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How much energy can really be saved by replacing windows?

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How much energy will WASCO windows save me?
The exact savings on your energy bill are difficult to predict, due to year-to-year changes in the severity of winter and warmness of summer, as well as changes in energy costs. Even if these factors are ignored, the percentage savings you will see remains dependent on what type of windows your house has now, how good of condition your windows are in, and how well insulated your home is.

If the exact savings can't be predicted, can WASCO give a typical range?
For a typical existing construction house[1] in Milwaukee, savings (on the *heating/cooling portion* of the energy bill) can reach 25% for the worst, but uncommon, case – a house with leaky, wood single pane windows with no, or ineffectual, storm windows. As far more common case is a house with insulated glass windows, or single pane windows with good storm windows, where savings would be around 9%. If your house is better insulated than the "typical" house, your percentage savings will be greater (although the dollars saved would be similar). If your house has relatively more windows per square foot of floor, energy savings can be greater. Likewise, if your house has relatively few windows, the savings will be less.

Your competitor claims greater energy savings than the above numbers. How can this be?
Claims of excessively high energy savings are often made by unrealistic assuming the existing conditions. For example, performing calculations based on an existing house that is well-insulated, except for a a large number of leaky, aluminum single-pane windows will result in a calculated savings significantly higher than the 25% stated above. These assumed existing conditions usually are likely much different than the **real** existing conditions inside your home! Another trick used by some manufacturers is to quote the maximum possible savings in peak cooling bills, instead of the total energy costs for a house over a whole year.

How can some companies guarantee energy savings?
A quick internet search turns up companies guaranteeing as high as 40% savings. Unfortunately, engineering simulations show that such claims are false. Companies make such guarantees by limiting the duration of the guaranteed energy savings and setting high standards for proof that their products did not perform as advertised. Then, they build into their price the added cost of honoring the guarantees of the few who successfully complain.

Why does WASCO offer low and high SHGC options, and which is recommended?
In Wisconsin's climate, a higher SHGC, especially on southern windows, actually **reduces** annual energy costs. WASCO therefore offers high SHGC packages using cardinal LoE180 glass to take advantage of this free source of renewable energy. If your home has many south-facing windows, this

[1]See the tables of assumptions at the end.

glass will be the best option. However, low SHGC glazing using cardinal LoE^3 366 yields greater comfort, and is the right choice if your home has many unshaded west-facing windows, through which the hot summer sun can bake a room in the afternoon.

Why doesn't WASCO recommend triple panes in the double-hung windows?
Although WASCO offers a triple pane option on its 700R double hung window, we recommend that consumers save their money in this case. The optimum space between the panes of glass for typical Wisconsin winter temperatures is ½" to 5/8". Glazing with these gaps does not fit in sliding window designs designed to fit well in the standard North American 3 ¼" "pocket". Therefore, a 5/16" gap is used. This increases the U-Factor of the glass by about 40% compared to the wider gaps. Because there are two panes of glass in a double hung, the triple pane option for hung windows comes at a higher cost than it does for casements. The combination of higher cost and lower performance make it hard to justify the triple pane glass based on energy savings in a double-hung window. However, some customers may still choose this option for comfort.

Useful Websites

www.nfrc.org The National Fenestration Registration Council

windows.lbl.gov Windows and Daylighting Group, Lawrence Berkeley National Laboratory

www.efficientwindows.org This website has online calculators for energy costs. WASCO is a member of this organization.

About the Author

David joined WASCO Windows, the family business, full-time in 2006 after more than a decade of industrial and academic experience. (He worked in the factory summers during high school, and has consulted for the company many instances since then.) He worked as an engineer for Cleaver-Brooks (a Milwaukee-based manufacturer of boilers), where he did structural as well as thermal design, and for Siemens Power Generation in Milwaukee and Germany, where he developed software for analyzing field test results. He has taught thermodynamics and power plants at Marquette University in Milwaukee, and most recently was a senior research associate at the Technische Universität Berlin in Germany, where he worked for the Institute for Energy Engineering in the area of Energy Conversion and Environmental Protection.

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Assumptions used in the simulation:

Simulation program:	ResFen 6.0
Location:	Milwaukee
House type:	2-Story existing frame (Envelope WV1)
Foundation type:	Basement
HVAC system type:	Gas furnace/AC
Total floor area:	2000 ft^2
Total window area:	300 ft^2, equally divided among the four sides
Electricity cost:	0.085 $/kWh
Gas cost:	0.928 $/therm

Window data used:

	WASCO Casement, high SHGC, dual pane	**Leaky, single glazed windows**	**Older clear insulated glass windows**
U-Factor (Btu/hr-ft^2°F)	0.27	0.84	0.49
SHGC	0.40	0.63	0.56
Air leakage (cfm/ft^2)	0.01	0.6	0.3

Results

	WASCO Casement, high SHGC, dual pane	**Leaky, single glazed windows**	**Older clear insulated glass windows**
Heating costs	$910.04	$1181.62	$980.57
Cooling Costs	$62.22	$83.30	$86.87
Total	$972.26	$1264.92	$1067.44