



# Airflow Control, Air Barriers, and Energy

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## Introduction

- Energy and R-value
- Airflow Control vs Air Barriers
- Airflow and Energy
- Metrics and Measurement





## Energy is important

- Slowing heat loss/gain through enclosures is important part of future buildings
- “High R” walls are required, new/retrofit
- But R-value is not a good measure for good enclosures

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## R-value: ASTM C518

- FTC “Rule” R-value reported at mean temperature of 75 F
- Typical hot plate: 95F, cold plate 55F

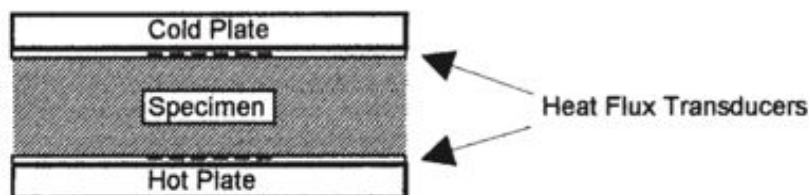


FIG. 3 Apparatus with Two Heat Flux Transducers and One Specimen

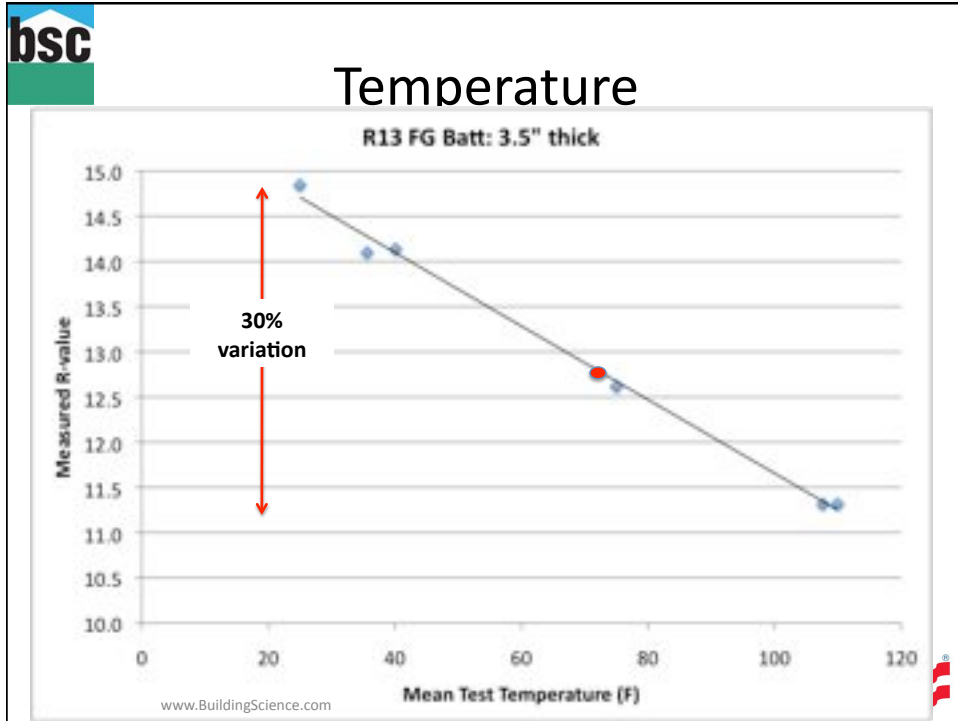
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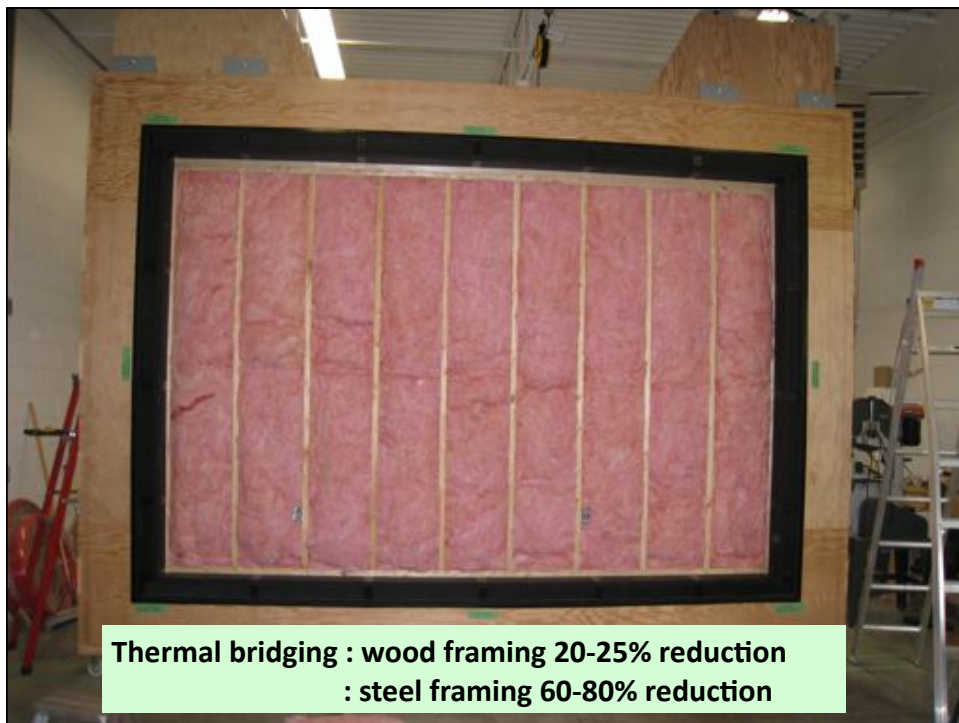


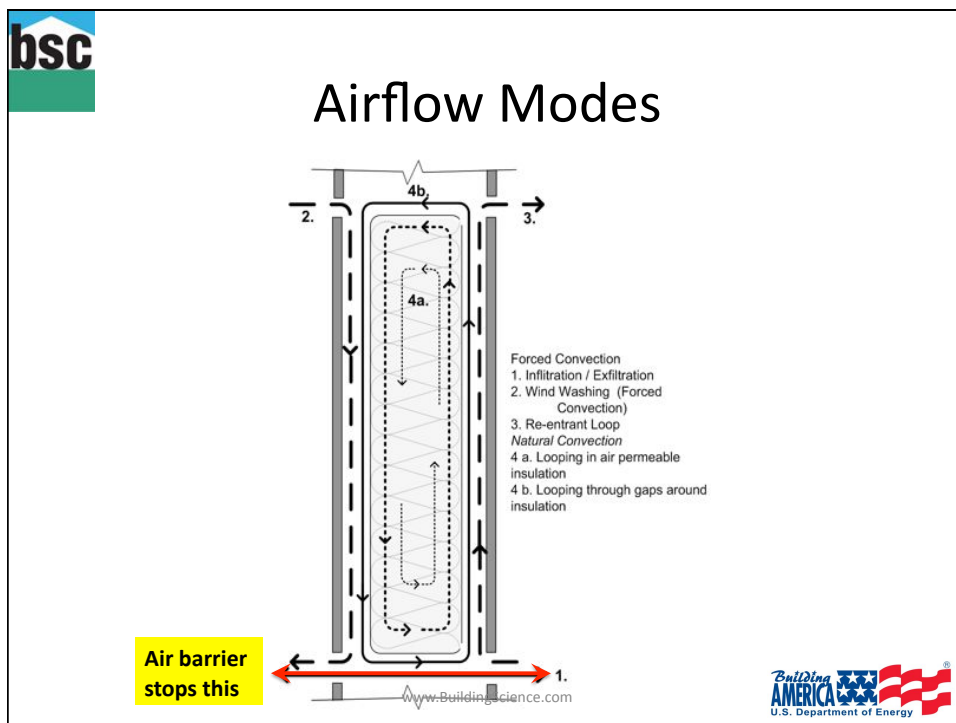
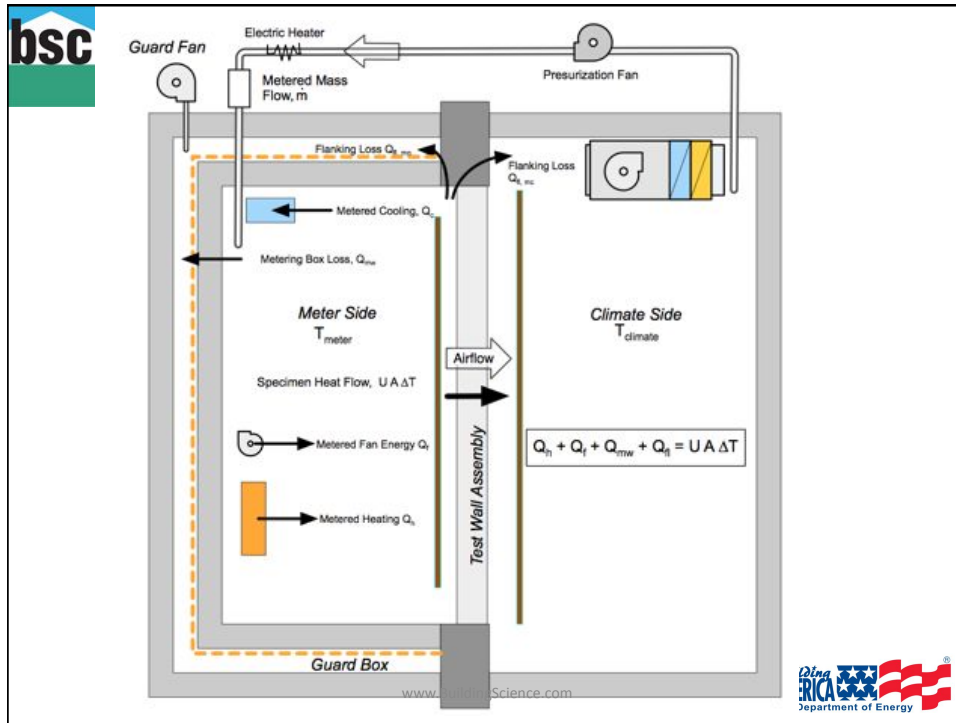


## Factors influence Heat Flow

- Temperature
- Thermal bridging
- Insulation installation defects
- **Airflow**









## Energy and Through-flow

- Easy to calculate energy from *through* flow
- Hard to quantify other terms

$$q = \frac{dm}{d\theta} c_o \cdot \Delta T \quad [1]$$

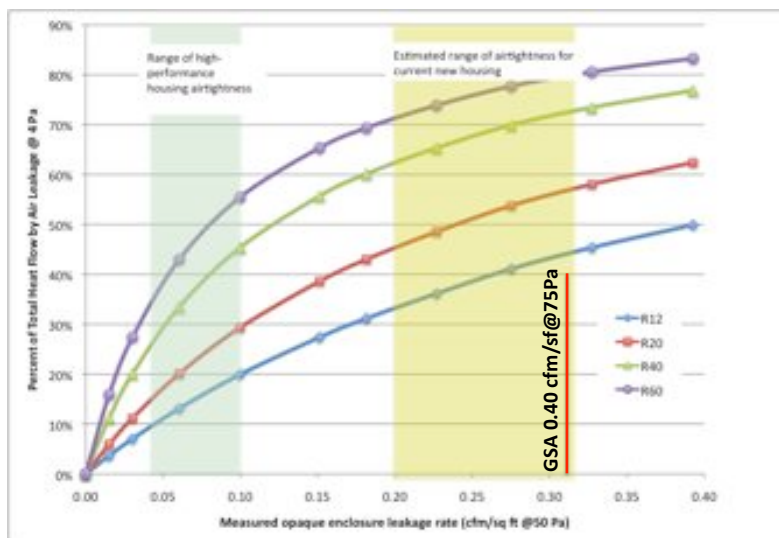
where  $\theta$  represents time and

$\frac{dm}{d\theta}$  is the mass flow rate of the fluid (kg/s) per unit time,  
 $c_o$  is heat capacity of the fluid (J / (kg·K)), and  
 and  $\Delta T$  is the temperature difference (K).

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## Airflow vs R-value



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## Convection Loops

$\Delta t$

$\Delta h$  cool air falls

warm air rises

Loops ONLY if a continuous space exists on BOTH sides

Loops ONLY if high air permeability insulation (i.e., very low density)

A: Air Loops Around Insulation

B: Air Loops Through Insulation

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## Convection Loops

inside Hot air = Light

Cold air = Heavy batt insulation Air gaps

outside

- Small gaps in batt insulation on both sides
- closed circuit
- energy cost
- cold surfaces

**Cold or Hot Weather**

Hot air = light

Cool Side Cold air = heavy

Result: Air Flow

Hot Side

Batt Air gaps

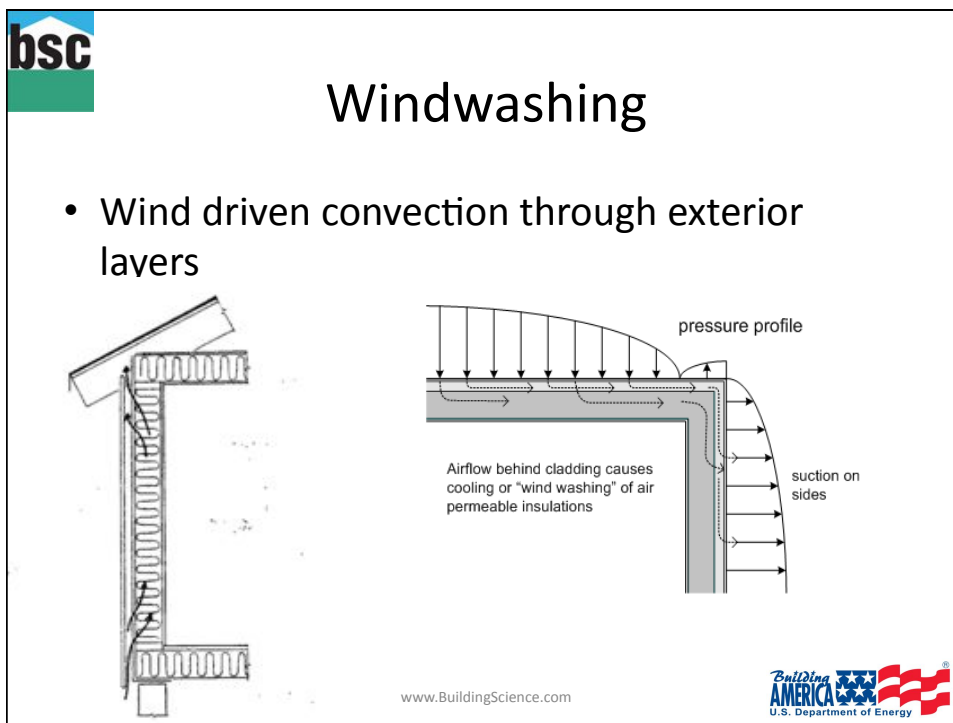
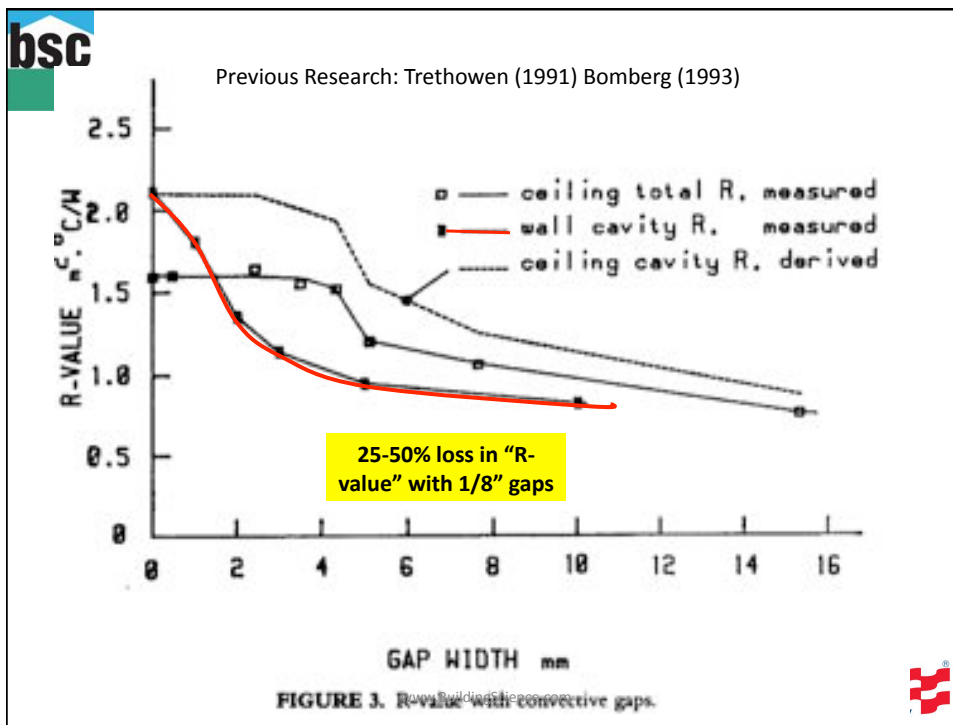
Hot air = light

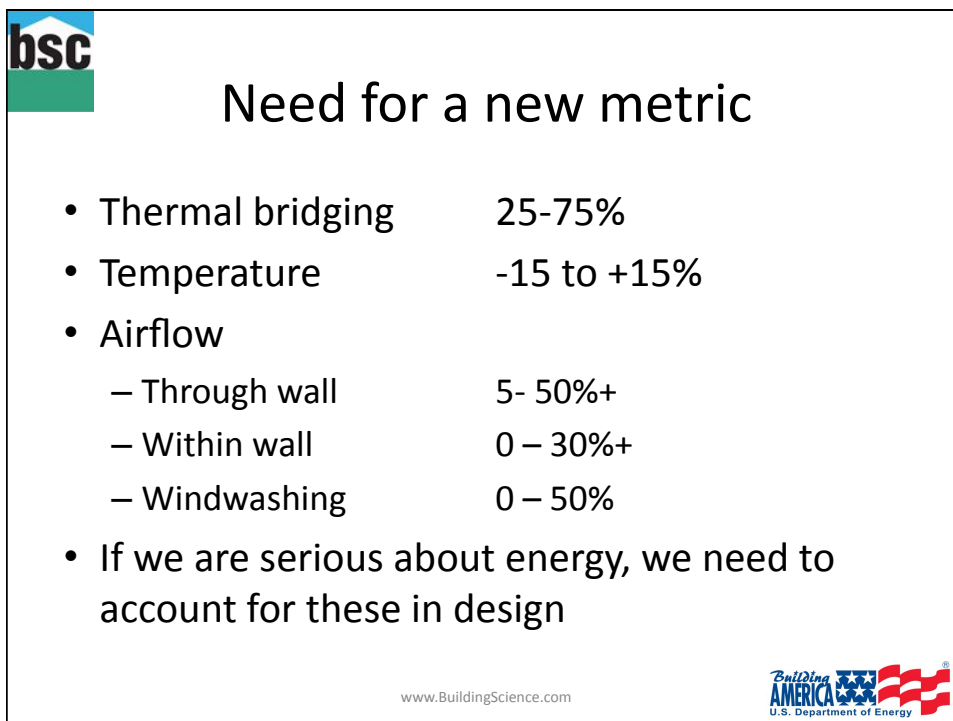
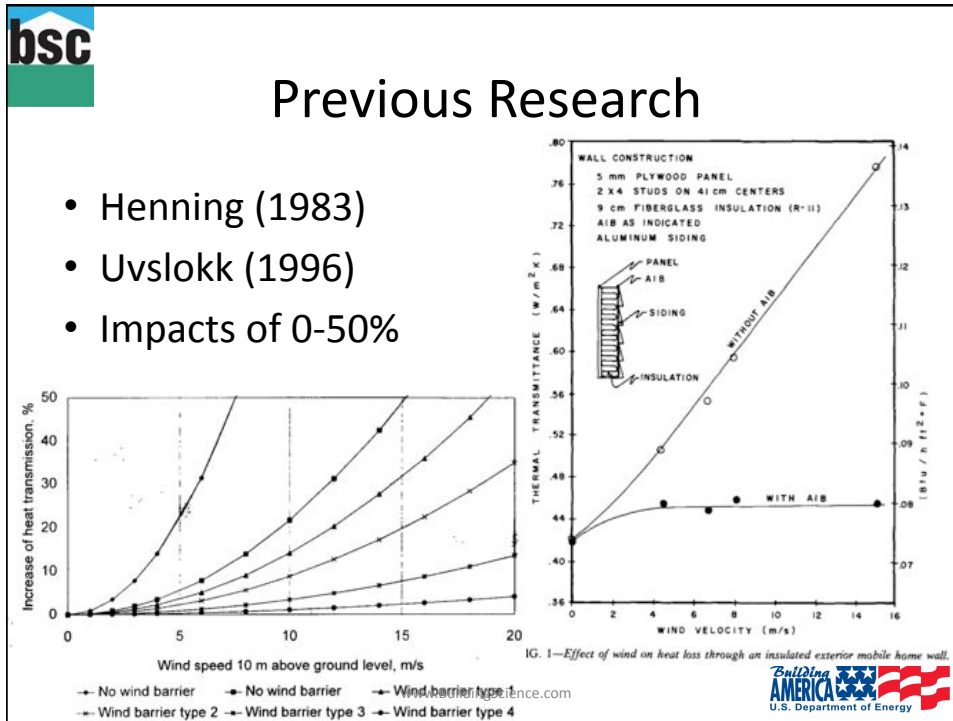
Cold

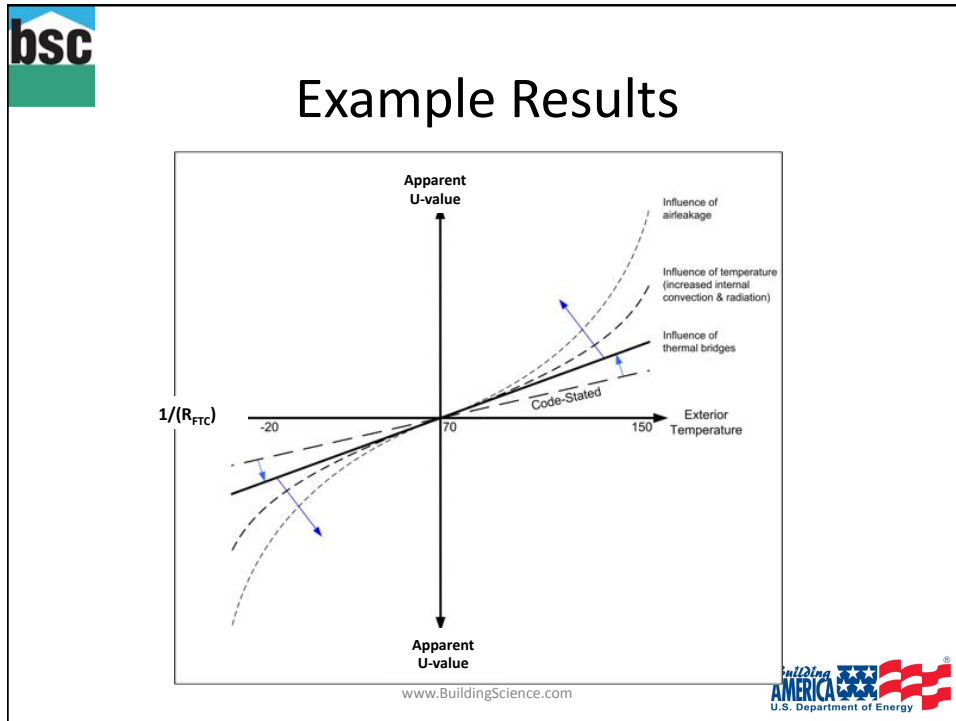
Cold air = heavy

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## Summary

- R-value measures insulation
  - We need assembly values, as built
- Air barriers are good start
  - But *controlling* airflow is what is needed
- What you cant measure, you cant control
  - We need better metrics, then standards to follow
  - Material airtightness is not very useful

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