

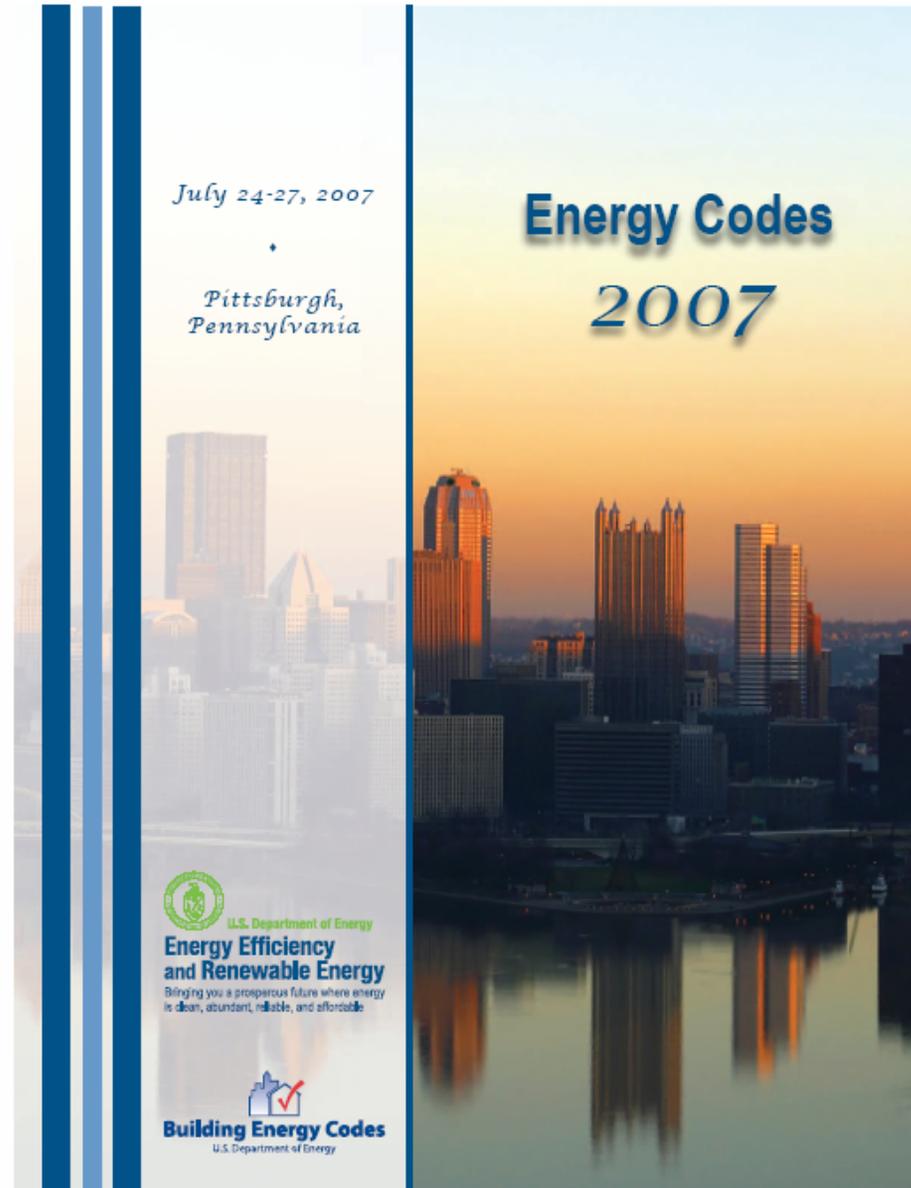
Start with the Goals

- ◆ **What are the key problems?**
 - ❖ **Lack of knowledge**
 - ❖ **Confusion**
 - ❖ **Lack of compliance**
 - ❖ **Poor installation practice**
 - ❖ **People need more PDF's**

Training and Education

Southface
Jeff Tiller, PE

Energy Codes
2007 Conference
Pittsburgh, PA



Key Audiences

- ◆ **Building Code Officials**
- ◆ **Designers – Architects and Engineers**
- ◆ **Builders/ Construction Managers**
- ◆ **Subcontractors**
 - ❖ **Insulators**
 - ❖ **HVAC**
 - ❖ **Framers**
- ◆ **“Program” Managers**

Training Approaches

- ◆ **Publicized workshops**
 - ❖ **Most expensive approach**
 - ❖ **Works where continuing education is required**
- ◆ **Lunch/ evening organizational meetings**
 - ❖ **Reach people who don't attend workshops**
 - ❖ **Only have 20 to 60 minutes**
- ◆ **Organizational annual meetings/ special training sessions**
 - ❖ **Often have 1 to 4 hours; sometimes more**

Examples of Organizational Meetings

- ◆ **AIA, ASHRAE chapters**
- ◆ **Code Inspectors Association annual meetings**
- ◆ **Homebuilder Association evening meetings**
- ◆ **HVAC Contractors annual meetings**
- ◆ **Training in offices of code enforcement officials**
- ◆ **Training in offices of architect/ engineer firms**

Publicized Workshops vs “Go To Them”

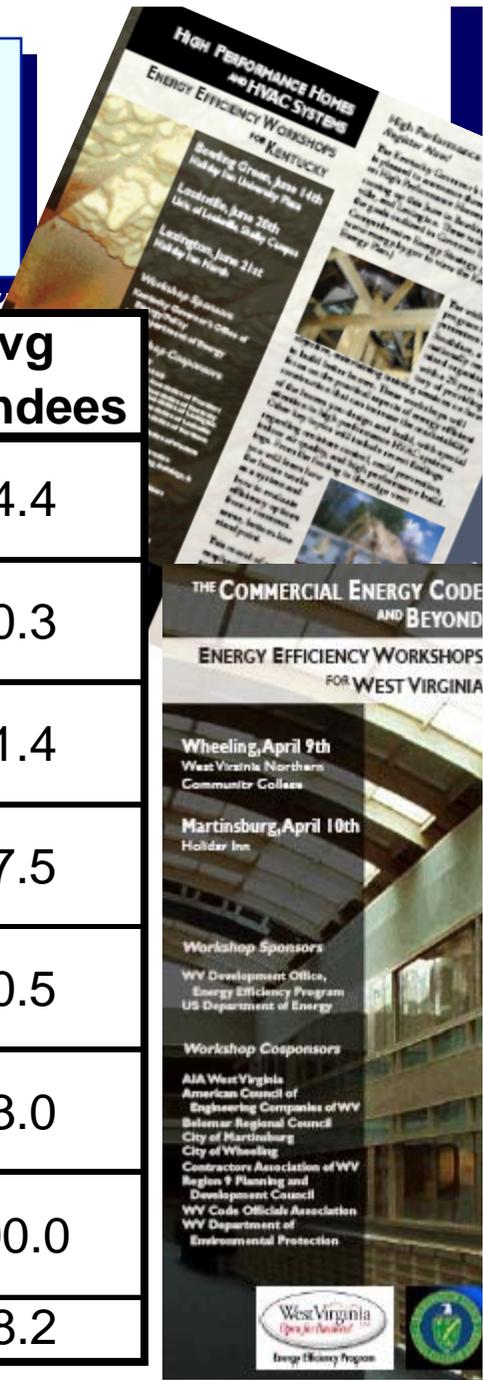
Publicized

- ❖ Find space
- ❖ Arrange food, etc.
- ❖ Find sponsors
- ❖ Brochure/ other PR
- ❖ Arrange continuing ed
- ❖ Register, answer calls
- ❖ Handle the money
- ❖ Develop program, handouts
- ❖ Conduct workshop
- ❖ Handle money and cont

Go To Them

- ❖ Make calls
- ❖ Set time and date
- ❖ Develop program, handouts
- ❖ Conduct workshop

“Code” Publicized Trainings (NC, KY,



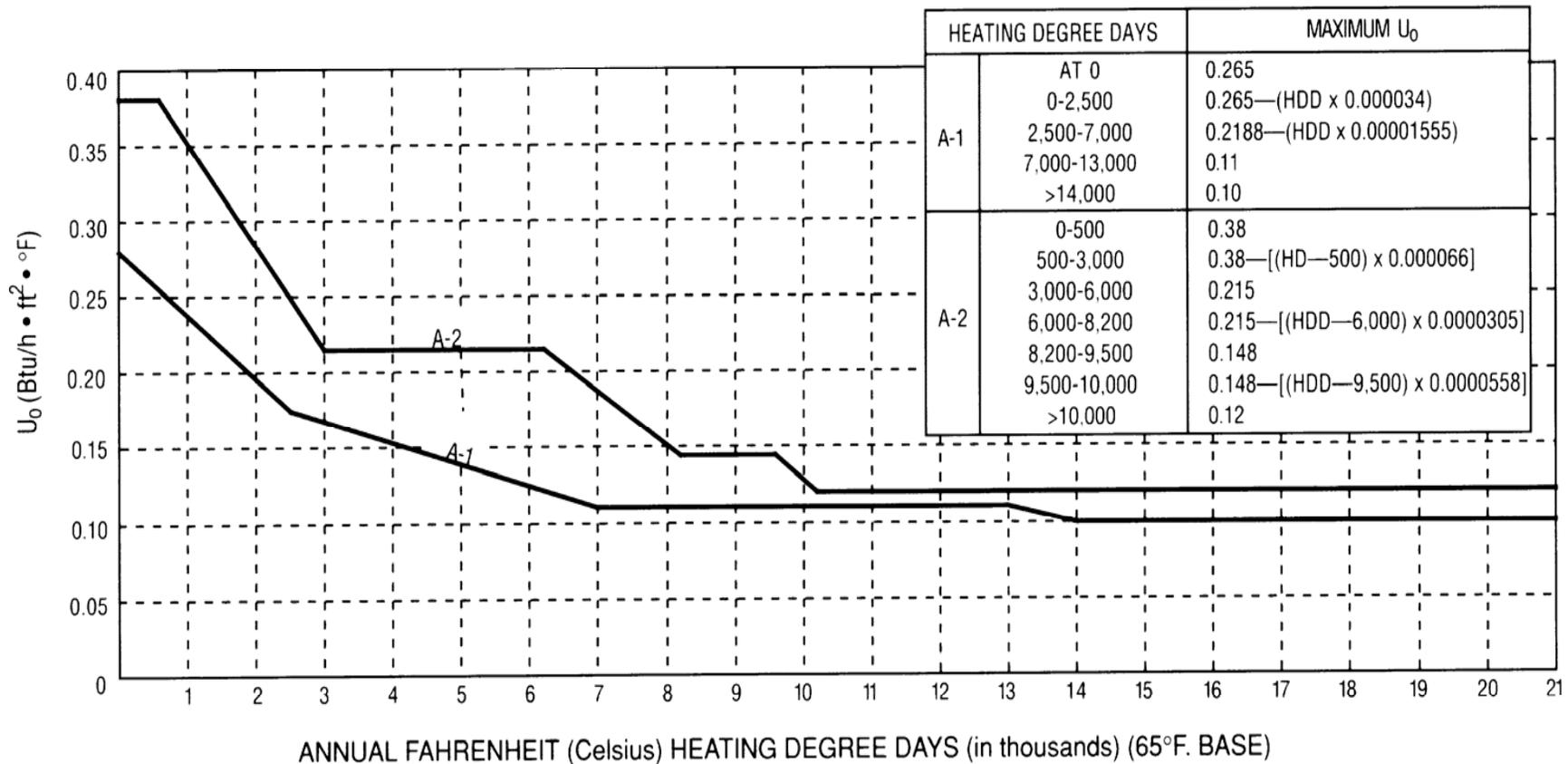
Training Title	Number	Registered	Avg Attendees
High Performance Homes and HVAC Systems	7	311	44.4
Building the High Performance Home	8	162	20.3
The Commercial Energy Code and Beyond	9	193	21.4
High Performance Homes from the Ground Up	2	95	47.5
Increasing Profits through Tax Incentives	4	42	10.5
Advanced Selling Techniques for ENERGY STAR Windows	2	26	13.0
Green Building from the Ground Up	1	100	100.0
TOTAL	33	929	28.2

Designing the Training

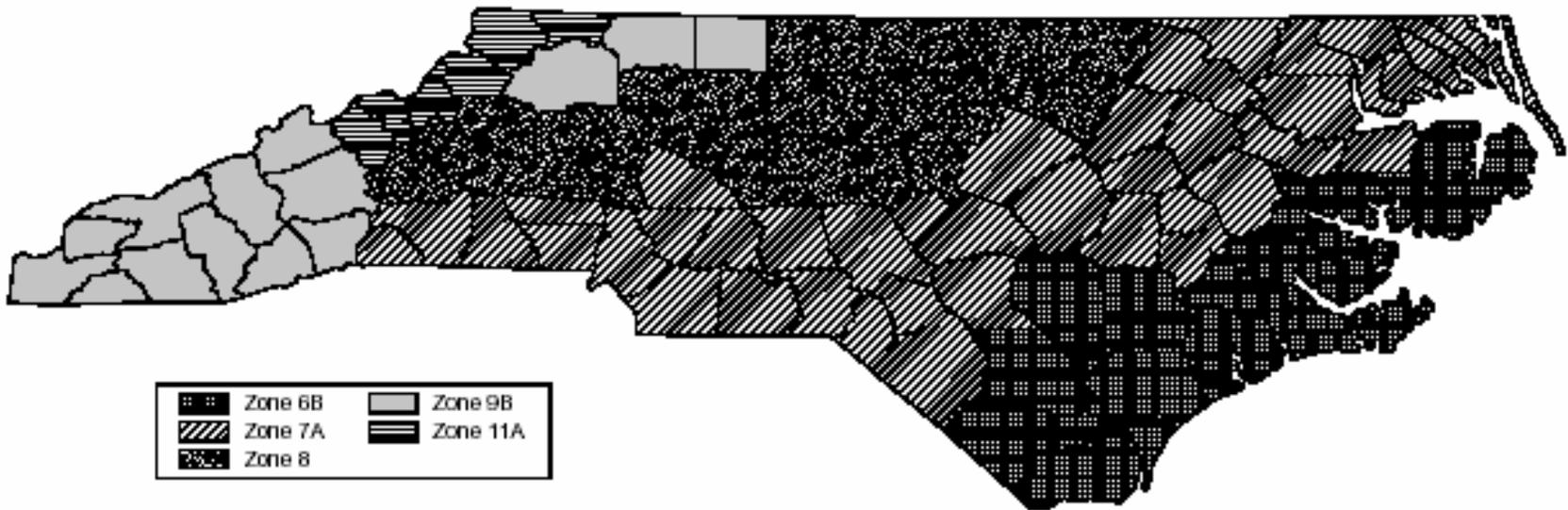
- ◆ **Emphasize the key components for success**
- ◆ **Don't have to cover every point**
- ◆ **Decide whether to reference code sections**
- ◆ **Seek to avoid confusion and burnout**
- ◆ **Challenge to go beyond code (but make clear what's beyond code and what's required)**
- ◆ **Inspire -- importance of saving energy**
- ◆ **Sell efficiency on the other benefits – comfort, moisture control, IAQ, environmental, etc.**
- ◆ **Other tools – samples, demos, videos, etc.**

Energy Code Insulation Requirements We've Come A Long Way

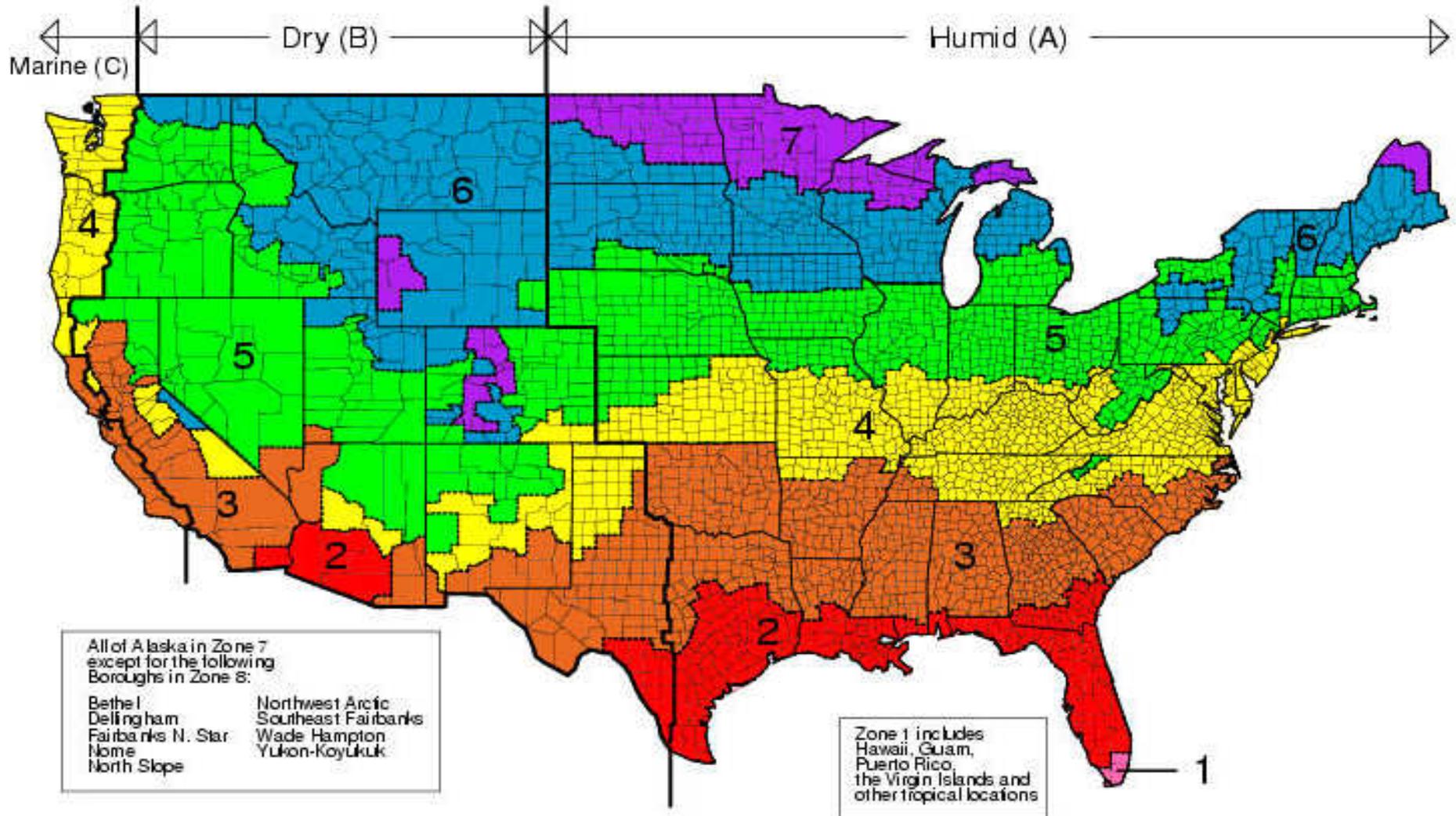
U_o WALLS—GROUP R BUILDINGS—HEATING



RESCheck Climate Zones for North Carolina



IECC 2006 Climate Zones



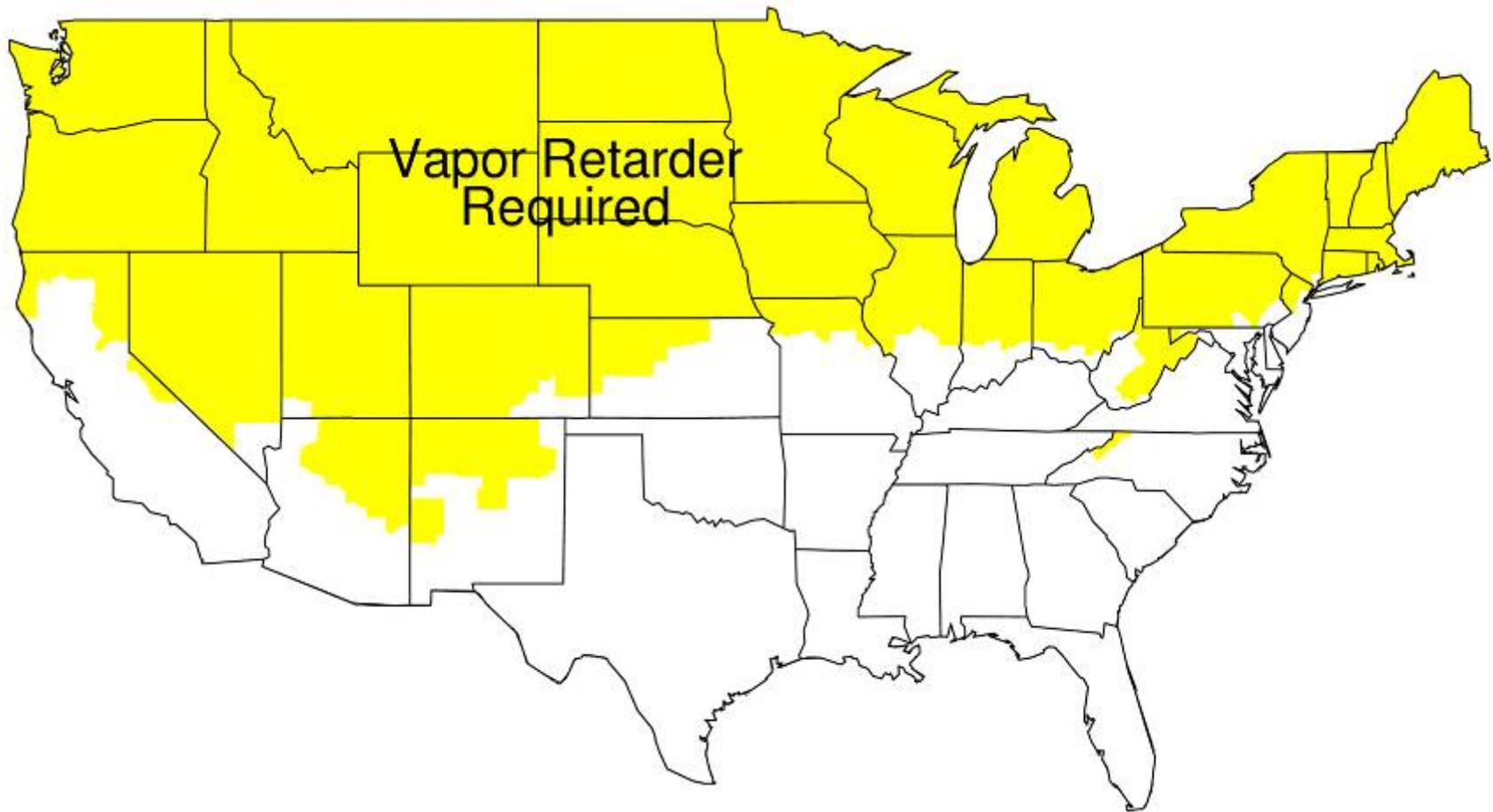
IECC 2006 Insulation Requirements

CLIMATE ZONE	U-Factor		SHGC	R-value						
	Windows/ Glass Doors	Skylight	Glazing	Ceiling	Wood Framed Wall	Mass Wall	Floor	Slab (R-value and Depth)	Basement Wall	Crawl Space Wall
1	1.2	0.75	0.4	30	13	3	13	0	0	0
2	0.75	0.75	0.4	30	13	4	13	0	0	0
3	0.65	0.65	0.4	30	13	5	19	0	0	5 (cont)/ 13 (cavity)
4 except Marine	0.4	0.6	NR	38	13	5	19	10, 2ft	10 (cont)/ 13 (cavity)	
5 and Marine 4	0.35	0.6	NR	38	19 or 13+5	13	30	10, 2 ft	10 (cont)/ 13 (cavity)	
6	0.35	0.6	NR	49	19 or 13+5	15	30	10, 4 ft	10 (cont)/ 13 (cavity)	
7 and 8	0.35	0.6	NR	49	21	19	30	10, 4 ft	10 (cont)/ 13 (cavity)	

Insulation – Keys to Success

- ◆ **Control moisture**
- ◆ **No gaps – complete coverage**
- ◆ **Minimal compression**
- ◆ **Locating the tricky areas**
 - ❖ **Basement walls**
 - ❖ **Slab edges – residential and commercial**
 - ❖ **Masonry walls in commercial**
 - ❖ **Behind “things” – shower/ tubs, stairs on outside walls, fireplace enclosures**

Moisture Control



Moisture Problem -- Inside View



What's Outside?

What's the Problem Here?



Under the Housewrap

A
Former
Header

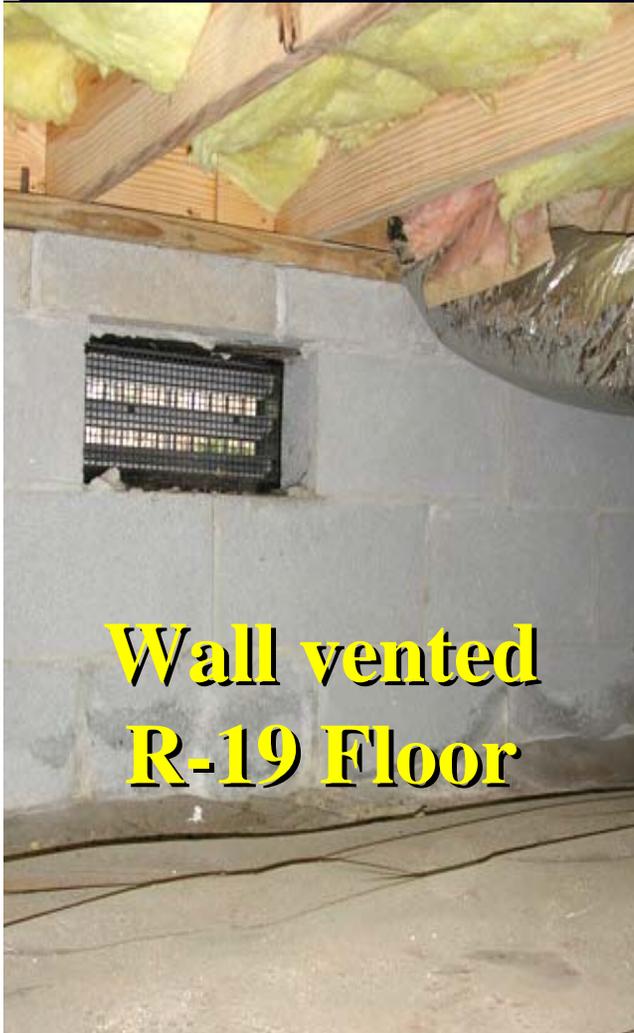








Crawl Space Study – Advanced Energy



**Wall vented
R-19 Floor**



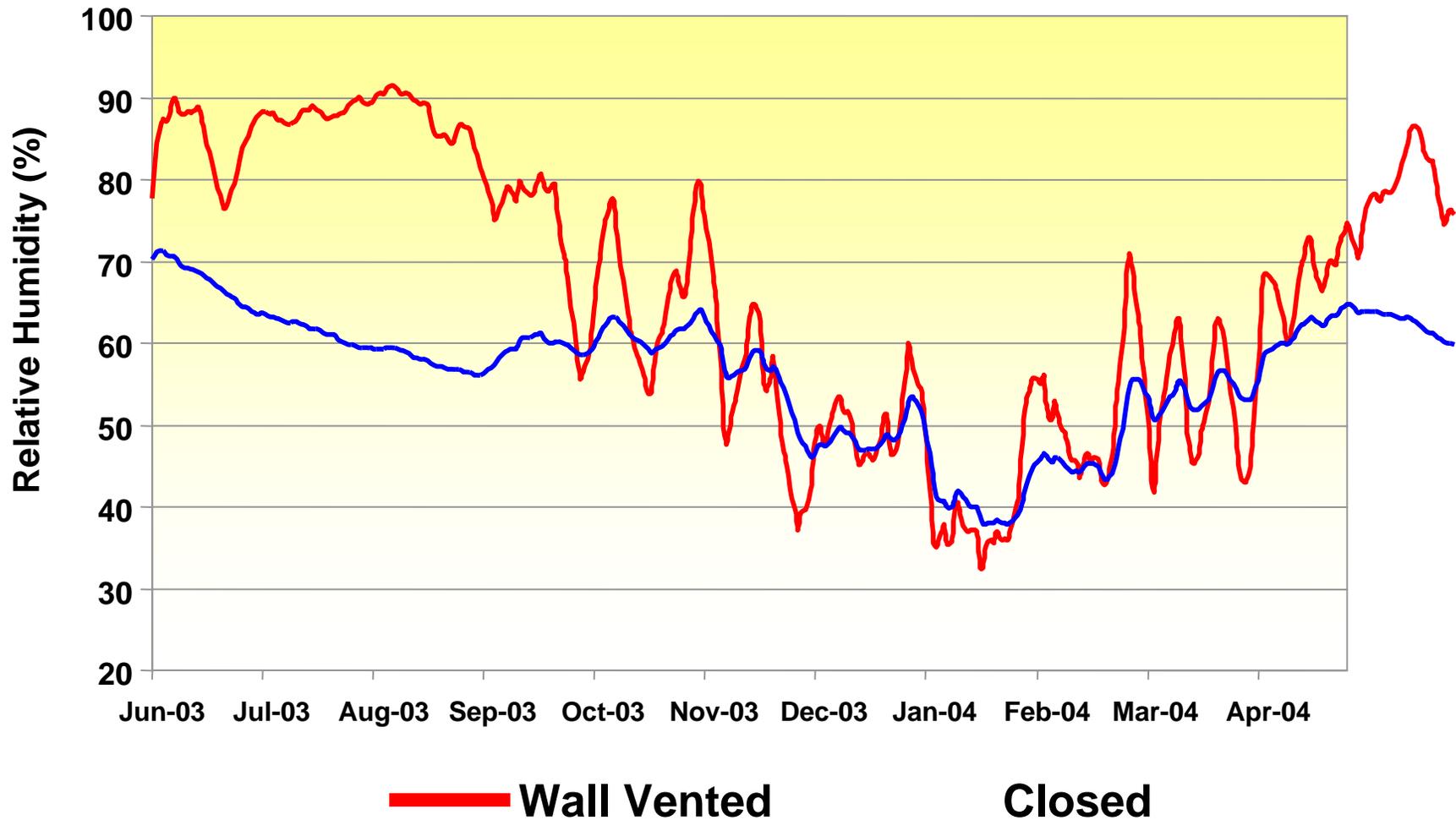
**Closed
Sealed liner
R-19 Floor**



**Closed
Sealed liner
R-13 Wall**

12 Total Homes in Research Project

Phase II Crawl Space Relative Humidity



Summer RH Summary

(Summer: June - August)

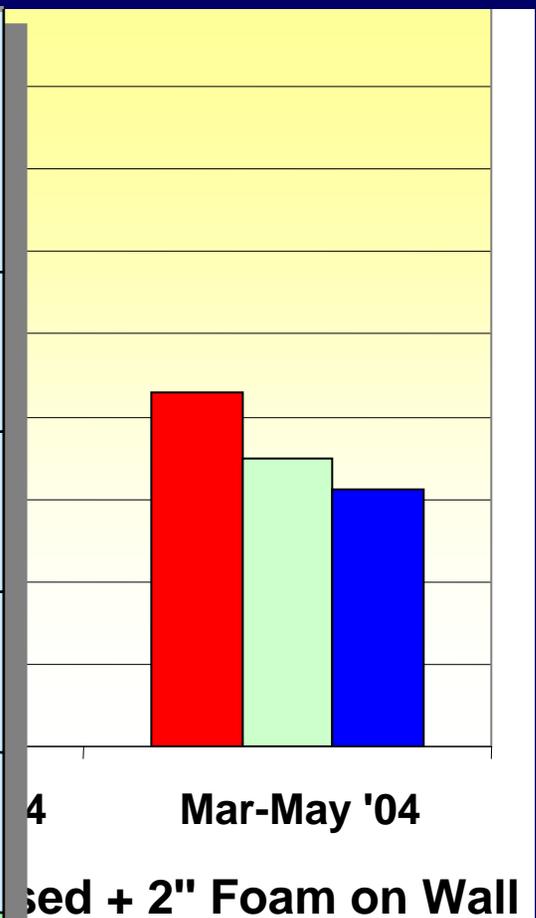
<u>Percentage of Time</u>	<u>2002</u>		<u>2003</u>	
	<u>Vented</u>	<u>Closed</u>	<u>Vented</u>	<u>Closed</u>
Above 90% RH	0%	0%	23%	0%
Above 80% RH	39%	0%	86%	0%
Above 70% RH	79%	0%	98%	5%
Above 60% RH	94%	0%	100%	64%
Above 50% RH	100%	100%	100%	100%

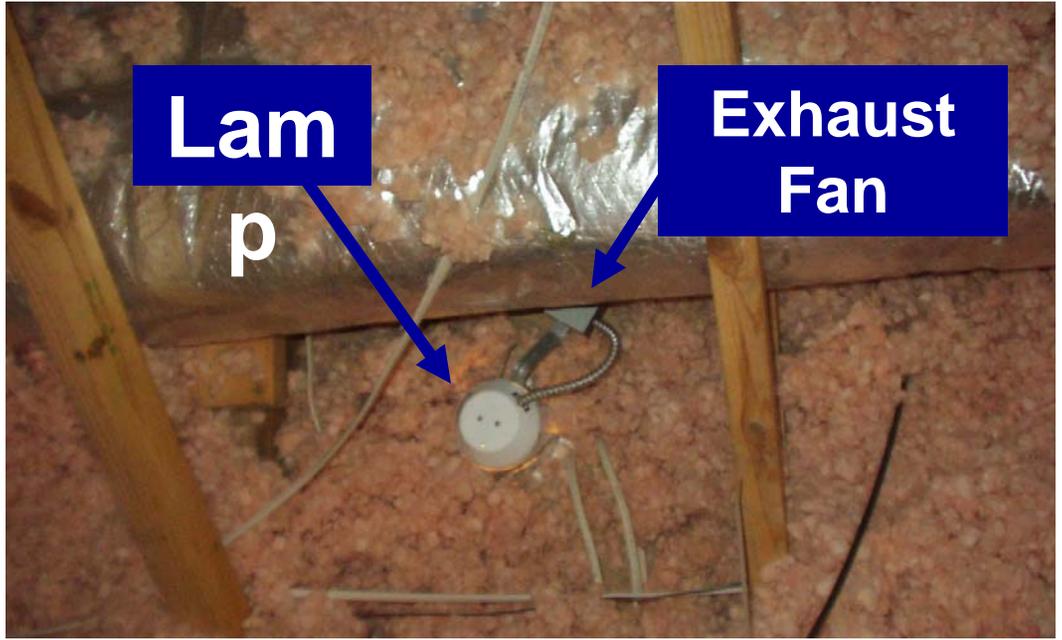
Seasonal Energy Use and Savings

Season	Closed with Floor	Closed with Wall Insulated
Summer	-22 %	-36%
Fall	-5 %	-10%
Winter	-10%	+4%
Spring	-19%	-28%
Annual	-15%	-18%

Thousands
kWh

■ Vel



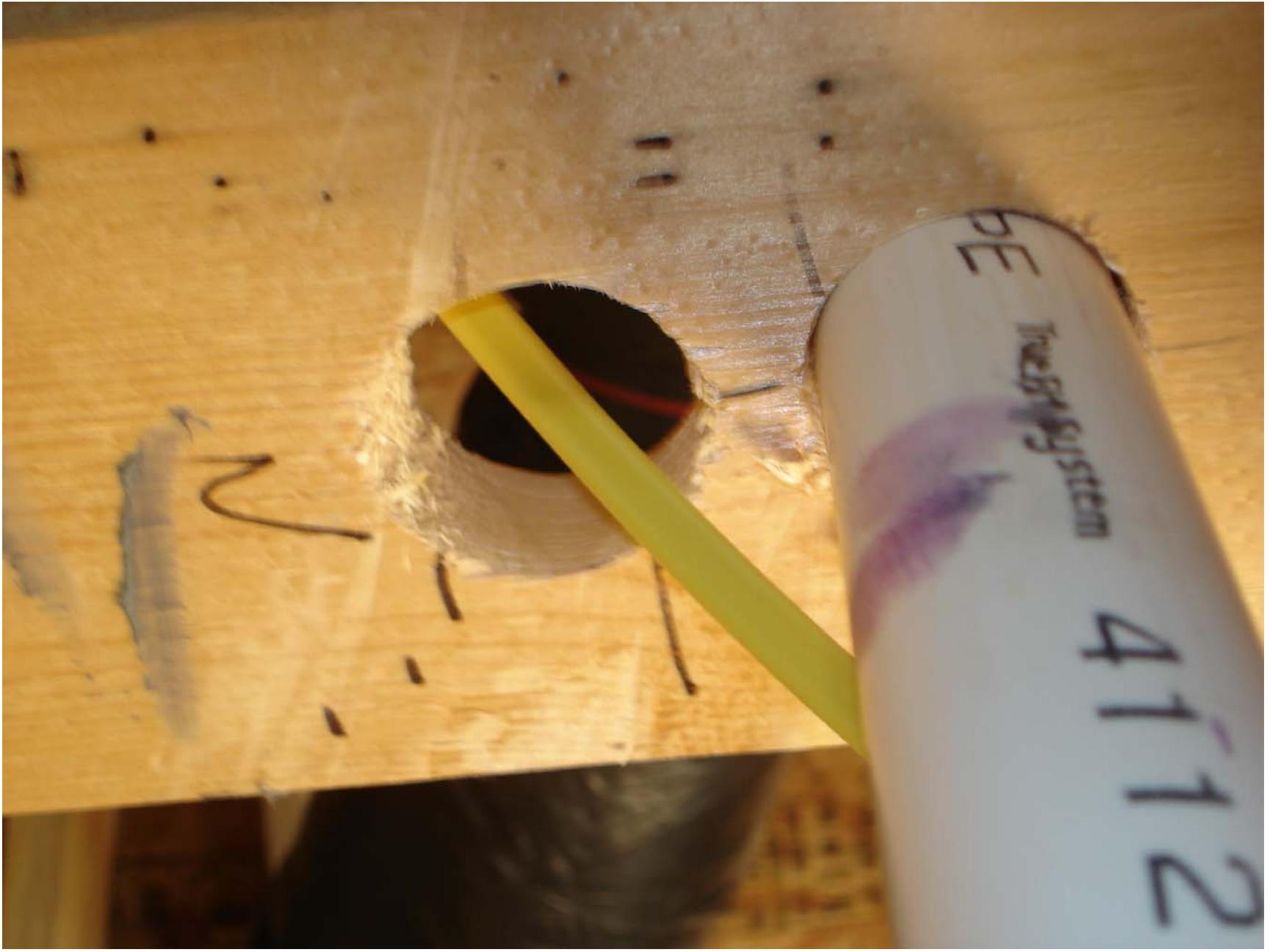


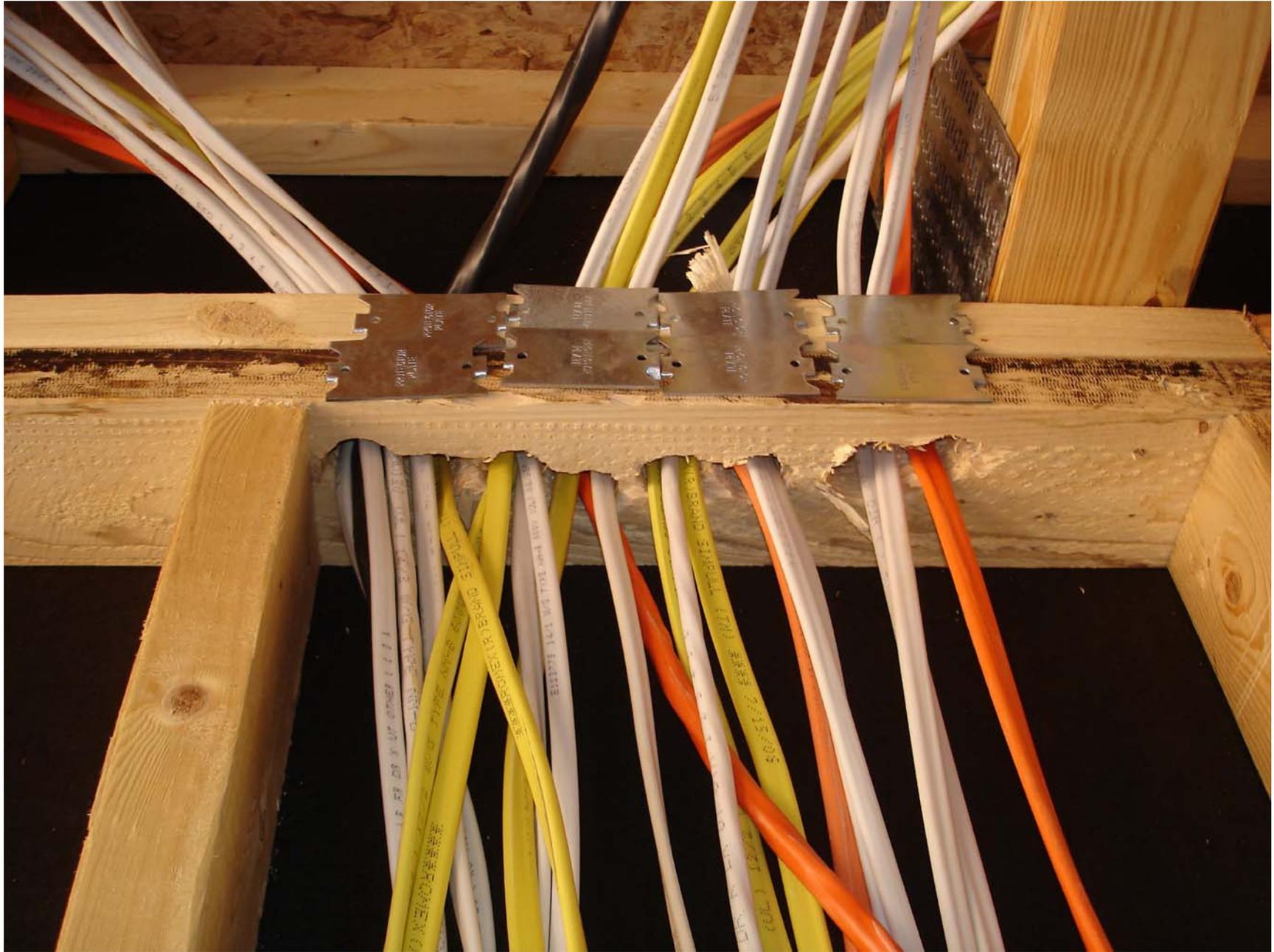
Air Leakage

- ◆ **Energy Code now more explicit on types of leaks to seal**
- ◆ **Start with the large leaks that are often hidden – bypasses**
- ◆ **Find the covert leaks**
- ◆ **Check sealant**

Rated Sealant?









Harsco
i n s t a

R-6.0

EXIBLE AIR DUCT

UL-181 DATA (F116)

MAXIMUM AIR VELOCITY	4000 FPM
10 IN. W.C.	10 IN. W.C.
0.2 IN. W.C.	0.2 IN. W.C.
LESS THAN 60	LESS THAN 60
LESS THAN 60	LESS THAN 60

MAXIMUM POSITIVE PRESSURE

MAXIMUM NEGATIVE PRESSURE

FLAME SPREAD

SMOKE DEVELOPED

SEE HART & COOLEY INSTALLATION INSTRUCTIONS FOR PROPER JOINT TREATMENT

RECOMMENDED OPERATING PRESSURES

SEE HART & COOLEY INSTALLATION INSTRUCTIONS FOR PROPER JOINT TREATMENT

1" DIA. AND OVER

1" DIA. AND OVER





Knee Walls/ Bonus Rooms



Fails Code?

Insulating/ Sealing The Knee Wall



Recommended Air Barrier

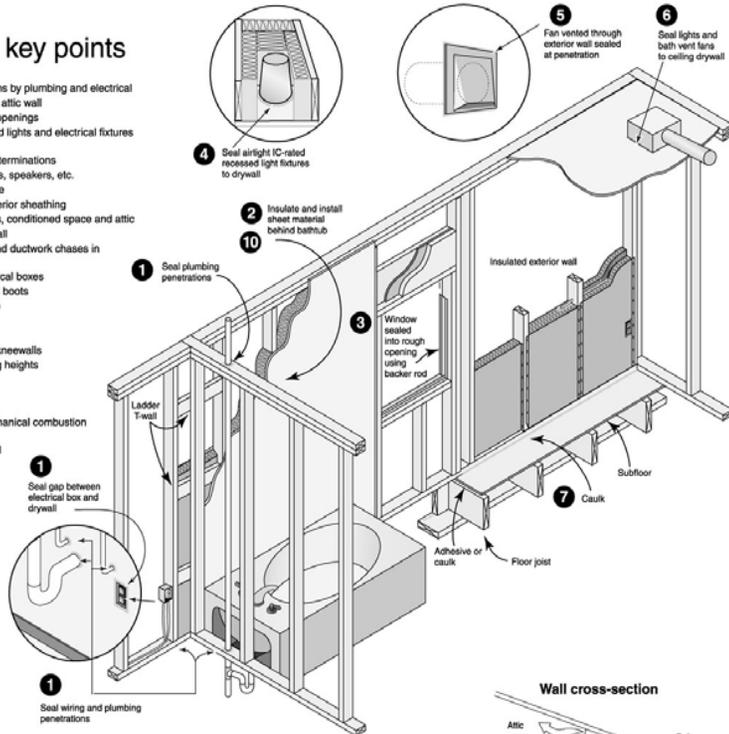
Air Seal Required by Code

Infiltration Controls

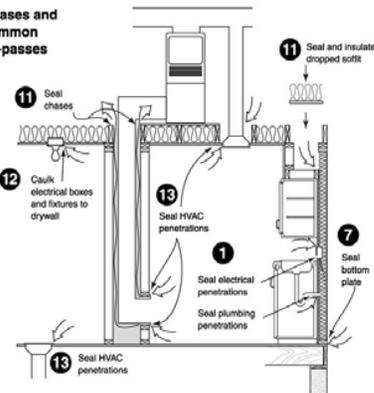
Appendix

Air sealing key points

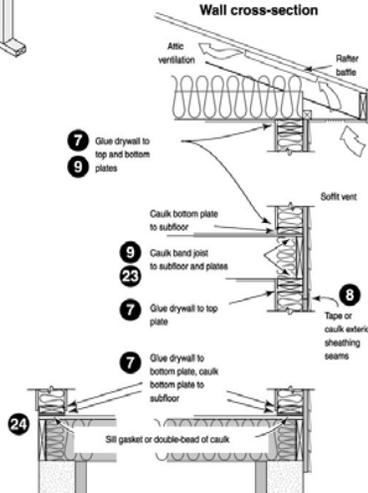
1. Plate and wall penetrations by plumbing and electrical
2. Tub/shower on outside or attic wall
3. Window and door rough openings
4. Airtight, IC-rated recessed light fixtures exposed to attic
5. Exterior wall exhaust fan terminations
6. Ceiling mounted bath fans, speakers, etc.
7. Bottom plate and top plate
8. Seams between rigid exterior sheathing
9. Band area between floors, conditioned space and attic
10. Garden tub on exterior wall
11. Mechanical equipment and ductwork chases in attics, crawlspaces
12. Ceiling/crawlspace electrical boxes
13. Ceiling/crawlspace HVAC boots
14. Shower and tub drain line
15. Fireplace inserts
16. Attic kneewall doors
17. Joist cavities under attic kneewalls
18. Transition between ceiling heights (e.g., 10' to 8')
19. Attic scuttle hole
20. Attic pull-down stairs
21. Wall penetrations of mechanical combustion closets
22. Thresholds at mechanical combustion closet doors
23. Band jost exposed to exterior
24. Band area exposed to unconditioned space (such as basement or garage)
25. Exterior wall penetrations for refrigeration lines, condensate line, etc.



Chases and common by-passes



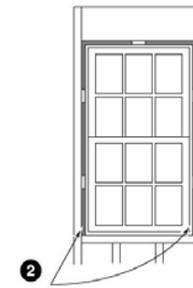
Wall cross-section



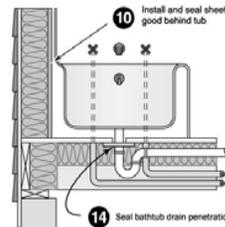
Appendix

Air sealing key points continued

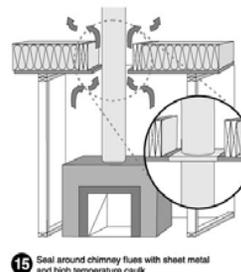
Window rough opening



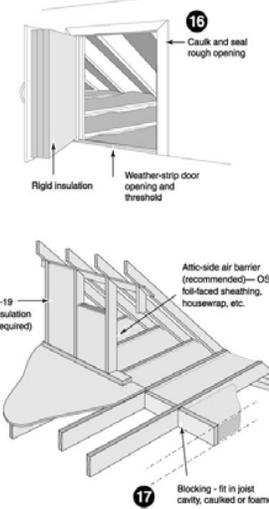
Shower/tub drain rough opening



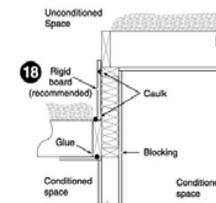
Combustion chase penetrations



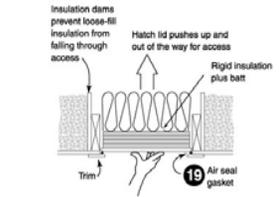
Attic knee-walls



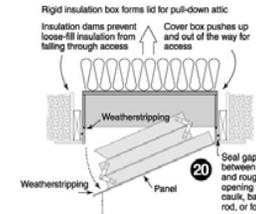
Two-level attic



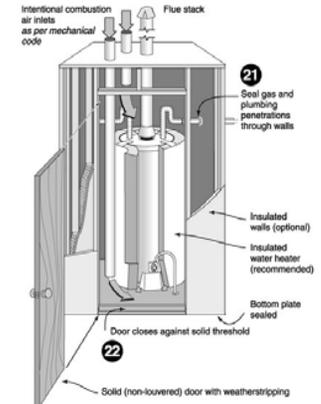
Attic scuttle



Attic pull-down stairs



Combustion closet



Exterior penetrations



Disclaimer:
This document is intended solely to help graphically demonstrate the air leakage provisions of section 502.1.4 of the 2000 IECC. It does not cover all airsealing locations or techniques. Other code provisions may be applicable as well.

Ductwork Systems



Duct Sealing and Leak Testing



Joints of duct systems shall be made substantially airtight by means of

- ❖ **welds**
- ❖ **mastic-plus-embedded fabric system**
- ❖ **gaskets**
- ❖ **mastics**
- ❖ **listed and labeled tapes**

Seal with Durable Materials



Uses for Non-Labeled Duct Tape



Test for Results



Air leakage – blower door

Gauges for pressure problems

Duct leakage – duct testing fan

Indoor air quality

You don't know 'til you test

Energy Efficiency: The Inspiration

- ◆ **Consumer protection – don't get ripped off**
- ◆ **Economics – everyone wins**
- ◆ **Good investment – will you be able to sell an inefficient home in the future?**
- ◆ **Reduces air pollutant emissions – good for the environment/ climate change**
- ◆ **Saving energy helps our nation's security**
- ◆ **In short – it's the right thing to do**