



FAQ

WinSert® Secondary Window Insert

What is WinSert?

WinSert is a unique and patented **lightweight, high performance secondary window insert** designed to be installed to the inside of existing single-pane or lower performing commercial windows.

What makes WinSert unique enough to patent?

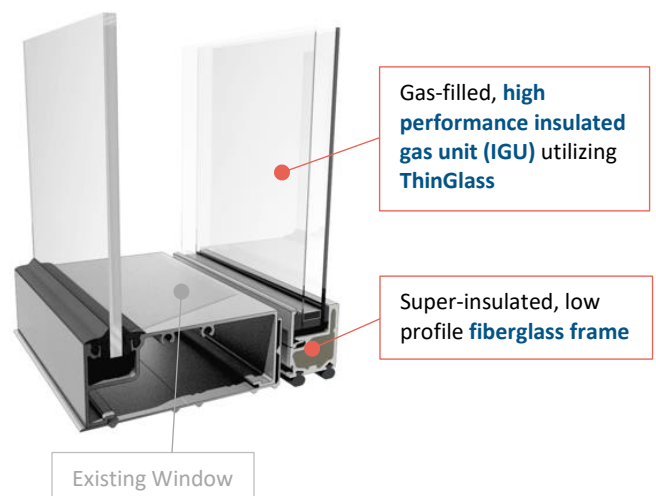
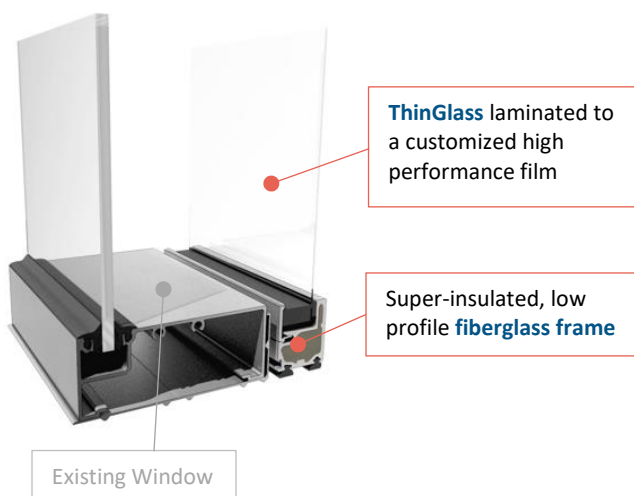
The WinSert product line uniquely combines several **best-in-class product components** and design elements leveraging off of Alpen High Performance Products' decades of industry leadership and experience in innovating and manufacturing the highest performance windows made in North America, including (i) thin 1 mm glass used in combination with the world's highest performance applied films, (ii) super insulated low profile fiberglass frames, and (iii) unique product installation systems allowing for low cost, non-disruptive and effective installations in virtually any building condition.

What WinSert options are available?

Two WinSert models are available based on the existing primary window characteristics, the climate of the project and the objectives of the window intervention upgrade.

The **WinSert Lite** uses a single pane of 'thin' glass in combination with high performance applied films to provide an ultra-lightweight, low cost and effective option for the market.

The **WinSert Plus** combines a second lite of glass to form a unique lightweight high performance "micro insulated glass unit" to super charge the performance of the existing primary window.



Has the WinSert system been tested?

All components and the entire WinSert system have been extensively tested for durability, safety and performance by third parties, by Alpen and by building owners in installed projects. The installed product has also been monitored and studied in fully instrumented field test conditions for years, validating the product line and the results. The performance attributes of WinSert have been independently certified and are available for review.

How much can the WinSert product line improve my existing windows?

Detailed performance results for the product are available online with the Attachment Energy Ratings Council (AERC) at <https://aercnet.org>. AERC is the leading independent certification agency verifying for the consumer comparative performance results for window attachments manufactured world-wide.



WinSert® Series AERC Data

Baseline Window	Secondary Window Addition		AERC Product Ratings over Baseline Window*			
	WinSert Unit	Mount Type	U-factor (Btu/hr·ft ² ·°F)	Solar Heat Gain Coefficient (SHGC)	Visible Transmittance (VT)	Air Leakage (AL) (cfm/ft ²)
SINGLE PANE Clear Glass, Aluminum Frame	--	--	1.12	0.72	0.77	2.0
	WinSert Lite	Inside Mount	0.55	0.38	0.52	0.06
	WinSert Lite	Overlap Mount	0.47	0.41	0.57	
	WinSert Plus	Inside Mount	0.28	0.35	0.51	0.06
	WinSert Plus	Overlap Mount	0.21	0.38	0.55	
	WinSert Plus Ultra	Inside Mount	0.27	0.28	0.46	
	WinSert Plus Ultra	Overlap Mount	0.19	0.30	0.49	
DOUBLE PANE Clear Glass, Aluminum Frame	--	--	0.68	0.67	0.71	2.0
	WinSert Lite	Inside Mount	0.41	0.39	0.48	0.06
	WinSert Lite	Overlap Mount	0.33	0.42	0.52	
	WinSert Plus	Inside Mount	0.25	0.35	0.47	0.06
	WinSert Plus	Overlap Mount	0.18	0.37	0.51	
	WinSert Plus Ultra	Inside Mount	0.24	0.28	0.42	
	WinSert Plus Ultra	Overlap Mount	0.16	0.30	0.46	

*Simulated over existing single pane (AERC 1 Baseline Window D) or double pane (AERC 1 Baseline Window F) baseline windows

Simply stated, existing tested results confirm the WinSert Lite and WinSert Plus products can improve insulating performance of an existing window by up to 3x to almost 6x.¹ The products can improve solar heat gain rejection performance by up to 2.5x.² Equally important, a WinSert install was independently tested by a recognized window testing laboratory to improve air infiltration of a standard test window condition by 97%.³

Windows are only one part of the overall building shell, so what does that mean for my building?

The impact of various window upgrade solutions on an existing building can, of course, vary widely—depending on the nature, condition, operability and even age of the existing building's windows and walls. Other aspects of the window upgrade evaluation and associated building can impact performance as well, including but certainly not limited to window-to-wall ratio, building shape, size, dimensions and orientation of the building. Surrounding shading can have a significant

¹ Based on AERC product ratings over a single-pane baseline window. The single-pane baseline window U-factor of 1.12 reduced to 0.47 for WinSert Lite and 0.19 for WinSert Plus Ultra, shown in the table above.

² Based on AERC product ratings over a single-pane baseline window. The single-pane baseline window SHGC of 0.72 reduced to a low as 0.28 for WinSert Plus Ultra, shown in the table above.

³ Reduced from 2.0 CFM/sqft to 0.06 CFM/sqft, third-party tested by Quast Consulting & Testing AERC 1.2 Air Leakage Performance Test

impact on expected performance of a window intervention solution, as well. With decades of expertise in building performance and baseline energy modeling available in-house, Alpen can provide a high level but detailed evaluation report customized for any building with a very limited amount of input from the building owner.

What impact can I expect on my building's energy usage if I do a WinSert upgrade?

The impact of a WinSert upgrade is dependent on the many building-specific factors listed above but can have a dramatic impact in reducing heating, cooling and fan loads—as much as 48% or even more in some cases⁴, particularly if thermostat set-points and existing mechanical systems can be tuned to reflect the much greater control of thermal transfers taking place at the perimeter of the building.

Heating, cooling and fan loads, of course, represent only a portion of a building's total energy loads. Traditionally, other significant energy draws in commercial buildings have carried big portions of the overall loads. In the standard DOE pre-1980 commercial reference buildings used in many base energy models, lighting loads represented 25% of the overall load and internal building loads from occupants and other equipment represented 32% of the overall loads⁵.

For many years now, a significant portion of most pre-1980 buildings have systematically upgraded lighting loads and other loads have continued to be addressed with “low hanging fruit”, or easy to access upgrades. Many pre-1980 buildings have significantly upgraded original HVAC systems in ways that are addressable. However, in most existing building stock, the building shell has not advanced in a meaningful way since its original construction, as window replacement and glazing upgrades have been avoided because of cost, occupant interruption and long payback realities. In other words, the building shell has simply lagged in upgrades compared to the rest of the building as many building owners have only been able to realistically consider (i) adding applied solar control film, (ii) replacing sealants and gasketing to minimize air infiltration, and (iii) adding window treatments, like blinds or shades.

As a result, heating, cooling and fan loads have often increased to a much higher overall portion of the building's energy loads—up to 50% or more of the building's energy bills in some cases. For instance, few buildings continue to use inefficient obsolete lighting systems. Similar to how the massive and mature vinyl replacement window business has systematically replaced annually the worst aging lowest performing windows in the nation's **residential** inventory, in commercial buildings, lighting upgrades have now systematically replaced the now largely obsolete inefficient lighting that existed in commercial buildings for decades. Whereas, a highly efficient and massive market has grown to make lighting upgrades relatively easy and affordable to access, no such parallel exists in the **commercial** building world for replacing aged windows.

WinSert represents the highest performance solution to address the building shell to ever hit the market. The product's extraordinary effectiveness, fast payback and non-occupant-disruptive installation creates an unprecedented window upgrade option not previously available to commercial property owners. The product can be installed in minutes with almost no penetration. Unlike other solutions in the market, the WinSert product is designed to be easily removeable at any time if the building owner wants to periodically get access to the primary window.

If the solution is so great, why isn't it in the market already?

It is! Thousands of units have been manufactured and installed in the market, and **the results in all cases have exceeded expectations**. In addition to successful projects installed already, the product has been scrutinized and studied in long term field tests, including the year-long, fully instrumented and scrutinized rigorous Green Proving Ground (GPG) Program sponsored by the U.S. General Services Administration (GSA)⁶.

“This technology performed well. We think it will represent a key tool in our net zero building tool belt.”

- Kevin Powell, Director of Emerging Building Technologies for the General Services Administration's Public Buildings Service

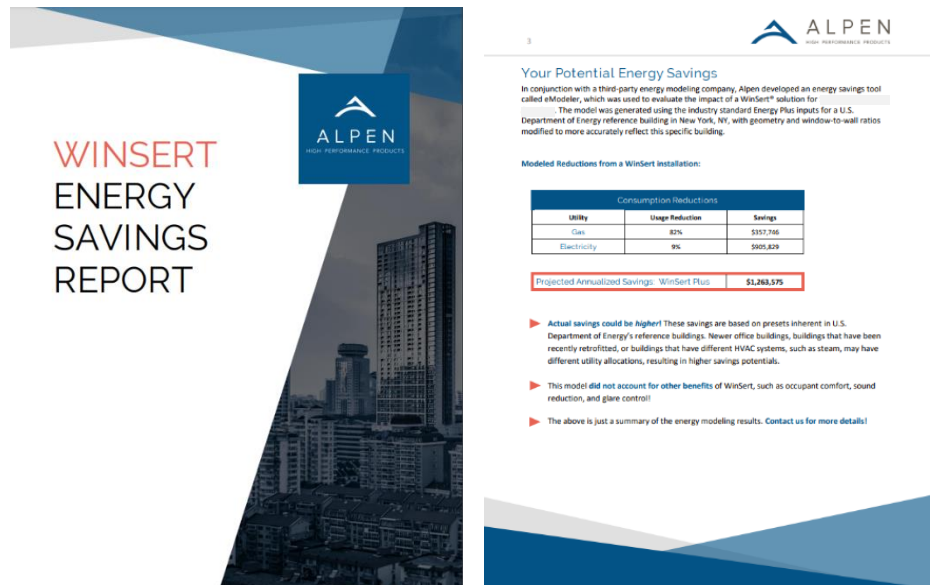
⁴ Based on findings from the U.S. General Services Administration Green Proving Ground Program testing and evaluation in combination with accounting for factors such as reduced window air infiltration, SHGC, setpoint reduction, and local fine avoidance.

⁵ Climate Zone 4A, Large Office Pre-1980. DOE commercial reference buildings: <https://www.energy.gov/eere/buildings/existing-commercial-reference-buildings-constructed-1980>

⁶ <https://www.gsa.gov/governmentwide-initiatives/climate-action-and-sustainability/center-for-emerging-building-technologies/published-findings/building-envelope/lightweight-secondary-windows>

Using the detailed study of our product in installed conditions, such as the evaluation performed by GSA's GPG Program, and in conjunction with a third-party energy modeling company, Alpen developed an in-house modeling tool to evaluate the potential energy savings of installing WinSert throughout a specific building. Alpen can use this tool to create customized energy savings reports with only a few data inputs about the building.

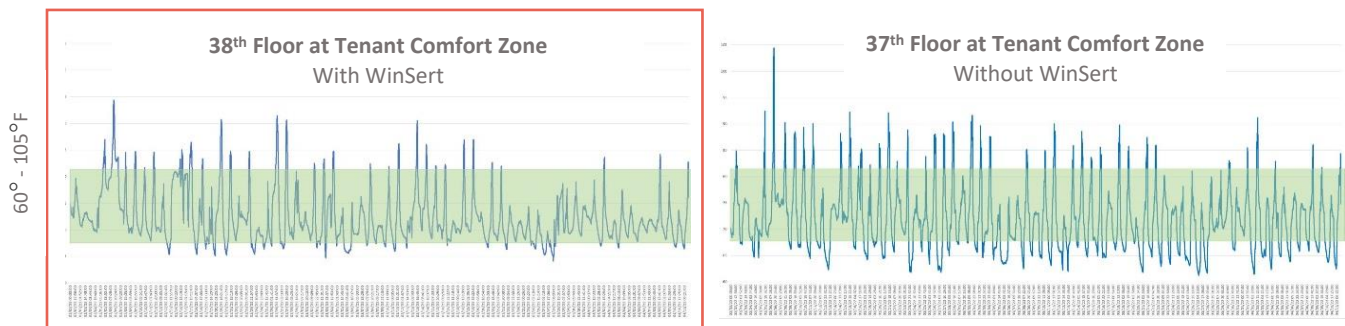
Alpen has additionally collected and documented compelling data from a field install in one of the nation's largest single glazed skyscrapers owned and operated by one of the nation's largest and most successful commercial real estate ownership groups.



Two sample pages of Alpen's custom 'WinSert Energy Savings Report', which can estimate energy savings from a WinSert installation based on tested third-party data and simple building input data.

In two identical offices in the building, one floor apart, one with WinSert installed and one without, data loggers were placed three feet inside the window to measure occupant comfort, and on top of the perimeter heating system to measure the output of the heating system. The office with the WinSert upgrade experienced a dramatic 29% improvement in the percentage of time the occupant temperature stayed within the ASHRAE 55 'comfort zone' between 67°F to 82°F, and reduced "extreme discomfort temperature" events below 65°F or above 90°F from 47 events to 2 events.

Improved Tenant Comfort 3 ft Inboard of Window



The percent of time spent within ASHRAE Comfort Zone (green band above between 67° - 82°F) improved 29% with WinSert installed (from 68% of the time, shown on the right, to 88% of time, shown on the left) over the span of two months from February 2, 2022 to April 11, 2022.

Thin glass is so thin. Isn't it fragile and prone to breakage?

Actually, no. It may not be intuitive, but even though thin glass would appear to be more fragile than more typical glass thicknesses used in window solutions, that is not the case. Scientifically, thin glass is significantly less "stiff" than thicker glass, more flexible and able to withstand stresses and directly applied loads or impacts. Glass stiffness is proportional to the cube of the thickness of the pane. In other words, thin glass is dramatically more flexible and less likely to break or crack than thicker glass. In fact, 1 mm float glass is 27 times more flexible than 3 mm glass. Bending loads placed on stiffer

3 mm glass results in more surface stress, as opposed to deformation, that will eventually break the glass well before similar bending loads will break thinner glass.⁷

Thin glass has been thoroughly and vigorously tested by independent parties. It has been subjected to destructive wind tunnel chambers, been exposed to rigorous impact testing and tested for thermal shock stress risk through the DOE's national labs, pictured at right above. It has also been tested now for years in thousands of units installed in the field. In all events—both in testing and in the field—**thin glass has proven to be more durable, safer and less prone to breakage than traditional thickness of glass.**



Left: A quad-pane corner sample of glass from Alpen with two 'thin' glass center panes.
Right: U.S. Department of Energy's national labs collaborated with Alpen to test 'thin' glass durability.

Why does it matter that WinSert uses “thin glass”?



A building tenant at 915 Broadway in Vancouver, WA works at his desk while WinSert was installed into the window behind him.

This unique element of “thin glass” in the WinSert product is key to reducing the weight of the unit. No secondary window is as effective or lightweight in the market today. The lightweight nature of the product and its unique compression-fit gasket system leads directly to a **lower overall cost** and **dramatically increased speed of installation**. It can be installed in minutes. It can be installed literally while the occupant of an office goes down the hall to make copies or get a cup of coffee. In fact, units have been installed in some cases while occupants continued working, like in the image to the left. In almost all cases, the product can be installed in an entire building, floor or office suite quickly and with virtually no interruption of existing occupancy.

Equally as important, the unit can just as easily be removed and re-installed repeatedly in minutes each time with no special tools or equipment should a building owner want to gain immediate access to the primary window. No other product on the market is as easy to install. Few secondary window products

are designed to be removable once installed, and no other high performance products are as easily removed. The speed of install has a direct impact on the important consideration of how minimally disruptive the process is for building occupants.

The ease and speed of install aided by the lightweight thin glass component also contributes to the unmatched low overall cost of the installed high performance solution. It's easy to not only install but easy to get to the primary window, and no other solution can provide the overall ability to deliver reduced energy loads at the lowest price—simply translating into the best payback and ROI in the marketplace.

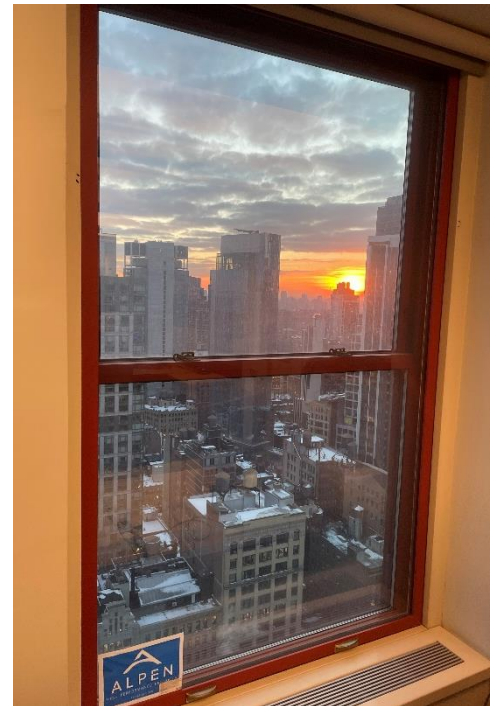
⁷ According to Technical Services Support form Corning, stresses in a 3' x 4' vertical TGU with 3mm panes and 500 Pa wind load (64 mph) show that the stress on the center pane is reduced by 5x when a standard 3mm center pane is replaced by 0.7mm thin glass (calculated according to EU draft standard prEN 16612). Edge seal forces are a contributor to loss of seal integrity, and hence IGU lifetime. [A. T. Wolf, Construction and Building Materials v.7 p. 101 (1993)]. Replacing a 3 mm center pane with thinner glass lowers the edge seal force from 34 N/m to 30 N/m, or 12%. This is due to the thinner center pane's greater ability to deflect and relieve pressure within the cavity.

How much lighter is a WinSert unit compared to other leading commercial solutions on the market today?

It's light. WinSert Lite is approximately 1 pound per square foot on average. Compared with other leading commercial-focused secondary window products, it can be 20% of the weight of other leading single pane solutions and less than 10% of the weight of typical dual pane solutions on the market.

Depending on size, the WinSert Plus unit is typically half the weight or less of other dual pane solutions and typically weighs 3 pounds per square foot.

As stated previously, the important and unique element of "thin glass" is key to reducing the weight of the WinSert product. It is central to the ease of install, impacting the speed of the install, which typically only takes minutes.



This 27-square-foot WinSert unit is easily lifted by a single person, shown at left above. The photo on the right shows that same unit installed in one of the nation's most important and iconic buildings in New York City.

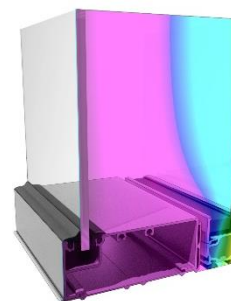
What is a "high performance frame" and why is that important?

Based on Alpen's industry-leading highest performance windows, the WinSert frame uniquely utilizes strong, energy efficient, low profile fiberglass frames, insulated with the highest performance insulating materials used in North American window manufacturing. **Fiberglass is 5x stronger than PVC⁸, is almost 6,000x more thermally efficient than aluminum⁹ and considered the most sustainable major window frame material in the market today** because of its low embodied energy content and reliance on a plentiful primarily underlying raw material—silica, or in other words, sand.

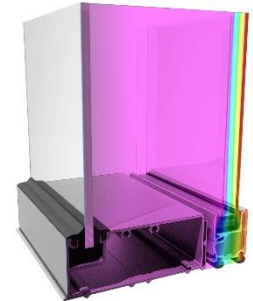
Existing Window



Existing Window
+ WinSert Lite



Existing Window
+ WinSert Plus



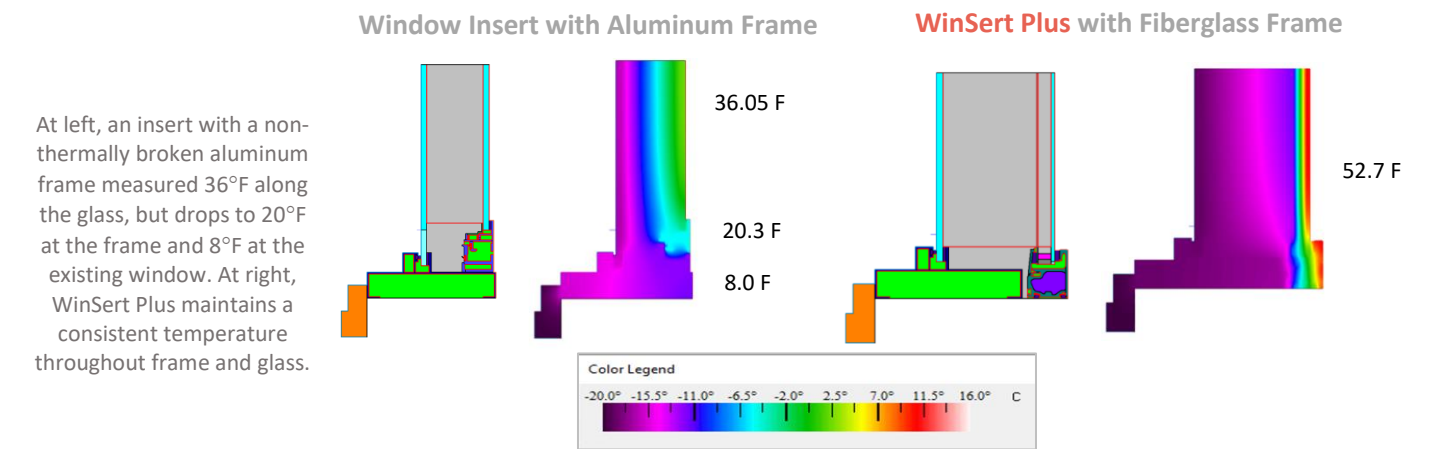
The high performance, insulated fiberglass frame "over-insulates" the highly conductive metal primary window frame, significantly reducing overall energy losses. It is significant and unique to the WinSert product line.

⁸ Measured by expansion coefficient – Polyvinyl chloride vs polycarbonate, glass fiber reinforced. https://www.engineeringtoolbox.com/linear-expansion-coefficients-d_95.html

⁹ Fiberglass thermal conductivity coefficient is 0.04 w/mk and Aluminum is 239 w/mk. <https://www.sciencedirect.com/topics/engineering/thermal-conductivity-coefficient>

Importantly, in most older existing single pane or lower performing dual pane commercial windows, the aluminum frame is actually more conductive and a bigger contributor to energy losses than the glass. The super-insulated fiberglass frame is key to improving the window performance to triple-pane or even quad-pane levels.

Many secondary windows use aluminum frames, which presents similar thermal conductivity concerns at the frame. This is illustrated in the images below, comparing a secondary window with an aluminum frame vs. WinSert Plus with fiberglass.



The U.S. Department of Energy’s Lawrence Berkeley National Laboratory tested and compared fourteen leading commercial secondary glazing solutions available on the market¹⁰. All were installed behind a 4x5 ft single-pane (6 mm), non-thermally broken aluminum window with identical modeled base glazing conditions. As shown in the table at right, **WinSert Plus performed up to 45% better than the next best alternative**. Center-of-glass is an important consideration for window performance, but how the full frame performs is truly the key for achieving high performance energy efficiency.

What other advantages and improvements can I expect from a window upgrade using the WinSert product line?

Two big factors beyond significant reductions in energy bills can be expected: **dramatic improvements in occupant comfort with the ability to “re-occupy” the space near the window**, and the ability to exert much **more control of the building’s mechanical systems and perimeter heating and cooling performance**, both of which have been field-tested and documented.

At the notable and historic Hills Plaza building in San Francisco, CA, data is continuously being collected to measure the impact of WinSert on inboard comfort levels. On a clear, 51°F day in direct sun, the radiant temperature four feet in from the window decreased by approximately 21°F with WinSert as compared to a window without a WinSert—a significant difference—illustrated in the image at the top of the next page.

As a visual demonstration of how WinSert performs in colder conditions, the infrared photo below shows a building’s window without WinSert on the left and a window with a WinSert mockup installed on the right. On a 27°F, snowy day, the Center of Glass temperature measured 42°F without WinSert, while the window with WinSert measured 64°F—a 22°F difference!

Configuration	U-factor (BTU/h-ft2-F)	
	Center-of-glass	Full frame (4’x5’ window)
Baseline D	1.03	1.12
D.I	0.37	0.52
D.II	0.19	0.34
D.III	0.18	0.37
D.IV	0.15	0.34
D.V	0.15	0.34
D.VI	0.37	0.54
D.VII	0.34	0.60
D.VIII	0.21	0.48
D.IX	0.45	0.53
D.X	0.45	0.45
D.XI	0.17	0.27
D.XII	0.17	0.19
D.XIII	0.35	0.53
D.XIV	0.36	0.52

The power of the WinSert fiberglass frame is demonstrated in the dramatically better full frame performance.

¹⁰ Secondary Glazing System (SGS) Thermal Performance and Annual Energy Use Analysis, Robert Hart, Valerie Green, Charlie Curcija, Lawrence Berkely National Laboratory, September 2020

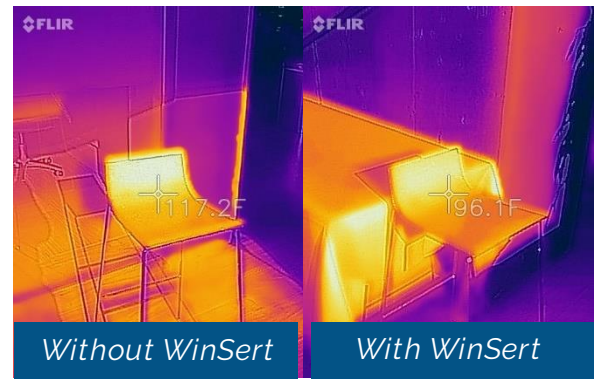
As mentioned previously, Alpen collected and documented compelling data from a WinSert field install in one of the nation's largest single glazed skyscrapers. Compared to an office without WinSert, an office with a WinSert upgrade experienced a dramatic 29% improvement in the percentage of time the occupant temperature (three feet inboard from the window) stayed within the ASHRAE 55 'comfort zone' between 67°F to 82°F and did so with far fewer extreme temperature events below 65°F or above 90°F. At the same time, **the HVAC system worked significantly LESS hard to maintain higher levels of tenant comfort**, with a 52% reduction in the average daily min/max perimeter heating air temperature swing over the 2.5-month period.

Additionally, WinSert was installed throughout a 4-story, multi-tenant office building built in 1975 in downtown Vancouver, WA. The vice president of property management for the building is able to monitor room temperatures on all elevations within the facility remotely using the building's energy management system and could testify to the drastic improvement. Following a record-shattering 115°F heat wave in 2021, he indicated that "the building is performing absolutely amazingly. I remember previous 95°F to 100°F days when it would be 90°F on the southwest facing rooms in the afternoon and there'd be nothing I could do about it, so to see the entire fourth floor within one degree of setpoint at 72°F is an absolute confirmation that these windows work."

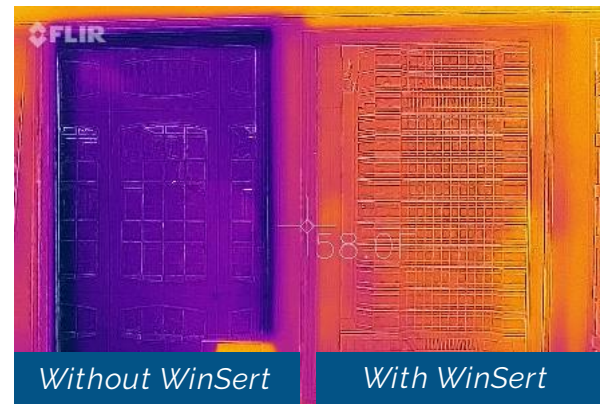
Are there other substantiable aspects of the WinSert product line that are helpful for ESG general sustainability considerations?

In addition to significant reductions in CO2 emissions and energy usage, these facts about the WinSert product line add other compelling considerations to assist in ESG considerations:

- ▶ **Indoor Air Quality:** Alpen was the first US based window manufacturer to complete certification of its products as Living Building Challenge Declare Label certified, offering transparent reporting on each of the components of the company's fiberglass window products to ensure there are no "red list" chemicals in its bill of materials. Alpen remains the only secondary window product meeting those stringent requirements. All of the high quality paints used on the product are water-based, low VOC and non-off-gassing coatings.
- ▶ **Low Embodied Energy:** Embodied energy has now entered the discussion around truly sustainable building product decisions. Two of the most significant high-energy building products are glass manufacturing and primary aluminum production. Very different than other leading commercial secondary window solutions are WinSert's use of its low embodied energy fiberglass frame (using less than a third of the embodied energy of a typical sized aluminum frame) and an almost proportionately dramatic reduction in the energy used to produce thin glass compared to more traditional thicknesses of glass typically used by other solutions. In fact, a WinSert secondary window uses approximately 1/10 the amount of embodied energy of leading alternative commercial secondary window solutions now on the market.
- ▶ **Waste Reduction:** WinSert saves room at the landfill. Compared to window replacement, reuse and adaption of the existing windows is not only dramatically less expensive but also creates significantly less waste environmentally.



At the Hills Plaza building in San Francisco, CA, a FLIR view shows thermal readings of two chairs 4 feet inside of a window with and without WinSert. The radiant temperature on the chair near the window without WinSert was 21.1°F higher.



Colder conditions: A FLIR view shows center-of-glass thermal readings for a window with and without WinSert, showing a 22-degree improvement with WinSert.