Restoring our Appreciation of Historic Wood Windows
&
Making a Case for Restoration versus Replacement

Introduction:

- With the recent concern over energy and heating costs and the growth in the window replacement industry, old wood windows have been faced with the increased treat of removal. Unfortunately, this knee-jerk reaction is based on often unfounded and misleading information and misconceptions.

- In 2006, the Preservation League of New York State accepted a nomination submitted by the Association for Preservation Technology (Northeast Chapter) and Historic Albany Foundation, and listed historic wood windows throughout the state on their "Seven to Save" list of endangered historic resources.

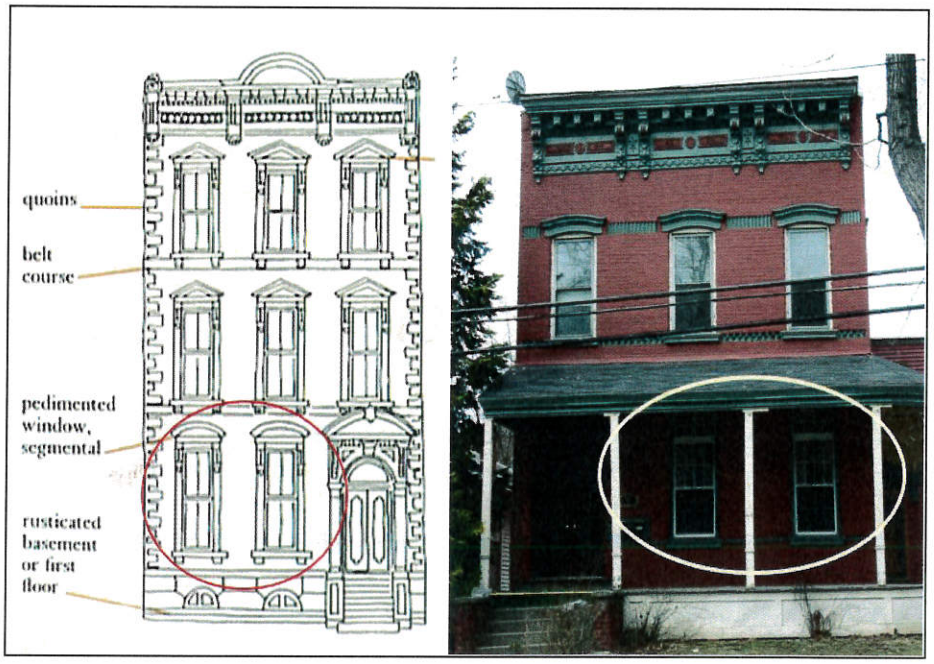
- Preservation agencies have been working over the past 10 years to increase the available testing data and information on the performance and long term value of restored and upgraded historic wood windows, in an effort to compete with the replacement window industry. Needless to say the new window business is a multi-billion one, and they have the advantage when it come to advertising dollars.

- Despite the general perception that new replacement windows are the most significant and inexpensive means of cutting energy costs and making one's building more energy efficient, window restoration has been found to be favorable over replacement in terms of architectural integrity and aesthetics, energy efficiency, sustainability, durability and economics.

ARCHITECTURAL INTEGRITY & AESTHETICS:

- One of the most important aspects of a building's original physical fabric, historic appearance and architectural character

- One of the few parts of a building serving both interior and exterior, as well as having both a functional and decorative role. What other architectural feature has this much "responsibility"??



- An original window in a historic building can offer important clues regarding date/age; style or construction method; building technology; later trends, fashions and changes of a period or a region. Windows are often the most reliable in understanding the history & evolution of a building, a street block or a whole community.

- On other hand, most new windows look entirely out of place in an older building. How can plastic or aluminum possibly enhance a building built prior to the 1930s where most design styles intended to celebrate the use and crafting of a variety of wood species, shapes, cuts, and finishes?

- ***Therefore, change the windows and you negatively impact the building's architectural integrity and greatly compromise its character – not to mention destroy all evidence of important history***

- New windows of non-wood materials in a historic building clearly state intent of cheap, mass-produced, and non-enduring with the false promise of being "maintenance-free."

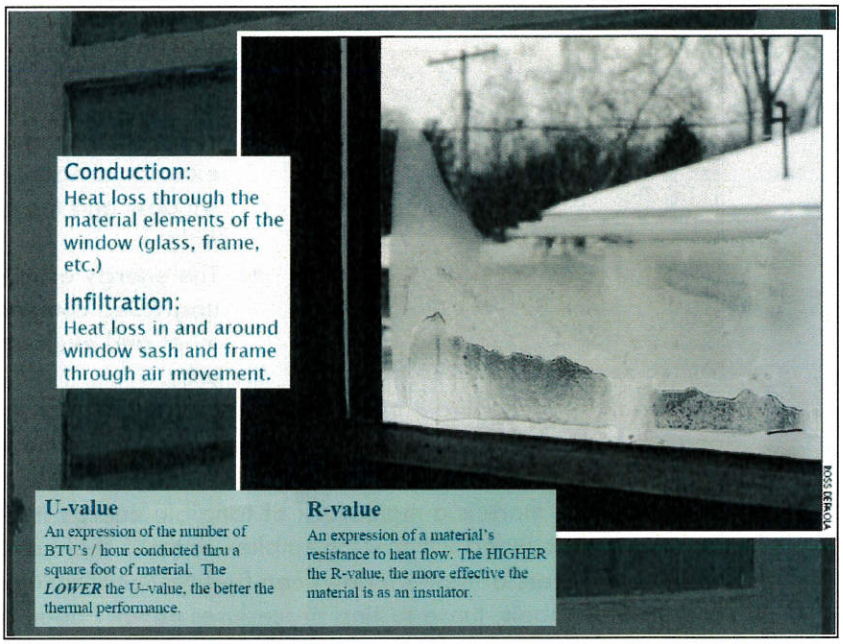
ENERGY EFFICIENCY:

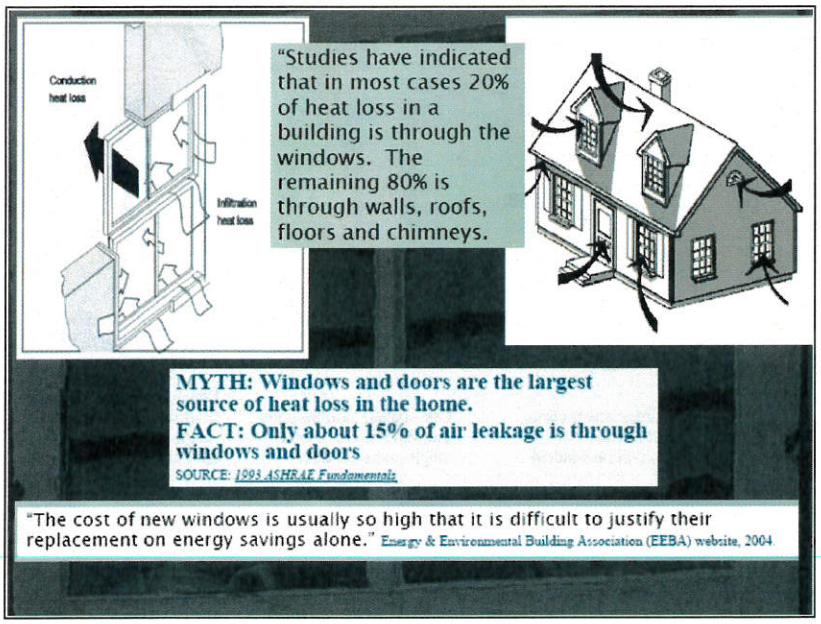
- This is the biggest reason people replace their old windows, yet the facts presented on energy savings for replacements are often skewed, misinformed, or outright false.

- Window manufacturers universally boast low U-values which is the measure of the rate of heat loss through a material.

- Quotes of U-values are often misleading implying that it is the value for the entire window unit, when in fact it is the value through the center of the glass (the location of the greatest heat loss)

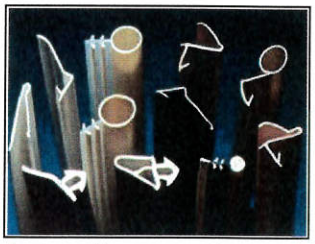
- In cases where replacements are not tight due to an existing original window opening that is not perfectly square, U-values are often significantly higher (worse) due to infiltration around the frame and rough opening.





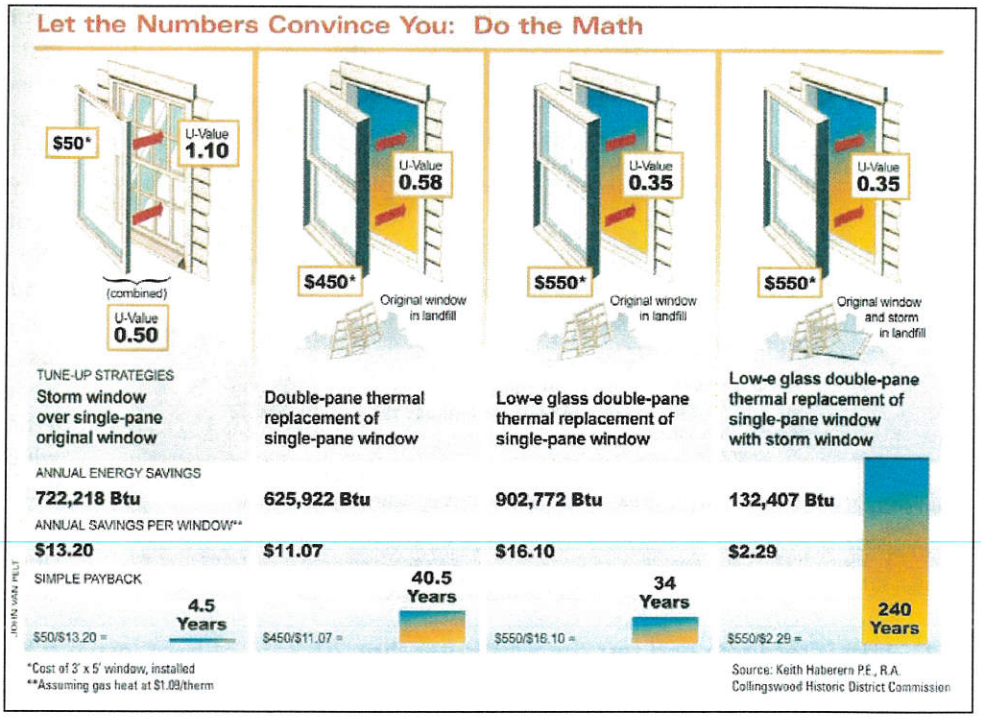
- ***Infiltration*** of outside air -- not the insulating factor or heat lost through the glass is the principal culprit affecting energy loss.
- Air infiltration can account for as much as 50% of the total heat loss of a building.
- The replacement window industry insist that windows are the principal source of heat loss and the public is misled to believe that installing energy-efficient or "Energy Star" windows are more important than insulating the attic, foundation, or walls and will generate the greatest energy cost savings.

- Fact is research and test data indicates that 20-25% of heat loss in a building is typically through doors and windows, while the remaining **75-80%** is lost through the roof, floors, walls & chimneys.
- Studies have shown that double-glazed replacement windows may save $3.00/year per window in energy cost (at 10 cent per KWH), yet this savings in energy takes 50-70 years to recover when the cost of the replacement windows and installation is calculated. It is ***extremely*** rare to find a replacement window that is made to last 50-70 years, so recouping that savings is nearly impossible.



- Historically, the solution for better energy efficiency has been stopping the air infiltration by the installation of effective weatherstripping.
- Weatherstripping is the easiest (and cheapest) way to keep old wood windows energy efficient and draft-proof since it stops heat from escaping around the windows.

- Storm windows or "secondary windows" are another method for increasing energy efficiency based on the concept that the use of storm windows, whether interior or exterior, creates an air space between the primary window and the storm, as long as the storm window is tight.
- The energy efficiency of restored windows incorporating upgraded components, such as weatherstripping, can meet and even exceed the efficiency of replacement units.
- Despite the truth behind energy efficiency (air infiltration vs. heat loss) window manufacturers insist on pushing U-values (or the prevention of heat loss) as the selling point for their products. **None claim to reduce air infiltration.**
- Unfortunately, there is a major lack of tangible energy information for existing products, such as existing historic wood window assemblies or those that have been restored or upgraded.
- While purchasers of new windows can find National ratings for U-factor and products containing Energy Star labels, these testing procedures haven't been applied to old windows or to retrofit products, so consumers have very little, if any, data to help make comparisons.



- Ways to retrofit historic wood windows include the substitution of low-E glazing into existing windows that are only single-glazed. Single pane low-E glass can provide an equivalent level of combined energy savings as a standard new double-glazed unit when used in combination with a storm sash.
- Replacing panes of glass, then tightening up the sash and frame (in terms of air infiltration) is a very simple and cost-effective way to achieve the desired whole-assembly U-value without having to modify visible glass/light, mullions, or sash weights.

SUSTAINABILITY:

- GREEN or SUSTAINABLE DESIGN is the new buzz word these days.
- It is wonderful that there a new trend among cities, businesses and residents to incorporate a GREEN or SUSTAINABLE DESIGN philosophy into their facilities management.
- Since at least 1966, when it was officially organized, the preservation movement and preservationists all over the world have been practicing green or sustainable design.
- Building preservation – which is the act of conserving the existing materials as well as the embodied energy that went into creating a structure or architectural feature and the act of repairing or recycling rather than replacing – holds the principals of sustainable design at the very center of preservation philosophy and practice.
- Preservationists understand and acknowledge that it would cost at least three times as much to construct a new building of equal material quality, craftsmanship, structural integrity and ornamentation as our historic built environment.
- The "repair first" approach not only makes use of existing materials (thus eliminating land filling and costly transportation of new products) it also encourages the use of local skilled labor and local materials. Therefore, preserving what we have and not needlessly filling our landfills with these building elements is being green or sustainable, while also adding to our local economy.

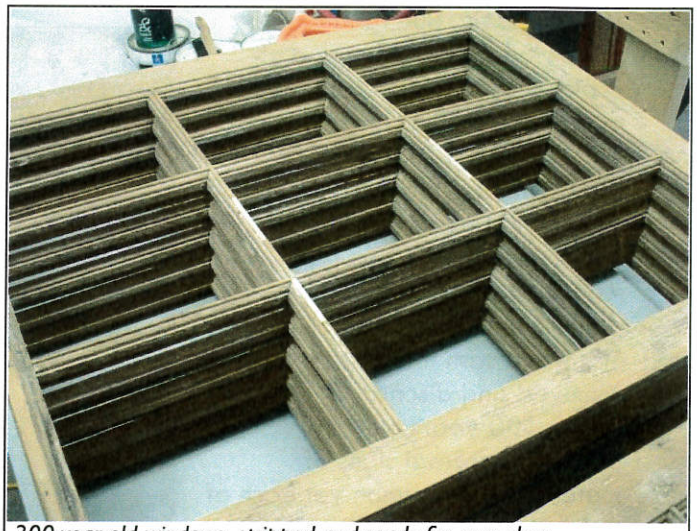
- Unfortunately, due to misconceptions of the value of replacement windows, thousands of wood windows are removed and sent to the landfills each year. Simply retaining original existing materials would have recycled them in place and wouldn't have placed any strain on landfills.
- The wood sash that are most often removed and discarded tend to be 75-100 years old and exhibiting **normal** signs of material deterioration yet each of these ailments are **ABSOLUTELY curable,** and the sash have the full capacity to be restored and upgraded to meet modern requirements, just as they were in previous centuries.

- The replacement windows which typically replace 100-year-old wood sash (which are reparable) only have an average 15- year life based on the industry standards & warranties (and aren't reparable), meaning they will need to be replaced **6 times over the next 100 years**.
- Given the math, it is amazing thousands of windows are replace each year under the claims of saving energy, money and improving one's home. Property owners think because a new product has an Energy Star label that they are being "green" or practicing sustainable design, yet something that will last 100 years and doesn't put anything into the landfills is more sustainable than a 20 year product that results in the landfilling of a reparable material.

DURABILITY:

- Old windows typically of 75-100 years old are most often discarded when they exhibit **normal** signs of deterioration. These may include broken sash cords, paint failure or build up, broken panes of glass, deteriorated glazing putty or even loose joinery or rotted wood members.
- The fact that they are at least 75 even 100 years old is actually is strong testimony of the quality of their materials, and their craftsmanship. Windows built today won't last that long and in fact are not intended to.
- This is in contrast to the windows of the 19th and early 20th century which were designed and constructed to endure centuries with only minor, yet easy maintenance.
- The window business has evolved from being custom craft-oriented to pre-fab product-oriented.
- Modern-day carpenters rarely know how to repair a sash, let alone fabricate one. Only know how to install a new "unit" – this was not the case prior to 1950 when all carpenters knew how to build, maintain or repair all elements of a wood window.
- Since the late 1940s, the "window business" has grown with a focus on product installation of in stock, pre-fabricated, low-priced and lower quality products.
- The result is that over the last 50 years, the construction industry has substituted whole-window products for window maintenance and repair services.

- Old windows dating to before the 1940s are constructed of denser, old, slow-growth wood whereas as new wood replacement windows are constructed of light, porous, fast-grown, farmed soft woods (mostly pine). Because they are porous they are more susceptible to moisture migration and thus do not hold paint well. The offering of an exterior cladding material is the manufacturer's solution to this problem – dubbed "maintenance-free."
- Cladding materials often traps moisture inside the wood and in moist environments can lead to substantial rot beneath the cladding. This is the primary reason for limited and short warranty terms



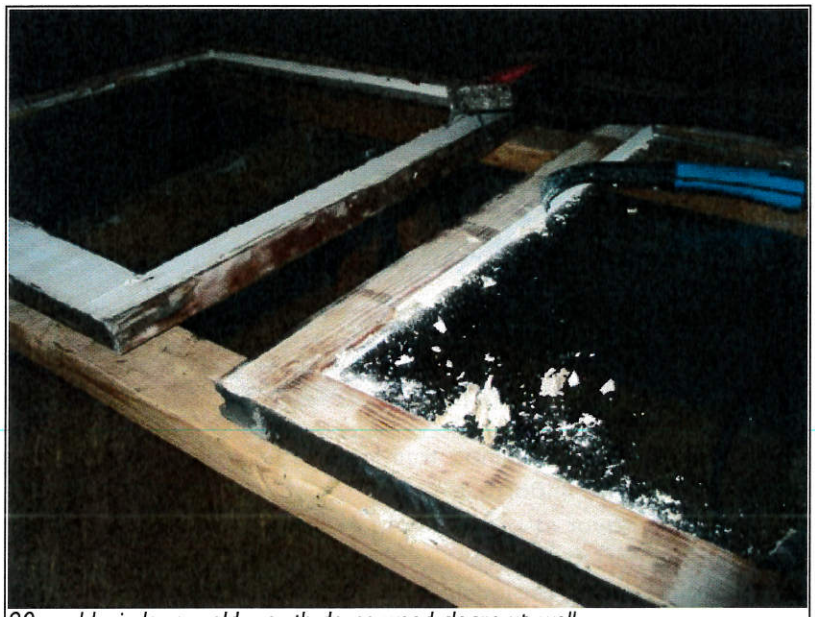
200-year old windows, stripped and ready for new glass.

- Old wood windows are made of wood that has the ability to endure for centuries. New wood replacement windows are made of wood that is extremely susceptible to rot.

- Replacement windows often have a thermal or insulated glass unit. This glass unit is sealed with gaskets to keep the argon gas inside and moisture out. These gaskets have a limited life and will deteriorate allowing the argon gas to escape and air vapor to enter. Most insulated glass units are equipped with a small amount of desiccant which will absorb moisture for a limited time. This gasket/desiccant system generally deteriorates within 25 years.
- Old windows are glazed with a system of glass, glazing clips and glazing putty. Historically glazing putty was linseed oil-based and cured slowly over the years. Glass is actually fluid and like the wood which holds it in place, it will expand and contract according to climate conditions. For this reason, glazing putty is intended to have some level of flexibility. Glazing putty has a lifespan of approximately 50 years. After 50 years it may crack, become brittle and separate from the glass or it may become extremely hard with very little flexibility.

- Glazing putty is intended to be renewable and replaced with new putty at little expense, effort and impact to the original window.
- If a pane of glass in an old window breaks it is designed to be easily and cheaply replaced. If a pane of glass in a replacement window breaks, a whole new window is necessary.
- Typically replacement windows work with a spring balance mechanism which relies on friction and the strength of the user. An old window typically uses a weight and pulley system with either cotton sash cords or chains. This system is reliant on gravity, the cords or chains and the matching of the weight to the weight of the sash.
- Replacement windows typical experience failure when a spring balance fatigues. An old window fails when the sash cord or chain breaks or the pulley jams. Spring balances cannot be fixed and must be entirely replaced. Broken sash cords can be fixed for under $25 (material + labor).
- Restored wood windows will not need much work for many, many years. Maybe an occasional cleaning of the glass, a quick spray of WD40 in the pulleys to keep them lubricated, and an effort to keep the painted surfaces intact.

300-yr old windows at Old North Church in Boston – Fully restored in 2003



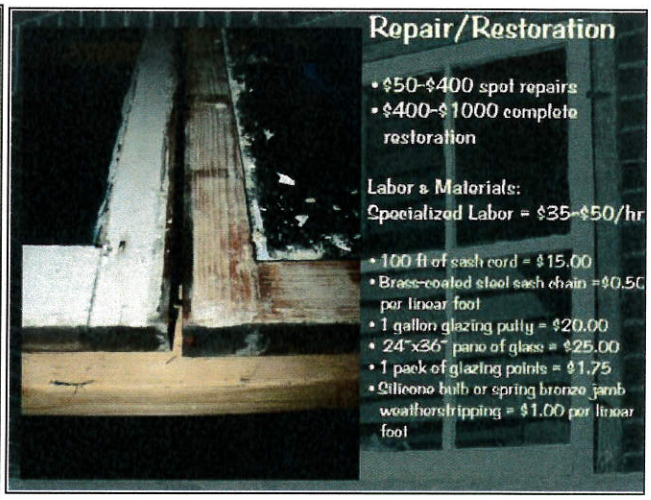
90-yr old windows – old growth dense wood cleans up well.

Broken 15-yr old vinyl replacement window

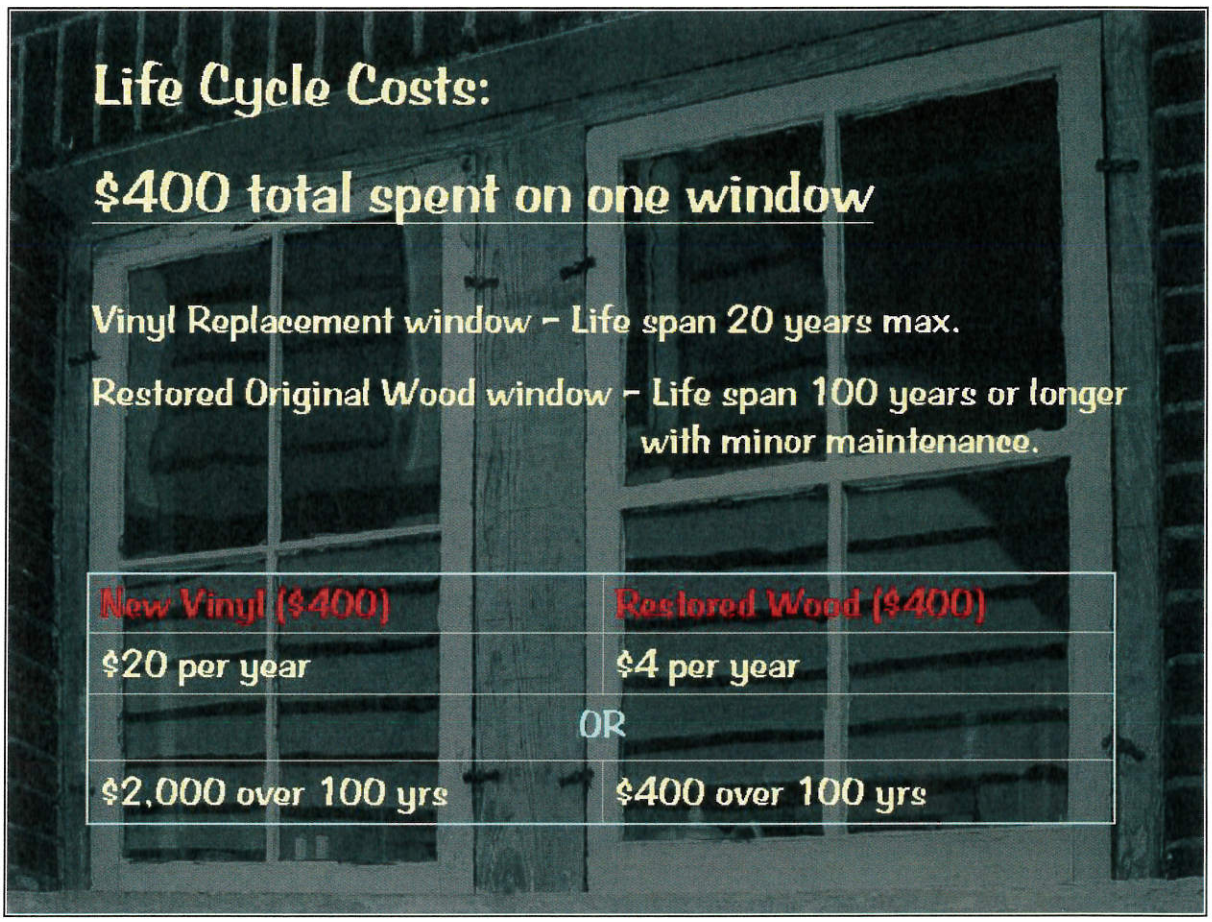
ECONOMICS:

- COST plays a large role in planning any project – thus it is important to look at typical cost comparisons in terms of initial outlay as well as LIFE CYCLE COSTS.

- A typical replacement window costs **$200-$1500** per window depending on the material and involves the removal of existing wood sash, and installation of vinyl frame or jamb liners and sash unit into the existing wood frame. The old weight and pulley system is discarded and replaced with a system that is reliant on friction and the user's strength. Any rotted wood is simply covered over with new vinyl cladding, rather than repaired or there is any additional cost. The idea is for the installer to be in and out in the shortest amount of time.
- These prices mostly cover the cost of the new product with minimal specialized labor for installation. The lower the product cost, you can naturally assume the lower the quality, since the labor should be the same.
- Comparing these costs to repair and/or restoration it is important to understand it is not a straight forward formula for the repair approach because the conditions and the extent of deterioration will vary from window to window.
- If there is only minor deterioration or problem conditions that require spot repairs, such as strengthening loose joinery, minor reglazing, replacing broken glass or sash cords, the cost = $50-$500 per window (based on 1-10 hours of labor)
- If the window requires complete restoration, the cost = $500-$1000 per window for residential double-hung windows or $1000-$5000 per window for complete restoration of large institutional windows or complex and highly decorative windows.
- These costs include all direct specialized labor at $35/hour and direct ordinary labor at $15/hour, in addition to materials, overhead and profits. These costs are for **skilled labor**, not for the product necessarily. All of the materials involved are relatively inexpensive.



- The OUTLAY of funds is not the only aspect of cost that is important to consider in the planning of a project. LIFE CYCLE COSTS are equally if not more important.
- ***Life cycle costs*** comparisons usually come out in favor of preservation even when values such as the architectural character of the original window and the inherent quality of material and craftsmanship are **NOT** accounted for. Maintenance/replacement costs further support preservation when fit into the equation.
- When figuring life cycle costs it is important to compare the lifespan of older wood windows which have proven to range between five decades and more than a century.



- The lifespan of vinyl or wood replacement windows ranges from several years to **at most two decades.**
- With replacement windows, it is generally the lifting and lowering mechanisms that wear out in about a decade's time.
- For comparison's sake, if $400 is spent on either replacing a window or restoring it, it is clear that $400 over the max. lifespan of one hundred years versus $400 over 20 years suggest that restoration offers the more favorable life cycle cost.
- It can be also be seen as $400 over 100 years or a minimum of $2,000 over 100 years for replacement windows since they will need to be replaced at least every 10-20 years.