



Weatherizing Older Wood Double-Hung Windows

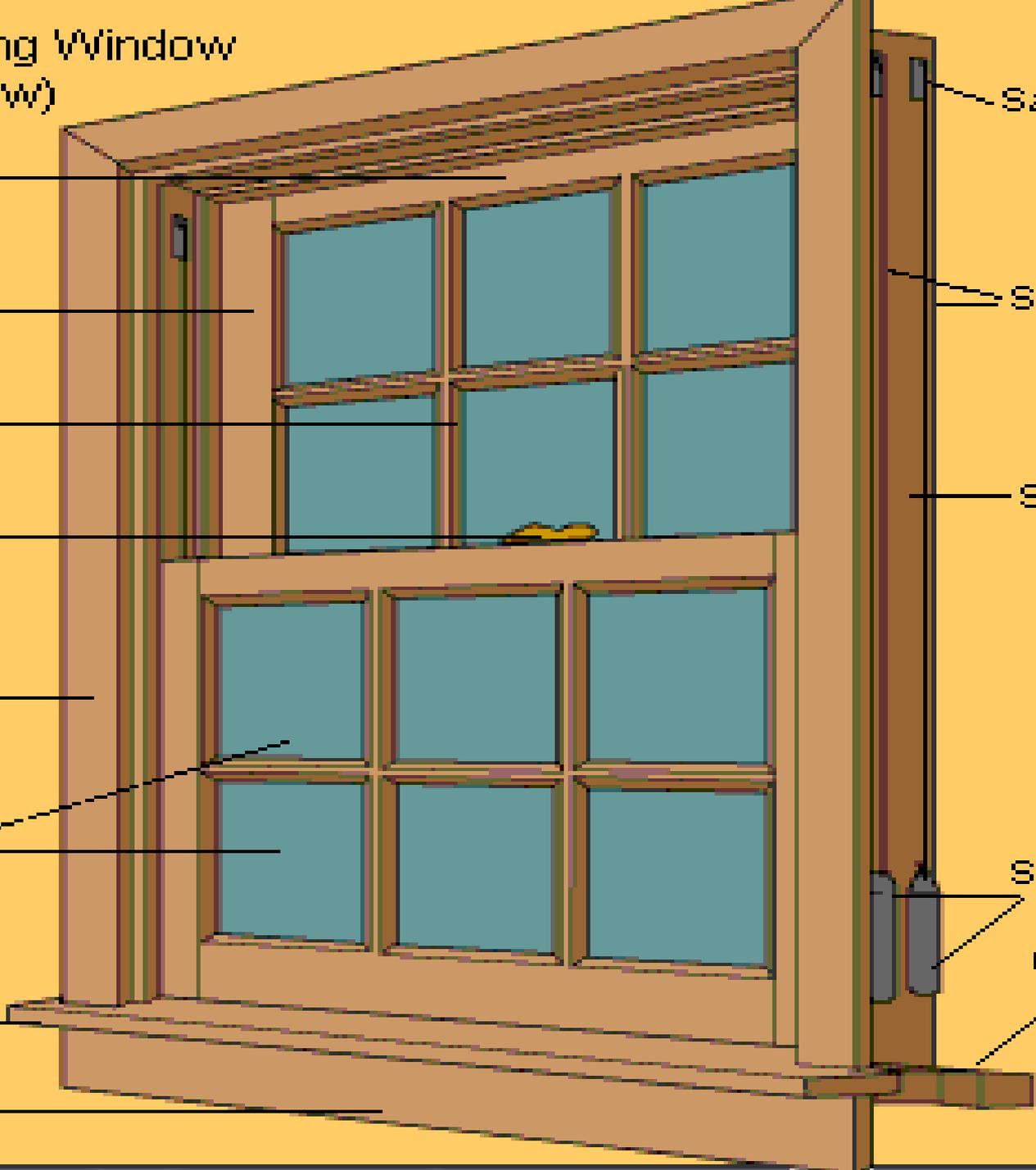
OVERVIEW

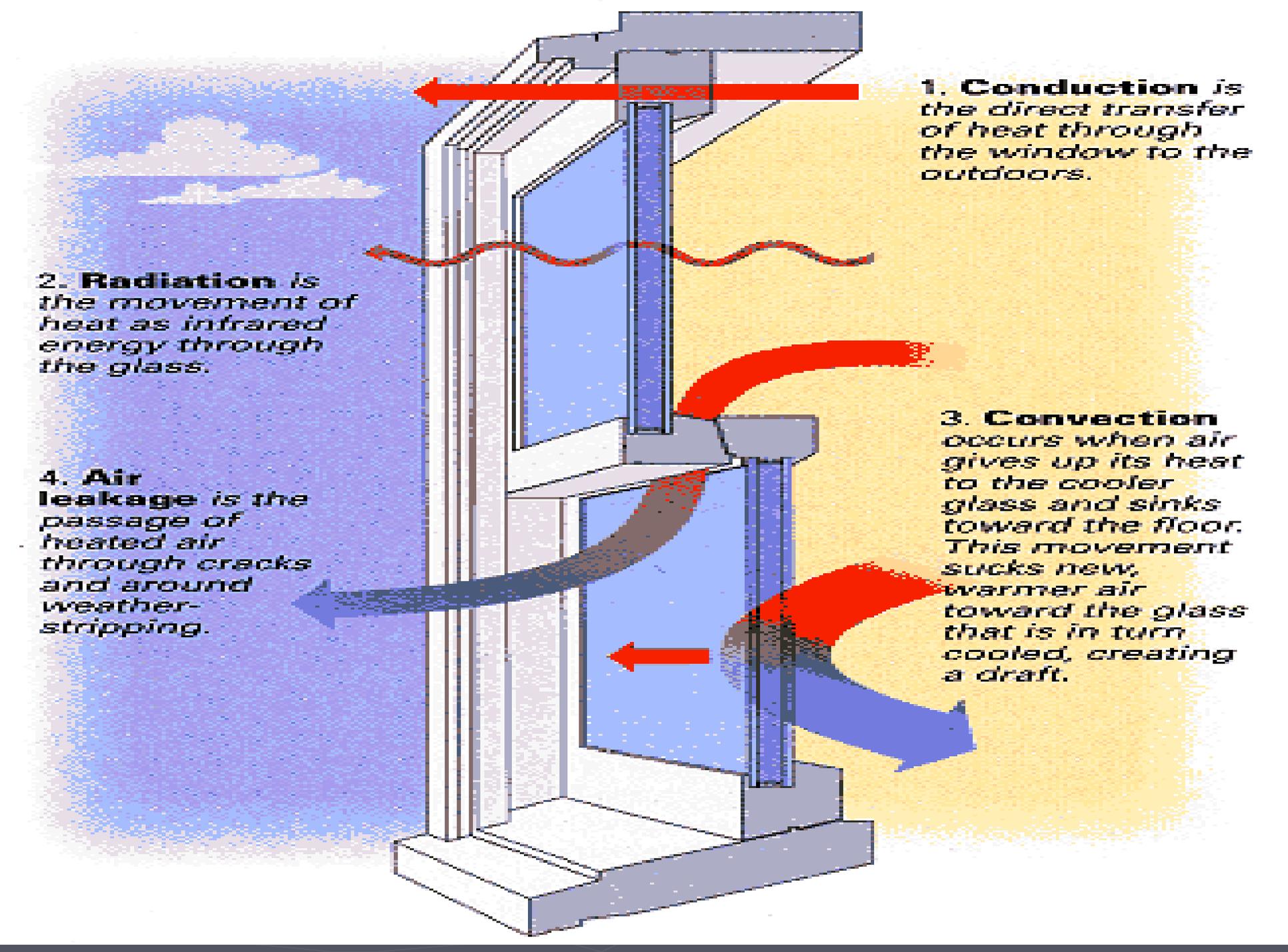
- ▶ Why keep older wood windows?
- ▶ Windows and Heat Loss
- ▶ Background information about residential energy efficiency
- ▶ Three most cost effective methods for reducing heating costs in older homes
- ▶ Methods for weatherizing older windows

Double-Hung Window (Interior View)

- Rail
- Stile
- Muntin
- Catch
- Casing
- Panes
- Stool
- Apron

- Sash Pulleys
- Sash Cords
- Side Jamb
- Sash Weights
- Outer Sill
- Sill Horn



A cross-sectional diagram of a window frame and glass panes. The interior is on the right, colored yellow, and the exterior is on the left, colored blue with clouds. A red arrow at the top points from the interior through the window to the exterior. A wavy red arrow points from the interior through the glass pane to the exterior. A blue arrow at the bottom points from the interior through a crack in the weatherstripping to the exterior. A blue arrow on the right side points from the interior through the window frame to the exterior. A red arrow on the right side points from the interior towards the glass pane. A blue arrow on the right side points from the interior towards the floor.

2. Radiation is the movement of heat as infrared energy through the glass.

4. Air leakage is the passage of heated air through cracks and around weather-stripping.

1. Conduction is the direct transfer of heat through the window to the outdoors.

3. Convection occurs when air gives up its heat to the cooler glass and sinks toward the floor. This movement sucks new, warmer air toward the glass that is in turn cooled, creating a draft.

Why Keep older windows?

- ▶ Economic Reasons
- ▶ Beauty Reasons



Economic Reasons

Double-glazed, argon filled, low-e replacement¹ windows will reduce heating costs –but not significantly

- ▶ Research and case studies show that \$ spent on replacement windows is a poor investment in regard to reducing space heating and cooling costs

- ▶ ¹Replacements , not purchasing new windows for a new home. When that is the case purchase most efficient window possible

Economic reasons

Consumer Reports Study:

Replacing single pane with double pane, Krypton gas fill, two low-e coatings (R-3.2):

Cost = **\$9,700** (not including installation)

Annual savings on heating costs: \$156

RES-FEN Computer program LBNL
(My own home in Ithaca)



RES-FEN Computer program ^{LBNL} (My own home in Ithaca)

- ▶ Replacing 19 single glazed wood windows with vinyl replacement windows (R-2.8)
- ▶ Cost: \$8,000 Installed
- ▶ Projected annual savings on heating costs:
\$100

Replacement windows and saving money on heating

- ▶ Replace wood windows if they are worn out, or if you want the convenience of tilt-back windows for cleaning purposes
- ▶ Don't Replace wood windows if your primary goal is to reduce heating costs (some steps to take later)

* Metal Windows

** New Homes & Deep Energy Retrofits**

High performance windows purchasing program

www.WindowsVolumePurchase.org

National Fenestration
Rating Council

	World's Best Window Co. Millennium 2000 ⁺ Vinyl-Clad Wood Frame Double Glazing • Argon Fill • Low E Product Type: Vertical Slider
ENERGY PERFORMANCE RATINGS	
U-Factor (U.S./I-P) 0.35	Solar Heat Gain Coefficient 0.32
ADDITIONAL PERFORMANCE RATINGS	
Visible Transmittance 0.51	Air Leakage (U.S./I-P) 0.2
Condensation Resistance 51	—
<small>Manufacturer certifies that these ratings conform to applicable NFRC procedures for determining whole product performance. NFRC ratings are determined for a fixed set of environmental conditions and a specific product size. NFRC does not recommend any product, and does not warrant the suitability of any product for any specific use. Consult manufacturer's literature for other product performance information. www.nfrc.org</small>	

The Case for Beauty in Keeping Older Windows



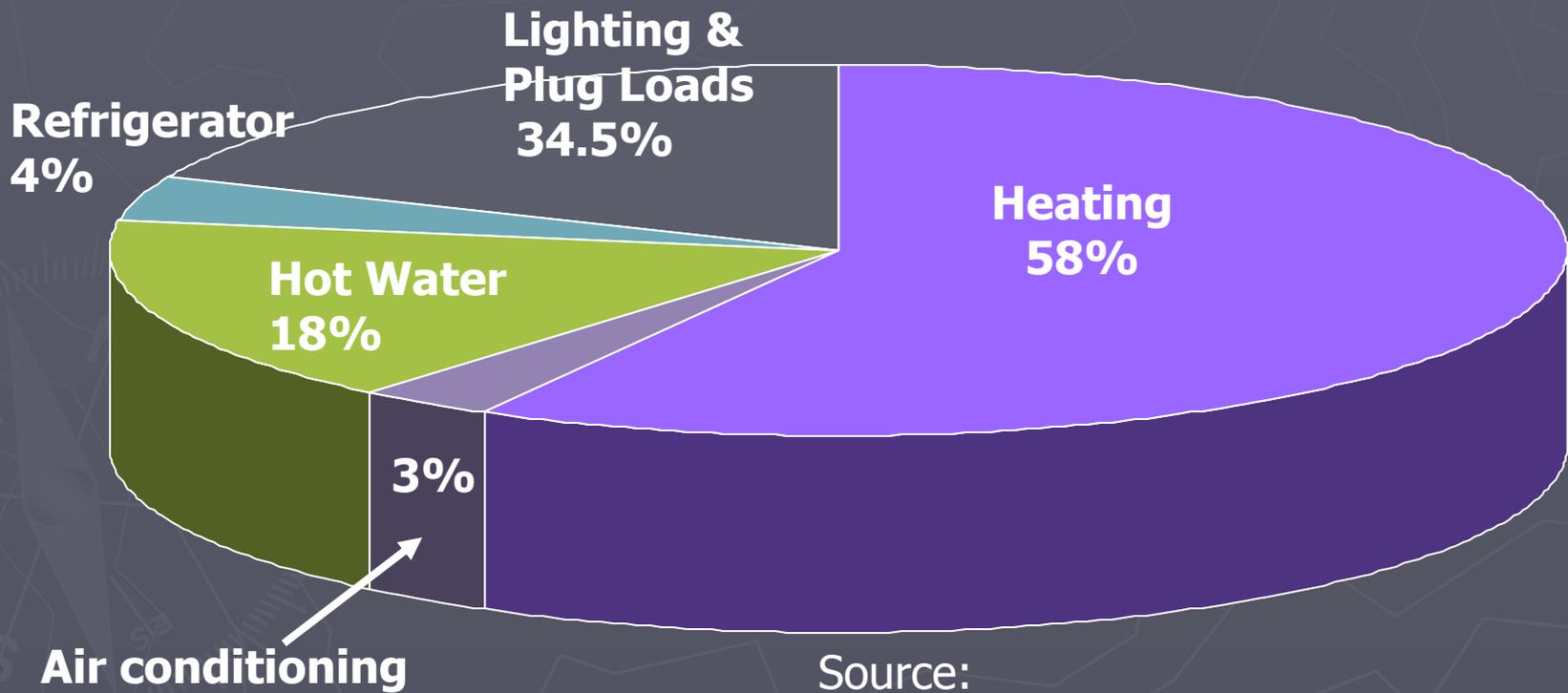


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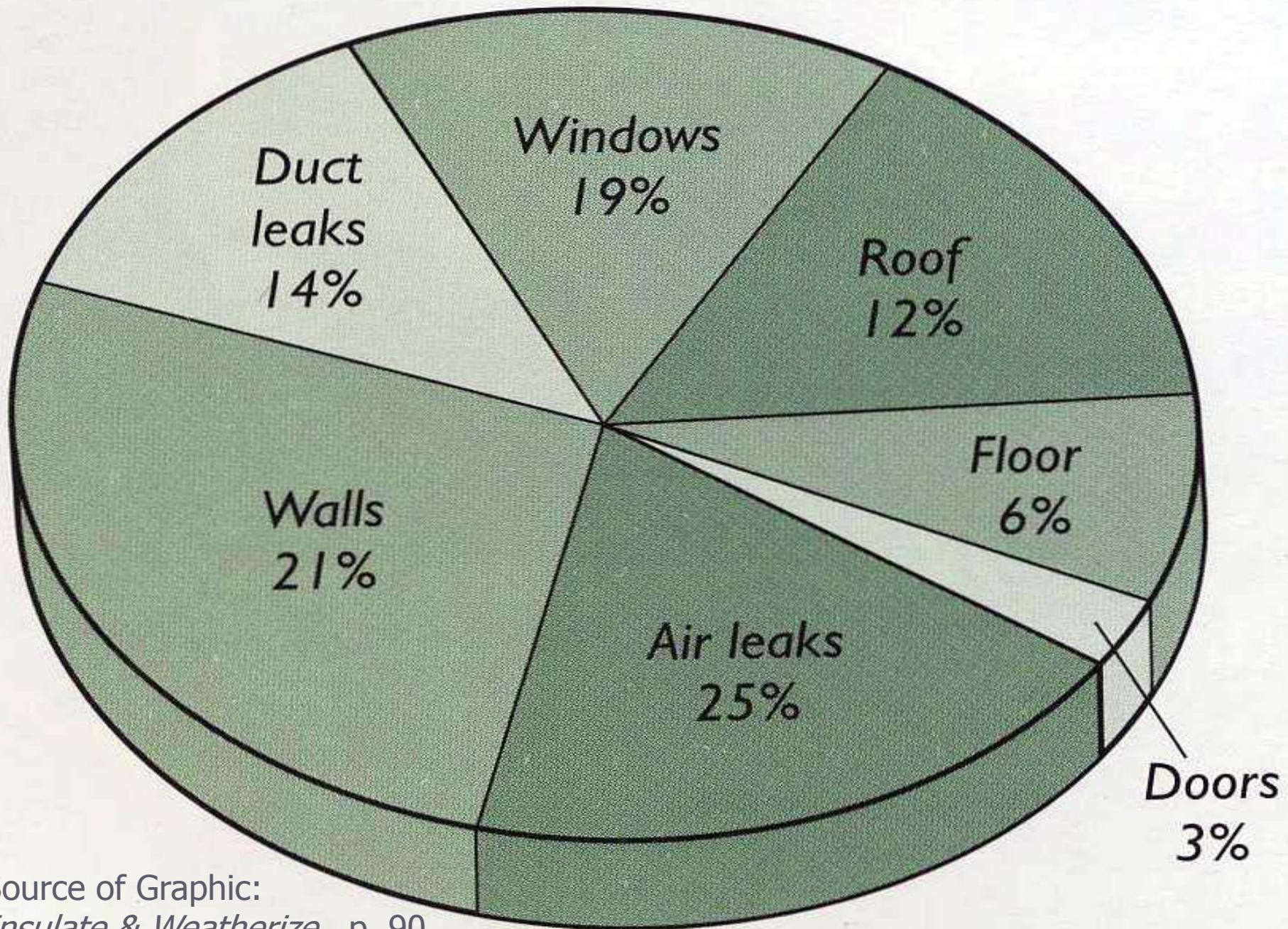




Home Energy Use Percentage of Energy (BTU's) Consumed



Source:
2001 Residential Energy Consumption Survey
Energy Information Administration

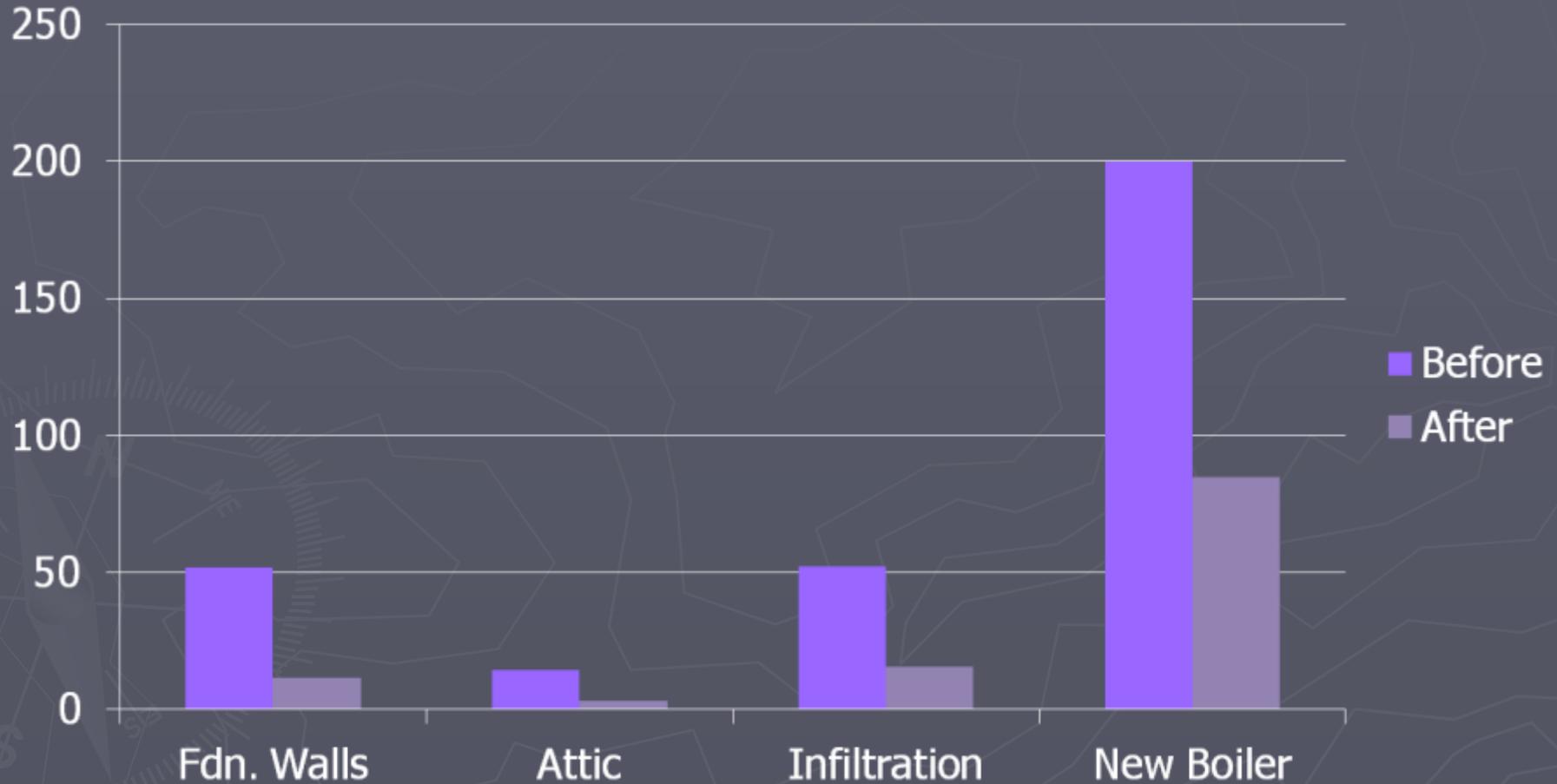


Source of Graphic:
Insulate & Weatherize, p. 90

Most Effective Strategies for Reducing Home Heating Costs

- ▶ Reduce air leakage into/out of the house¹
- ▶ Increase Thermal Insulation Levels²
- ▶ Update Heating System³
 - Have Furnace Ducts Sealed
 - Duct leaks responsible for up to 14% heating system losses (houses heated with a furnace)

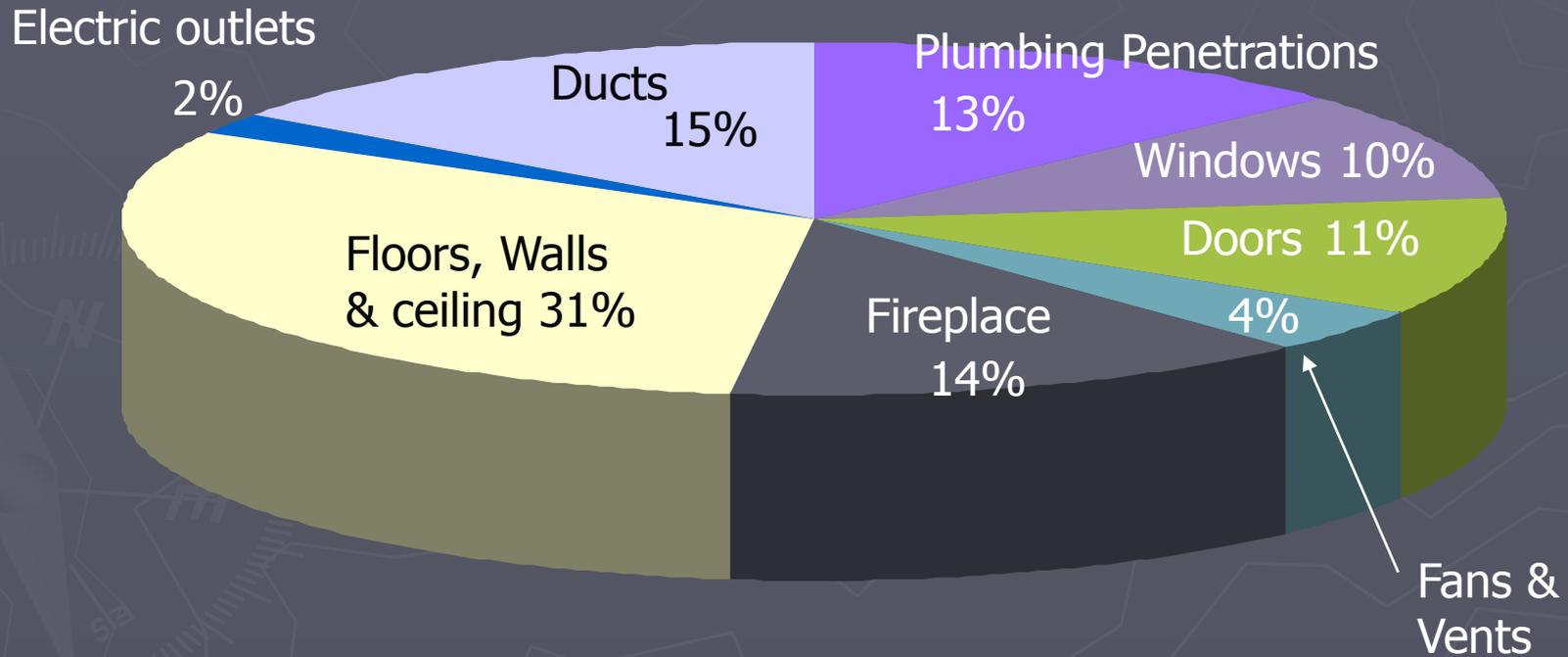
Energy Modeling 611 Utica Street



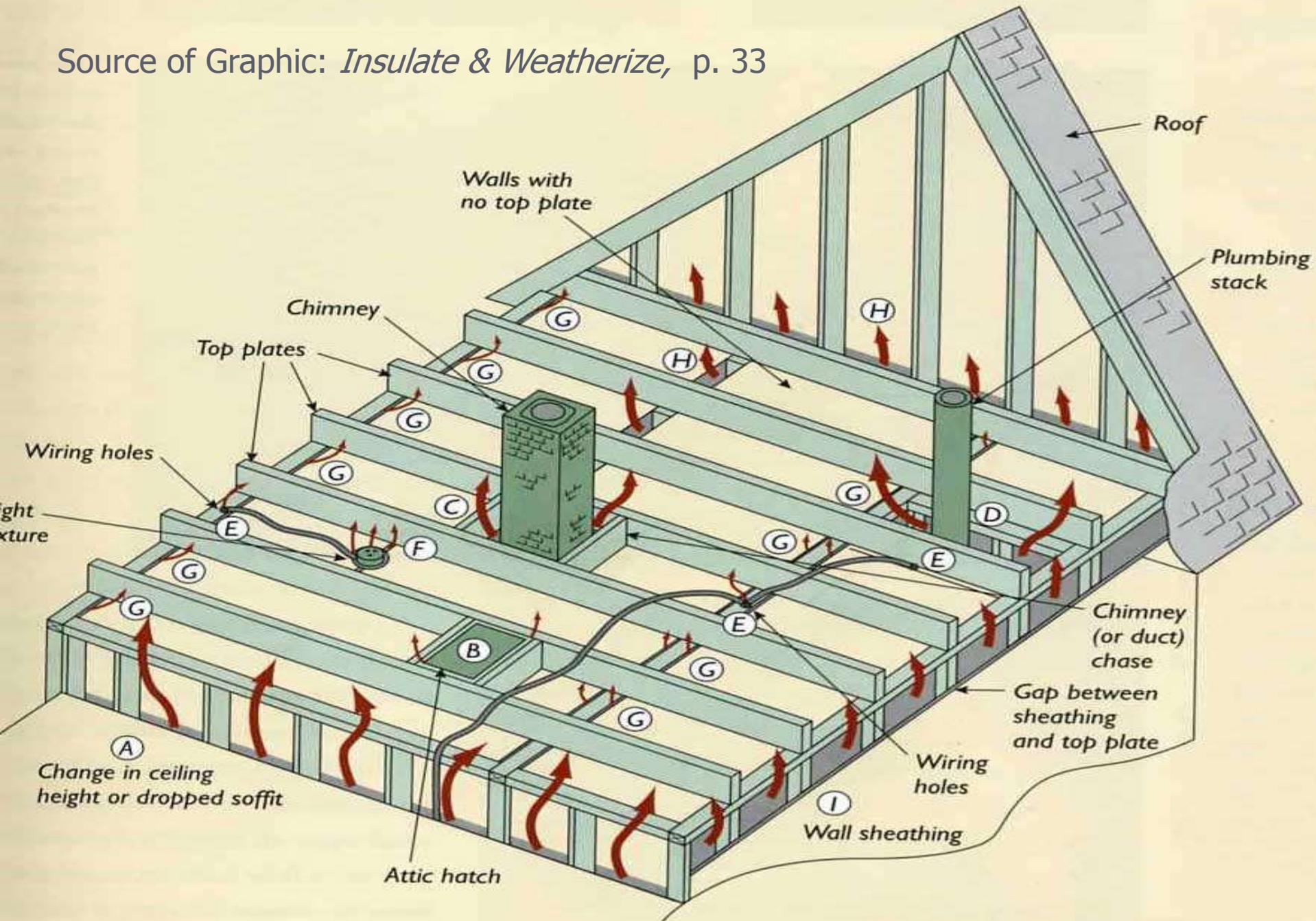
The Thermal Stack Affect (What Drives Air Leakage)



Where Air Leaks Are Located



Source of Graphic: *Insulate & Weatherize*, p. 33





Sealing Air Leaks in Building Envelope

- ▶ Least Expensive Energy Saving Step
- ▶ Most often overlooked step in home weatherization
- ▶ Strong potential for high return on \$ spent for air sealing
- ▶ Most effectively done with use of a blower door

Recommended Thermal Insulation Levels

Attics: Code is now R-49, R-60 best

Frame Walls: Code is now R-20 or 13 + 5
R-40 best

Foundation Walls: Code: R-15, R-20 better

Most insulation products do not block air flow

Air sealing is a separate step and should be done before adding insulation

END

