

# Triple E New Construction



*a conservation program*

**Doug Manthey – Conservation Technologies**  
**Chad Trebilcock – Minnesota Power**

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# Agenda



- Overview of Minnesota Power's Conservation Improvement Program (CIP)
  - Chad Trebilcock
- The Nuts and Bolts of Minnesota Power's Triple E New Construction Program
  - Doug Manthey

# CIP Overview

- CIP formally started in 1980 under Minnesota Statute 216B.241
- Applies to electric and gas utilities
  - Delivered fuels (propane, fuel oil) exempted
- Next Generation Act of 2007
  - Shift from 1.5% spending to 1.5% savings requirements

# Next Generation Act of 2007

- 25% Renewable by 2025
- Greenhouse Gas Reduction Goals
  - 15% by 2015
  - 30% by 2025
  - 80% by 2050
- 1.5% Energy Savings Goals



# Filing Requirements

- Minnesota Rules Chapter 7690
- Triennial Filing June 1<sup>st</sup>
  - Proposal for CIP activity
- Consolidated Filing
  - April 1<sup>st</sup>
  - Annual Filing
- Reporting through eDockets & eFiling

# What CIP Means To Customers

- Energy Savings Opportunities
- Most beneficial to those who take advantage of programs

# Minnesota Power's Conservation Improvement Program (CIP)



## ■ Residential

- Power of One Home
- Energy Partners Low – Income

## ■ Business, Commercial, Industrial, Agricultural

- Powergrant

## ■ Small Scale Renewables

## ■ Integrated Energy Education and Communications

- Learn and Earn
- Energy Design Conference and Expo

## ■ Energy Analysis

- Triple E Plan Review
- Home Energy Analysis with Building Diagnostics
- Low income analysis
- C&I/Agriculture Analysis (facility review, new construction facility plan review)

## ■ Research and Development



# Helping Customers with Energy Conservation

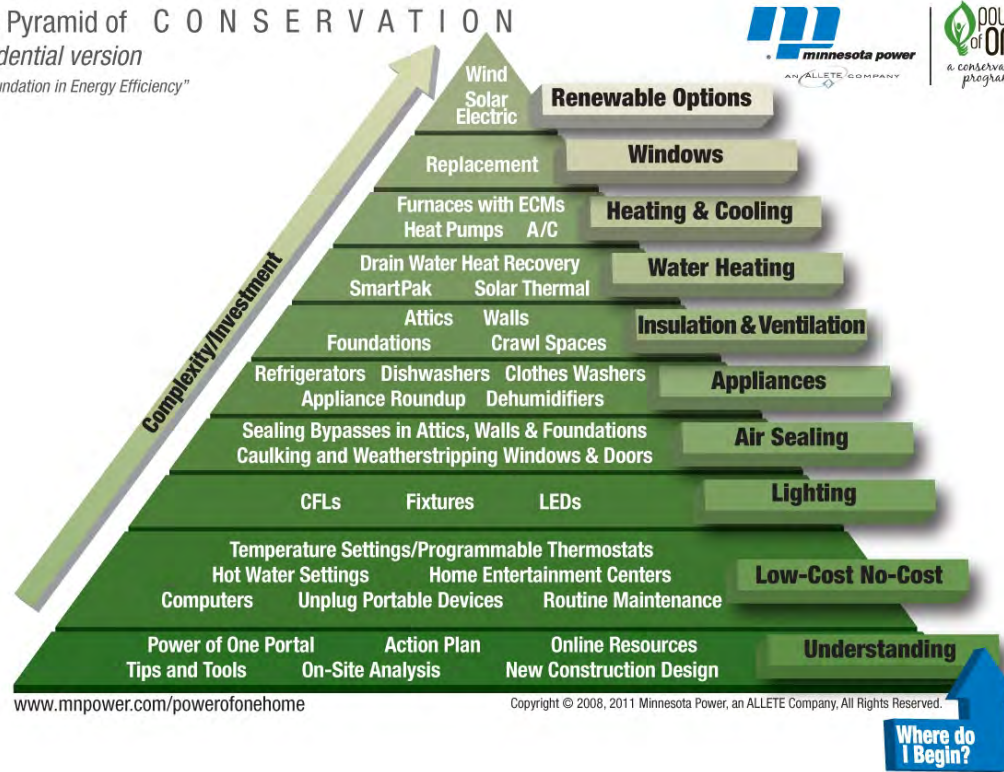


a conservation program

## The Pyramid of CONSERVATION

residential version

"A Foundation in Energy Efficiency"



[www.mnpower.com/powerofonehome](http://www.mnpower.com/powerofonehome)

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# So I'm thinking about changing heating fuels.....



- Customers want to know specifically what is the most economical and what the savings will be.
- There are a lot of variables:
  - What is the square footage and volume of the house?
  - How well insulated and air tight is your house?
  - What do you keep your thermostat set at?
  - What fuel source are you considering?
- Let's Simplify This
- No matter what the answers are I can measure the question in the form of BTU'S more specifically Millions of BTU's.....with a few assumptions.

# Behind the Numbers

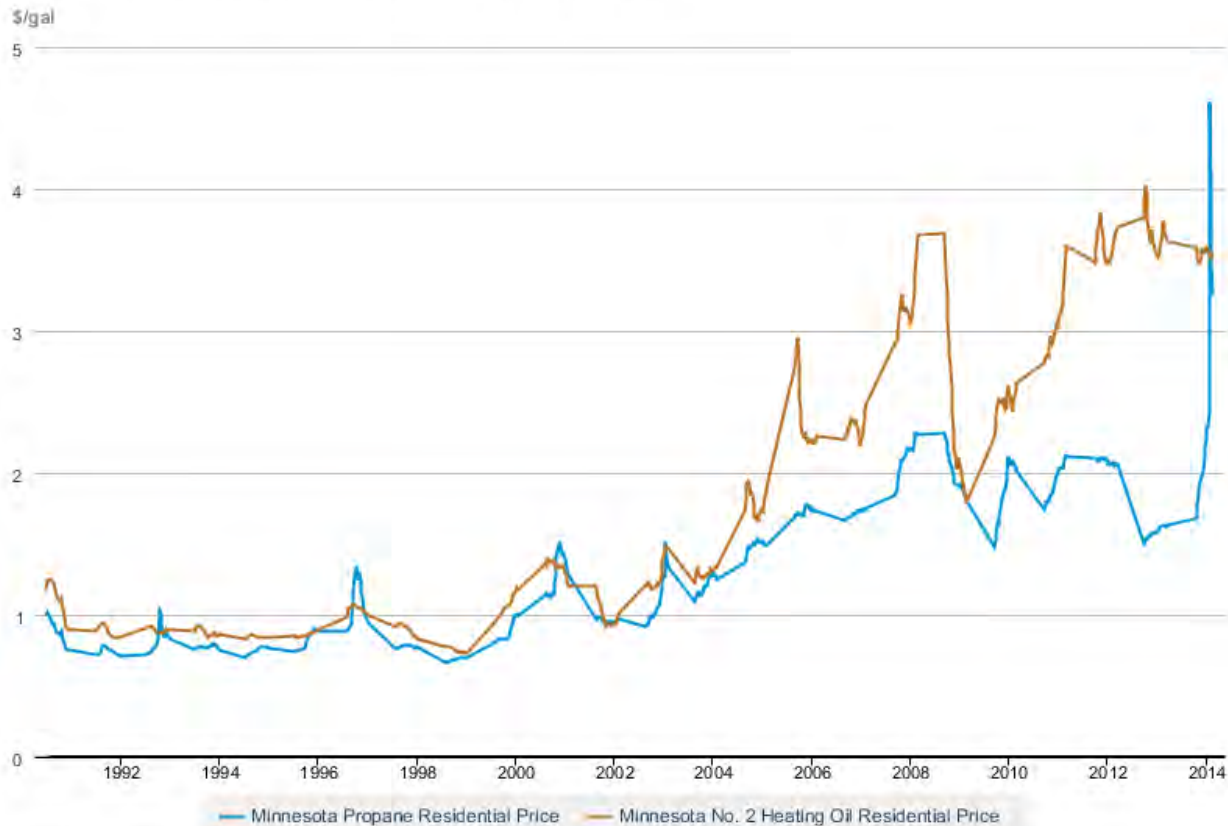
- Keep everything as equal as possible including distribution losses and equipment efficiency. (90% efficient and distribution efficiency)
- Propane @ \$5.69 per gallon = \$72.87/MMBtu
  - (\$2.00 per gallon = \$24.26/MMBtu)
- Fuel Oil @ \$3.58 per gallon = \$29.91/MMBtu
- Firm Electric @ .091 cents per kWh = \$28.06/MMBtu
- Dual Fuel @ .05196 cents per kWh = \$16.92/MMBtu
- Natural Gas @ .086 cents per therm = \$10.70/MMBtu
- GSHP @ .091 cents = \$9.75/MMBtu

# More Numbers.....

- 4000 sq. ft. house Built to Triple E Tier I Standards
  - Annual Consumption of 57.8 MMBtu/yr
- Propane = \$4,211 (\$1,402 @ \$2/gallon)
- Fuel Oil = \$1,728
- Firm Electric = \$1,621
- Dual Fuel = \$977.98
- Natural Gas = \$618.46
- GSHP on Firm Rate = \$570.49

# Cost Variability – Propane & Heating Oil

Weekly Heating Oil and Propane Prices (October - March)



Source: U.S. Energy Information Administration

[http://www.eia.gov/dnav/pet/pet\\_pri\\_wfr\\_dcus\\_smn\\_w.htm](http://www.eia.gov/dnav/pet/pet_pri_wfr_dcus_smn_w.htm)

# Space Heating



- Home Must be Electrically Heated
  - Firm Rate
  - Dual Fuel (must have non-electric backup)
  - Controlled Access/Storage Heating
  - Ground Source Heat Pumps
- To participate in the Triple E Program please call 218-355-3061

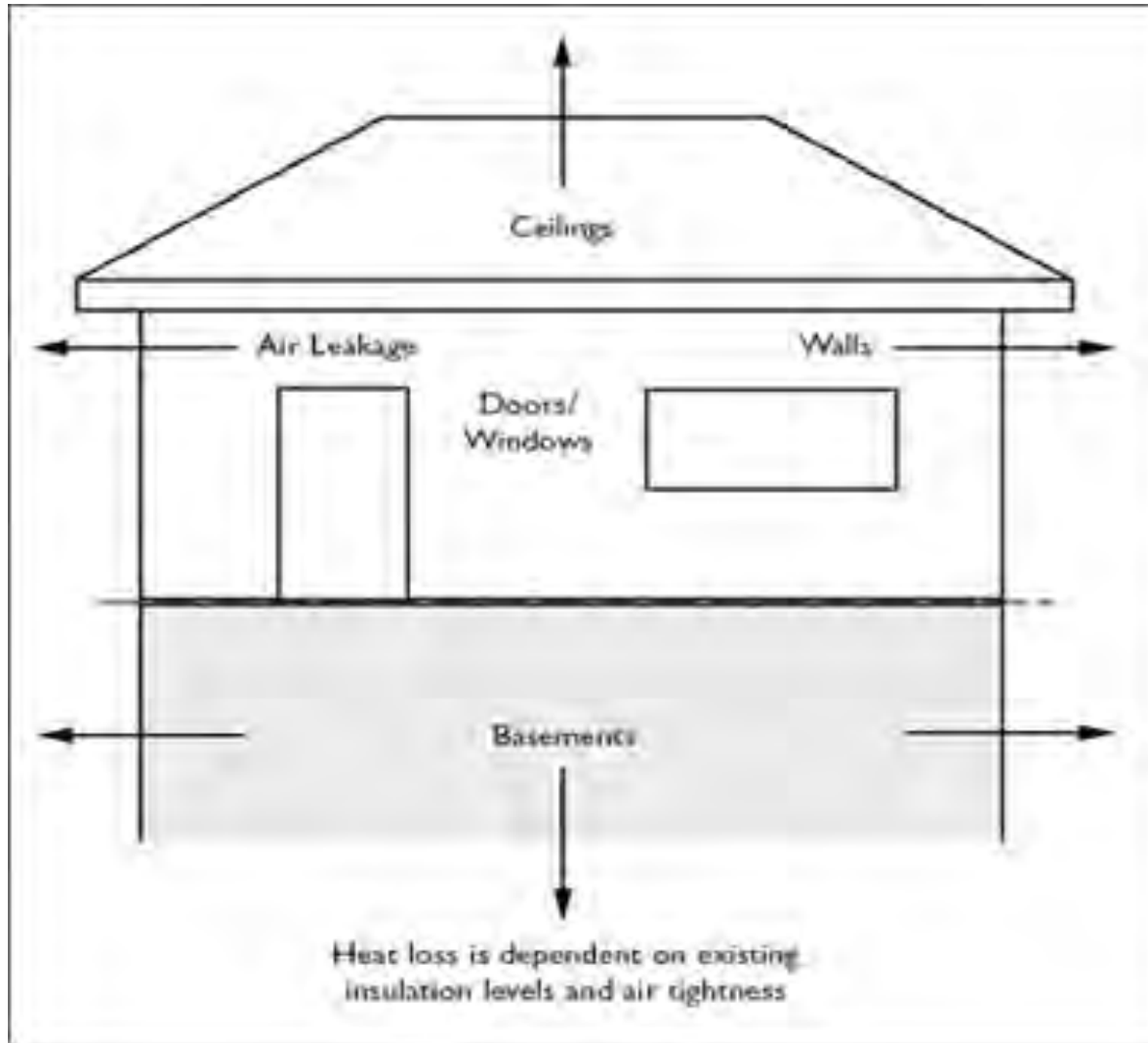
# Program History



## Triple E

- Energy Efficiency / Education / Evaluation
- Goal is kWh
  - Method is better building

# Heat Loss



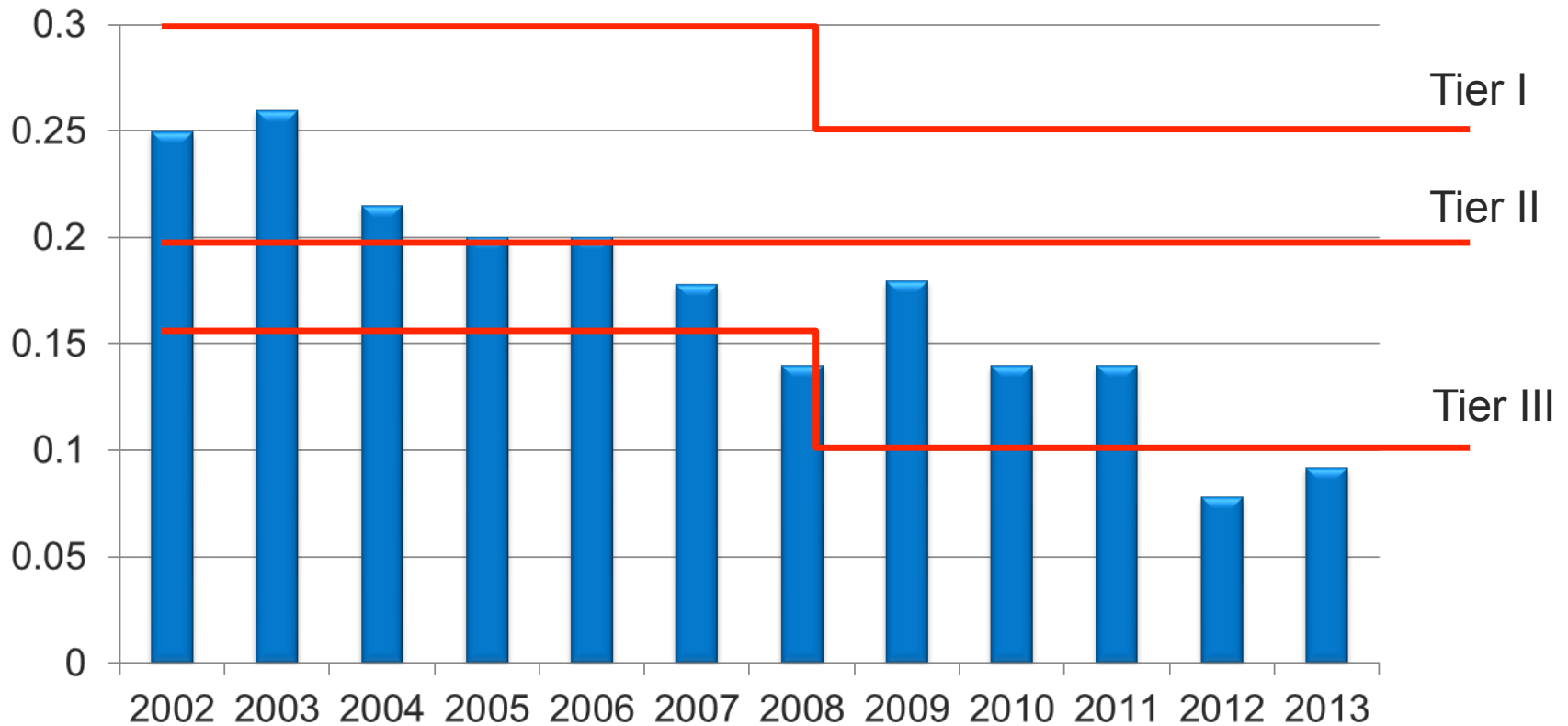


# Basic Goals

- House as a System
- Increase Insulation
- Decrease air Leakage
- Budget – cost benefit
- Southern Exposure, Lights, Appliances, etc.

# Historical Air Tightness

cfm/sq ft floor @ 50



# Air Tightness By Insulation Types

- Air Tightness does NOT depend on the type of insulation that is installed
  - Cellulose with Poly - .159
  - Fiberglass with Poly - .24
  - Insulated Concrete Forms (ICF) - .147
  - Spray Foam - .159
  - Structurally Insulated Panel (SIP) - .138

# Program Process



- Plan Review
- Framing Visit
- Pre-Drywall Visit
- Final Test

# Plan Review



1. Review all aspects of the building
  - Insulation Requirements
  - Lights and Appliance Reminder
  - Checklist
2. Chance to change the Plan
3. Reminder of new aspects of the program
4. For a limited time – Heat loss calc

# Framing Visit

1. On-Site review of project
2. Chance to confirm the plan
3. Discuss areas that are difficult to air seal and/or insulate.
  - Cantilevers
  - Bonus Rooms
  - Can Lights
  - Installs on exterior walls: tubs, showers, fireplaces, soffits, etc.

# Pre-Drywall Visit

1. Confirm all program requirements
  - Insulation Levels
  - Reminder about lights and appliances
  - HVAC Review
2. Review Air tightness opportunities
  - Bonus Rooms
  - Can Lights
  - Rigid Material behind tubs/showers/soffit installs

# Final Test



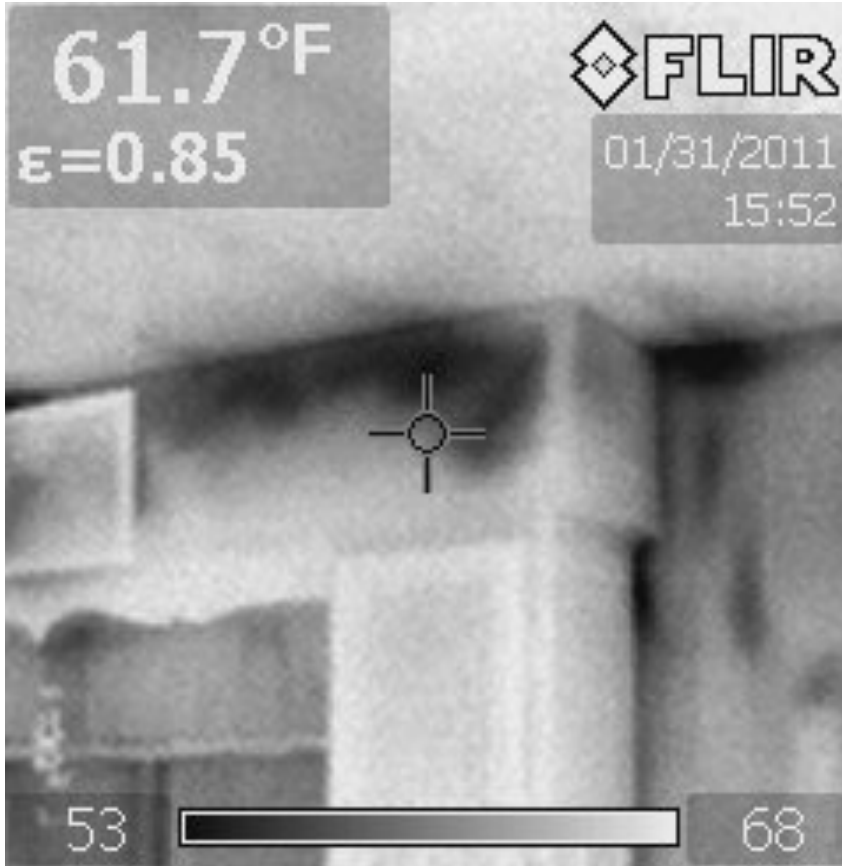
1. Blower Door
2. Infrared Camera
3. Appliance Checks
4. Light Count



# Blower Door Testing



# Infrared Camera



# Program Requirements

	<u>Tier I</u>	<u>Tier II</u>
■ Attic	R-50	R-60
■ Exterior Walls	R-21	R-21+5 cont. R-20 cont.
■ Rim/Band	R-20 cavity	R-20+5 cont.
■	R-15 cont.	R-20 cont.
■ Foundation/Basement	R-15	R-20
■ Slab Perimeter	R-15	R-20
■ Under Slab	R-15	R-20
■ Flrs over Ext/Unheated	R-24+5 cont	R-30+5 cont
■ Flrs over heated space	R-24	R-30

# Additional Requirements (Tier I)

- Window U-Value:  $\leq .33$  /  $\leq .28$  additional rebate.
- Electric Heat: Required
- Back Up Heat:  $\geq 90\%$  AFUE w/ECM motor or 90% AFUE boiler
- Electric Cooling (SEER):  $\geq 14.5$
- Air to Air Heat Exchanger:  $\geq 76\%$
- Thermostats for Forced Air: Energy Star Programmable
- Water Heater: Any
- Duct Location: Any (except under slab)
- Duct Insulation: R-8
- Energy Star Lighting: 5 Fixtures
- Appliances: Energy Star dishwasher, clothes washer and refrigerator

# Additional Requirements (Tier II)

- Window U-Value:  $\leq .30$  /  $\leq .28$  additional rebate.
- Electric Heat: Required
- Back Up Heat:  $\geq 90\%$  AFUE w/ECM motor or 90% AFUE boiler
- Electric Cooling (SEER):  $\geq 14.5$
- Air to Air Heat Exchanger:  $\geq 80\%$
- Thermostats for Forced Air: Energy Star Programmable
- Water Heater: Varies w/size
- Duct Location: Conditioned Space
- Duct Insulation: R-8
- Energy Star Lighting: 5 Fixtures
- Appliances: Energy Star dishwasher, clothes washer and refrigerator

# “New” to Triple E

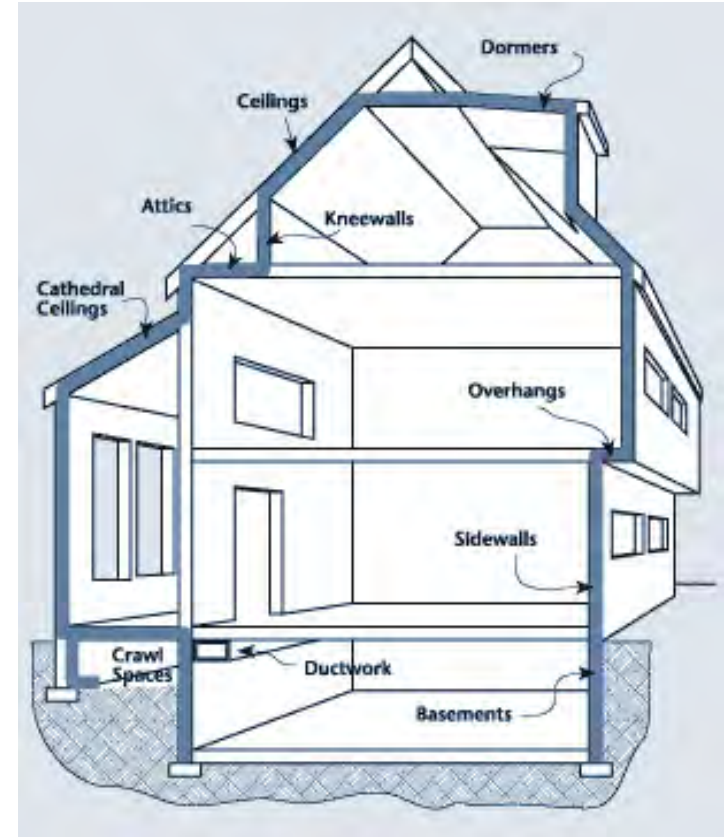
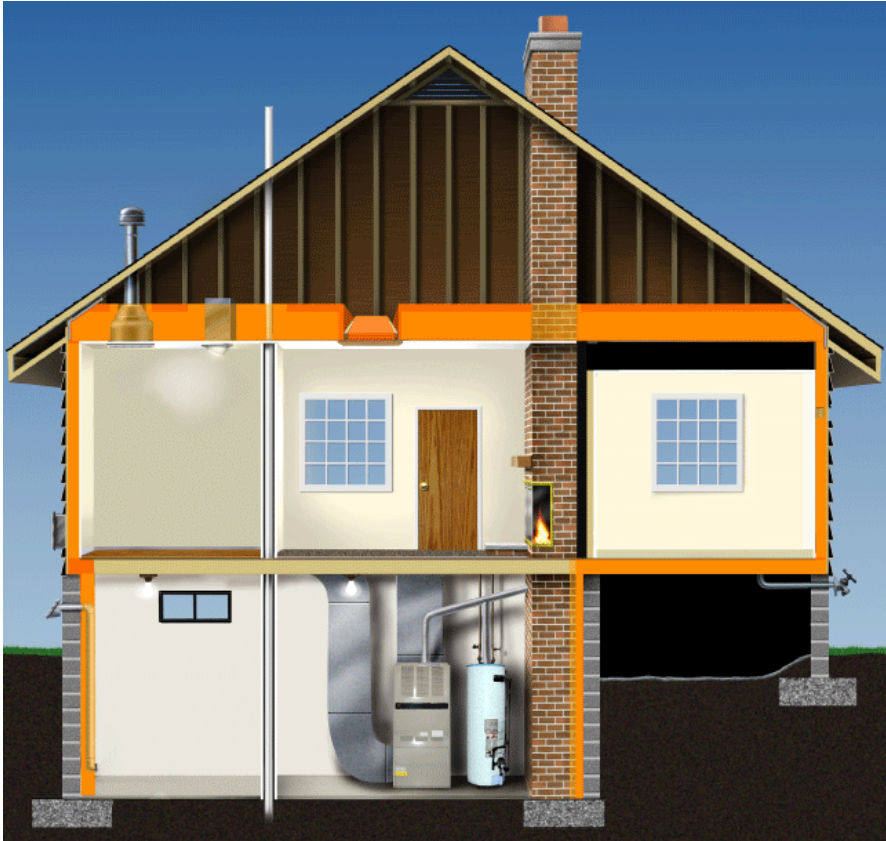
- Thermal break on all concrete outside the slab
- Six sided cavities
- Back up heat requirements
- Passive Radon (with electric box)
- Fire breaks in double stud walls
- No under slab ductwork
- FA system must have sealed ductwork
- Mechanical rooms part of house – not garage
- Limited Time Only – modeling every house

# Available Rebates



	Tier I	Tier II	Tier III
Prescriptive Standards	\$0	\$800	
Performance Standards	\$0	\$500	\$800
Plan Review Completed	\$100		
Framing Visit Completed	\$100		
Pre-Rock visit Completed	\$100		
Building Orientation	\$200		
Drain Water Heat recovery	\$400		
GSHP – Closed Loop	\$200/ton		
GSHP – Open Loop	\$100/ton		
Window Upgrade	\$300		
Balanced ventilator, labeled	\$50		

# All the Crazy Things





# Plans



- Simple Things to Avoid
  - Bonus Rooms
  - Cantilevers
  - Can Lights
  - Exterior wall assemblies
  - Attic Duct Work
  - Vault to flat ceilings

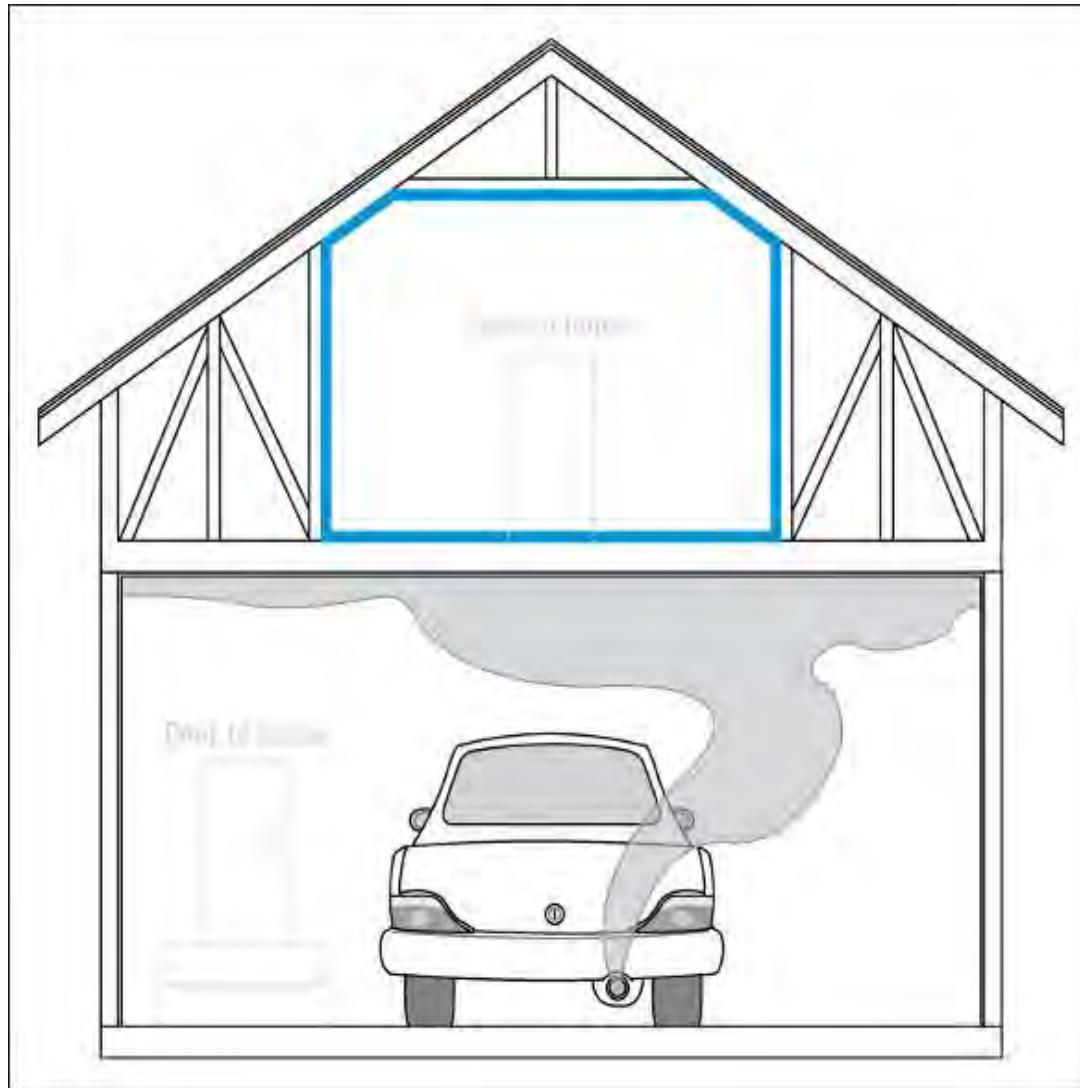
# Bonus Rooms



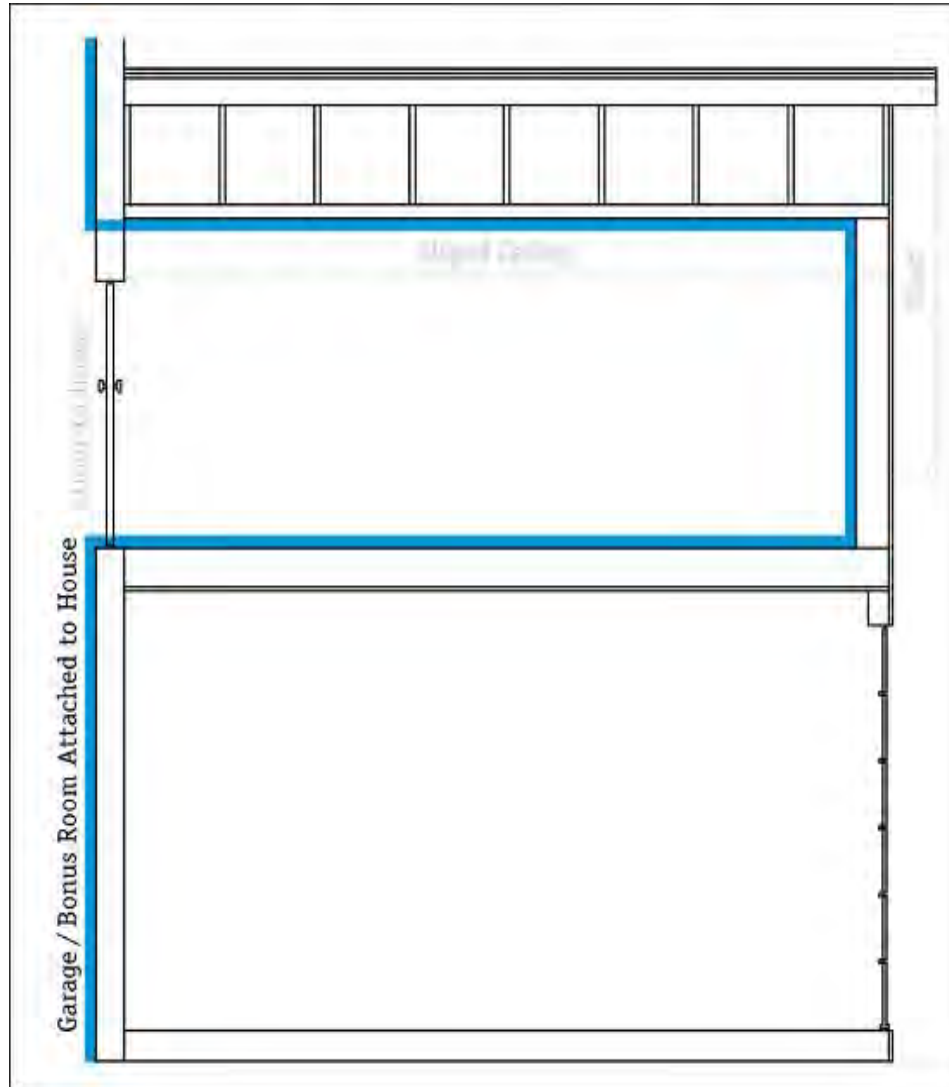
# Bonus Rooms

- Avoid Building Bonus Rooms
- Make them cold storage
- If you make it conditioned space, make it accessible from the second floor only
- If that doesn't work – keep the stairs out of the garage
- Good luck

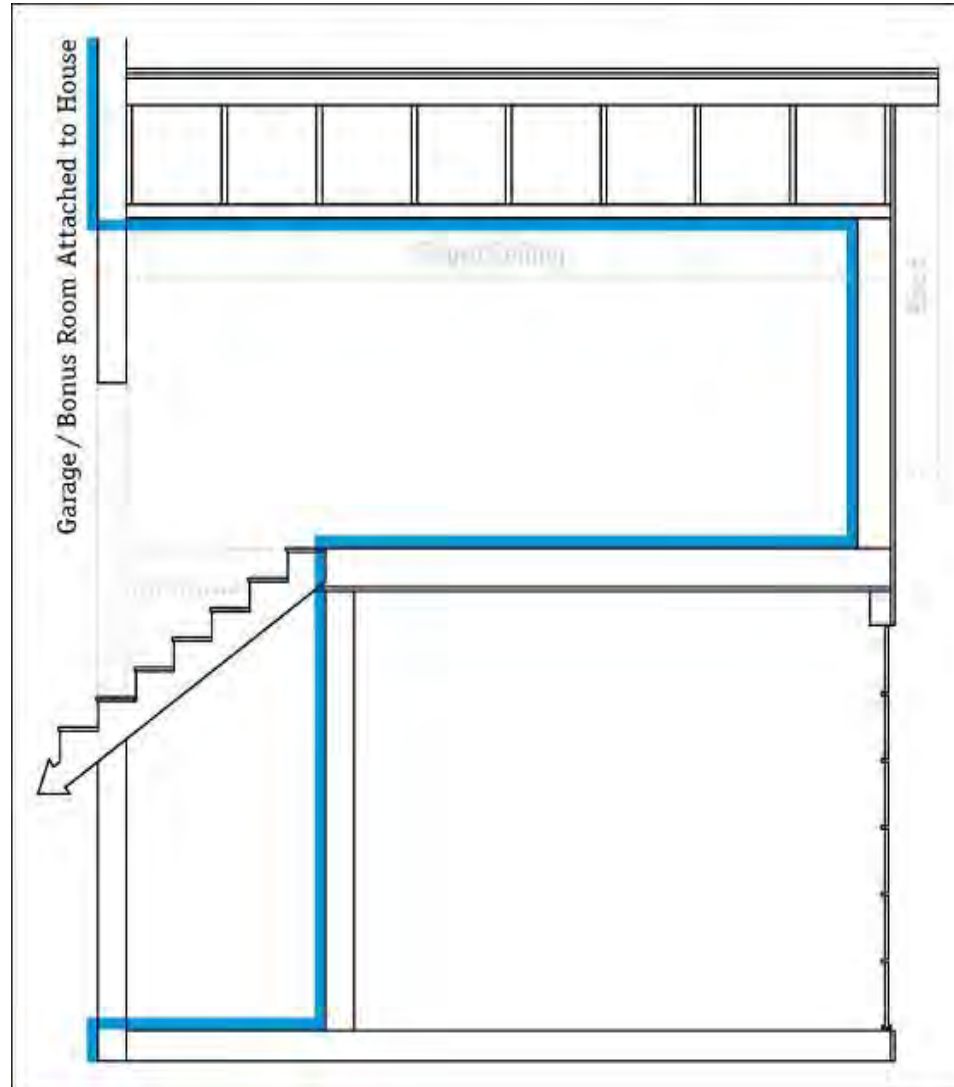
# Determine the Thermal Enclosure



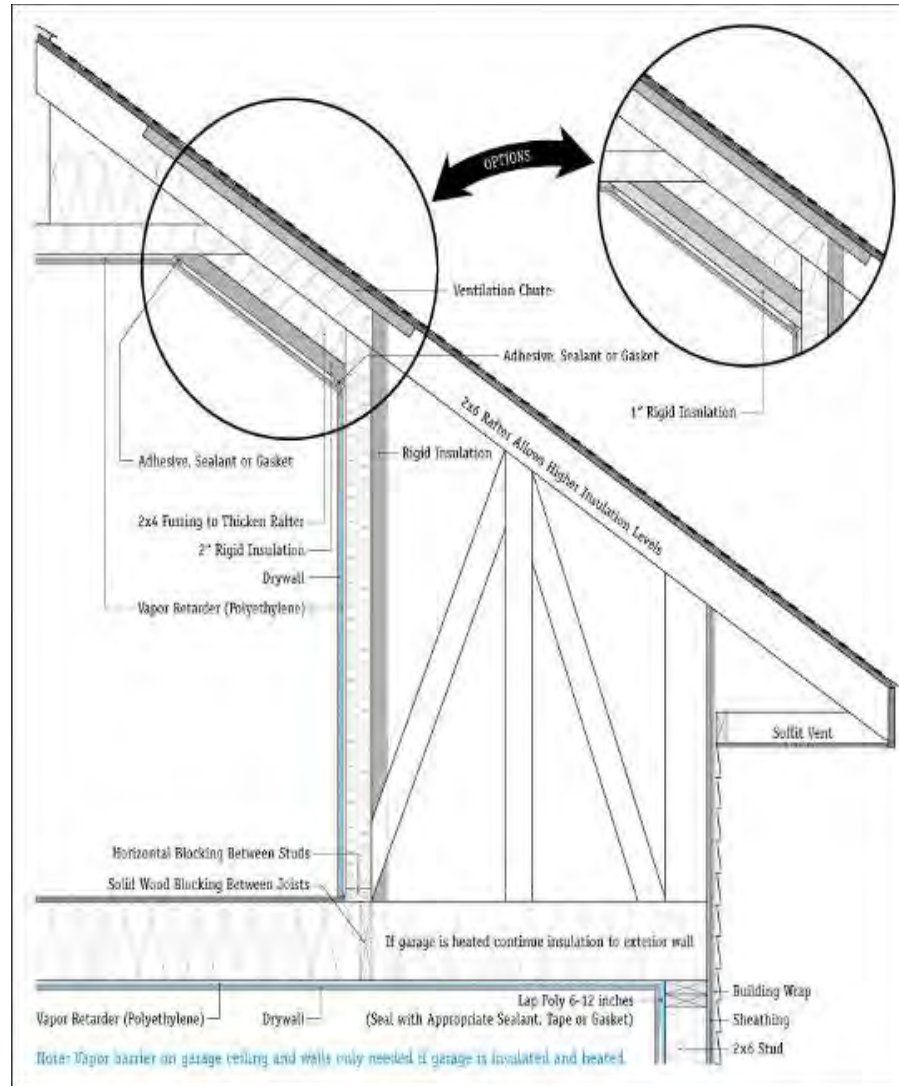
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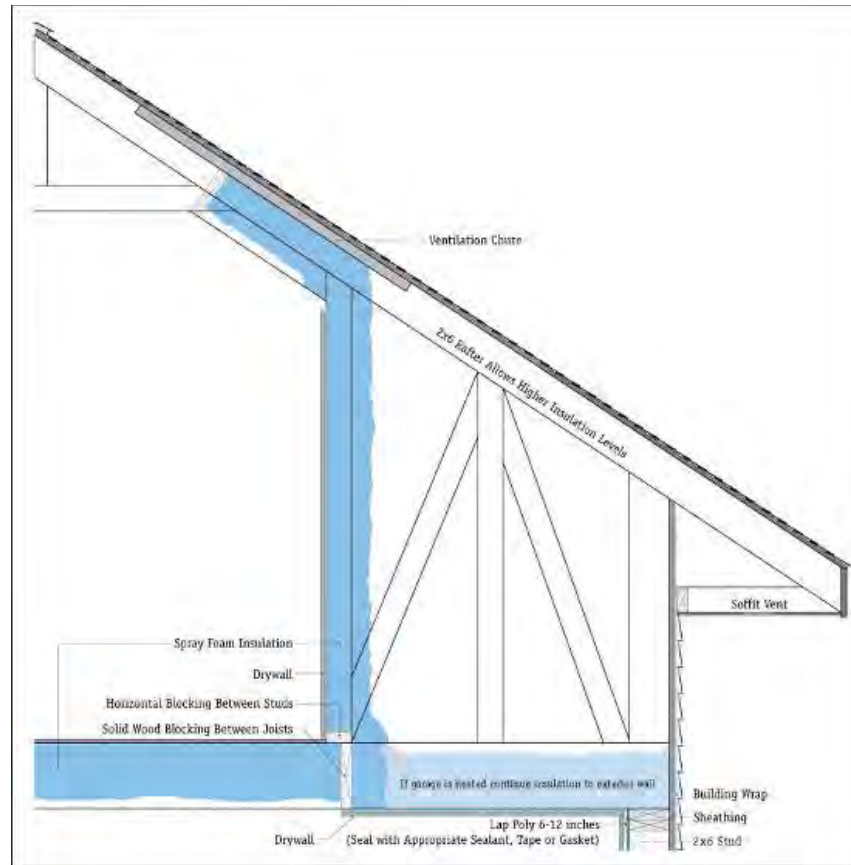
# Determine the Thermal Enclosure



# Bonus Room Detail – With Fiber Insulation



# Bonus Room Detail – With Spray Foam Insulation





# Examples



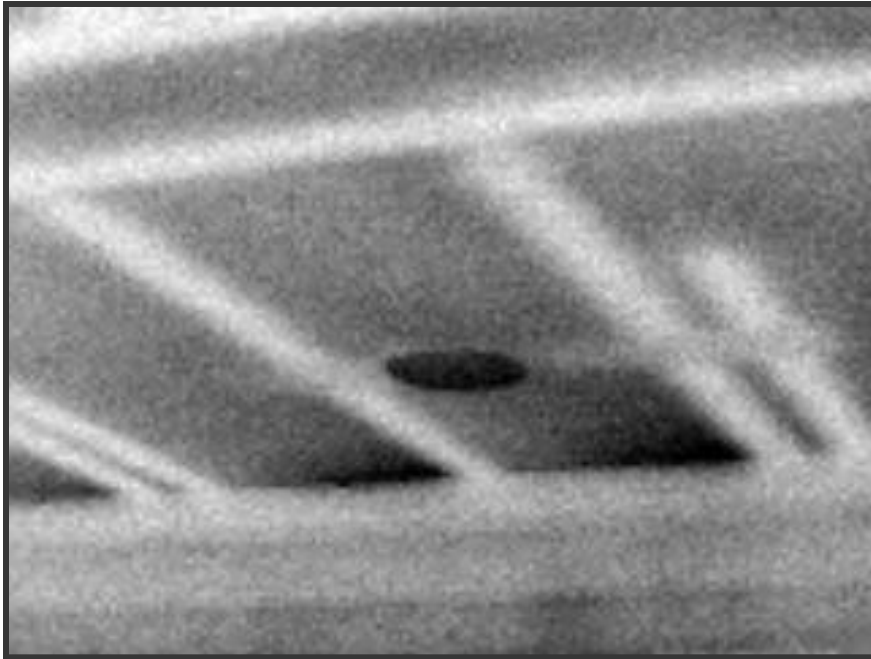
# Cantilevers



# Cantilevers

- Avoid them
- Air Seal
- Insulate
  - Cavity filled
  - Continuous underneath
- Good Luck

# Examples



# Examples



# Can Lights

- Keep them out of insulated spaces
- Build dropped ceilings or soffits for them
- Build boxes around them
- LED - ???
- Good luck

# Can Lights



# Examples





# Examples



# Examples



# Examples



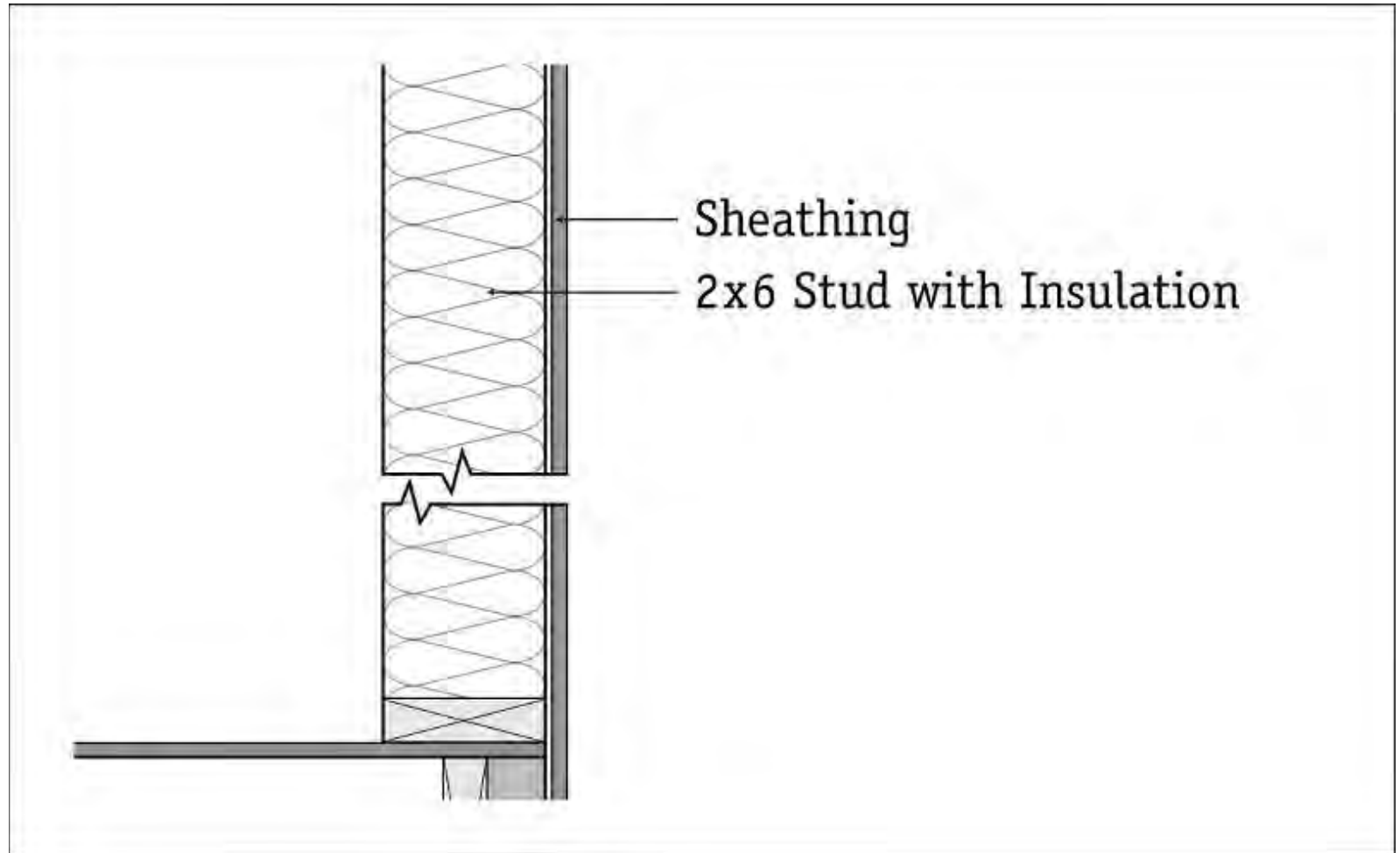
# Exterior Walls Assemblies

- Tubs, Showers, Fireplaces, Stairs, etc.
  - Move to interior wall in design stage
  - Insulate, vapor barrier/air seal and “rock” before installing framing

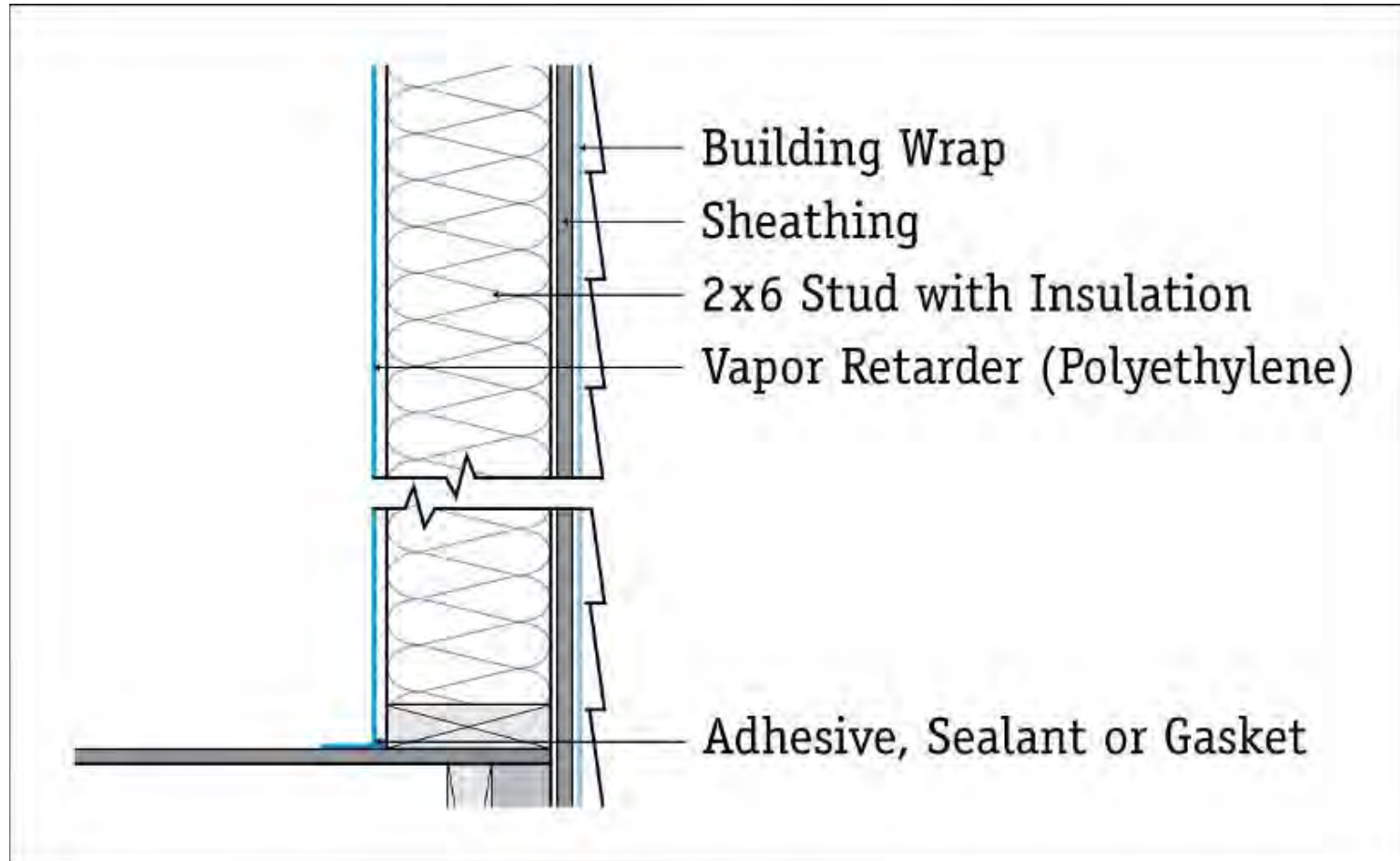
# Exterior Wall Assemblies



# Examples



# Examples



# Examples





# Examples



# Examples



# Examples



# Examples



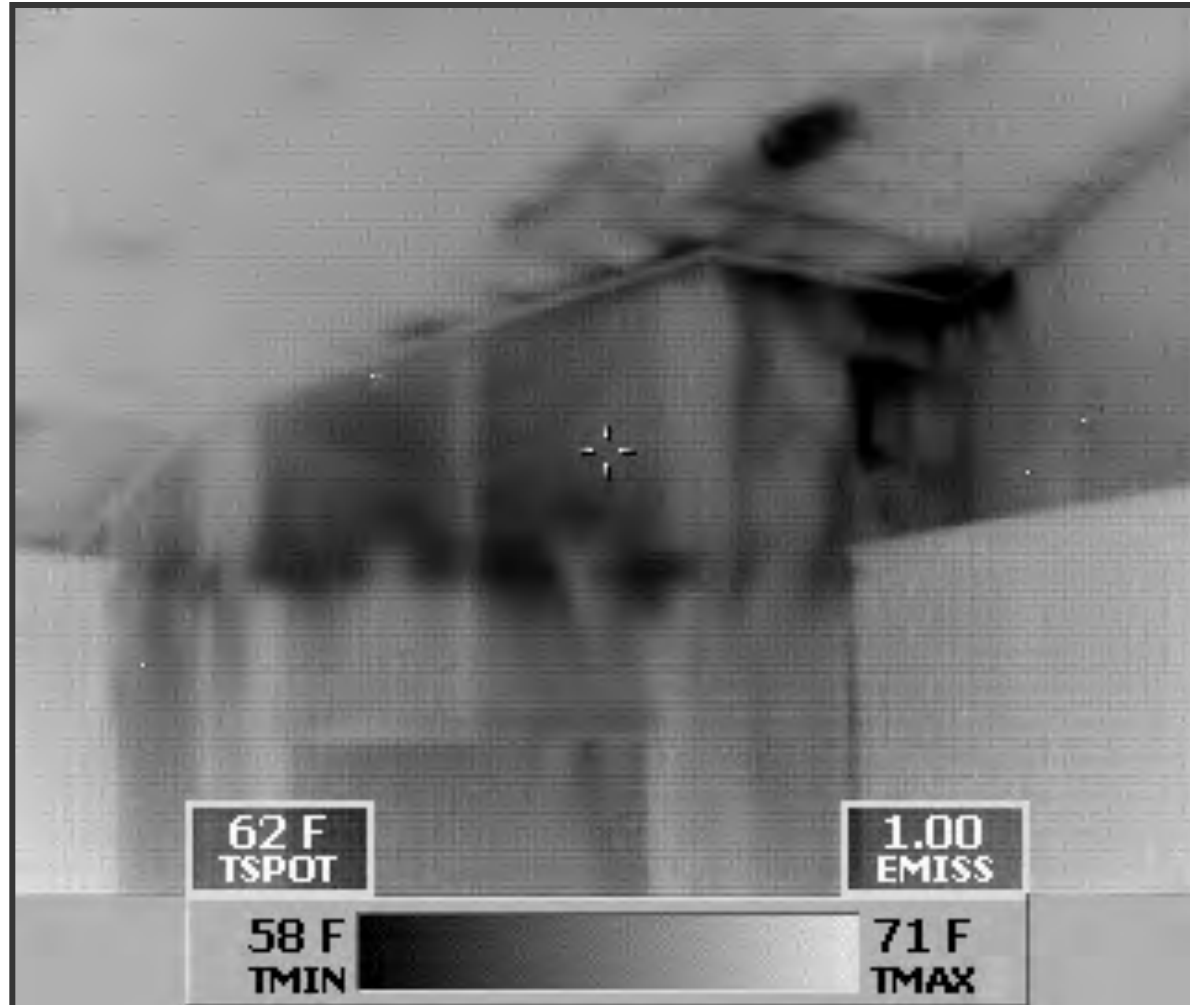
# Examples



# Examples



# Examples

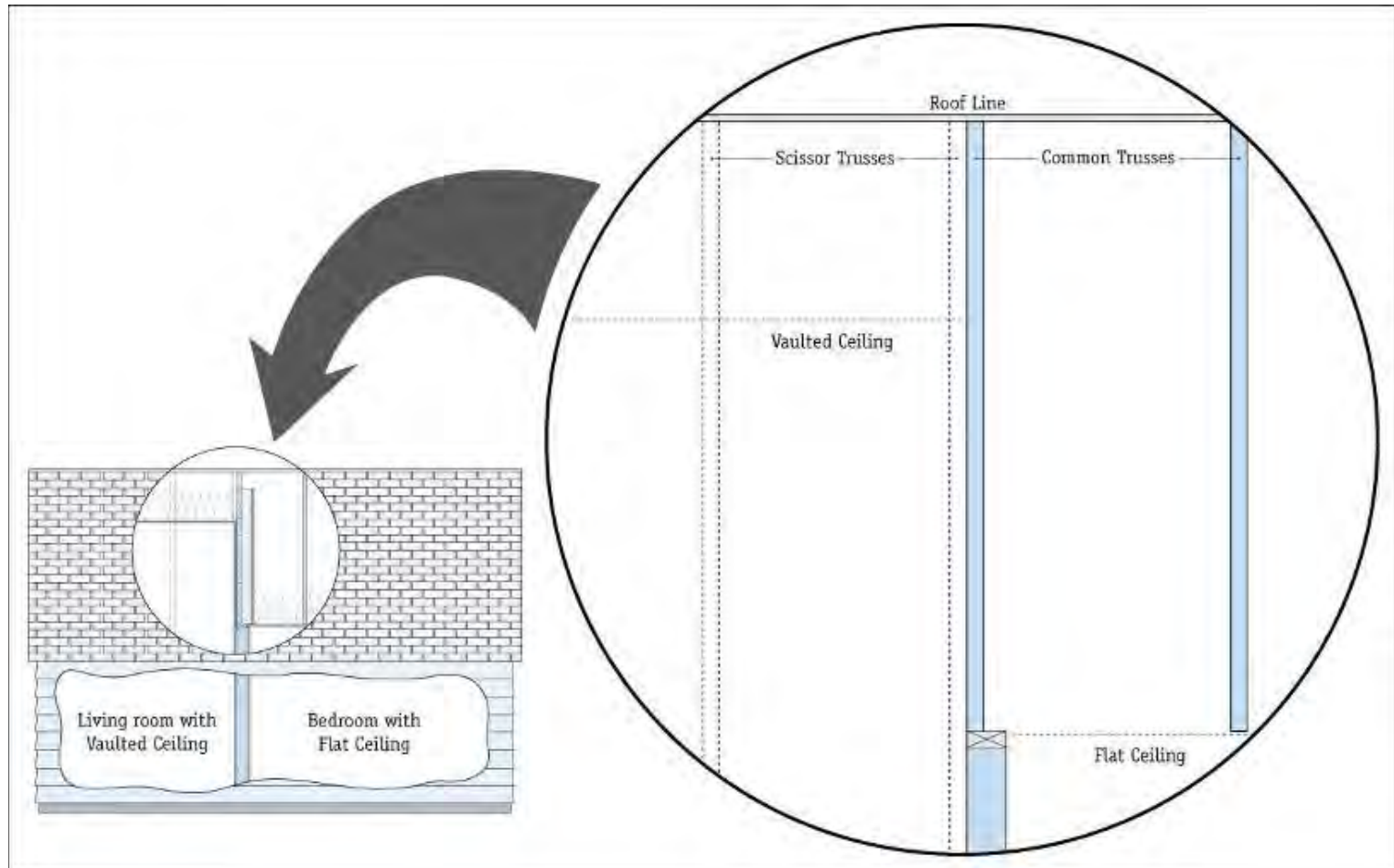


# Duct Work in the Attic





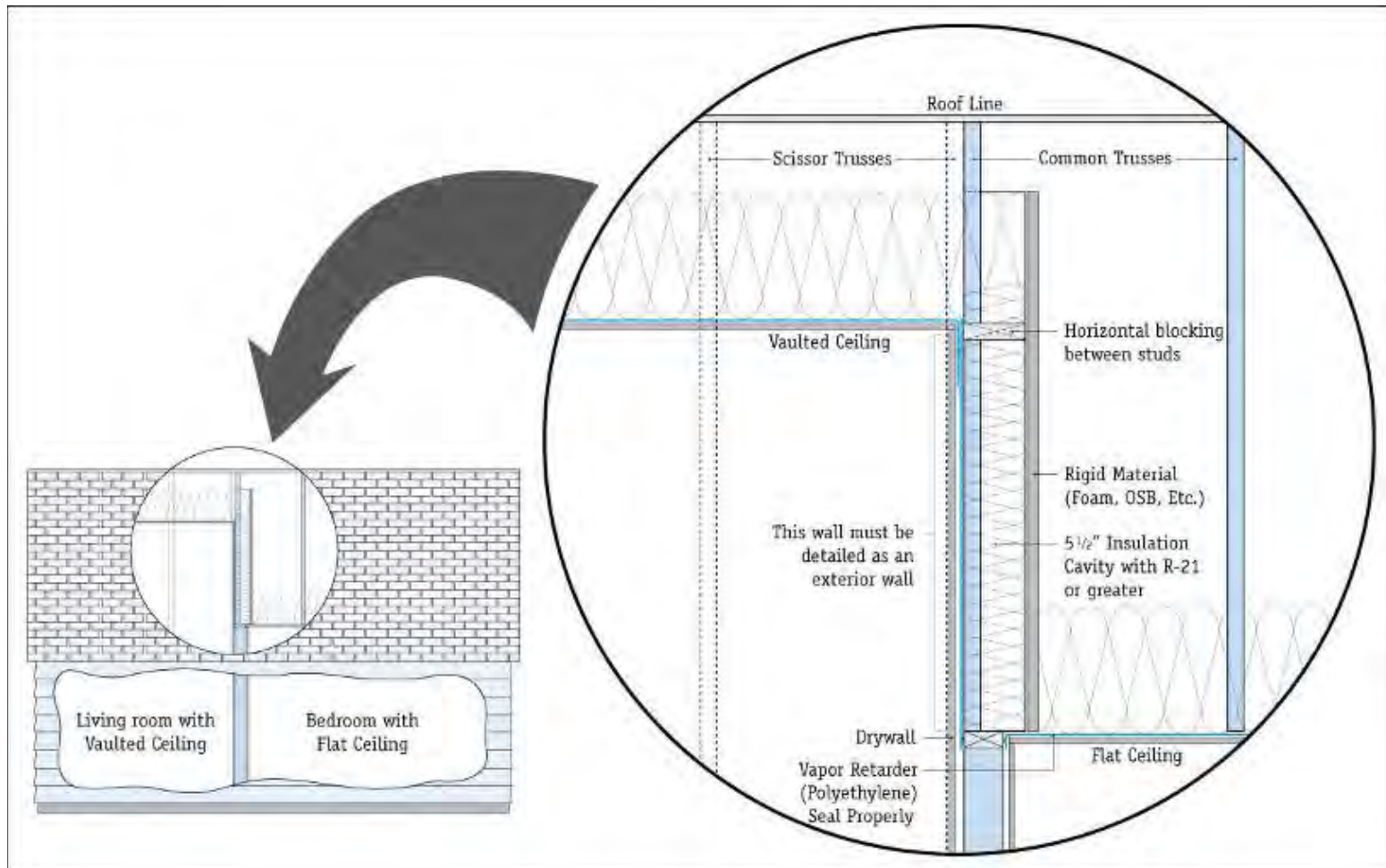
# Vault to Flat Ceilings



# Examples



a conservation program



# Spray Foam – Skim Coat



# Spray Foam – Skim Coat

## Coverage Issues



# Spray Foam – Skim Coat

## Coverage Issues

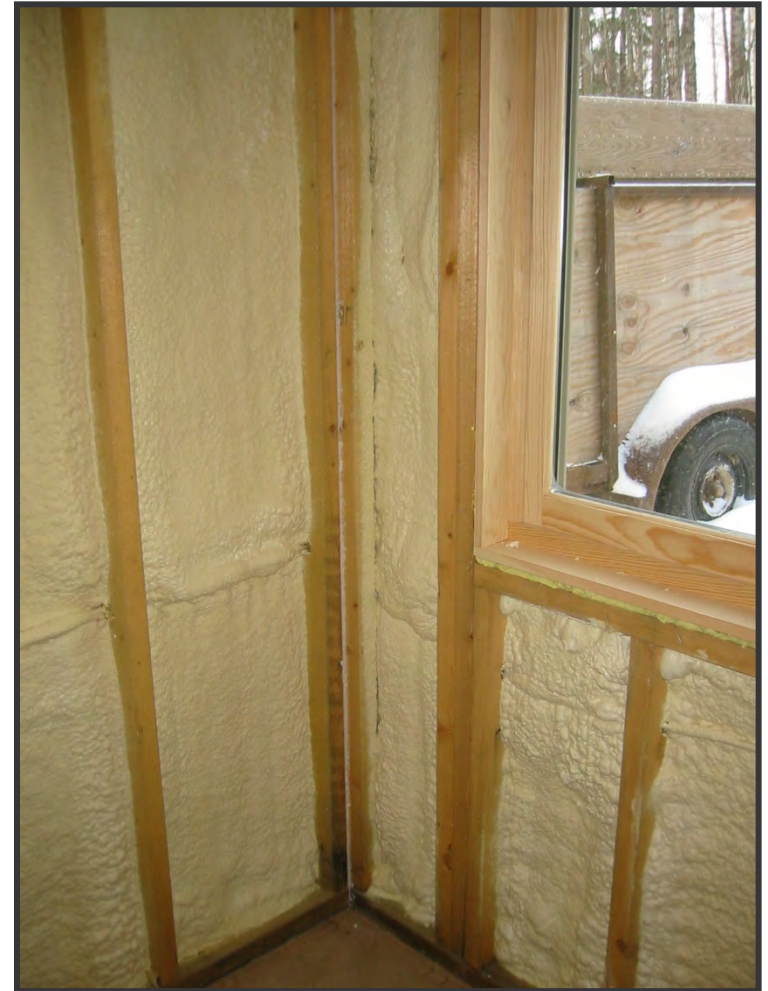


# Spray Foam – Skim Coat

Depth Issues



# Spray Foam – Other Issues



# Spray Foam

Measure Depth





# Spray Foam – Manufactured On Site



# Triple E



- Energy Efficiency
- Education
- Evaluation

Thank You