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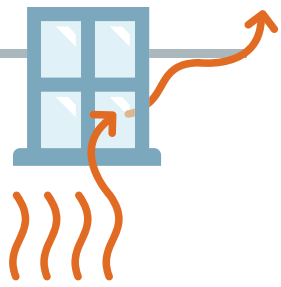
MARCH 2024

ULTRALIGHT INSULATING PANELS FOR OPERABLE WINDOWS

OPPORTUNITY

How much energy do windows use?

34% OF COMMERCIAL ENERGY USE IS ATTRIBUTED TO WINDOWS[1]



TECHNOLOGY

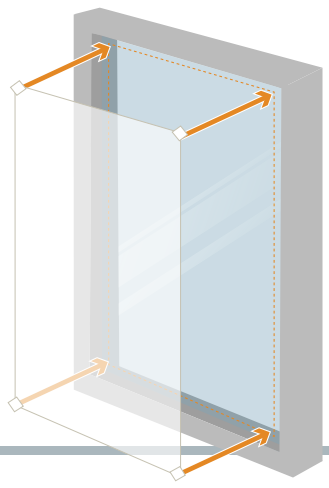
How do window insulation panels work?

SNAP-ON PANELS

Ultra-light (0.17 lbs/ft^2) panels mount to the interior glass surface of existing windows.

Two versions: one for shaded facades/cold climates and one with a coating to block solar heat gain for sunny facades/warm climates.

Made with low-embodied carbon materials that can be recycled.



M&V

Where did Measurement and Verification occur?

PACIFIC NORTHWEST NATIONAL LABORATORY (PNNL) assessed the impact of window insulation panels, provided by WexEnergy, at the Eau Claire Federal Building and Courthouse in Eau Claire, Wisconsin.

RESULTS

How did window insulation panels perform in M&V?

52%
INCREASE IN INSULATION
Improved the center-of-glass U-factor from 1.15 to 0.55.[2]

10-MINUTE INSTALLATION
Ultra-light panels simplify retrofit installation. Requires no skilled labor and few tools.[3]

2%–7%
WHOLE BUILDING ENERGY SAVINGS
4–7% modeled savings for warm climates and 2–7% for cold climates, based on a single- or double-pane baseline. Highest savings for single-pane windows with non-metal frames.[4]

More Cost-Effective in Warm Climates

Positive return on investment possible at scale*

Location			Savings from Single-Pane Window with Non-Metal Frame					
Climate/Panel	Zone	City	Electricity Savings kW/ft^2/yr	Gas Savings kbtu/ft^2/yr	Annual Savings $/ft^2/yr	Whole-Building Savings %	Payback* yrs	SIR positive ROI if >1
Warm SHGC Coating	1A	Miami, FL	1.3	0.0	$0.17	6%	14	1.1
	2A	Houston, TX	1.2	0.1	$0.16	6%	15	1.0
	2B	Phoenix, AZ	1.7	0.1	$0.23	7%	10	1.5
	3A	Atlanta, GA	1.2	0.3	$0.15	6%	15	1.0
	3B	Las Vegas, NV	1.4	0.1	$0.19	7%	13	1.2
	WARM CLIMATE AVG.		**1.4**	**0.1**	**$0.18**	**6%**	**13**	**1.2**
Moderate SHGC Coating	3C	San Francisco, CA	0.2	0.3	$0.03	2%	78	0.2
	4A	Baltimore, MD	0.5	1.6	$0.08	4%	38	0.5
	MODERATE CLIMATE AVG.		**0.3**	**0.9**	**$0.05**	**3%**	**58**	**0.3**
Cold No Coating	5A	Chicago, IL	0.5	2.9	$0.09	6%	21	1.0
	5B	Boulder, CO	0.5	1.8	$0.08	5%	22	0.9
	6A	Minneapolis, MN	0.5	4.0	$0.10	7%	20	1.1
	COLD CLIMATE AVG.		**0.5**	**2.9**	**$0.09**	**6%**	**21**	**1.0**

*Assuming a 54K ft^2 building with < 10 uniquely-sized fixed ribbon windows; average GSA utility rates of $0.13/kWh for electricity and $9.10/MMBtu for gas; installation cost of $1.6/ft^2; and material cost of $16/ft^2 for the panel with SHGC coating in zones 1A-4A and $9/ft^2 for the panel without coating in zones 5A-6A.

DEPLOYMENT

Where does M&V recommend deploying window insulation panels?

CONSIDER WHEN IT IS IMPORTANT TO KEEP WINDOWS OPERABLE

- Best suited to operable single-pane or older double-pane windows that do not have condensation issues.
- Also consider for large windows that are comprised of smaller glass panes, and historic buildings where an envelope upgrade is needed to achieve net-zero operations.

[1]Apte, J. and D. Arasteh. 2006. Window-Related Energy Consumption in the US Residential and Commercial Building Stock. Berkeley, CA: Lawrence Berkeley National Laboratory [2]Window Retrofits: Ultralight Window Insulating Panels, Michael Myer, Edward Louie, Ammar Dehwar (PNNL), February 2024, p. 7 [3]Ibid, p. 8 [3]Ibid, p. C-12