CLEAR SOLUTIONS

INOVUES

Non-Invasive Window Retrofits Can Lift Academic Achievement

Window to Wellbeing: Thermal and Acoustic Benefits of Window Retrofits

Upcycled Fixed and Operable Windows by INOVUES Save Money, Enable Electrification & Help Students Thrive

CHALLENGES

RISING ENERGY COSTS

U.S. educational institutions spend over $14 billion annually on energy costs. Up to 40% of energy can be conserved through smart retrofits, such as non-invasive building envelope upgrades, on their own or in combination with heat pump technologies.

STATE OF FACADES

~40% of educational facilities, including 39% of urban K-12 schools, have the most energy-inefficient, acoustically inferior single-pane window glazing.

ACADEMIC PERFORMANCE

1°F decrease in thermal comfort can lead to 3%+ decrease in the likelihood of successful on-time graduation; high outside noise levels can result in 10% lower math scores on standardized tests.

SOLUTION IMPACT

INOVUES' solutions can improve energy efficiency by up to 40%, GHG emissions by up to 30%, and sound control by up to 70%.

U.S. K-12 and Higher Education institutions are under constant pressure to reduce annual operating expenses, while balancing multiple complex objectives:

- The safety and well-being of students and faculty
- Obsolete building components that don't meet today's building and energy standards
- Rising energy, systems, and construction costs
- Electrification, net zero, and sustainability targets

Approximately half of all educational buildings today have inefficient single-pane windows, reflecting a need for affordable yet impactful retrofit solutions. Beyond energy costs and emissions savings, better insulating double or triple glazing helps create a conducive learning environment by ensuring greater thermal and acoustic comfort. Cost-effective, non-invasive window upfits can enhance students' well-being, facilitate concentration, and improve test scores.

LOWER ENERGY & GHG EMISSIONS

K-12 schools spend approximately $8 billion annually on energy, the second largest expense after salaries, and can save an estimated $2 billion through energy efficiency upgrades. The potential savings in higher education are similar, though their estimated energy costs are slightly lower, approximately $6 billion per year. The solutions include window retrofits that can enhance occupant thermal and acoustic comfort and reduce utility costs, on their own or in combination with heat pump technologies.

SOCIAL IMPACT
QUALITY & EQUITY IN K-12 EDUCATION

- **THERMAL COMFORT:** Warmer climates and higher temperatures during exams can negatively affect student performance.
- **NOISE IMPACT:** Higher outside noise levels are linked to 10% lower student scores on math tests.
- **SOLUTIONS:** Thermal and acoustic comfort improvements can negate negative impacts, enhancing student wellbeing and learning outcomes.

CASE STUDIES

Case Study 1: University of Minnesota

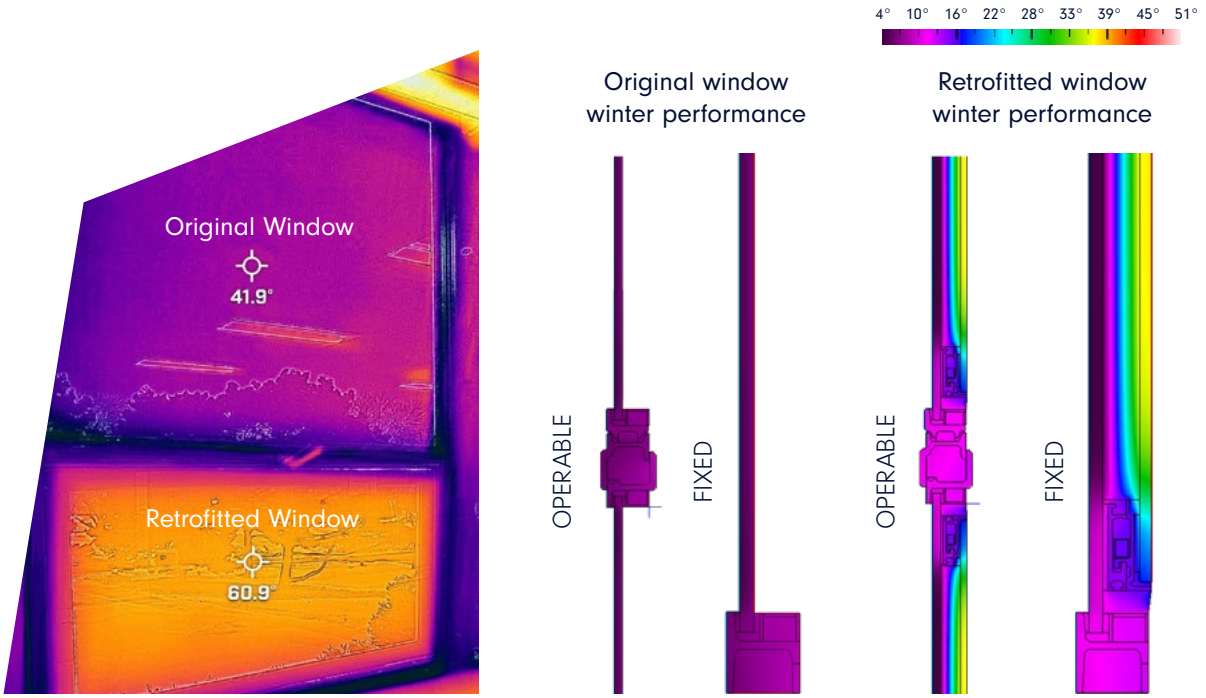
3X BETTER INSULATION: INOVUES UPFITS FIXED & OPERABLE WINDOWS AT THE UNIVERSITY OF MINNESOTA

- **CHALLENGE:** Single-glazed windows that lead to poor thermal comfort and energy loss.

- **SOLUTION:** INOVUES' patented Insulating Glass Retrofit (IGR) system, applied from the interior of operable and fixed windows without removing, replacing, drilling or altering any existing components.

- KEY TAKEAWAYS:

ENHANCED THERMAL COMFORT: Infrared (IR) winter-time images show a 19°F temperature difference between the retrofitted window on the bottom (60.9°F) and the colder original window on the top (41.9°F). The retrofitted window is closer to the recommended thermostat set point temperature of 68°F (per energy.gov), demonstrating it is significantly better at reducing heat loss.



ZERO-WASTE: INOVUES' solution eliminates waste by reusing existing frames and glazing, minimizing material use by approximately 70% compared to window replacements. It also eliminates the need for costly and disruptive demolition and abatements.

FINANCIAL UPSIDE: UMN achieved improved energy efficiency at a fraction of the cost of full window replacements. INOVUES' solution offered comparable performance at approximately 30% of the price, while delivering a more sustainable solution.

CASE STUDIES

Case Study 2: Creekside Five

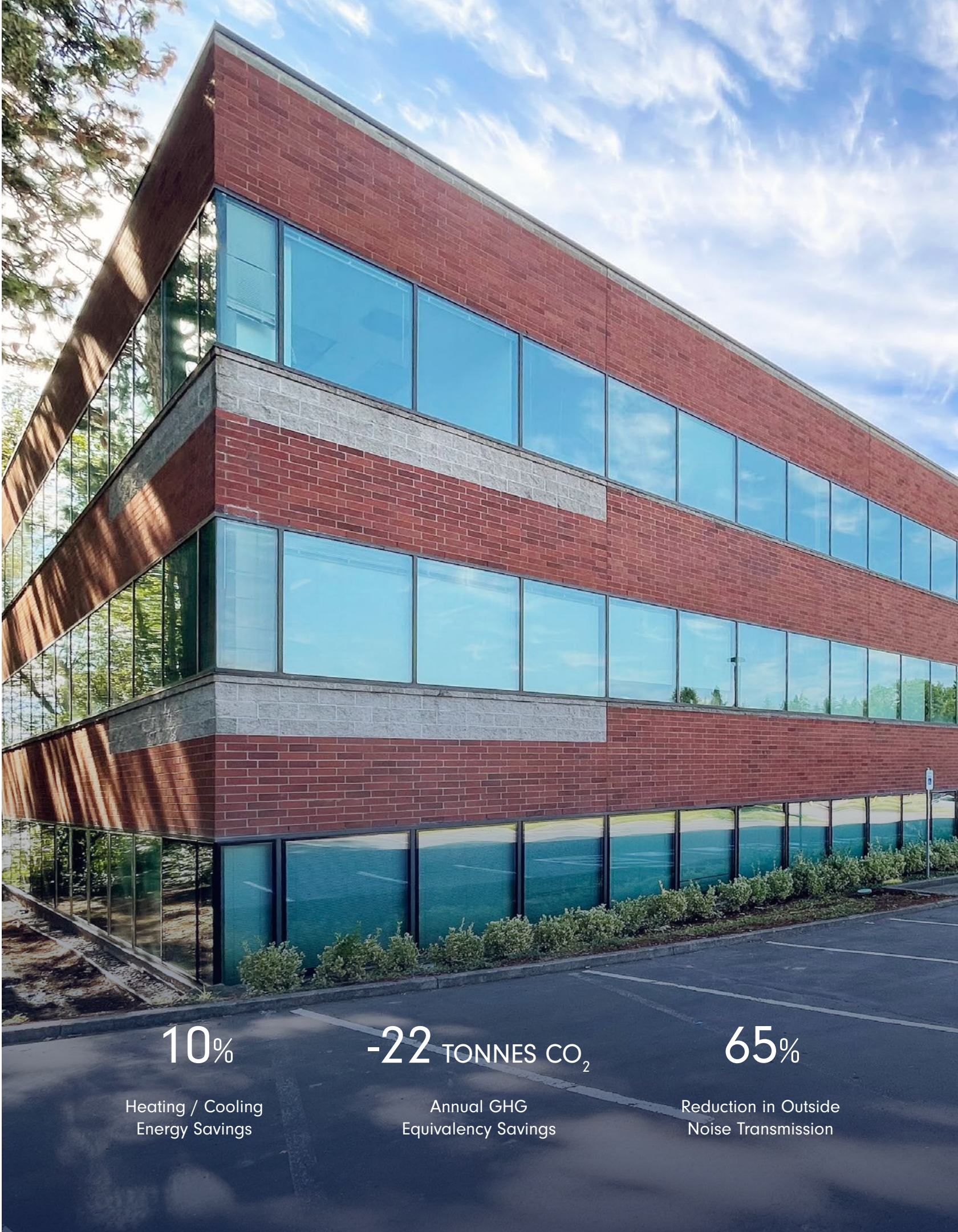
INOVUES MEETS ENERGY & CARBON REDUCTION TARGETS AT CREEKSIDE, OREGON

- **CHALLENGE:** Quick non-disruptive installation, maintain the facade aesthetic.
- **SOLUTION:** INOVUES transformed existing double-glazed windows into high-performance, triple-glazed windows.
- **KEY TAKEAWAYS:**

65% ACOUSTIC IMPROVEMENT: Independent studies on the window retrofit at Creekside by Energy 350 found a 5.4 dB reduction in sound transmission compared to the existing double-pane windows in a 90 dB exterior noise simulation. This significantly surpassed the targeted 3 dB improvement. It translates to approximately 65% reduction in sound energy, a welcome enhancement given the building's close proximity to a commuter railway and major roads.

10% HVAC ENERGY SAVINGS: Parallel energy models by INOVUES and a third-party energy consultant targeted 8% energy performance improvement. After two rounds of measurement and verification (M&V), the retrofit is on track to meet its target, conserving over 30,000 kWh of electricity per year, equal to 10% of heating/cooling electricity / 8% total energy savings.

SIGNIFICANT CO_2 IMPACT: Based on average national data from the EPA GHG calculator, the 30,000+ kWh annual savings eliminate 22 metric tons of CO_2 per year, the equivalent of burning over 24,000 pounds of coal or planting 360 trees.



10%

Heating / Cooling
Energy Savings

-22 TONNES CO_2

Annual GHG
Equivalency Savings

65%

Reduction in Outside
Noise Transmission

SWR

BREATHABLE SECONDARY WINDOW RETROFIT (SWR) SYSTEM

	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^2 F 5.92 W/m^2 K	0.42 Btu/hr ft^2 F 2.39 W/m^2 K	0.21 Btu/hr ft^2 F 1.18 W/m^2 K
R-Value (CoG)	0.96	2.77	10.99
SHGC	0.75	0.47	0.31
VLT	80	39	56

Compatible with most fixed windows and window wall systems. Installs quickly from the interior.

- **ENGINEERED SYSTEM:** breathable patent-pending design eliminates dust and heat build-up that could cause thermal stress, fogging, and condensation.
- **ULTRA-SLIM:** elegant profile available in multiple colors.

IGR

NON-INVASIVE INSULATING GLASS RETROFIT SYSTEM

	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^2 F 5.92 W/m^2 K	0.50 Btu/hr ft^2 F 2.85 W/m^2 K	0.32 Btu/hr ft^2 F 1.78 W/m^2 K
R-Value (CoG)	0.96	2.92	10.99
SHGC	0.75	0.34	0.31
VLT	80	64	48

Compatible with most windows and curtain walls, fixed or operable, as an exterior or interior retrofit.

- **HIGHLY COMPACT & LIGHTWEIGHT:** 1" total added thickness with 1.5" frameless-looking sightline and as low as 2 lb/sq. ft. total added weight.
- **INSULATING CAVITY:** 0.63" hermetically-sealed air gap, utilizing multiple primary and secondary seals and desiccants for longer service life.

BETTER TOGETHER:
WINDOW UPGRADES & HEAT PUMPS

SYNERGY

Energy-efficient window and facade retrofits enable heat pump technologies by reducing heating and cooling loads. Efficient facades help minimize the HVAC system size, driving down new and replacement equipment costs. They also allow heat pumps to operate more efficiently in a greater variety of climates.

EFFICIENCY

Especially in milder climates less prone to freezing temperatures, heat pumps can reach efficiencies of 300% or more, while gas furnaces have a maximum theoretical efficiency of 100%.

INCENTIVES

Greater than ever federal and utility incentives reduce the upfront cost of advanced window solutions and heat pumps, but they are available for a limited time.

CONCLUSION

The focus on window retrofits is a strategic investment in learning environments and outcomes. The return on investment is not only measured in dollars saved and carbon emissions reduced, but also in the successful education and wellbeing of students. Together, we can shatter the glass ceiling, making a lasting difference that resonates through classrooms and generations.

BECOME PART OF THE SOLUTION

Contact INOVUES today to start your journey to energy savings and enhanced thermal and acoustic comfort. From assessment of your building's energy use and budget-smart retrofit recommendations to incentive and rebate application assistance, we offer an integrated path to better, more sustainable buildings.

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