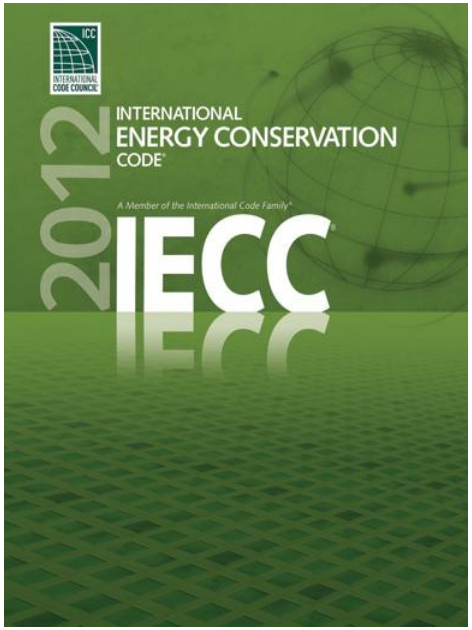
Energy Boot Camp for Builders

Building Science and Changes to the Montana Energy Code

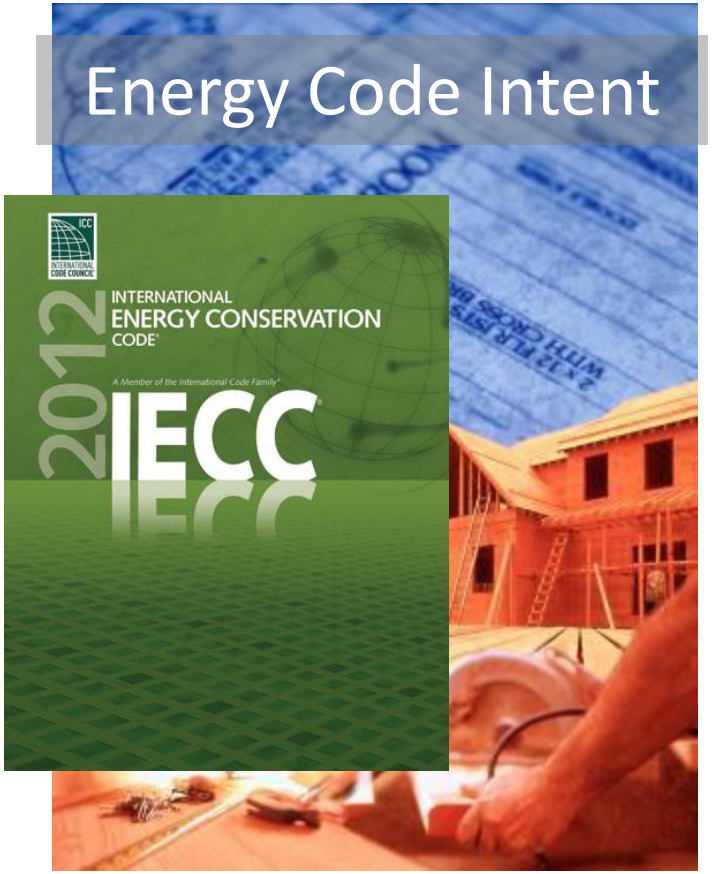


NCAT

December 2013
Presented by Dale Horton, Architect
National Center for Appropriate Technology

Energy Code Intent

"…shall regulate the design and construction of buildings for the effective use and conservation of energy over the life of each building."



Source: USDOE Building Energy Codes University

2012 IECC Economics

MTDEQ and USDOE 2012 IECC Economics		
Savings and cost of implementing the 2012 IECC vs the exising Montana State Energy Code		
	USDOE	MT DEQ
Floor Area (SF)	2400	Weighted
Weighted Annual Savings	$310	$233
Life Cycle Cost Savings	$4,105	$4,043
Implementation Cost Estimate	$2,558	$3,175
Simple Payback	7.3	12.8
Annual Mortgage Increase	$130	
Net Annual Cash Flow Savings	$180	

Training Objectives

1. Montana Energy Code Changes
2. Building Science Shapes the Energy Code
3. Software tools (REScheck and REM/Rate)
4. Building and Duct Tightness Testing
5. Other

What this training will not provide a comprehensive energy code training.

This course is about the Energy Code and Building Science

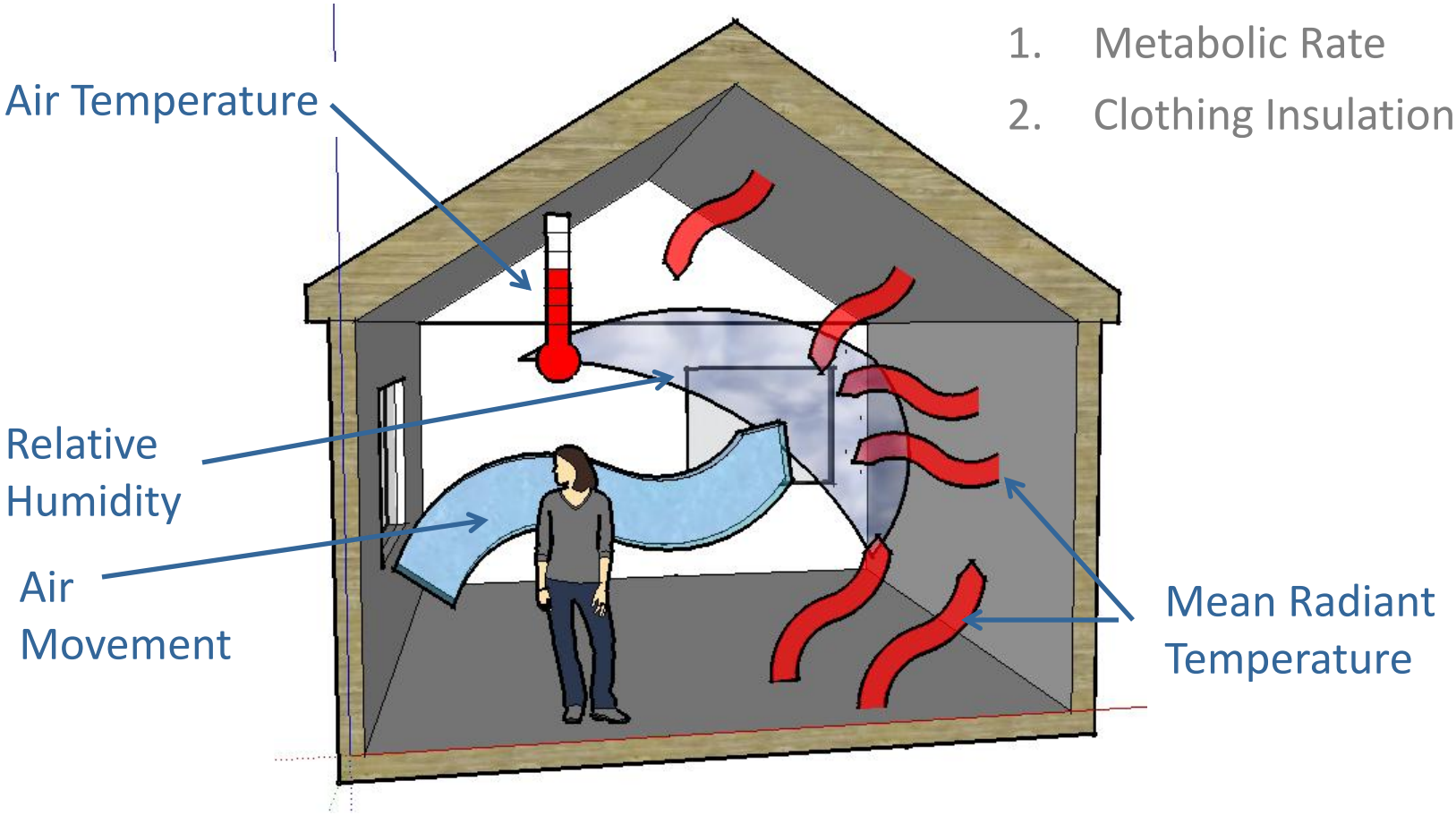
More than that, it is about building better houses:

- Comfort
- Durability
- Occupant Health
- Energy Savings
- Affordability

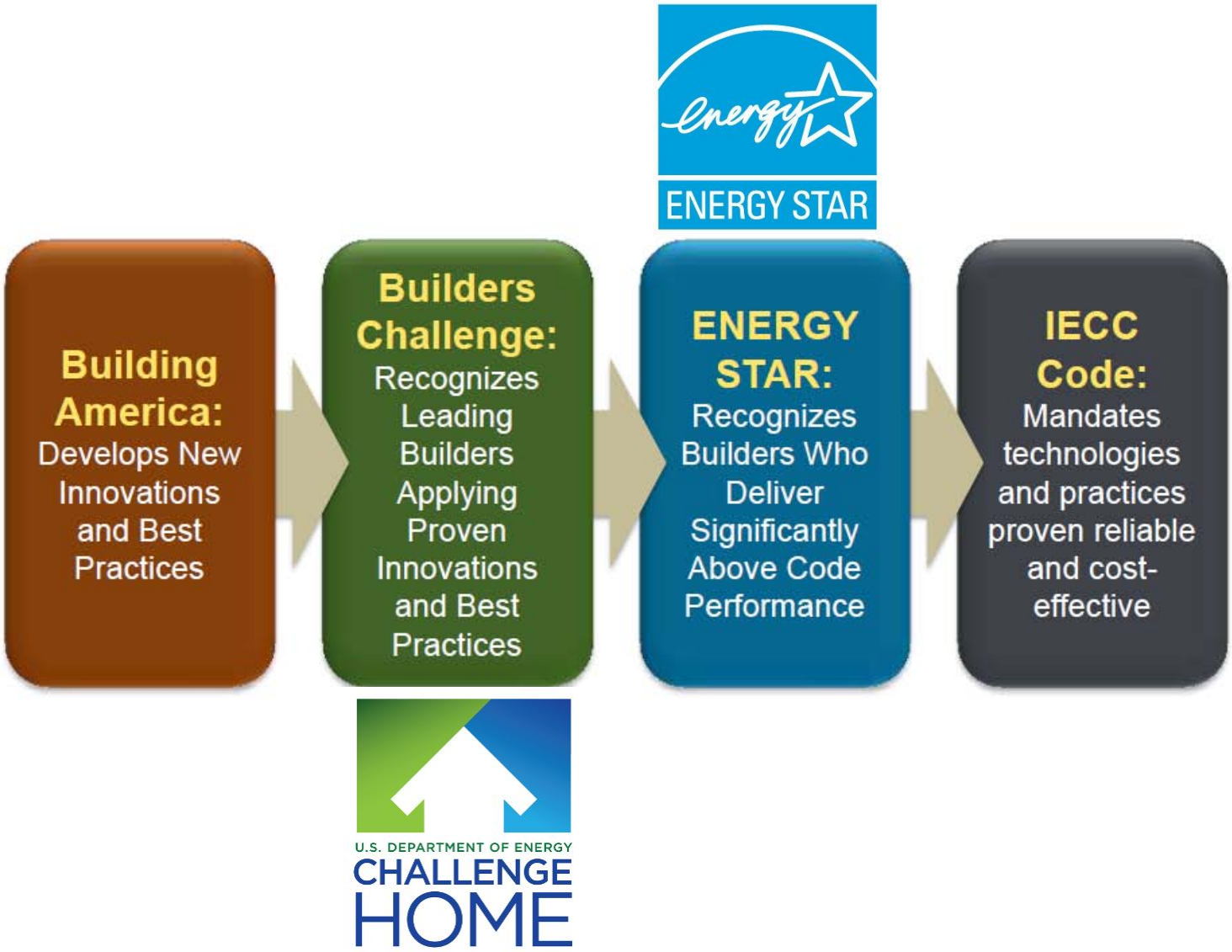
External Human Comfort Factors

Internal Comfort Factors

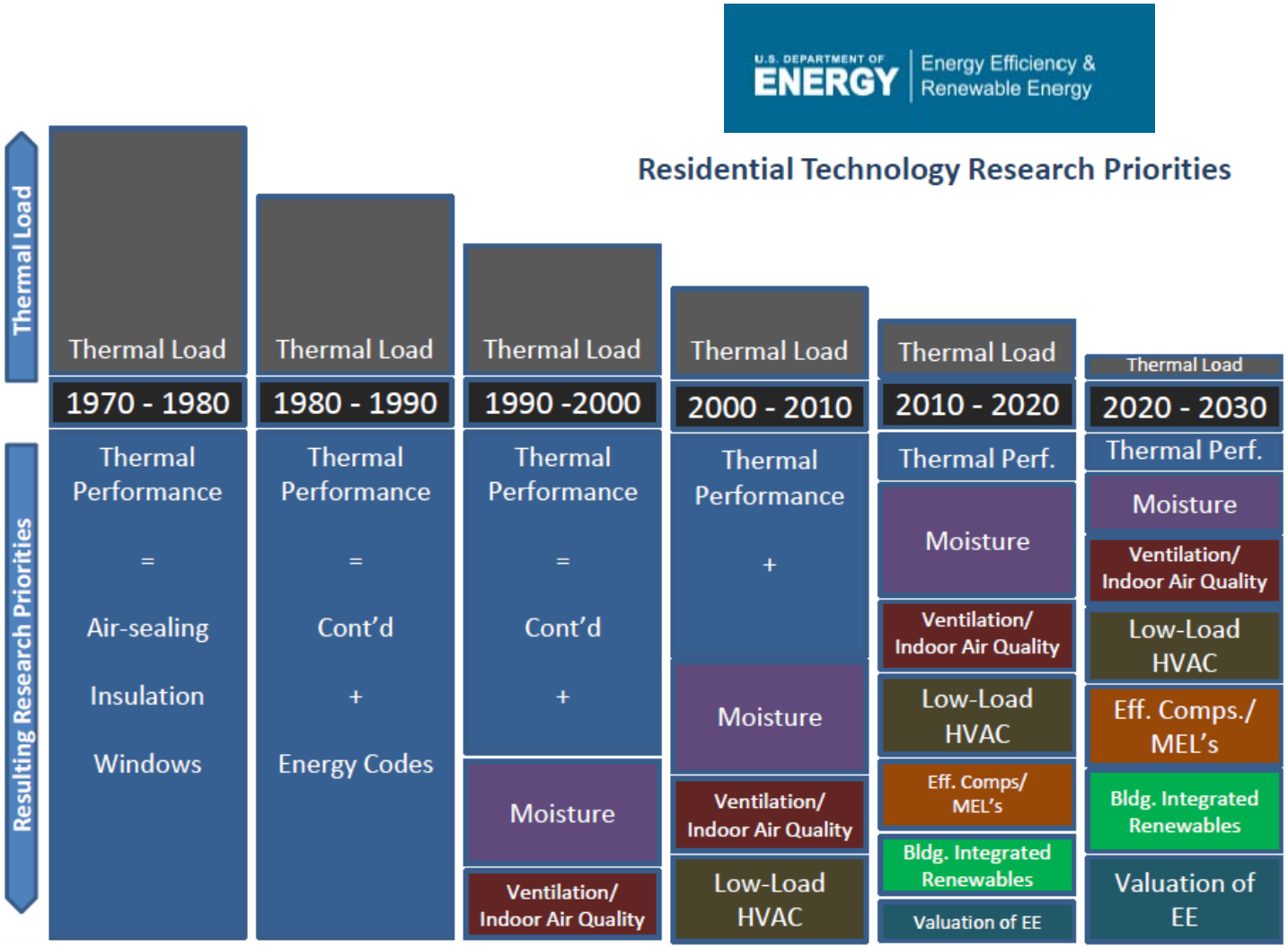
1. Metabolic Rate
2. Clothing Insulation



“Good Government” As-A-System



Thermal Loads Reduced as Homes Improve



Above Code Standards

- Home Energy Rating
- ENERGY STAR for New Homes
- Next Step Home
- LEED
- National Green Building Standard
- Passivhaus

ENERGY STAR: Added Value Based on Building Science

ENERGY STAR

NORTHWEST ENERGY STAR HOMES

Core Efficiency Measures

Guarantees that efficiency measures are included in every qualified home.

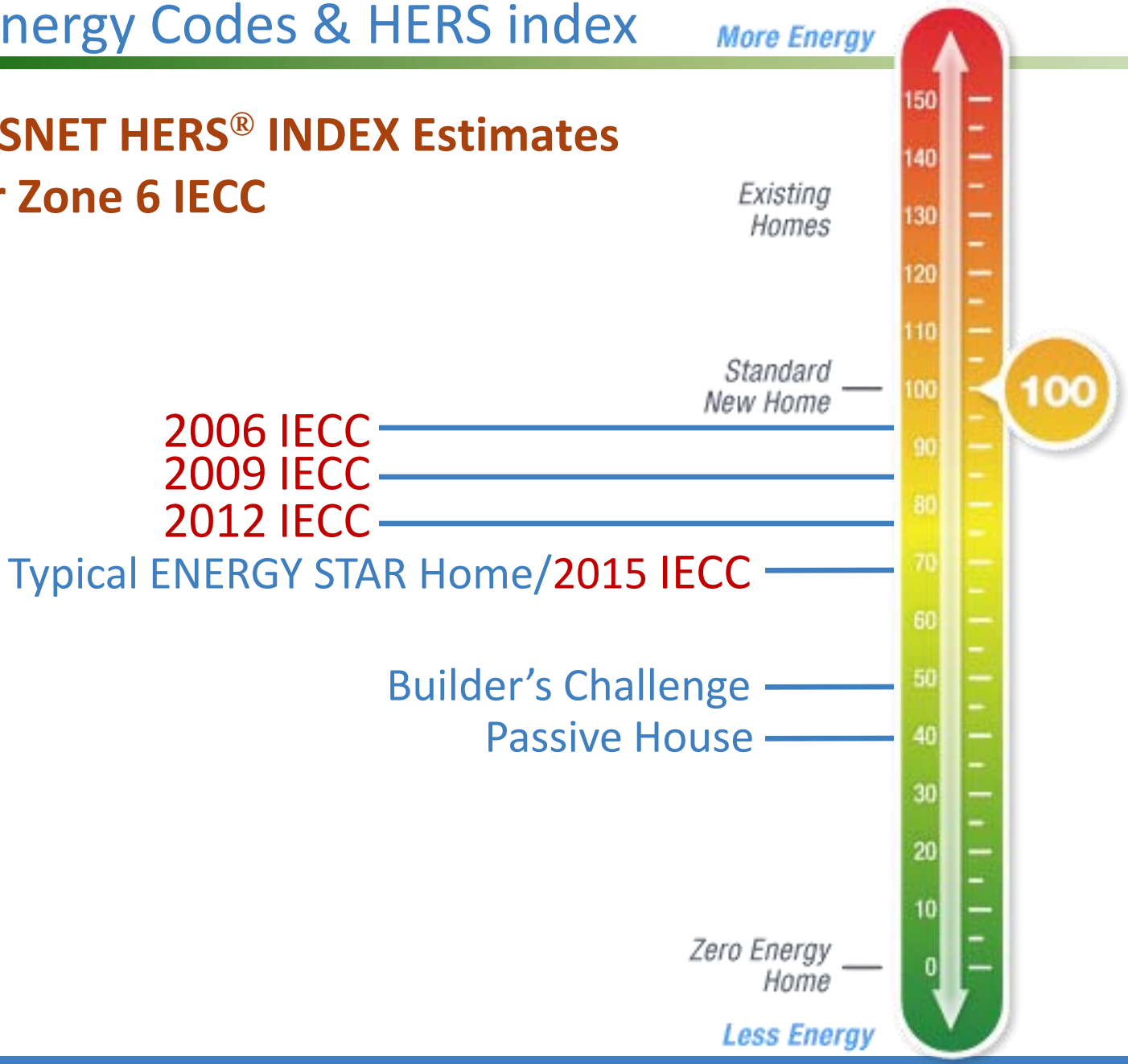
+

System Inspection Checklists

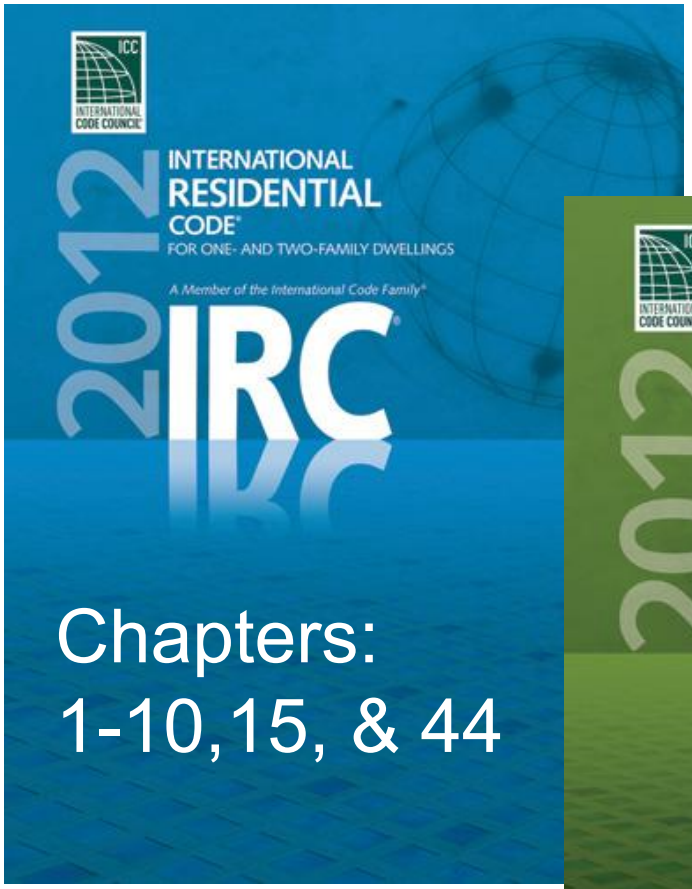
Sets standards for details that have a critical impact on efficiency, comfort, quality, and durability.

Energy Codes & HERS index

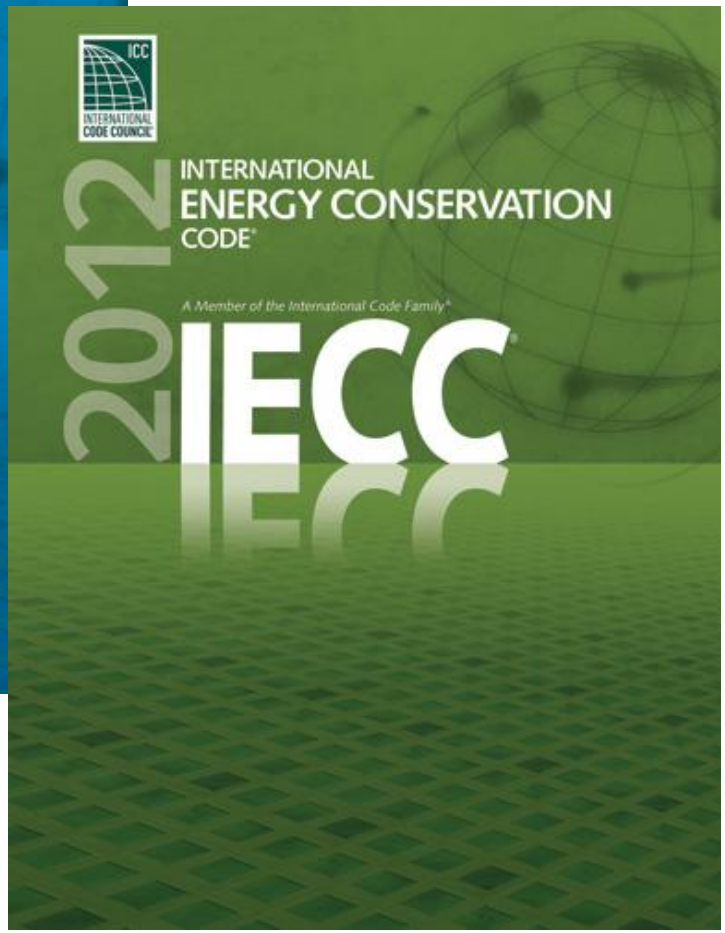
RESNET HERS® INDEX Estimates for Zone 6 IECC



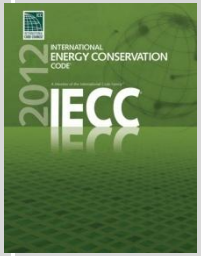
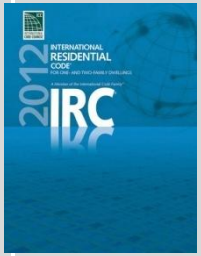
The Montana State Codes as Amended



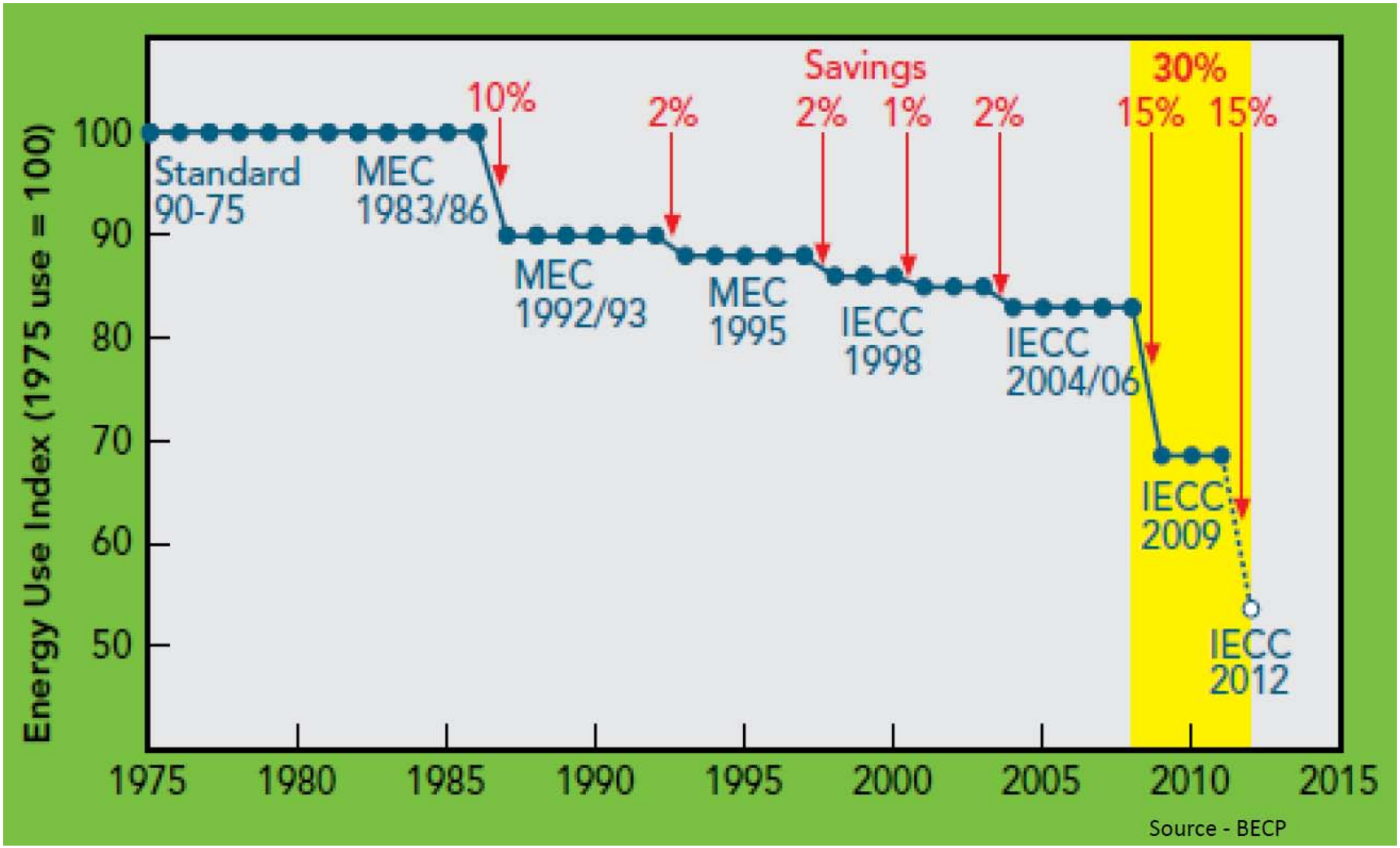
Chapters:
1-10,15, & 44



I-Codes Overlap and Interaction

Topic	 IECC	 IRC	 IMC
HVAC Sizing	■		
Insulation Values	■		
Window/Skylight U-Factors	■		
House Tightening	■		
Duct Sealing and Tightening	■		
Lighting Efficiency	■		
Foam Thermal Properties		■	
Vapor Retarders		■	
Crawlspace Ventilation		■	
Mechanical Ventilation		■	■

Energy Code Evolution



2011 Montana Energy Code Compliance Study

2011 Montana Enegy Code Compliance Study			
Method	Local Code Jurisdictions	Self-Certifying Areas	Combined
PNNL Checklist	**79%**	**50%**	**61%**
Significant Items	**96%**	**72%**	**81%**
Energy Consumption	**83%**	**52%**	**64%**

2011 Montana Energy Code Compliance Study

2011 Montana Enegy Code Compliance Study

Provisions with Poor Compliance

Compliance Item	Qty Inspected	% Compliant
Construction documentation	66	20%
HVAC Loads Calculations	49	14%
Basement wall exterior insulation installed per manufacturer's	17	24%
Crawl space continuous vapor retarder	58	53%
Duct insulation	10	60%
Insulation labeling	79	48%
Attic hatch insulation and gasket	79	44%
Energy Certificate	82	63%

House as a System

Viewing a house as a system *means understanding and managing the way that three things move on* or through homes.

- Moisture (Water and Vapor)
- Air
- Heat

Source: stock.xcchng

Source: stock.xcchng

Source: stock.xcchng

What Tighter Houses Mean

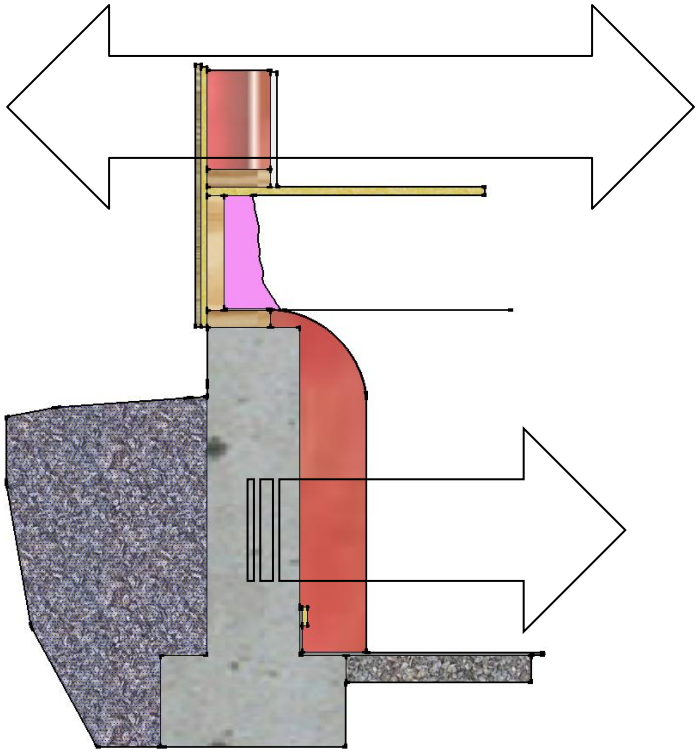
A. Reduced drying potentials
B. Increased importance of controlling moisture flow

Source: These principles are a variation on EEBA “Houses that Work” publications.

Top Building Science Principles

The Critical Nature of Drying Potential

- **Heating Climates** - to the exterior
- **Cooling Climates** - to the interior
- **Climates with both Heating and Cooling** – both directions



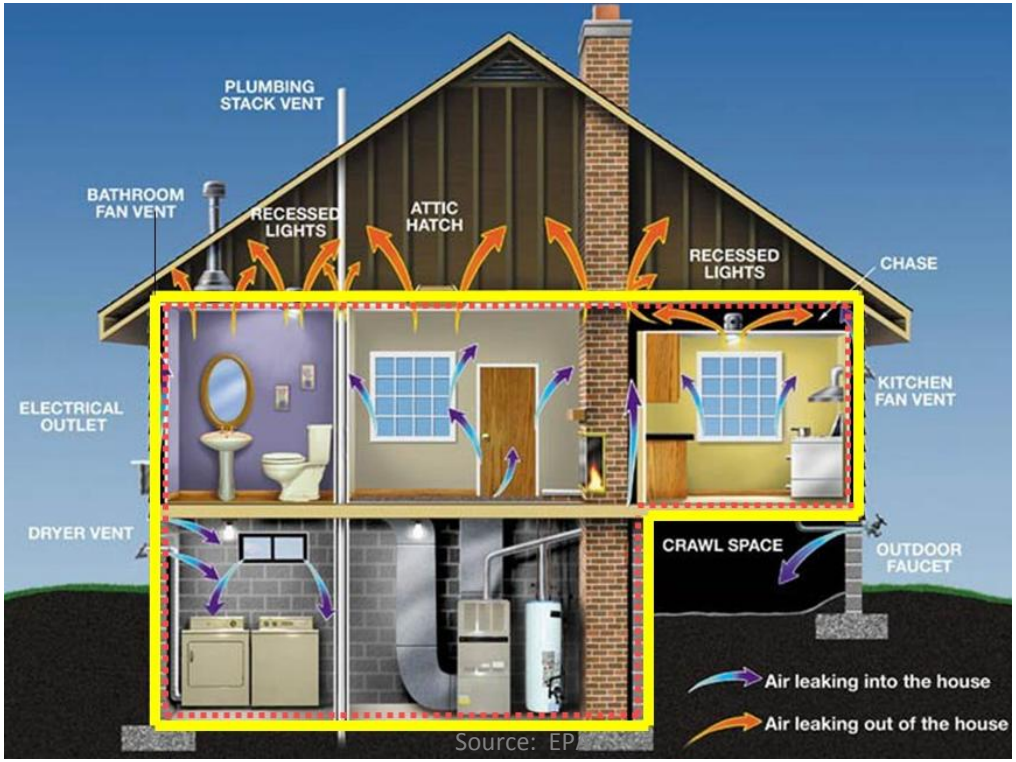
Source: NCAT

Top Building Science Principles

The Importance of Continuity

- Air barriers
- Thermal barriers

All must be continuous to be truly effective.



Top Building Science Principles

The Big Three Agents of Destruction

- Water
- Heat
- Ultraviolet Radiation

Of the three, which is the most important by far?

Source: Paul Tschida, MT DEQ

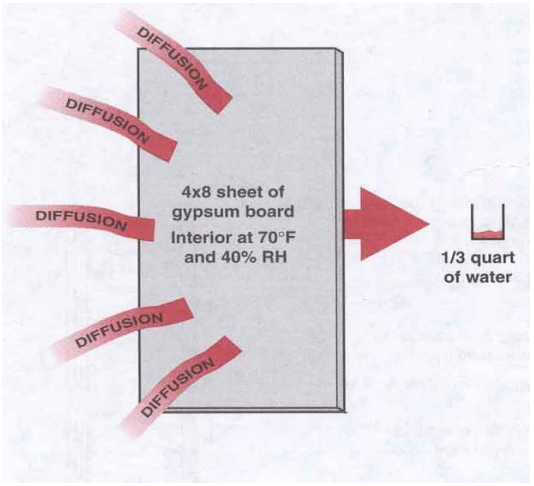
Source: Paul Tschida, MT DEQ

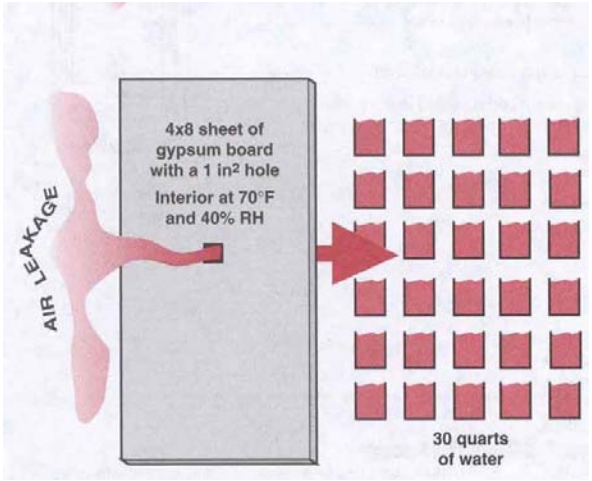
Top Building Science Principles

Moisture Control Priorities:

- Liquid or bulk water
- Air-transported water vapor
- Water vapor diffusion

Source: stock.xcchng





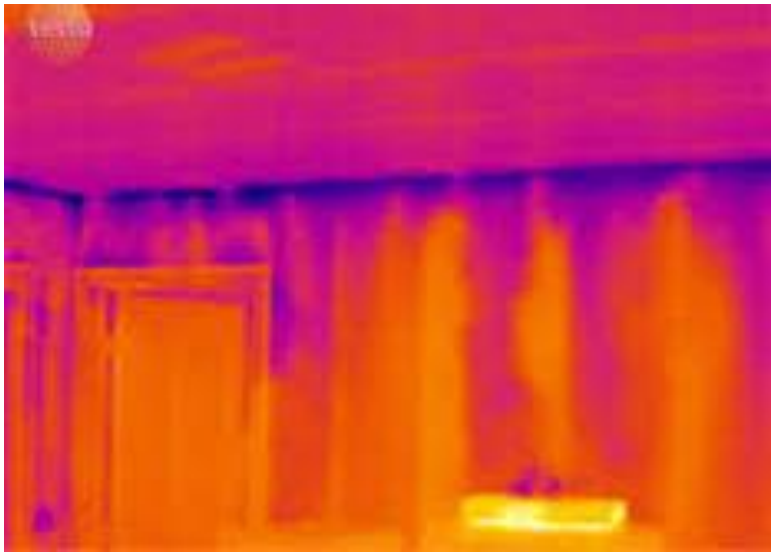
Source: EEBA Builders Guide Series by Joe Lsitbuerk, Building Science Corporation

Top Building Science Principles

"People do what you inspect, not what you expect."

Lou Gerstner, former CEO of RJR Nabisco and IBM

Source: Energy Conservatory



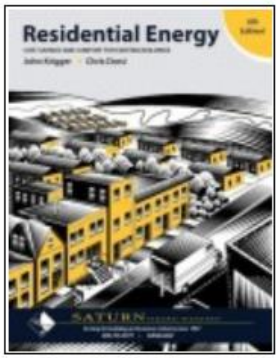
Source: Energy Conservatory

Corollary: "If you measure it, it gets better."

Saturn Resource Management

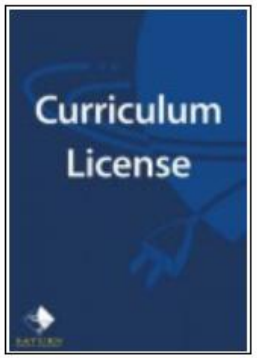
SATURN
RESOURCE MANAGEMENT

Featured Products



Residential Energy
$59.00

Energy Auditor
$595.00

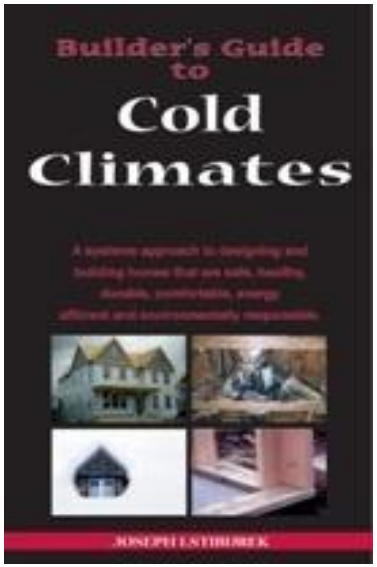


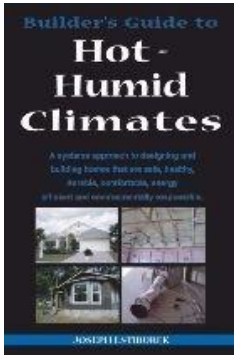
Curriculum License
$4,700.00

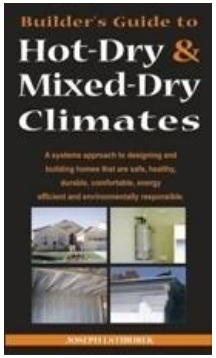
Energy Auditor Field Guide
$39.00

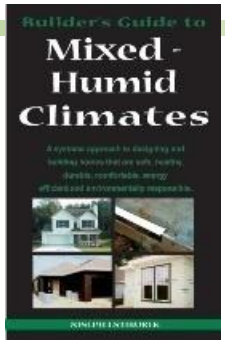
http://www.srmi.biz/

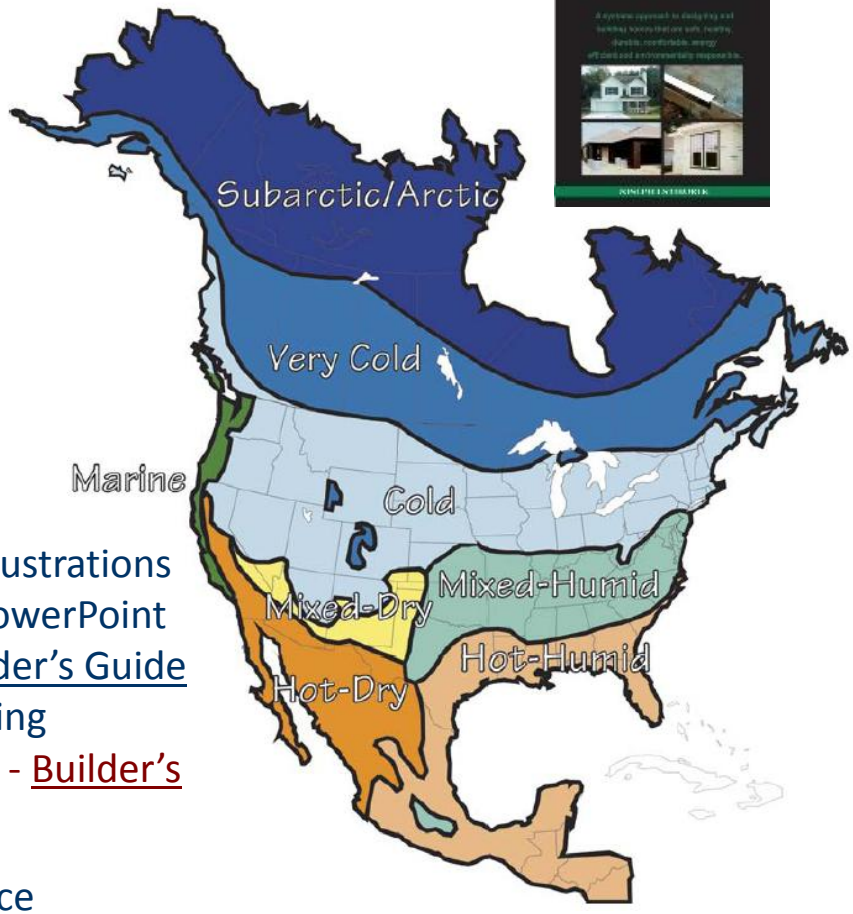
EEBA Publications











NCAT thanks Joe Lstiburek for permission to use illustrations from the Builder's Guide to Cold Climates in the PowerPoint presentation developed for this training. The Builder's Guide to Cold Climates images are noted with the following statement in the PowerPoint presentation: Source - Builder's Guide to CC

For more excellent publications and building science information from Building Science Corporation refer to their web site: **www.buildingscience.com**

USDOE Building America