

Question: During winter months, how can heat loss associated with older single glazed (single layer of glass) windows be reduced?

Answer and Discussion:

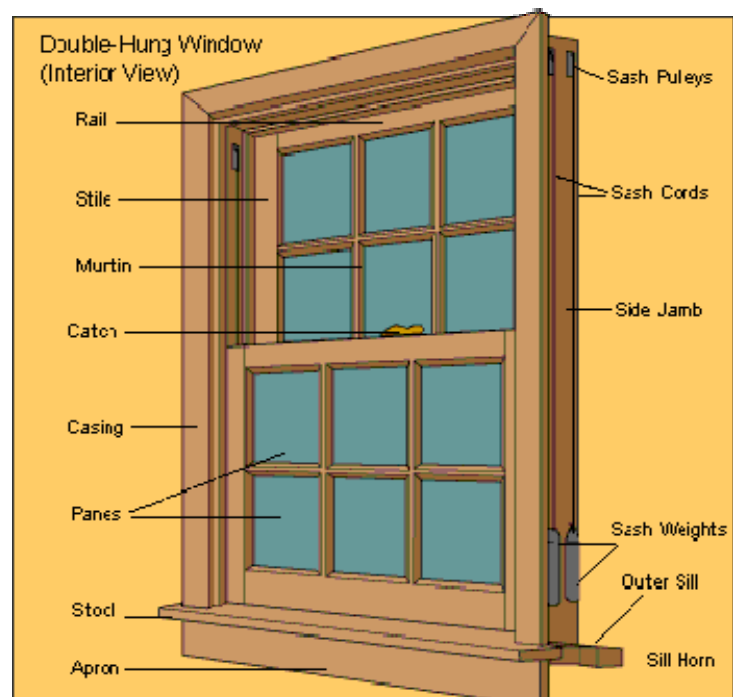
Yes, there are several steps that can be taken to reduce heat loss through older single glazed windows..

Simple, quick steps for tightening up an older window

- Replace cracked/broken window panes. Even cracked pieces of glass will let in lots of cold air. If you are on a tight time or money budget a short-term inexpensive fix is to simply seal cracks with clear adhesive tape.
- Replace missing/deteriorated glazing. This prevents air from entering from around glass panes and is also very important for long-term maintenance. Always paint the glazing after it has cured, and remember to overlap a thin line of paint onto the glass. This will help to keep moisture from running down the outside of the glass and getting under the glazing where it can eventually rot the muntins (see Figure 1 for graphic showing names of window components)..

Figure 1: Parts of a Double Hung Window

- Make certain that a sash lock(catch) is present and in good working order¹. A proper fitting sash lock has significant impact on the air-tightness of a double hung window. The lock should pull the upper and lower window sash tightly together, and at the same time push the bottom sash down and the top sash up. You may need to spend some time cleaning the back of meeting rails. Often dried paint drips will prevent the top sash from fully contacting the bottom sash at the meeting rail. Make certain those surfaces are flat and smooth for a good seal.



- Wide window sash may require two window locks(catches) to get a tight seal across the full width of the meeting rails.
- Adding a thin piece of foam weather stripping to the sill and head jamb to improve the seal when the windows are closed and locked will further increase air tightness, which increases energy efficiency.

¹ If the screw holes for the sash lock are worn and oversized you can tighten them by taking a small piece of wood match stick or tooth pick and inserting them in the oversized hole along with a drop of wood glue. Wait 24 hours and the screws should fit tightly when re-inserted.

- Putting a thin bead of caulk where the interior casing touches the interior walls may also increase air tightness.
- There are special gaskets made that are designed to fit over counterweight pulley's. They are made in such a way so that they allow the pulley to turn and allow the sash cord move, but still seal out the cold air that may be infiltrating from a poorly sealed counterweight cavity.
- A simple and inexpensive step to significantly reduce heat loss through windows is to use a clear plastic sheet on a frame or tape clear plastic film to the inside of your window frames during the cold winter months. You must tape the plastic tightly to the window frame. This can dramatically reduce heat loss via air leakage around window components. It will also reduce conductive heat loss through the window.
- Install energy-saving window treatments on windows, close them at night and open them during the day on those windows exposed to the sun. Commercially made insulated window treatments are expensive to purchase. However the materials to make insulated window treatments can be purchased at fairly low cost. They can be made by anyone with simple sewing skills. Cornell Cooperative Extension Housing Fact Sheets on how to make energy saving window treatments are available on the College of Human Ecology web-site at: <http://www.human.cornell.edu/che/DEA/outreach/housingfactsheets.cfm>

Question: Will installing energy efficient replacement windows lower my heating costs?

Answer: Yes, but not significantly.

Energy experts advise homeowners to replace older windows only if they are rotted or worn out or if the convenience of tilt-back windows for cleaning purposes is very desirable. They caution not to replace windows if the primary goal is to reduce heating costs.

In Autumn 2003 I investigated how much it would cost to replace the existing single-glazed wood windows (R-1) in my 95 year old home with new, highly energy efficient double-glazed, low-E, argon-filled vinyl replacement windows (R-3). Here is what I learned.

- My existing 19 windows lose about 17.4 million BTU's of heat each heating season
- The annual cost of this lost heat is about \$130
- New highly efficient ENERGY STAR² rated vinyl replacement windows would lose about 2 million BTU's of heat annually. The annual cost of this lost heat would be about \$16.
- If I install the vinyl replacement windows the total annual savings on my heating bill would be about \$114.
- To realize this annual \$114 savings I would need to invest \$8000 in vinyl replacement windows.

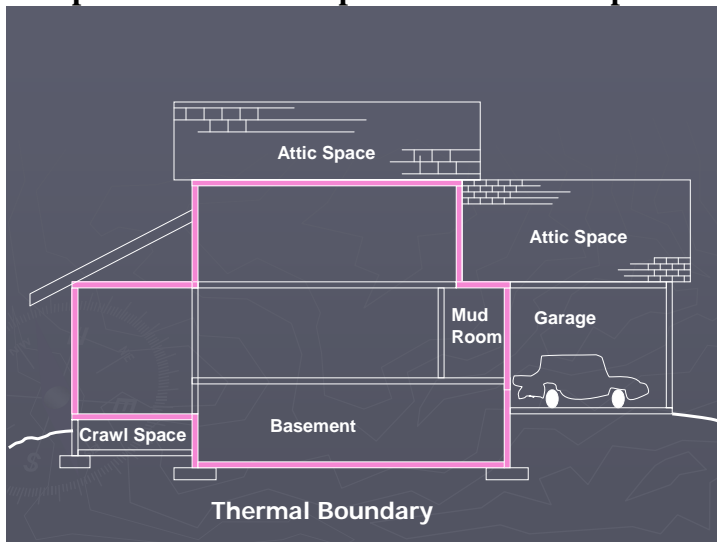
² ENERGY STAR is a joint program of the United States EPA and The U.S. Department of Energy. The ENERGY STAR label helps consumers identify the most energy efficient products on the market. Only windows with an R-value of 2.8 or higher can carry the ENERGY STAR label.

Spending \$8,000 to save a little over \$100 per year does not seem like a good investment for reducing my heating bills. And vinyl windows would subtract from the beauty of my older home, rather than add to it as my older windows do. In addition, there are other less expensive options available to me for reducing loss of heat through my older windows. For example, a recent case study completed by the National Association of Home Builders (NAHB) Research Center and Lawrence Berkeley National Laboratories found that installing storm windows made with low-e glass over existing single glazed wood windows was just as effective at reducing window heat loss as having double glazed, gas-filled low-e replacement windows (R-3) installed. Low-E storm windows can be installed at a fraction of the cost of highly efficient replacement windows. The low-e storms reduced annual energy consumption for heating purposes by an average of 21% compared to a reduction of 13% for plain glass storms.

Question: What are the advantages of caulking windows on the outside rather than inside:

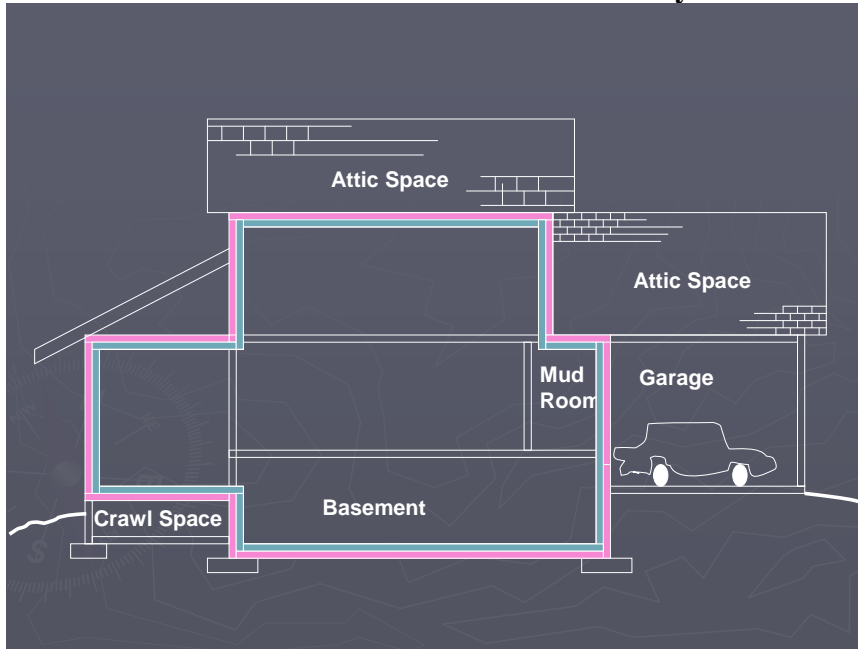
Answer: If the reason the windows are being caulked is to reduce rain penetration into the building, then the caulking must be done on the outside. But if the primary reason windows are being caulked is to reduce heating costs due to air infiltration/exfiltration, then there is no advantage to caulking windows on the outside. In fact caulking windows on the outside will do little to cut down on air leakage from the building. Some understanding of building envelope basics is required to understand why this is so:

Complete and uninterrupted thermal envelope



The slide above illustrates a house with the thermal boundary highlighted in pink. The thermal boundary is the insulation material installed in a homes walls ceilings and floors that separate heated from un-heated spaces. Ideally a newly built home will have some type of insulation material completing surrounding the heated spaces of the house (yes, even under the concrete basement floor). There should be no gaps or openings in this thermal envelope. But the thermal envelope is only half of what is required to obtain a comfortable home with low annual heating costs. It must also have an air boundary.

Continuous unbroken Air and Thermal Boundary



And the air boundary (illustrated in blue in the above slide) must be exactly aligned with, and always in contact with the thermal boundary (the insulation). Of course it is very difficult to add a complete and continuous air boundary in an existing home. The time to make certain the air and thermal boundaries are complete, uninterrupted and always touching each other is when a house is built, unfortunately, even at present, few houses are constructed in this way. And until they are our homes will become increasingly more expensive to heat and cool as the cost of energy rises.

What does all this have to do with caulking windows on the inside rather than the outside? The building's interior wall material³, typically plaster or gypsum wall board, can act as a fairly good air barrier. However we must take action to seal any penetrations in the plaster or gypsum if we are to obtain a reasonably good air barrier and thus reduce heat loss from the building. Basically a window opening is a penetration of the gypsum or plaster coated walls. It is a leak in the air barrier.

As mentioned earlier, installing a clear plastic sheet on a frame or taping clear plastic film to the inside of window frames during cold winter months can cut down on air leakage through the actual window components. But to keep air from escaping between the

³ Please note that an air barrier on the exterior side of the insulation can also be effective. And in new construction this is sometimes accomplished by using the exterior plywood sheathing. But in existing homes the exterior sheathing is under the siding. Therefore we cannot gain access to the exterior sheathing as easily as we can the interior wall finish material. In addition many older homes were constructed with narrow board sheathing. Creating an air barrier on the exterior side of such a wall would be almost impossible because of the number of joints.

window frame and window rough opening we need to apply a bead of caulk where the **interior** casing touches the **interior** walls.