RESNET ANNUAL CONFERENCE
FEBRUARY 17, 2009

ENERGY STAR

ENERGY STAR for Homes:

The Road Ahead

Sam

Dean

METHOD TO ENERGY STAR MADNESS

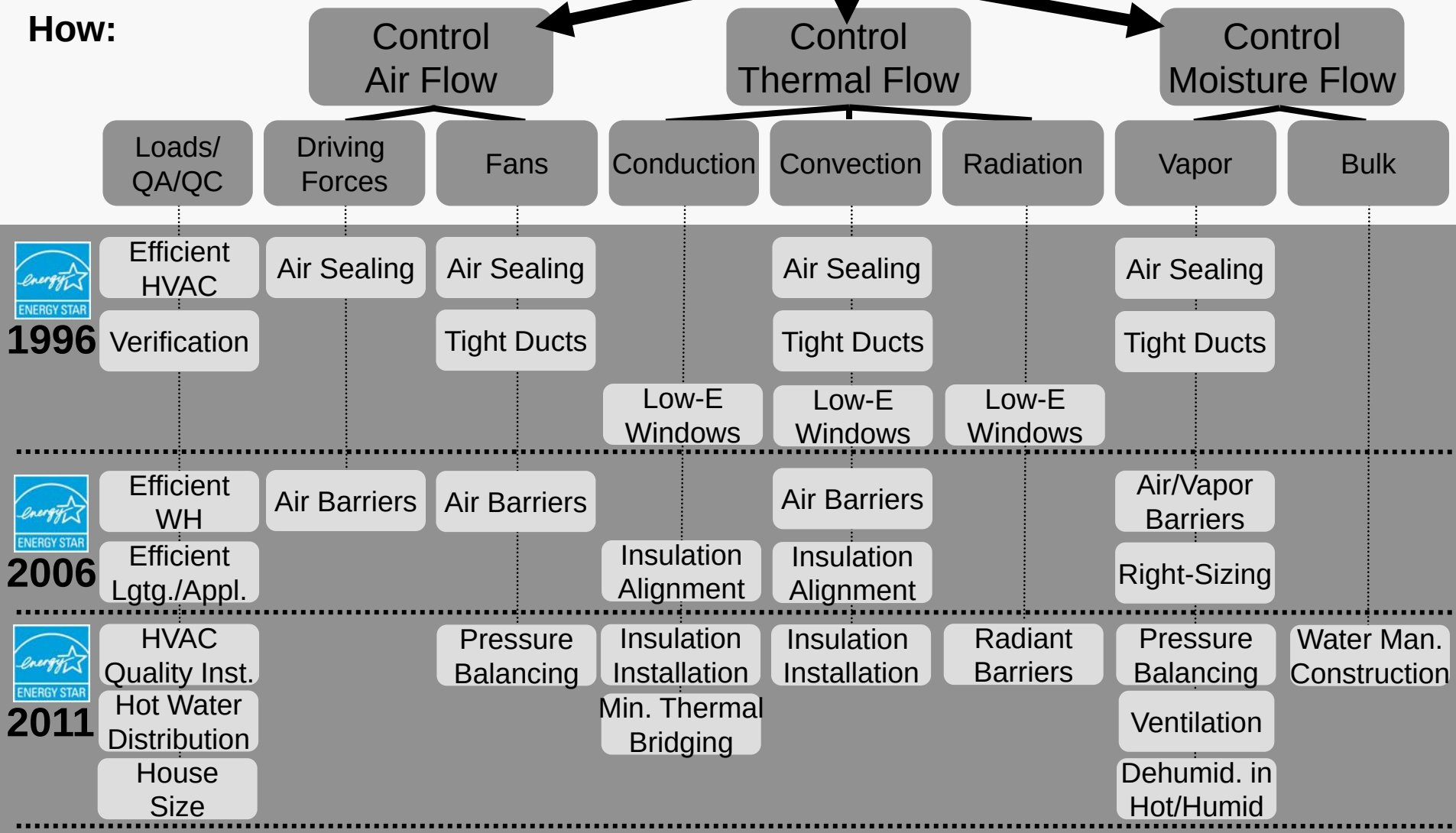
Goal:

- < Risk
- > Customer Satisfaction
- > Differentiation
- > Environmental Protection
- > National Security

= **Affordable Comfortable Healthy Durable** =

Better Home
Lower Cost
Badge of Honor

How:



METHOD TO INDOOR AIR PLUS MADNESS

Why:

< Risk of IAQ Problems
Trivial Extra Cost

=

< Risk
> Customer Satisfaction
> Differentiation

=

Affordable
Comfort
Health
Durability

How:

- Source Control
  - Moisture Bulk
    - Water Man. Construc.
    - Moisture Resist. Mat.
    - Protect Materials
  - Moisture Vapor
    - Air Sealing
    - Air Barriers
    - Tight Ducts
    - HVAC Quality Inst.
    - Proper Vap. Barriers
    - Dehum. In Hot/Humid
  - Radon
    - Radon Resist. Con.
    - Test Kits Zones 1 & 2
  - Biological
    - Seal Foundation
    - Screen Openings
  - Combustion
    - Direct/Power Vent Equip.
    - FPL/Stove Vented/Stds.
    - CO Alarms
    - No Smoking Com. Areas
    - Garage Isolation
  - Chemical
    - Pressed Wood
    - Inter. Paints Finishes
    - Carpets
- Dilution
  - Ventilation
    - Whole-Hse Ventilation
    - Spot Ventilation
    - Garage Ventilation
- Filtration
  - Filters/ Air Cleaning
    - MERV 8 Filter
    - No Ozone Generators

What:

EPA Indoor airPLUS QUALIFIED HOME

ENERGY STAR QUALIFIED HOMES 2011 SPEC

KEY INNOVATIONS

- *More rigorous mandatory requirements*
- *Substantial increase in checklists*
- *Size Factor*

Note that HERS Index threshold under development.

ENERGY STAR QUALIFIED HOMES 2011 SPEC

PRESCRIPTIVE/PERFORMANCE PATH

Mandatory Requirements for All Labeled Homes

+

Performance Path
Minimum HERS Index Score Adjusted for Size

or

Prescriptive Path
Builder Option Package Specifications
(only for homes with CFA ≤ Benchmark Home)

ENERGY STAR QUALIFIED HOMES 2011 SPEC

MANDATORY REQUIREMENTS

- **Duct Leakage**
  - Outside: ≤ 4 CFM/100 sf CFA
  - Total: ≤ 6 CFM/100 sf CFA
- **Hot Water Efficiency**
  - Shower Heads < 2.0 gpm
  - Efficient Hot Water Distribution
- **ENERGY STAR Products**
  - Refrigerator, Dishwasher, Clothes Washer where provided
  - ALP or Bulbs in 80% Sockets
  - Ceiling Fans, where provided

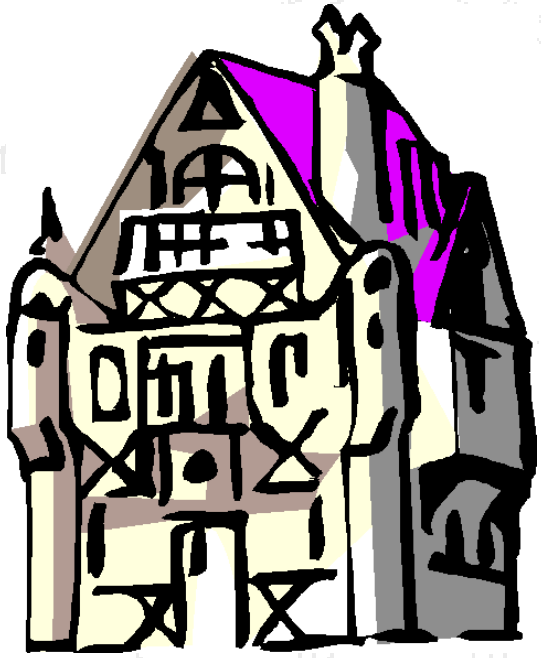
ENERGY STAR QUALIFIED HOMES 2011 SPEC

CHECKLISTS

- *Thermal Bypass*
- *Quality Framing*
- *HVAC Quality Installation Contractor*
- *HVAC Quality Installation Verifier*
- *Indoor Air Quality*
- *Water Managed Construction*

ENERGY STAR QUALIFIED HOMES 2011 SPEC

SIZE ADJUSTMENT FACTOR STRATEGY



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ENERGY STAR QUALIFIED HOMES 2011 SPEC

SIZE ADJUSTED HERS INDEX SCORE

Benchmark Home Size

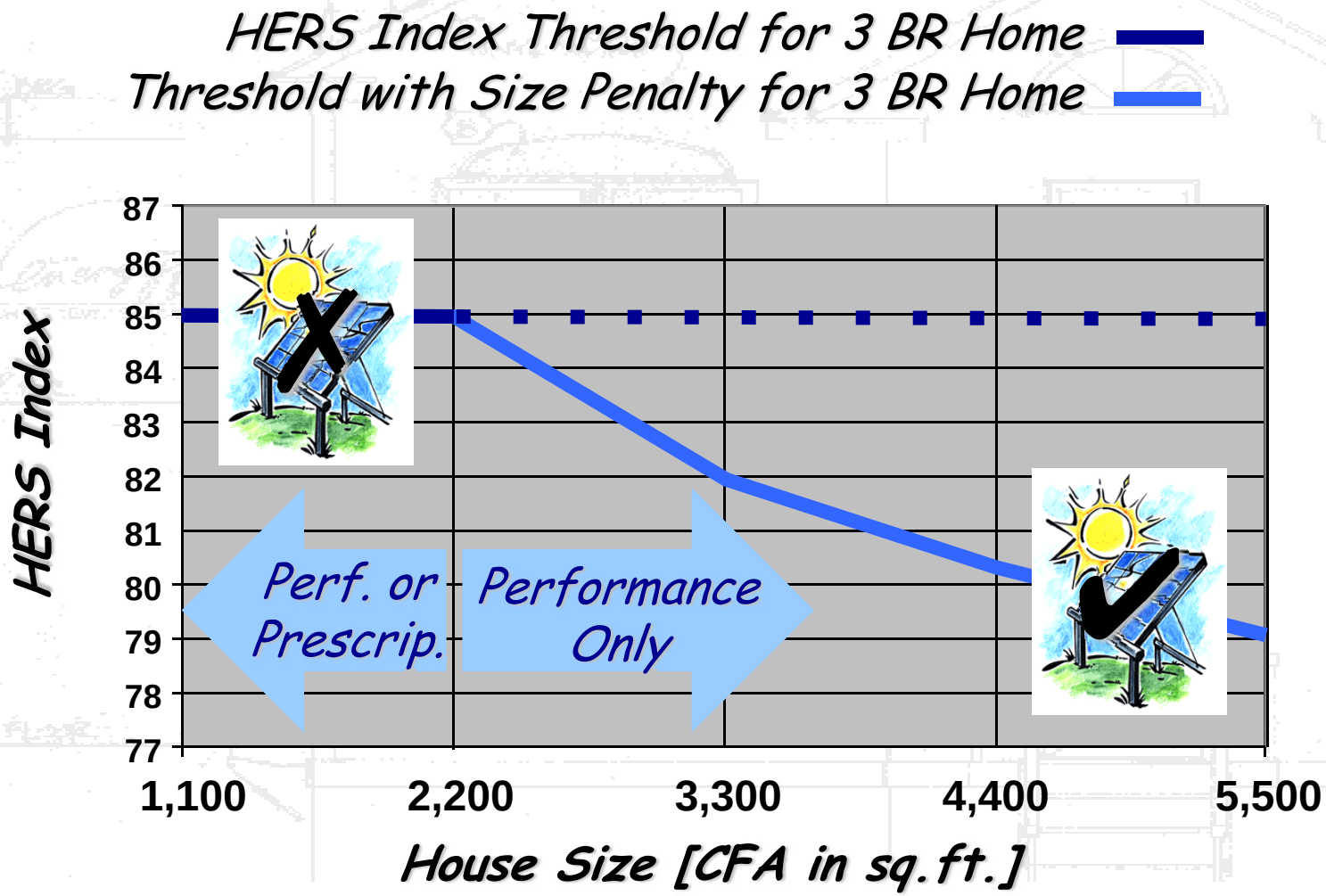
BR's	1	2	3	4	5	6	7	8
CFA	1,045	1,620	2,200	3,010	3,300	3,960	4,620	5,280

$$\left(\frac{\text{CFA Benchmark Home}}{\text{CFA Rated Home}}\right)^{0.05} \times \text{HERS Index Score}$$

Size Modification Factor not to exceed 1.0

ENERGY STAR QUALIFIED HOMES 2011 SPEC

SIZE PENALTY EXAMPLE



CLIMATE CHOICE

- *Builds on ENERGY STAR specs*
- *Acts as "farm system"*
  [Expedite specific bundle of targeted technologies that don't yet meet ENERGY STAR criteria]

CLIMATE CHOICE ADVANCED TECHS.

Base: ENERGY STAR 2011 + Indoor airPlus

- *Super Air-Tight Construction*
- *Super Insulation*
- *Super Windows*
- *Super-Efficient Equipment*
- *Ducts Inside Conditioned Space*
- *ENERGY STAR Water Heating*

MARKET TRANSFORMATION: ONE BUNDLE AT A TIME

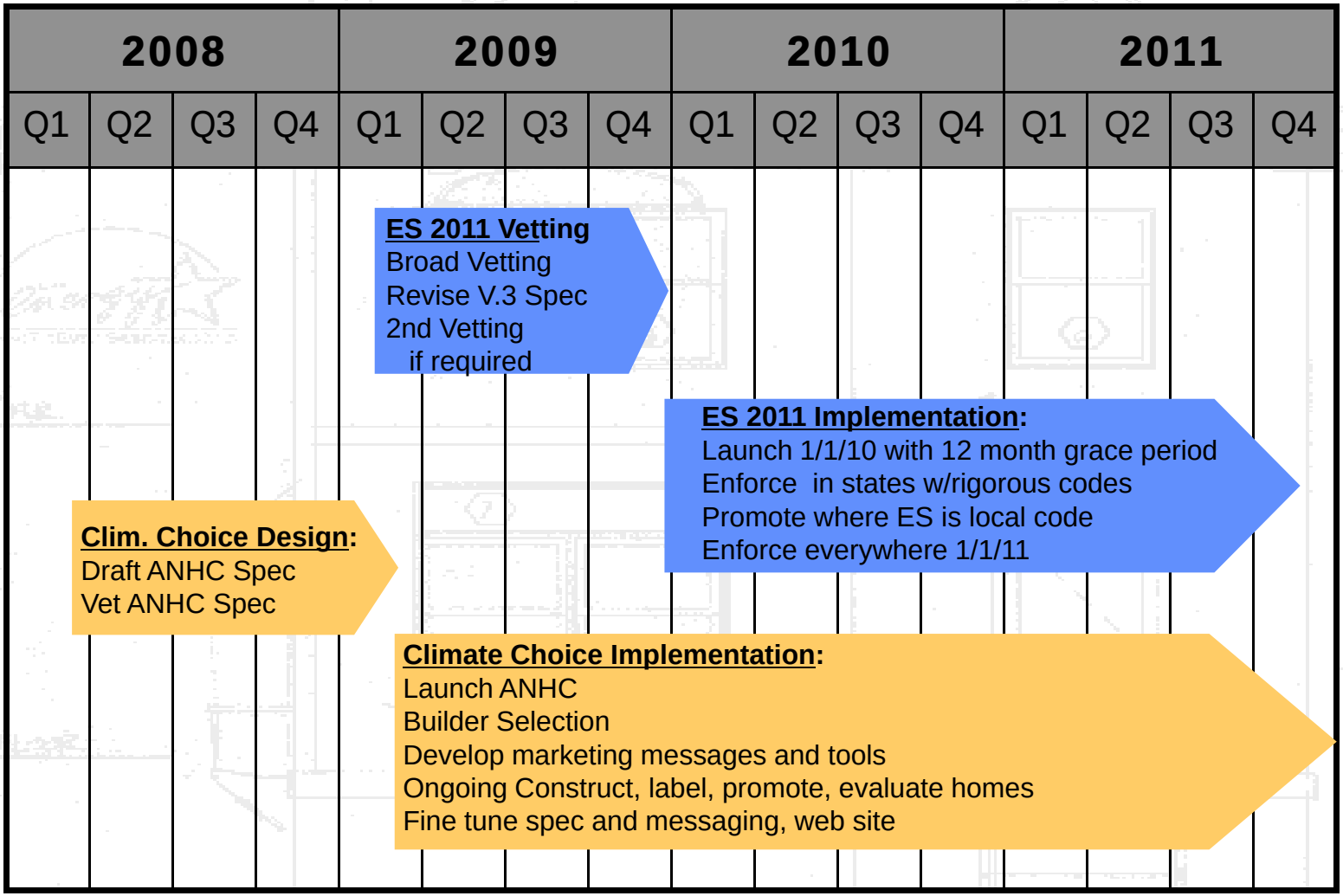
Size Adjustment	Lighting/ Appliances	HVAC Quality Installation	Safe Materials	Behavior/ Design
		Water Heating Distribution	Combustion Safety Techs.	ENERGY STAR WH
High Eff. HVAC Equip.	High Eff. Lgtg./Appl.	Insulation Installation	Pest Barriers	Super-Tight Construction
Tight Ducts	High Eff. Water Htr.	Min. Thermal Bridging	Radon Resist. Construction	Super Eff. HVAC Equip
Air Sealing	Right-Sizing	Ventilation Field Verified	Ventilation Field Verified	Ducts in Condit. Space
Low-E Windows	Insulation Alignment	Pressure Balancing	Pressure Balancing	Super Window
Verification	Air Barriers	Water Man. Construction	Water Man. Construction	Insulation 50%> Code

ENERGY STAR 1996 ENERGY STAR 2006 ENERGY STAR 2011 EPA Indoor airPLUS QUALIFIED HOME

Climate Choice

NICHE OR MAINSTREAM PRODUCT?

TIMELINE


2008
2009
2010
2011
Q1 Q2 Q3 Q4 Q1 Q2 Q3 Q4 Q1 Q2 Q3 Q4 Q1 Q2 Q3 Q4
ES 2011 Vetting
Broad Vetting
Revise V.3 Spec
2nd Vetting
if required
ES 2011 Implementation:
Launch 1/1/10 with 12 month grace period
Enforce in states w/rigorous codes
Promote where ES is local code
Enforce everywhere 1/1/11
Clim. Choice Design:
Draft ANHC Spec
Vet ANHC Spec
Climate Choice Implementation:
Launch ANHC
Builder Selection
Develop marketing messages and tools
Ongoing Construct, label, promote, evaluate homes
Fine tune spec and messaging, web site

ENERGY STAR QUALIFIED HOMES VERSION 3:

HVAC QUALITY INSTALLATION

Right-Sizing

Equipment (ACCA Manual J/S)
Ducts (ACCA Manual D)
Terminals (ACCA Manual T)

Air Distribution

Duct Leakage
Static Pressure
Flow Across Coil
Room-by-Room Air Flow

Refrigerant Charge

Testing
TXV Valve

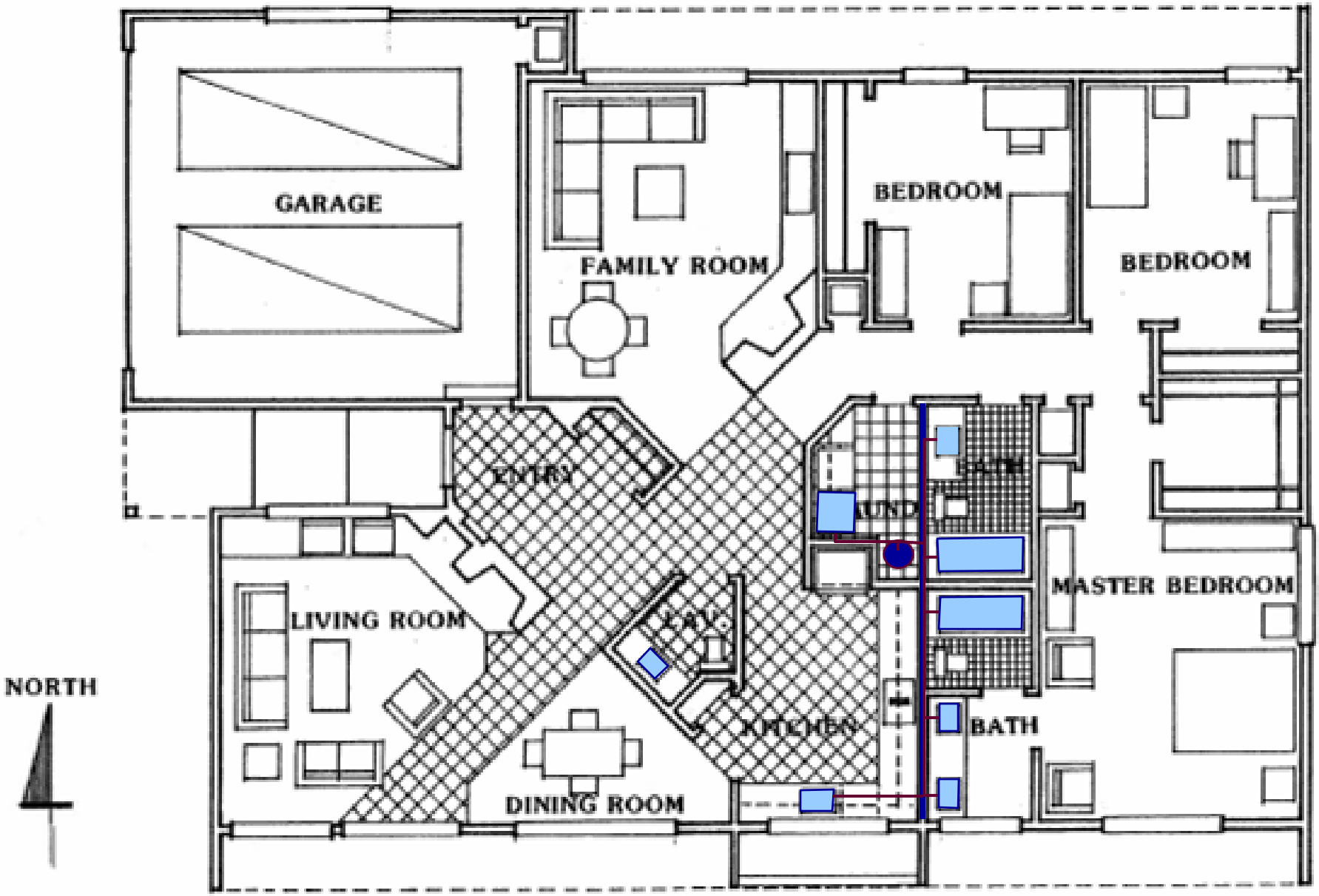
EFFICIENT WATER HEATING SYSTEM

- Energy Factor
- Distribution
- Insulated Piping
- Heat Trap Above Tank/Heater

ENERGY STAR QUALIFIED HOMES VERSION 3:

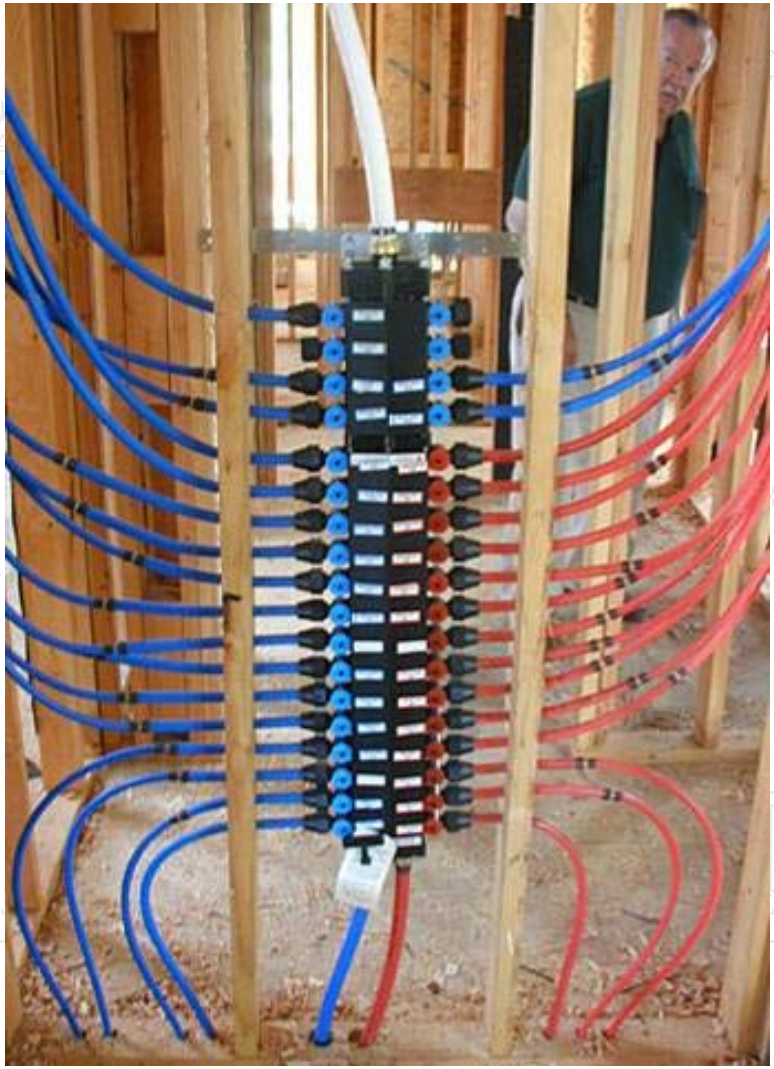
WATER HEATING DISTRIBUTION

- Core System (Wet Walls)
- Manifold System
- Demand Pumping System

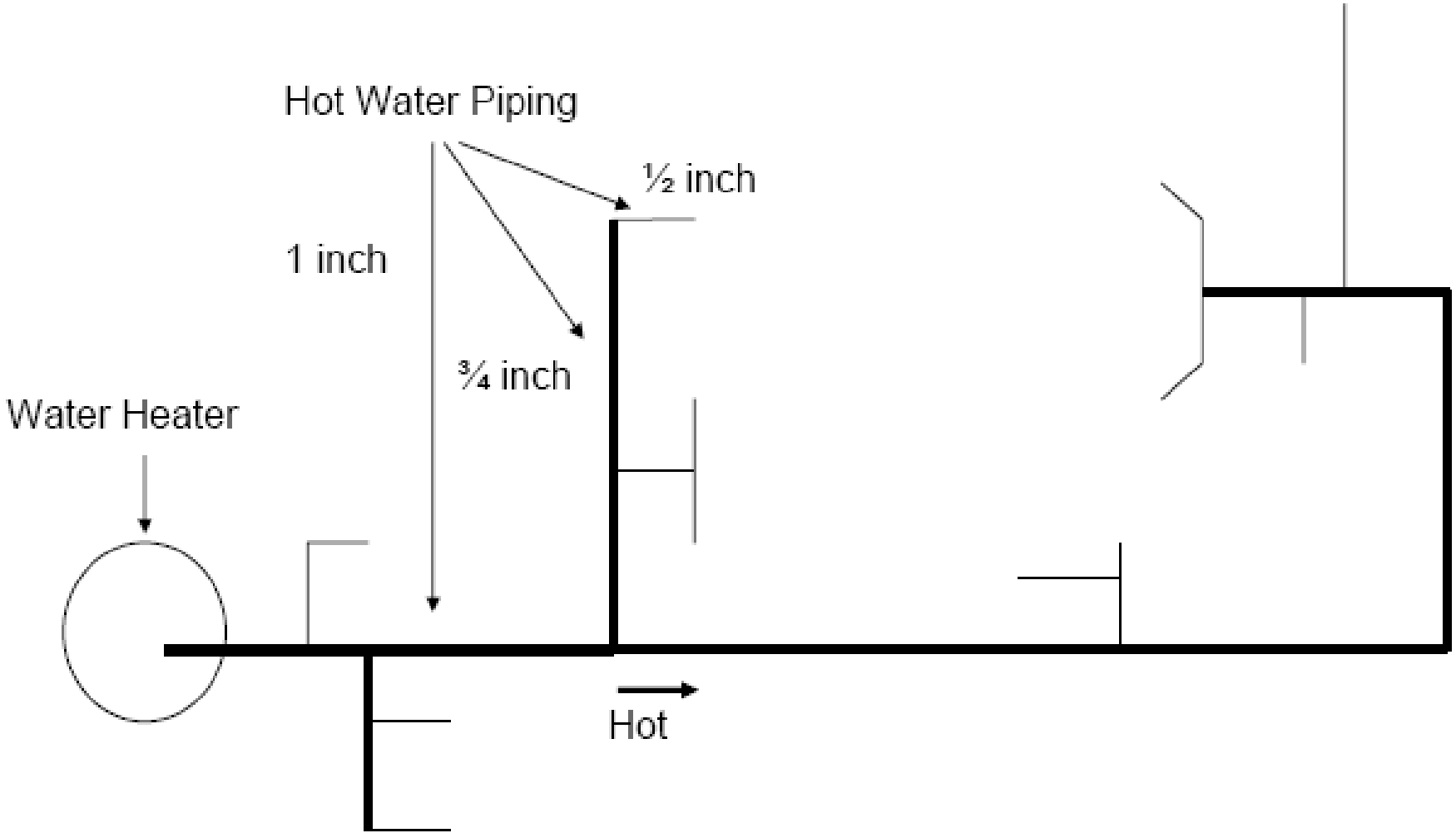

GARAGE
FAMILY ROOM
BEDROOM
BEDROOM
ENTRY
LAUN
LIVING ROOM
MASTER BEDROOM
KITCHEN
BATH
DINING ROOM
NORTH

1800 SQ. FT.

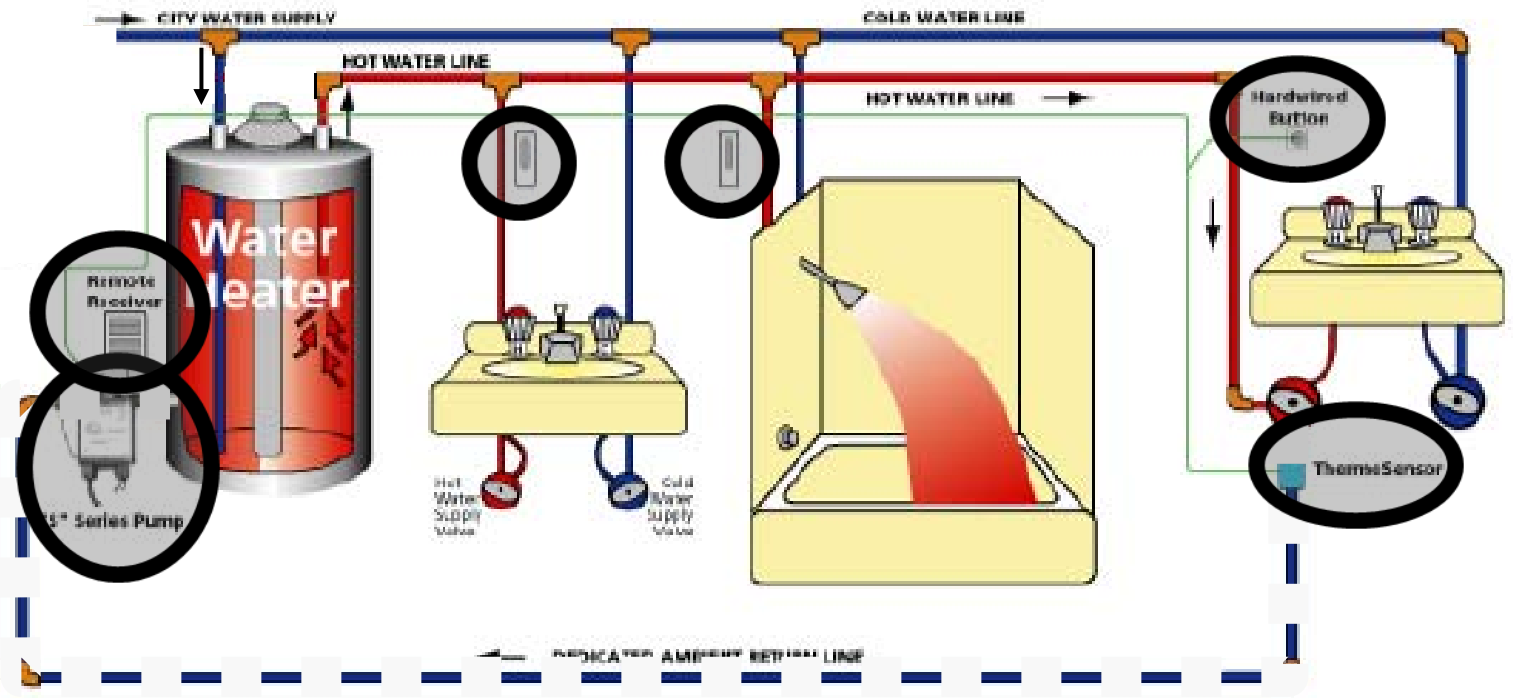
MANIFOLD HOT WATER DISTRIBUTION



Single Trunk and Branch



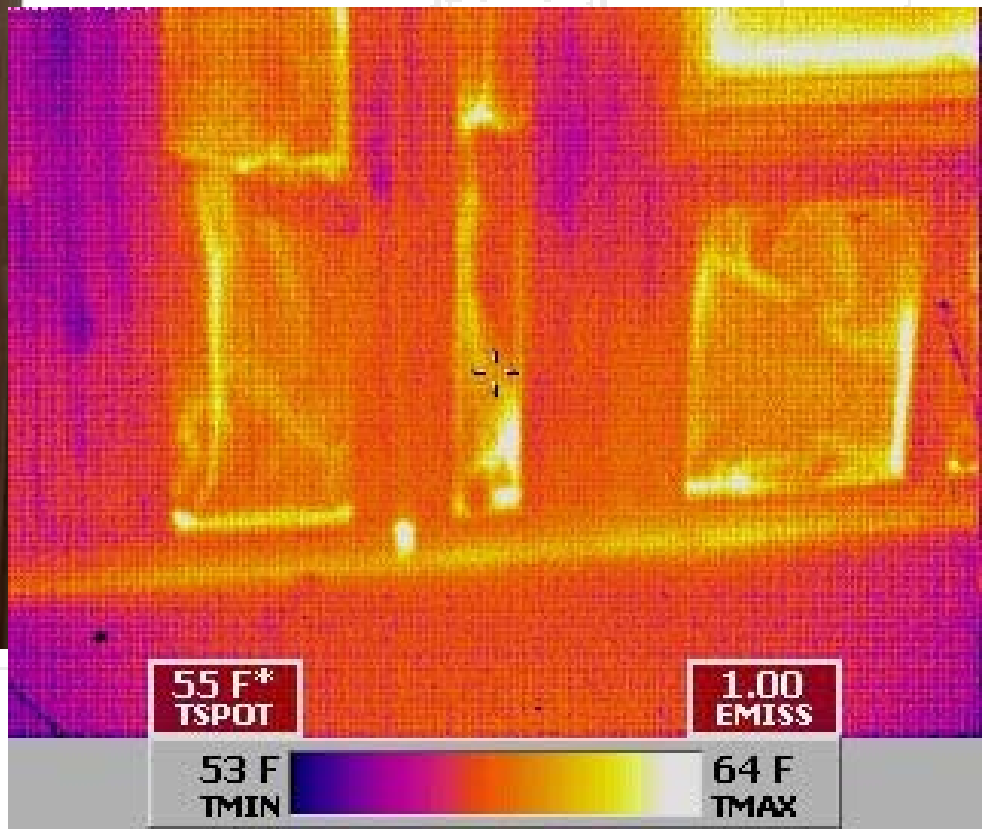
DEMAND PUMPING SYSTEM



EFFECTIVE INSULATION SYSTEM

- Zero-Tolerance (Gaps, Voids, Compression)
- Air-Tight Assemblies
- Six-Sided Air Barrier (Thermal Bypass Checklist)
- Minimal Thermal Bridging

FRAMING PROBLEM EXPOSED



ENERGY STAR QUALIFIED HOMES VERSION 3:

MINIMAL THERMAL BRIDGING

Choose One System:

- Optimum Value Engineered Framing (OVE)
- Insulated Sheathing
- Structural Insulated Panels (SIPS)
- Insulated Concrete Forms (ICF)

Plus:

- Raised Heel Trusses
- Raised HVAC Attic Platform Framing

MINIMAL THERMAL BRIDGING:

OVE FRAMING

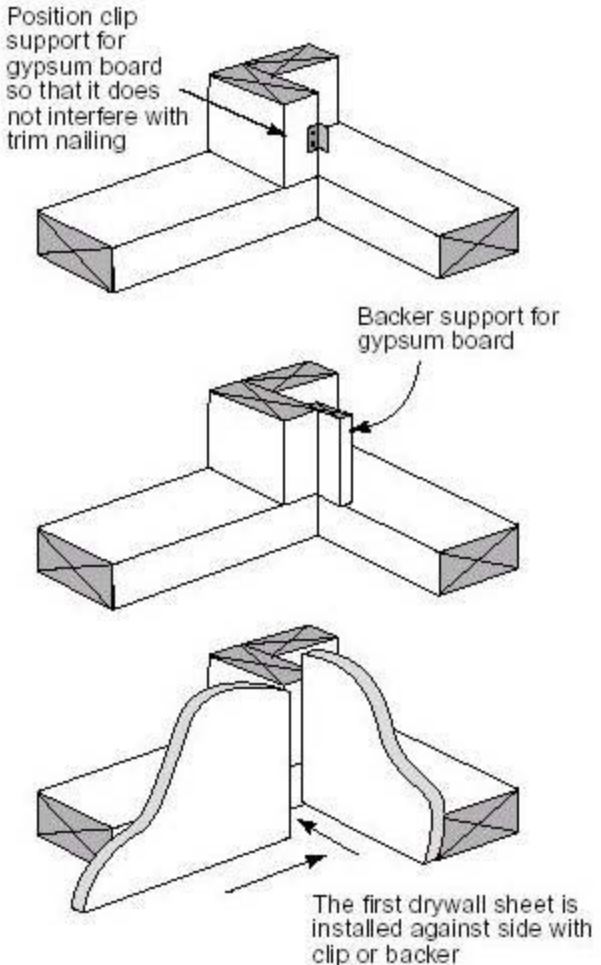
MINIMAL THERMAL BRIDGING:

OVE FRAMING

Courtesy of Building Science Corp.

Courtesy of Southface Institute

INSIDE "TWO-STUD" CORNERS



MINIMAL THERMAL BRIDGING:

OVE FRAMING

Ladder T – Allows insulation in exterior wall cavity at wall intersections

MINIMAL THERMAL BRIDGING:

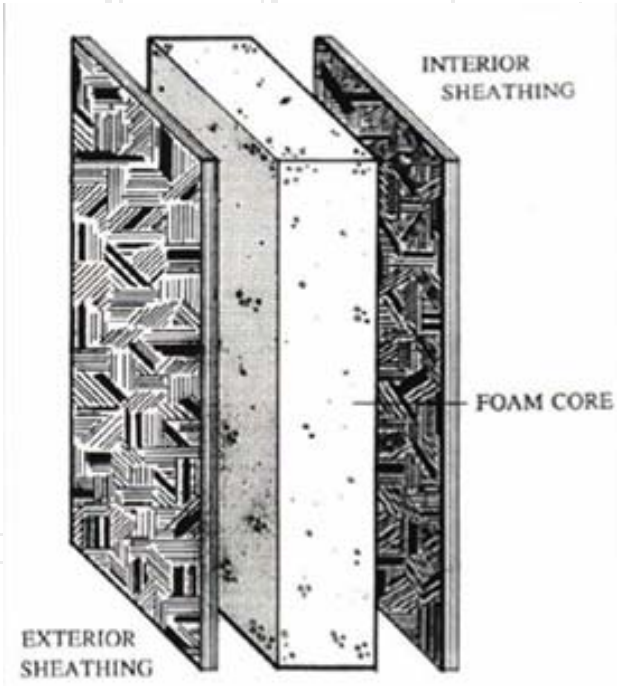
INSULATED SHEATHING

ENERGY STAR

MINIMAL THERMAL BRIDGING:

STRUCTURAL INSULATED PANELS

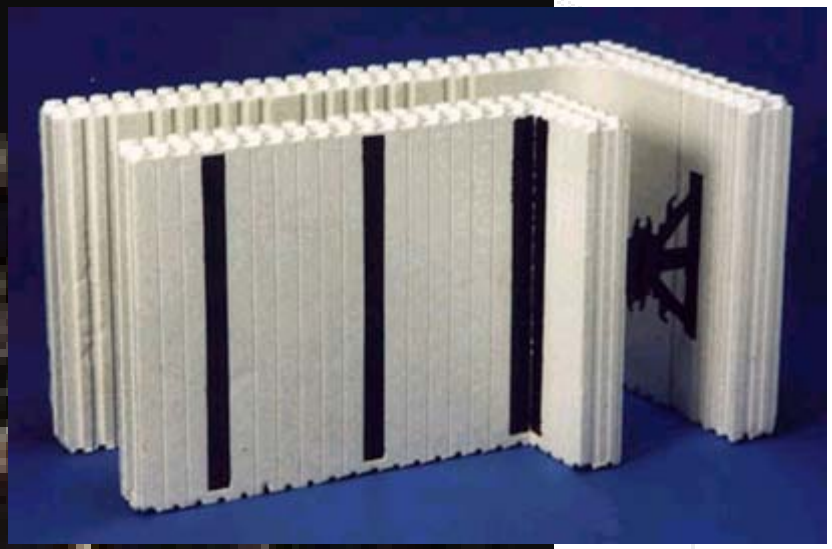
ENERGY STAR



MINIMAL THERMAL BRIDGING:

INSULATED CONCRETE FORMS

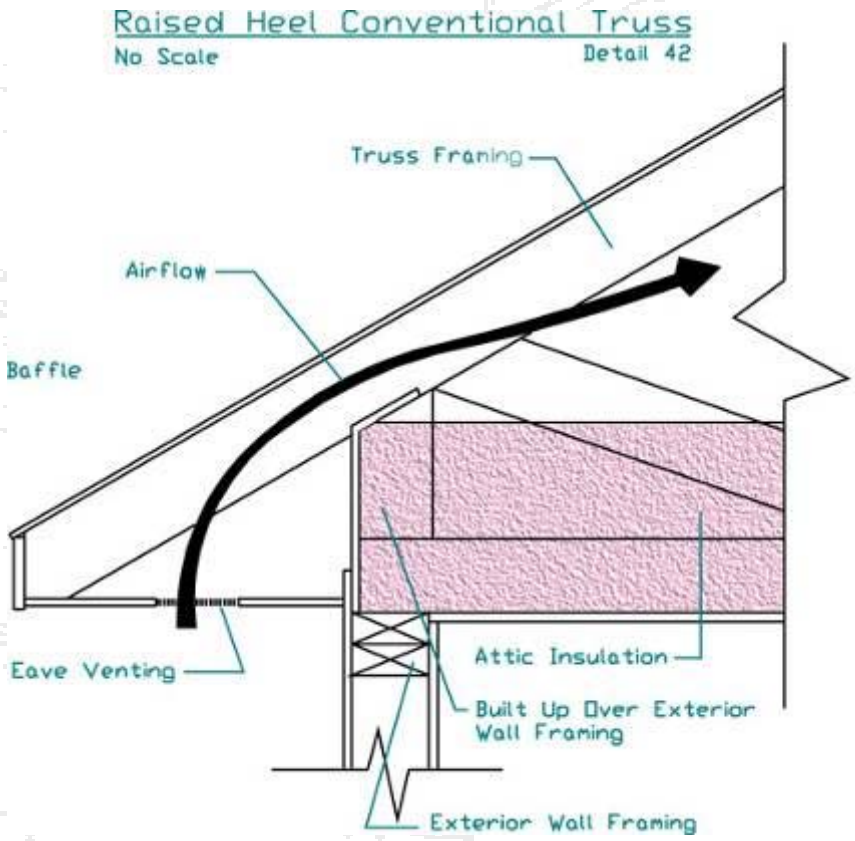
ENERGY STAR

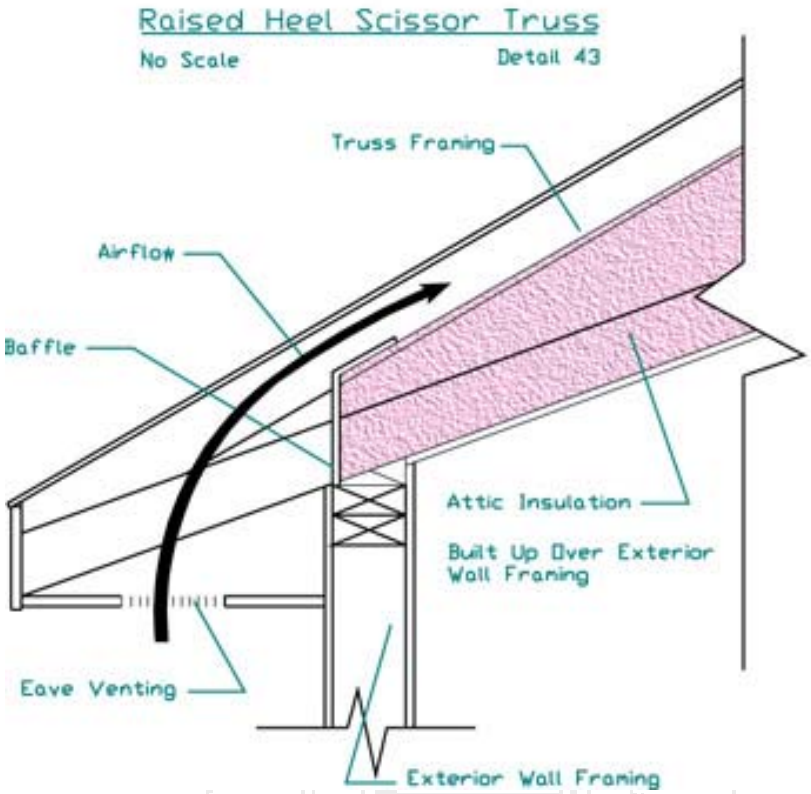


MINIMAL THERMAL BRIDGING:

RAISED HEEL TRUSSES

ENERGY STAR





MINIMAL THERMAL BRIDGING:

RAISED HEEL TRUSSES

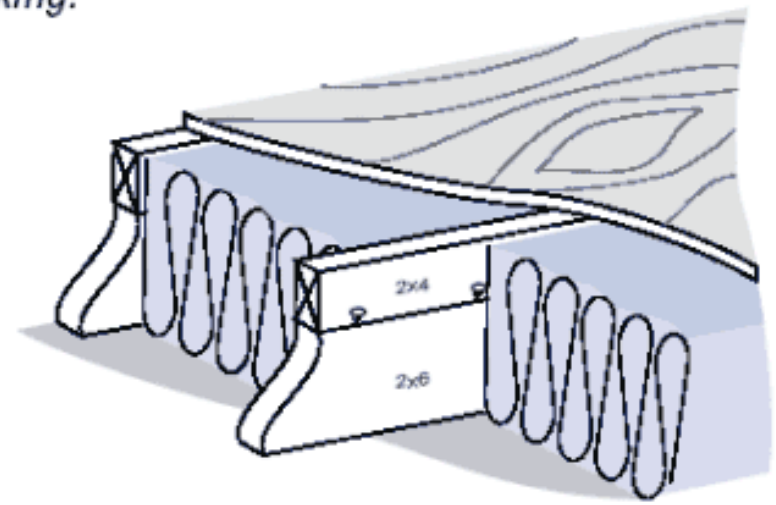
MINIMAL THERMAL BRIDGING:

RAISED HVAC PLATFORM FRAMING

ENERGY STAR

INCREASE ATTIC INSULATION LEVELS UNDER DECKING

For many products, an insulation depth of 10 to 14 inches is needed to achieve an R-30 to R-38 insulation value. Thus, a 2x4 or 2x6 extension needs to be added to a 2x6 joist to provide sufficient depth before installing decking.



VENTILATION

WHOLE-HOUSE VENTILATION

CONTINUOUS EXHAUST

FRESH AIR DAMPER

DUCTED FRESH AIR SUPPLY

VENTILATION:

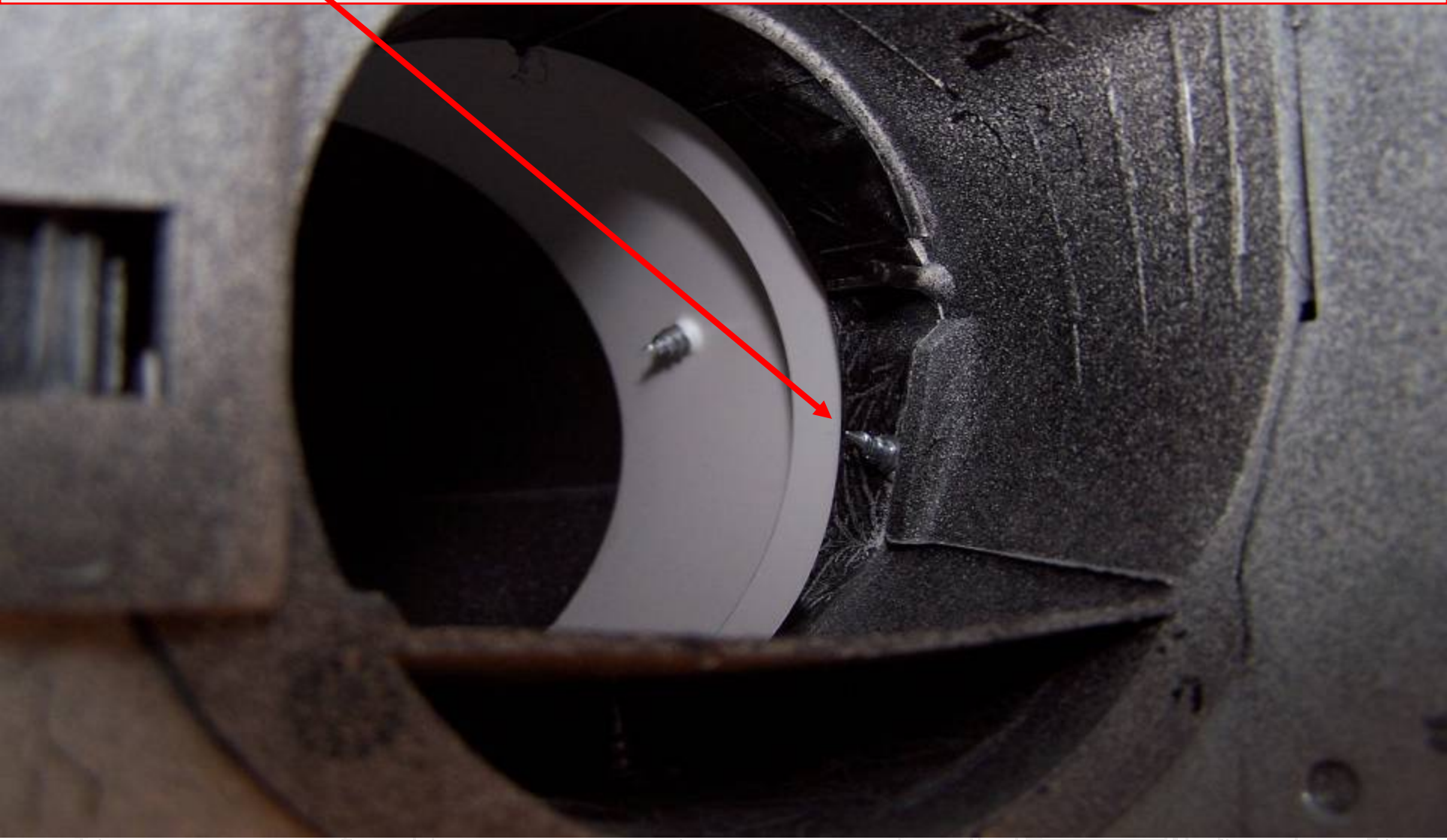
WHOLE-HOUSE VENTILATION

ERV

VENTILATION:

SPOT VENTILATION

Screw pinning damper closed- No airflow



Only testing will find these things

2 problem: Very restrictive ductwork

Poor ducting installation

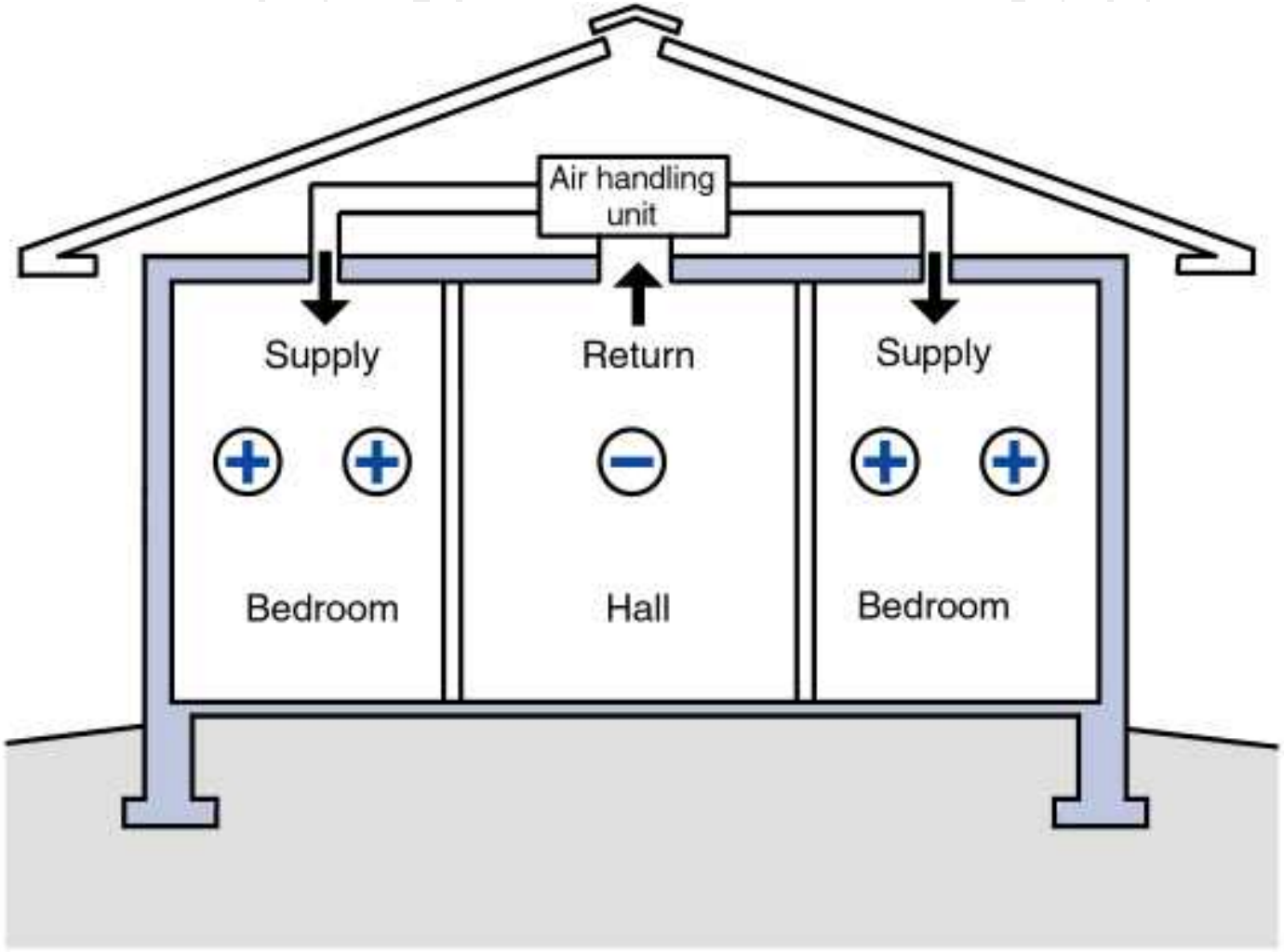
Soffitt guy doesn't do pipe

Any problem with a little extra ?

This is the reading from a 110 cfm fan: *OUCH!*

Testing tells the story

PRESSURE BALANCING: PROBLEM



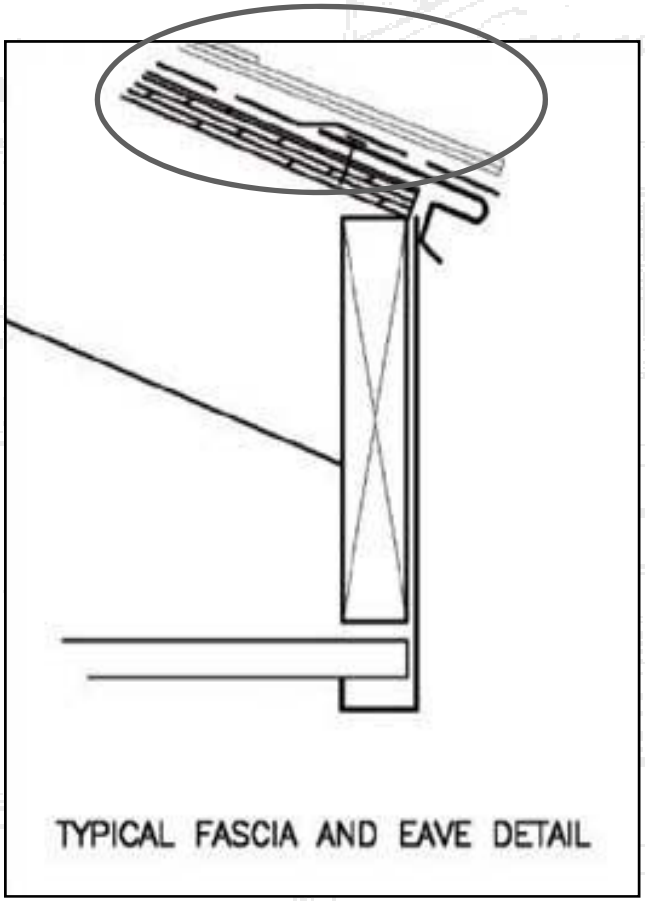
PRESSURE BALANCING: SOLUTIONS

TRANSFER GRILLE

JUMP DUCT

MOISTURE CONTROL:

WATER MANAGED ROOFS

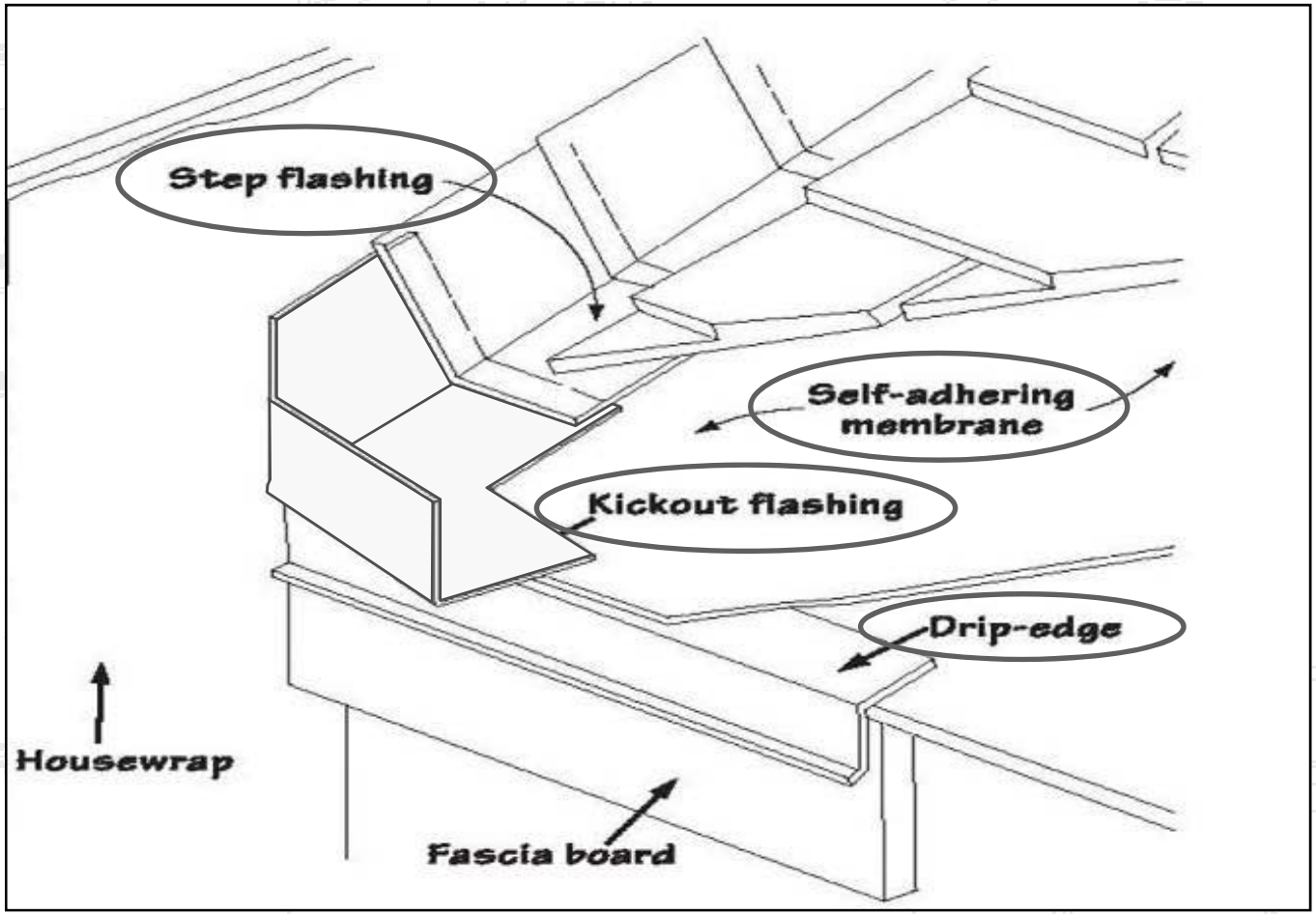


BITUMINOUS MEMBRANE AT VALLEYS

MOISTURE CONTROL:

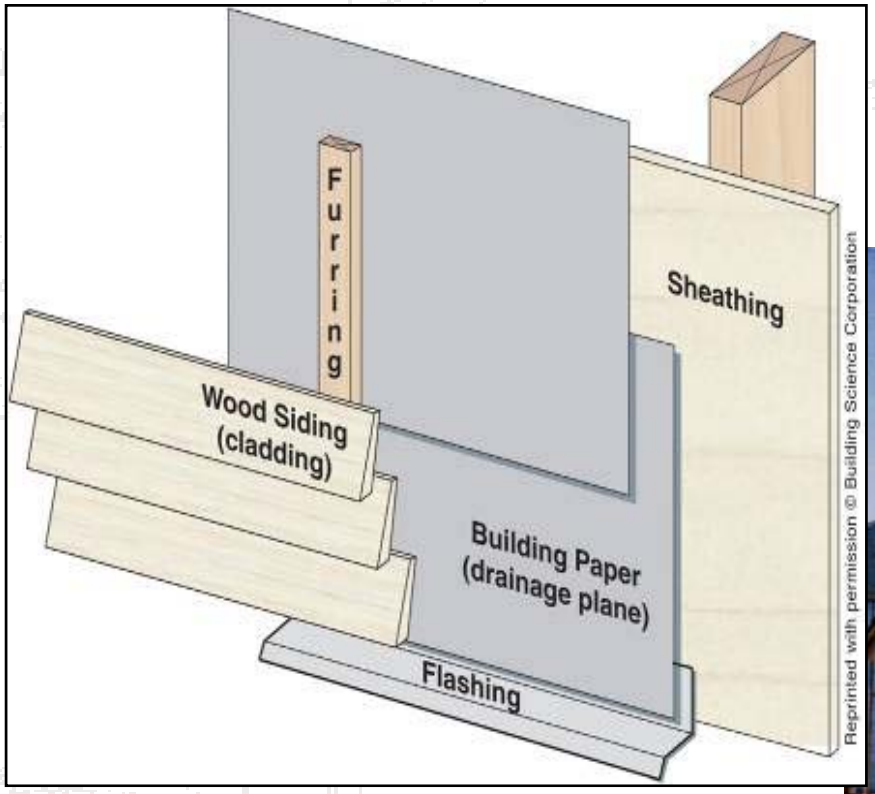
WATER MANAGED ROOFS

MORE ROOF FLASHING DETAILS



MOISTURE CONTROL :

WATER MANAGED WALLS

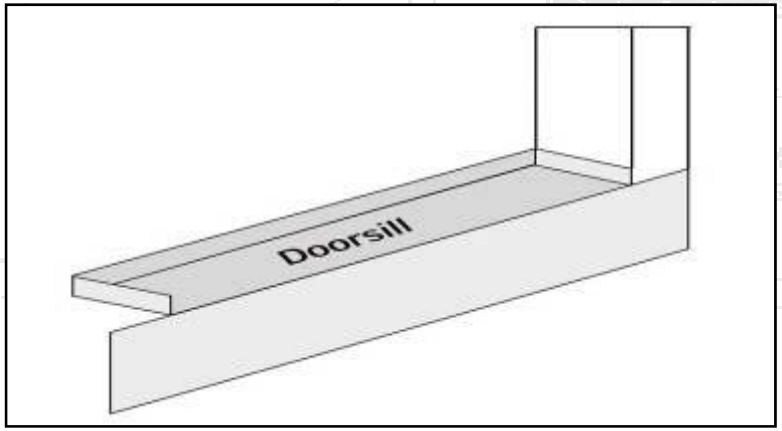


DRAINAGE PLANE DESIGN

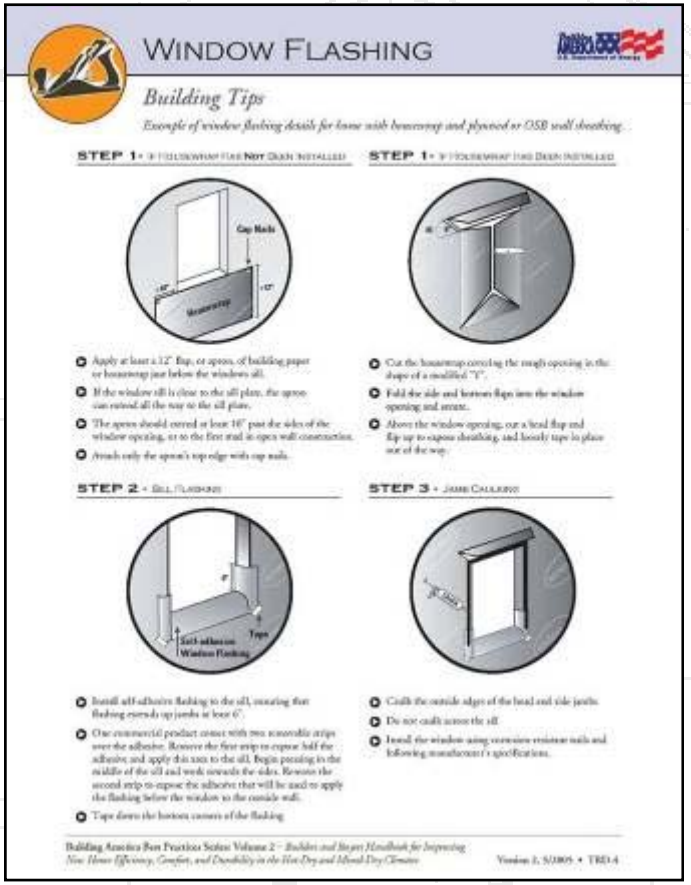
MOISTURE CONTROL:

WATER MANAGED WALLS

WINDOW/DOOR PAN FLASHING



BEST PRACTICE INSTALLATION



WINDOW FLASHING

Building Tips

Example of window flashing details for home with housewrap and plywood or OSB wall sheathing

STEP 1 • IF FLOW-WRAP HAS **NOT** BEEN INSTALLED

- Apply at least a 12" flap, or apron, of building paper or housewrap just below the windows sill.
- If the window sill is close to the sill plate, the apron can extend all the way to the sill plate.
- The apron should extend at least 10" past the sides of the window opening, so to the first stud in open wall construction.
- Attach only the apron's top edge with cap nails.

STEP 1 • IF FLOW-WRAP HAS BEEN INSTALLED

- Cut the housewrap covering the rough opening in the shape of a modified "I".
- Fold the side and bottom flaps into the window opening and secure.
- Above the window opening, cut a head flap and flip up to expose sheathing, and loosely tape in place out of the way.

STEP 2 • SILL FLASHING

- Install self-adhesive flashing to the sill, ensuring that flashing extends up jambs at least 6".
- One commercial product comes with two removable strips over the adhesive. Remove the first strip to expose half the adhesive and apply this area to the sill. Begin pressing in the middle of the sill and work towards the sides. Remove the second strip to expose the adhesive that will be used to apply the flashing below the window to the outside wall.
- Tape down the bottom corners of the flashing.

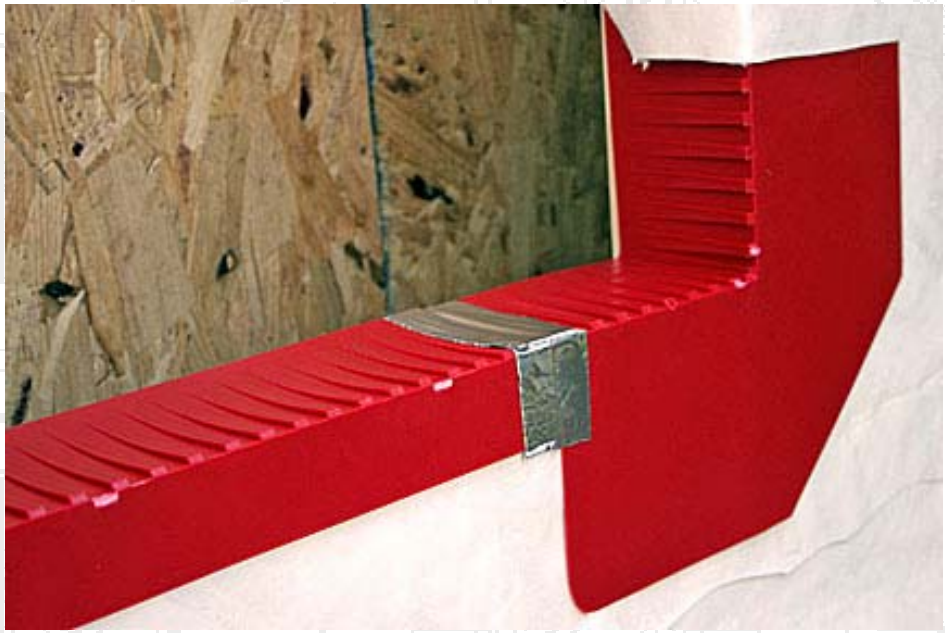
STEP 3 • JAMB CAULKING

- Caulk the outside edges of the head and side jambs.
- Do not caulk across the sill.
- Install the window using corrosion-resistant nails and following manufacturer's specifications.

Building America Best Practices Series: Volume 2 – Builder's and Buyer's Handbook for Improving New Home Efficiency, Comfort, and Durability in the Hot-Dry and Mixed-Dry Climates Version 1, 5/2005 • TRI 4

MOISTURE CONTROL:

WATER MANAGED WALLS



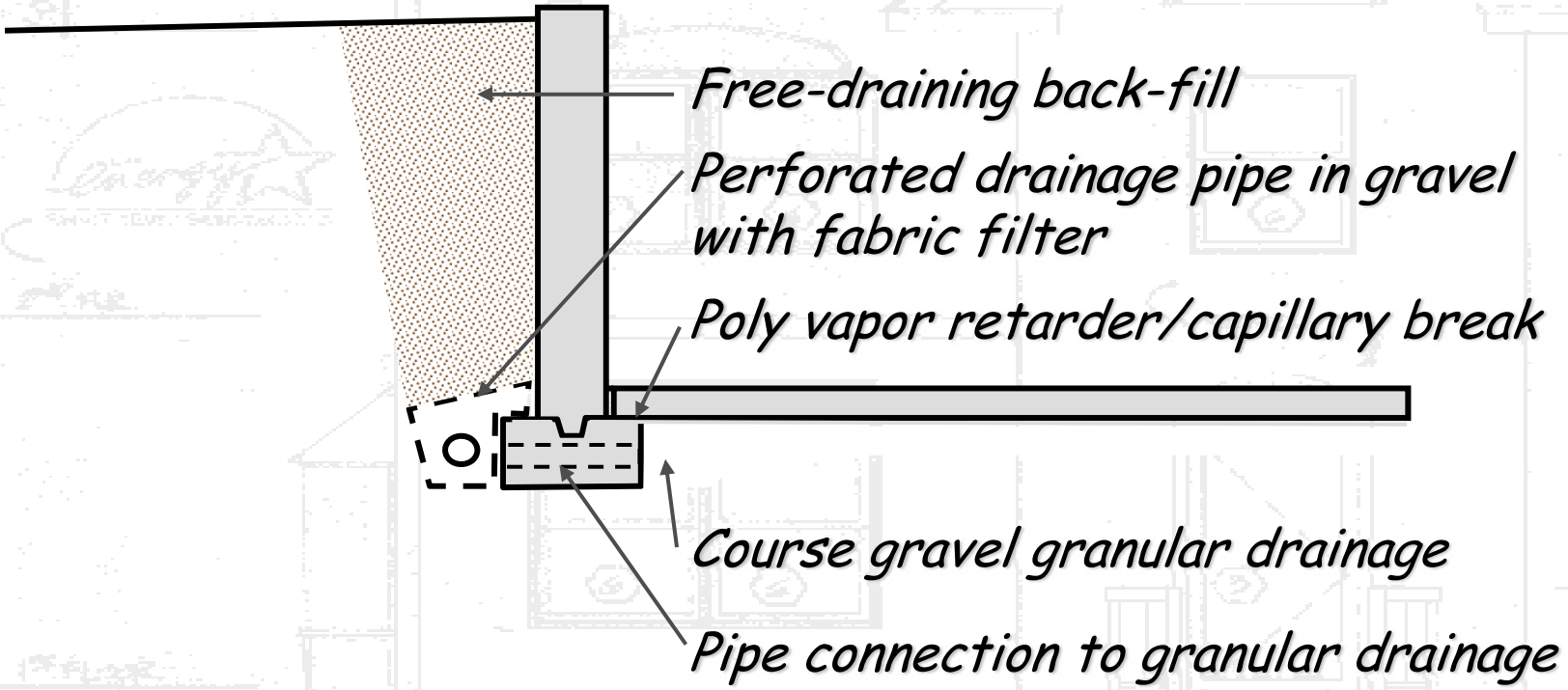
WINDOW/DOOR PAN FLASHING

MOISTURE CONTROL:

WATER MANAGED FOUNDATIONS

ENERGY STAR

FOUNDATION DRAINAGE SYSTEM
WITH CAPILLARY BREAKS



V.3: THERMAL ENVELOPE

Envelope	**Insulation:** • Prescriptive R-value requirements ≥ 2004IRC • Thermal Bypass Checklist for complete air barriers • **Insulation installation RESNET Grade 1** • **Quality Framing Checklist** • **Raised Heel Trusses** • **HVAC Platform where attic air handler** • **Radiant Barrier where ducts in attic in Climate Zones 1-3**
	Windows: • ENERGY STAR

V.3: HVAC EQUIP./QUALITY INSTALL

HVAC	**Equipment:** •ENERGY STAR Heating in Northern climates •ENERGY STAR Cooling in Southern climates **•TXV Valve if refrig. charge not verified**
	Quality Installation Checklist: •ACCA Manual J and S equipment sizing or equivalent •Total duct leakage ≤ 4 cfm to outdoors/100 sq. ft. **•ACCA Manual D duct sizing or equiv.** **•ACCA Manual T terminal sizing or equiv.** **•Ensure proper refrigerant charge** **•Verified room-by-room air flow** **•Verified air flow across coil / heat exch.** **•Pressure balancing in bedrooms** (transfer grills, cross-over ducts, or dedicated returns)

V.3: HVAC VENTILATION

HVAC	**Ventilation:** •**Whole-house per ASHRAE 62.2 min.** •**Spot ventilation per ASHRAE 62.2** •**Ventilation Installation Checklist**
	Safety: •**Ventless fireplaces not allowed** •**Air handler and ducts shall not be located in garage**

V.3: WATER HEATING SYSTEM

Water Heating System	**Efficient Equipment;** •Efficient water heating
	Efficient Distribution: **•Shower heads ≤ 2.0 gpm** **•Efficient plumbing layout** (core, manifold, or demand pumping)

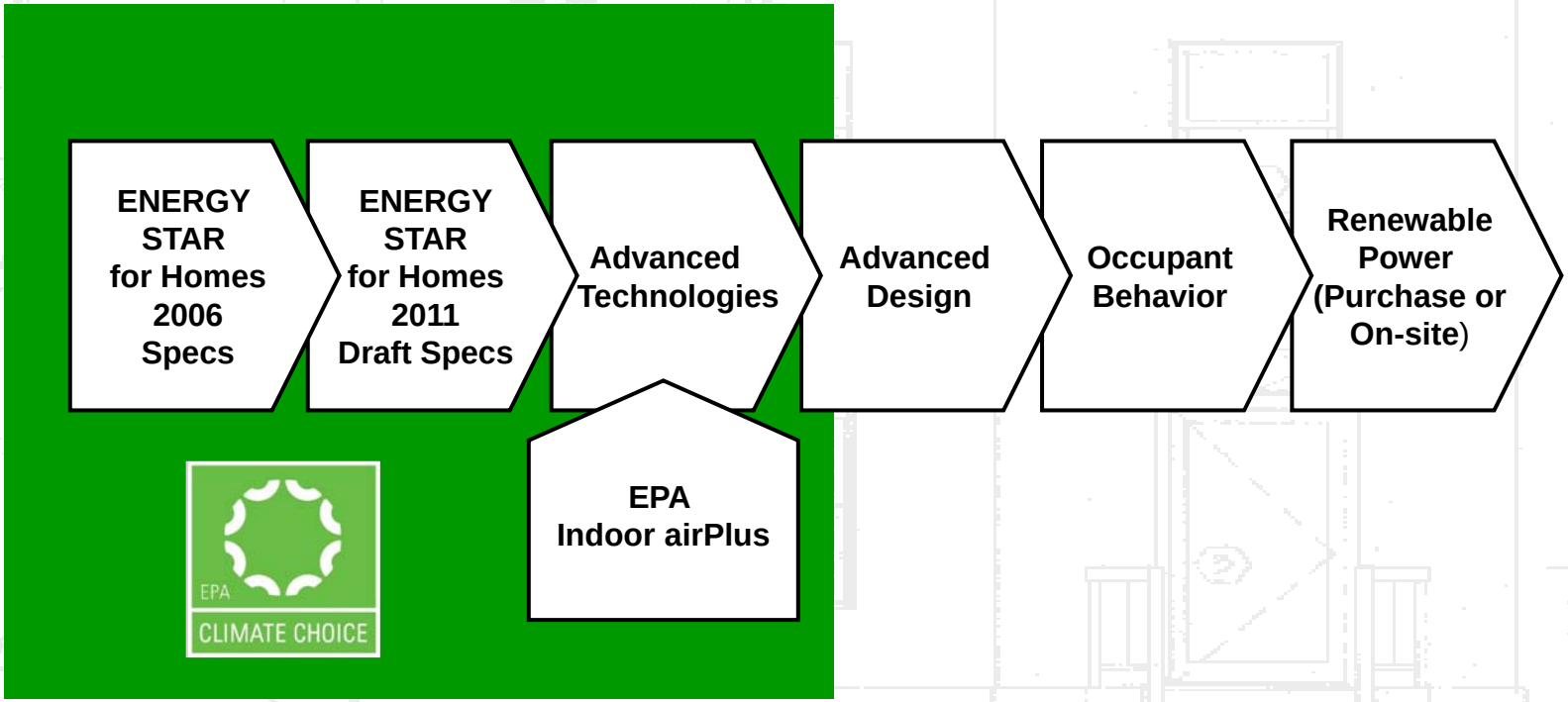
ANHC BOP: LIGHTING/APPLIANCES

Lighting	•**ENERGY STAR ALP** (60% ENERGY STAR QUALIFIED FIXTURES), or •**80% ENERGY STAR Qualified Bulbs**
Appliances	**ENERGY STAR Qualified Appliances** (Refrigerator, Dishwasher, Clothes Washer where provided by Builder)

V.3: BULK MOISTURE CONTROL

Moisture Control	• **Water-managed roof** • **Water-managed walls** • **Water-managed foundation** (see EPA Indoor Air Plus specifications)

PATH TO NO/LOW CARBON



ADVANCED NEW HOME CONSTRUCTION

- Builds on ENERGY STAR specs
- Acts as “farm system”

  [Expedite specific bundle of targeted technologies that don’t yet meet ENERGY STAR criteria]

MARKET TRANSFORMATION: ONE BUNDLE AT A TIME

Dehumid. In Warm/Humid.	Lighting/ Appliances	Size Penalty	Safe Materials	Occupant Behavior
		HVAC Quality Installation	Combustion Safety Techs.	Design
High Eff. HVAC Equip.	High Eff. Lgtg./Appl.	Water Heating Distribution	Pest Barriers	Super Eff. Or Solar WH
Tight Ducts	High Eff. Water Htr.	Min. Thermal Bridging	Radon Resist. Construction	Super Eff. HVAC Equip
Air Sealing	Right-Sizing	Ventilation Field Verified	Ventilation Field Verified	Ducts in Condit. Space
Low-E Windows	Proper Insulation	Pressure Balancing	Pressure Balancing	Super Window
Verification	Air Barriers	Water Man. Construction	Water Man. Construction	Insulation 50%> Code

V.1 V.2 V.3

RETOOLING HOW WE BUILD HOMES

Net-Zero Ready Homes with:

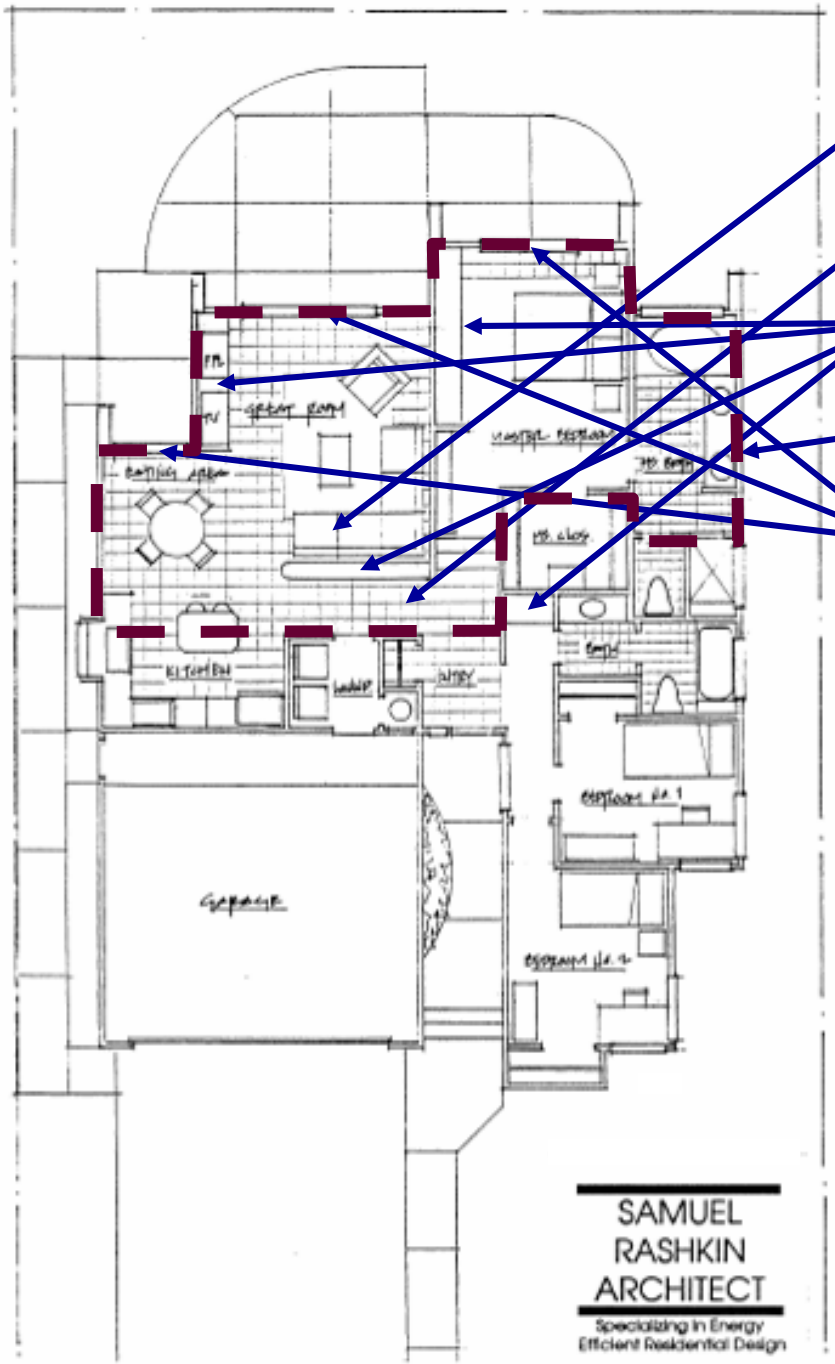
~30% - 50% Less

- Square Feet but 100% Function
- Framing
- Plumbing
- HVAC Equipment Size
- Cooling/Heating Loads
- Waste
- Construction Time

~70% Less Call-Backs

WHY OPPORTUNITY TO RETOOL… THE NUMBERS

- 11+ million
- 1+ million
- 12+ million (1/5)



3 Bedroom 1,150 sq. ft.

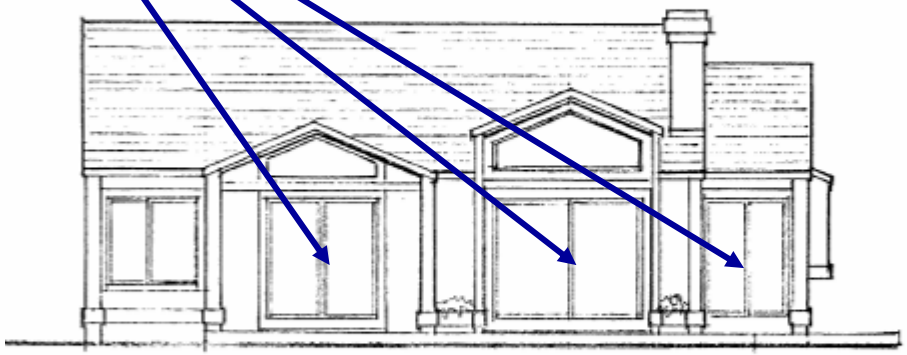
Open layout

Generous Circulation

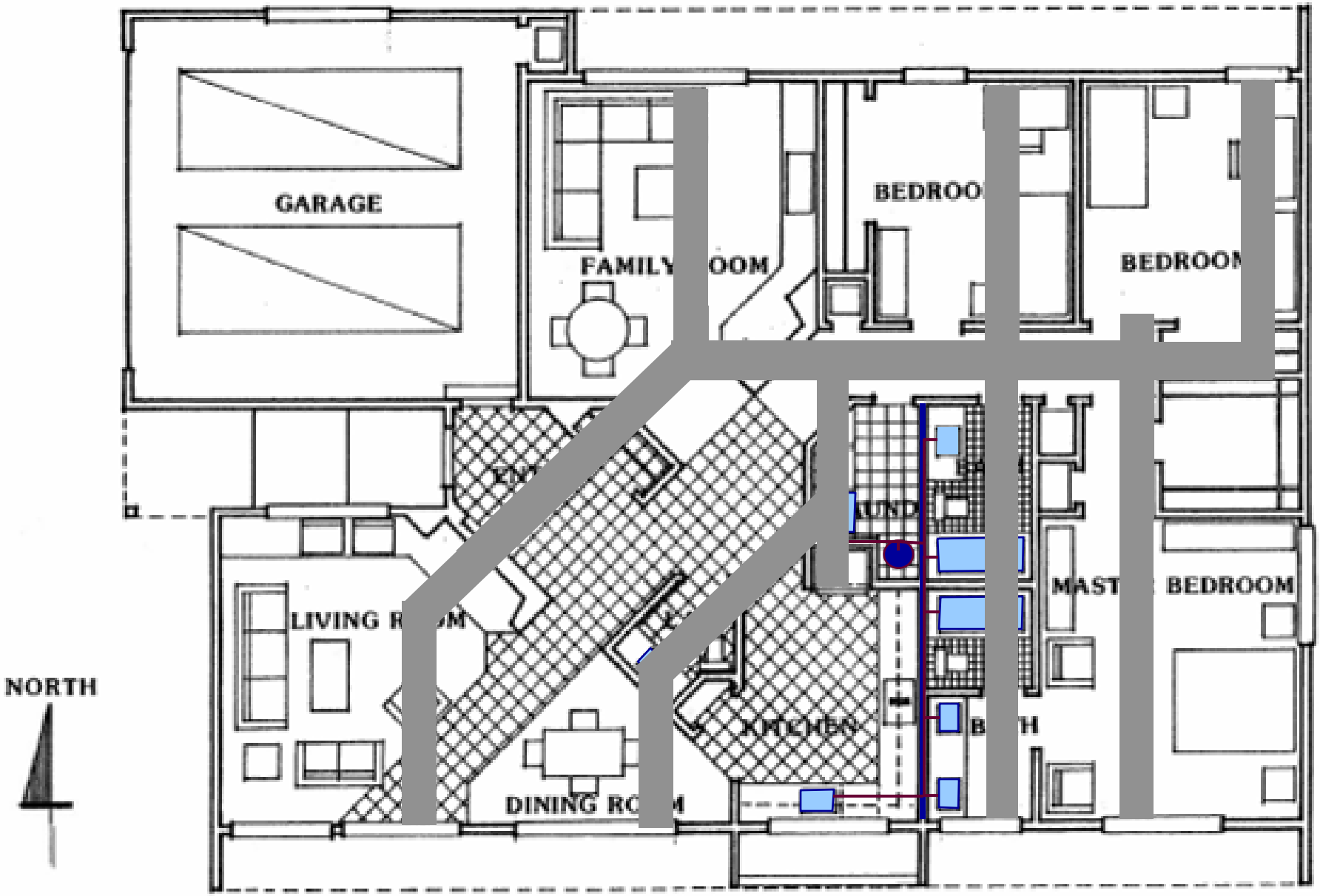
Built-in Furniture

Varying Ceiling Height

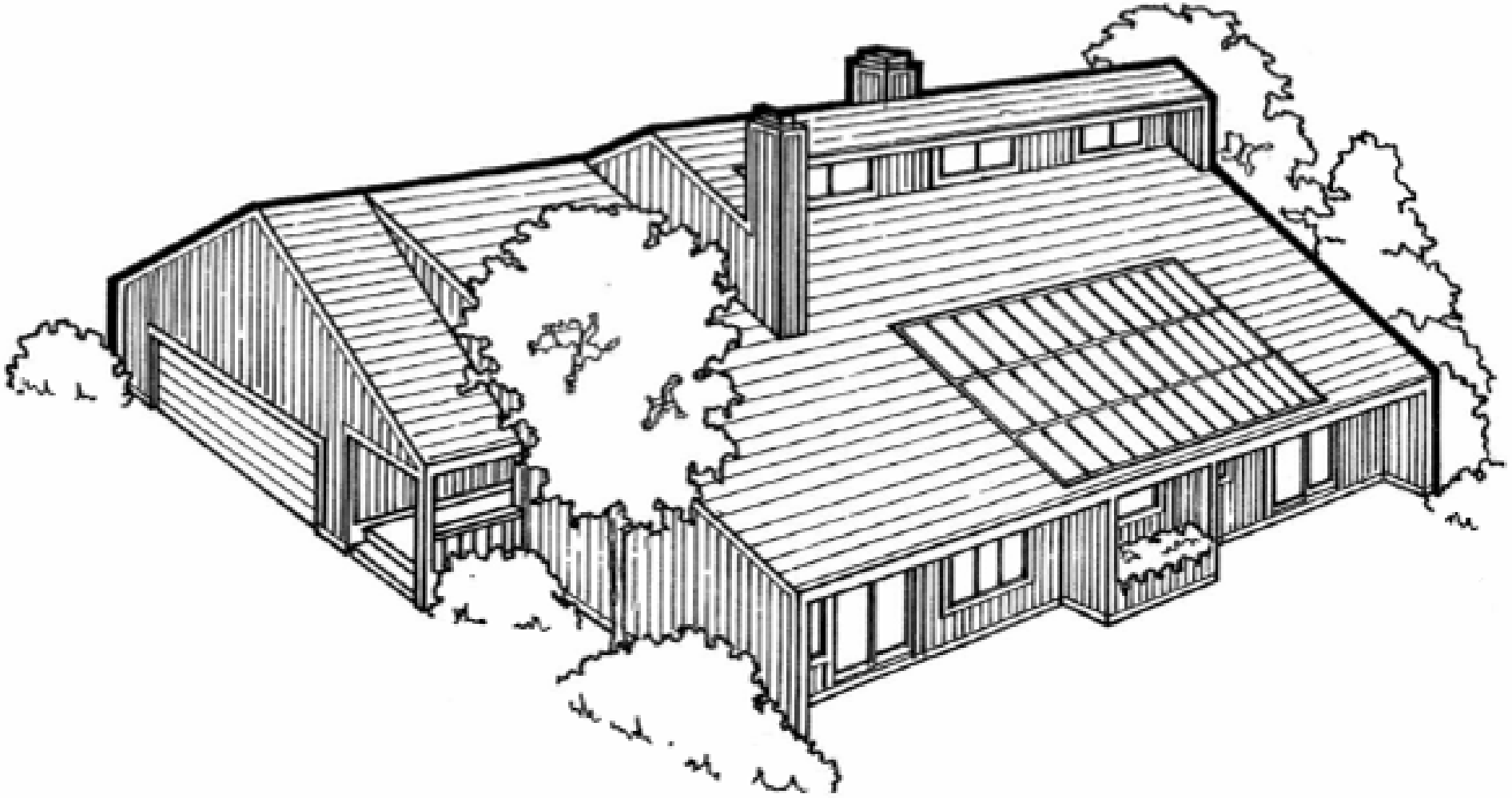
Outdoor/Indoor Linkages



SOUTH ELEVATION

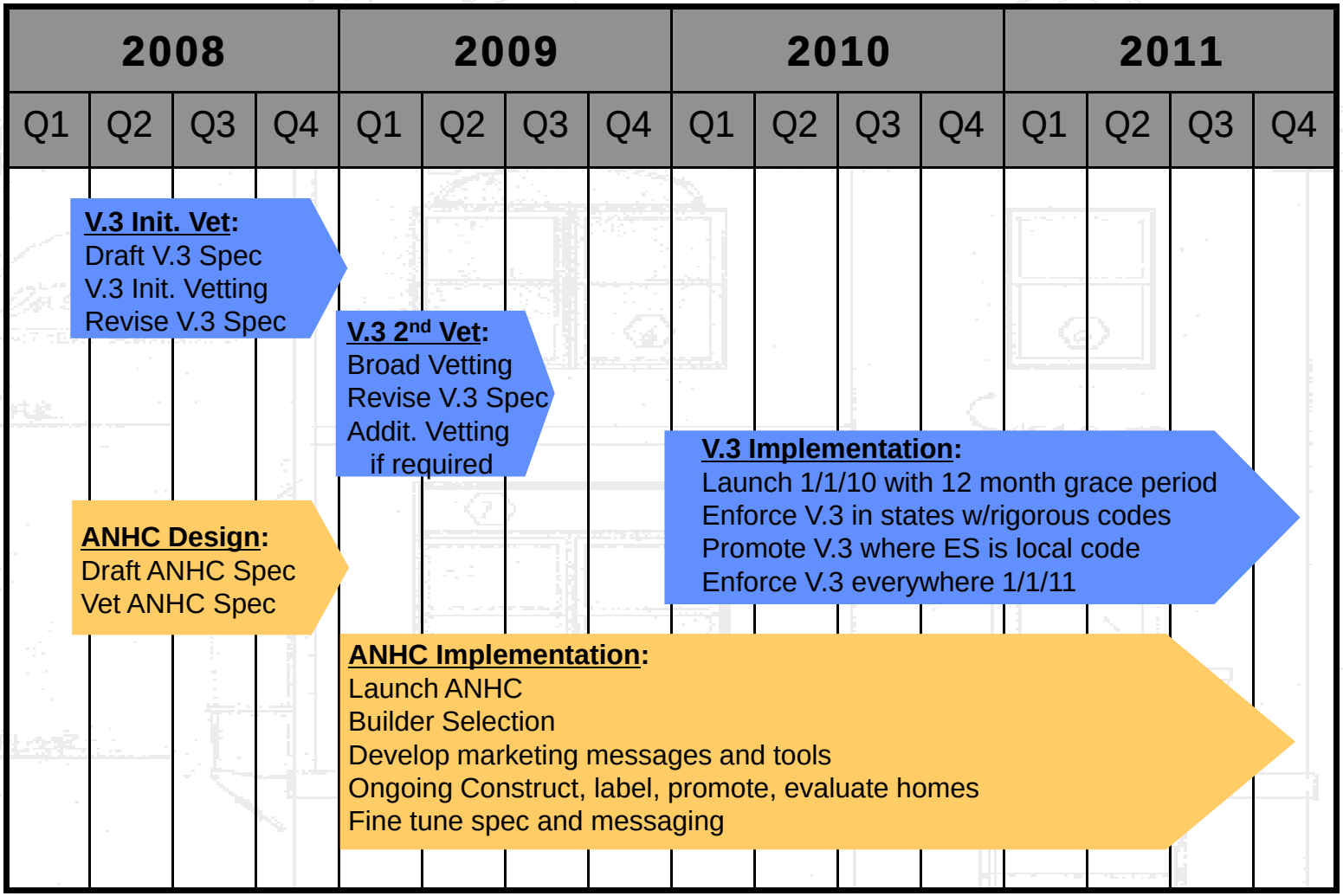


1800 SQ. FT.



NICHE OR MAINSTREAM PRODUCT?

TIMELINE


2008
2009
2010
2011
Q1 Q2 Q3 Q4 Q1 Q2 Q3 Q4 Q1 Q2 Q3 Q4 Q1 Q2 Q3 Q4
V.3 Init. Vet:
Draft V.3 Spec
V.3 Init. Vetting
Revise V.3 Spec
V.3 2nd Vet:
Broad Vetting
Revise V.3 Spec
Addit. Vetting
if required
V.3 Implementation:
Launch 1/1/10 with 12 month grace period
Enforce V.3 in states w/rigorous codes
Promote V.3 where ES is local code
Enforce V.3 everywhere 1/1/11
ANHC Design:
Draft ANHC Spec
Vet ANHC Spec
ANHC Implementation:
Launch ANHC
Builder Selection
Develop marketing messages and tools
Ongoing Construct, label, promote, evaluate homes
Fine tune spec and messaging

HOW TO GET MORE INFORMATION

On the Web at:

http://www.energystar.gov/homes