and restored pre-war windows.”

Some modern windows (like those designed for passivhaus use) are really energy efficient and airtight with special glazing, gases and coatings. However, the majority of North American replacement windows are not engineered to such high standards. There has long been a debate, particularly in historic preservation circles, about whether old windows, particularly in century-old buildings, should be replaced or repaired. Shannon's study shows that restored windows can do the job.

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There are lots of reasons to save old windows instead of buying new. There is the aesthetic, as noted by the National Trust for Historic Preservation:

> If you had a beautiful piece of art that was custom designed, crafted by hand, made from native old-growth wood, and imbued with clues to its age and crafting traditions, would you throw the authentic piece in the dumpster if a simulated plastic version suddenly became available? Seems ridiculous, right? However, this is precisely what people all over the country are doing when they rip out their historic wood windows and replace them with new windows.

Then there is the embodied energy saved, the energy that it takes to make the new replacement window. Shannon writes:

> An existing 200 year-old window essentially consists of wood and glass with paint or varnish. The energy needed to restore it is minimal. Comparing this to a new window, one must consider first the embodied energy required to extract raw materials to produce the new product, then the direct energy used to remove the existing window and dispose of it in a land fill. More direct energy is needed to then take the new window to the building.

Then there is the issue of the longevity of new replacement windows. As Donovan Rypkema has noted: “That is why they are called 'replacement' windows; you have to replace them every 30 years.”

But then there is the big question: do new windows actually save energy? Shannon and her team built the tiny house and installed four windows.

© Shannon Kyles/ Restored windows installed in tiny house

Two 1830s Georgian windows were purchased. One was restored by Furlan Conservation in Hamilton, Ontario. The other was restored by Paradigm Shift Customs in Brantford. Two new windows were purchased from Pollard Windows. One was a wooden sash window. The other was a vinyl casement. All four windows were installed by John Deelstra, Professor of Carpentry at Mohawk College. All windows were installed with foam insulation. To make a complete comparison, other considerations including ease of opening and access to air circulation were also considered. The restored windows had opening windows and storms that were hinged so that no lifting or access from the exterior was needed for air circulation.

© Shannon Kyles/ sealing window

On May 10, surrounded by a gaggle of politicians, building officials and restoration experts, poor Certified Energy Advisor Michael Masney of **Green Venture** did a very public blower test. The results:

Test Results

BD 23117-A All window openings sealed.
Air leakage rate @ 50 Pa: 2.69
ACH = number of air changes per hour
Equivalent Leakage Area: 35.4 square inches

BD 23117-B Older windows sealed.
Air leakage rate @ 50 Pa: 2.77
ACH = number of air changes per hour
Equivalent Leakage Area: 34.6 square inches

BD 23117-C New windows sealed.
Air leakage rate @ 50 Pa: 2.70
ACH = number of air changes per hour
Equivalent Leakage Area: 35.6 square inches

The blower door test results are shown above and are explained below.

The **Air Leakage Rate at 50 Pascals (ACH)** is the number of complete air changes per hour that occurs in your house when a pressure difference between the inside and outside of the home is set at 50 Pascals (Pa).
A 50-Pa pressure difference simulates wind blowing at 56 kilometers per hour on your home. The higher the ACH, the leakier the house.

The **Equivalent Leakage Area (ELA)** represents the total air leakage area. It's like taking all of the air leakage areas (e.g., cracks, holes, etc.) in the home and putting them together to create one large hole in the building envelope. The larger the ELA, the leakier the house.

Green Ventures Test results /Screen capture

> The air infiltration test is accurate to plus or minus three percent. The results as shown in the report show that there was virtually no difference between the performance of the restored old windows and the new windows.

TreeHugger favourite **Ted Kesik** has said that "preserving historic windows not only conserves their embodied energy, it also eliminates the need to spend energy on replacement windows." **Donovan Rypkema has noted** that renovation and restoration uses twice as much labor, and half as much material as new construction; with windows, it is almost 100 percent labour and it is pretty much all local. Now Shannon Kyles and her team at Mohawk College demonstrate that, in fact, it is pretty much just as energy efficient to use old windows as it is to buy new.

Shannon notes that "current energy retrofit funding is limited to replacement of windows, and is not available for window restoration." Perhaps it's time to change that; these tests prove once and for all that for many reasons, restoration is in many cases as good as replacement. Throw in the issues of embodied energy, labor and durability, and the balance can tilt in their favor.

> Door Blower readings on test building measuring energy efficiency of old versus new windows - virtually no difference in air infiltration **pic.twitter.com/TnJqJD9gGh**
>
> — shannon kyles (@glitteringpanes) **May 11, 2017**

Download PDF of **Shannon Kyles' report here.** I will add contact information for Shannon Kyles shortly.

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