

# Triple E New Construction



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

# 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
  - Triple E Plus
  - 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
- Research and Decelopment

# Helping Customers with Energy Conservation



## The Pyramid of CONSERVATION

residential version  
 "A Foundation in Energy Efficiency"





# Space Heating

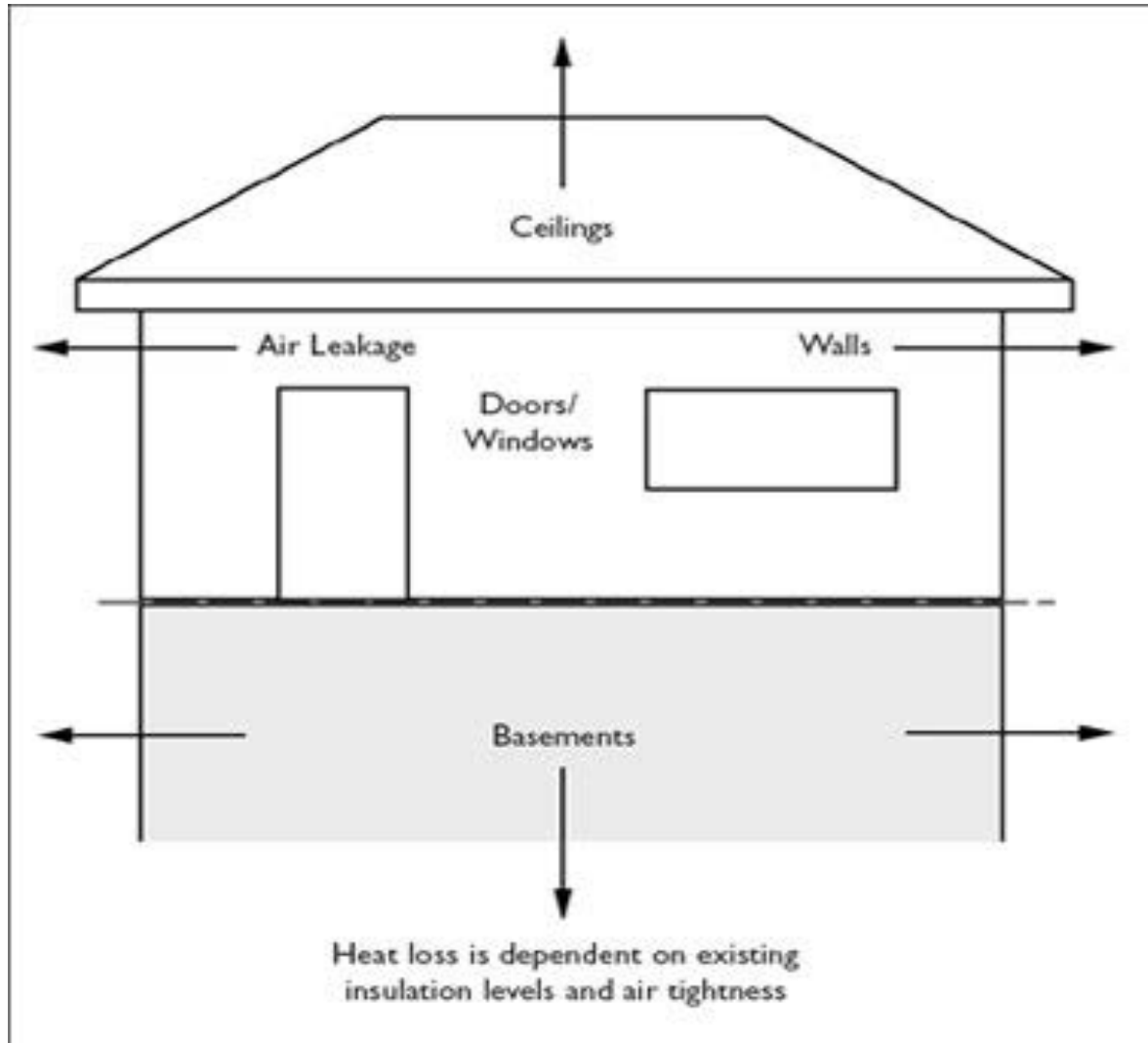
- Home Must be Electrically Heated
  - Firm Rate
  - Dual Fuel (must have non-electric backup)
  - Controlled Access/Storage Heating
  - Ground Source Heat Pumps
- To participate in the Triple E Program please call 218-355-2843

# Program History

## Triple E

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

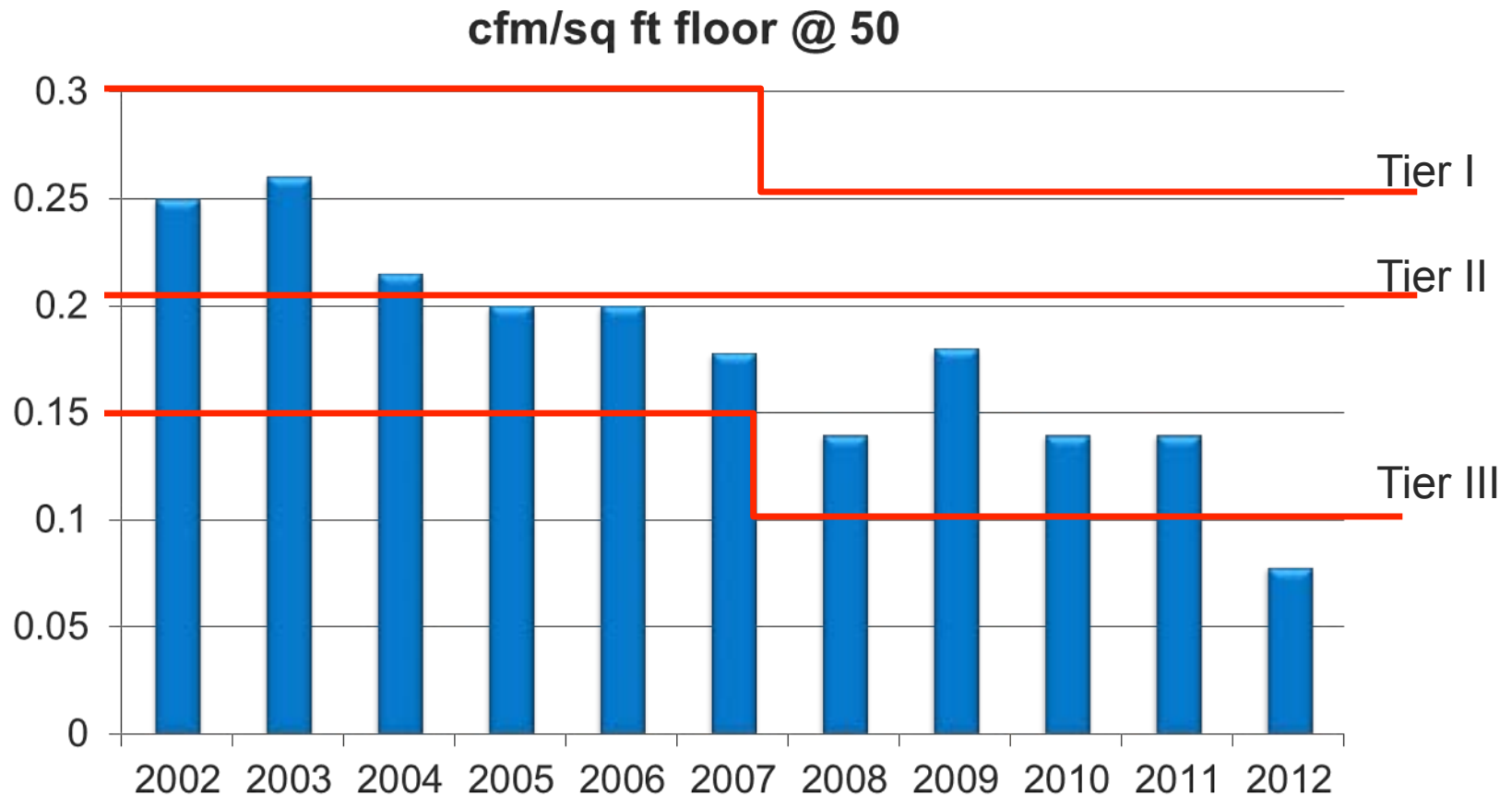
# Heat Loss



# Basic Goals

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

# Historical Air Tightness



# 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

# Raising the Bar

- Put out Bids on Three Houses
  - Slab House
  - Basement House
  - House with Basement & a Cantilever
- Cost/Benefit was performed

# 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

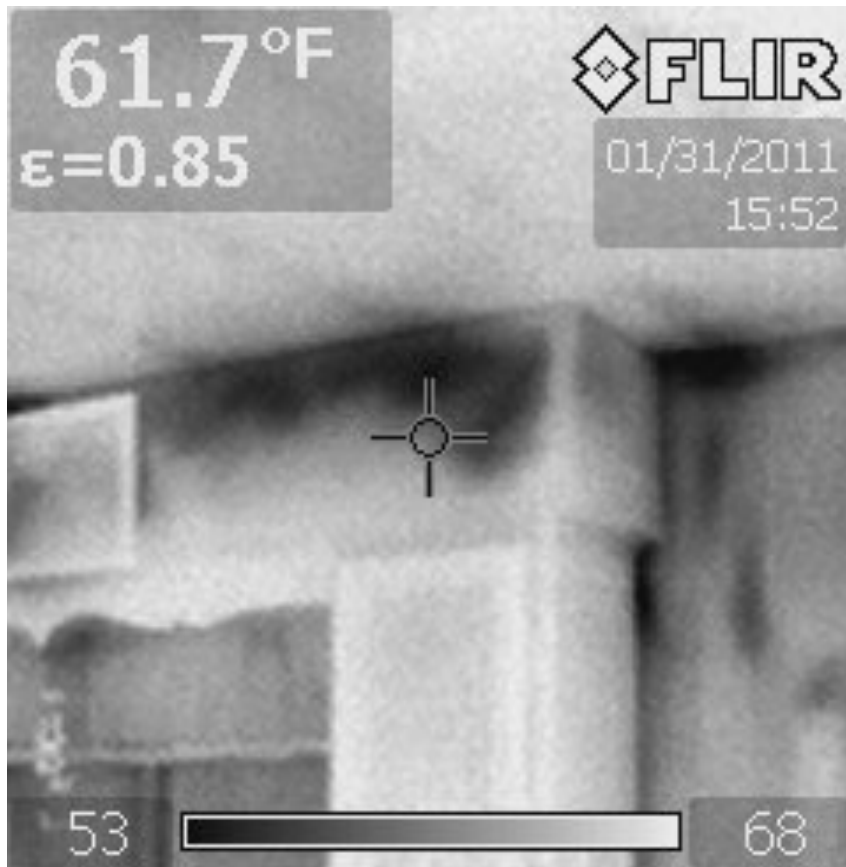
# Final Test

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

# Energy Saved - kWh

	<b>Code - Ann Consump</b>	<b>Code - Design Load</b>	<b>As Built - Ann Consump</b>	<b>As Built - Design Load</b>
House #1	11,810.00	6.27	5,451.00	3.72
House #2	15,532.00	8.06	8,294.00	5.16
House #3	13,129.00	6.30	9,407.00	4.86
House #4	35,578.00	18.43	13,188.00	8.82
House #5	14,800.00	8.15	3,428.00	3.05
House #6	8,323.00	4.75	4,777.00	3.19
House #7	34,025.00	15.77	19,020.00	9.88
House #8	17,877.00	9.08	9,085.00	5.59
House #9	27,255.00	13.77	13,920.00	8.32
House #10	19,958.00	16.00	6,271.00	9.23
House #11	39,593.00	20.54	11,283.00	9.88
House #12	13,745.00	7.20	5,216.00	3.57
<b>Average</b>	<b>20,968.75</b>	<b>11.19</b>	<b>9,111.67</b>	<b>6.27</b>

# Slab House

1,500 Sq. ft.  
 Attached Garage  
 Electric DF Boiler  
 w/NG Fireplace

Electric water heater  
 SEER 13 AC  
 Air Tightness: 3 ACH  
 Vent: 55% eff.

	<u>Base</u>	<u>Tier I</u>	<u>Tier II</u>
Design Heating Load-KBtu/Hr	30.4	25.8	22
Annual Consumption-MMBtu/yr	104.7	92	80.2
Total Cost Per Year	\$1,715	\$1,507	\$1,318

# Basement House

3,750 Sq. ft.  
 Attached Garage  
 Electric DF Boiler  
 w/NG Fireplace

Electric Water Heater  
 SEER 13 AC  
 Air Tightness: 3 ACH  
 Vent: 55% eff.

	<u>Base</u>	<u>Tier I</u>	<u>Tier II</u>
Design Heating Load-KBtu/hr	40.2	31	25.1
Annual Consumption-MMBtu/yr	138	112	98
Total Cost per year	\$2,200	\$1,785	\$1,556

# Basement House w/ Cantilever

4,000 Sq. ft.  
 Attached Garage  
 Electric DF Boiler  
 w/NG Fireplace

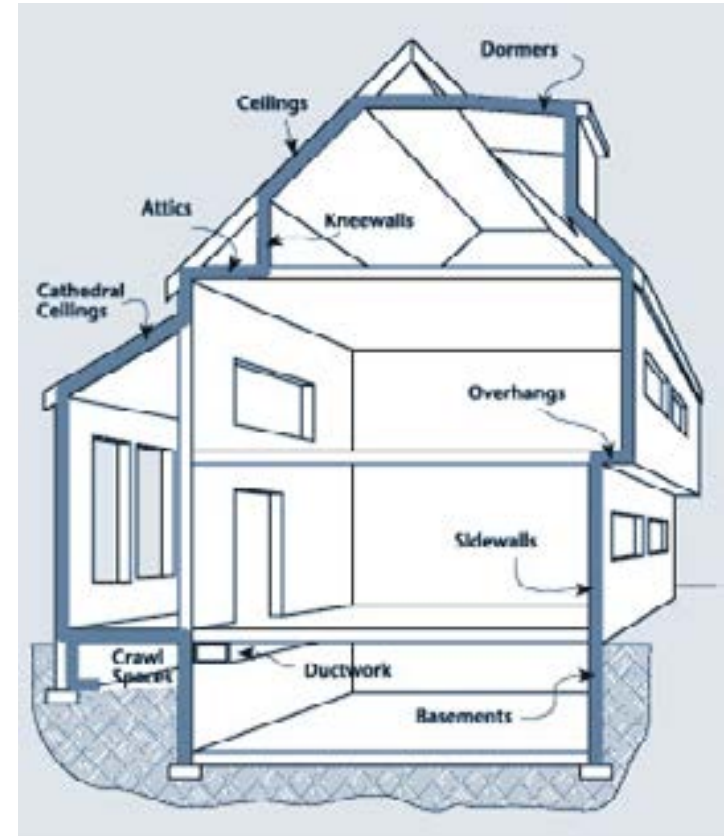
Electric Water Heater  
 SEER 13 AC  
 Air Tightness: 3 ACH  
 Vent: 55% eff.

	<u>Base</u>	<u>Tier 1</u>	<u>Tier II</u>
Design Heating Load-KBtu/Hr	42.4	32.7	26.1
Annual Consumption-MMBtu/yr	145	118.1	102.5
Total Cost Per year	\$2,310	\$1,873	\$1,619

# 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

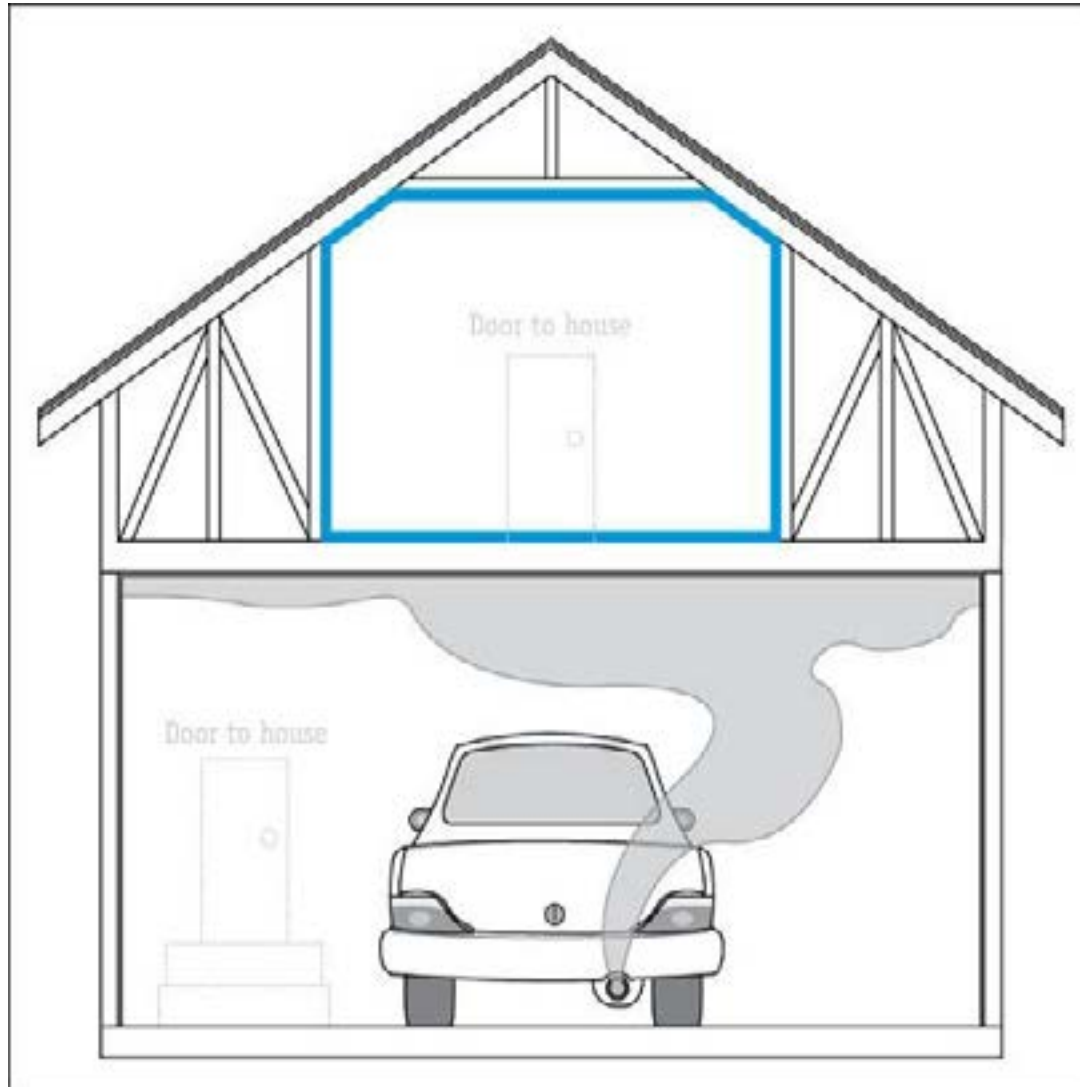
# Bonus Rooms



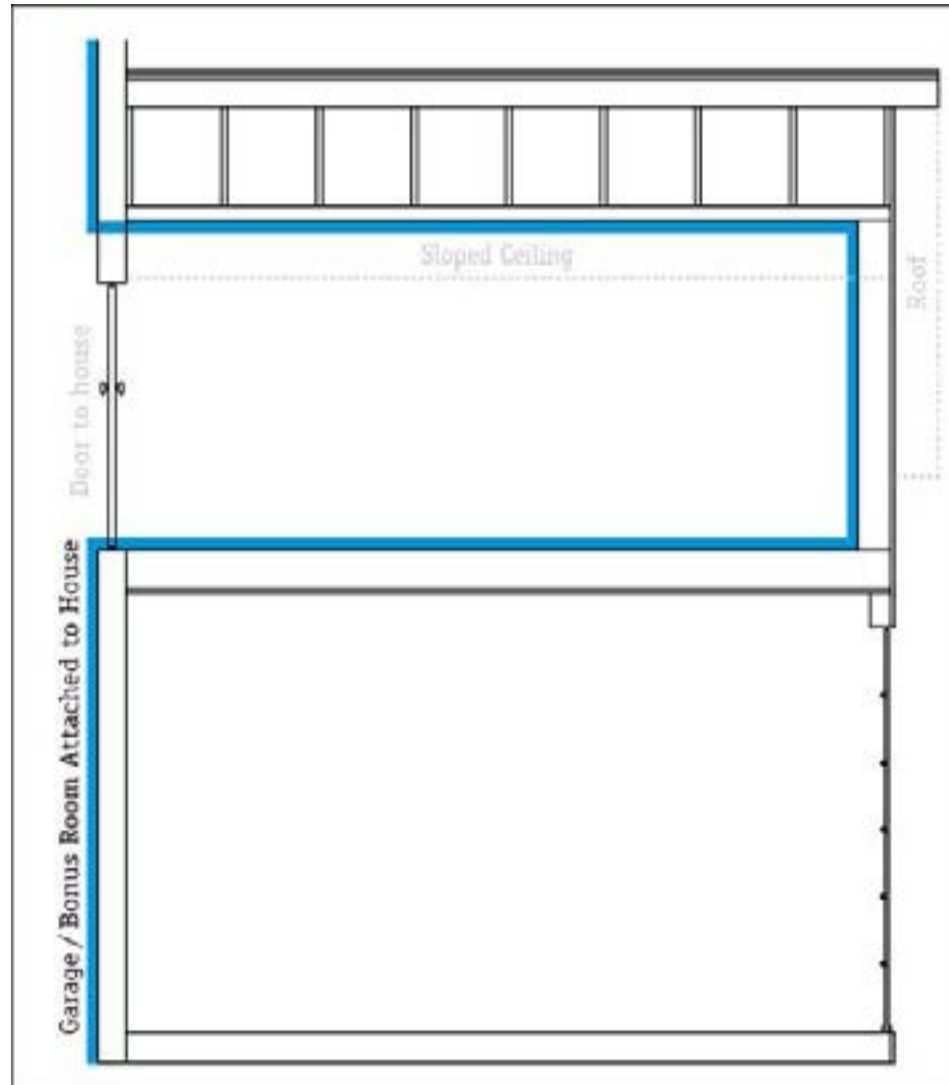
# Bonus Rooms

- 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

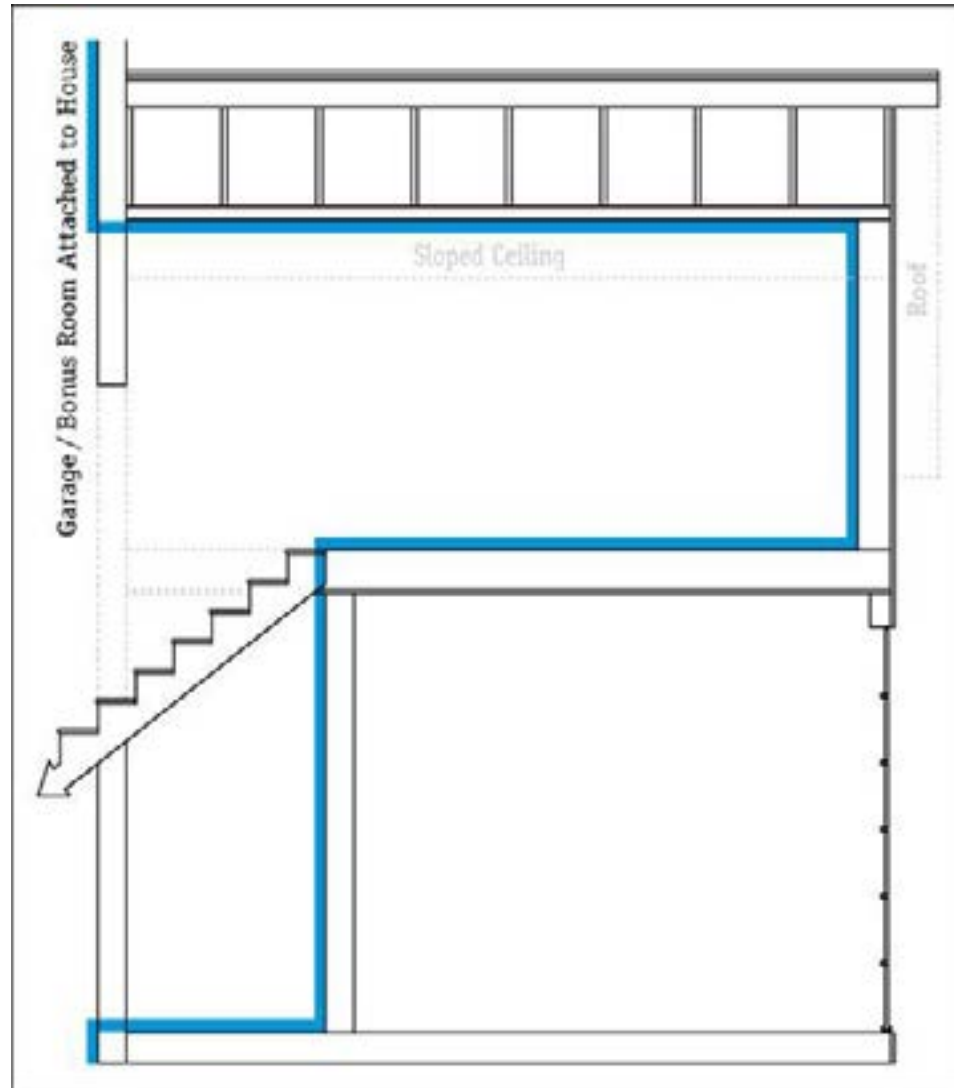
# Determine the Thermal Enclosure



# Determine the Thermal Enclosure



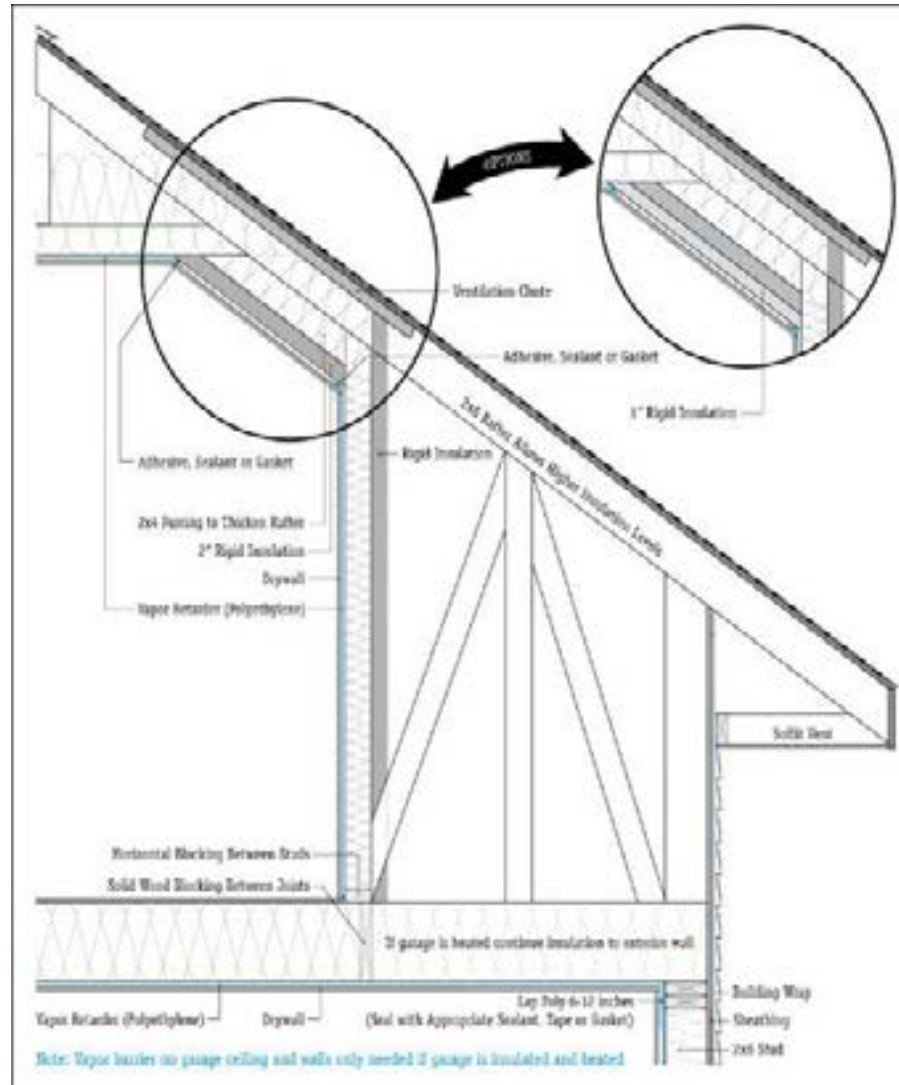
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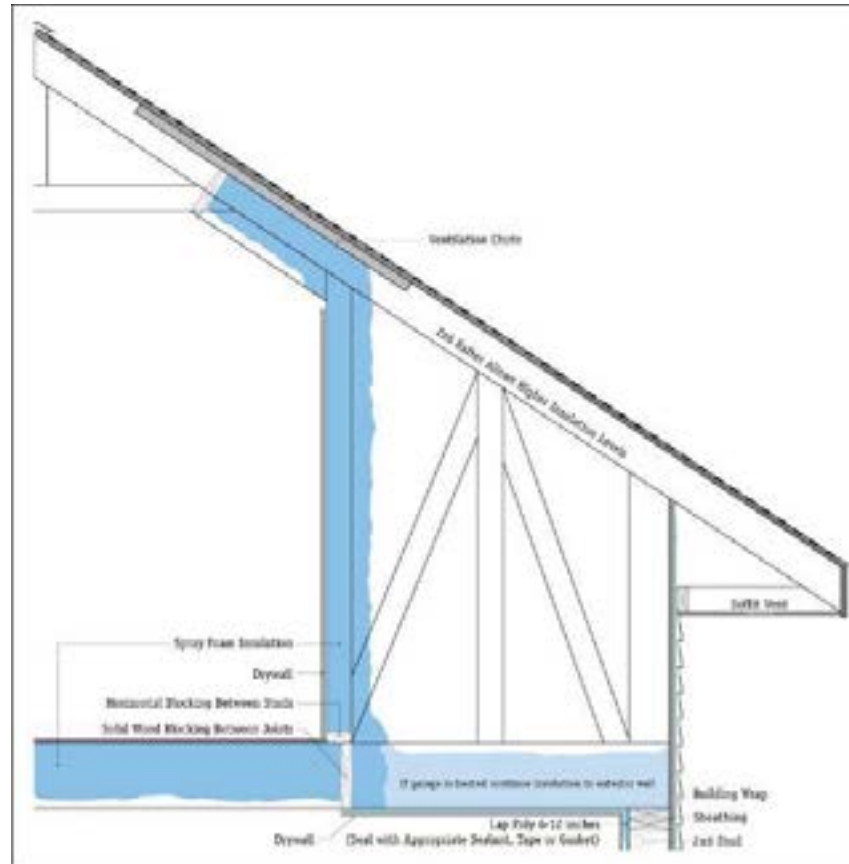
# Bonus Room Detail – With Rigid Foam Insulation



a conservation program



# Bonus Room Detail – With Spray Foam Insulation





# Examples



# Bonus Room - Examples



# Bonus Room - Example



# Bonus Rooms - Example



# Bonus Rooms - Example



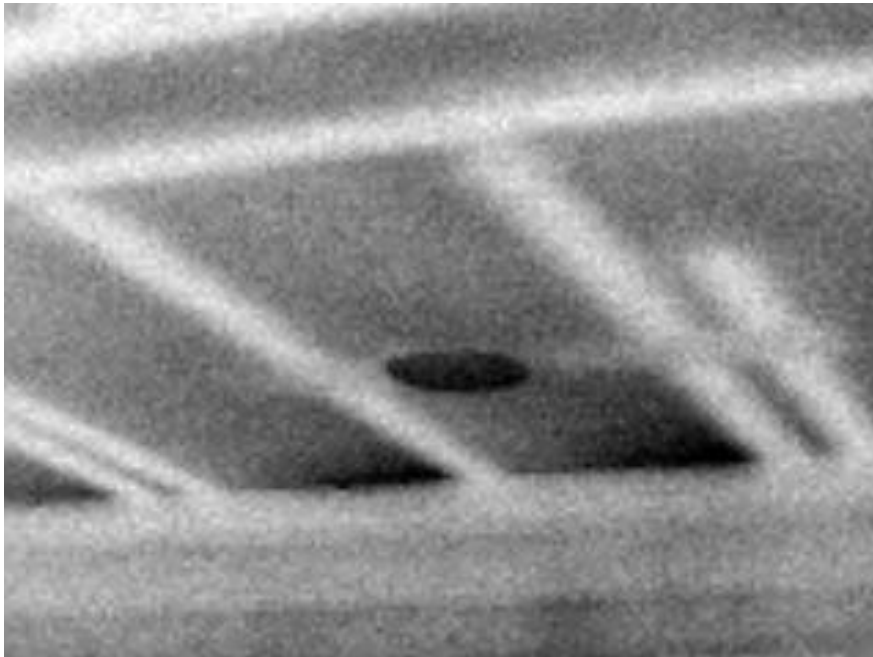
# Cantilevers



# Cantilevers

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

# Examples





# Examples



# Cantilevers - Example



# Can Lights

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

# Can Lights



# Examples



# Examples



# Examples



# Examples





# Examples



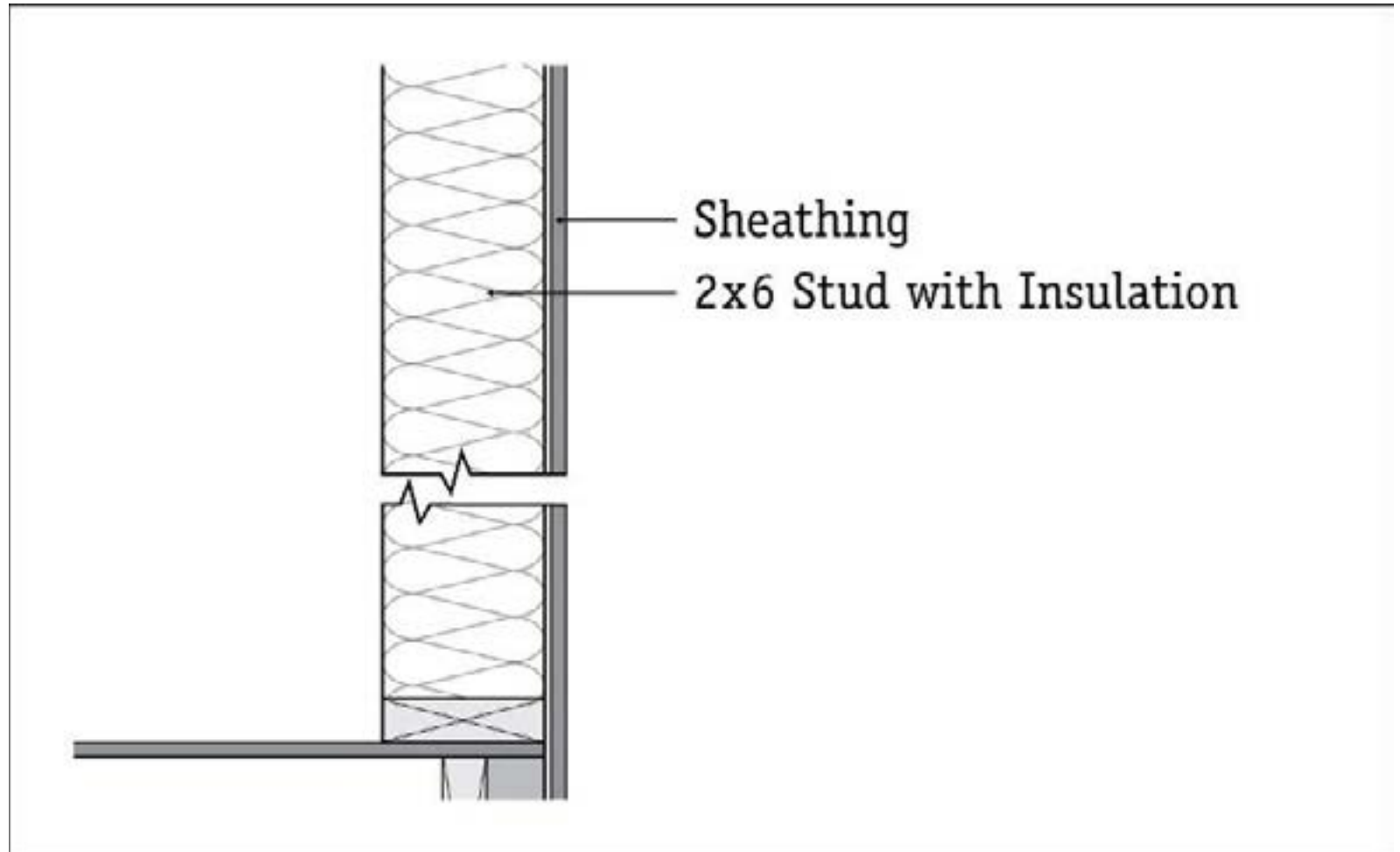
# Exterior Walls Assemblies

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

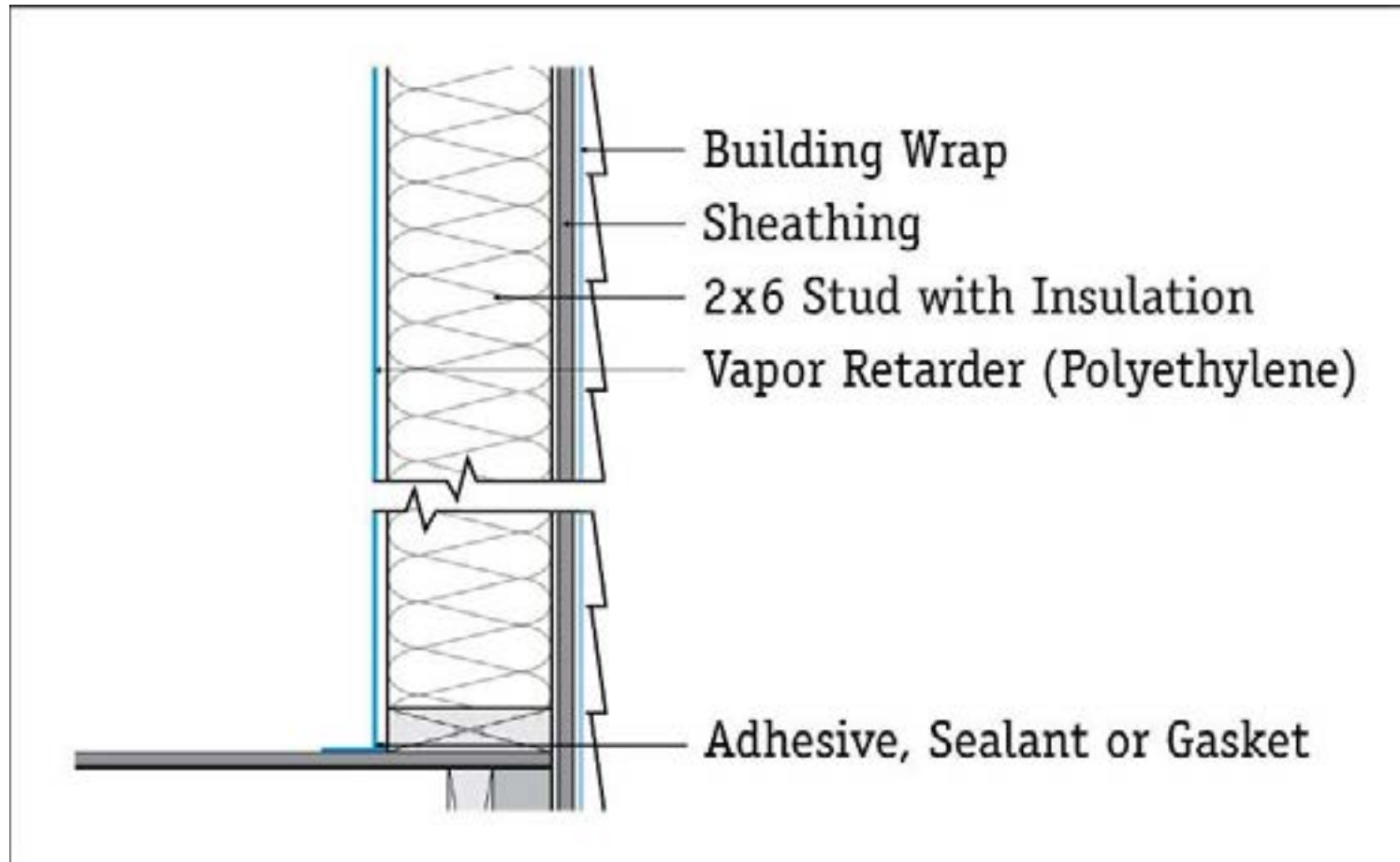
# Exterior Wall Assemblies



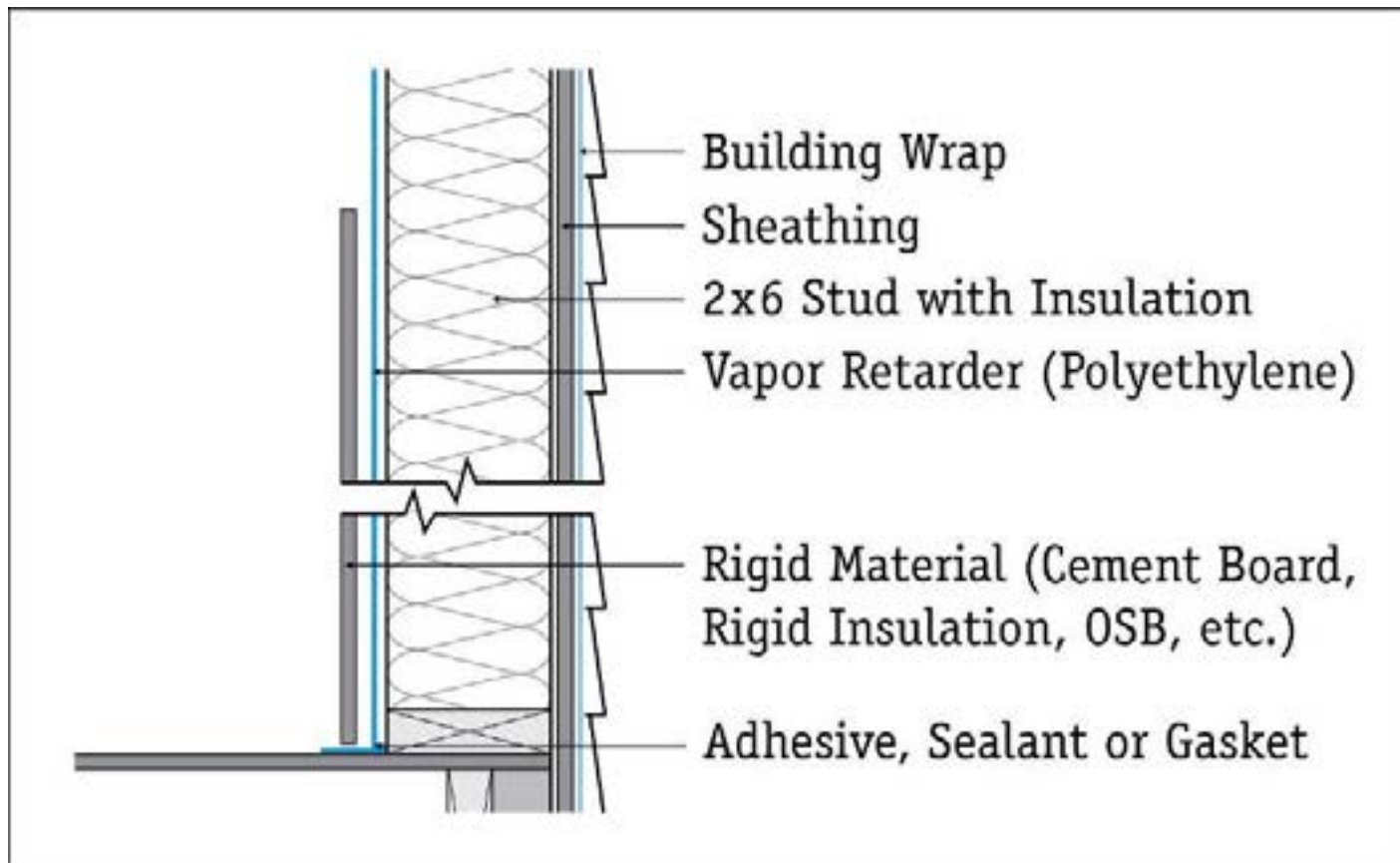
# Examples



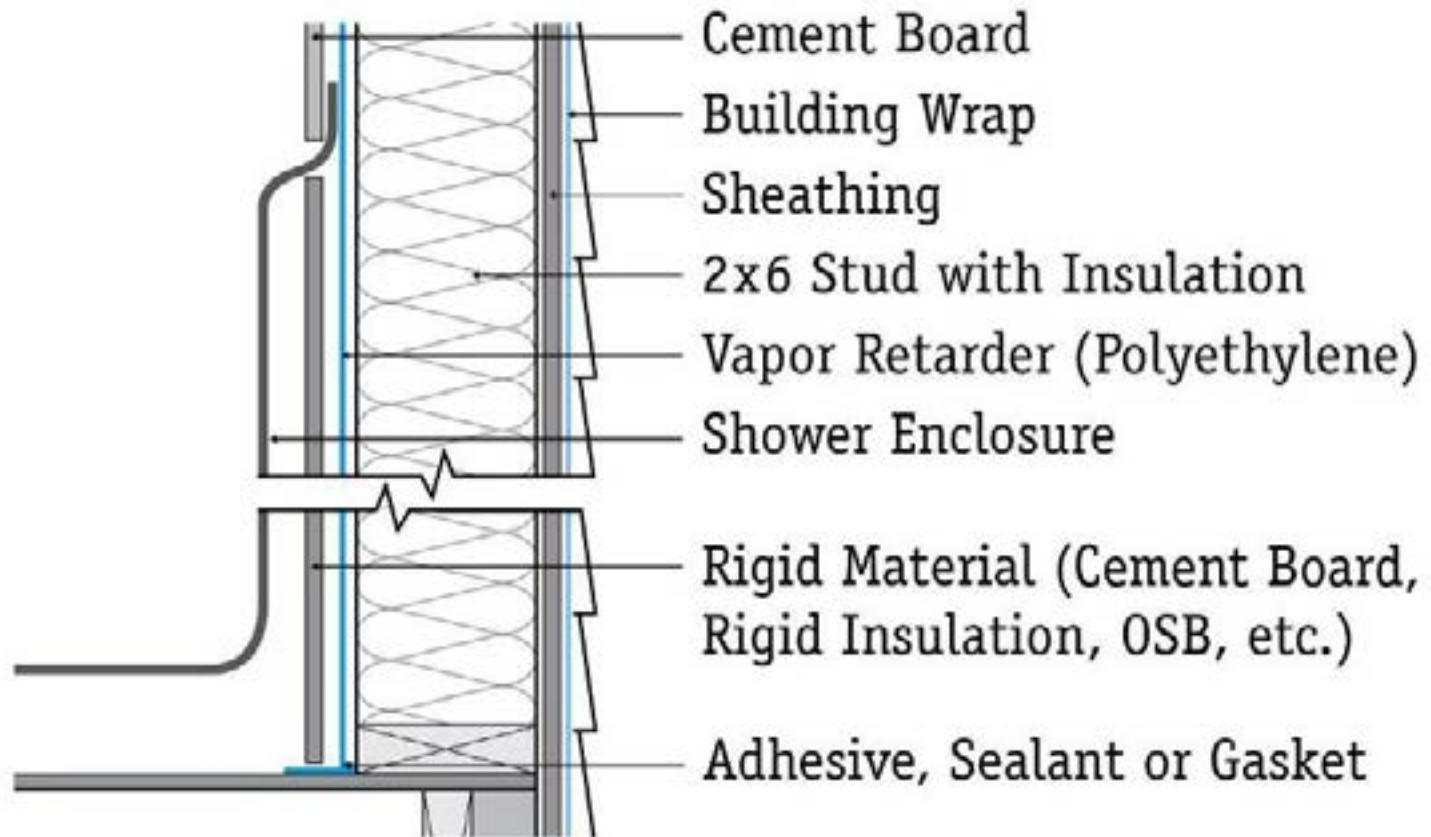
# Examples



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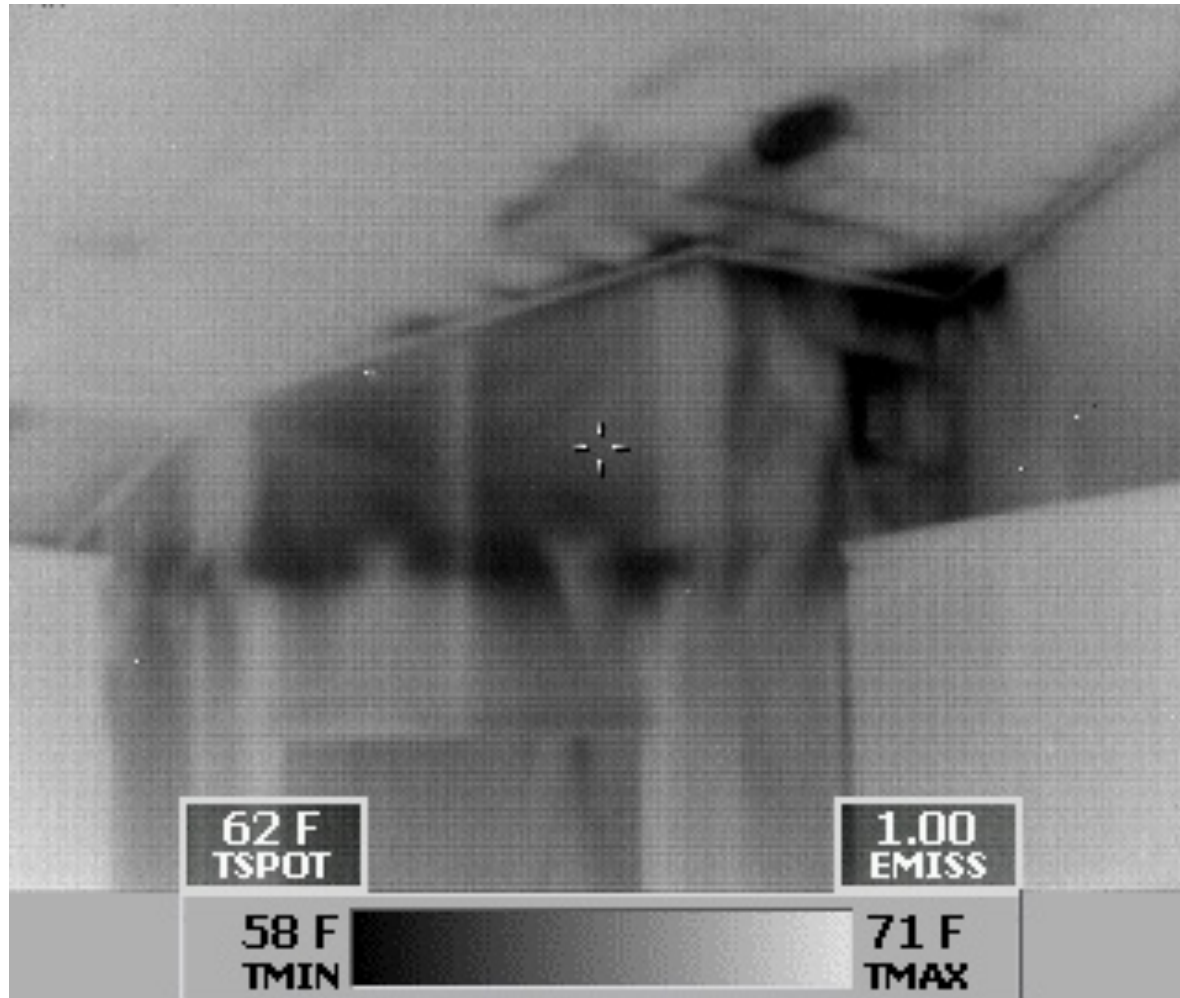
# Examples



# Examples



# Examples

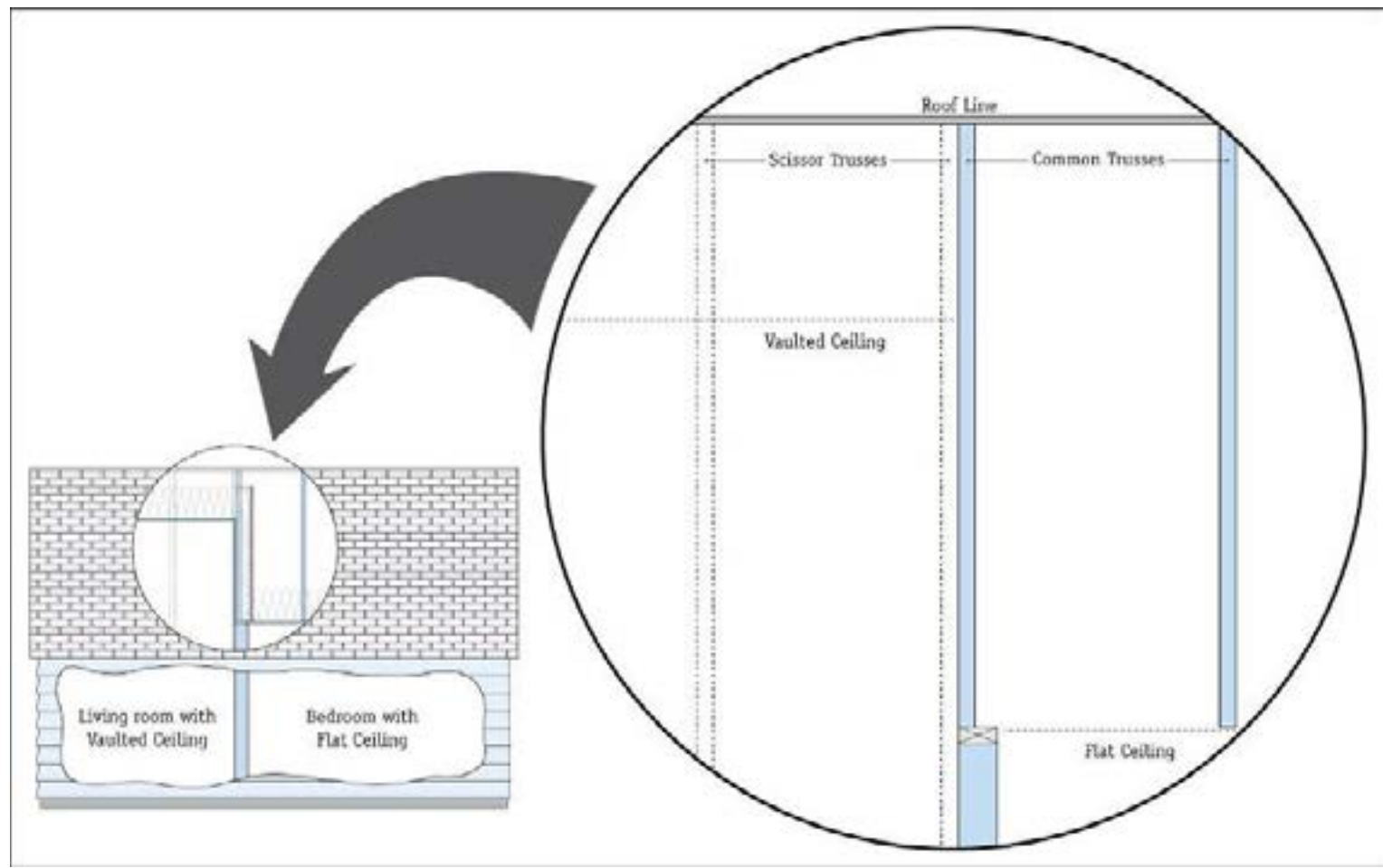


# Duct Work in the Attic

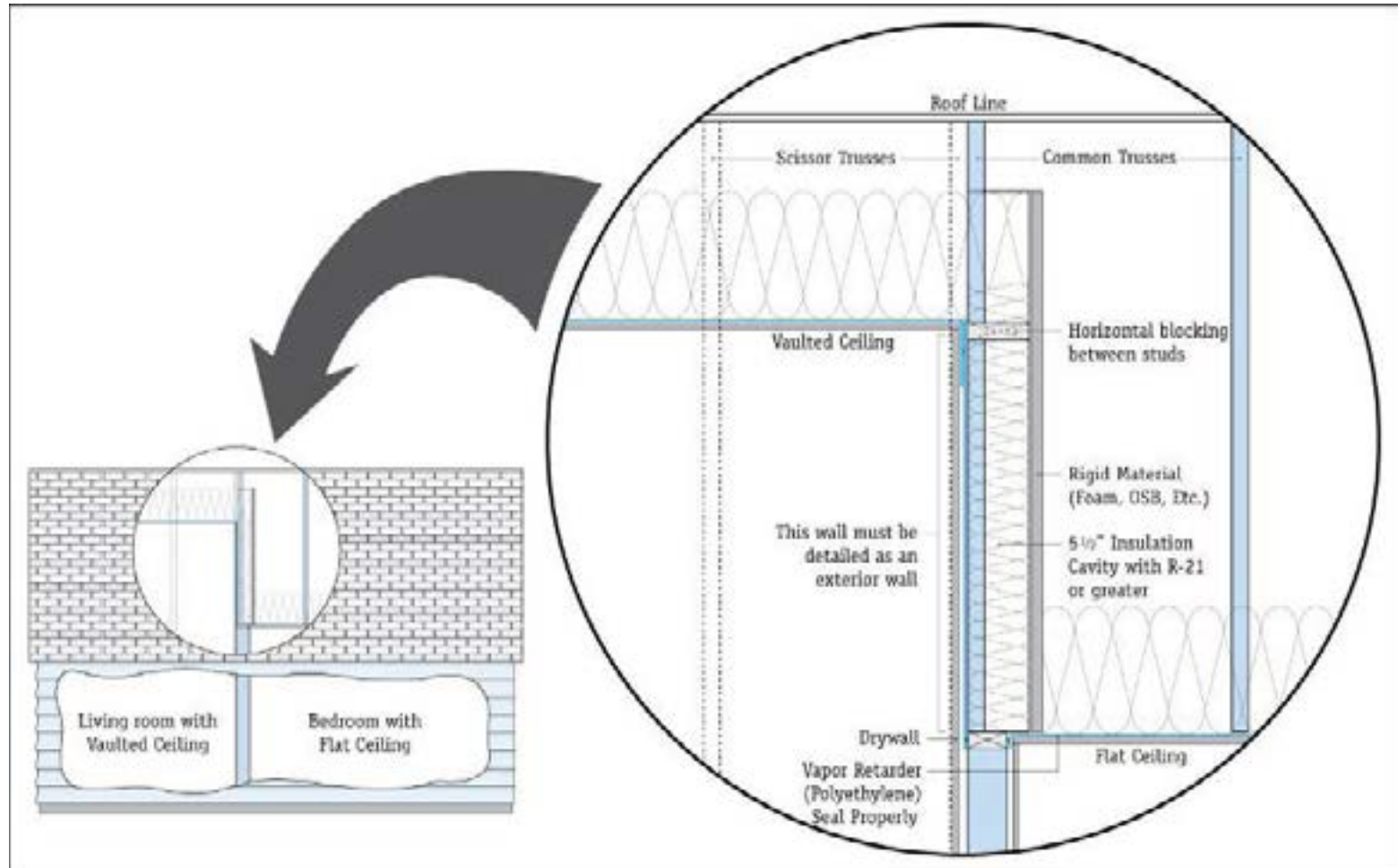




# Vault to Flat Ceilings



# Examples



# Examples



# Triple E

- Energy Efficiency
- Education
- Evaluation

Thank You