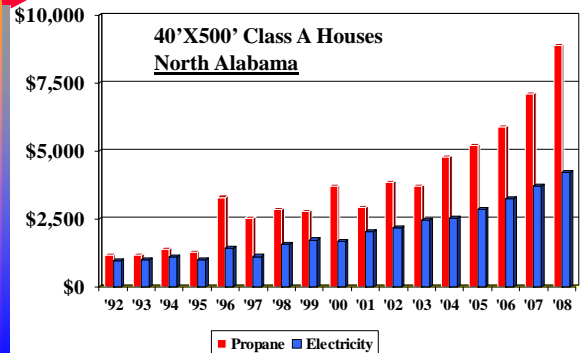


How To Totally Enclose Curtain Sided Houses



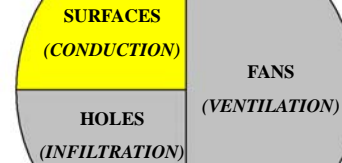
Jess Campbell, Dennis Brothers,
Gene Simpson & Jim Donald
Auburn University

Per House Energy Costs -15 Years

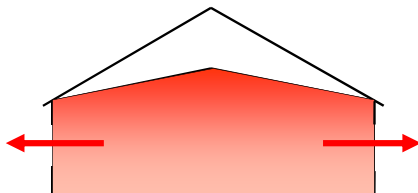


Reasons To Wall Up

- Reduce Surface Area Heat Loss
- Reduce Air Infiltration
- Reduce Energy Cost
- Better Control Over Environment
- Improved Bird Performance
- Increase Both Grower & Company Revenue
- Bottom Line: Can't Afford Not To Wall Up



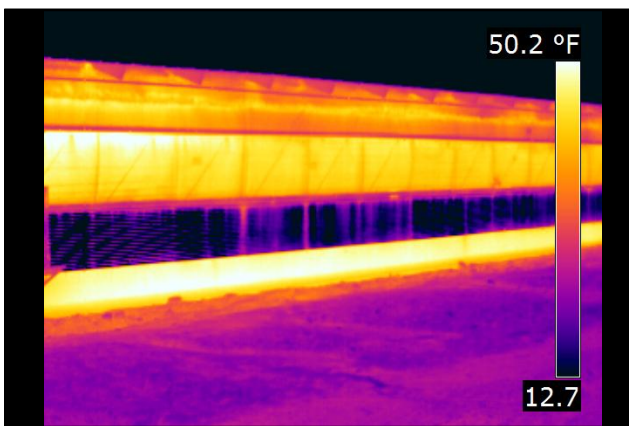
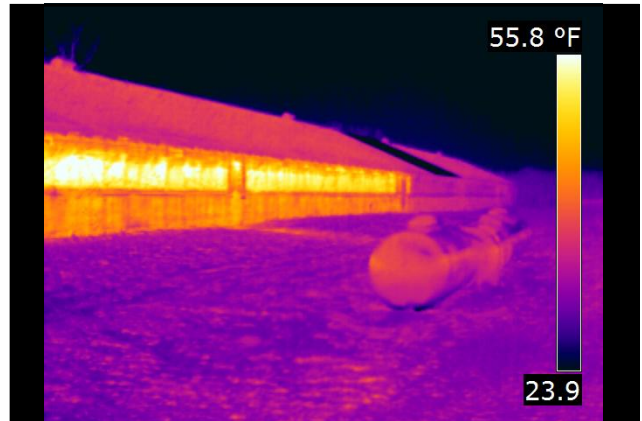
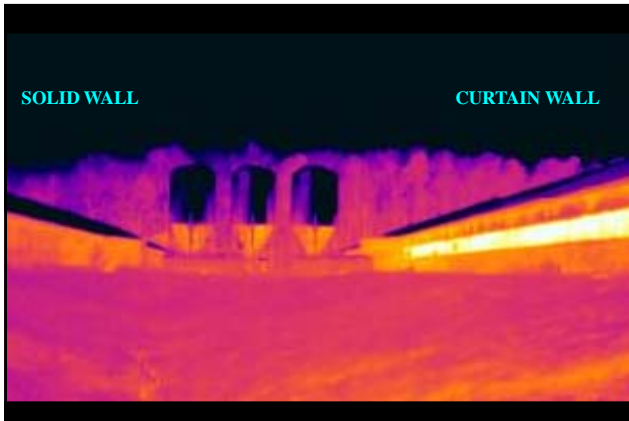
HEAT LOST BY CONDUCTION



FROM THE SIDE WALLS

Economic Considerations For Walling Up Older Houses

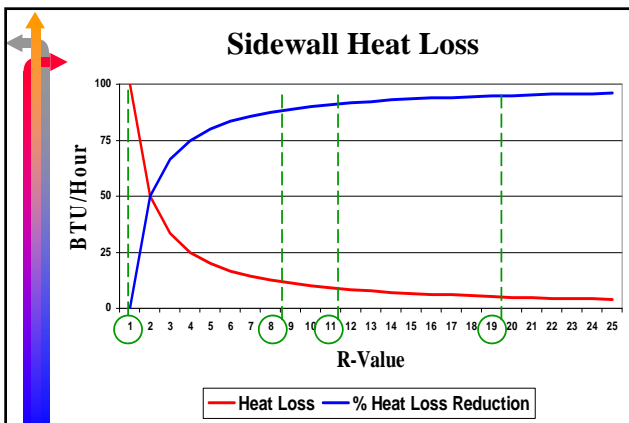
- Structural Integrity Of Existing House
- Potential For Extending Useful House Life
- Fuel Cost
- Improved Performance
- Electrical System & Generator?
- Risk?
- What Works for Grower & Company?



Thermal Insulation of Materials

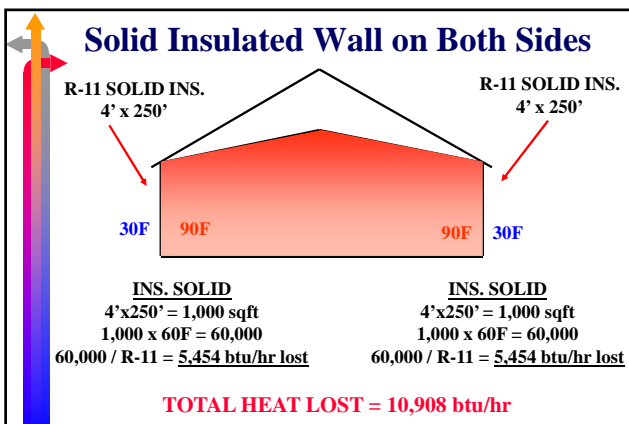
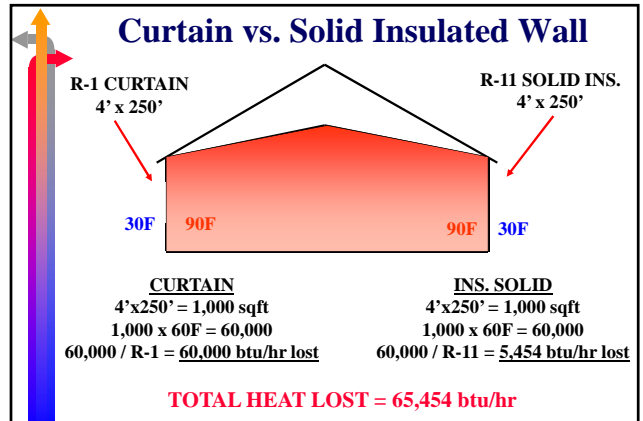
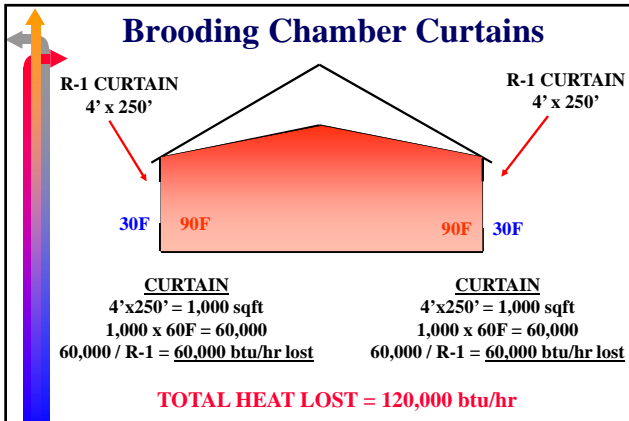
Thermal & Radiative R-Values Are Not The Same

- Wood - Average R-1.5/in.
- Curtain - R-1
- Polystyrene Beadboard (Styrofoam) - R-3/in.
- Blown-In Fill, Cellulose Or Fiberglass - R-3.2/in.
- Batts, Fiberglass, Cotton - R-3.2/in.
- Polystyrene (Blue/Pink Board) - R-5/in.
- Closed Cell Polyurethane Foam, Sprayed - R-7/in.
- Bubble Wrap – R-1 Thermal At Best



Surface Area Heat Loss Equation

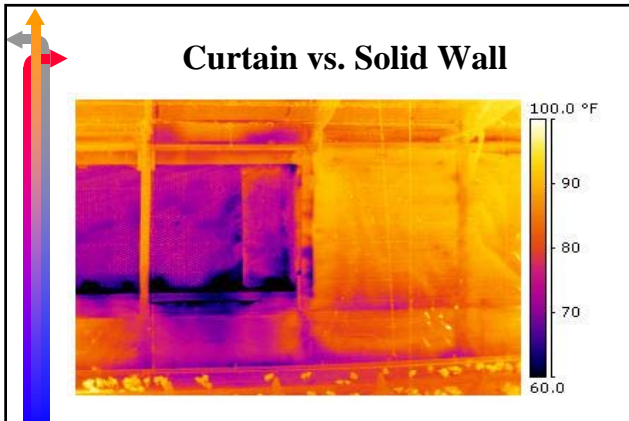
$$\frac{\text{Surface Area} \times \text{Temp Difference}}{\text{R-Value}} = \text{BTUs Lost/Hr}$$

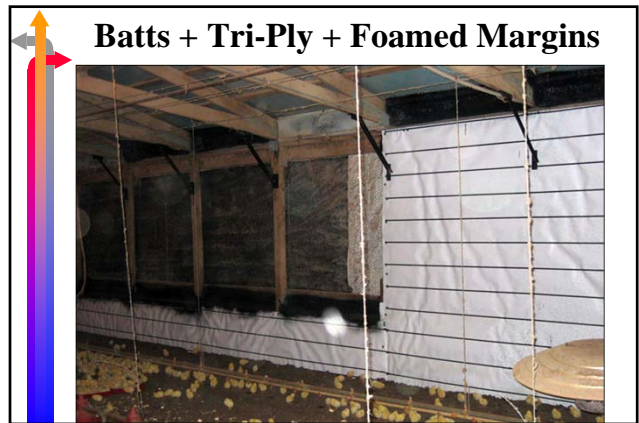
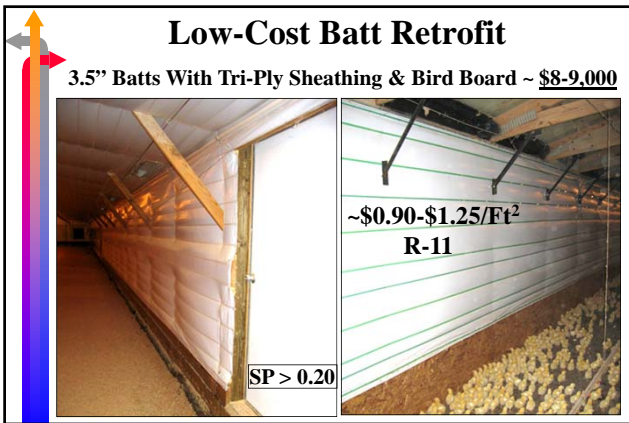
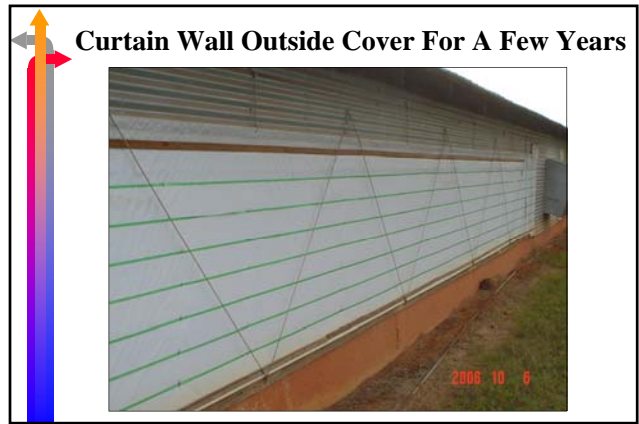
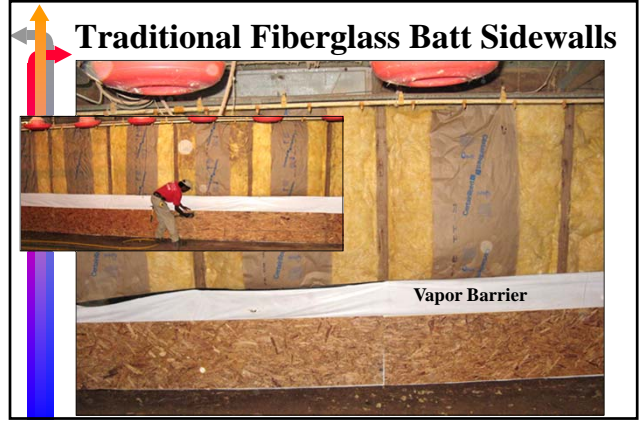


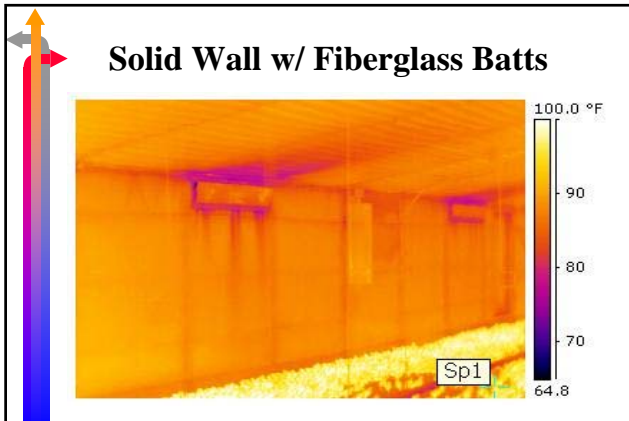
Rule of Thumb

← **50** btu/hr heat lost ≈ 1 sqft curtain
 ← **5** btu/hr heat lost ≈ 1 sqft solid insulated wall

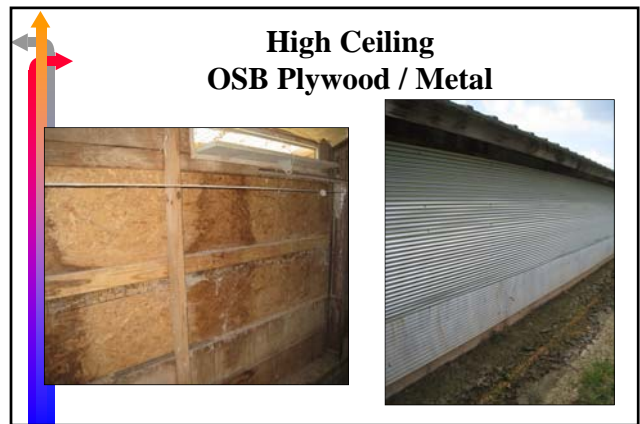
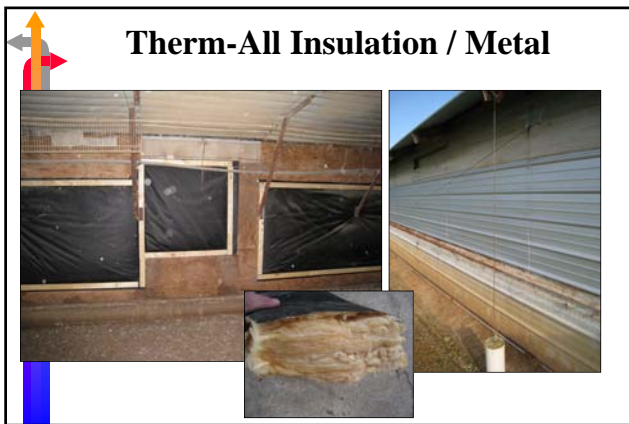








- ### Bottom Line Economics
- Batts + Foamed Margins ~\$9-15,000
 - Propane Savings:
 - Open Ceiling - 20-30%
 - Dropped Ceiling - 35-45%
 - Fuel Savings Payback Period 2-4 Years
 - Wind Speed Uniformity Greatly Increased
 - Also Expect Performance Increase



Closed Cell Foam Sidewalls

Curtain Nailed Up & 1 X 4 Treated Middle Strip Added

(Costs ~ \$1.00-1.30/Ft²)

Conventional Professional Applicator Sprays Foam From Ceiling To Floor ~1" Thick - R-8

(1.75-3# Density)

Color Choices

Causes Of Damage

1. Birds Pecking
2. Equipment Damage
3. Darkling Beetles

Bird Pecking - 1 Flock

Solutions

- Barrier/Sealant On Bottom
- Care With Equipment
- Start Good Beetle Control Program & Stay On It

Beetle Damage - 3 Flocks



Sprayed Wall Ready For Bottom Treatment

- Higher Density Foam
- Lumber W/ Chert
- Polyurea (Bed Liner)
- Roll Roofing
- Etc.

Bottom 2'- Hard Overcoat

Foam Wall, Then Spray Thin, Hard Overcoat.

Poly-Urea Bottom Overcoat. Can Also Use High Density Foam (6-10#) Or Chert.

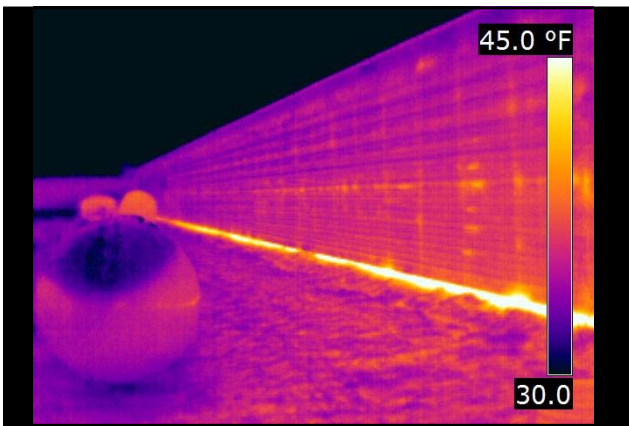
High Ceiling Houses



Closed Cell Polyurethane Spray Foam Retrofits

- R-7 Per Inch of Thickness (All Densities)
- Dries Solid, Waterproof & Class 1 Fireproof
- Seals, Insulates, & Serves As A Vapor Barrier
- Extends Productive Life Of Older Houses
- Spray ~ 1" On Walls, Ridge Caps, & Dog House Ceilings; Smoke Test & Touch-Up Any Cracks
- Costs ~ \$0.90-1.30/ Ft² (Different Densities)
- Must Control Darkling Beetles

Roll Roofing Material & Board Insulation?

Insulating Concrete Foundations?



Insulating Concrete Foundations?



Insulating Concrete Foundations?



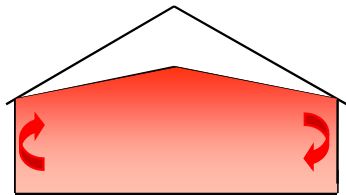
Rigid Board Insulation Doesn't Have Enough Thermal R-Value For Walls, Is More Subject To Damage, & Generally Is Not Cost Effective Except On Open Ceilings & (Temp) Tunnel Inlet Area



Other Exterior Retrofit Work

- Do House Repairs Before Retrofitting
- **Caution:** Batts Are Moisture Sensitive
- **Caution:** Low Density Foam Is UV Light Sensitive
- **Solutions:**
 - For Batts: Install Treated 2" X 4" Between Posts At Pad, Cover Curtain With Tri-Ply, Band & Strip
 - For Closed Cell Foam: Cover Curtain With Tri-Ply Or Metal Before Curtain Begins To Degrade.
 - Replace With Metal Later, As Cash Flow Permits.
- **Ongoing Low Cost Retrofit Tests @ AU – Batts, Spray Foams, & Combinations.**

SOLID WALLING GOAL



LEAST AMOUNT OF HEAT TRANSFER BY CONSISTENTLY INSULATING ENTIRE WALL

Conclusions

- Walling Up Pay Back Is Within 2-5 Years
- Have A Plan - Spend Your Money Wisely
- Spray Foam & New Technologies - Touchup and Solid Walls
- Metal, Fiberglass Batts, Vapor Barrier & Plywood

The End!