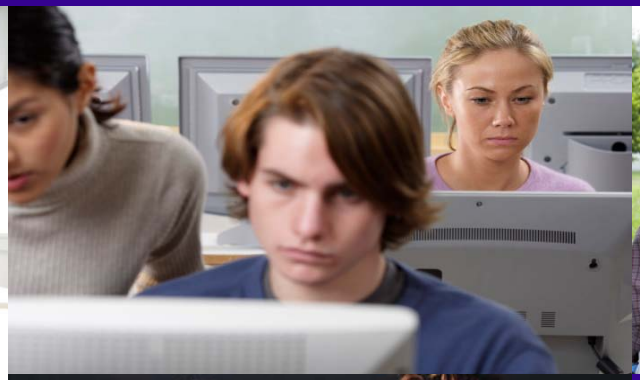
Energy Codes: Part II
Enforcement thru Education




Retired Housing & Environment Extension Specialist - Researcher

Shirley Niemeyer, Ph.D.
UNL Emeritus Faculty

Code Education - Whose Responsibility?

- State of Nebraska?
  - NE Energy Office
- Code officials?
- Education Institutions?
- Builders, contractors & housing organizations?
- Utility companies?
- Business & Industry?
- County commissioners, City councils?
- Insurance institutions?
- Safety officials?
- Consumers?
- Persons who code applies to responsible for knowing?

Collaborations

Code Education: How?

Curriculum & Methods Example

Get a Head Start on Energy

Nebraska Energy Assistance Network

Curriculum

A coalition of power suppliers - companies , agencies, organizations , & educational institutions, etc.

Resources

Get a Head Start on Energy

Curriculum

Resource CD & video for all 7 modules

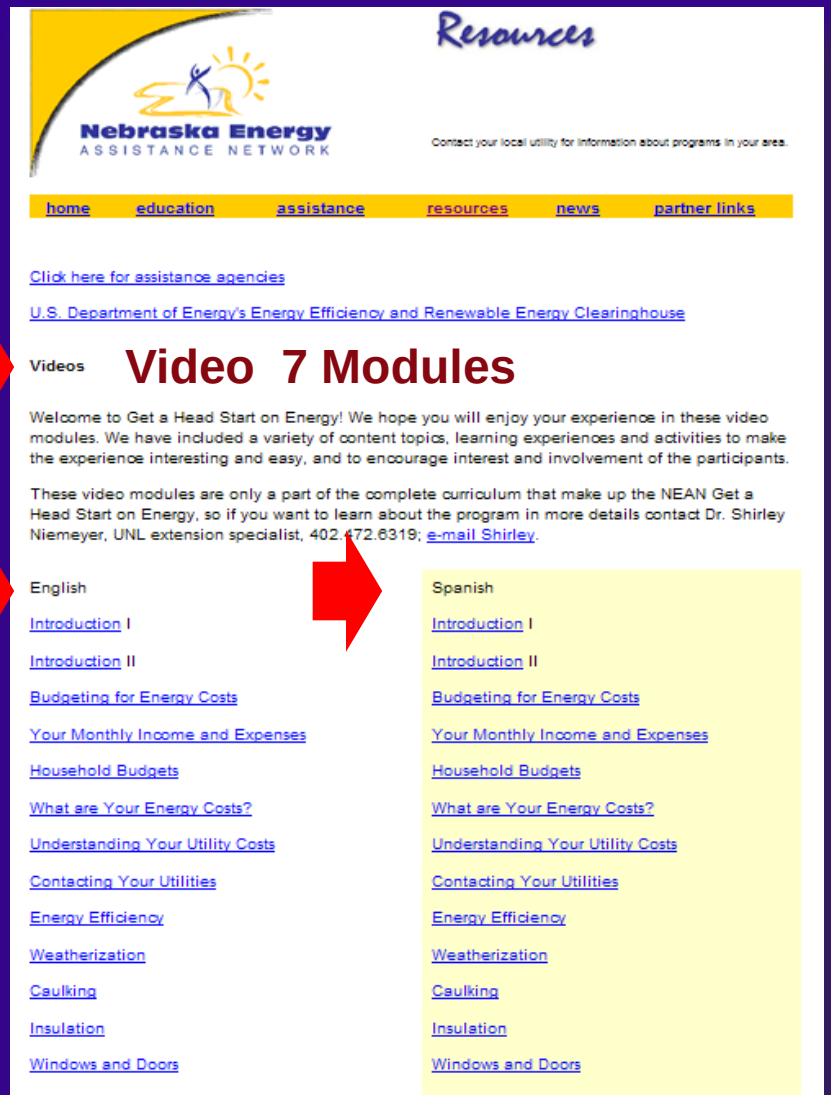
- **Spanish & English versions**
- **Videos available free at www.nebraskaenergyassistance.com**
- **DVD, with Teaching Guide notebook**

Teaching guide on Facilitators CD

- **Objectives & expected impacts**
- **Activity sheets to provide to learners**
- **Handouts to add or clarify information**
- **Pre- & post-evaluations**
- **Available free as NEAN member or purchase**

Resources: Curriculum on Web Site

www.nebraskaenergyassistance.com



How Use? Community Uses

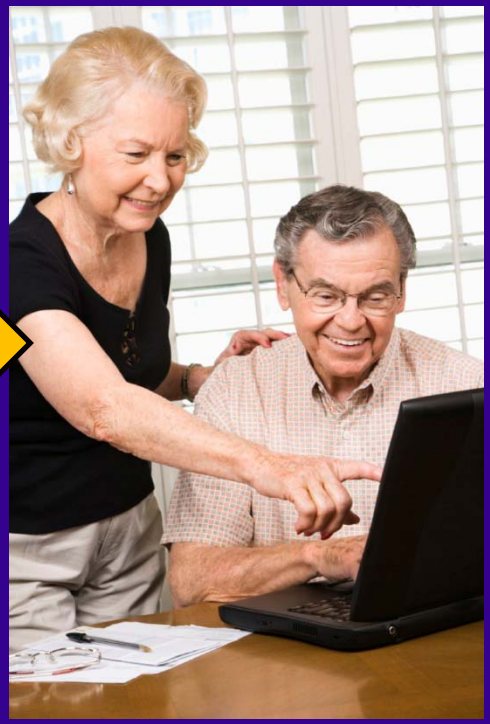
1. Use in 1-on-1 sessions with families, others
2. Use as a stand-alone program in larger groups
3. Use all or portions of materials
4. Other. . .

Get a Head Start on Energy

- Recorded Webinar: 4 Webinars on NEAN Website – to train trainers.
- View or download 7 DVD videos in English or Spanish: VERY VISUAL

  http://nebraskaenergyassistance.com/using-energy-wisely/get-a-head-start-on-energy-videos/
- Evaluation using *Survey Monkey*
- Meetings – via polycom

Interactions



Webinars Outcomes & Evaluation

Webinar 1:	74
Webinar 2:	72
Webinar 3:	70
Webinar 4:	95

- Average of 78 attendees per webinar
- Participants attended 3.45 of the 4 webinars
- evaluations returned ~1/3 of participants
- 8 received CEUs

Collaboration

Translation of English video & activities version to Spanish

Educational Displays/Marketing

Collaboration with NE Head Start, NE Health & Human Services, etc.

Univ. of FL Extension Partnerships In Education

- *Build Green & Profit:* Univ. of FL Series approved for continuing education courses for building officials & contractor licensing.
- 2- day program provides all 14 continuing education hours required by
  - Construction Industry Licensing Board &
  - Building Code Adm. & Inspections Board
- 600 classes reaching 15,000+
- Presented by FL Cooperative Extension Service
- Sponsors: Home Depot, Advanced Concepts

Code Education: How?

- **Webinars via Internet: computers, I-phones, I-pads, polycom, etc.**
- **Distance Education with INTERACTIVE & ACTIVITY materials on website – offering credits to become certified or for cont. edu.**
- **Weekly news featuring a code section or portion for public & professionals via local & area news papers/media.**
- **Coffees**
- **Other ideas?**

Why Codes for Energy? Why Education? Economics

Increase Bottom Line

Wasted Energy & More Expenses

Why Codes for Energy?

Why Education? Economics

Average Low-income HH Spent on Winter Energy Costs

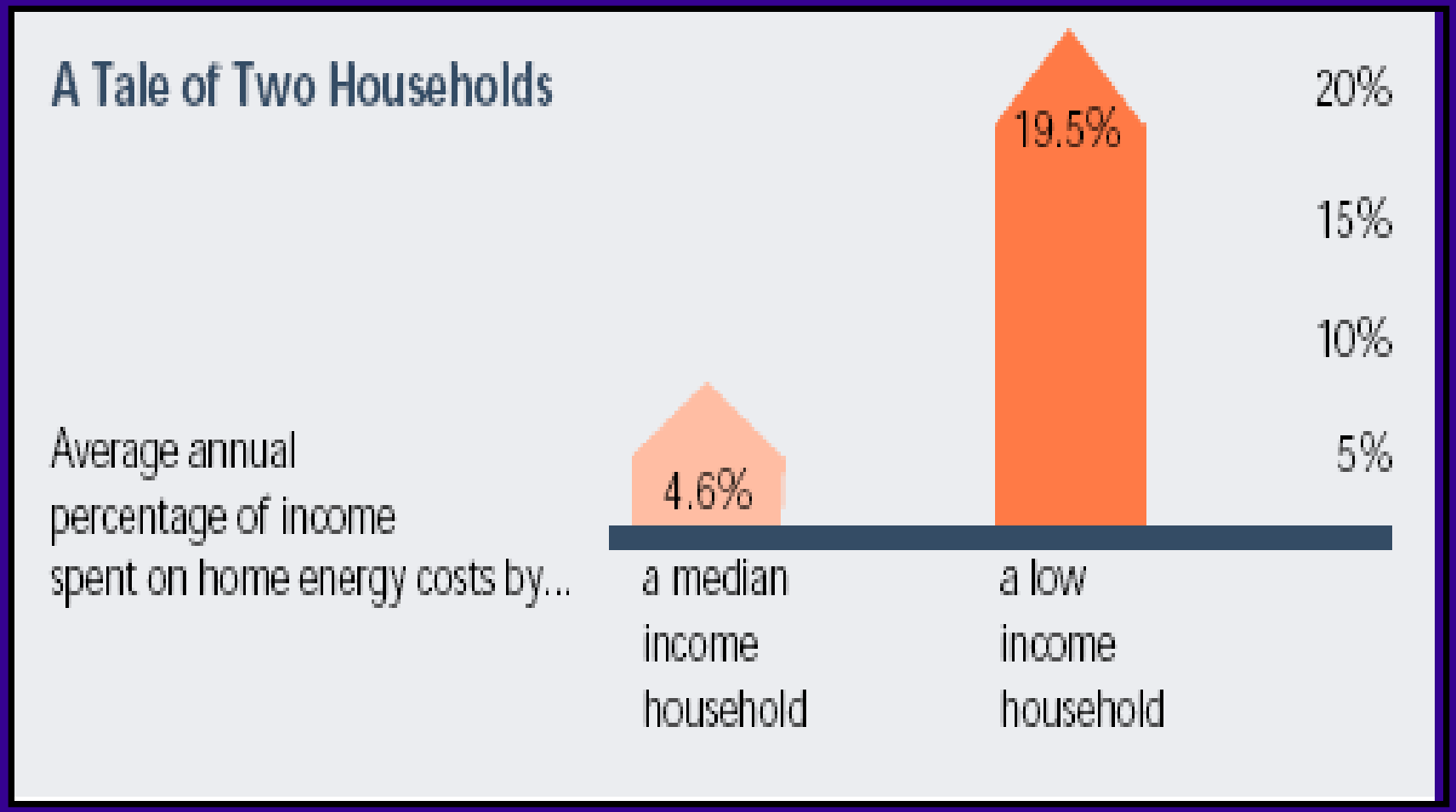
The Cold Slam: What Low-income Households Pay for Home Energy in the Winter Months, October 2000 through March 2001: ii

primary household fuel source	percentage of low-income household's using this source of fuel	total average home energy bills	annual percentage of an average low-income household's income spent on home energy costs
Natural Gas	53%	$1102	29%
Propane	4.6%	$1279	29%
Fuel Oil	9.4%	$1087	27%
Kerosene/Other	1%	$845	20%
Electricity	32.7%	$543	13%

Source: National Low-income Energy Consortium

http://www.nliec.org/facts.pdf

Why Codes? Economics What we pay?



Source: http://www.neada.org/ ***National Energy Assistance Directors' Association***
National Low-income Energy Consortium

Family's inability to pay home energy bills & consequences

Some studies have shown connection to . . .

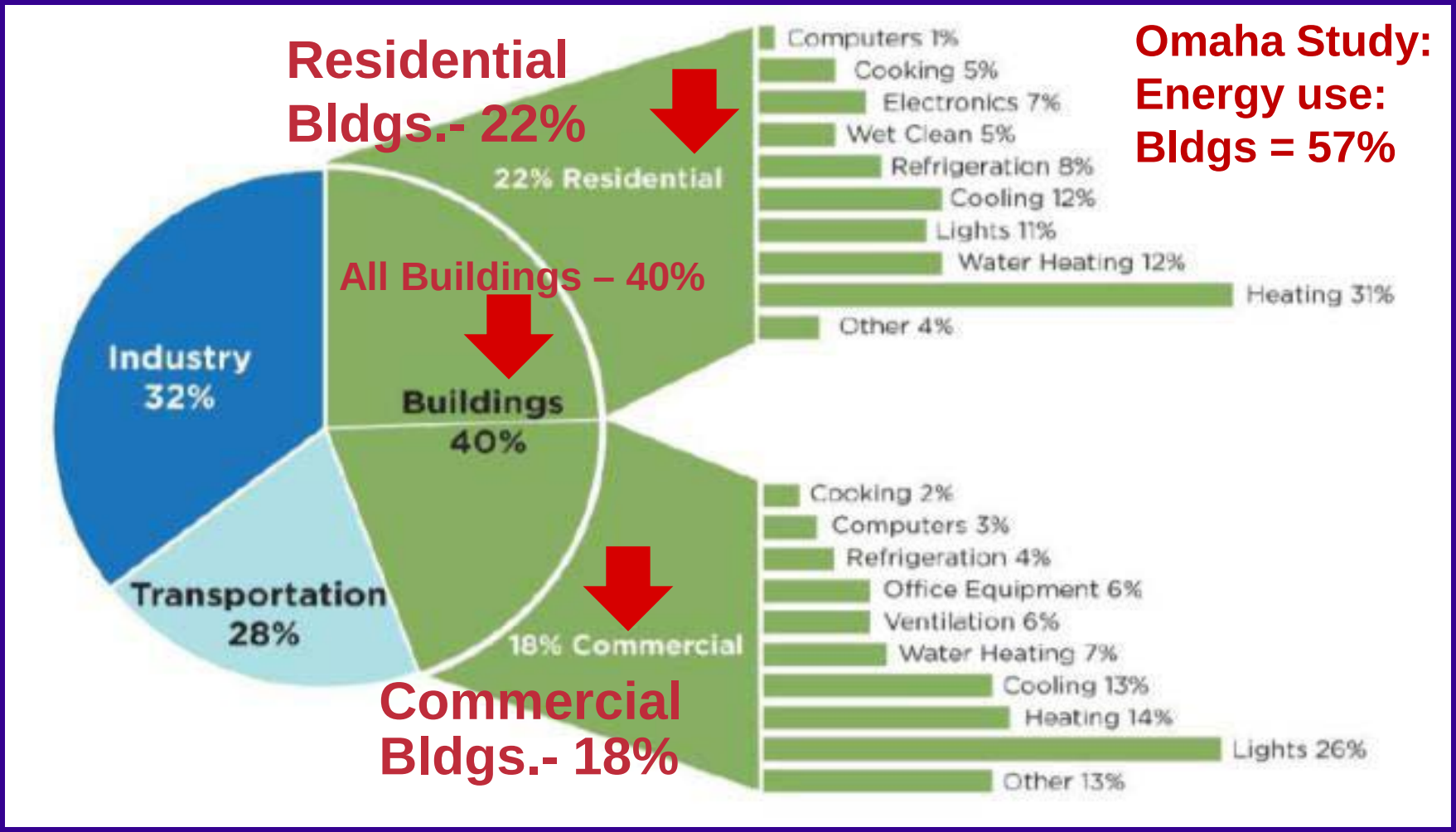
- **Homelessness**
- **Heat stroke**
- **Disintegration of families**
  - **Children removed because of loss of heat or electricity**
  - **Force to sell homes**
  - **Disruptions of child's education – move frequently**

Source: National Low Income Energy Consortium
http://www.nliec.org/cold.pdf

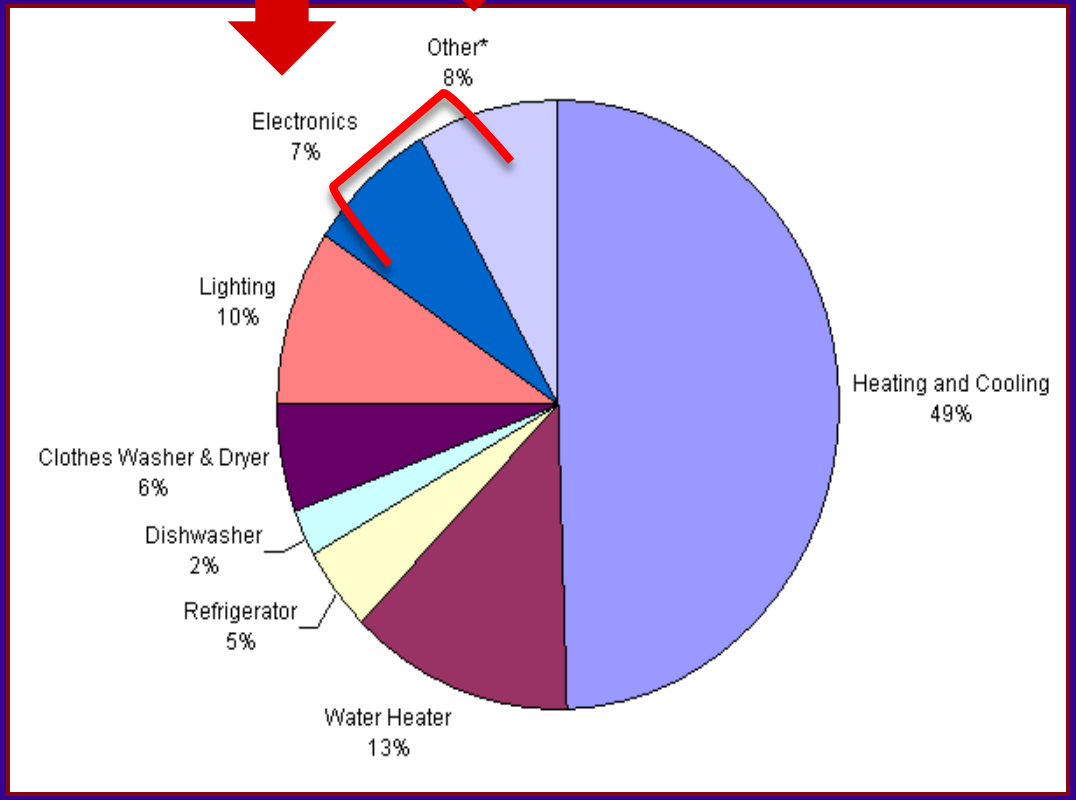
Why Codes? Safety & Health

- Indoor air quality
- Fire
- Moisture – mold
- Lead

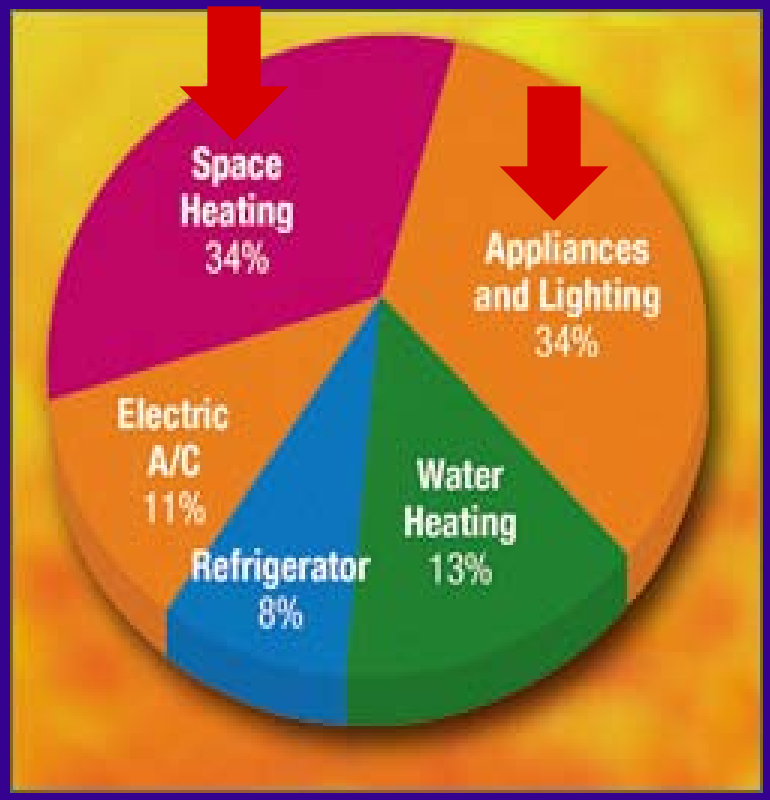
Why Codes?
Energy Use by Sectors



How Energy is Used in Home



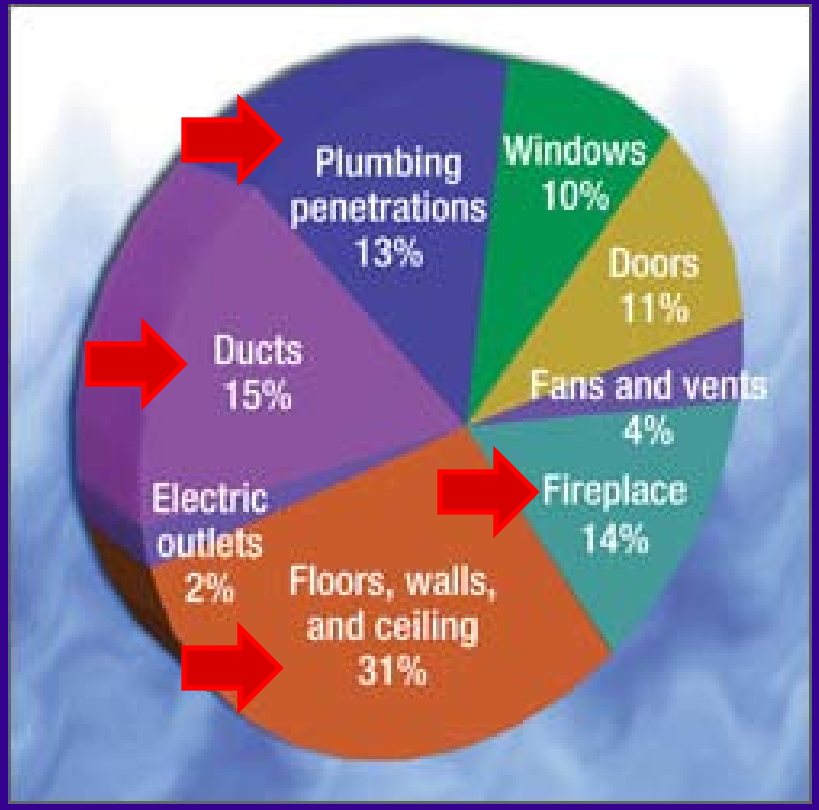
Source: Energy Star Website



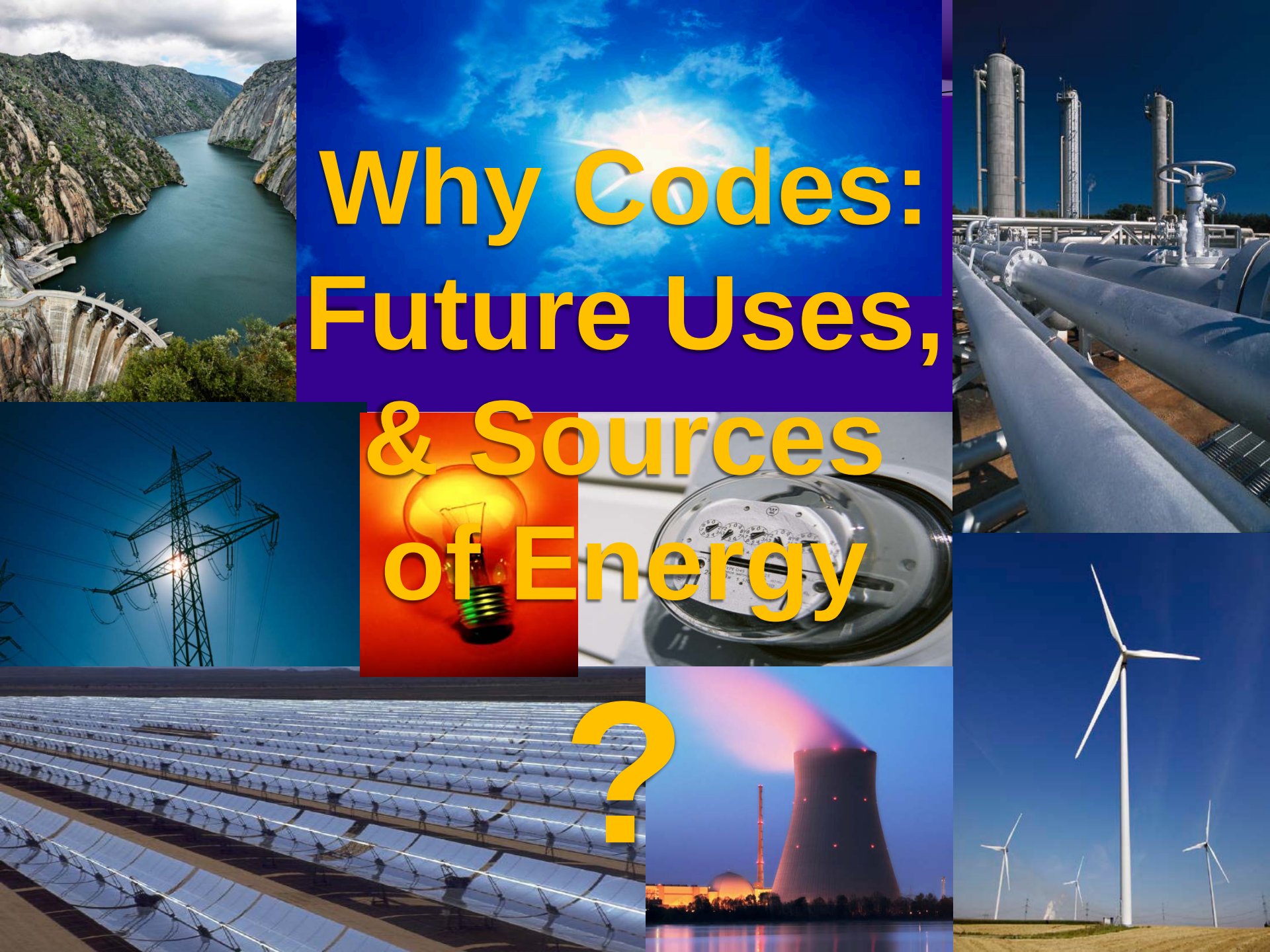
US Department of Energy

Codes Related to Energy Efficiency in Structure

Air Leaks: Air Losses & Gains



Source: US Department of Energy


Why Codes:
Future Uses,
& Sources
of Energy
?

Why Codes?

Conserving Natural Resources

- **Buildings represent . . .**
  - **Over 40% of our primary energy use**
  - **72% of our electrical consumption**
  - **55% of natural gas consumption**
  - **39% of CO_2 emissions – significant impact on atmosphere**

Source: Achieving Energy Performance – *Going Beyond Codes & Standards*
Gordon V.R. Holness P. E. Presidential Member – ASHRAE

Why Codes? Natural Resources & Environment

US Buildings' Carbon Emissions in Metric Tons

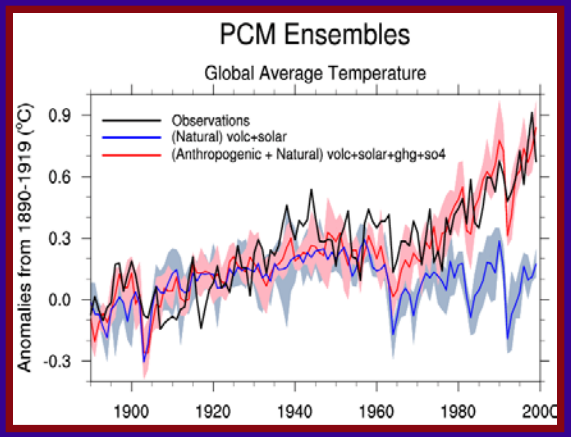
Intergovernmental Panel of Climate Change IPCC Third Assessment Report –

Climate Change 2001 Working Group I: *The Scientific Basis*
www.ipcc.ch

Energy Code Education & Enforcement - Why

- *High Plains Regional Climate Center* at University of Nebraska-Lincoln, put together a 5-page explanation of changes thus far & latest science on what is likely to happen in 6-state area covered by the High Plains Center (ND,SD. NE, KS, WY, CO)
- Average temperature in High Plains has increased 1.7° F over past 115 yrs.

  Based on a composite of climate models, U.S. climate research program projects at least another 8° F. increase by 2090.



Source: High Plains Center http://www.hprcc.unl.edu/Publications/files/HighPlainsClimateChangeGuide.pdf

Why Codes? Natural Resources & Environment

- **ND has seen its statewide winter temperature increase 5 degrees since 1895, while NE & KS have seen about a 2-degree increase.**

- **Climate scientists calculate that there is a 90% probability that temperature increase of past 60 years is a result of human activity.**

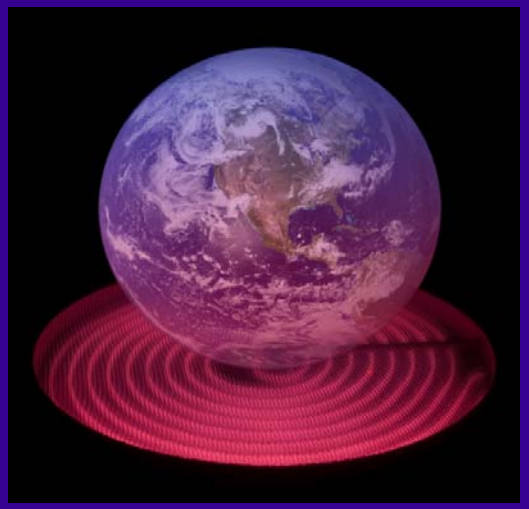
Report at:

http://www.hprcc.unl.edu/publications/files/HighPlainsClimateChangeGuide.pdf

Why Codes? Natural Resources & Environment

- "Models incorporating different greenhouse gas emission scenarios project global temperatures to increase by 2°F-11.5°F by 2100."
- "If rate of greenhouse gas emissions is reduced, the temperature increase is projected to be on lower end of range."
- "If emission rates continue at or near current rates, temperature increase is projected to be at higher end."

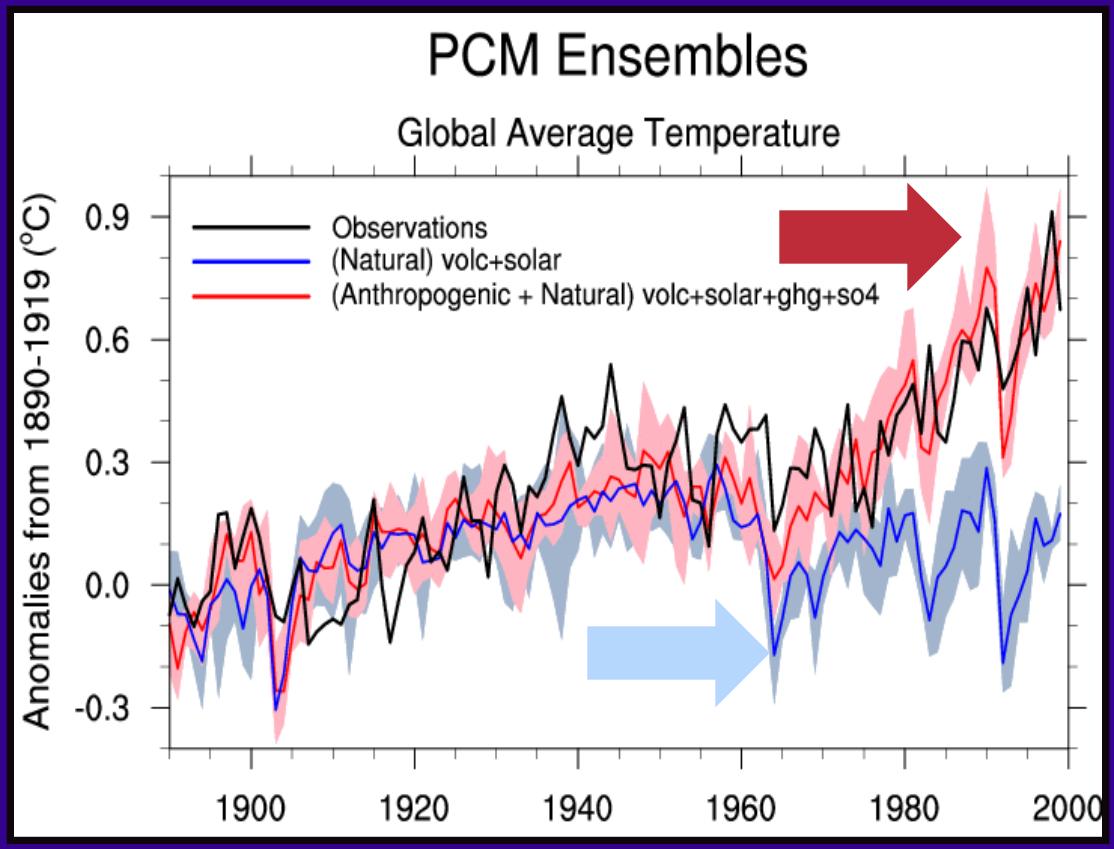
Source: U.S. Global Change Research Program (USGCRP)
http://www.hprcc.unl.edu/publications/



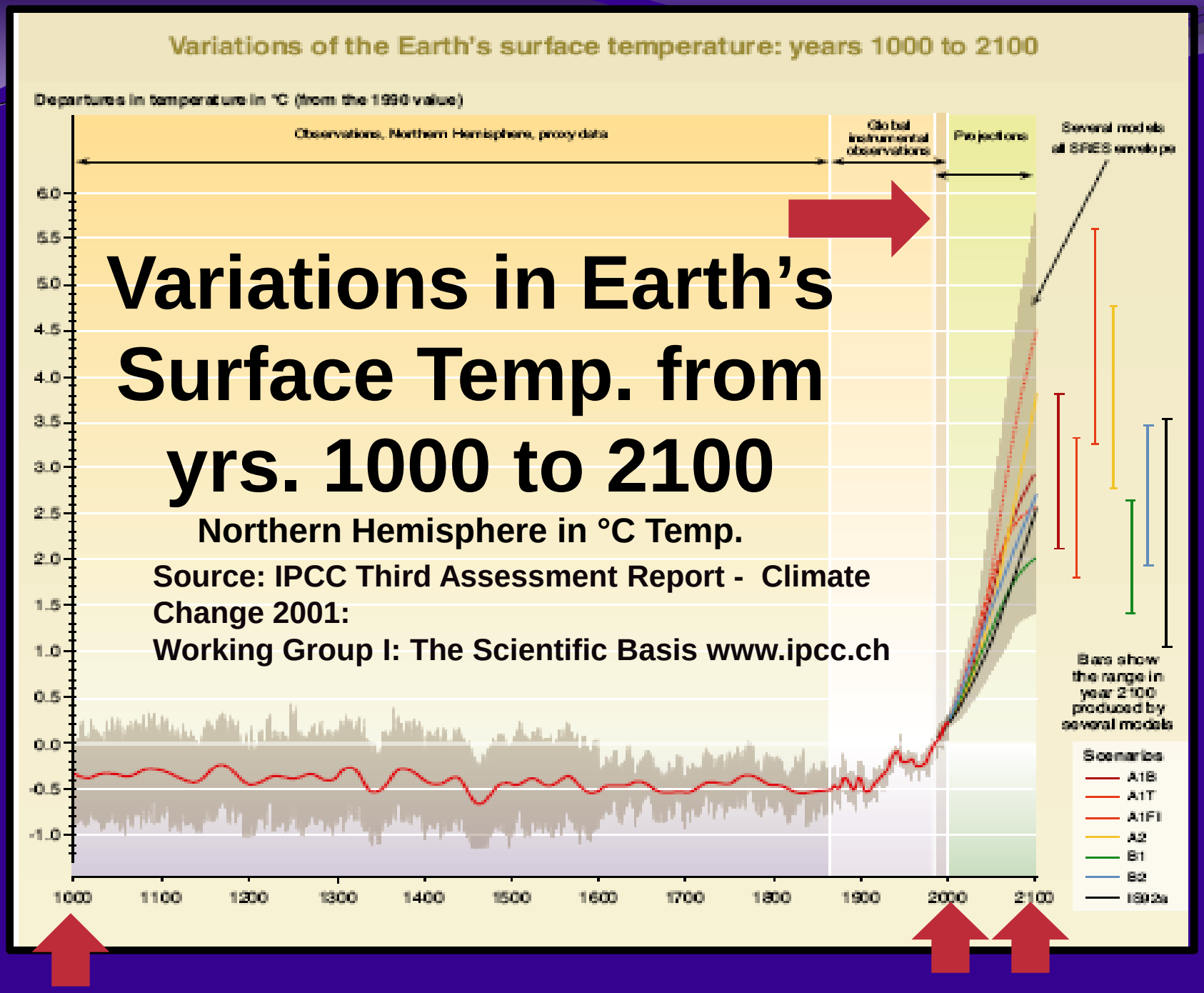
"Natural Forces Not Fully Explain Observed Late 20th Century Warming."

Source: National Center for Atmospheric Research

- "NCAR Climate model with "natural" forcings (volcanic & solar) does not reproduce observed late 20th century warming."
- "When increases in anthropogenic greenhouse gases & sulfate aerosols are included, model is able to reproduce observed late 20th century warming."



Meehl, G.A., W.M. Washington, C. Ammann, J.M. Arblaster, T.M.L. Wigley, & C. Tebaldi, 2004: Combinations of natural & anthropogenic forcings & 20th century climate. J. Climate, 17, 3721-3727.



Variations in Earth's Surface Temp. from yrs. 1000 to 2100

Northern Hemisphere in °C Temp.

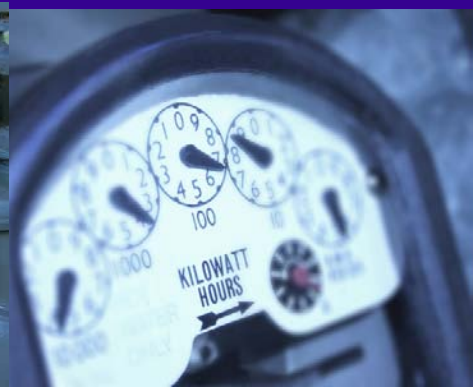
Source: IPCC Third Assessment Report - Climate Change 2001:
Working Group I: The Scientific Basis www.ipcc.ch

Why Codes? Natural Resources & Environment

- **"*Climate change is real, & human activities have a profound effect on the way in which it is occurring*."**

  Source: Clinton M. Rowe, R. J. Oglesby, M. R. Anderson, M. Shulski & A. L. Houston at UNL with the earth & atmospheric sciences and/or School of Natural Resources.





Why Codes? Natural Resources & Environment

- **5 University of Nebraska-Lincoln climate scientists signed a statement . . .**
- **“*It is time to stop debating & start taking action on climate change.*”**

Why Codes – U.S. Homes

- "Since 1990, growth in CO_2 emissions from residential sector averaged 1.9% /year
- 32.7% of total increase in U.S. energy-related CO_2 emissions since 1990."
- "Long-term trends in residential CO_2 emissions strongly influenced by living space attributes, & building shell & appliance efficiency choices & demographics." Source: U.S. DOE

Why Code Education?

- **"The national model for building energy codes has potential of making homes & businesses up to 30% more energy efficient thus lowering energy bills & saving money."**
- **"Unfortunately studies have indicated that compliance with these codes is as low as 16% & many jurisdictions struggle to obtain a 50% compliance rate. Source: National League of Cities Webinar: Streamlining Code Compliance, Sept. 21, 2012**

Energy Use? What is Possible?

- **New Buildings**
  - **50% to 55% energy use reductions achievable on a cost effective basis on new building construction - U.S. National Renewable Energy Laboratory studies.**

    Achieving Energy Performance – Going Beyond Codes & Standards, Gordon V.R. Holness

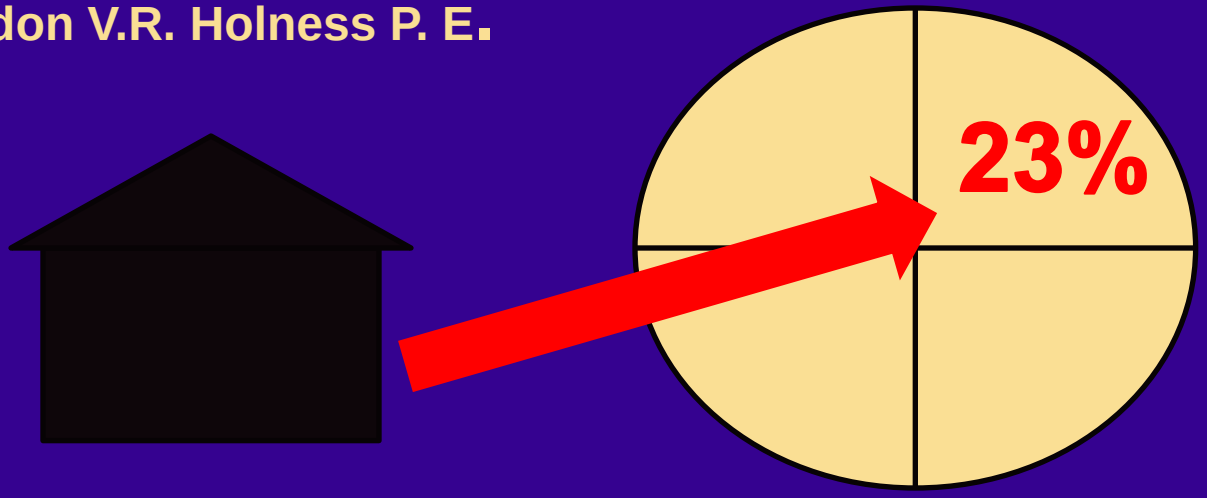
- **Existing Buildings**
  - **"There are significant opportunities for building energy savings, but may need financial incentives to effectively move the marketplace."**

Sources: Mckinsey Global Institute Studies *Achieving Energy Performance – Going Beyond Codes & Standards*, ordon V.R. Holness P. E.

Codes: What is Possible?

- **Programs could reduce total building energy use in US by 23% by 2020 while offering a 17% annualized return on investment.**

Source: ***Achieving Energy Performance – Going Beyond Codes & Standards,*** **Gordon V.R. Holness P. E.**



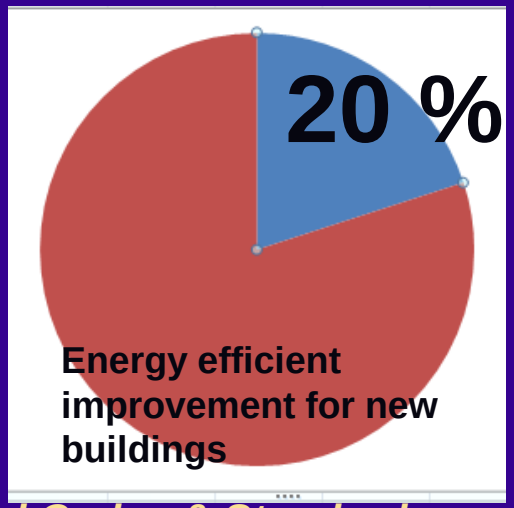
What Has Been Achieved?

How effective efforts been in reducing total building energy use?

1992 *Commercial Building Energy Consumption Survey* by DOE Energy Information Agency
www.eia.gov/emeu/cbecs/ess.html

- 1993 - Indicated <u>average</u> annual building consumption intensity of 90.5 kBtu/sf.yr. (existing & new construction)

- 2003 survey showed hardly any change at 90.1 kBtu/sf.yr. despite a <u>20% improvement in energy efficiency for new building construction.</u>



Source: Achieving Energy Performance – *Going Beyond Codes & Standards*
Gordon V.R. Holness P. E. Presidential Member – ASHRAE

What Has Been Achieved?

- Part attributed to
  - Ratio of new buildings to existing building stock
  - Significant increases in plug & process loads (computers, printers, cooking equipment, elevators, etc.).
  - Lack of progress related to effectiveness of implementation & enforcement of building codes.

Source: *Achieving Energy Performance – Going Beyond Codes & Standards* Gordon V.R. Holness P. E. Presidential Member – ASHRAE

What Has Been Achieved?

- **New construction**
  - **2% of all construction projects**
  - **14% of construction costs**
- **Retrofit existing buildings**
  - **86% of construction dollars go to retrofit existing buildings, which have been minimally impacted by energy codes.**

Source: Achieving Energy Performance
– *Going Beyond Codes & Standards*
Gordon V.R. Holness P. E. Presidential Member – ASHRAE

What is Happening?

Increase in Sq. Ft. & Electronics/Equipment?

Homes built since 1990 on average 27% larger than homes built in earlier decades Source:. Residential Energy Consumption Survey (RECS) 2009

Bigger, More Appliances & Electronics, & More Natural Resources to Build, Maintain & Operate Housing

What is Happening? Why?

2010 U.S. Persons Per Household = 2.58 persons/hh
1950 U.S. Average = 3.37 p/hh

Source: U.S. Census

New Home Characteristics	1950	1970	2003
Average sq. ft.	983	1,500	2,330
2,400 sq. ft. +		10%	38%
4 bedroom	1 %	24%	37%
1 ½ bathrooms or less	96%	52%	5%
2-car or more garage		39%	82%

Source: NAHB 1998 Housing Facts, Figures & Trends

Appliances, Electronics & Misc. Energy Growth

- From 1995 to 2005 total residential electricity consumption doubled to 4.5 quads (EIA).

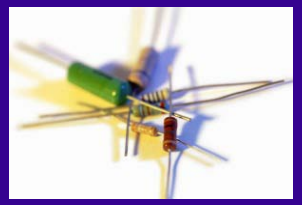
- Of this, ~ 28%, or 1.3 quads, could be attributed to 'other' or miscellaneous energy consumption.

Source: *How Small Devices are Having a Big Impact on U.S. Utility Bills http://www.energystar.gov/ia/partners/prod_development/downloads/EEDAL-145.pdf*

Appliances, Electronics & Misc. Energy Growth

- Electronics products 13% of total home electric consumption; almost 3 x level in 1980 Source: (Building Energy in the 1980's & Annual Energy Outlook 2005, EIA).[5]
- By 2015: EIA projects . . .
  - Residential electricity consumption to increase 20% from 2005 levels, to 5.4 quads.
  - Lighting will still be at ~ 18% of total
  - Space heating, water heating, AC & major appliances will consume smaller % of energy than in 2005.
  - However: total miscellaneous category is projected to grow to 34%

Appliances, Electronics & Misc. Energy Growth



- **Proliferation** of home computer equipment & consumer **electronics,** other devices (power tools, portable appliances, & personal care products, etc.

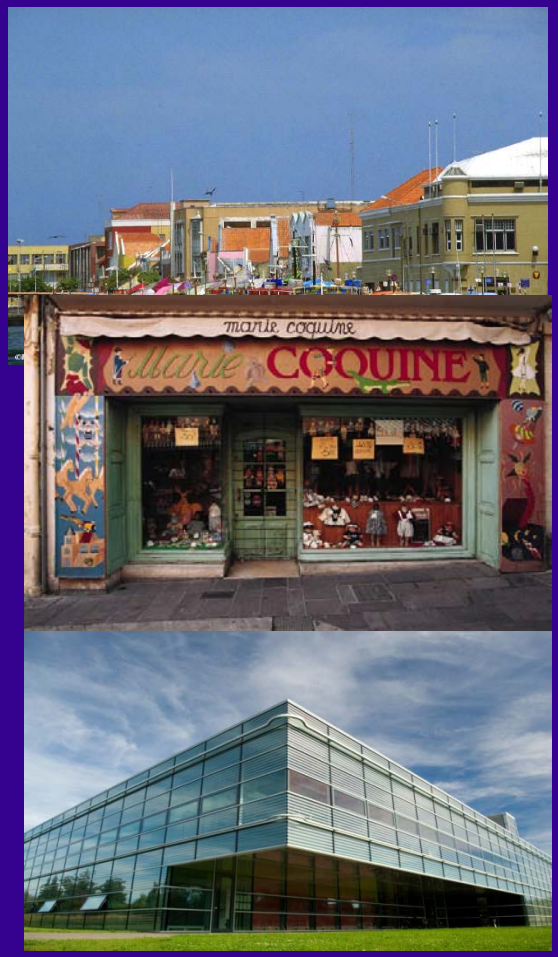
- Breadth of **devices grows continuously,** driven by technological innovation designed to meet surging consumer demand & changing lifestyles.

Need More Work
Create Demand & Supply for Code Education

- Message of energy codes & building/remodeling for energy efficient structures **must go beyond . . .**
  - Building community
  - Building owners & home owners
  - Landlords
  - Decision makers & policy makers
  - Etc.

Role of Codes? Need More Work

- To make more progress on reducing building energy use, place greater emphasis on improving our existing building stock.



Source: Achieving Energy Performance –
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Presidential Member – ASHRAE

Need More Work?

Existing buildings – residential/commercial

- **How do existing codes in your area or jurisdiction address existing building remodels/renovations as they relate to energy & efficiency?**
- **How reach/educate small one or more person remodelers working with smaller remodels?**
- **What codes apply to renovations or remodels? To replacing equipment?**

Need More Work?

- **Problem: Keeping new buildings operating efficiently.**
  - **Building performance can deteriorate as much as 30% in first 3 to 4 years of operation.**
  - **Commissioning & retro-commissioning reduces performance decay.**

- Source: Achieving Energy Performance –
- Going Beyond Codes & Standards
- Gordon V.R. Holness P. E.

Need More Work?

- Retro-commissioning of existing buildings can result in energy savings of 10% to 40% by improving operational strategies.
- $0.20 to $0.50 per sq./ft cost returned in less than 1 yr. through energy savings of at least 15%
  - Source: Building Commissioning Association (www.bcxa.org).

Energy Codes: Part II
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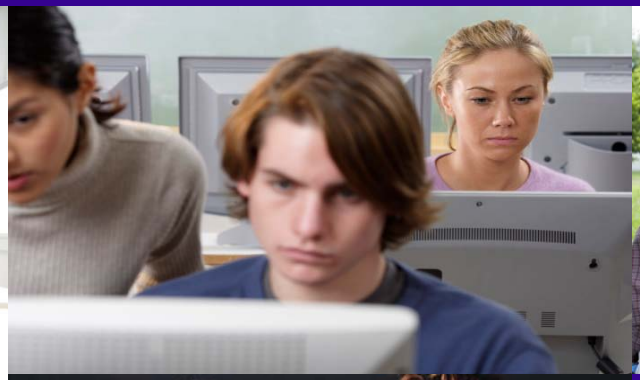




Retired Housing & Environment Extension Specialist - Researcher

Shirley Niemeyer, Ph.D.
UNL Emeritus Faculty

- U.S. contribution of global greenhouse gas emissions: about 20% of world total
- U.S. population 5% of world's population.
- Greenhouse gas emissions have increased 70% between 1970 & 2004

Code Education: How?
Curriculum & Methods Examples