

# ASHRAE and Beyond the Code Initiatives

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PIMA

Chicago Roofing Contractors Association  
Meeting

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# Learning Objectives

- Examine Energy Trends in Commercial Construction
  - Historical Perspective
  - Crystal Ball?
- Describe the Role of ASHRAE 90.1
  - Past and Future
  - New 90.1-2007 Wall and Roof R-values
  - Proposed 90.1 Wall and Roof Values
- Explore “Beyond the Code” Opportunities

# The Ethics of Energy Conservation

**“Concern for man himself and his fate must always form the chief interest of all technical endeavors, in order that the creations of our mind shall be a blessing and not a curse to mankind. Never forget this in the midst of your diagrams and equations.”**

**Albert Einstein, 1931**

**“Insulation is sexy”**

**2009**

**President Barack Obama,**



# Today's Energy Situation

- Energy supply questions
  - Reliance on foreign sources
  - Global economic growth
- Rising energy prices
- Climate Change/ Environmental footprint
- Concern about peak energy demands
  
- Do **BUILDINGS** Matter?
- Does **COMFORT** matter?



# BOMA Energy Facts

- The commercial real estate industry spends approximately \$24 billion annually on energy and contributes 18% of US carbon dioxide emissions.
- Energy represents the single largest controllable operating expense for office buildings, typically a third of variable expenses.

■ [www.boma.org](http://www.boma.org)

BEEP (BOMA Energy Efficiency Program)



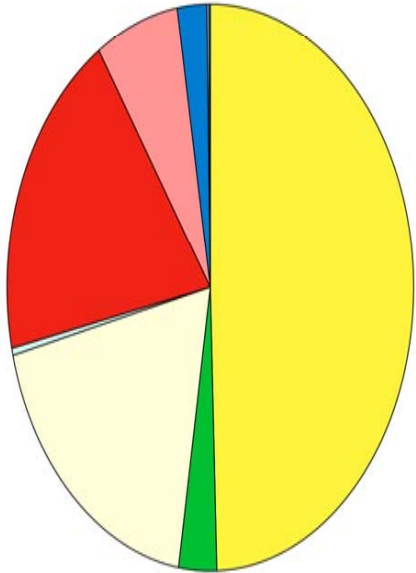
# Did You Know? Electricity Sources

Hydro 6.5%

Renewables 2.3%

Nuclear 19.3%

Coal 49.7%



Natural Gas 18.7%

Petroleum 3%

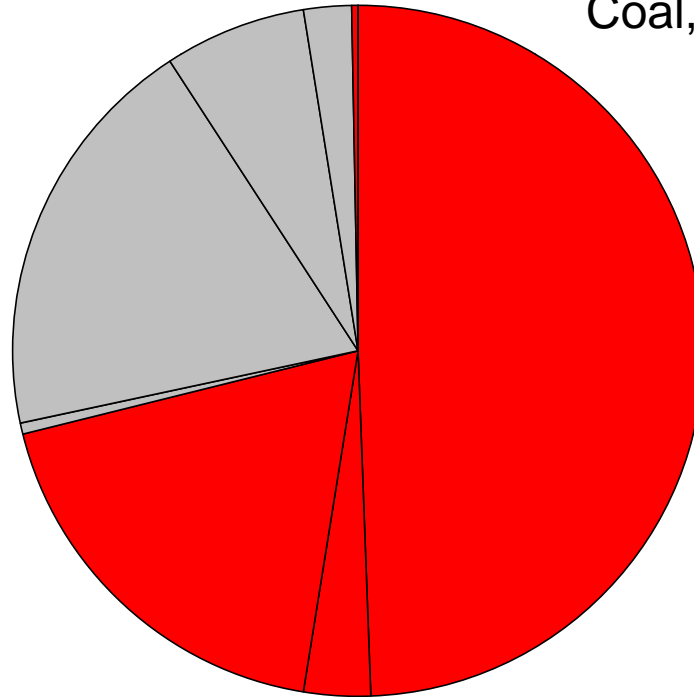
Source: EIA (Energy Information Administration), 2005



# Did You Know? Electricity Generation

Fossil Fuels 71.4%

Coal, natural gas, petroleum

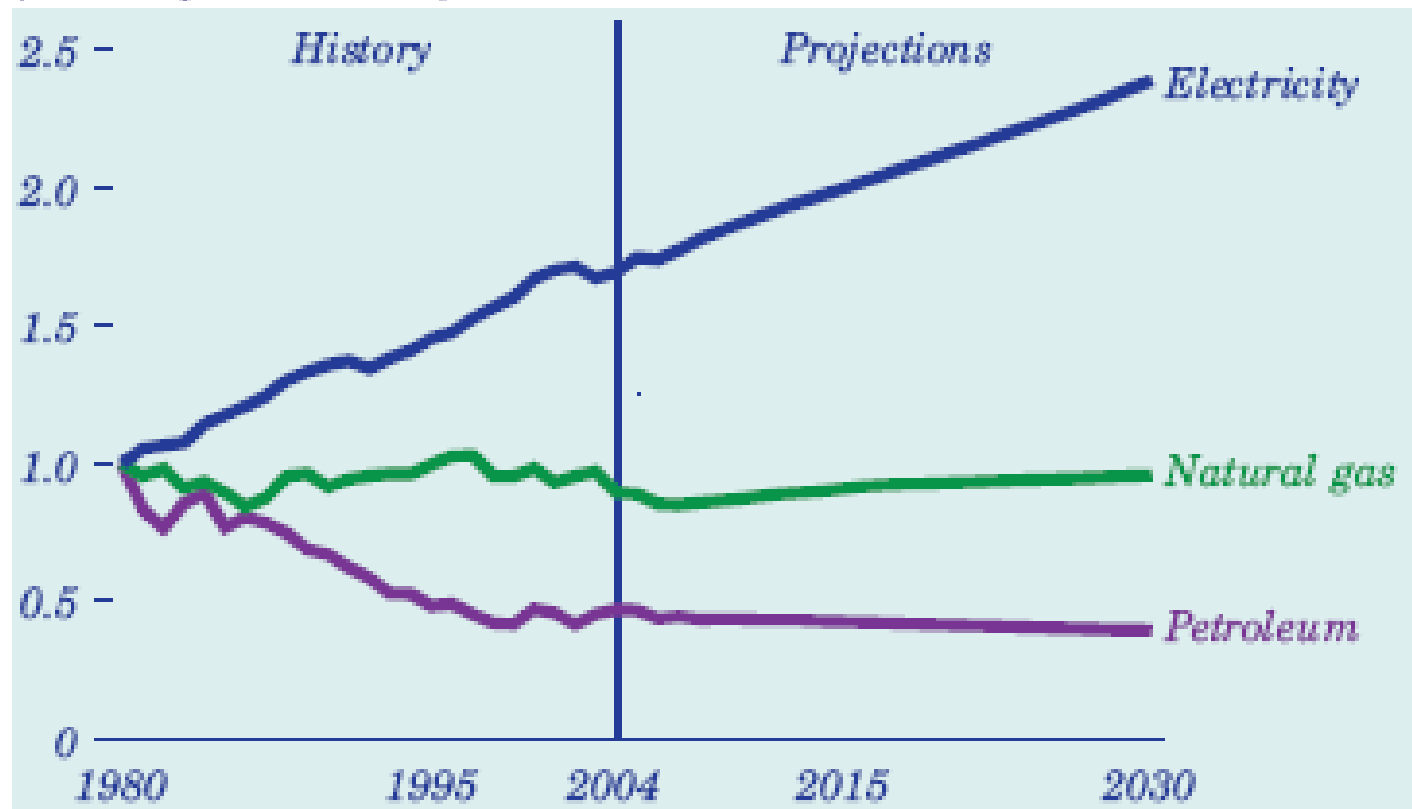


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# Commercial Energy Consumption

*Figure 39. Delivered commercial energy consumption per capita by fuel, 1980-2030 (index, 1980 = 1)*



Source: EIA 2005

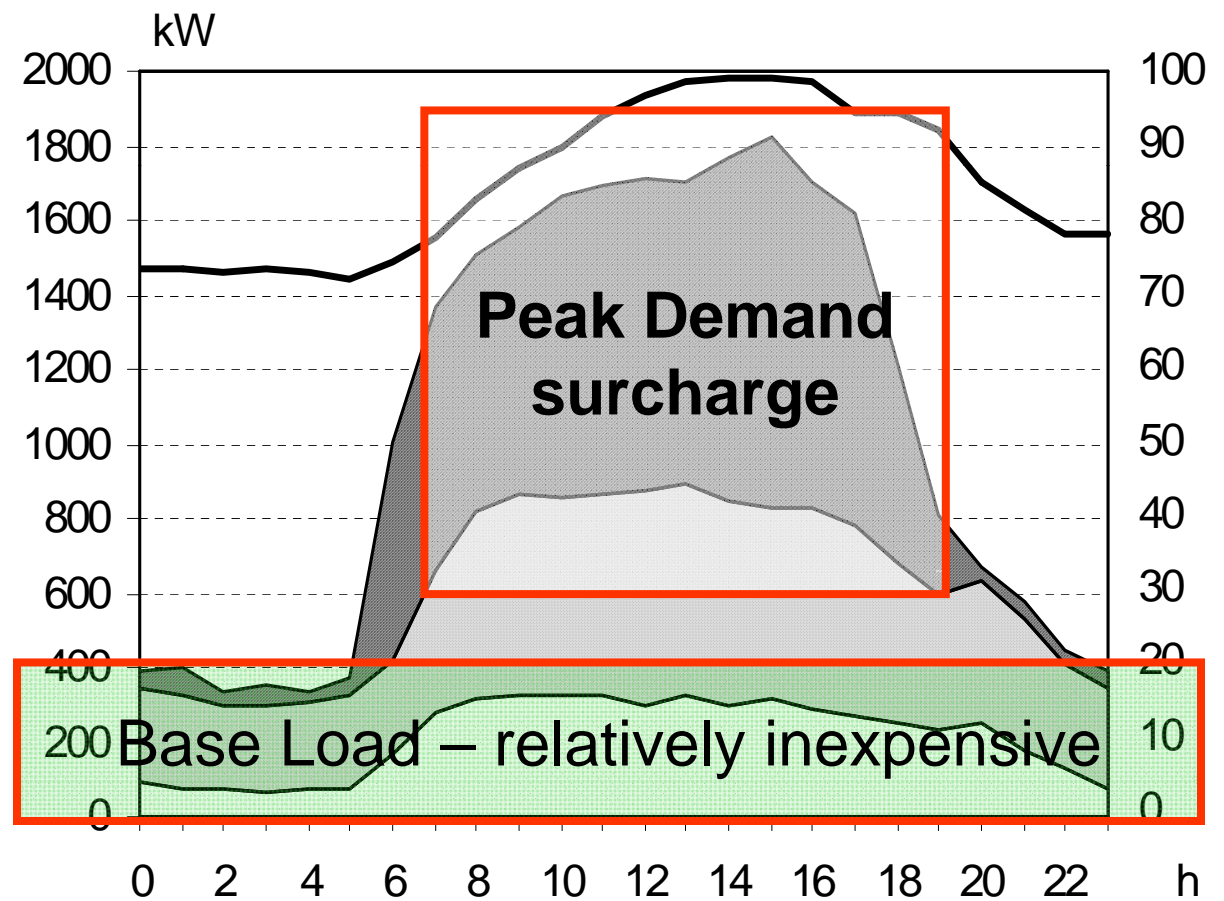
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# Utility Concerns

## Regional Capacity vs Demand

- Energy Demand
- ◆ Base Load
- ◆ Peak Demand
- ◆ Cooling driven





# • The Role of Buildings Codes Past, Present, and Future



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# Why Do We Have Building Codes?

- Protect life and structures
- Official government position on building safety
- Minimum standards that are practical, economically justified

# Origin of Building Codes

- Code of Hammurabi
  - 6th King of Babylonia 1795-1750 B.C.
  - That's over 3750 years ago...
- Simple and elegant

“If a builder build a house for a man and do not make its construction firm and the house which he has built collapse and cause the death of the owner of the house, the builder shall be put to death.”



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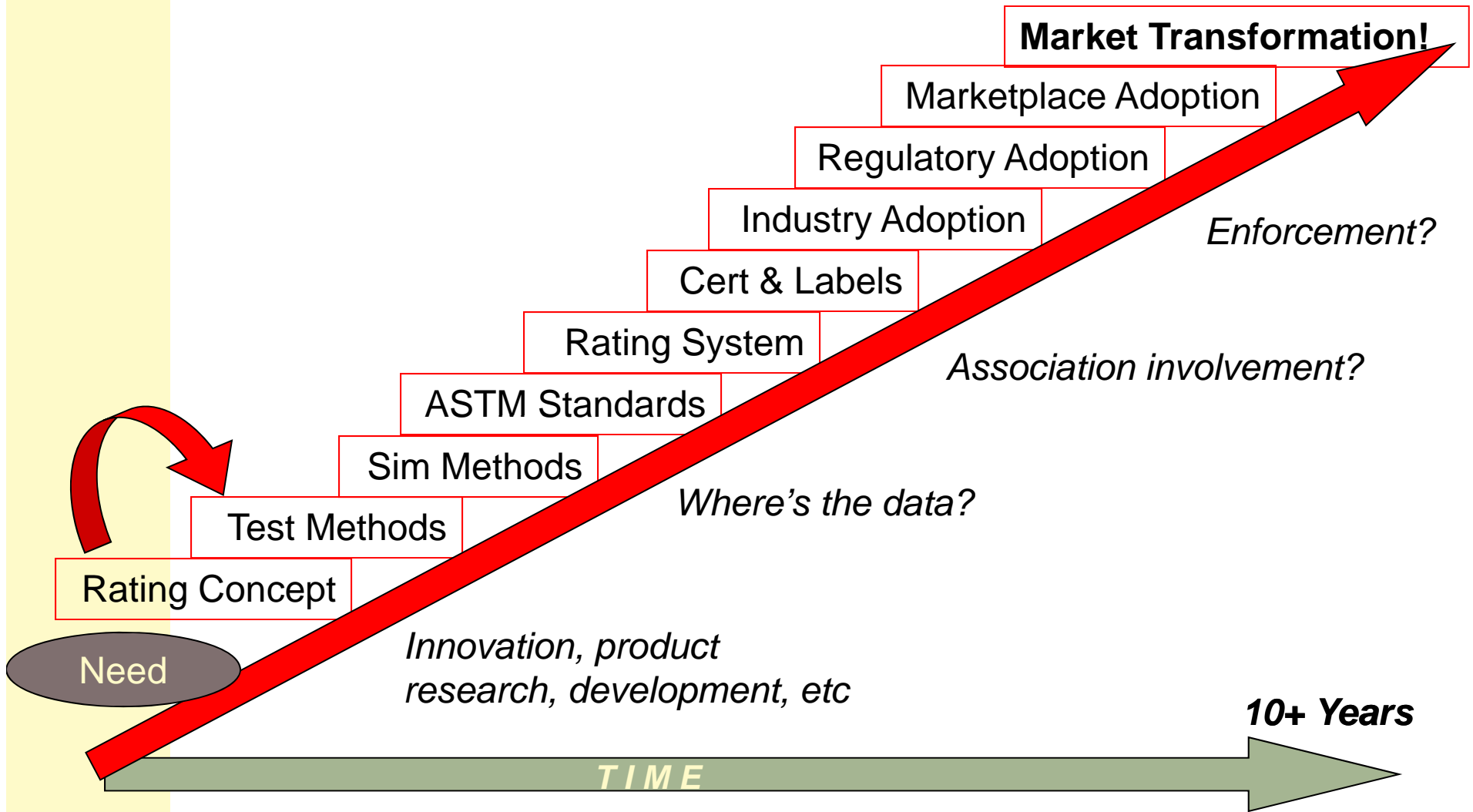
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# Beyond Codes

- Code of Hammurabi
- The Burning of Rome--64 AD--fire safety and sanitation required
- Great London Fire--1666 AD
- Chicago Fire--1871
- San Francisco Earthquake--1906
- Hurricane Andrew and Katrina

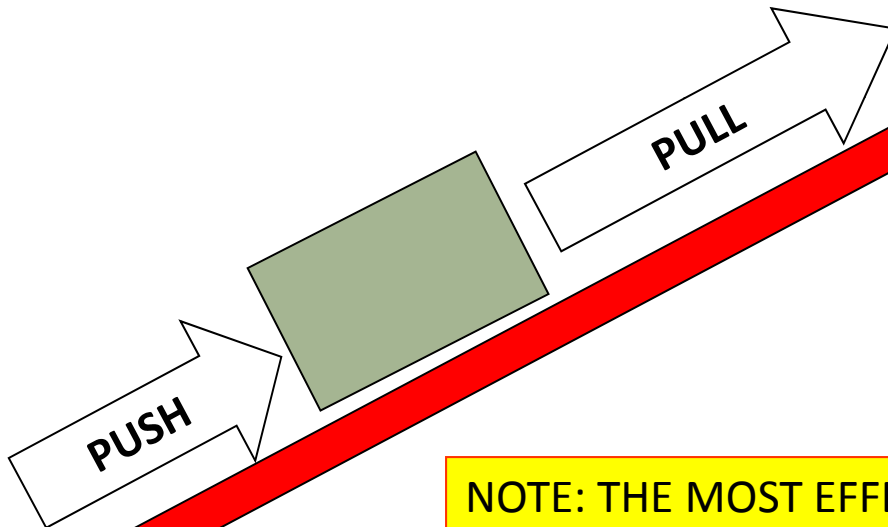
# The First Step - Standards



# Moving the Energy Efficiency Market

Energy Awareness,  
Marketing,  
Advertising,  
Incentives, LEED, etc.

Laws,  
Codes  
Regulation



**NOTE: THE MOST EFFECTIVE APPROACH TO MARKET TRANSFORMATION IS TO INCREASE THE "PULL" ... RECOGNIZE THE URGENCY OF THE ENERGY SITUATION AND THE NEED FOR CHANGE.**

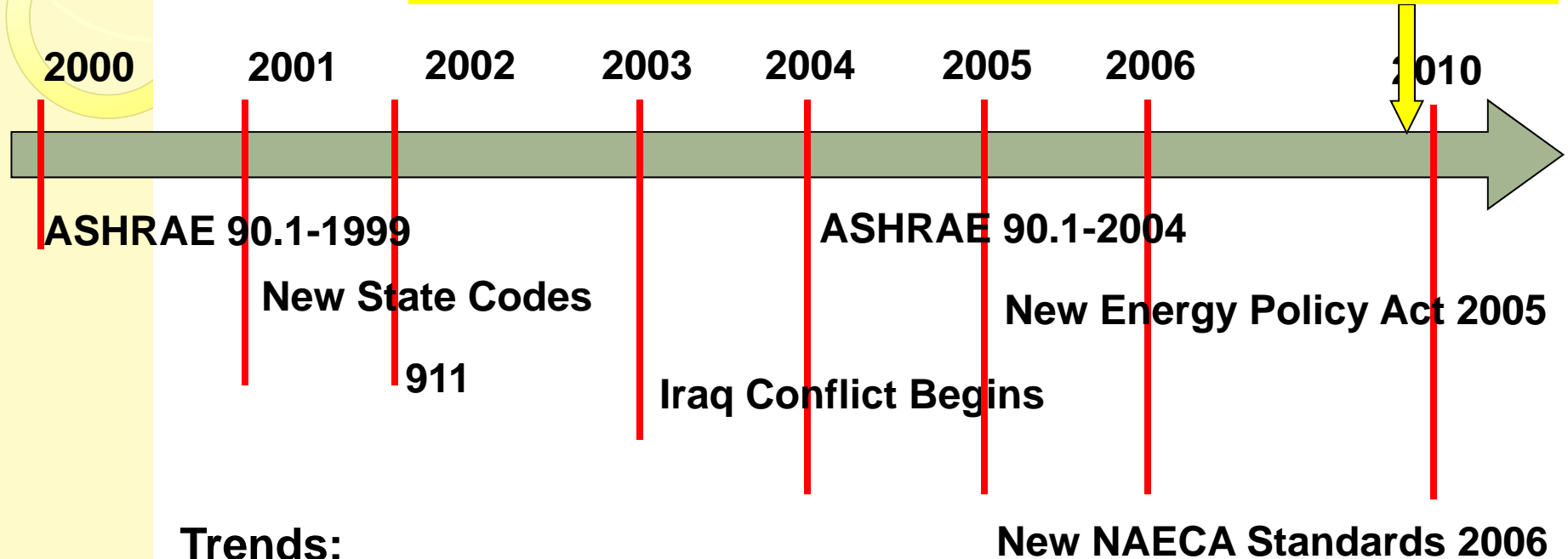
# What Happened After Energy Crisis in 1973?

- **Tried to Save Energy**
  - **Increased Energy Conservation Consciousness**
  - **Developed Standards**
    - **Buildings, Cars, Appliances, Industrial Processes**
- **Innovated (developed new technologies)**
  - **Insulation (polyiso), Glazing Technologies, HVAC, Lighting**
- **Adopted Minimums (codes)**
- **Provided Incentives**
  - **Utility Programs, Rebates, etc.**



# Recent Past & Current Trends

## New ASHRAE 90.1-2007 Envelope R-values



### Trends:

- Energy Prices
- Energy Availability
- Energy Security
- Peak Power Concerns
- Looking back for lost opportunities...



# Today's Expectations?

- “Expect” that we’re getting an energy efficient solution
  - Buildings, appliances, cars(?)
- Generally Complacent
  - “How bad does it have to hurt?”
    - Gas at \$5? \$7? \$9?
    - What will cause a change in action?
  - “We’ve got codes to handle that...”



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# ASHRAE

- American Society for Heating, Refrigerating and Air Conditioning Engineers
  - A Standards writing organization
  - Significant focus on building performance
  - **Authors of Standard 90.1 - Energy Standard for Buildings Except Low-Rise Residential Buildings**



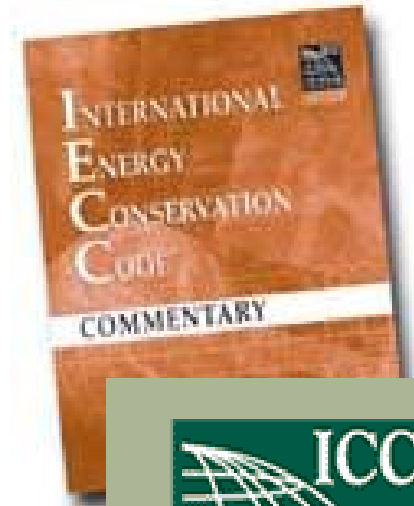
# Why is 90.1 Important?

- The National standard referenced in law
  - Energy Policy Act of 1992
  - Energy Policy and Conservation Act 2005
- The “Model” against which all state codes must be compared
  - DOE must certify state code compliance as being at least as efficient as 90.1
- The “Standard of Care” for design professionals



# It's Already IN the Code

- The International Code Council has already embraced ASHRAE Standard 90.1
  - The referenced Standard in the 2009 International Energy Conservation Code (IECC)
  - Our most referenced Code for Commercial Buildings

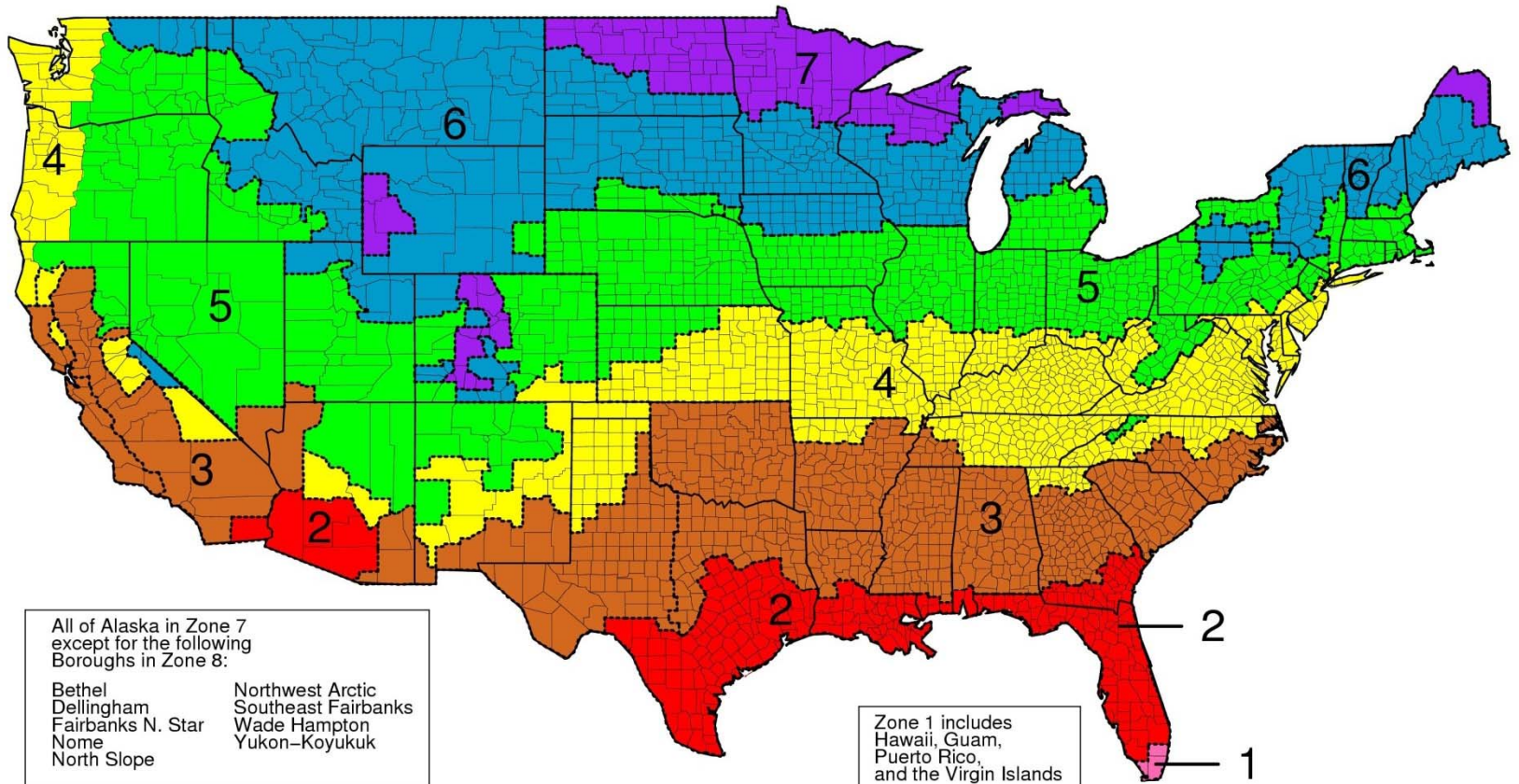


# ASHRAE 90.1-2007

- Latest increases in roof and wall insulation since 1989!
- Impacts all climate zones and building types
- Passes ASHRAE cost effectiveness tests
- Pending 2010 amendments raise the bar even higher



# ASHRAE Climate Zone Reminder



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# Conventions Used in Tables

	Non-residential		Residential		Semi-heated	
Roofs	Old (2004)	<i>New (2007)</i>	Old (2004)	<i>New (2007)</i>	Old (2004)	<i>New (2007)</i>
Insulation Entirely Above Deck	R-15ci	<b>NC</b>	R-15ci	<i>R-20ci</i>	NR	<i>R-3.8ci</i>

**“ci” means continuous insulation**

**“NC” means “No Change”**

**“NR” means “No Requirement”**

# New (2007) Changes – Zone 1 - Roofs

	Non-residential		Residential		Semi-heated	
Roofs	(2004)	<i>New (2007)</i>	(2004)	<i>New (2007)</i>	(2004)	<i>New (2007)</i>
Insulation Entirely Above Deck	R-15ci	NC	R-15ci	<i>R-20ci</i>	NR	<i>R-3.8ci</i>
<i>Metal Buildings</i>	<i>R-19</i>	<i>NC</i>	<i>R-19</i>	<i>NC</i>	<i>NR</i>	<i>R-6</i>
Attic and Other	R-30	NC	R-38	NC	NR	<i>R-13</i>

**Note: Zone 1 is essentially Miami**

# New (2007) Changes - Zone 2 - Roofs

	Non-residential		Residential		Semi-heated	
	(2004)	<i>New (2007)</i>	(2004)	<i>New (2007)</i>	(2004)	<i>New (2007)</i>
Insulation Entirely Above Deck	R-15ci	<i>R-20ci</i>	R-15ci	<i>R-20ci</i>	R-3.8ci	<i>NC</i>
<i>Metal Buildings</i>	R-19	<i>NC</i>	R-19	<i>NC</i>	R-6	<i>R-10</i>
Attic and Other	R-30	<i>R-38</i>	R-38	<i>NC</i>	R-13	<i>NC</i>

**Note: Zone 2 is primarily the Gulf Coast**

# New (2007) Changes - Zone 3 - Roofs

	Non-residential		Residential		Semi-heated	
Roofs	(2004)	<i>New (2007)</i>	(2004)	<i>New (2007)</i>	(2004)	<i>New (2007)</i>
Insulation Entirely Above Deck	R-15ci	<i>R-20ci</i>	R-15ci	<i>R-20ci</i>	R-3.8ci	<i>R-5ci</i>
<i>Metal Buildings</i>	R-19	<i>NC</i>	R-19	<i>NC</i>	R-10	<i>NC</i>
Attic and Other	R-30	<i>R-38</i>	R-38	<i>NC</i>	R-13	<i>R-19</i>

**Note: Zone 3 is most of California and the Southeast US**

# New (2007) Changes – Zone 4 - Roofs

	Non-residential		Residential		Semi-heated	
Roofs	(2004)	<i>New (2007)</i>	(2004)	<i>New (2007)</i>	(2004)	<i>New (2007)</i>
Insulation Entirely Above Deck	R-15ci	<i>R-20ci</i>	R-15ci	<i>R-20ci</i>	R-3.8ci	<i>R-5ci</i>
<i>Metal Buildings</i>	R-19	<i>NC</i>	R-19	<i>R-13 + R-13</i>	R-10	<i>NC</i>
Attic and Other	R-30	<i>R-38</i>	R-38	<i>NC</i>	R-13	<i>R-19</i>

**Note: Zone 4 is Virginia, Kentucky, St. Louis, etc.**

# New (2007) Changes – Zone 5 - Roofs

	Non-residential		Residential		Semi-heated	
Roofs	(2004)	<i>New (2007)</i>	(2004)	<i>New (2007)</i>	(2004)	<i>New (2007)</i>
Insulation Entirely Above Deck	R-15ci	<i>R-20ci</i>	R-15ci	<i>R-20ci</i>	R-5ci	<i>R-7.6ci</i>
<i>Metal Buildings</i>	R-19	<i>R-13 + R-13</i>	R-19	<i>R-13 + R-13</i>	R-10	<i>R-13</i>
Attic and Other	R-30	<i>R-38</i>	R-38	<i>NC</i>	R-19	<i>NC</i>

**Note: Zone 5 is PA, Chicago, most of Nevada**

# New (2007) Changes – Zone 6 - Roofs

	Non-residential		Residential		Semi-heated	
Roofs	(2004)	<i>New (2007)</i>	(2004)	<i>New (2007)</i>	(2004)	<i>New (2007)</i>
Insulation Entirely Above Deck	R-15ci	<i>R-20ci</i>	R-15ci	<i>R-20ci</i>	R-5ci	<i>R-10ci</i>
<i>Metal Buildings</i>	R-19	<i>R-13 + R-19</i>	R-19	<i>R-13 + R-19</i>	R-10	<i>R-16</i>
Attic and Other	R-38	<i>NC</i>	R-38	<i>NC</i>	R-19	<i>R-30</i>

**Note: Zone 6 is Minneapolis and Maine**

# New (2007) Changes – Zone 7 - Roofs

	Non-residential		Residential		Semi-heated	
Roofs	(2004)	<i>New (2007)</i>	(2004)	<i>New (2007)</i>	(2004)	<i>New (2007)</i>
Insulation Entirely Above Deck	R-15ci	<i>R-20ci</i>	R-15ci	<i>R-20ci</i>	R-5ci	<i>R-10ci</i>
<i>Metal Buildings</i>	R-19	<i>R-13 + R-19</i>	R-19	<i>R-13 + R-19</i>	R-10	<i>R-16</i>
Attic and Other	R-38	<i>NC</i>	R-38	<i>NC</i>	R-19	<i>R-30</i>

**Note: Zone 7 is Northern Minnesota and Canada**

# New (2007) Changes – Zone 8 - Roofs

	Non-residential		Residential		Semi-heated	
Roofs	(2004)	<i>New (2007)</i>	(2004)	<i>New (2007)</i>	(2004)	<i>New (2007)</i>
Insulation Entirely Above Deck	R-20ci	<i>NC</i>	R-20ci	<i>NC</i>	R-10ci	<i>R-15ci</i>
<i>Metal Buildings</i>	R-13 + R-19	<i>R-16 + R-19</i>	R-13 + R19	<i>NC</i>	R-16	<i>R-19</i>
Attic and Other	R-38	<i>R-49</i>	R-38	<i>R-49</i>	R-30	<i>NC</i>

**Note: Zone 8 is Northern Alaska**

# What Does It All Mean?

- An average 33% increase in required minimum insulation levels for roofs
  - Similar increases for walls
  - Possible increases for metal building insulation requirements in next code cycle
- When adopted, becomes the new “Standard of Care” for certifying professionals – the building’s “designer of record”



**Remember: First change since 1989... These are MINIMUM values... the WORST we can build...**

# Change Can Be Slow...

- Changes to the National model energy code can be slow to penetrate and transform a market
  - Don't rely on the code.
  - “Stay Ahead of the Game”
- Remember, the code is a minimum!



# State Adoption Can Be Slow

- Each State acts on its own time table regarding adoption of its new code
  - Usually 3- to 5-year cycles
- Roofing Contractors: “Don’t wait on the state!”
  - Employ the national code requirements even if the state lags behind.
- What is your “Standard of Care”?



## National Versus State

- ASHRAE 90.1 is the benchmark
- The new ASHRAE 90.1-2007 roof insulation values exceed all state codes that adopted energy codes based on the ASHRAE 90.1-2004 version.



# Beyond the Code: Value in Going Beyond the Minimums

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Advancing HVAC&R to serve humanity  
and promote a sustainable world

# Expectations Have Changed

- We used to just “Expect” that we’re getting an energy efficient solution
  - Buildings, appliances, cars(?)
- We became generally complacent about energy and its true costs
  - “Doesn’t the energy code handle that?”



# Trends Beyond the Code

- US Green Building Council
  - LEED – Leadership in Energy and Environmental Design
  - Every architect knows about it
- Energy Star
  - Homes, Buildings, Products



**All of these programs have one thing in common:  
Going far beyond the code minimums - 15%, 30%,  
50% more efficient**

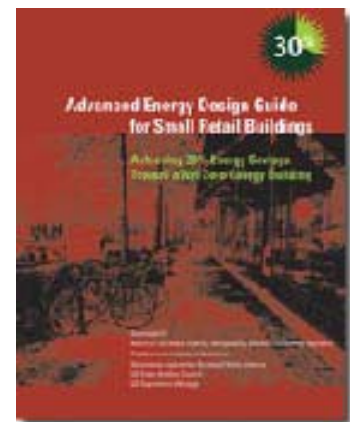
# AIA Position

- Architects across the country know that we have to do better than code
- Targeting a 50% reduction in fossil fuel use versus (2004) practice
- Zero energy buildings by 2030



# Sustainability and the AIA

- 2007 Convention theme is “Sustainability”
- Increasing collaboration
  - ASHRAE, IESNA (Illuminating Engineering Society of North America), ASCE, USGBC, EPA and DOE
  - Publication of *Advanced Energy Design Guides* for various building types
  - Developing ASHRAE SP-182 Minimum Standards for Green Buildings
  - Joint research into sustainable infrastructure



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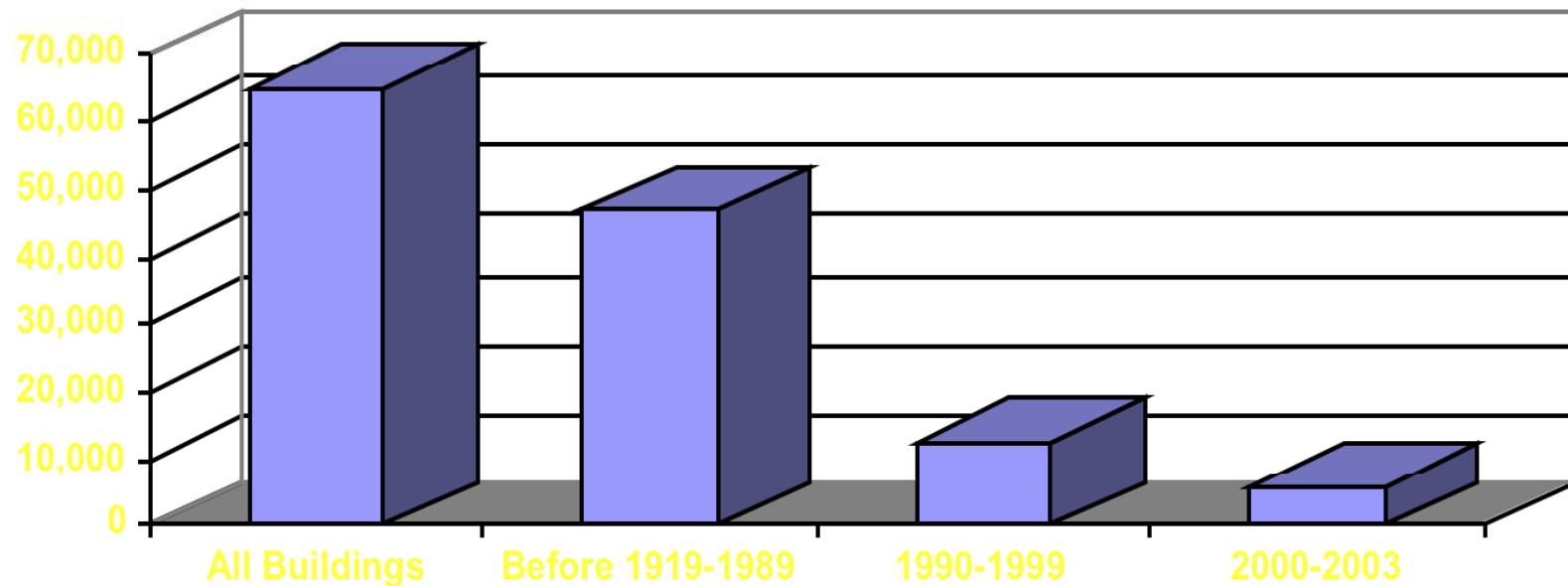
# Reroofing

- Re-roof focus is a great opportunity for being a valued partner with up-to-date information
- Many older codes weak on requiring energy efficient measures during re-roofing
- Exceeding the energy code where it does regulate Reroofing



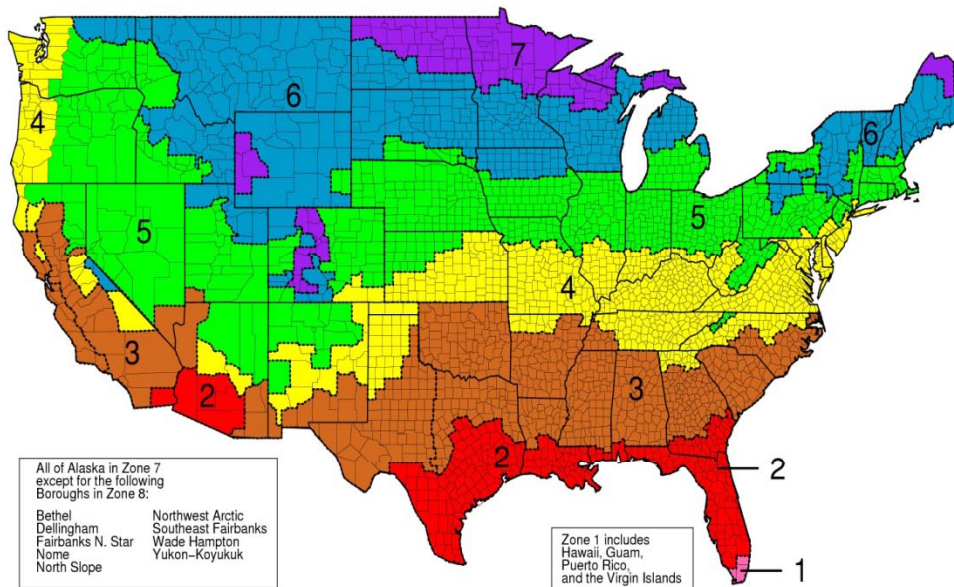
# Age Distribution: Existing Commercial Floor Space

**Most Buildings constructed before 1989:  
Likely Under-insulated**



US EIA Commercial Buildings Energy Consumption Survey, 2003

# Consider Upgrading Roof Insulation When Reroofing



## Recommended R-values

Zone	Roofs	Walls
1-3	R-25	R-20
4-6	R-30	R-25
7-8	R-35	R-25

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[www.polyiso.org](http://www.polyiso.org)

# Know the Investment Value

**Example:** An Owner Invests \$1 in Energy Performance Improvements

Reduce Energy Consumption by:	Save/sf	Potential Asset Value
10%	20 ¢	\$2.50
20%	40 ¢	\$5.00
30%	60 ¢	\$7.50

Assumptions: Energy costs = \$2/sf; Capitalization rate = 8%

Information Courtesy of BOMA International



# Summary: Roofs Matter

- (More) change is coming
  - New minimum R-values
- Codes are minimum
  - Can drive markets
- Beyond the code initiatives
  - AIA, USGBC, Energy Star, BOMA, Mayors, Governors-local climate initiatives
  - Shift from supply to demand reduction
  - Growing awareness of environment/energy link



# ARRA, Climate, New Jobs Bill, New Executive Order Target Reroofing

- State Energy Programs, Energy Efficiency and Conservation Block Grants
- US House Climate Protection Bill-REEP Program
- Ramp Up Retrofit
- Building Star Proposal (Jobs Bill)



# Tools from PIMA: [www.polyiso.org](http://www.polyiso.org)

- Case studies – commercial buildings
- Product/Installation Information
- Energy Code Updates



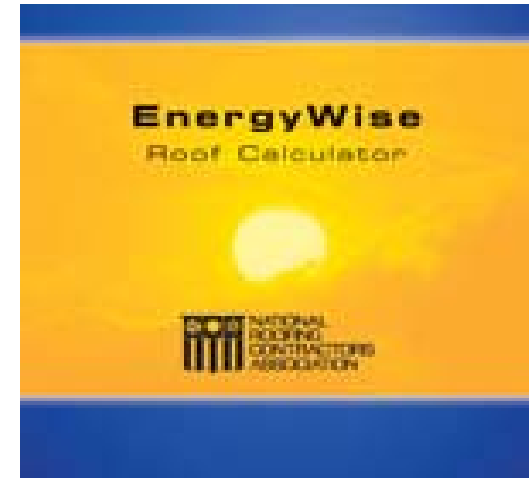
# Other Beyond the Code Tools

- ASHRAE/AIA Small Building Design Guide
- Financial Payback Calculator ([energystar.gov](http://energystar.gov))
- Federal tax incentives
- Utility incentives



# Evaluate Potential Savings From Increasing Roof Insulation

- **Energy Wise: Calculator developed by NRCA and PIMA**
- **Compare savings based on R-value**
- **Offered on CD and online**
- **SpecRight Training Program**



# Some Web Sites of Interest

- [www.pima.org](http://www.pima.org)
- [www.usgbc.org](http://www.usgbc.org)
- [www.boma.org](http://www.boma.org)
- [www.ashrae.org](http://www.ashrae.org)
- [www.bcap-energy.org](http://www.bcap-energy.org)
- [www.nrca.net](http://www.nrca.net)
- [www.specright.net](http://www.specright.net)
- [www.architecture2030.org/](http://www.architecture2030.org/)
- [www.energystar.gov](http://www.energystar.gov)
- [www.energycodes.gov/](http://www.energycodes.gov/)



# Questions??



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Thanks for Your Kind Attention



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