Welcome

Taking the Performance Path: An Introduction to Using ERI/HERS Ratings for Builders and Designers & HERS Associate Training

EEBA

Energy & Environmental Building Alliance

HOUSES THAT WORK™

EEBA's Educational Series

2018 National Education Partners

CEU's…

In accordance with the Department of Labor and Industry's statute 326.0981, Subd. 11,

"This educational offering is recognized by the Minne Department of Labor and Industry as satisfying **7 hours** of credit toward **Building Officials and Residential Contractors code /1 hour energy** continuing education requirements."

For additional continuing education approvals, please see your credit tracking card.

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Which version of the IECC is adopted in your area?

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Course objectives

- Understand basic building science terminology and principles as they relate to the International Energy Code.
- Introduction to RESNET, the HERS Index, and understanding the methods used in calculating an Energy Rating Index and HERS score.
- Understand the implications of different climate zones and building assemblies on the Energy Rating Index and HERS scores.
- Attain a basic understanding of computer modeling and the major approved energy rating software packages used in calculating an energy rating.

HERS Associate Learning Objectives

- Introduction of course, RESNET and the HERS Index
- Guiding principles used by HERS Raters to rate a home and produce a HERS Index Score
- Relate the principles of building science as they apply to HERS
- Inspection and testing protocols used in rating a home
- Computer modeling and the methodology to produce a HERS Index
- HERS Scores and the IECC

Agenda

Morning:

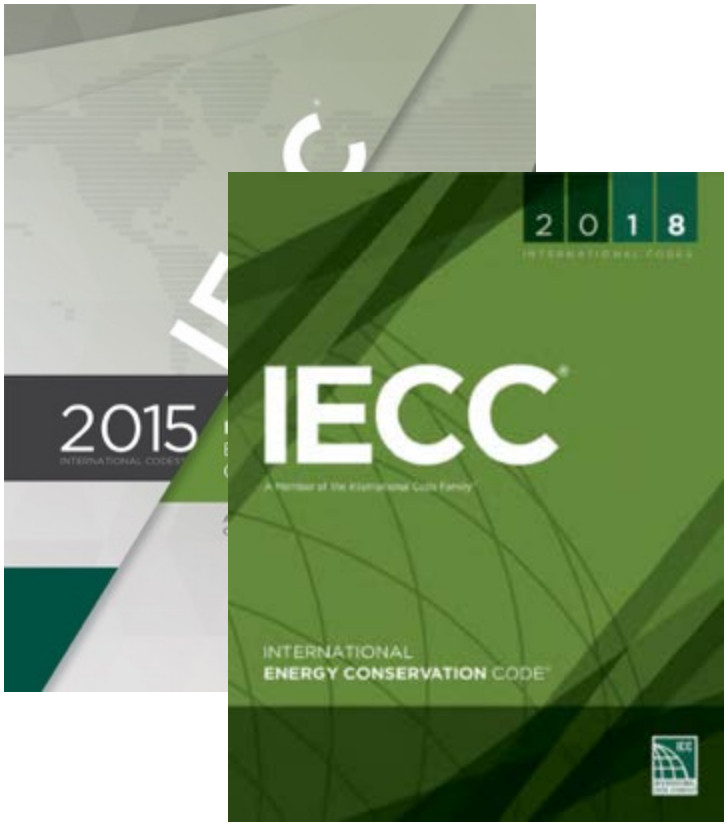
- Introduction questions
- Benefits of energy codes
- Building Science

Afternoon:

- Overview & history of energy codes
- The 2015 IECC & ERI
- HERS rating demonstration
- Conclude/exit exam
- Course evaluations

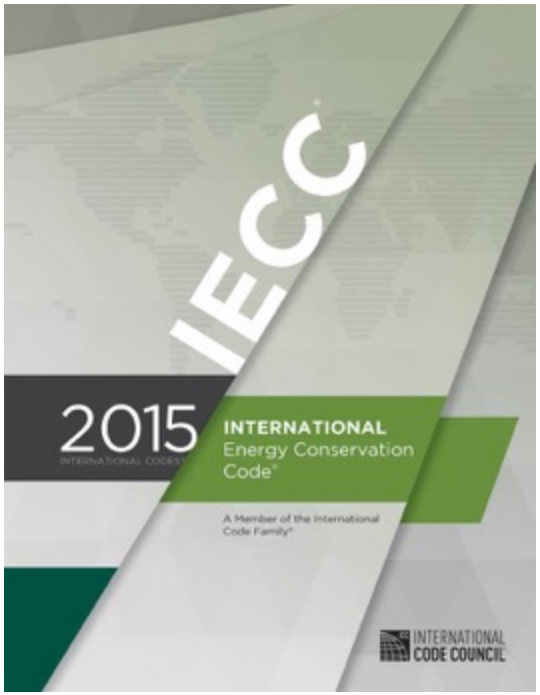
- Certificate of completion
- CEUs
- Please set phones to silent

Why energy codes?



- Codes benefit homeowners & occupants
- Codes benefit society
- Codes benefit builders & the industry

The 2015 IECC



- This training focuses on the 2015 IECC
- More stringent than 2009, but similar to 2012 IECC
- Prescriptive & Performance compliance paths still available
- Introduces new compliance option: The Energy Rating Index
- We will cover more details later

Activity

- Split into groups of 4-5 students
- Identify real world examples of benefits of energy efficiency measures from your past experience (savings, health, comfort, durability)
- Each group briefly present your results to class

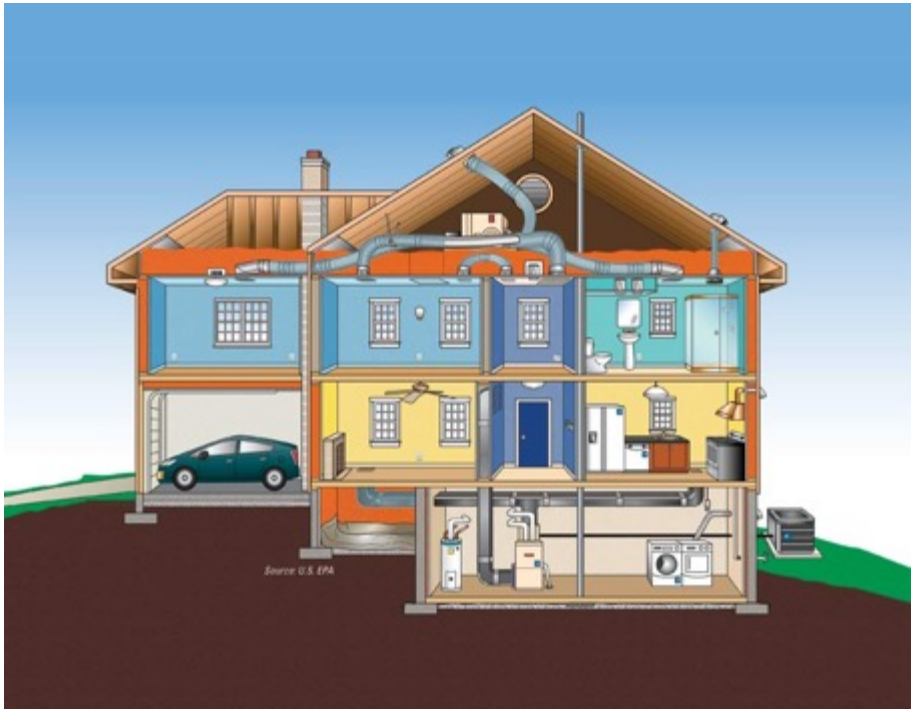
Building science

- What is building science?
- Scientific principles from a variety of fields that govern building performance
- Optimize building performance and understand, prevent and correct building failures
- Improve the quality of life!

The house as a system

A house is a system made up of interrelated parts:

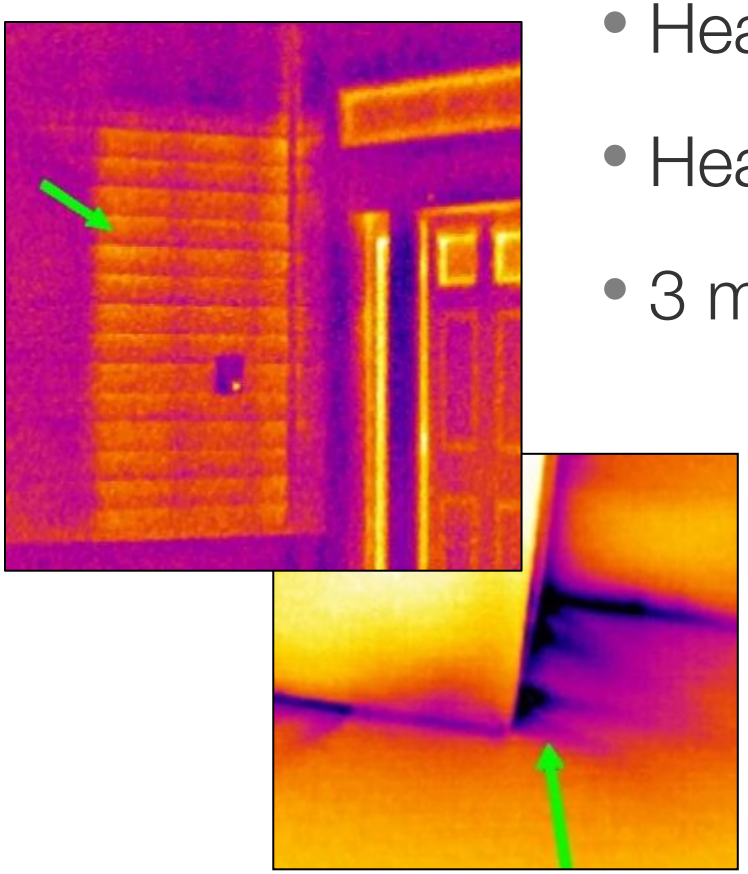
- The building thermal envelope
- Space conditioning
- Ventilation
- Water heating & distribution
- Lighting & appliances



The human factor

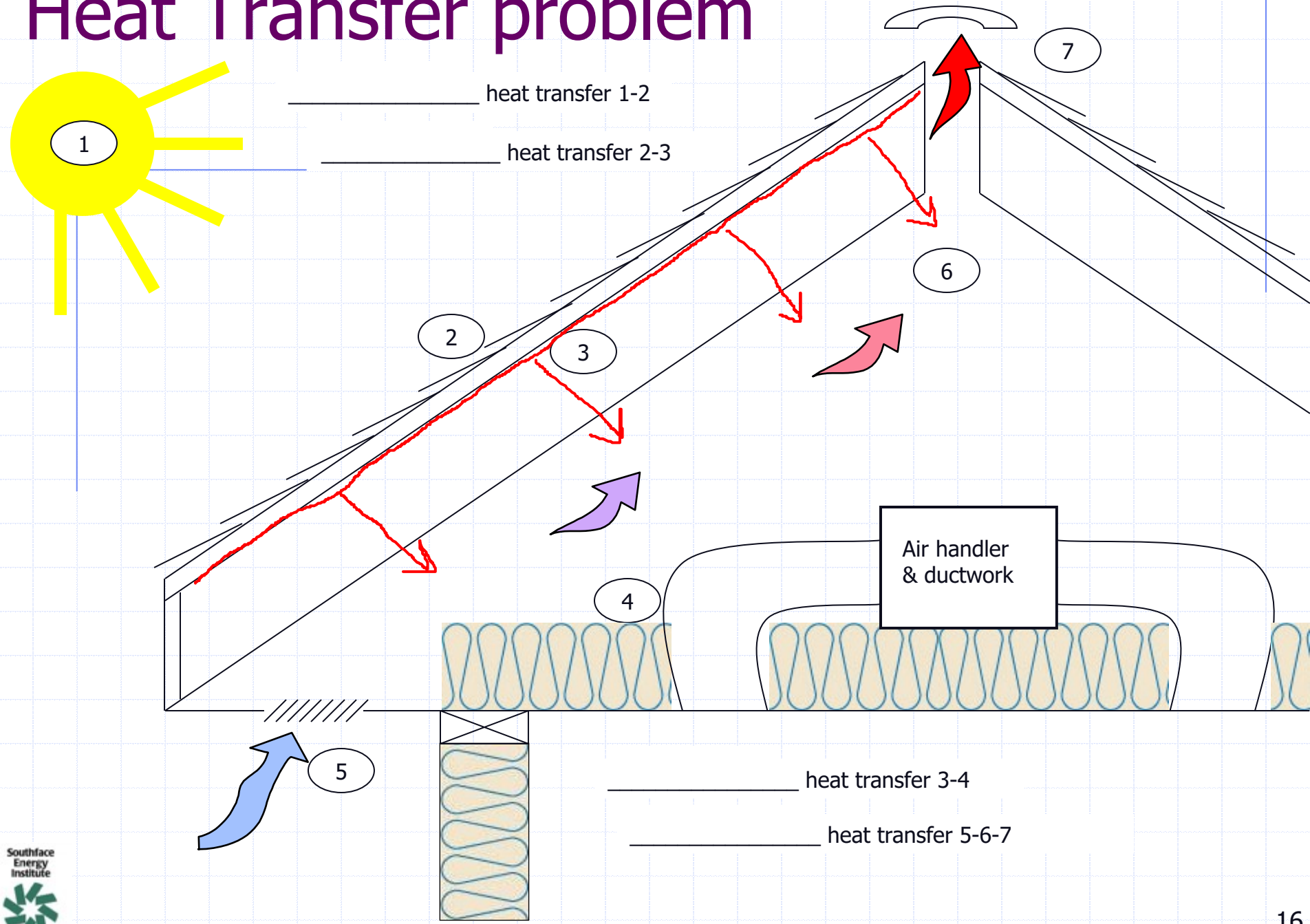
- It's not just about energy efficiency
- Many efficiency measures also improve comfort, health and reduce maintenance
- All efficiency measures should take occupants into account (e.g. air sealing & ventilation)

Heat transfer



- Heat is a form of energy
- Heat always moves from hot to cold
- 3 methods of heat transfer:
  - Radiation – heat “jumps” from a hot surface to a cooler surface
  - Conduction – heat moves through a material
  - Convection – heat energy carried by a fluid (including air)

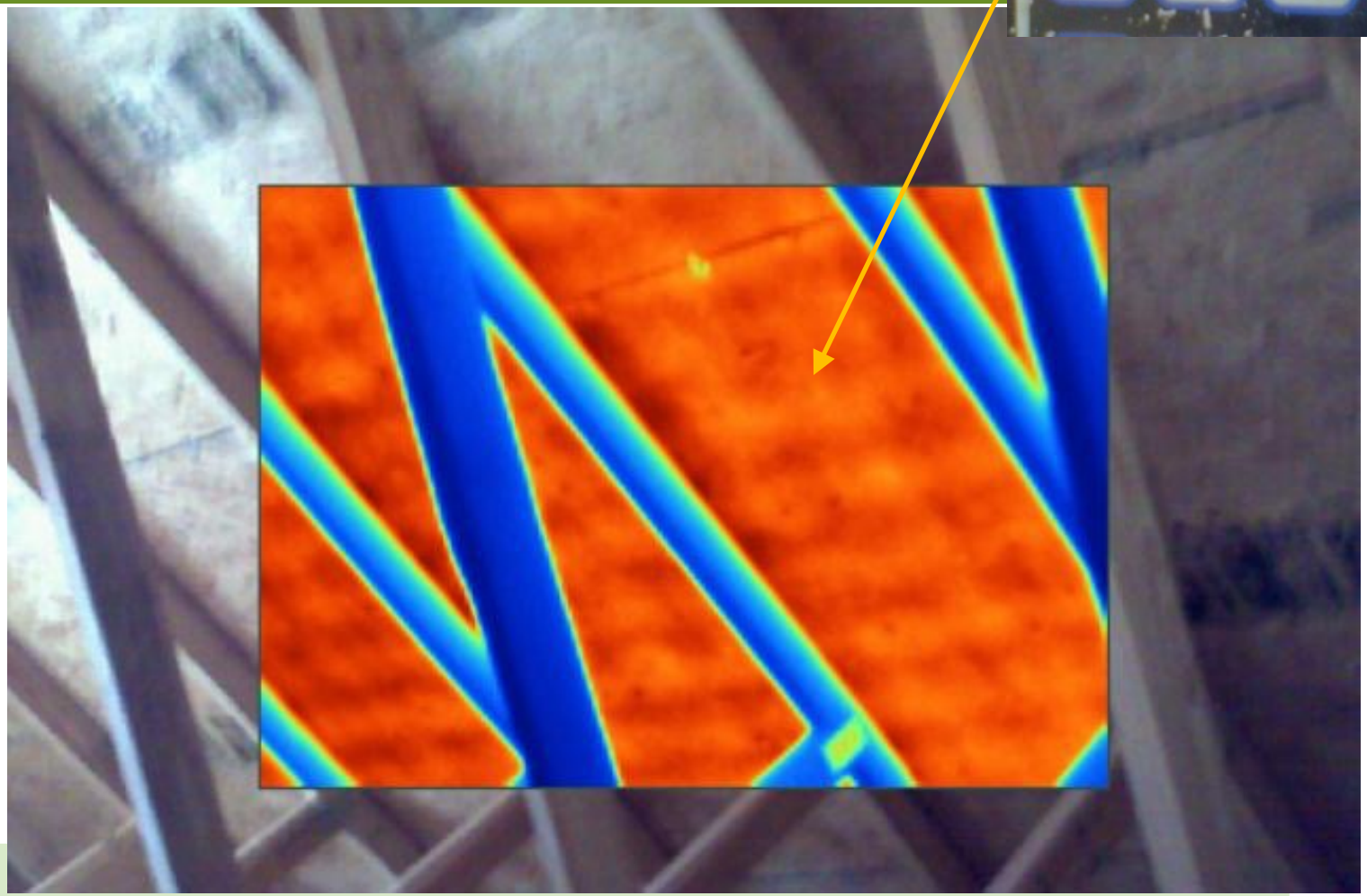
Heat Transfer problem



Southface Energy Institute

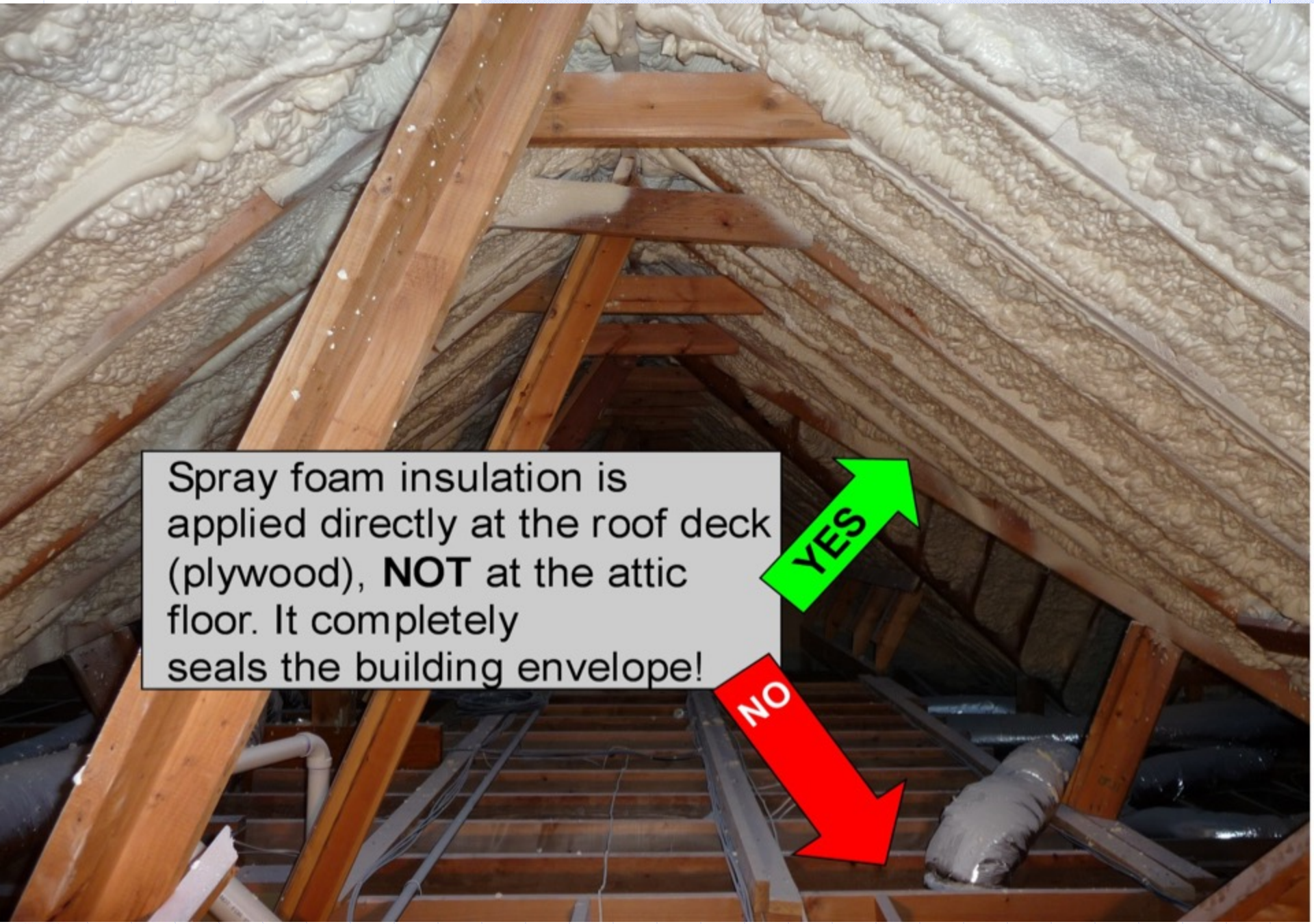
Radiation

Radiation heat transfer from a hot surface to a cool surface



Radiation

Radiation is the movement of heat from a hot surface to a cold surface with nothing solid or opaque in between (low-emitting surfaces slow radiation)

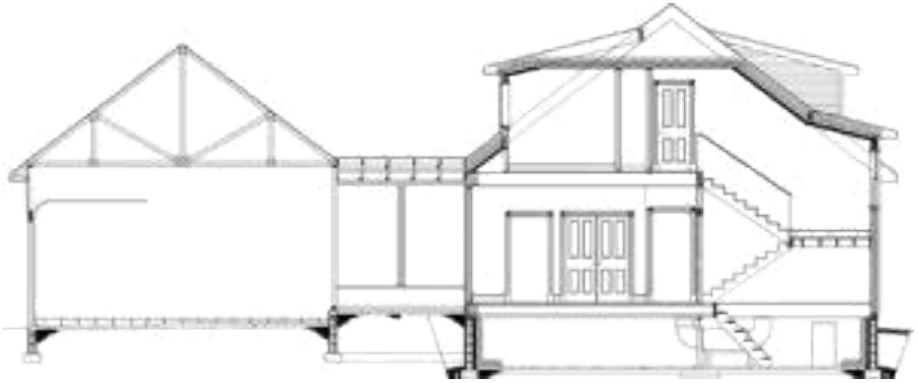

Spray foam insulation is applied directly at the roof deck (plywood), **NOT** at the attic floor. It completely seals the building envelope!
YES
NO

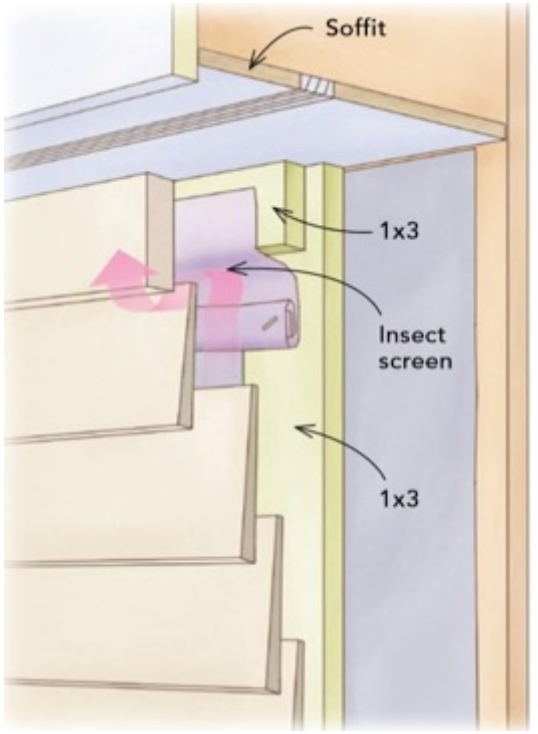
Moisture transport

- Moisture moves from wet to dry
- Moisture can move as a liquid or a vapor
  - **Bulk flow** *Liquid*
  - **Capillary action** *Liquid*
  - Diffusion *Vapor*
  - Infiltration *Vapor*

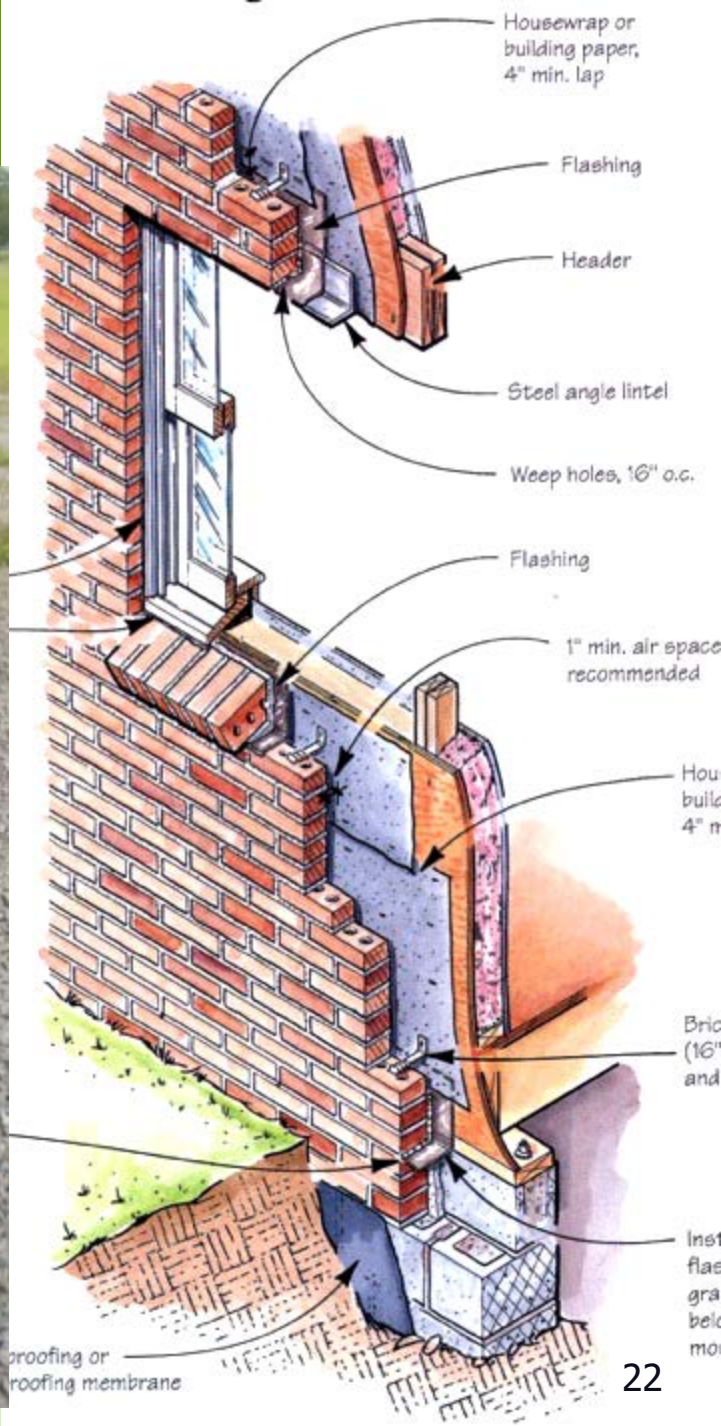
Appropriate measures for moisture control are essential!

Moisture transport
Drainage Planes and Cladding



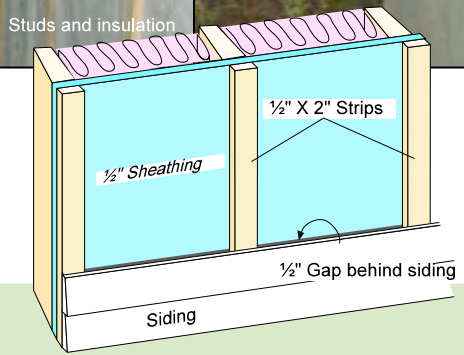


Cladding -Brick Veneer



Brick Veneer

Rain Screen / Drainage Plane



Housewrap: Details are Critical

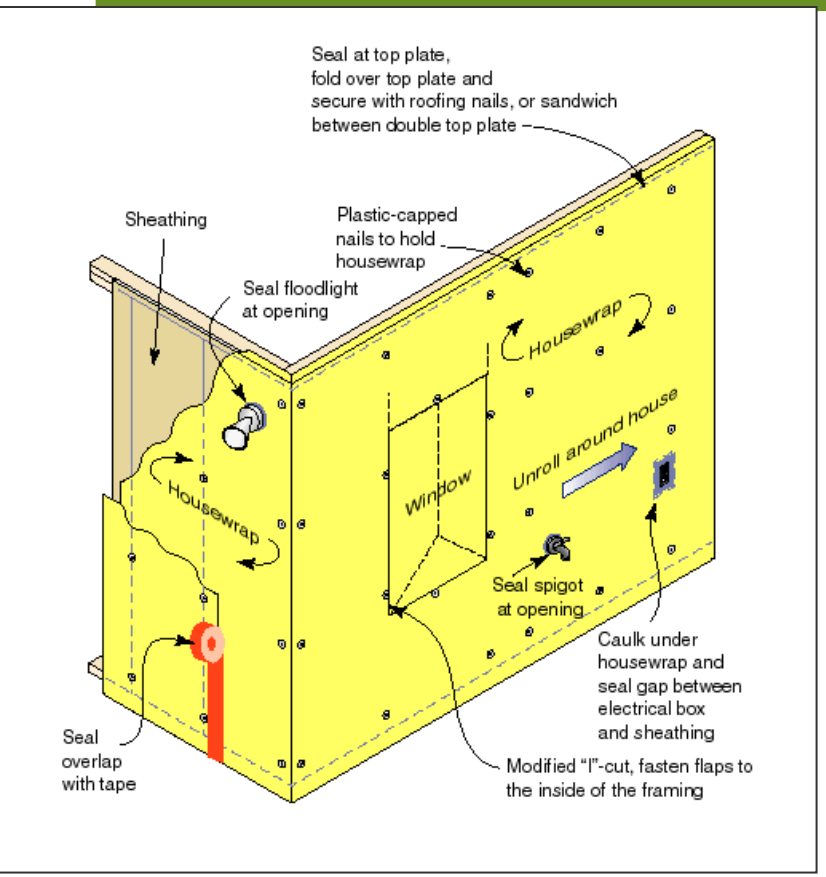
Top Sash after trim removed

Rotten Header

Windows (incorrectly) have flange over housewrap

See WRB factsheet for more details

Housewrap as a Weather Barrier



Technology Fact Sheet

WEATHER-RESISTIVE BARRIERS

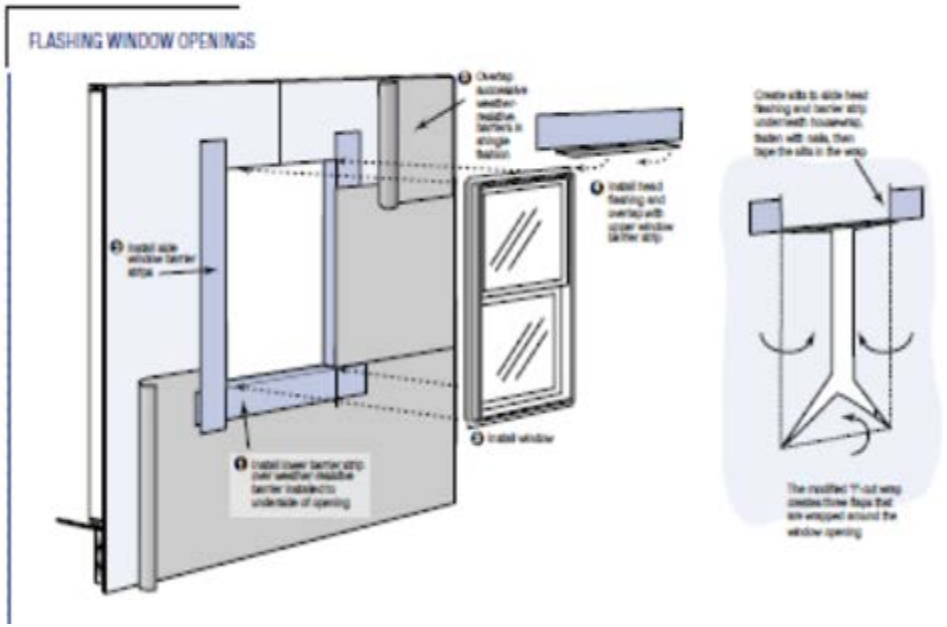
How to select and install housewrap and other types of weather-resistive barriers

INTRODUCTION

Weather-resistive barriers are a part of exterior wall systems that protect building materials from exterior water penetration. They perform like a shell for buildings—liquid water that has

WHEN AND HOW TO USE WEATHER-RESISTIVE BARRIERS

As part of a whole-wall design, weather-resistive barriers need to be integrated with other wall system components, including structure,



Durability and WRB's

- Flashing must be integrated with wall and roof drainage plane surfaces

No Weather Barrier – Air Leakage

Alternative WR Barriers

Fluid-Applied Weather Resistive Barrier

Retrofit:
Lap Siding nailed direc
to studs

Plywood on boarded up doorway

Siding Drainage Plane Retrofit

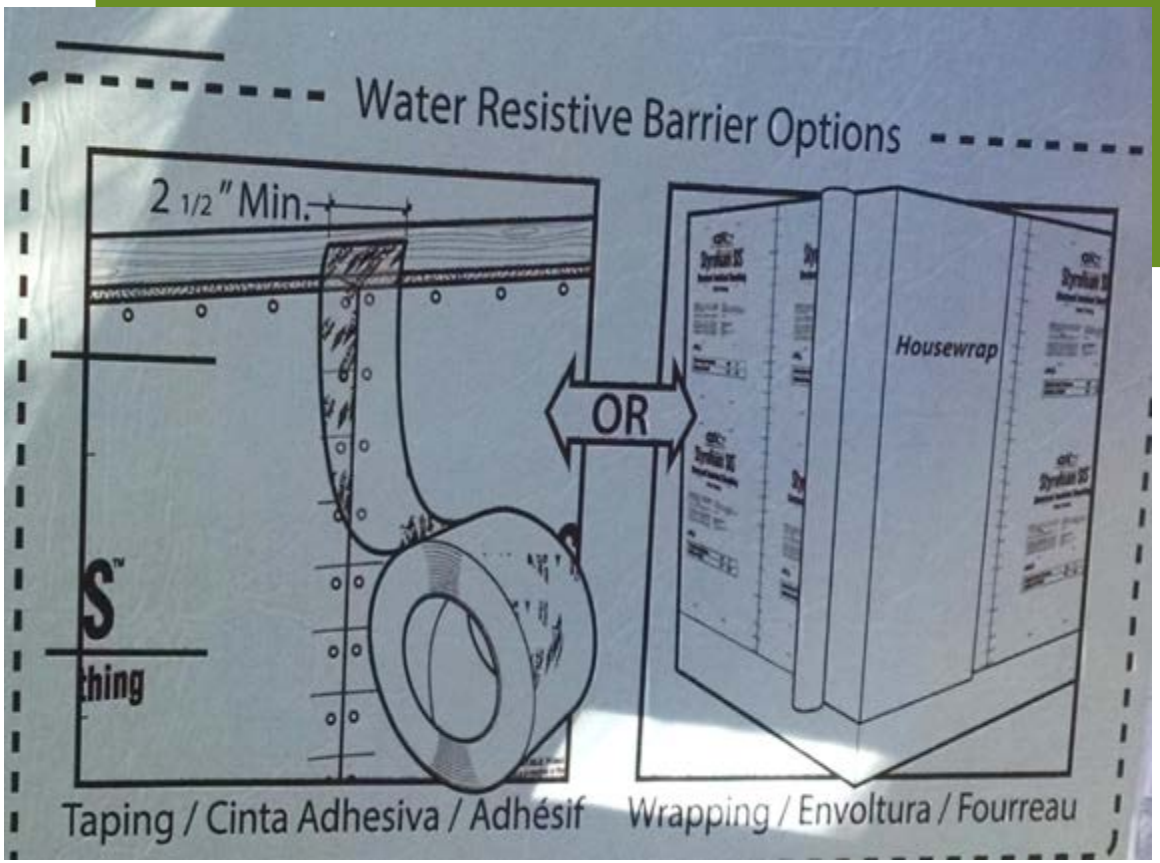
Siding Drainage Plane Retrofit

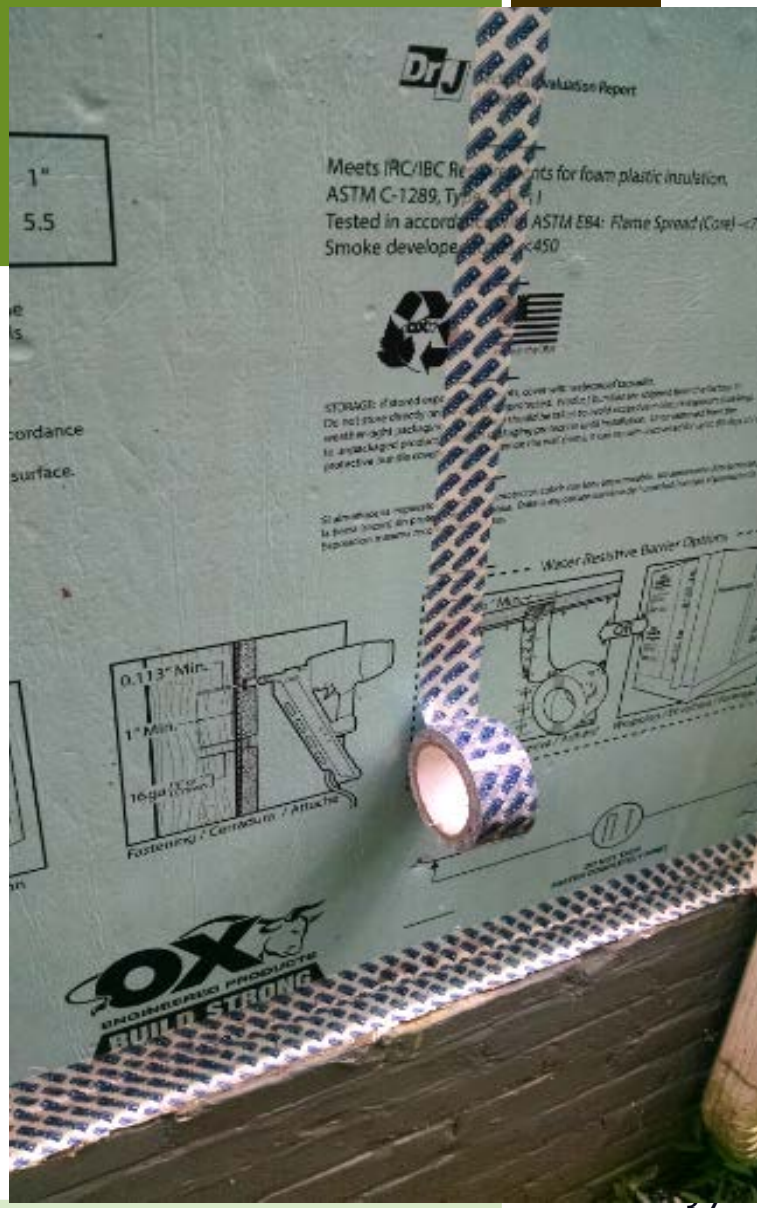
Air Seal & Insulate Sash Weight Box

Install Structural Insulated Sheathing

Set Nails in SIS

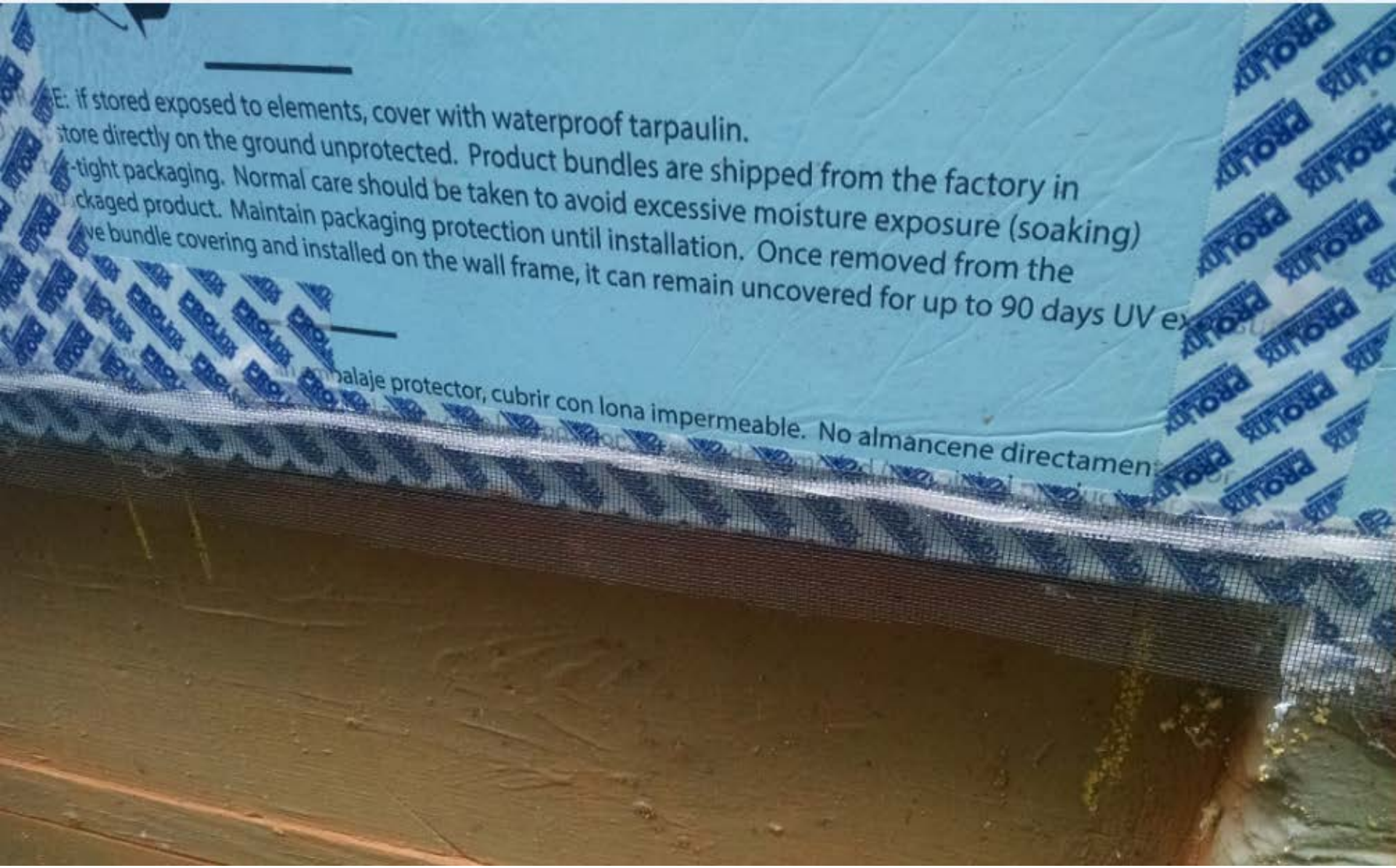
Seal Seams of SIS





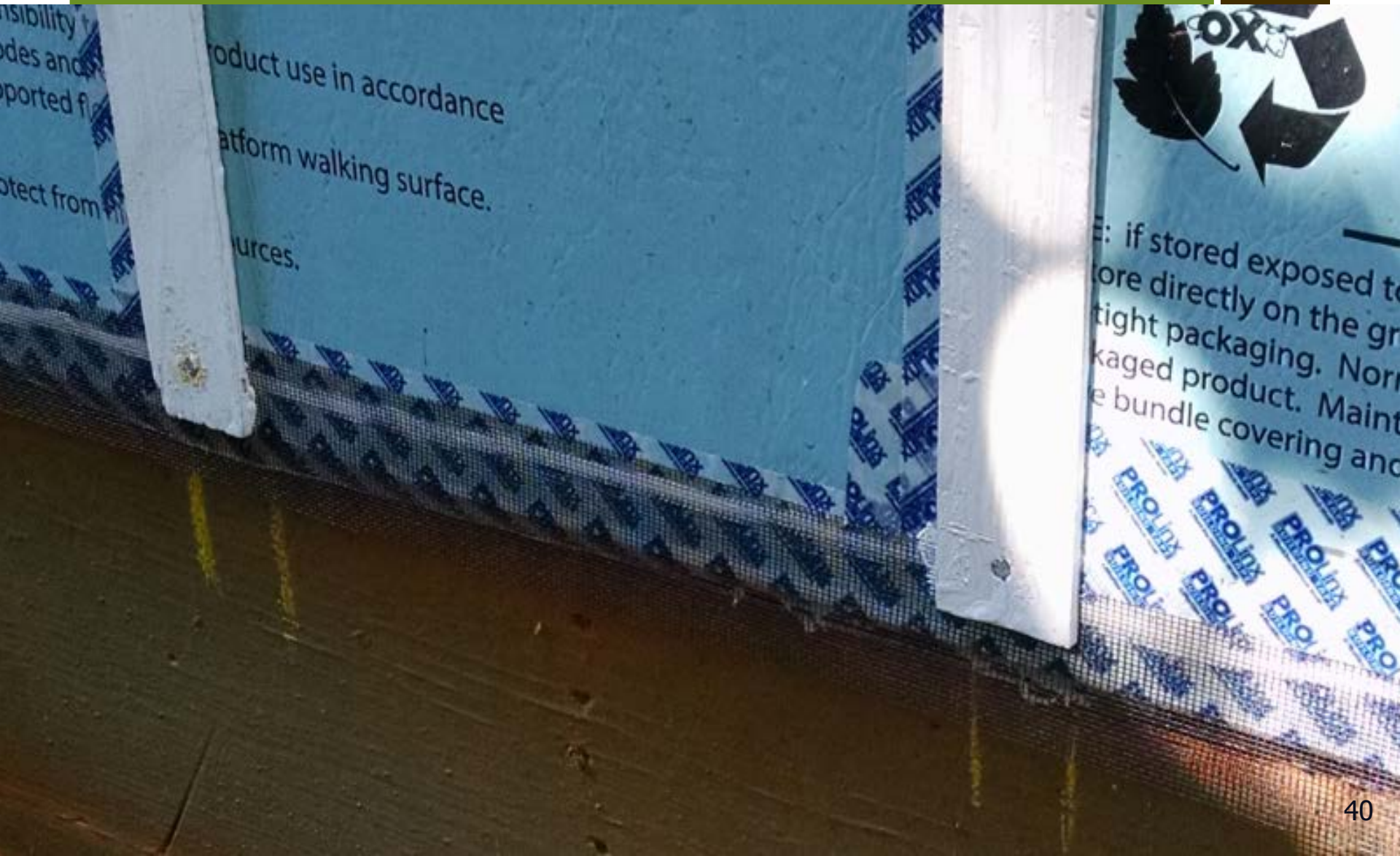
Prep for Furring Strips

3” Insect Screen Before Furring

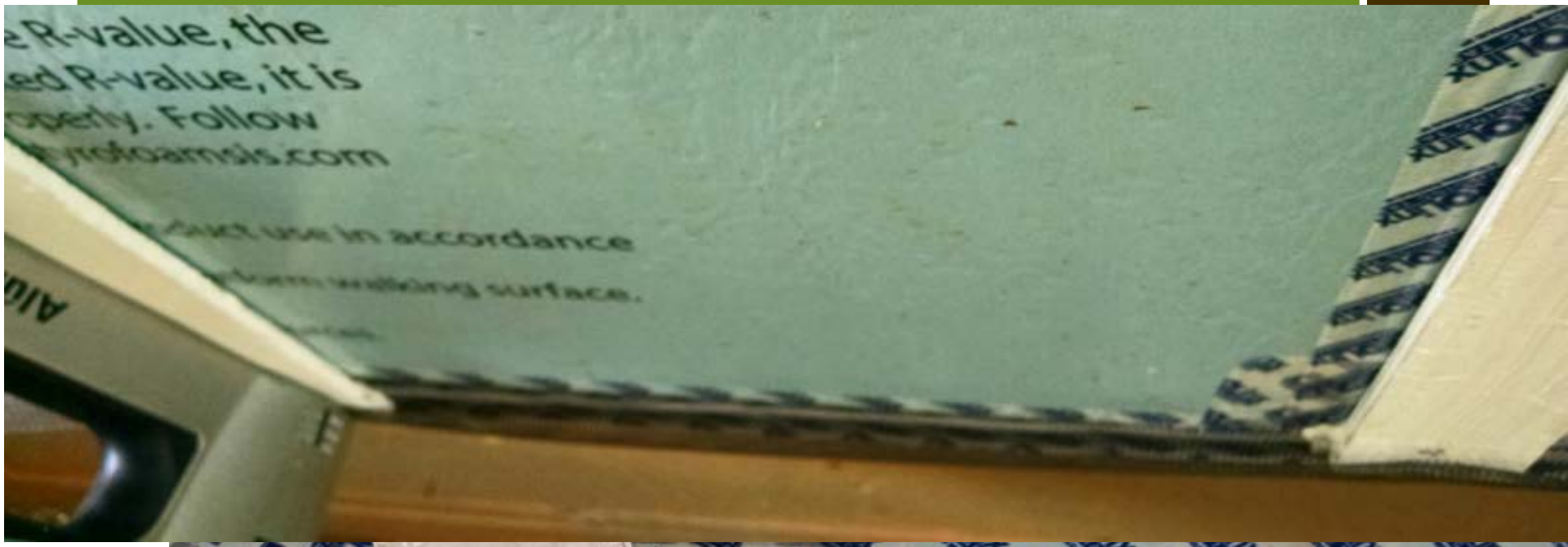


3/16” PT Furring Strips (with lower end primed)

Aligns with Wall Studs and Covers Top Half of Insect Screen



Bottom of Screen Folded Up & Stapled



Ready for Siding …

Siding Caulked At Edge, Not At Butt Joints

Floating Butt Joint With Flashing

3/16” Gap Between Siding & WRB

Siding Installation

Siding Drainage Plane Retrofit

Siding Drainage Plane Retrofit

Siding Drainage Plane Retrofit

Siding Drainage Plane Retrofit

Kitchen hood exhaust penetration

Siding Drainage Plane Retrofit

Siding Drainage Plane Retrofit

Siding Drainage Plane Retrofit – Interior Stripped to Studs

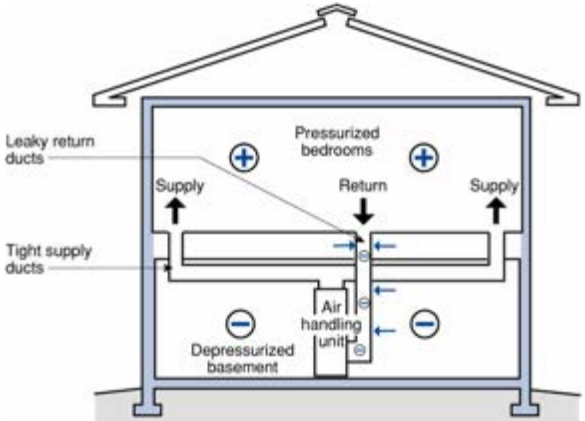
- Install vertical spacer strips into sides of cavity
- Install ½” foam board piece (~14.25” width) against strips
- Seal edges with caulk or foam
- Slightly com-press batt into cavity against foam board

Constructing a system

Siding Drainage Plane – New Construction

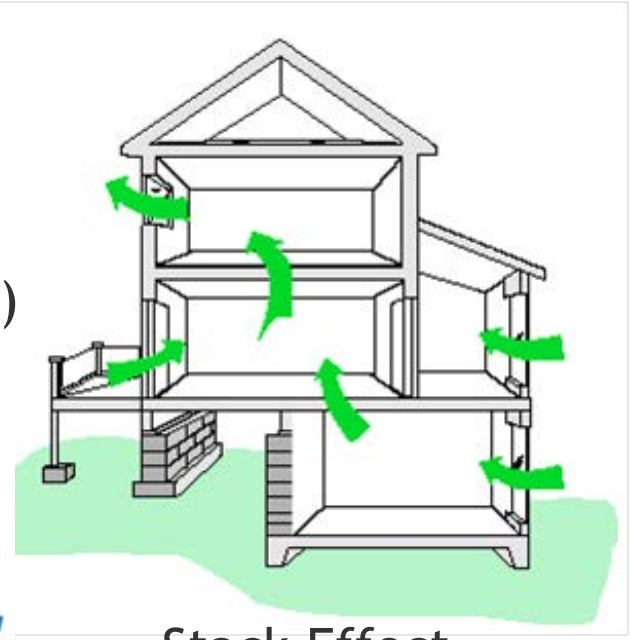
Air flow

- Air moves from areas of higher pressure to areas of lower pressure
- Natural and man-made forces that can create pressure differences cause air to flow
- Whenever air moves out of a home, an equal amount of air enters the home (and vice versa)

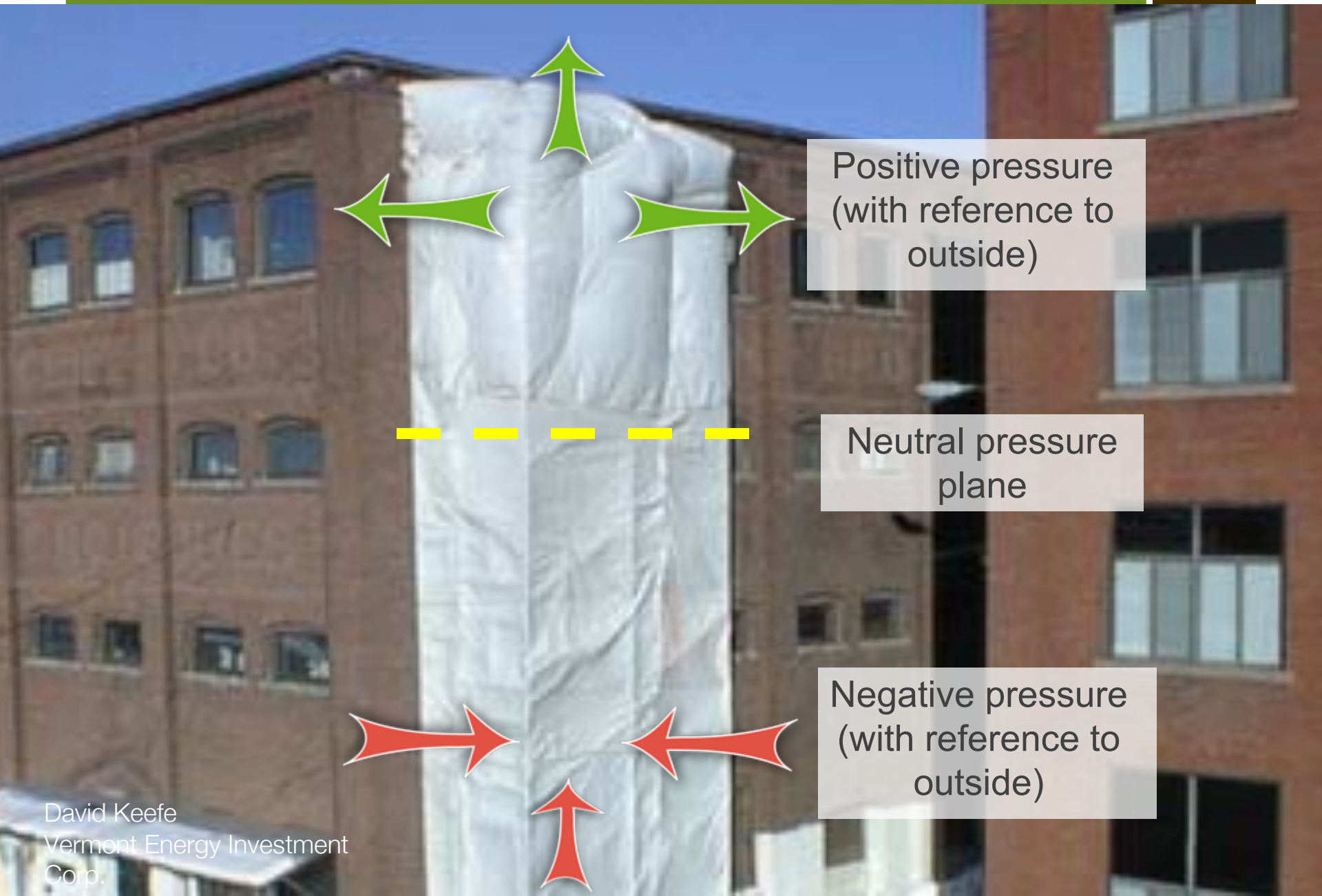


Mechanical Systems


Wind


Stack Effect

Stack Effect



David Keefe
Vermont Energy Investment Corp.

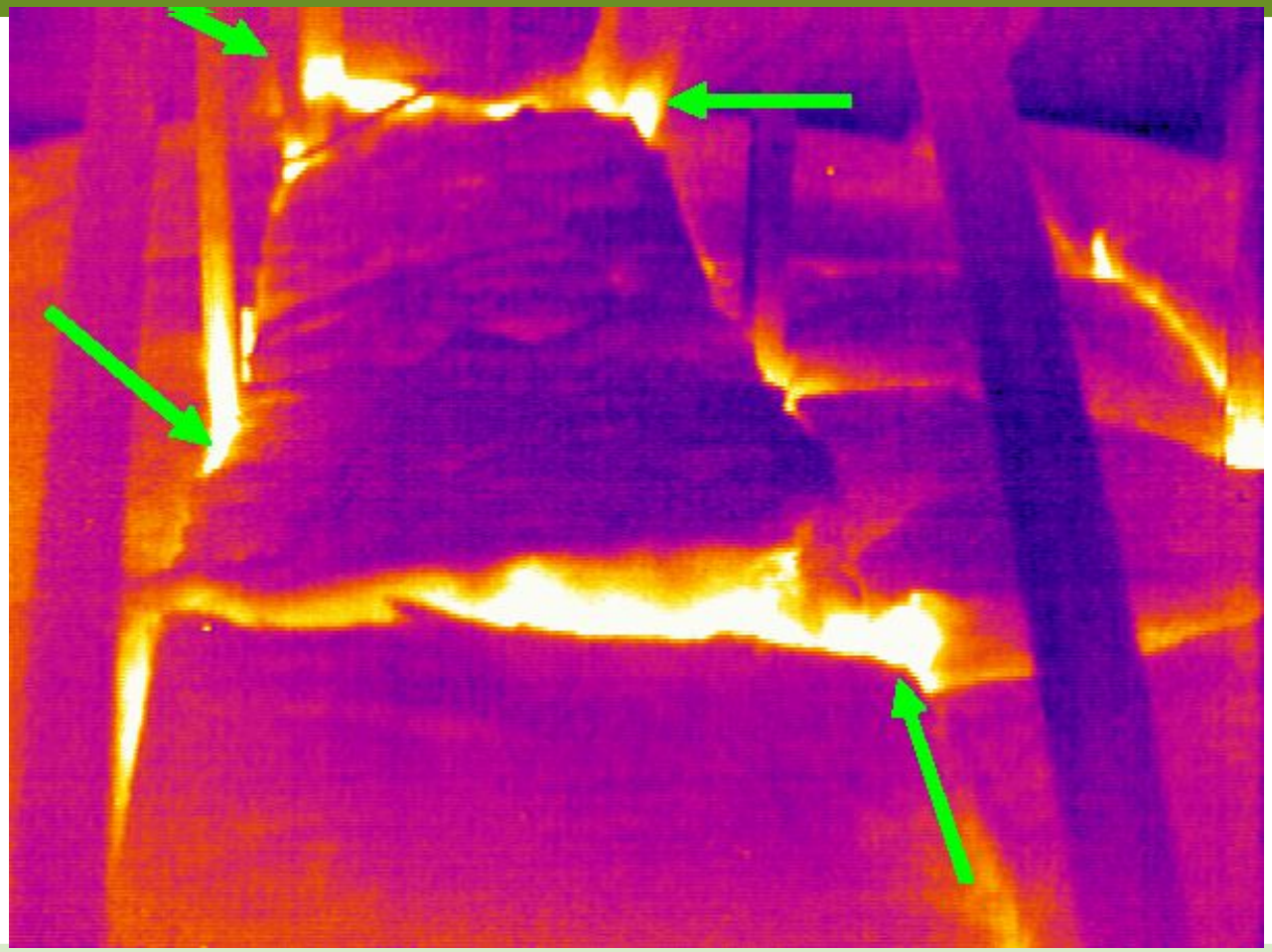
Thermal and air barriers

- The building envelope is comprised of thermal & pressure boundaries
- The thermal & pressure boundaries must be complete and aligned

- Insulation products such as fiberglass batts need to be completely enclosed on all sides
- Insulation is most effective when it is continuous and located on the exterior

Continuous Insulation & Air Barrier

- **Building Thermal Envelope**
  (air barrier and insulation must be in contact)



Mechanical systems

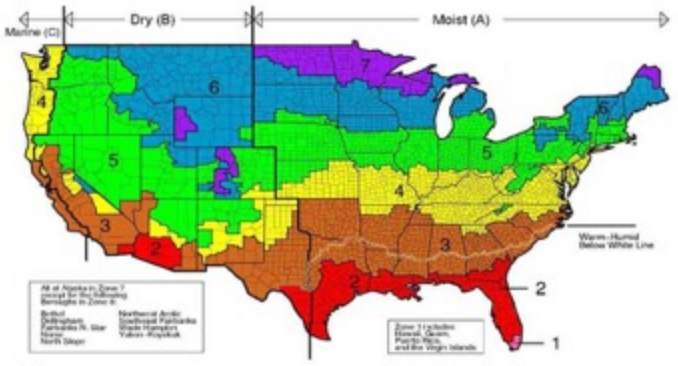
- Water heating & distribution
- Heating & Cooling
- Ventilation
- Lighting & Appliances

Codes: Applied building science

- Energy codes today are based on building science
- Some examples include 2015 IECC envelope & mechanical system requirements

2015 IECC envelope examples

- Homes must pass mandatory air leakage testing (blower door)
  - Climate zones 1&2 must test at $\leq$ 5 ACH_{50}
  - Climate zones 3 - 8 must test at $\leq$ 3 ACH_{50}
- Homes must meet minimum thermal boundary requirements (insulation, windows, etc.)
  - Different pathways available to demonstrate compliance (e.g. prescriptive tables & REScheck)



2015 IECC mechanical examples

- Mechanical ventilation systems are mandatory (i.e. ASHRAE 62.2)
- Heating and cooling system ducts must be sealed and pass mandatory air leakage testing
- Heating and cooling equipment must be properly sized and meet minimum efficiency ratings
- >75% of lighting equipment shall be high efficacy
- Combustion safety testing included in Appendix (informative)

Which term best describes heat transfer between a warm surface and a cool surface that are not touching each other?

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Which is typically a more significant means of moisture vapor transport between the interior and exterior of buildings?

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Energy codes

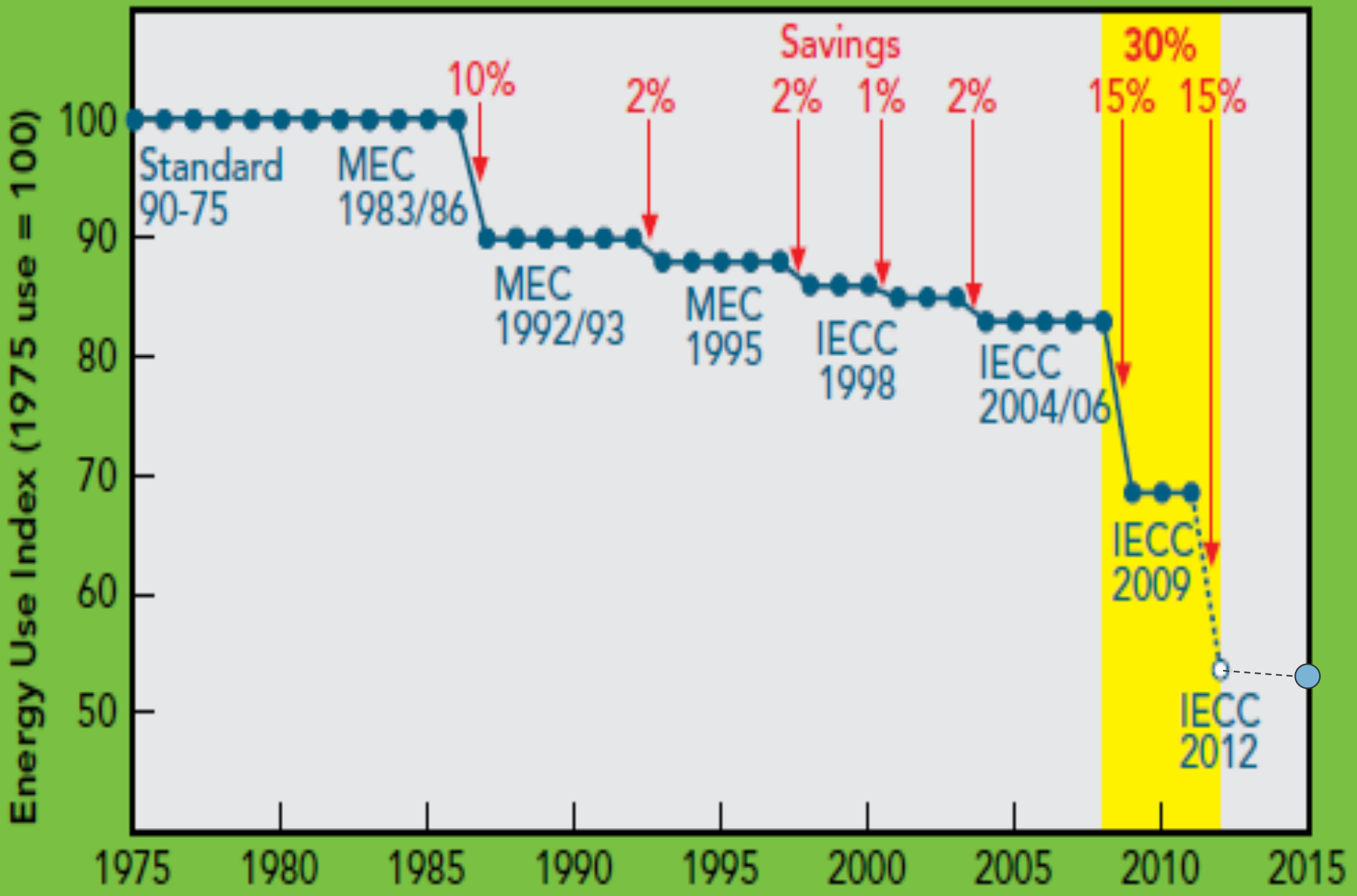
- A brief history of energy codes
- Overview of the 2015 IECC
- Compliance options – focus on the ERI

History of energy codes

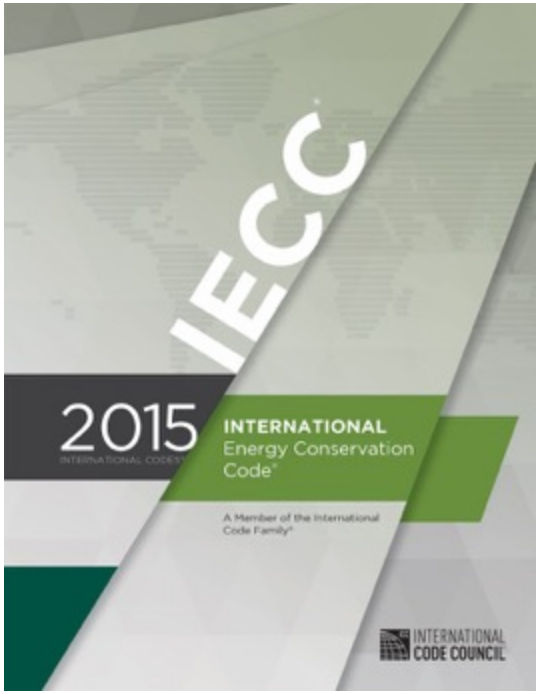
- MEC 1992, '93, 95 – Early energy codes (complicated)
- IECC 98, 2000, '03 – Strengthening of codes
- IECC 2004, '06 – Codes become simpler
- IECC 2009 – Big jump in stringency, duct & envelope testing introduced, ARRA "mandated"
- IECC 2012 – Stricter testing requirements
- IECC 2015 - More stringent, new compliance path introduced (Energy Rating Index)

- Historically, the code increased in stringency about 1-3% each cycle - until more recently!
  - '09 Code is ~15% more stringent than '06 version
  - '12 Code is ~30% more stringent than '06 version
  - '15 Code is ~30+% more stringent than '06 version

Brief History of Energy Codes



The 2015 IECC: Overview

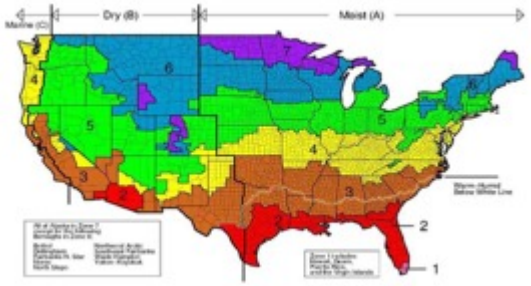


- What are the mandatory requirements of the 2015 IECC?
- Like previous versions, the 2015 IECC provides prescriptive and performance options
- The 2015 IECC introduces a new compliance option: the Energy Rating Index (ERI)

The 2015 IECC: Prescriptive

INSULATION AND FENESTRATION REQUIREMENTS BY COMPONENT[a]

CLIMATE ZONE	FENESTRATION *U*-FACTOR[b]	SKYLIGHT[b] *U*-FACTOR	GLAZED FENESTRATION SHGC[b, e]	CEILING *R*-VALUE	WOOD FRAME WALL *R*-VALUE	MASS WALL *R*-VALUE[i]	FLOOR *R*-VALUE	BASEMENT[c] WALL *R*-VALUE	SLAB[d] *R*-VALUE & DEPTH	CRAWL SPACE[c] WALL *R*-VALUE
1	NR	0.75	0.25	30	13	3/4	13	0	0	0
2	0.40	0.65	0.25	38	13	4/6	13	0	0	0
3	0.35	0.55	0.25	38	20 or 13+5[h]	8/13	19	5/13[f]	0	5/13
4 except Marine	0.35	0.55	0.40	49	20 or 13+5[h]	8/13	19	10 /13	10, 2 ft	10/13
5 and Marine 4	0.32	0.55	NR	49	20 or 13+5[h]	13/17	30[g]	15/19	10, 2 ft	15/19
6	0.32	0.55	NR	49	20+5 or 13+10[h]	15/20	30[g]	15/19	10, 4 ft	15/19
7 and 8	0.32	0.55	NR	49	20+5 or 13+10[h]	19/21	38[g]	15/19	10, 4 ft	15/19



Fill in the prescriptive code R-values

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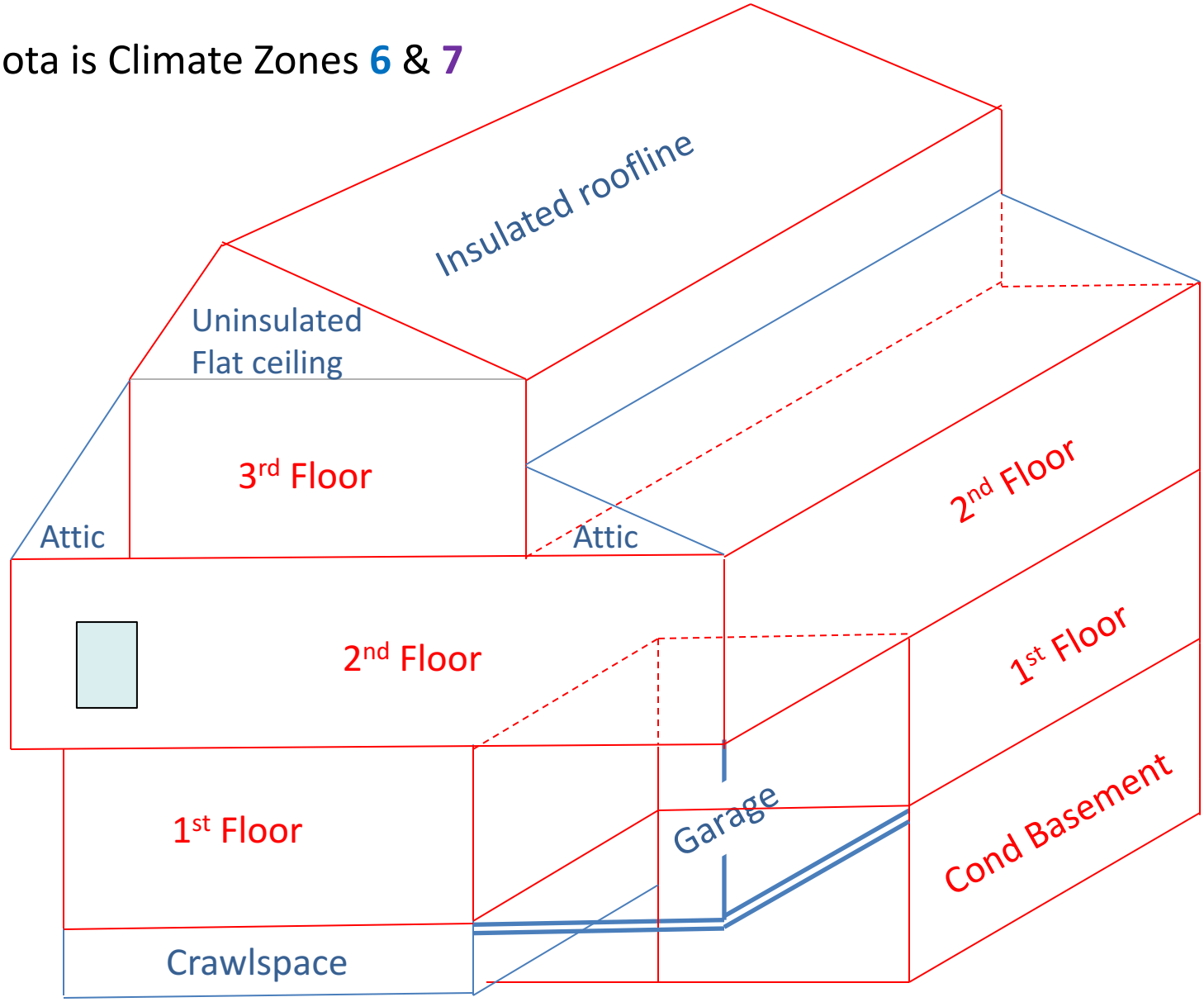
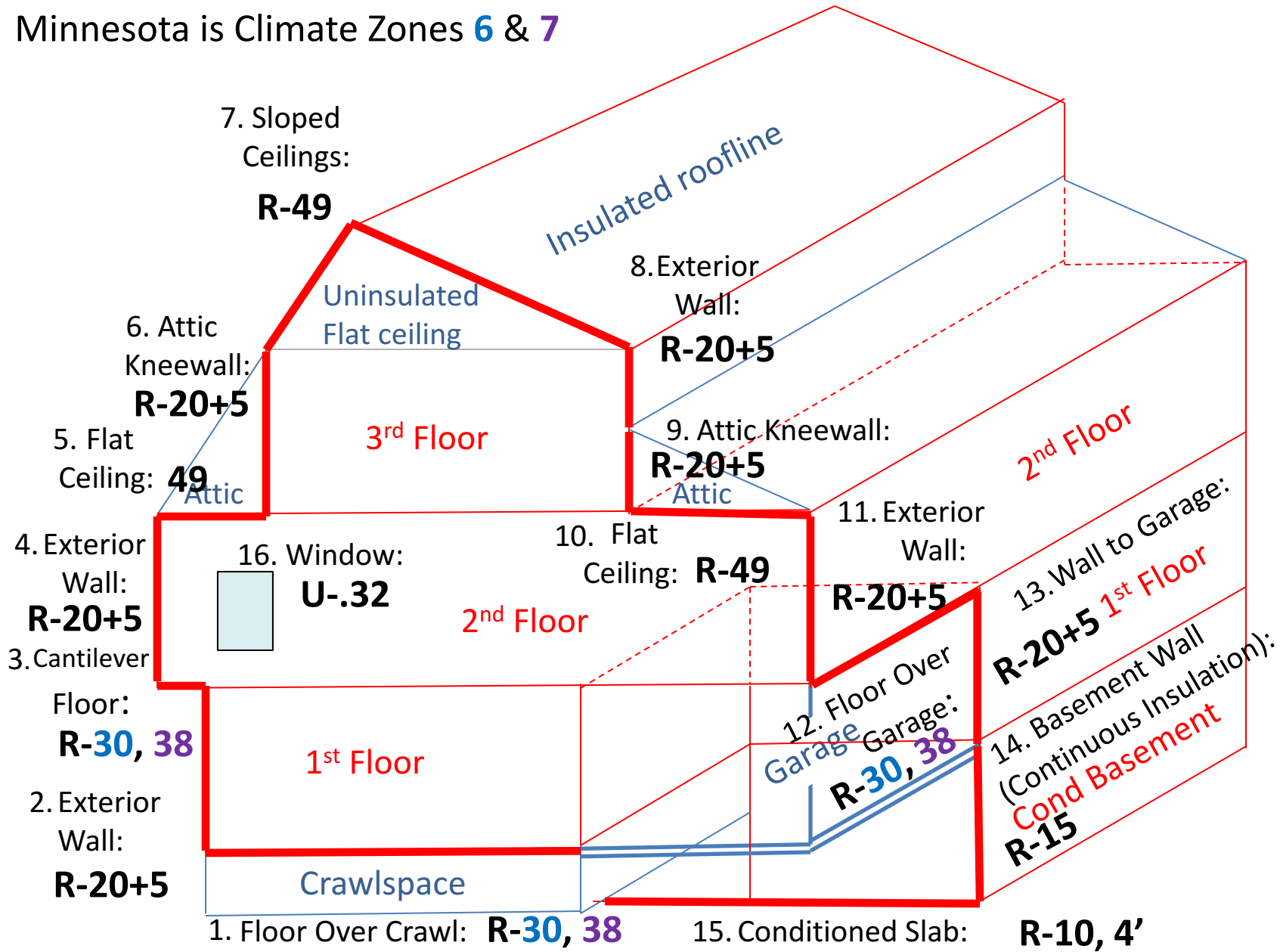
Minnesota is Climate Zones **6** & **7**



Fill in the prescriptive code R-values

Southface

Minnesota is Climate Zones 6 & 7



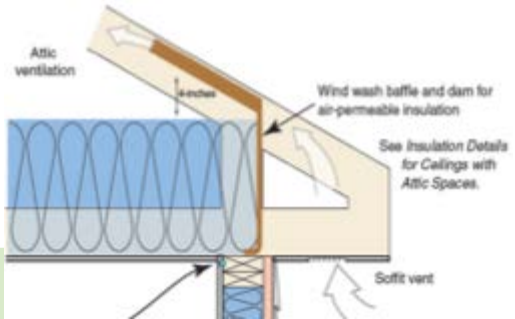
2015 IECC: R402.2

Specific Insulation Requirements (Prescriptive)

- R402.2.1 Ceilings with Attic Spaces
- R402.2.2 Ceilings without Attic Spaces
- R402.2.3 Eave Baffle
- R402.2.4 Access hatches and doors
- R402.2.5 Mass Walls
- R402.2.6 Steel Framing
- R402.2.7 Walls with Structural Sheathing
- R402.2.8 Floors
- R402.2.9 Basement Walls
- R402.2.10 Slab-on-grade floors
- R402.2.11 Crawlspace walls
- R402.2.12 Masonry Veneer
- R402.2.13 Sunrooms

R402.2 Specific insulation requirements (Prescriptive). In addition to the requirements of Section R402.1, insulation shall meet the specific requirements of Sections R402.2.1 through R402.2.13.

R402.2.1 Ceilings with attic spaces. Where Section R402.1.2 would require R-38 insulation in the ceiling, installing R-30 over 100 percent of the ceiling area requiring insulation shall be deemed to satisfy the requirement for R-38 wherever the full height of uncompressed R-30 insulation extends over the wall top plate at the eaves. Similarly, where Section R402.1.2 would require R-49 insulation in the ceiling, installing R-38 over 100 percent of the ceiling area requiring insulation shall be deemed to satisfy the requirement for R-49 insulation wherever the full height of uncompressed R-38 insulation extends over the wall top plate at the eaves. This reduction shall not apply to the *U*-factor alternative approach in Section R402.1.4 and the total UA alternative in Section R402.1.5.

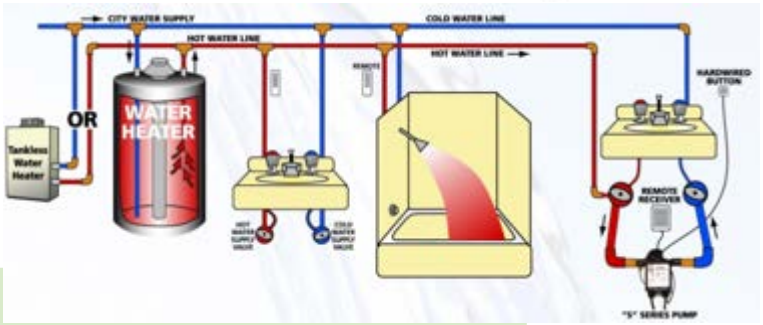


2015 IECC mandatory requirements

- R401.3 Certificate
- R402.4 Air leakage (air sealing, testing, fireplace, fenestration, combustion zones and recessed lighting specifics)
- R402.5 Maximum fenestration U-factor and SHGC
- R403.1 Controls
- R403.3.2-3 Duct sealing & testing
- R403.5.1 Hot water circulation & temperature maintenance systems
- R403.6 Mechanical ventilation
- R403.7 Equipment sizing and efficiency rating
- R403.8 Systems serving multiple dwelling units
- R403.9 Snow melt and ice system controls
- R403.11 Portable spas
- R404.1 Lighting equipment

R403.5.3 Hot water pipe insulation (Prescriptive). Insulation for hot water pipe with a minimum thermal resistance (*R*-value) of R-3 shall be applied to the following:

1. Piping $^{3}/_{4}$ inch (19.1 mm) and larger in nominal diameter.
2. Piping serving more than one dwelling unit.
3. Piping located outside the conditioned space.
4. Piping from the water heater to a distribution manifold.
5. Piping located under a floor slab.
6. Buried in piping.
7. Supply and return piping in recirculation systems other than demand recirculation systems.



According to the 2015 IECC, new homes are required to have mechanical whole-house ventilation systems.

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What is the minimum percentage of high-efficacy lighting required by the 2015 IECC?

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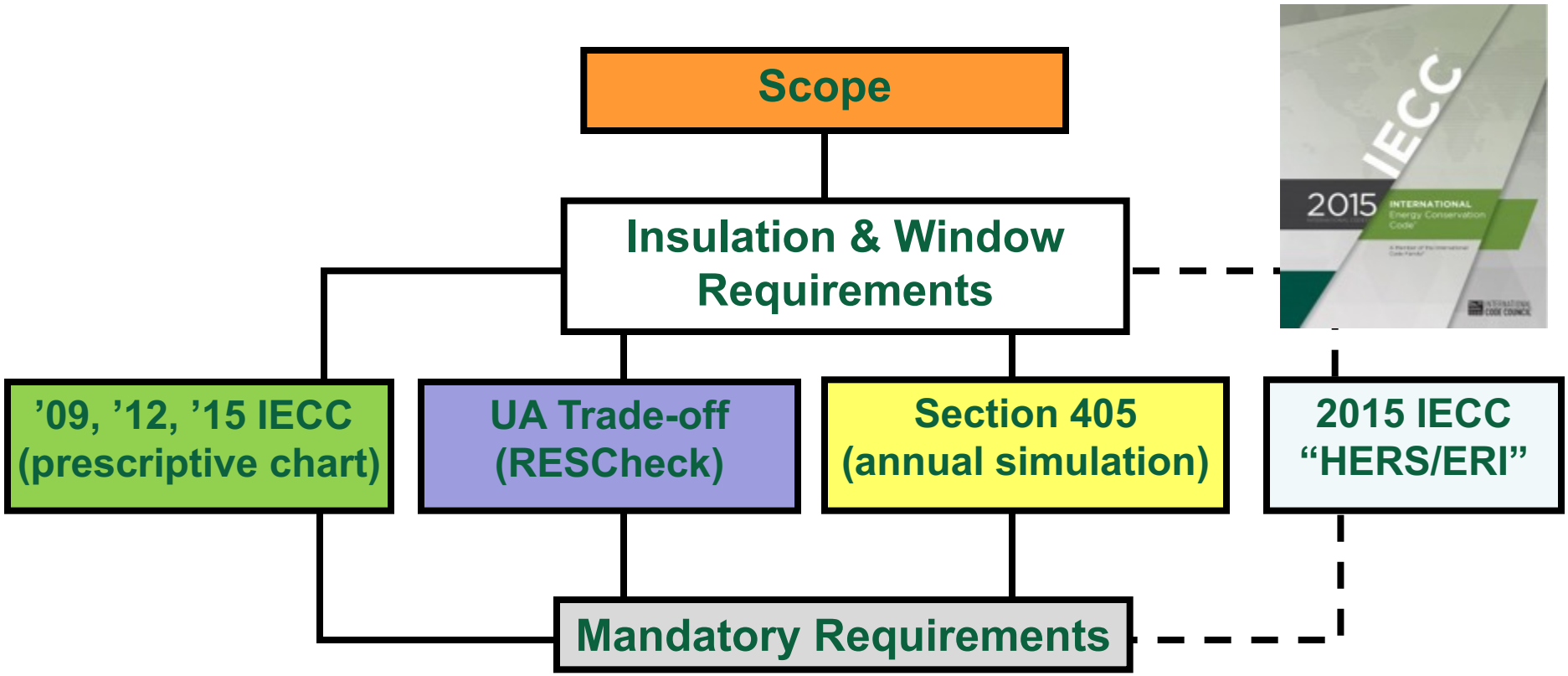
2015 IECC compliance options

REScheck™

- Prescriptive (table) or Total UA Alternative (REScheck)
- Simulated Performance Alternative (computer simulation using the *standard reference* and *proposed design*)
- Energy Rating Index (HERS Rating)

Compliance Paths for Insulation & Windows

Southface



- The new ERI path gives the most design flexibility – such as credit for mechanical equipment efficiency
- It also credits items not covered by the code (e.g., appliance efficiencies)

Benefits of choosing the ERI

- The ERI path can be cost-effective & beneficial to builders
- Choosing the ERI can offer benefits compared to the prescriptive, trade-off and simulated performance approaches

Benefits of choosing the ERI

Stringent prescriptive envelope requirements ma
the 2015 IECC prescriptive and tradeoff paths
more difficult than previous codes!

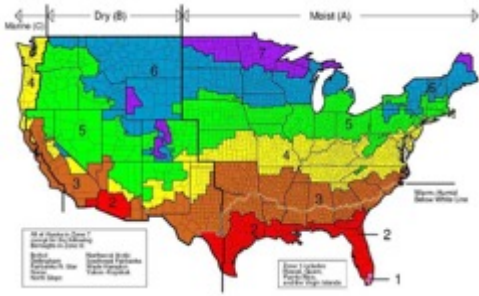
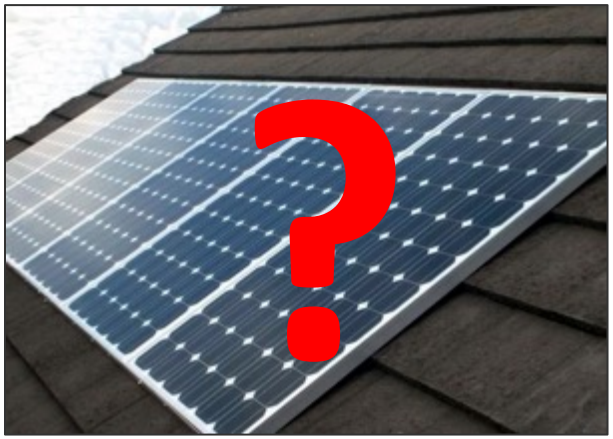


TABLE R402.1.2
INSULATION AND FENESTRATION REQUIREMENTS BY COMPONENT[a]

CLIMATE ZONE	FENESTRATION *U*-FACTOR[b]	SKYLIGHT[b] *U*-FACTOR	GLAZED FENESTRATION SHGC[b, e]	CEILING *R*-VALUE	WOOD FRAME WALL *R*-VALUE	MASS WALL *R*-VALUE[i]	FLOOR *R*-VALUE	BASEMENT[c] WALL *R*-VALUE	SLAB[d] *R*-VALUE & DEPTH	CRAWL SPACE[c] WALL *R*-VALUE
1	NR	0.75	0.25	30	13	3/4	13	0	0	0
2	0.40	0.65	0.25	38	13	4/6	13	0	0	0
3	0.35	0.55	0.25	38	20 or 13+5[h]	8/13	19	5/13[f]	0	5/13
4 except Marine	0.35	0.55	0.40	49	20 or 13+5[h]	8/13	19	10 /13	10, 2 ft	10/13
5 and Marine 4	0.32	0.55	NR	49	20 or 13+5[h]	13/17	30[g]	15/19	10, 2 ft	15/19
6	0.32	0.55	NR	49	20+5 or 13+10[h]	15/20	30[g]	15/19	10, 4 ft	15/19
7 and 8	0.32	0.55	NR	49	20+5 or 13+10[h]	19/21	38[g]	15/19	10, 4 ft	15/19

Benefits of choosing the ERI

The ERI may allow more options in materials choice, technologies and innovative strategies than the simulated performance path



Which of these technologies are credited in the ERI path?

Check any of the following strategies that receive credit in the ERI pathway:

- ❑ 95% furnace (PVC flue pipe & combustion intake) in basement
- ❑ High efficiency mini split heat pump for bonus room
- ❑ The home features 95% LED lighting
- ❑ ENERGY STAR Washer, Dryer and Refrigerator supplied by builder
- ❑ Energy/Heat Recovery Ventilator provides fresh air for home
- ❑ NEST thermostat is used for HVAC control
- ❑ Minimum efficiency direct vent gas water heater in basement
- ❑ Solar powered clothes line is strung between house and garage

Economics of Lighting

9 bulbs x 60 watts each = 540 w

540 w x 4 hours a day = 2160 wh

2160 wh x 350 days = 756,000 wh a year

756,000 / 1000 = 756 kwh

756 kwh x $.10 = $75.60 per year

The Economics of Lighting for Builders

Bulb Cost Assumption:			Electricity Rate: 0.12 $/kwh		
Incandescent = $0.25					
LED = $2 each					
				Bulb Wattage	
	# Incand	# LED's	Price Premium	Incand	LED
All Incand House	60	0	$ -	60	10
50% LED House	30	30	$ 52.50	60	10
100% LED House	0	60	$ 105.00	60	10

	$ Cost for 1 month - ON half the time				Simple Payback	
	Incand	LED	Total	$ Savings	(months)	(days)
100% Incand House	$ 158.11	$ -	$ 158.11	0		
50% Incand / 50% LED	$ 79.06	$ 13.18	$ 92.23	$ 65.88	0.80	24.3
100% LED House	$ -	$ 26.35	$ 26.35	$ 131.76	0.80	24.3


UT LED 60W
EQUIVALENT 2-CT
60-Watt Equivalent LED Bulb 2-Pack
• Warm White
Bombilla LED equivalente de 60 vatios: paquete de 2
• Blanco cálido
New Lower Price
$2 98
Was $3 98
1 A 25


40w
LED
SYLVANIA
ULTRA
LED
40w
LED
How many HOURS does this LED last?
$4 98
Everyday
Low
Price
1 A 11


KICHLER
G40
4.0w
300
9.13
LED
60w
40w
Classic
KICHLER
LED
$15 98
$13 98
$9 98
Everyday
Low
Price

How is the ERI determined?

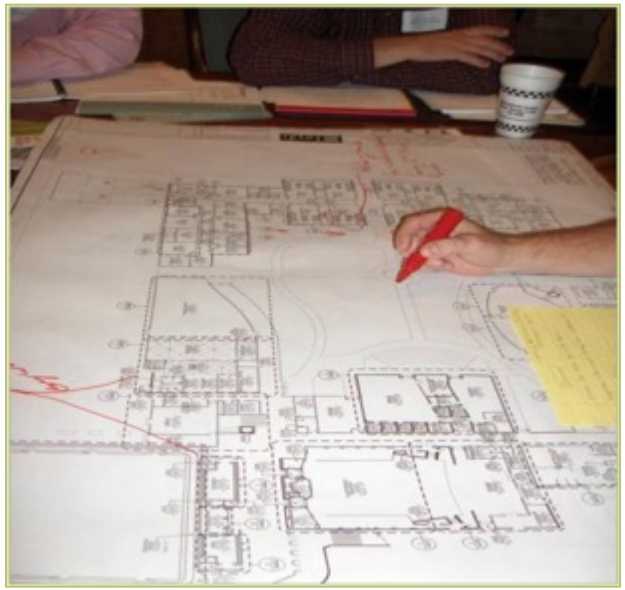
- The ERI is a numerical integer value
- Lower numbers indicate lower energy use
- The HERS Index is currently accepted for use as the ERI
- A HERS Index is generated from a HERS Rating using modeling software
- HERS stands for *Home Energy Rating System*

HERS was developed by the Residential Energy Services Network (RESNET)

Explaining the Energy Rating Index

1. Simulate two homes

- ***Rated*** Home – what will be built
- ***Reference*** Home – same home but exactly meets '06 code



2. Compare Annual Energy

- Space Heating & Cooling, Hot Water, Lighting and some Appliances
- Multiply by 100
  (lower w/ renewables)

40 30 30 50

$$\textbf{Index} = 100 \times \frac{[\textbf{\textit{Rated}}\ \text{Home's Htg + Clg + WtrH + L.A.}]}{[\textbf{\textit{Refer}}.\ \text{Home's Htg + Clg + WtrH + L.A.}]} = 75$$

70 20 30 80

Southface

HERS Index – What's it Mean?

Southface

- HERS **Index,** now often referred to as HERS Index Score (lower is better)
- Rated home with Index of 100 = Reference home exactly meeting 2004/06 IECC
- Net Zero Energy Home = HERS Index of 0

$$\textbf{Index} = PE_{fraction} \times 100 \times \frac{[\text{Rated Home's } \underset{40}{\text{Htg}} + \underset{30}{\text{Clg}} + \underset{30}{\text{WtrH}} + \underset{50}{\text{L.A.}}]}{[\text{ Ref. Home's } \underset{70}{\text{Htg}} + \underset{20}{\text{Clg}} + \underset{30}{\text{WtrH}} + \underset{80}{\text{L.A.}}]} = 75$$

$PE_{fraction}$ is ratio of renewables to purchased energy

(E.g, a home that produces 20% of its annual energy would have a $PE_{fraction}$ of 0.8)
In this example, 0.8 x 75 = **60**

Explaining the Energy Rating Index

1. 2015 IECC targets

- **Low 50's**

TABLE R406.4
MAXIMUM ENERGY RATING INDEX

CLIMATE ZONE	ENERGY RATING INDEX
1	52
2	52
3	51
4	54
5	55
6	54
7	53
8	53

2. Who Can Do This?

- 3rd party – HERS Rater
- Approved software

3. Benefits

- Greater design flexibility
- High efficiency equipment and appliances credited

4. Backstops

- Envelope cannot be traded to be worse than 2009 IECC
- Must meet Mandatory Requirements
  (air sealing, duct insulation and sealing, duct and house testing, etc.)

Pros and Cons?

1. Concerns

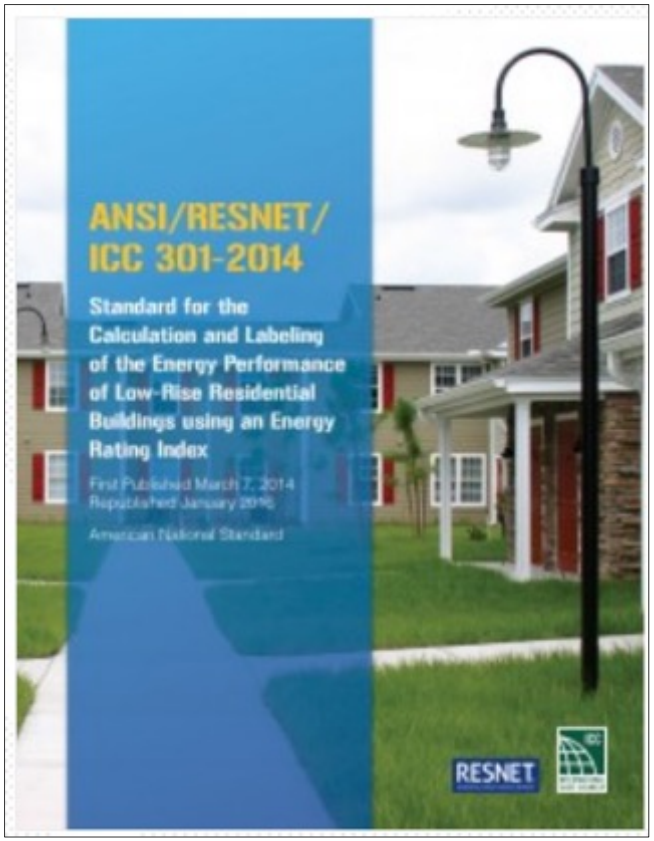
- **Conflict of interest** because rater works for the builder
- **Size Bias** against small houses
  - **Code** – because it uses the antiquated ACH50 term for air tightness (which favors larger, high volume homes)
  - **ERI** –small homes have less envelope load and are hindered in trade-offs
- **Credit for unregulated items** not in the Prescriptive code
  "Should the dishwasher be allowed to trade down insulation R-values?"

2. Benefits

- **Professional** (HERS Rater) who understands energy efficiency is now involved and energy code isn't ignored
- **Marketing** – Builders can market their index and guarantee performance

Approved modeling software

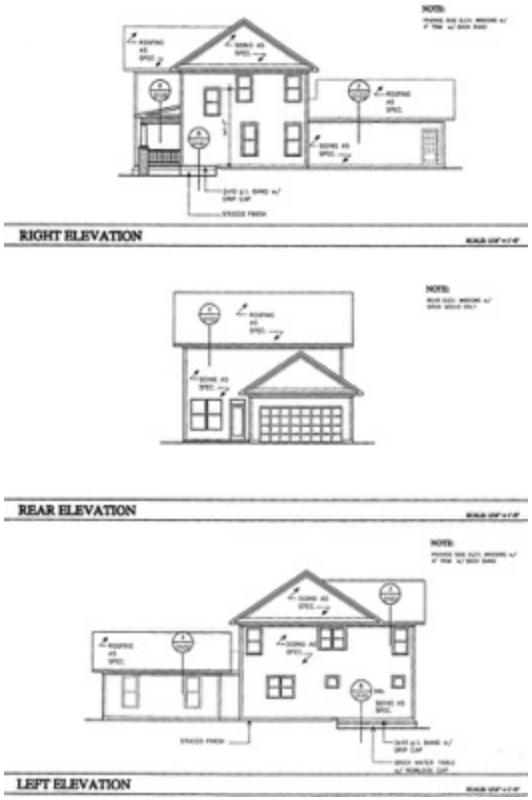
- Software meets requirements of the ANSI/RESNET/ICC 301 Standard
- Software must be capable of generating reports as described in R406.6.2



ERI: What does it mean?

- A numeric scale where a lower number means less energy use
- An index of 0 means a home that uses no purchased energy (a net zero or Zero Energy Home)
- An index of 100 is a reference home that exactly meets the 2006 IECC
- The 2015 IECC sets a maximum ERI for each climate zone
- The ERI is not a “magic bullet” or “easy”
- However, it opens more options and allows builders more credit for innovative strategies (“*the ERI shall consider all energy used in the residential building*”)

ERI: Rated home vs. reference



The software compares the projected energy use of the ***rated*** home against a ***reference*** home that is:

- The same shape and size, building structure, and orientation
- Constructed to meet the 2006 IECC

The ERI rates the house, not the behavior of people living in the house

Compliance: Maximum ERI

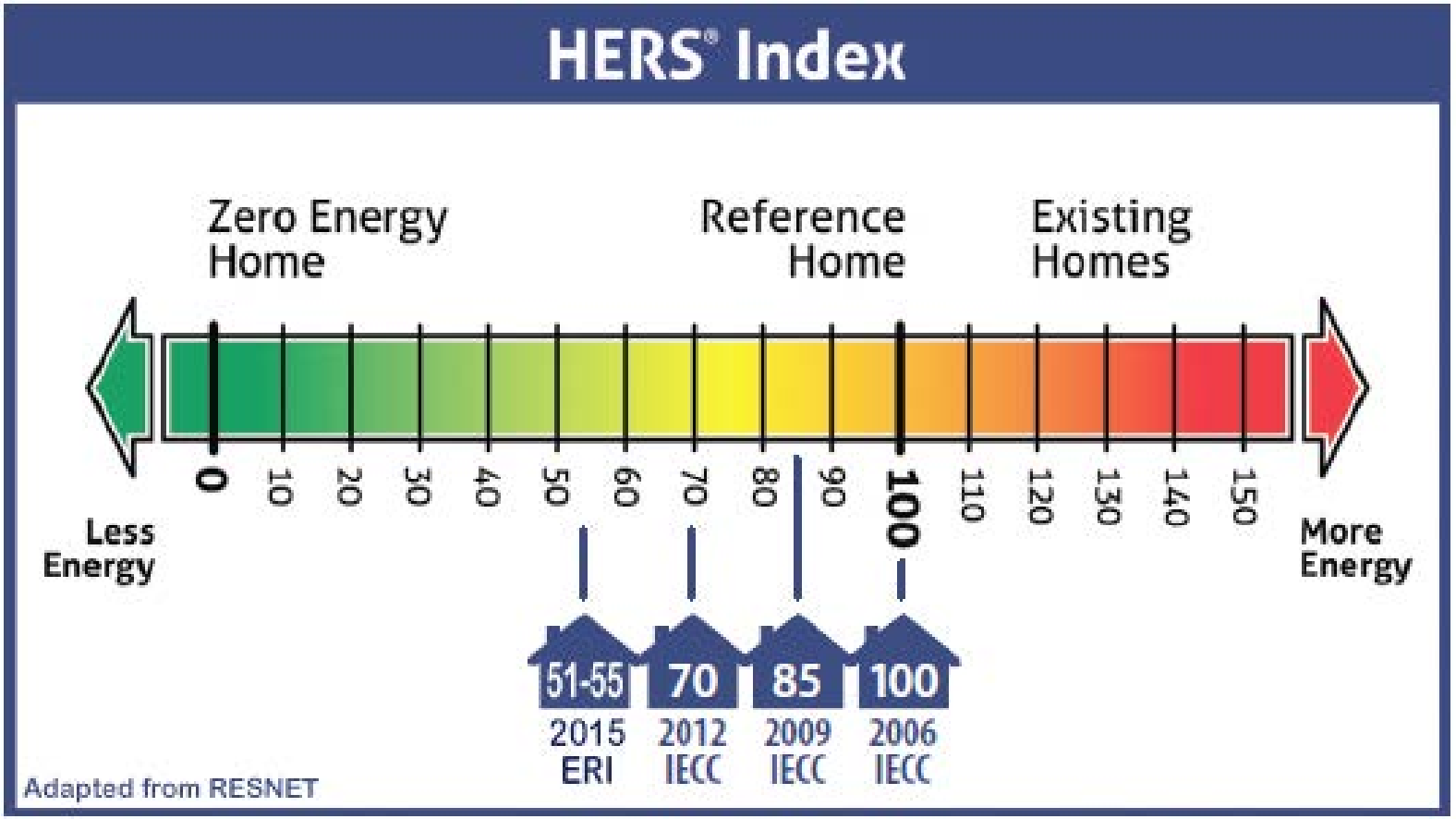
TABLE R406.4
MAXIMUM ENERGY RATING INDEX

CLIMATE ZONE	ENERGY RATING INDEX
1	52
2	52
3	51
4	54
5	55
6	54
7	53
8	53

The rated design must have an ERI less than or equal to the above table to comply with 2015 IECC

NOTE: Some states have amended these numbers!

How does the ERI compare to previous codes versions?

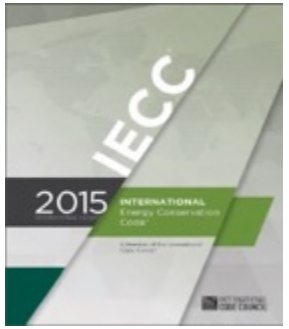


A word about renewables…

- The 2015 IECC does not directly address renewables in the ERI
- There are differing opinions on how renewables should be handled with the ERI
- States are addressing this differently

- TX – no solar
- VT, MA (2012) – cap
- AL, IL, MD, NJ, NV, UT, WA – as written in 2015 IECC
- FL, 2018 IECC – harder backstop for renewables

ERI mandatory requirements



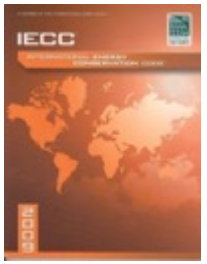
- Home must meet mandatory requirements of sections R401.2 and R403.5.3
- The building thermal envelope shall be greater than or equal to levels of efficiency of the 2009 IECC
- Software & rating procedure must comply with specifications in section R406
- Compliance must be verified by approved 3rd party (e.g. HERS Rater)

ERI mandatory requirements – Minimum '09 Envelope

TABLE 402.1.1
INSULATION AND FENESTRATION REQUIREMENTS BY COMPONENT[a]

CLIMATE ZONE	FENESTRATION *U*-FACTOR[b]	SKYLIGHT[b] *U*-FACTOR	GLAZED FENESTRATION SHGC[b, e]	CEILING *R*-VALUE	WOOD FRAME WALL *R*-VALUE	MASS WALL *R*-VALUE[i]	FLOOR *R*-VALUE	BASEMENT[c] WALL *R*-VALUE	SLAB[d] *R*-VALUE & DEPTH	CRAWL SPACE[c] WALL *R*-VALUE
1	1.2	0.75	0.30	30	13	3/4	13	0	0	0
2	0.65[j]	0.75	0.30	30	13	4/6	13	0	0	0
3	0.50[j]	0.65	0.30	30	13	5/8	19	5/13[f]	0	5/13
4 except Marine	0.35	0.60	NR	38	13	5/10	19	10/13	10, 2 ft	10/13
5 and Marine 4	0.35	0.60	NR	38	20 or 13+5[h]	13/17	30[g]	10/13	10, 2 ft	10/13
6	0.35	0.60	NR	49	20 or 13+5[h]	15/19	30[g]	15/19	10, 4 ft	10/13
7 and 8	0.35	0.60	NR	49	21	19/21	38[g]	15/19	10, 4 ft	10/13

2009 IECC insulation and window efficiencies table



Activity

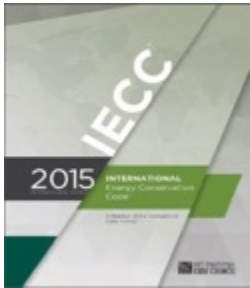
- Split into groups of 4-5 students
- Note the requirements on Table R402.1.2 from the 2015 IECC
- Discuss the implications this may have for builders (including other climate zones) who follow the Prescriptive and Total UA compliance paths
- Present a summary to the class

2015 IECC prescriptive table

TABLE R402.1.2
INSULATION AND FENESTRATION REQUIREMENTS BY COMPONENT[a]

CLIMATE ZONE	FENESTRATION *U*-FACTOR[b]	SKYLIGHT[b] *U*-FACTOR	GLAZED FENESTRATION SHGC[b, e]	CEILING *R*-VALUE	WOOD FRAME WALL *R*-VALUE	MASS WALL *R*-VALUE[i]	FLOOR *R*-VALUE	BASEMENT[c] WALL *R*-VALUE	SLAB[d] *R*-VALUE & DEPTH	CRAWL SPACE[c] WALL *R*-VALUE
1	NR	0.75	0.25	30	13	3/4	13	0	0	0
2	0.40	0.65	0.25	38	13	4/6	13	0	0	0
3	0.35	0.55	0.25	38	20 or 13+5[h]	8/13	19	5/13[f]	0	5/13
4 except Marine	0.35	0.55	0.40	49	20 or 13+5[h]	8/13	19	10 /13	10, 2 ft	10/13
5 and Marine 4	0.32	0.55	NR	49	20 or 13+5[h]	13/17	30[g]	15/19	10, 2 ft	15/19
6	0.32	0.55	NR	49	20+5 or 13+10[h]	15/20	30[g]	15/19	10, 4 ft	15/19
7 and 8	0.32	0.55	NR	49	20+5 or 13+10[h]	19/21	38[g]	15/19	10, 4 ft	15/19

2015 IECC insulation and window efficiencies table



HERS Raters

- Must meet rigorous standards and maintain continuing education
- Abide by the RESNET Code of Conduc
- Undergo regular Quality Assurance
- Provide objectivity, technical proficienc & ethical standards
- Can offer innovative insights to high performance construction
- Can provide valuable Quality Assuranc

RESNET

www.resnet.us

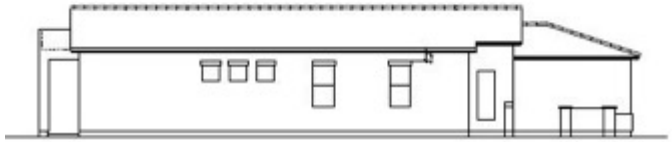
What Is RESNET?

- The Residential Energy Services Network or RESNET is a not-for-profit, membership corporation that is governed by a board of 20 (who are elected by membership).
- RESNET is a recognized national standards-making body for building energy efficiency rating and certification systems in the United States involving:
  - A consensus based standard development and amendment process
  - Transparent review / adoption process
  - Formal public review / comment process

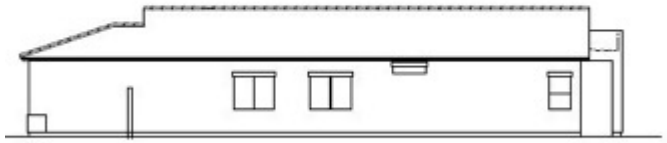
HERS Rating demonstration

FRONT ELEVATION

REAR ELEVATION



LEFT ELEVATION

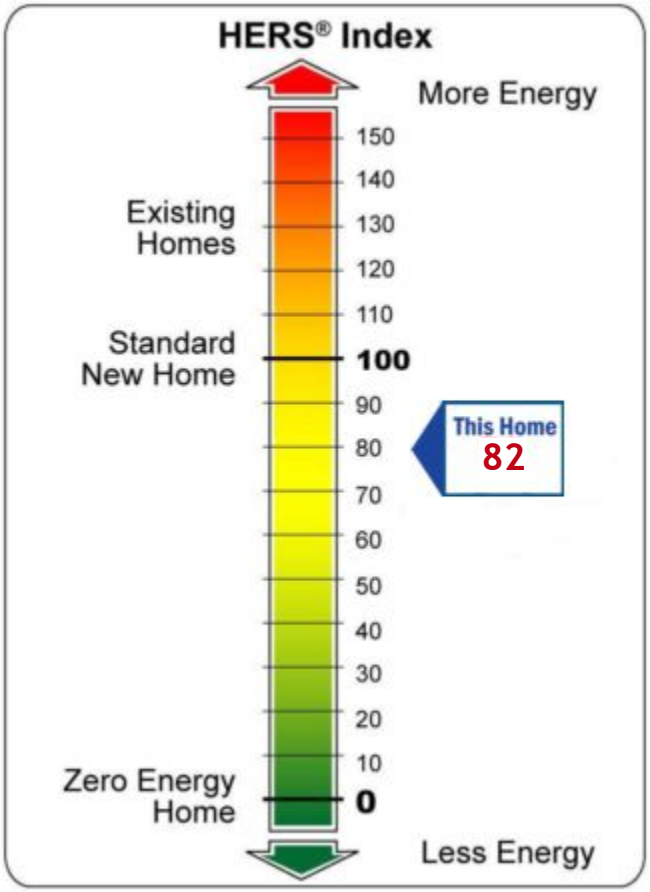


RIGHT ELEVATION

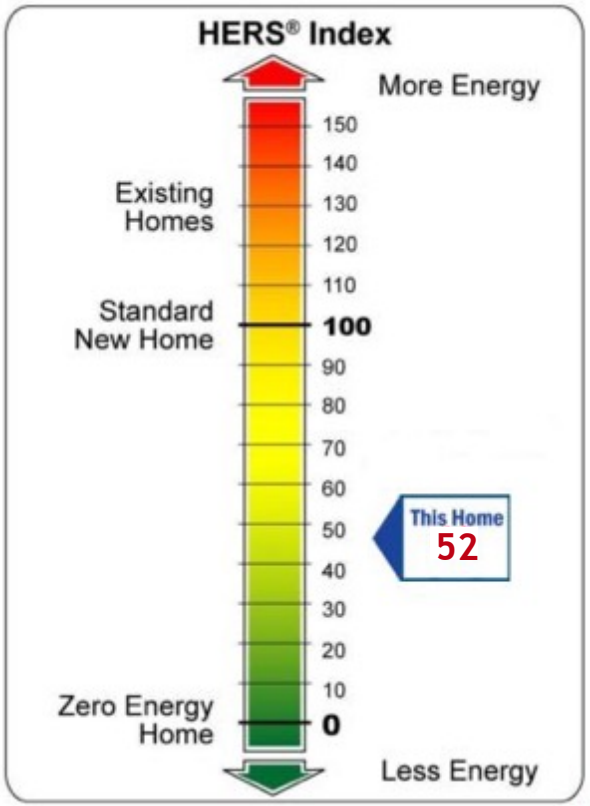
HERS Rating demonstration

Example home – CZ2:

- 1400 ft^2, single story
- Slab foundation
- Vented attic
- 1 HVAC system
- Building envelope meets 2009 IECC prescriptive requirements
- Mechanicals and appliances typical for area



HERS Rating demonstration



- Radiant barrier roof decking
- Install more efficient appliances (refrigerator, dishwasher, laundry)
- 100% high efficacy lighting
- High efficiency HVAC & water heater

Marketing and the HERS Index

- Energy efficiency measures and the HERS Index can be used as a marketing tool
- The HERS Index is already a widely recognized mark of high performance building
- Market data indicate that energy efficient homes spend less time on the market and have a higher selling price

Marketing and the HERS Index

HERS - Energy Label for Homes

- Which home is energy efficient?

EPA Fuel Economy Estimates

CITY MPG

11

Expected range for most drivers 09 to 13 MPG

Estimated Annual Fuel Cost

$3,748

based on 15,000 miles at $3.00 per gallon

Combined Fuel Economy

This Vehicle

12

10 — 21

All Standard Pickups

HIGHWAY MPG

14

Expected range for most drivers 11 to 17 MPG

Your actual mileage will vary depending on how you drive and maintain your vehicle.

See the FREE Fuel Economy Guide at dealers or www.fueleconomy.gov

EPA Fuel Economy Estimates

CITY MPG

18

Expected range for most drivers 14 to 22 MPG

Estimated Annual Fuel Cost

$2,285

based on 15,000 miles at 3.20 per gallon

Combined Fuel Economy

This Vehicle

21

10 — 30

All Midsize

Calif. Emission Control Syst.

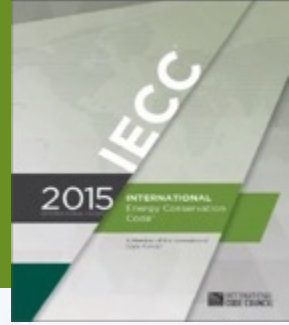
HIGHWAY MPG

25

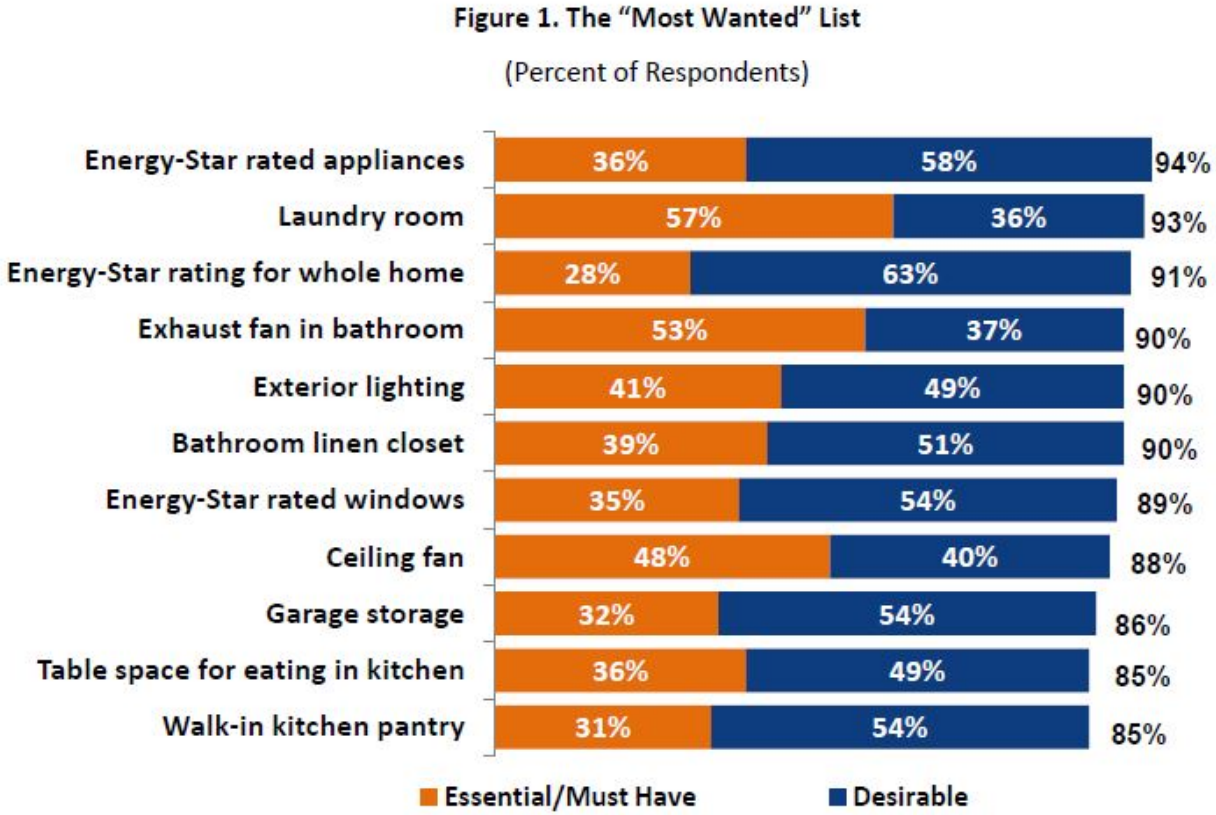
Expected range for most drivers 20 to 30 MPG

Your actual mileage will vary depending on how you drive and maintain your vehicle.

See the FREE Fuel Economy Guide at dealers or www.fueleconomy.gov

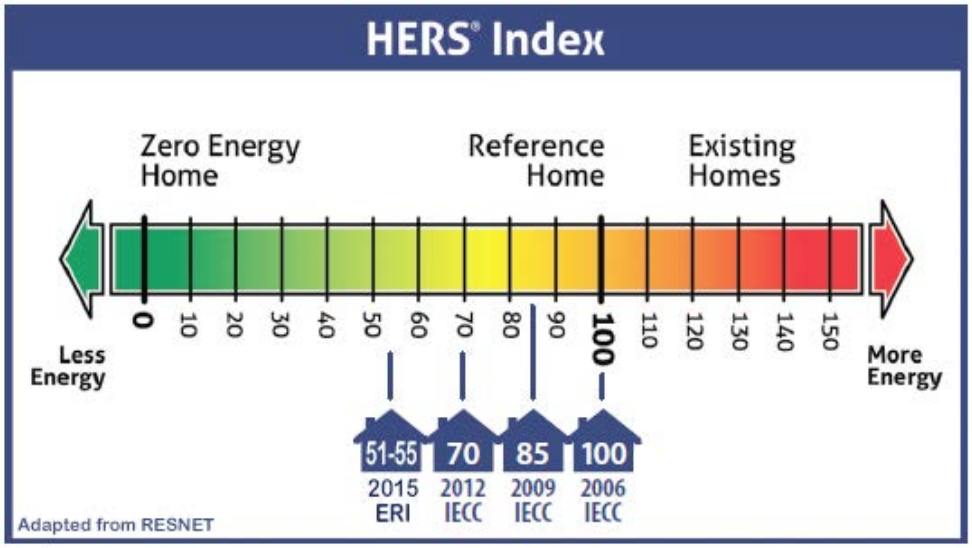


Marketing and the HERS Index



Source: NAHB "What Homebuyers Want"

Benefits of the ERI



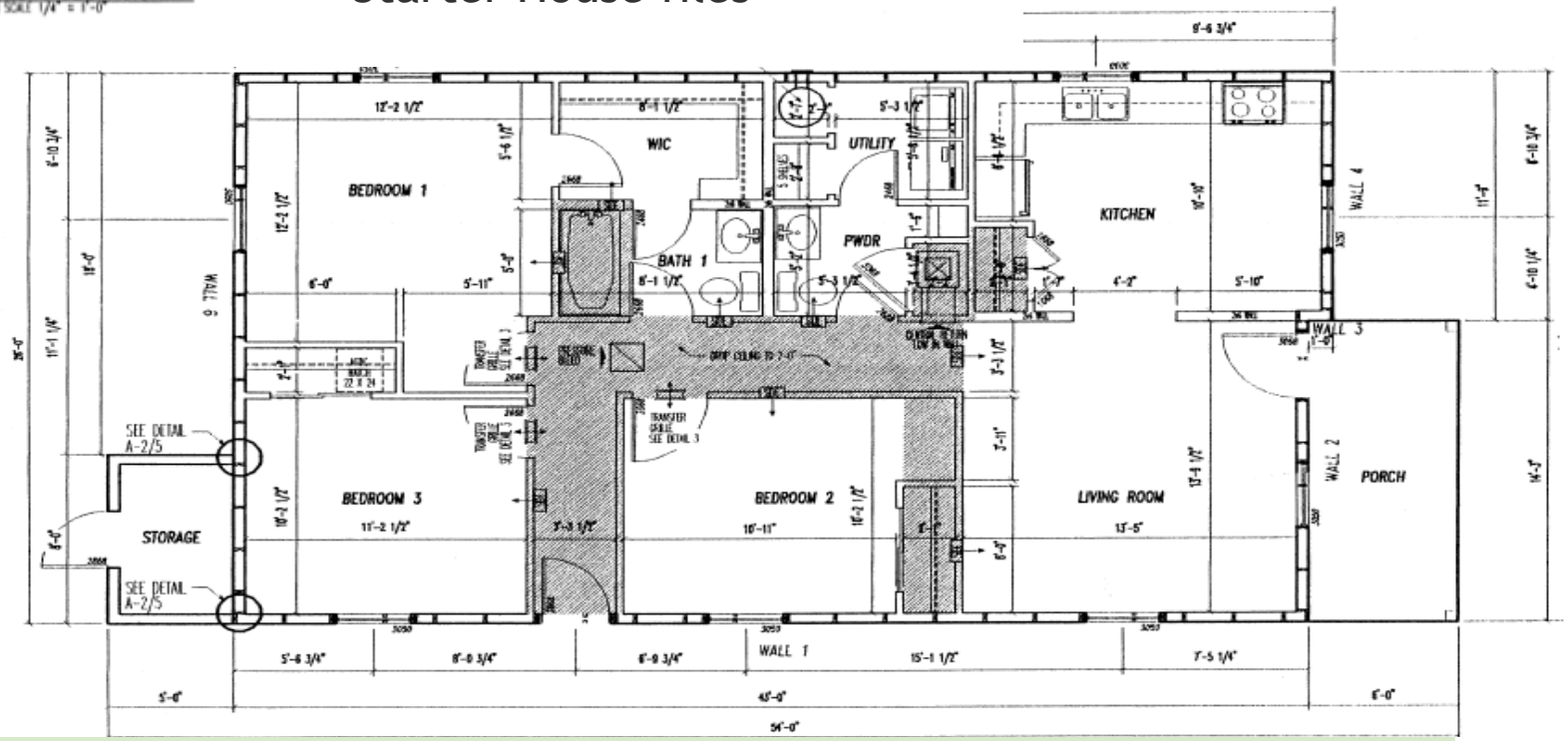
- Increased quality of homes
- More cost-effective options available to builders
- More opportunities for success in the industry

HERS – Software Demo

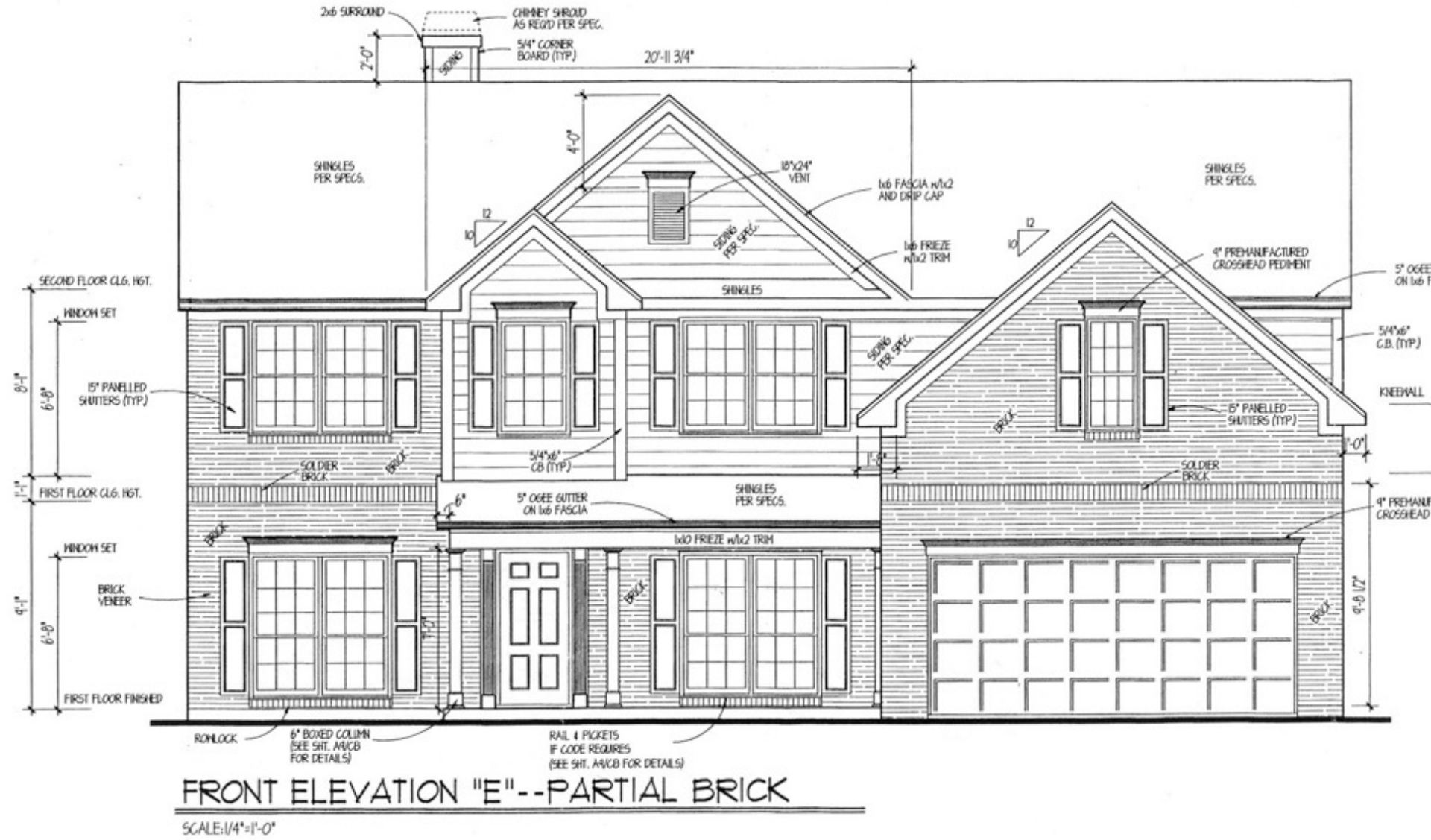
1|FRONT ELEVATION
SCALE 1/4" = 1'-0"

3|LEFT ELEVATION
SCALE 1/4" = 1'-0"

Starter House files



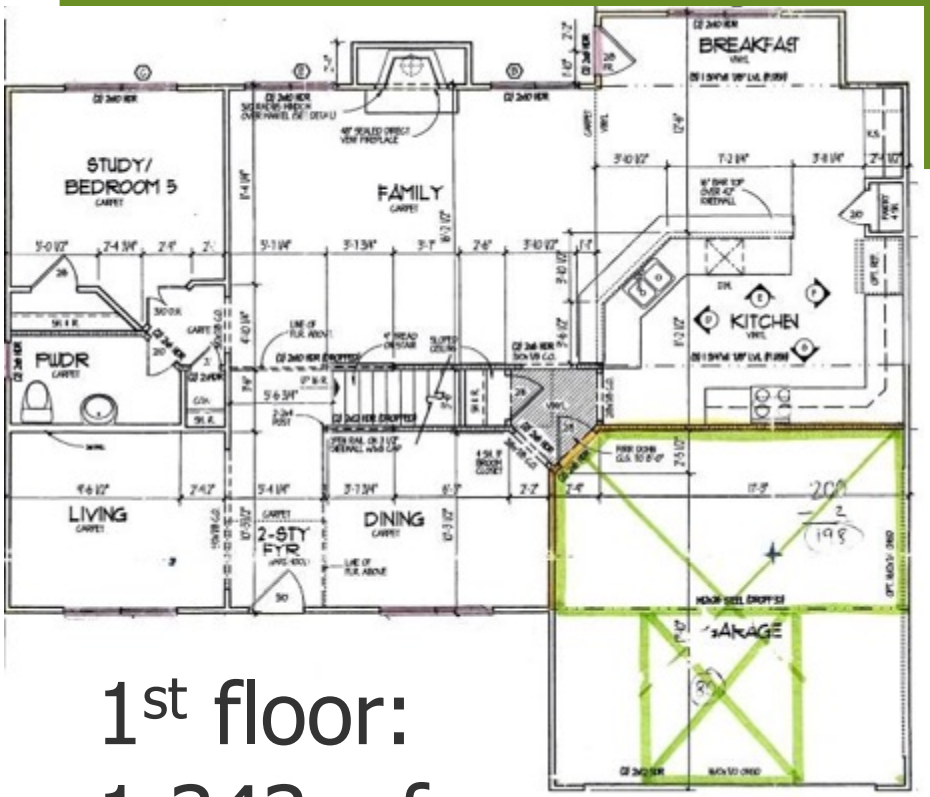
“Acme” base case 2816 s.f home



FRONT ELEVATION "E"--PARTIAL BRICK

SCALE: 1/4"=1'-0"

Acme Home



1st floor:
1,343 s.f.

2nd floor:
1,473 s.f.

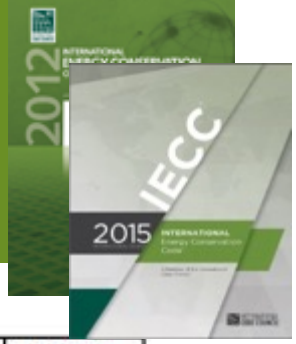
Acme Base - 2816 s.f. home in REM/Rate

- Two mechanical systems – both in the vented attic
- 75% of 1st floor ducts inside; all others plus 2nd floor ducts in attic
- 80% furnaces, 14 SEER A/C's, no mechanical ventilation, 50 gal gas DHW
- Basic 2009 energy code compliant R-values (assume Grade III)
  - R-30 flat ceiling, R-19 vault
  - R-13 + OSB walls
  - R-19 floor over garage; no slab insulation

- Typical DP low-e windows: U-0.35 SHGC-0.30; poor orientation
- Duct leakage is 12% Total; 8% To Outside
- Envelope Leakage is 7 ACH_{50}, 0.45 ELR_{50}, 3009 cfm_{50}

- Elec rate 12.5¢/kWh + $10 base fee; Gas rate 75¢/therm + $20 base fee

IECC 2012/15 Prescriptive Code:
Insulation & Fenestration by Climate Zone



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2	0.40	0.65	0.25	38	13	4/6	13	0	0	0
3	0.35	0.55	0.25	38	20 or 13+5[h]	8/13	19	5/13[f]	0	5/13
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6	0.32	0.55	NR	49	20+5 or 13+10[h]	15/20	30[g]	15/19	10, 4 ft	15/19
7 and 8	0.32	0.55	NR	49	20+5 or 13+10[h]	19/21	38[g]	15/19	10, 4 ft	15/19

For SI: 1 foot = 304.8 mm.

a. *R*-values are minimums. *U*-factors and SHGC are maximums. When insulation is installed in a cavity which is less than the label or design thickness of the insulation, the installed *R*-value of the insulation shall not be less than the *R*-value specified in the table.

b. The fenestration *U*-factor column excludes skylights. The SHGC column applies to all glazed fenestration. Exception: Skylights may be excluded from glazed fenestration SHGC requirements in Climate Zones 1 through 3 where the SHGC for such skylights does not exceed 0.30.

c. "15/19" means R-15 continuous insulation on the interior or exterior of the home or R-19 cavity insulation at the interior of the basement wall. "15/19" shall be permitted to be met with R-13 cavity insulation on the interior of the basement wall plus R-5 continuous insulation on the interior or exterior of the home. "10/13" means R-10 continuous insulation on the interior or exterior of the home or R-13 cavity insulation at the interior of the basement wall.

d. R-5 shall be added to the required slab edge *R*-values for heated slabs. Insulation depth shall be the depth of the footing or 2 feet, whichever is less in Climate Zones 1 through 3 for heated slabs.

e. There are no SHGC requirements in the Marine Zone.

f. Basement wall insulation is not required in warm-humid locations as defined by Figure R301.1 and Table R301.1.

g. Or insulation sufficient to fill the framing cavity, R-19 minimum.

h. First value is cavity insulation, second is continuous insulation or insulated siding, so "13+5" means R-13 cavity insulation plus R-5 continuous insulation or insulated siding. If structural sheathing covers 40 percent or less of the exterior, continuous insulation *R*-value shall be permitted to be reduced by no more than R-3 in the locations where structural sheathing is used – to maintain a consistent total sheathing thickness.

i. The second *R*-value applies when more than half the insulation is on the interior of the mass wall.

2018 Southface HERS Trainings

HERS Part 1: Apr 9-14

HERS Part 2: Apr 30 – May 1

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Questions or comments?

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