



# Commercial Secondary Windows: Solutions for the Existing Window Problem

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SOLARC Energy Group

**Utility Energy Forum**  
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# Today's presentation

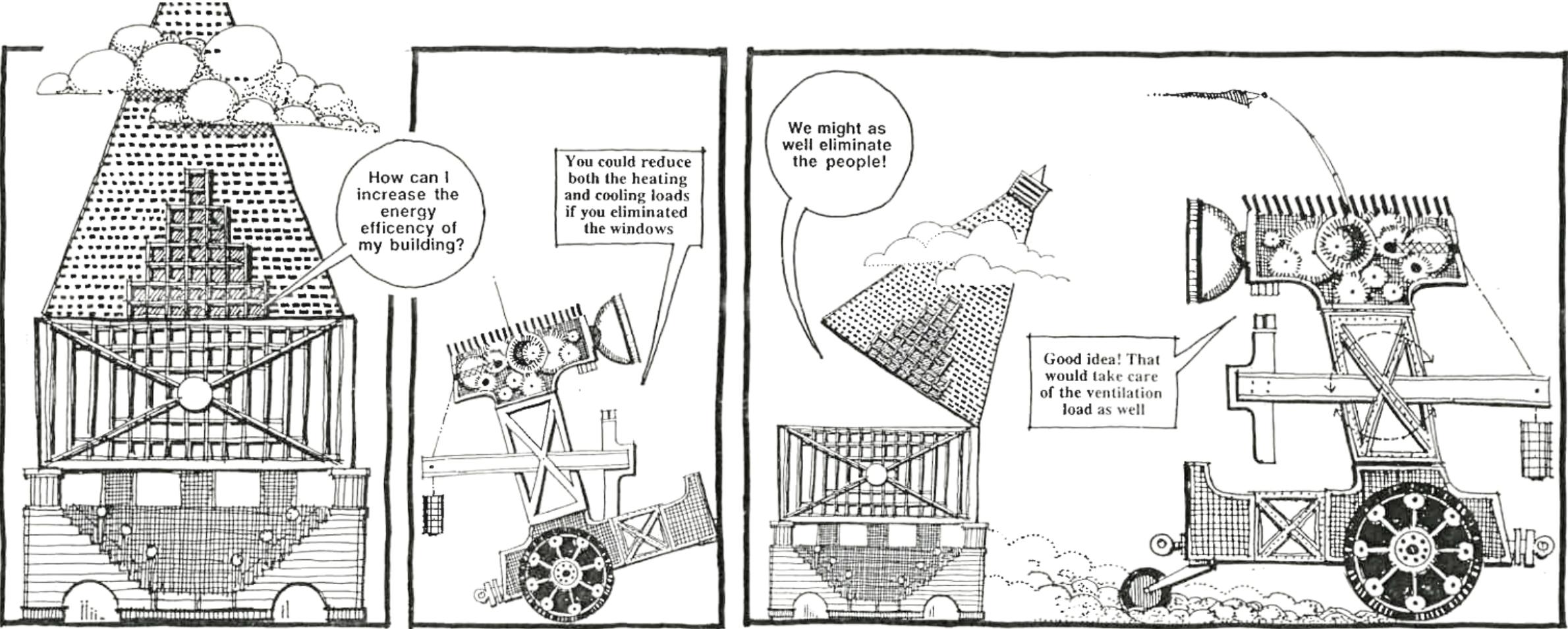
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- **Nature of the problem**
- **Manufacturers and products**
- **Applications**
- **Customer benefits**
- **Benefits analysis considerations**
- **Lessons learned / emerging market**



Rainer Tower, Seattle, Washington. Courtesy: Solarc Energy Group  
Architect: Minoru Yamasaki

# Windows: Problem and Solution?



Original Cartoon: G.Z. "Charlie" Brown; gift to Mike Hatten

# What is the Problem?

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## Windows

- **Lack of Thermal Comfort**
- **Noise Transmission**
- **Glare**
- **Excessive Energy Use**
- **Air and Water Leakage**



Capitol Gateway Plaza Building II, Boise, Idaho. Courtesy: Solarc Energy Group

# What is the Solution?

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## Windows

- **Views / Psychological Relief**
- **Daylight**
- **Natural Ventilation**
- **Architectural Design Element**
- **Opportunities to Upgrade**



Old High School, Wooster Ohio. Courtesy: Erika Willis Class of 1974  
Architect: Heard & Blythe Architects, Cleveland, Ohio

# Challenges to Upgrading

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- **Cost!!**
- **Complexity of Retrofit Construction**
- **Potential Need for Structural Upgrade**
- **Historic Building Façade Restrictions**



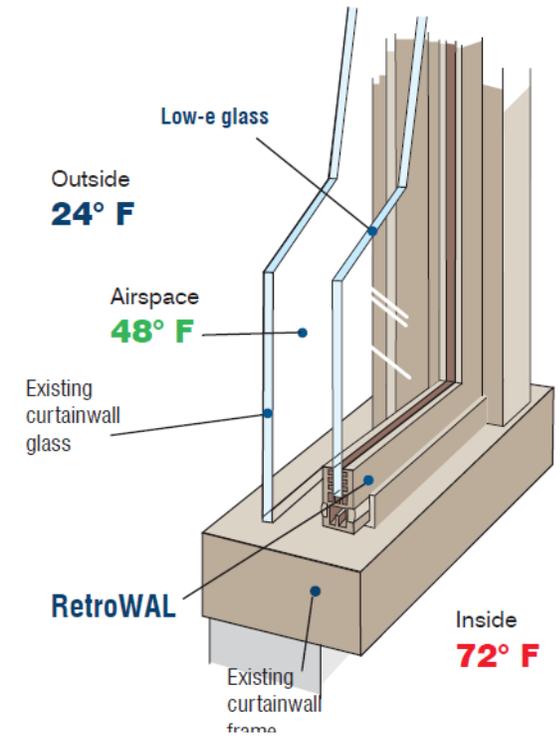
Gerlinger Hall, University of Oregon. Courtesy: Solarc Energy Group.  
Architect: Ellis F. Lawrence, Lawrence & Holford.

# Products and Manufacturers

## Thermolite RetroWAL

- Low-E single pane
  - Curtainwall or storefront
- ### Performance (as marketed)
- 65% thermal improvement
  - 20% min. reduction in solar gain
  - 90% infiltration reduction

Images: Thermolite Window Systems;  
<https://thermolitewindows.com/supplemental-window-systems/interior-windows/>



TEST* <small>(Independent Third-Party Testing, Detailed Information Available Upon Request)</small>	BEFORE Single Glazed Window	AFTER Single Glazed Window + THERMOLITE
Thermal Transmittance U-Value Conduction	1.03	.14 to .37
Shading Coefficient Solar Heat Gain	0.82	.16 to .66
Air Infiltration (15 mph) Air Infiltration (25 mph)	0.28 cfm/sq. ft. 0.50 cfm/sq. ft.	0.01 cfm/sq. ft. 0.04 cfm/sq. ft.
Sound Transmission Class	26	49

**Blast Resistancy** Performance Condition 5 (failure) Up to Performance Condition 1

\*All numbers are calculated using LBNL Window 6.3 program. All numbers are calculated with and without blinds in between glass.

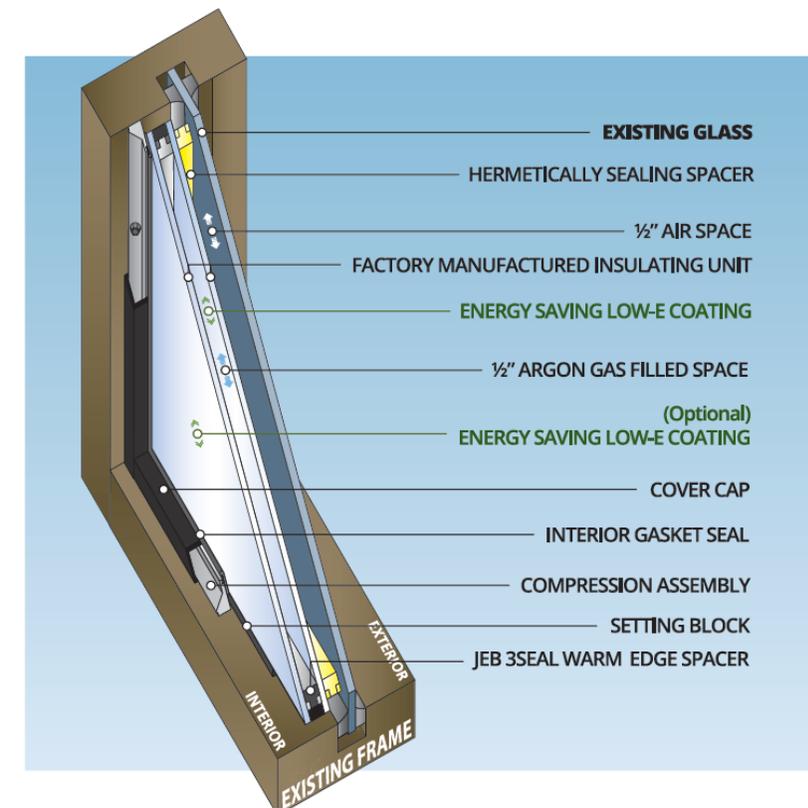
# Products and Manufacturers

## Renovate by Berkowitz

- Low-E argon-fill double pane
- Single pane primary window

## Performance (as marketed)

- 80% thermal improvement
- 50% min. reduction in solar gain
- Sound transmission reduction



### System Performance

Data	Existing 1/4" Clear	RbB Platinum	RbB Platinum Plus II	RbB Platinum Plus II XL
<b>R-Value<sup>1</sup></b> (Center of Glass)	.97	5.56	6.67	6.67
<b>SHGC<sup>2</sup></b> (Solar Heat Gain Coefficient)	.84	.42	.35	.27
<b>STC<sup>3</sup></b> (Sound Transmission)	30	37	37	37
<b>Winter U-Value<sup>4</sup></b> (Center of Glass)	1.02	.18	.15	.15
<b>VLT</b> (Visible Light Transmission)	89%	63%	57%	50%

<sup>1</sup>R-Value – Higher is better <sup>2</sup>SHGC – Lower is better <sup>3</sup>STC – Higher is better <sup>4</sup>U-Value – Lower is better

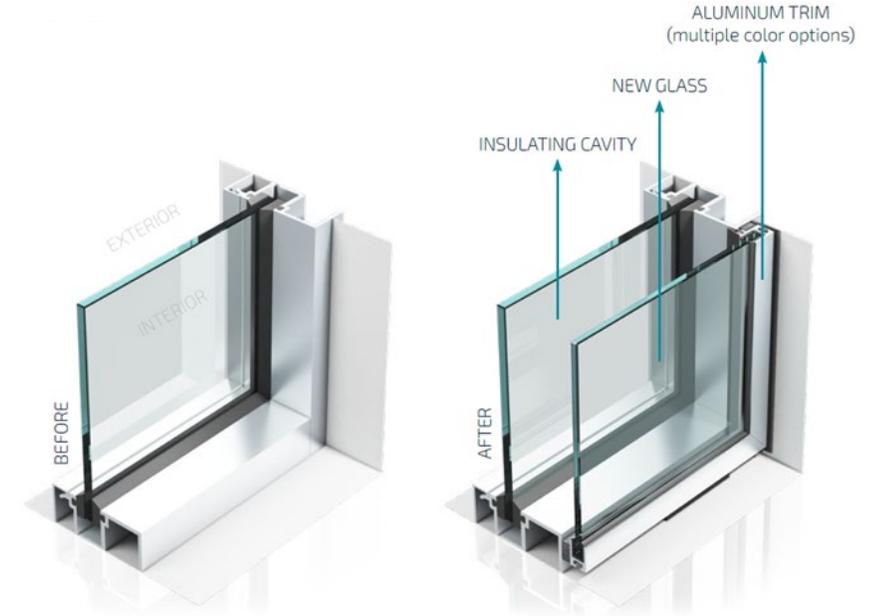
# Products and Manufacturers

## Inovues SWR

- Low-E single pane
- Double pane vacuum IGU
- Single pane primary window

## Performance (as marketed)

- 60% to 80% thermal improvement
- 33% min. reduction in solar gain
- 90% reduction in 1<sup>st</sup> cost



	Before	After (w/ Solar Low-E)	After (w/ VIG)
Glass	1/4" Clear (Single-Glazed)	+ 1/4" Solar Low-E Clear (Double-Glazed)	+ Vacuum Insulated Glass (Triple-Glazed)
U-Value (Total)	1.04 Btu/hr ft <sup>2</sup> F 5.92 W/m <sup>2</sup> K	0.42 Btu/hr ft <sup>2</sup> F 2.39 W/m <sup>2</sup> K	0.21 Btu/hr ft <sup>2</sup> F 1.18 W/m <sup>2</sup> K
R-Value (CoG)	0.96	2.77	10.99
SHGC	0.75	0.47	0.31

*U-Value, Center-of-Glass (CoG) R-Value, Solar Heat Gain Coefficient (SHGC), and Visible Light Transmittance (VLT) calculated using methods set by the National Fenestration Ratings Council (NFRC) and the Attachments Energy Rating Council (AERC), together with the industry-standard WINDOW 7.8 and THERM 7.8 software by the Lawrence Berkeley National Laboratory (LBNL). U-value / R-value measure the insulating properties of a window. They are reciprocal: a lower U-value / higher R-value indicates better insulation. SHGC measures the amount of solar heat that enters the building through the glass. VLT measures the amount of visible light that passes through the glass — higher VLT generally translates to brighter, naturally lit interiors.*

# Products and Manufacturers

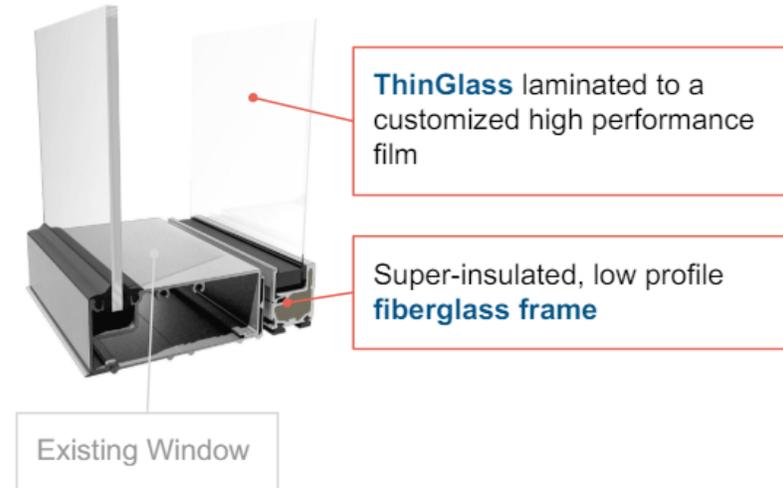
## Alpen WinSert

- Lightweight single and double pane
- Single pane primary window

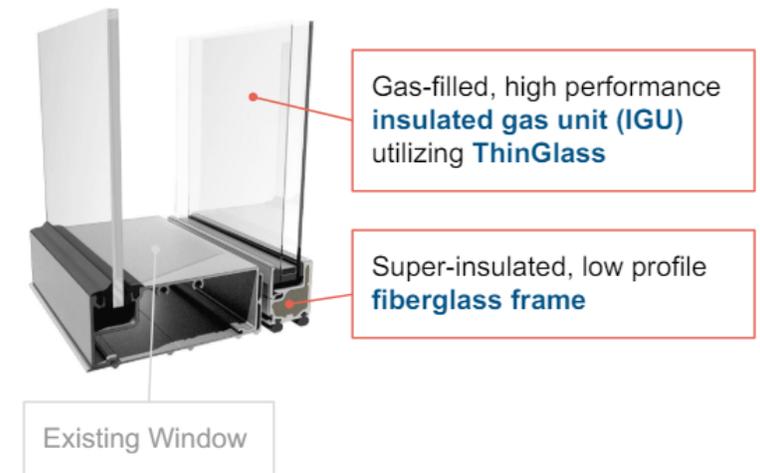
## Performance (as marketed)

- 50% to 80% thermal improvement
- 50% min. reduction in solar gain
- 67% reduction in net weight

## WinSert Lite



## WinSert Plus



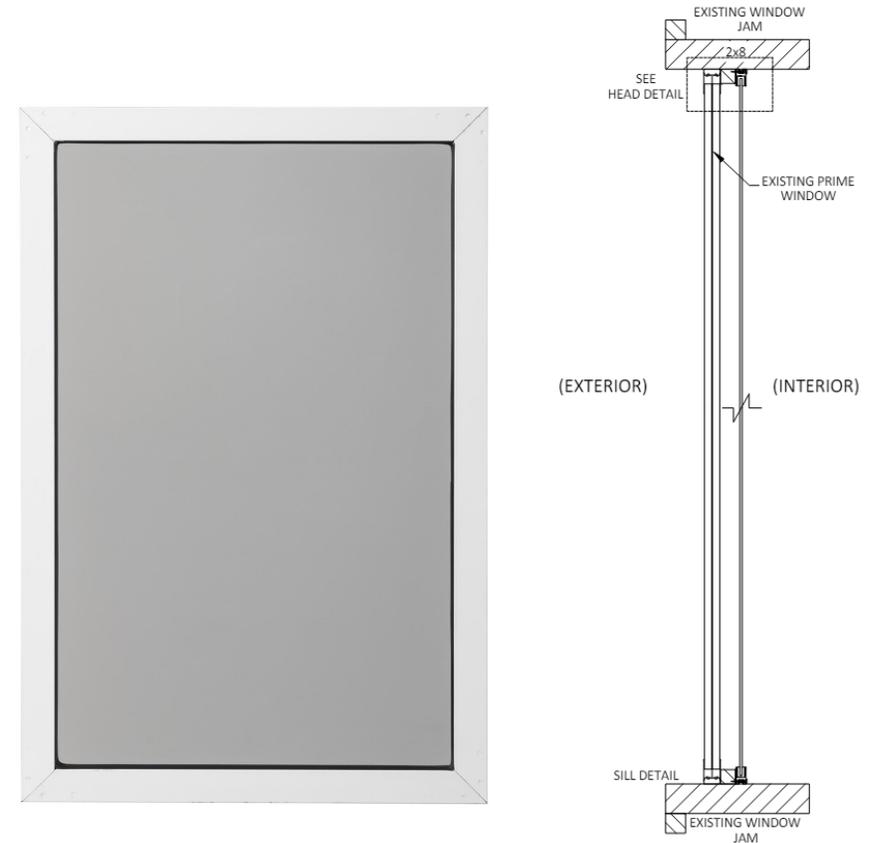
# Products and Manufacturers

## Quantapanel 700 Series

- Low-E single pane “storm windows”
- Single pane primary window

## Performance (as marketed)

- 75% thermal improvement
- 33% min. reduction in solar gain
- 67% reduction in net weight



U-Factor	Solar Heat Gain Coefficient (SHGC)	Visual Transmittance (VT)	Air Leakage (AL)
<b>0.24</b>	<b>0.53</b>	<b>0.58</b>	<b>0.01</b>
Lower U-Factor indicates more insulation.	Lower SHGC indicates less heat gained from the sun.	Higher VT allows more daylight to enter the room.	Lower AL indicates less outside air enters the room.

# Products and Manufacturers

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## Other Manufacturers

- **Indow Windows** <https://www.indowwindows.com>
- **Allied Window Inc.** <https://www.ailliedwindows.com>
- **Wausau Window and Wall Systems** <https://www.wausauwindows.com>
- **Innerglass Window Systems LLC** <https://www.stormwindows.com>

# Attachments Energy Rating Council



Rates, labels and certifies the energy performance of window attachments

- Independent, public interest organization
- DOE-funded

**AERC** SAMPLE

**AERC ENERGY PERFORMANCE CERTIFICATE  
COMMERCIAL SECONDARY WINDOW**

MANUFACTURER ABC

PRODUCT INFORMATION		GLAZING INFORMATION
SERIES	1000	GLAZING TYPE
PRODUCT	XYZ-1	XYZ GLASS COMPANY XXXX CLEAR (IGDB: 9999)
INSTALLATION POSITION	Interior	
AERC NUMBER	WP-L-ABCDE	
DESCRIPTION	This product is an interior secondary window with clear glass.	
MANUFACTURER URL	https://ManufacturerName.com	

PRODUCT RATINGS INSTALLED OVER BASE WINDOW		
RATING	PRIMARY BASELINE WINDOW	WITH SECONDARY WINDOW ADDITION*
U-FACTOR [Btu/h·ft <sup>2</sup> ·°F]	1.12	0.63
SOLAR HEAT GAIN COEFFICIENT (SHGC)	0.72	0.56
VISIBLE TRANSMITTANCE (VT)	0.77	0.61
AIR LEAKAGE (AL) [cfm/ft <sup>2</sup> ]*	2.0	1.15

For more information, visit [AERCenergyrating.org/Commercial](https://AERCenergyrating.org/Commercial)

This certificate indicates that the product has been rated according to strict standards set forth by the Attachments Energy Rating Council (AERC).

DISCLAIMER: THE ATTACHMENTS ENERGY RATING COUNCIL RATINGS ARE BASED ON CERTAIN ASSUMED CRITERIA INCLUDING ATTACHMENT INSTALLATION OVER A SINGLE PANE CLEAR GLASS ALUMINUM FRAME EXISTING WINDOW. AERC DOES NOT REPRESENT OR GUARANTEE IN ANY RESPECT THAT THE CONSUMER WILL EXPERIENCE ENERGY SAVINGS. SEE WEBSITE FOR ADDITIONAL RATING CRITERIA DETAILS.

\*Simulated over a single pane clear glass aluminum frame existing window (AERC 1 Baseline Window D).  
\*\*Based on AERC 1.2 physical test method.

# AERC

## Searchable database

- Products
- Manufacturers (3 entered)
- Performance specifications
- Application specifications

Images: AERC Product Search User Interface Screen  
<https://aercenergyrating.org/product-search/commercial-product-search/>

The screenshot displays the AERC Energy Improvement website's commercial product search interface. At the top, there is a navigation menu with 'Residential', 'Commercial', 'Resources', 'Membership', and 'About Us'. The 'Commercial' tab is active. Below the navigation is a search bar with the placeholder text 'Search by Product, Model Number, AERC Number'. The main content area is titled 'Certified Product Search (Commercial)'. On the left, a 'Refine Search' panel allows filtering by 'Product Category' (Commercial Secondary Windows is selected), 'Position' (Interior is selected), and performance metrics (U-Factor, Solar Heat Gain Coefficient, Visual Transmittance, and Air Leakage) using sliders. The 'Search Results' section shows 11 products, sorted by 'A to Z'. The first product is 'ALPEN WinSert Lite Inside Mount', with a 'Commercial Secondary Windows' badge. Its specifications include: Manufacturer: Alpen High Performance Products, Inc; Product Line: WinSert; AERC Number: CSW-L-4GZVS; Position: Interior; Model #: Winsert Lite Inside Mount; Date Certified: 2021-11-15; Product Description: Winsert Lite Inside Mount; Product Colors; Manufacturer Website: http://www.thinkalpen.com; More Information: Single Pane, Clear Glass, Metal Frame. Performance metrics are shown as progress bars: U-Factor (0.55), Solar Heat Gain Coefficient (0.38), Visual Transmittance (0.52), and Air Leakage (0.06). Two tables provide detailed performance data for single and double pane configurations.

**Refine Search** [Clear Filter](#)

**Product Category:**  
 Commercial Secondary Windows  
 All

**Position**  
 Exterior  
 Interior

**U-Factor:**

**Solar Heat Gain Coefficient:**

**Visual Transmittance:**

**Air Leakage:**

**Baseline Windows Options:**  
Coming soon: An additional personalization feature that will allow you to filter through options based on number of panes, type of glass, type of frame, and

**Search Results**  
11 products Sort by a **A to Z**  
[Export as CSV](#)

**ALPEN WinSert Lite Inside Mount** **Commercial Secondary Windows**

**Manufacturer:** Alpen High Performance Products, Inc  
**Product Line:** WinSert  
**AERC Number:** CSW-L-4GZVS  
**Position (Interior/Exterior):** Interior  
**Model #:** Winsert Lite Inside Mount  
**Date Certified:** 2021-11-15  
**Product Description:** Winsert Lite Inside Mount  
**Product Colors:**  
**Manufacturer Website:** <http://www.thinkalpen.com>  
**More Information:** Single Pane, Clear Glass, Metal Frame

U-FACTOR	SHGC	VT	AL
0.55	0.38	0.52	0.06

Double Pane, Clear Glass, Metal Frame

U-FACTOR	SHGC	VT	AL
0.41	0.39	0.48	0.06

# Commercial Secondary Windows

## Applications & Installation Considerations

- **Interior installation**
- **Fixed (or operable) windows**
- **Single or double pane primary window**
- **Historic buildings**
- **Reduced installation effort and cost**

**50%**

**the cost of existing  
window replacement**

Source: Savings and Economic Analysis of Secondary Glazing Systems, February 2016, Northwest Energy Efficiency Alliance.



*Pictured above: Lake Union, Wash. office building with secondary window upgrade*

# Commercial Secondary Windows

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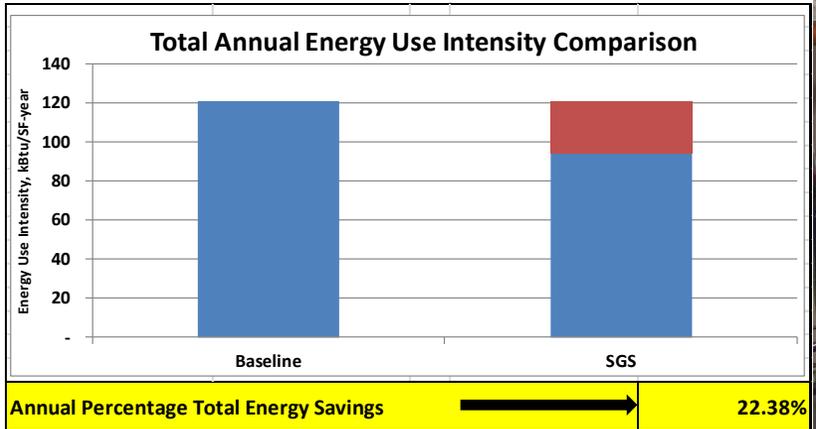
## Customer Benefits (Energy & Non-energy)

- **Energy cost savings**
- **Reduced cooling and heating loads**
- **Improved occupant comfort and productivity**
- **Reduced deterioration of furnishings**

# Commercial Secondary Windows

## Energy Cost Savings

- Heating, cooling, fans, and pumps
- Electricity and fossil fuel costs
- 20% whole building savings possible
- Opportunity for HVAC system re-balance

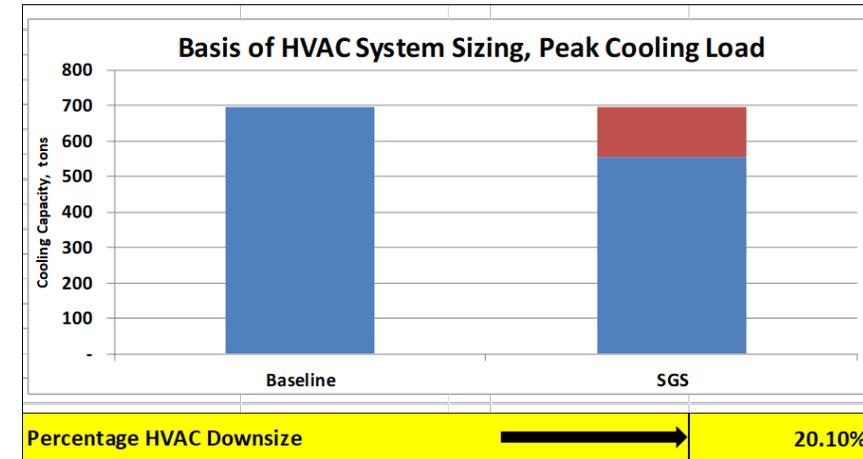


Photographs: Courtesy of Solarc Energy Group  
Graph: CWS Savings Calculator Output Graphics, NEEA

# Commercial Secondary Windows

## Reduced Heating and Cooling Loads

- **Peak Cooling and Heating Loads**
- **Lower Peak Cooling = Smaller Future HVAC**
- **20% reduction is possible**
- **Translates to an average of 17% first cost savings on HVAC upgrade project**

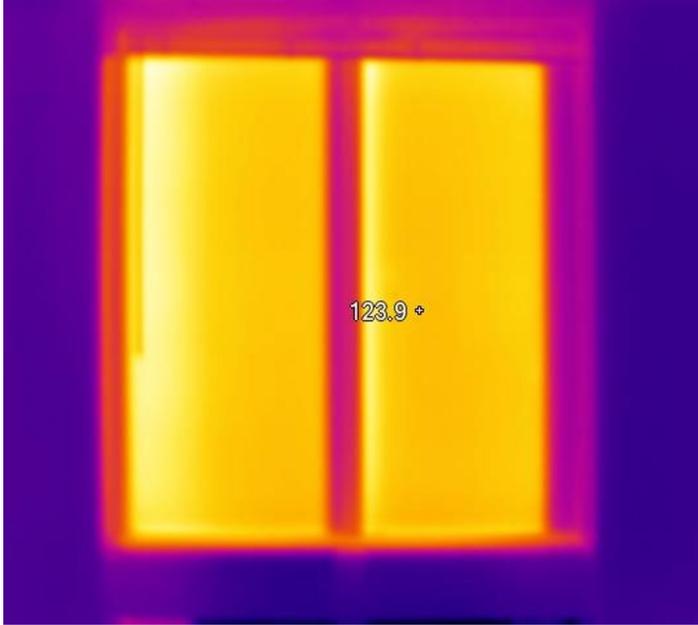
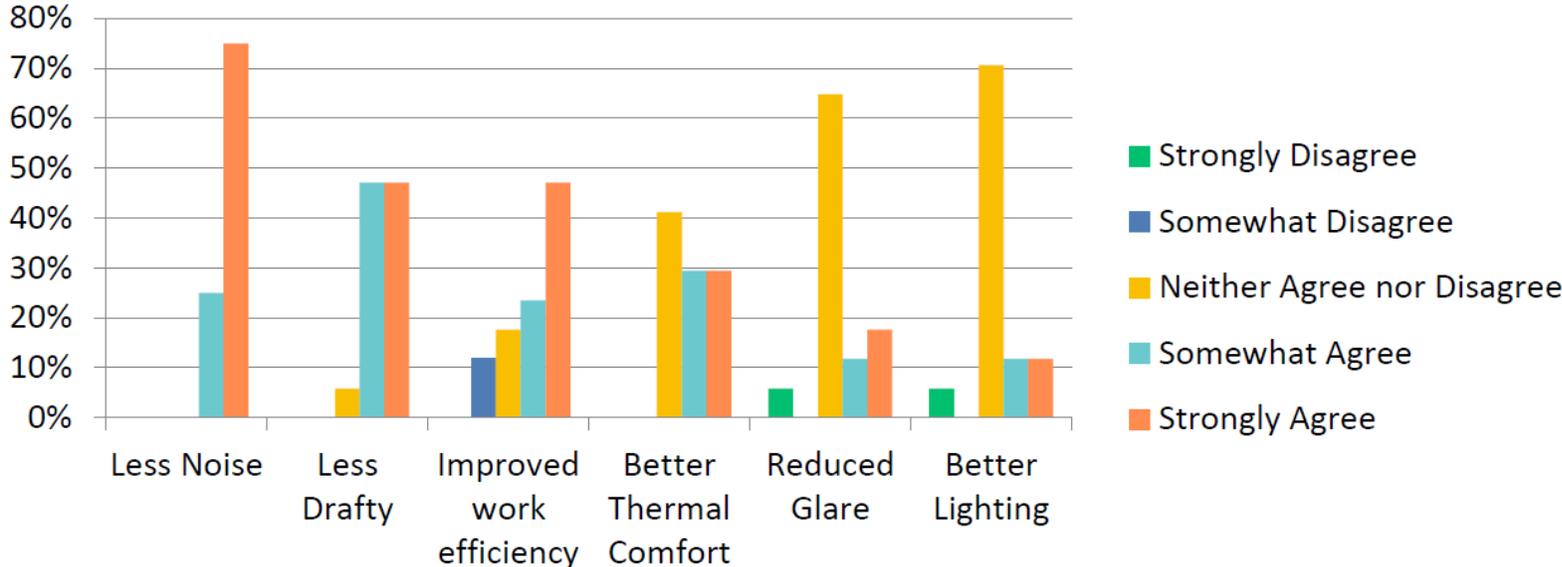


# Commercial Secondary Windows

## Improved Occupant Comfort and Productivity

Figure 1: Occupant Survey Results Regarding CSW Attributes

Please rate how strongly you agree or disagree with the statements listed below related to the window attachments (n=17)



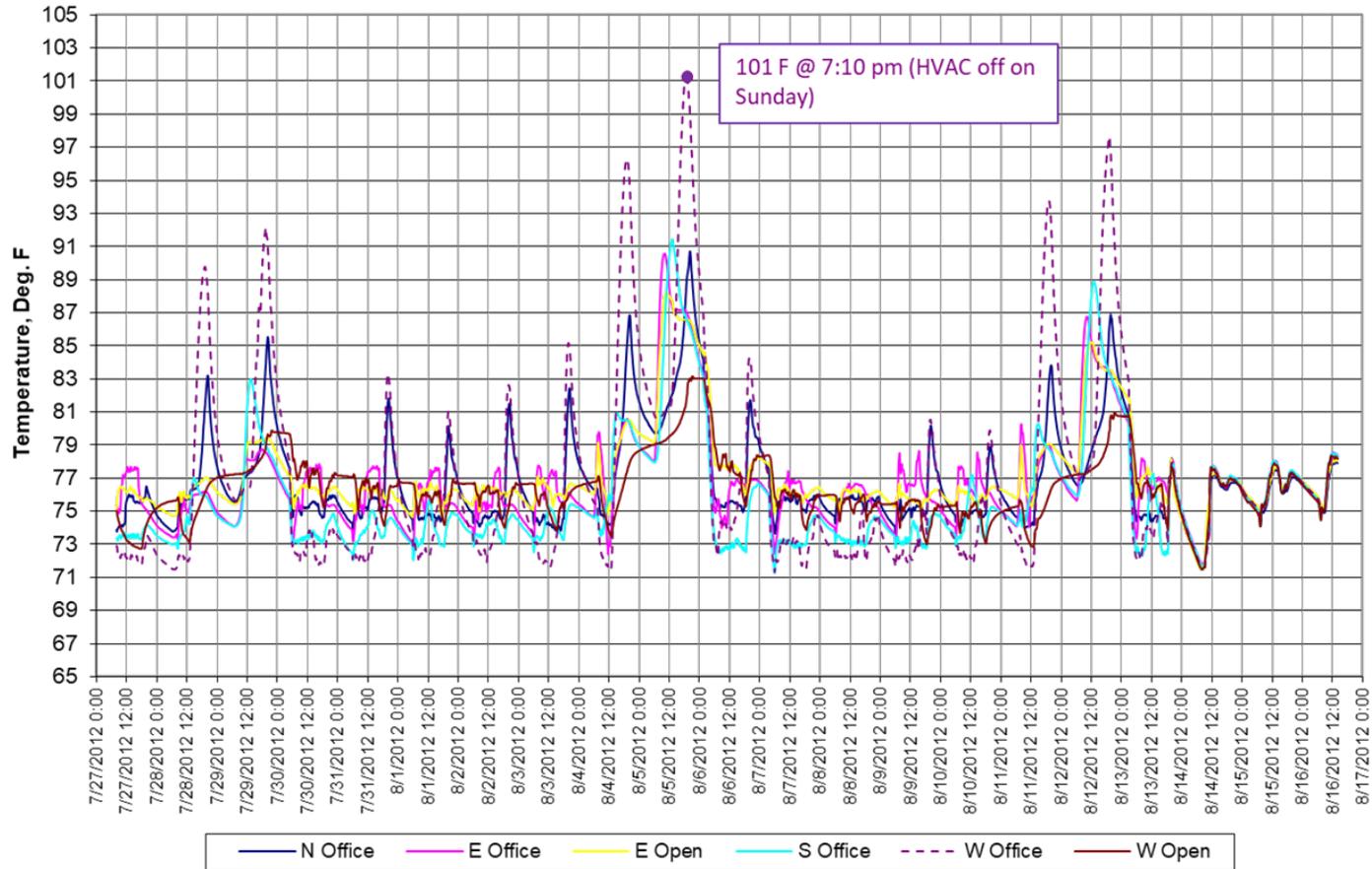
Infrared image of primary window at Rainier Tower, Seattle Washington; Courtesy of Solarc Energy Group.

Source: Commercial Secondary Windows Field Observations and Decision-maker Interviews Report; Energy 350 / NEEA, February 9, 2023

# Commercial Secondary Windows

## Improved Interior Furnishing Service Life

Existing High Rise Perimeter Space Temperatures (Seattle)



Photographs and Graph: Courtesy of Solarc Energy Group

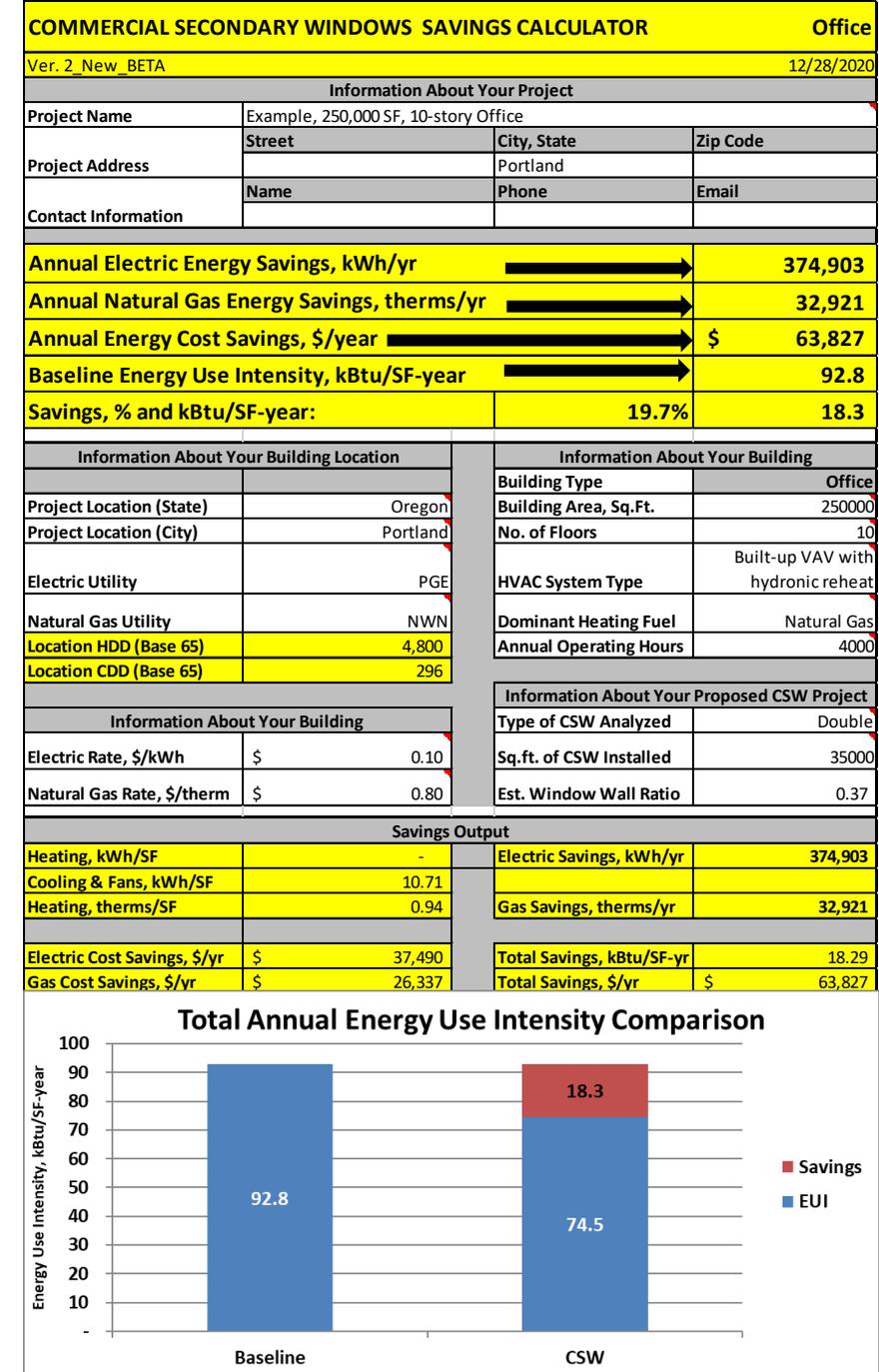


# Commercial Secondary Windows

## Benefits Analysis Considerations:

## Energy Cost Savings ROI Example

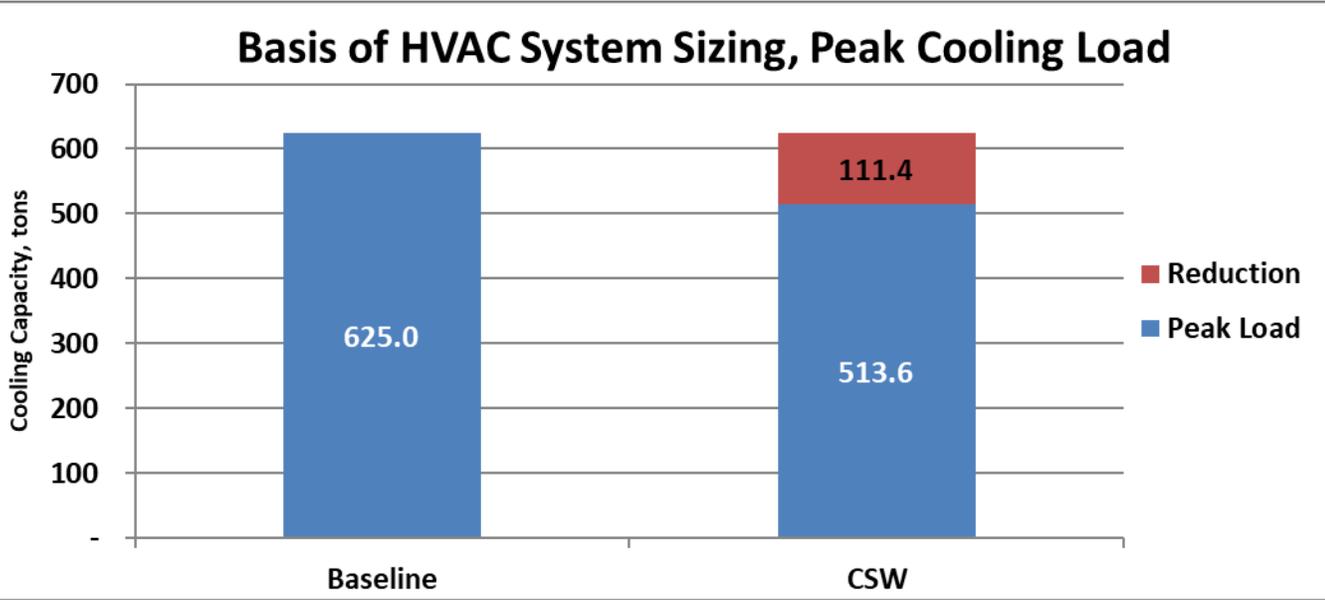
- **250,000 SF Office: Double Pane CSW**
- **19.7% savings = \$63,800 per year**
- **35,000 SF CSW = \$1,155,000 (at \$33/SF)**
  - ROI = 18.1 years (without incentives)
  - ROI = 12.9 years (if utility incentives qualify)
- **Decision-makers will likely need to consider non-energy benefits to approve project**



# Commercial Secondary Windows

## Benefits Analysis Considerations: Reduced Heating & Cooling Demand

- **Smaller chiller = ~\$80,000 reduced future equipment cost**



Photographs: Courtesy of Solarc Energy Group  
Graph: CWS Savings Calculator Output Graphics, NEEA

# Commercial Secondary Windows

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## Lessons Learned / Emerging Market

- **ROI is getting much better**
- **Utility incentives are important, if available**
- **Non-energy benefits are important**
- **Best in class product offerings incorporate sophisticated technology**
- **Consider double pane CSW for cold climates**
- **Products are likely to see near-term technical evolution**
- **USDOE Building Envelope Innovation Prize (\$2,000,000)**

# Learn More

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For information, case studies, resources and more:

**Northwest Energy Efficiency Alliance (NEEA):** [BetterBricks.com/solutions/windows](https://www.betterbricks.com/solutions/windows)

**Attachments Energy Rating Council (AERC):** [aercnet.org/resources/window-attachments](https://aercnet.org/resources/window-attachments)

**GSA Lightweight Secondary Windows Case Study:** <https://www.gsa.gov/climate-action-and-sustainability/center-for-emerging-building-technologies/completed-assessments/building-envelope/secondary-windows>

**Building Envelope Innovation Prize:** <https://www.energy.gov/eere/articles/doe-launches-2-million-prize-advance-cost-effective-energy-efficient-commercial#:~:text=The%20U.S.%20Department%20of%20Energy,improve%20efficiency%20of%20commercial%20windows.>

**Manufacturer's Literature:** See individual websites.

**Questions on Today's Presentation:** Mike Hatten email: [mikeh@solarcenergygroup.com](mailto:mikeh@solarcenergygroup.com)

