

# Successful Office Building Window Upgrade Using Commercial Secondary Windows

Case Study of Pacific Tower at 915 Broadway, Vancouver



Brad Begin  
Chairman

Alpen High Performance Products



## The Project: 915 Broadway, Vancouver WA

Five-story mixed use  
commercial office building

Built 1975

250 Single Pane Windows

Non-thermally broken  
aluminum frames

6,091 square feet glazing

100% occupied

Privately owned

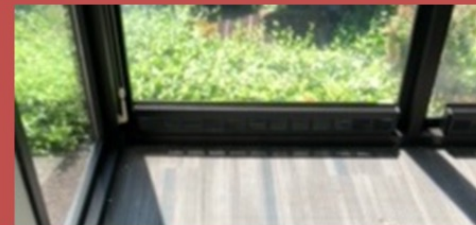
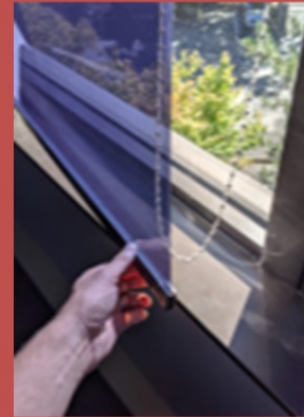


Building design included  
floor to ceiling glass design  
popular during period

# Motivation: Severe Occupant Discomfort and HVAC Systems Straining Under Current Climate Loads

## Problem Statement and Project Objectives

1. Reduce **extreme** tenant seasonal discomfort from of low performing, leaky single-pane windows
2. Reduce building energy loads
  - *Perimeter heating and cooling system designed for 1970s vintage building consistently running at peak loads*
  - *Not effectively responsive to attempts to influence with sophisticated building energy management system*
  - *Mechanical system inadequate for current climate conditions with single-pane, high window-to-wall ratio in designs widely used for first time in 60s and 70s architectural design*



### Secondary Objectives:



## Thermal Images Before Project

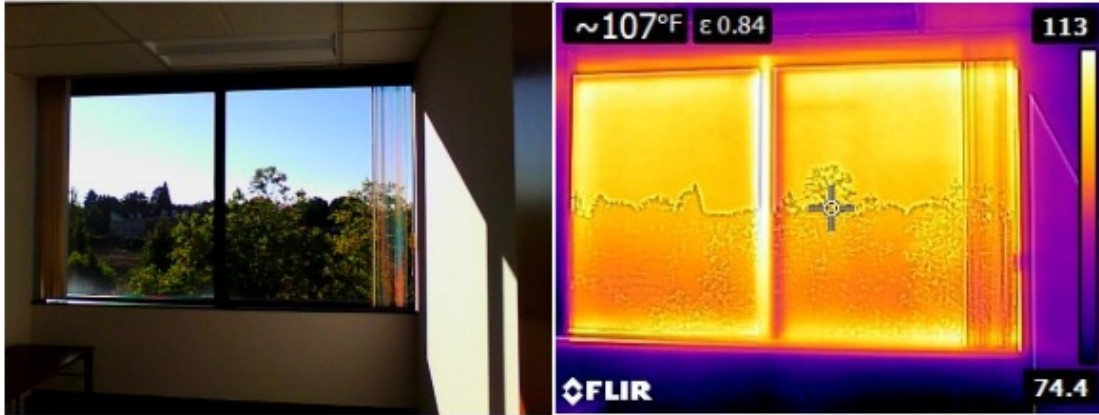
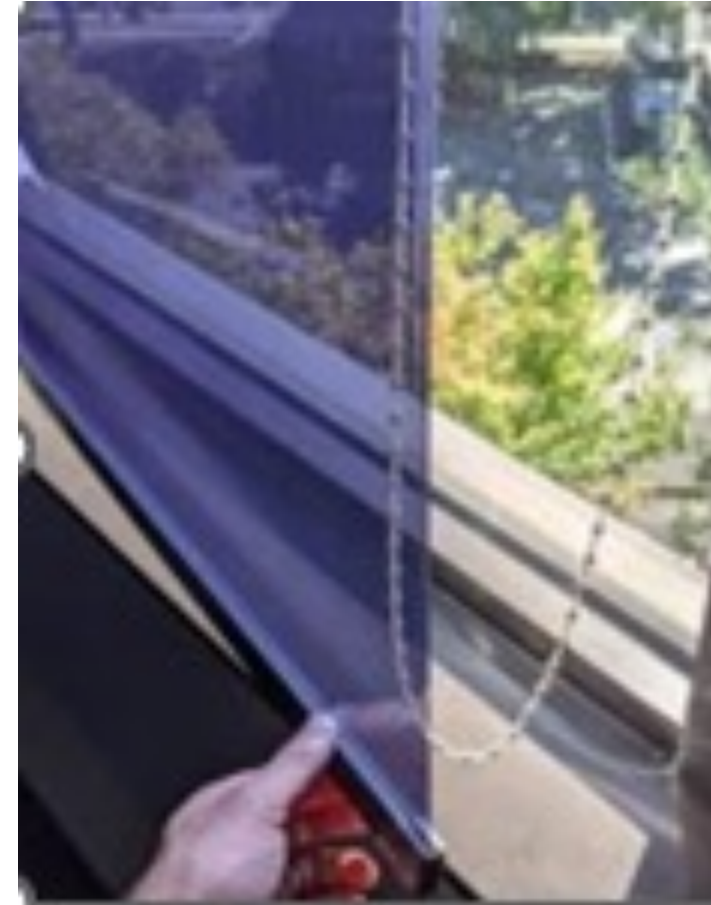


FIGURE 3 – THERMAL IMAGE OF PRE-INSTALL SE (SUNNY SIDE) GLAZING INTERIOR (9/2/20 8AM – OAT=63 °F)



FIGURE 4 – THERMAL IMAGE OF PRE-INSTALL SE (SUNNY SIDE) GLAZING EXTERIOR (9/2/20 8AM – OAT=63 °F)



**Throughout the building, tenants used a variety of window treatments to manage heat gain as direct solar radiation on elevations caused unbearable discomfort during much of the year**

**HVAC system designed for 1975 conditions could not generate enough cooling for current changing climate**

# Initial Plan by Owner: Replace and Update Windows

Three bids for window replacement were obtained by owner

- All bids were between \$2 million and \$3 million a significant portion of value of building
- Would have required substantial displacement of tenants in 100% occupied building
- Project time frame from start to finish estimated at 3 to 5 months

Rejected as impractical by owner and project abandoned



## PLAN B

### Secondary Windows Introduced to Building Owner through NEEA, Clark PUD and Bonneville Power Administration

**Solution offered with some subsidy of project costs with requirement for monitoring before and after install conditions**

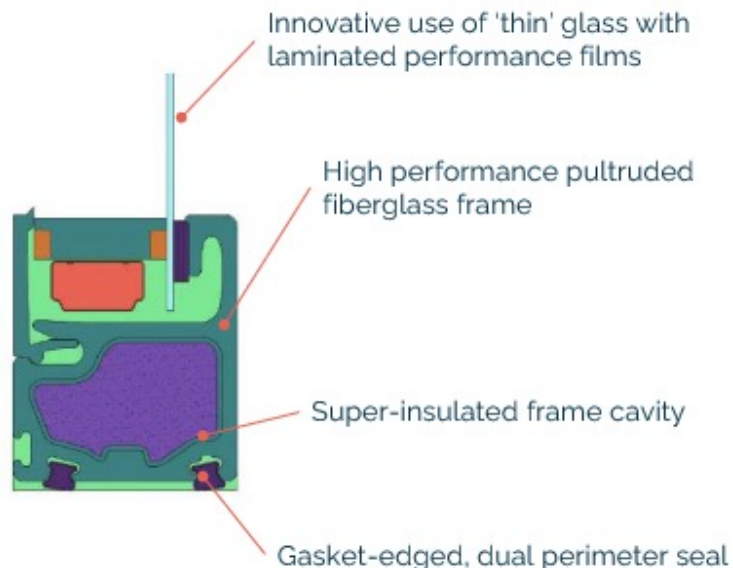


# How Does a Secondary Window Work?

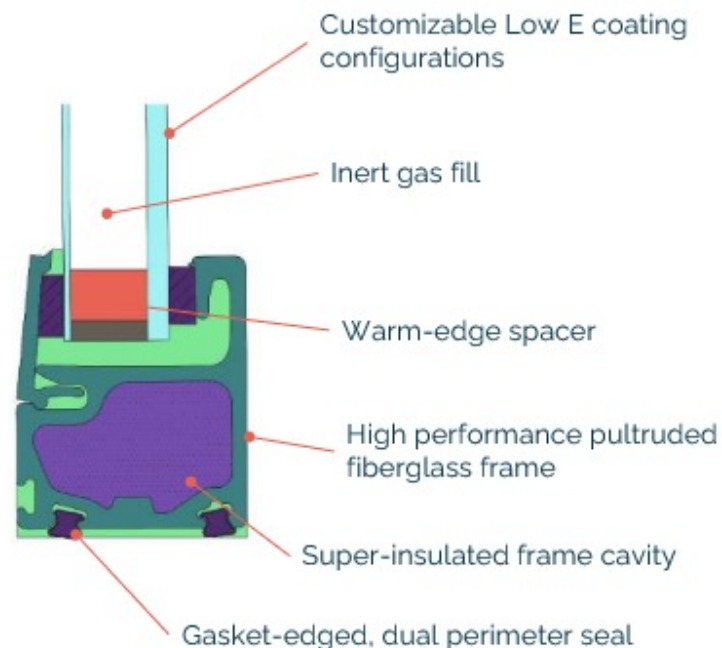


# Product Solutions Considered

## WinSert Lite



## WinSert Plus



	WinSert Lite	WinSert Plus
<b>Weight</b>	Entire unit averages < 1 lb/square foot	Dual-pane performance with single-pane weight
<b>Thermal Insulation</b>	Up to 2.5x better	Up to almost 6x better
<b>Solar Heat Gain</b>	Reduced by 47%	Reduced by 61%
<b>Single Glazed U-factor</b>	Improved to as low as 0.47	Improved to as low as 0.19
<b>Single Glazed SHGC</b>	Improved to as low as 0.38	Improved to as low as 0.28



## Project Execution:

- WinSert Plus solution Selected
- Install Completed in two weeks (two installers)
- No tenant disruption for more than 15 minutes
- Approximately 10—15 minutes per window

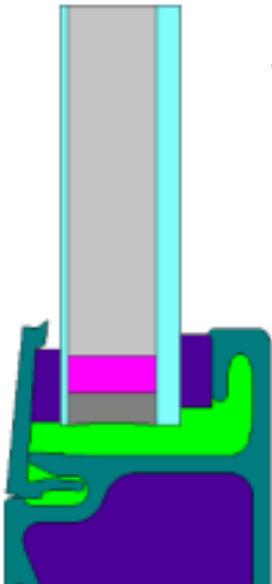
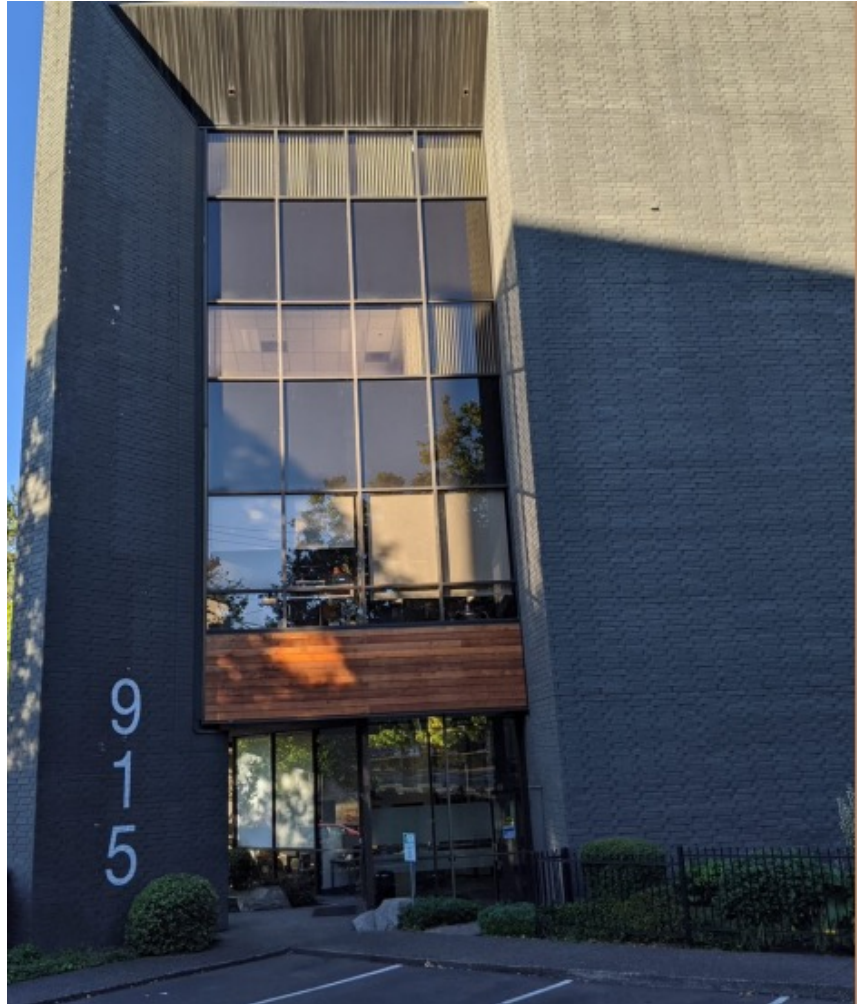


Diagram of the WinSert™ Plus window insert.



## RESULTS: STUDIED AND PUBLISHED BY ENERGY 350 ON BEHALF OF NEEA



### 915 Broadway Project Report

Submitted to



700 NE Multnomah St Ste 1300  
Portland, OR 97232  
(503) 688-5400  
neea.org

Submitted by



1033 SE Main St., Suite 1  
Portland, OR 97214  
(971) 544-7211  
energy350.com

# Comfort Results

## Occupant Comfort

Outside Temperature 71°F



### Radiant Temperature

Pre-Install Post-Install  
87.4°F 74.3°F



### Surface Temperature of Glass

Pre-Install Post-Install  
95°F 79.2°F

		Pre-Install	Post-Install
Test Details	Date	4/19/21	6/18/21
	Time	1:45-2:00 PM	12:30-1:00 PM
	Location	Office 302 (SE Corner) (Exposed to morning sun but shaded at time of testing)	
Exterior Conditions	Outside Dry Bulb Temperature	73.1 °F	73.4°F
	Outside Conditions	Mostly Sunny	Sunny
Interior Measurements	Dry Bulb Temperature - Near Thermostat	74.8°F	75.7°F
	Dry Bulb Temperature - Desk near windows	78.3°F	73.4°F
	Globe Temperature – Desk near windows	87.4°F	73.9°F
	Glass Surface Temperature	95.0°F	79.2°F

***“Our tenants are extremely happy,” said Dave Berg (owner rep). “We used to get daily or weekly complaints, but we haven’t heard a single complaint since the secondary windows were installed.”***

# Results – Shell Improvement, Sound and Energy Savings

## Building Shell Improvement (First Year Post Install)

Pacific Tower



**Building Envelope Performance (BEP)**  
 🏆 Congratulations! you meet the requirements to receive the Retro 30 award.

**32% Improvement**

Existing Building <i>Baseline</i>		Retrofit <i>Improvements</i>	
BEP $kBtu/ft^2$	33.7	BEP $kBtu/ft^2$	22.9
Wall R-Value	2.8	Wall R-Value	2.8
Wall Facade Material	<b>Spandrel Glass</b>	Wall Facade Material	<b>Spandrel Glass</b>
Roof R-Value	31.3	Roof R-Value	31.3
Roof Surface Material	<b>Gray Membrane</b>	Roof Surface Material	<b>Gray Membrane</b>
Window U-Factor	1.04	Window U-Factor	0.23
Window SHGC	0.73	Window SHGC	0.37
Air Leakage Rate $scfm/ft^2$	0.4	Air Leakage Rate $scfm/ft^2$	0.37
Update Inputs		CO <sub>2</sub> Reduction $lbs./year$	0

## Sound Attenuation

	Pre-Install	Post-Install	Additional Reduction
Ambient Exterior Sound Level (dB)	61.7	59.5	
Interior Sound Level (dB)	47.3	38.2	
Reduction (dB)	14.4	21.3	6.9 dB

## Energy Savings



ENERGY SAVINGS  
**10.3% reduction in building energy use**



## Cost and Time Comparison Versus Window Replacement



*COST*

**89 percent less expensive than  
a full window replacement**

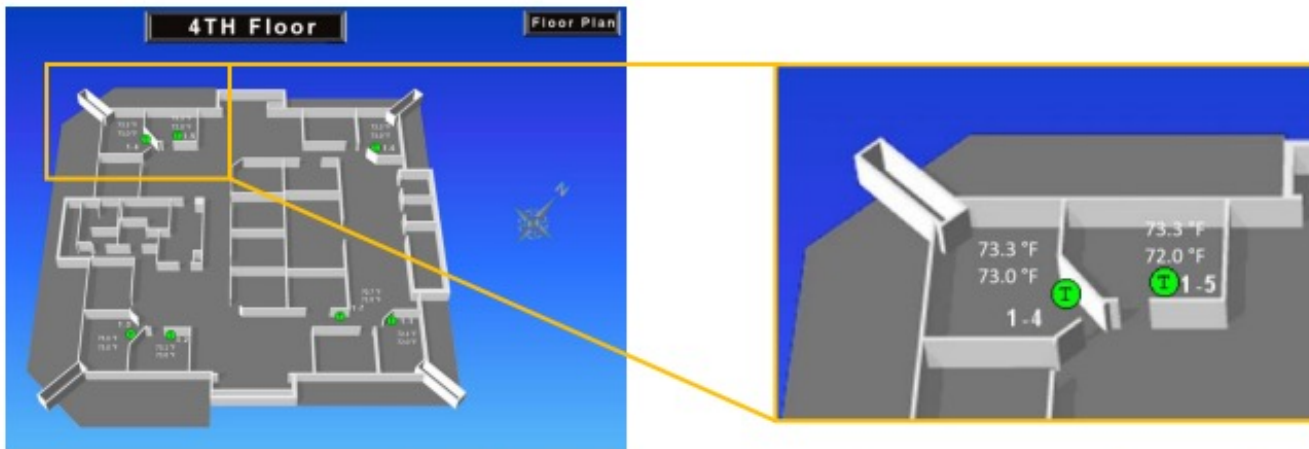
Two weeks versus 3 to 4 months  
for window replacement

No tenant disruption versus significant  
disruption of window replacement



# Unexpected Benefits – Resiliency Under Extreme Climate Conditions

## Record Heat Event Shortly After Install



Temperature measurements from the 4<sup>th</sup> floor of 915 Broadway Street, taken on a record-breaking 115 °F day after the WinSert installation. Temperatures used to reach as high as 90 °F on 95 °– 100 °F days before the installation.

*“Today we hit a high of 115 degrees in downtown Vancouver, which beats the previous all-time record of 108 set yesterday. This is absolutely unprecedented here, and I just wanted to preface this by setting that stage . . . The building is performing absolutely amazingly. I remember previous 95- and 100-degree days when it would be 90 degrees 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 degrees is an absolute confirmation that these windows work.”*

*– David Berg, VP of Property Management*

# Utility Rebate Programs Created in Region

B O N N E V I L L E P O W E R A D M I N I S T R A T I O N

**Energy Efficiency  
Implementation Manual  
2024-2025**



### 8.5.3 Secondary Windows

#### Basis for Energy Savings

Secondary windows are sometimes referred to window inserts, secondary glazing systems, or window retrofit panels. The base case used to calculate energy efficiency savings for secondary windows is a commercial building with single-pane, clear glass, low-performance windows. The efficient case used to calculate savings requires the installation of laminated or insulated glass interior window attachments with low-E coating on double-lite (IGU) glass. This measure doesn't require replacing the existing glass or window frames, and generally doesn't alter the existing window aesthetics (i.e., historic buildings) or exterior appearance of the building.

Energy savings result from reduced load on the building's heating and cooling systems and vary by heating zone and heating system type.

More information about the basis for savings can be found on the [Regional Technical Forum website](#).

#### Requirements and Specifications

##### Pre-conditions:

- Existing windows must be single-pane glass
- The building's primary heat source must be electric (e.g., zonal, VAV with electric reheat, or heat pump)

##### Post-conditions:

Installed products must:

- Have one or more low-E coatings resulting in an overall solar heat gain coefficient (SHGC<sub>Overall</sub>) of 0.55 or less, and
- Have a center-of-glass U-factor (UCOG) less than or equal to 0.20.

#### Payment

MEASURE CATEGORY	PAYMENT PER SQUARE FOOT
Secondary Windows	\$3



## Commercial Secondary Windows

### Commercial Secondary Windows incentives

\$0.45 per annual kWh saved

\$15 per annual therm saved

Up to 70% of eligible project costs

## Project Recognition

BUILDING ENVELOPE CAMPAIGN PARTICIPANT SPOTLIGHT

### PACIFIC TOWER

BEC PARTICIPANT  
**Pacific Tower**

LOCATION  
**Vancouver, WA**

SECTOR  
**Commercial Office**



915

RETRO 30 AWARD



BUILDING ENVELOPE CAMPAIGN

U.S. DEPARTMENT OF ENERGY

OAK RIDGE National Laboratory

Better Buildings® U.S. DEPARTMENT OF ENERGY



G L A S S

INNOVATIVE, HIGH-PERFORMANCE SOLUTIONS FOR TOMORROW'S BUILT ENVIRONMENT

### GLASS MAGAZINE AWARDS

PLUS

GRAPPLING WITH RISING COSTS • INTRODUCTION TO HIG • HOW TO CHOOSE THE RIGHT SOFTWARE

OFFICIAL PUBLICATION NGA GLASS.ORG

**First Secondary Window Project to Obtain Retro 30 Status, Department of Energy (ORNL)**

**Green Project of the Year  
Glass Magazine  
National Glass Association**



## Post Script – Further *Low Cost* Opportunities to Innovate



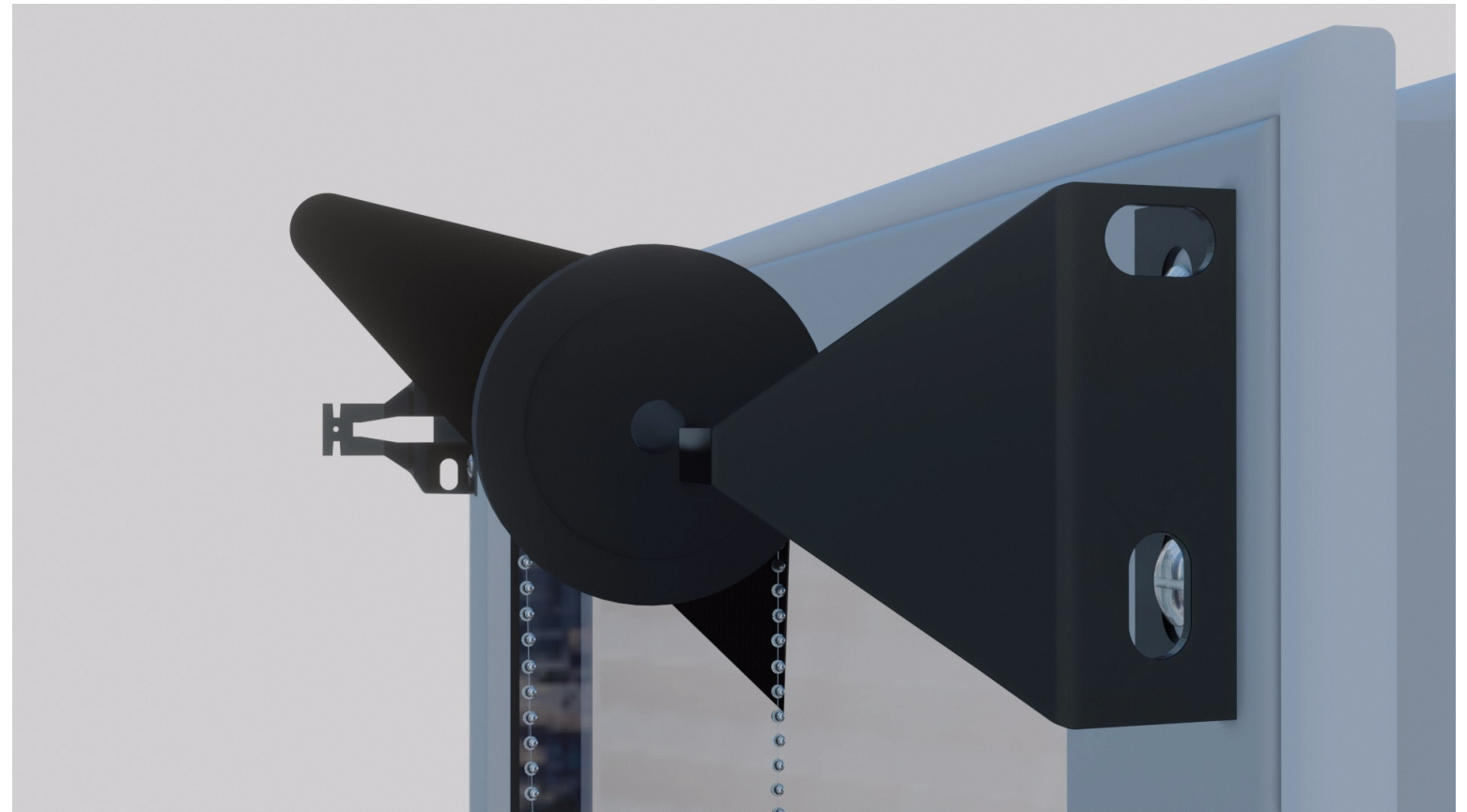
“The Only Thing Worse than The Windows is the Window Treatments”

### Small Trial of Low Cost Integrated Solar Shades

Before: Variety of “Bad” Shades



After: Integrated Solar Shades



## Questions or Comments?

**Brad Begin**

Chairman

Alpen High Performance Products

[bbegin@thinkalpen.com](mailto:bbegin@thinkalpen.com)

[www.thinkalpen.com](http://www.thinkalpen.com)

