Towards a Climate-Friendly Built Environment

Presented to:

Legislative Commission on Global Climate Change

Presented by:
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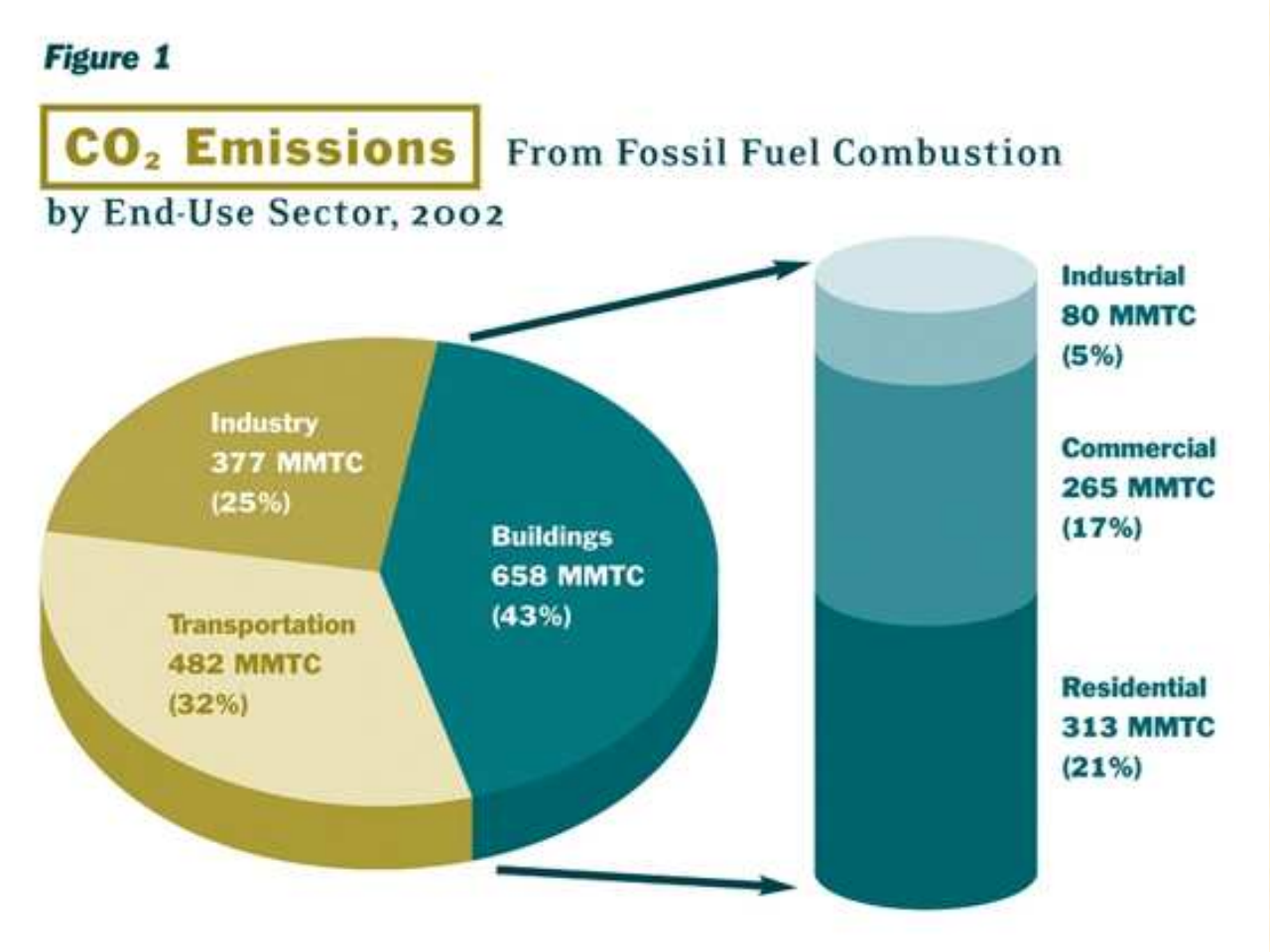
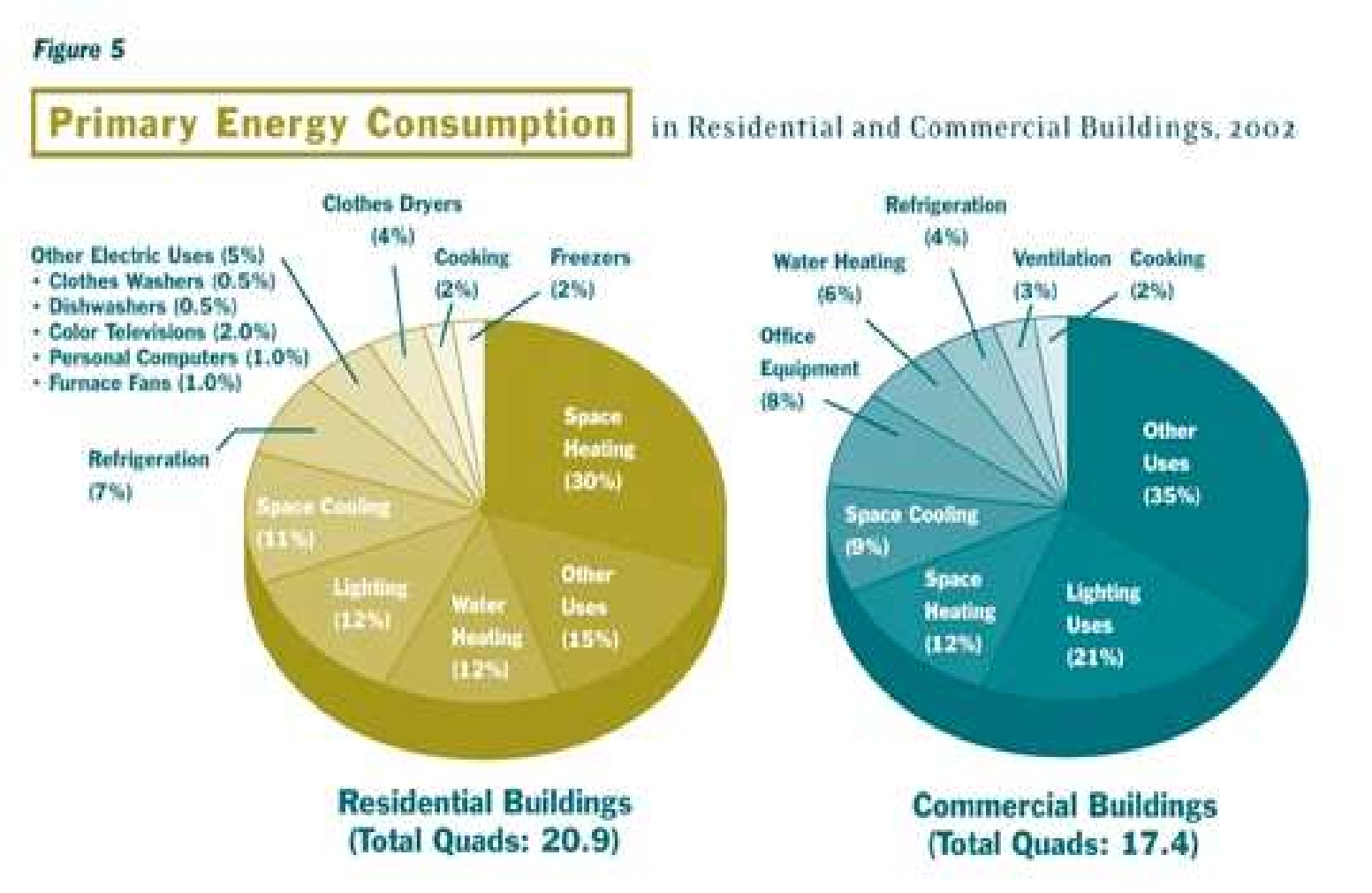
Much of the material for this talk is drawn from: *Towards a Climate-Friendly Built Environment,* Sponsored by the Pew Center on Global Climate Change (June, 2005) (http://www.pewclimate.org/global-warming-in-depth/all_reports/buildings/index.cfm).

Three Closely Linked Global Challenges Call for a Broad Response

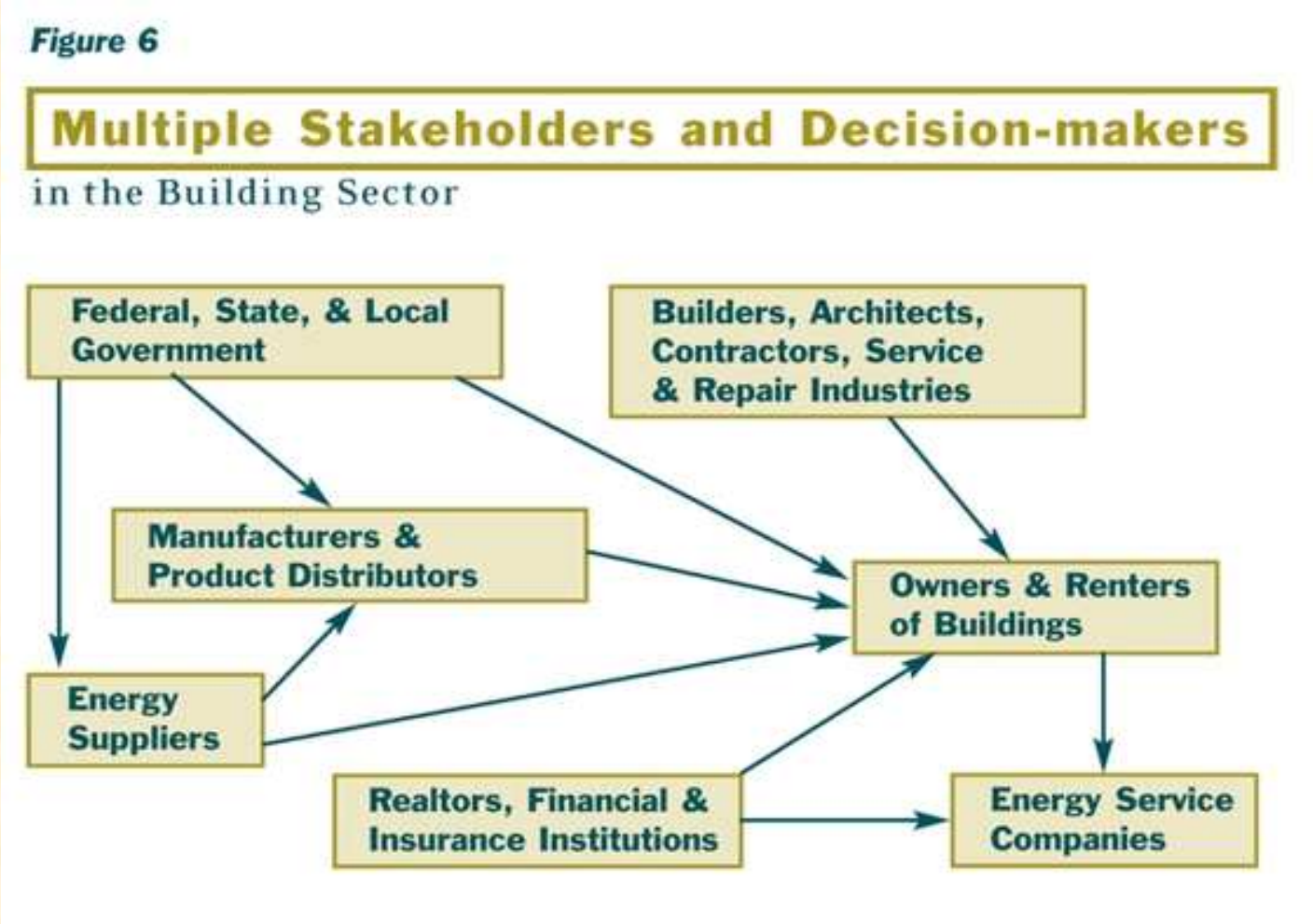
≈ 43% of US CO_2 Emissions are from the Energy Required by Buildings



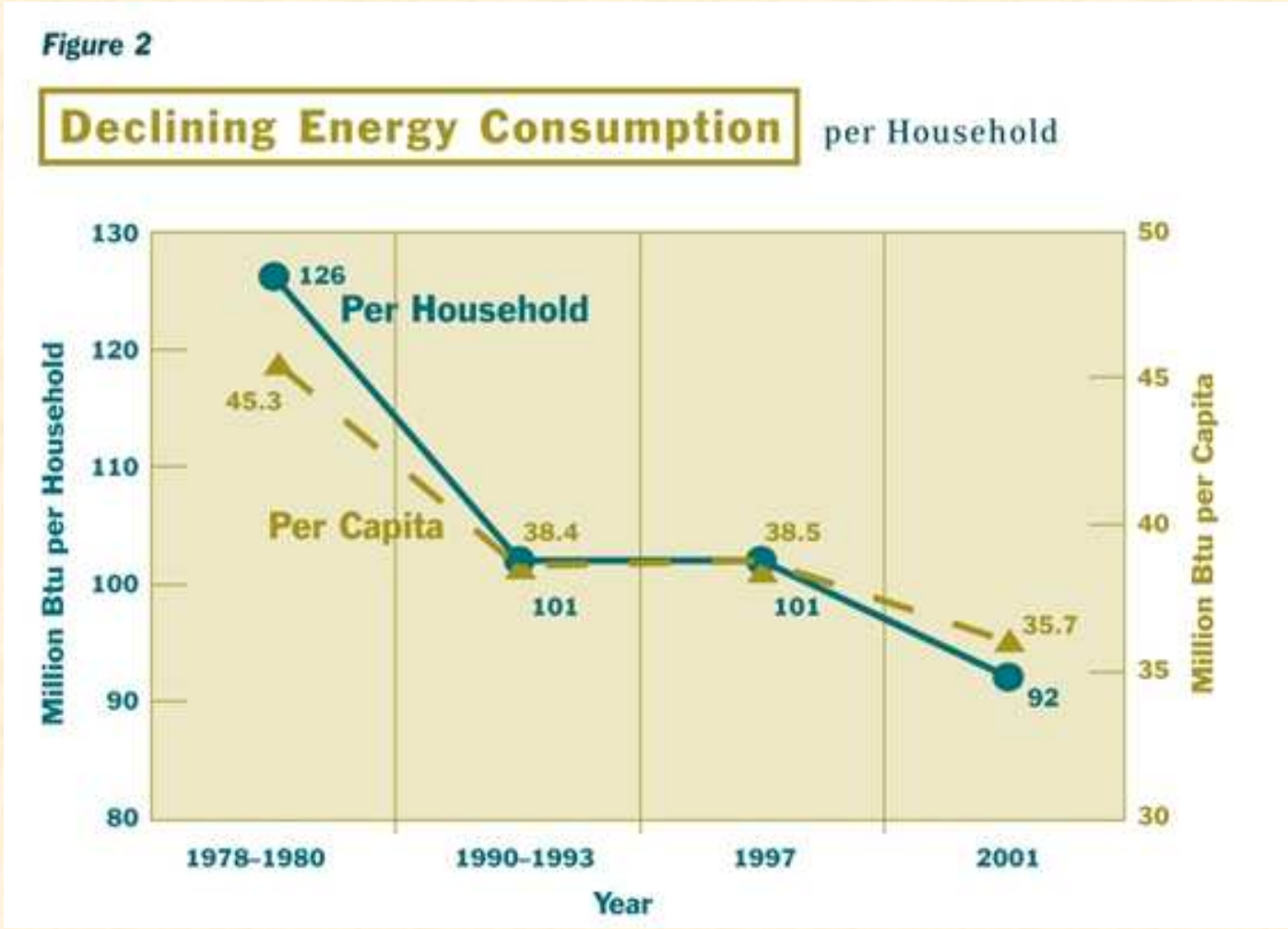
Diverse Sector, Diverse Uses



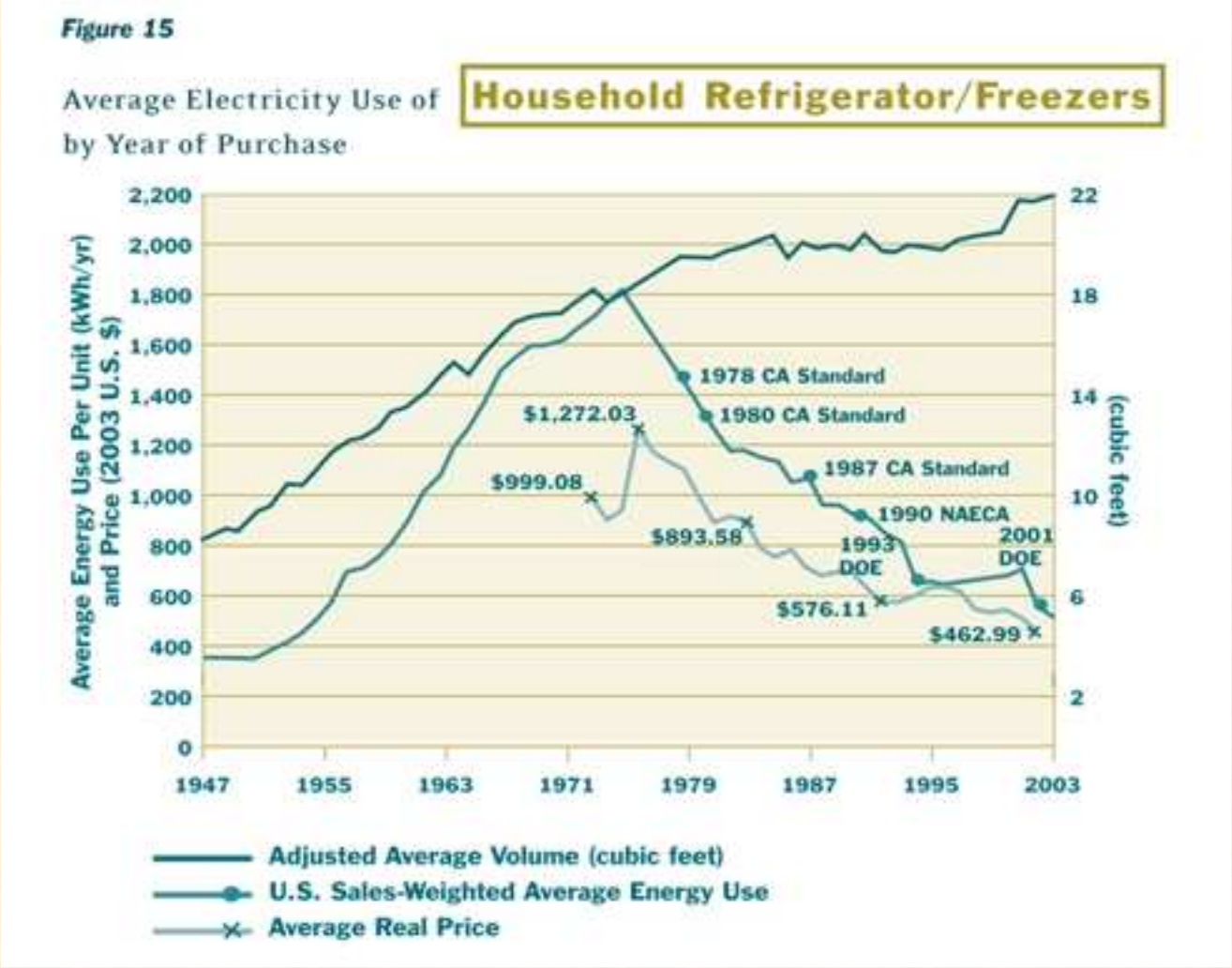
The Fragmented Building Industry Inhibits Innovation and Change



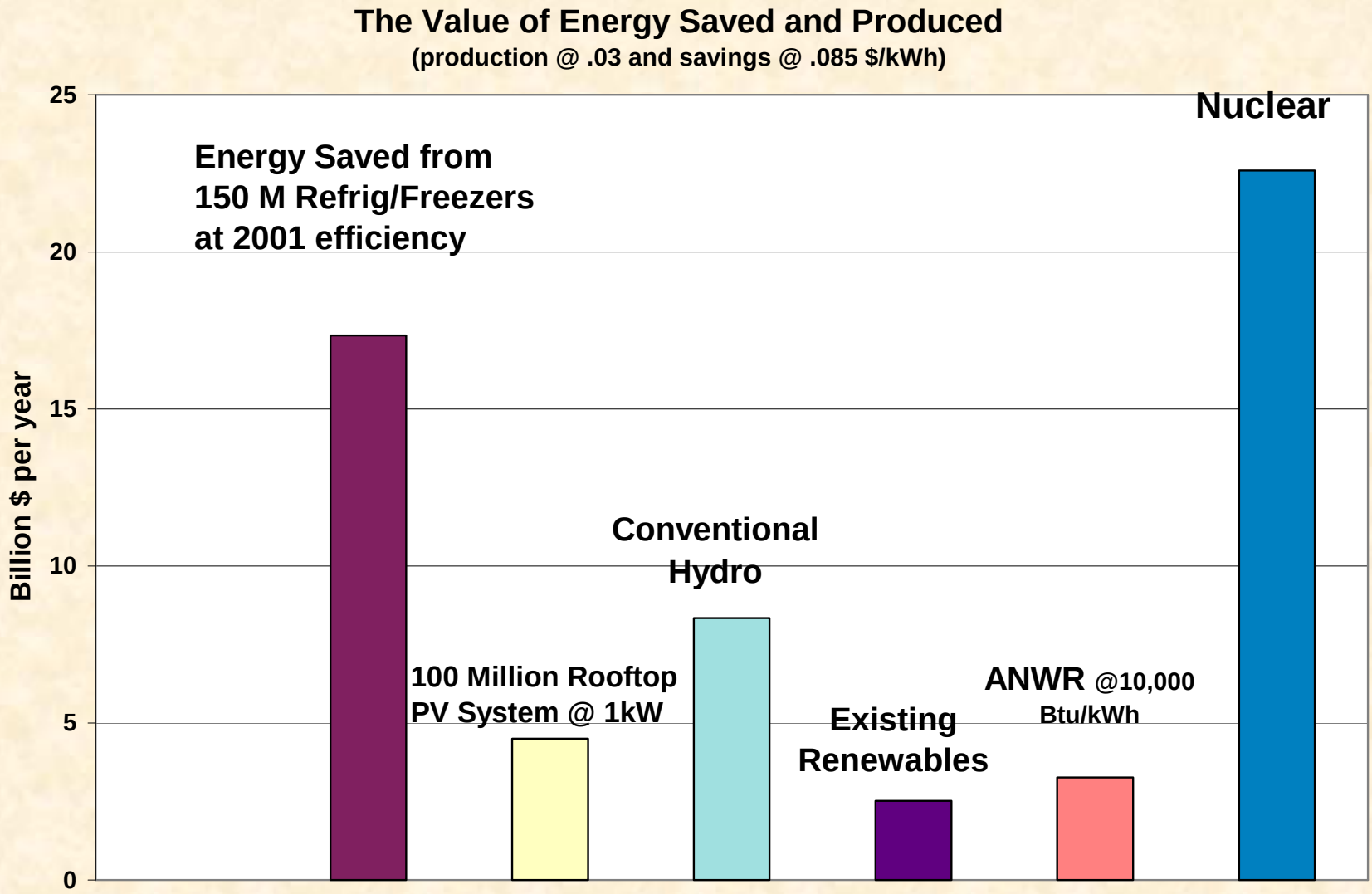
Past Success in Reducing GHGs from the Buildings Sector



Household Refrigerator Illustrates Potential for Improved Efficiency



Value of Energy Saved & Produced



Source: Art Rosenfeld, 2005

Future Energy Challenges Require Eliminating More Energy Waste

- **In the U.S. over the next 30 years:**
  - **Most of the current stock of buildings will still be occupied**
  - **The built environment will grow by 70%**
  - **New energy services in buildings will continue to expand**
  - **GHG emissions from buildings are expected to increase ~ 1.5% per year**

Opportunities for Improvement are Great

- The full complement of cost-effective climate-friendly technologies are rarely used
- Renewable energy only a small fraction of energy used on-site
- Sprawling urban landscape has spawned ever-longer trips
- Life cycle issues suggest the need for an integrated approach

Emerging Energy Technologies Could Make a Difference

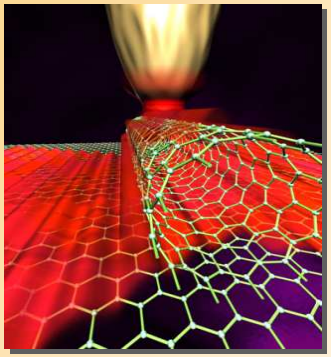
- Sealing methods that address unseen air leaks
- Electrochromic windows
- Unconventional water heaters (solar, heat pumps, tankless…)
- Inexpensive nanocomposite materials for solar energy
- Thermoelectric materials that transform heat into electricity
- Abundant sensors dispersed to continuously optimize operations
- Solid state lighting
- Selective water sorbent technologies for geothermal heat pumps
- 80-90% efficient integrated energy systems

New Scientific Discoveries Can Transform Current Technologies

New energy technologies

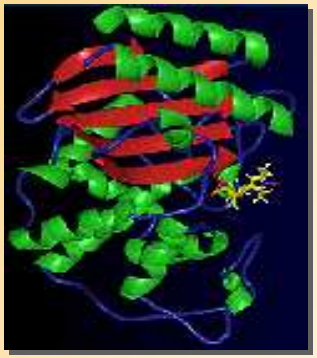
Science to meet energy needs

Nano



Manipulating atoms

Bio

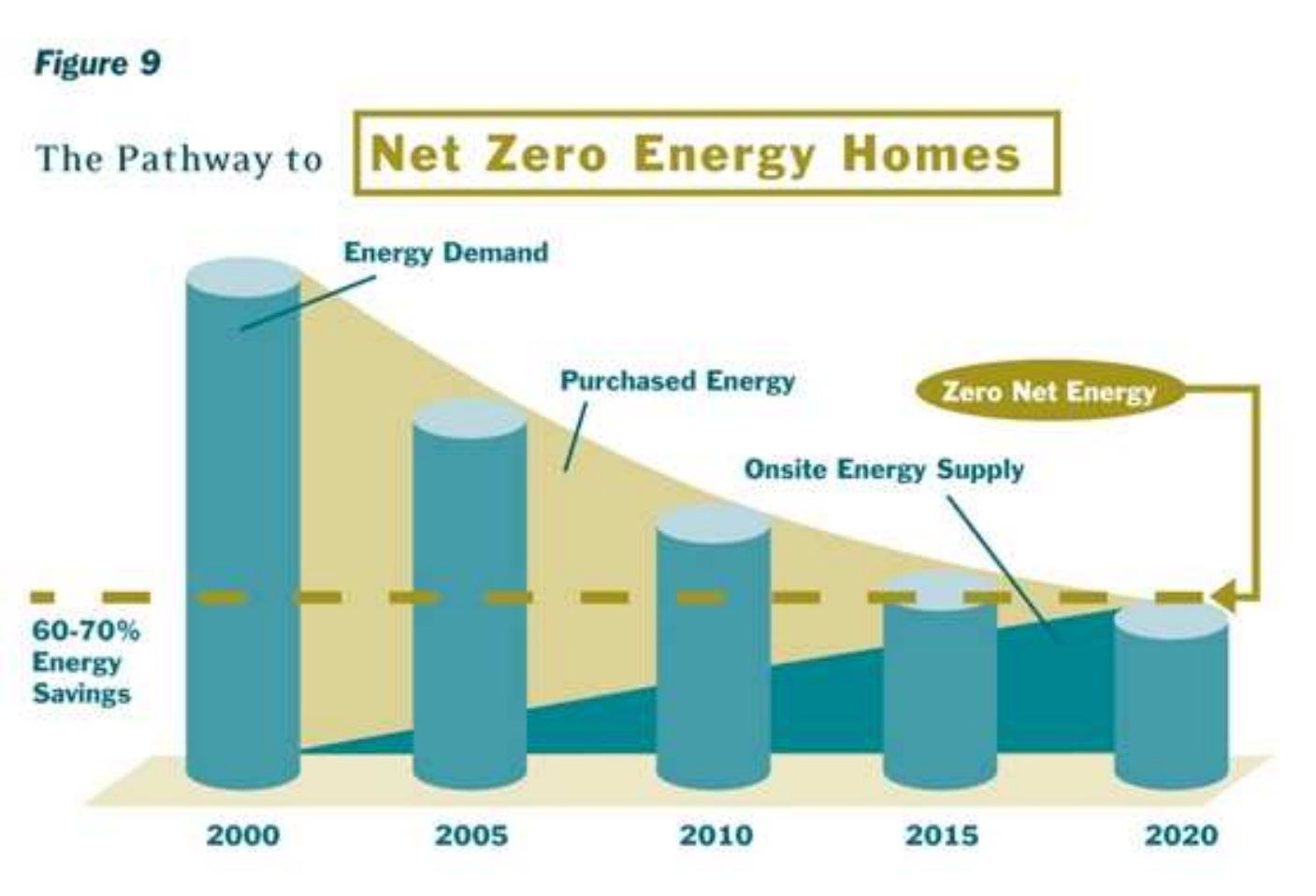


DNA to living organisms

Info

PCs to petaflops

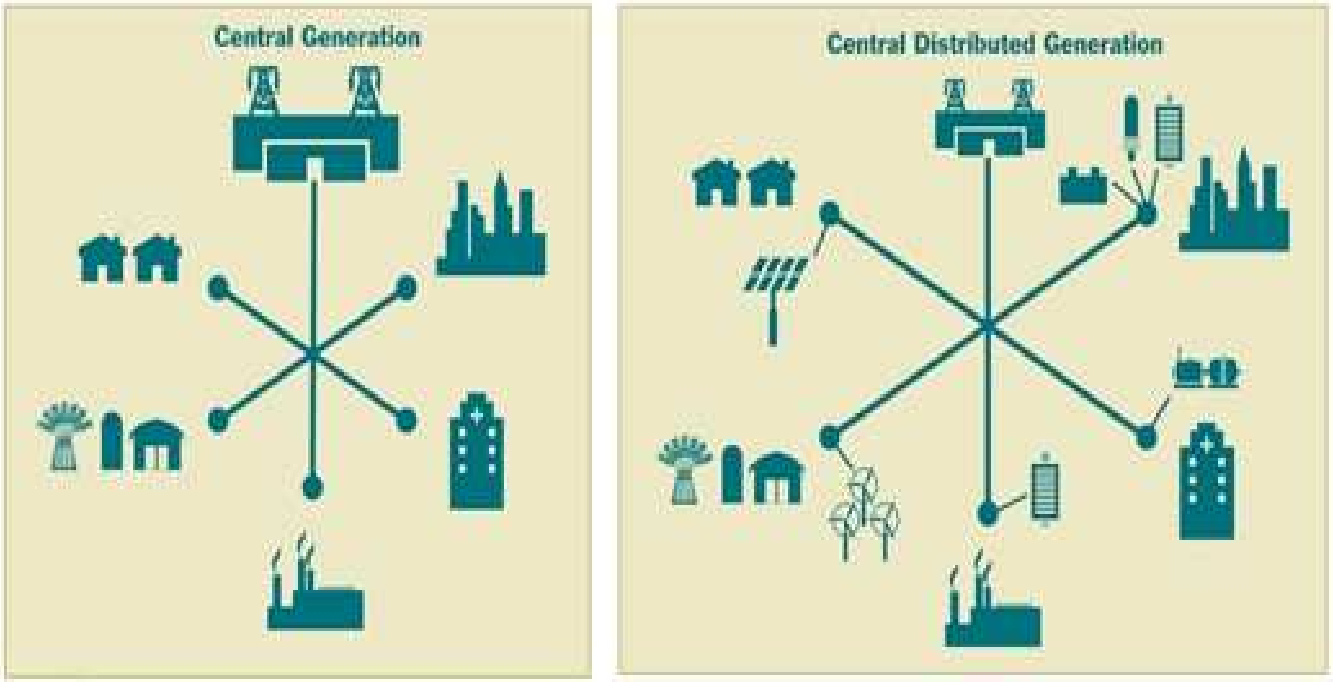
“Net Zero Energy” Homes Show Promise



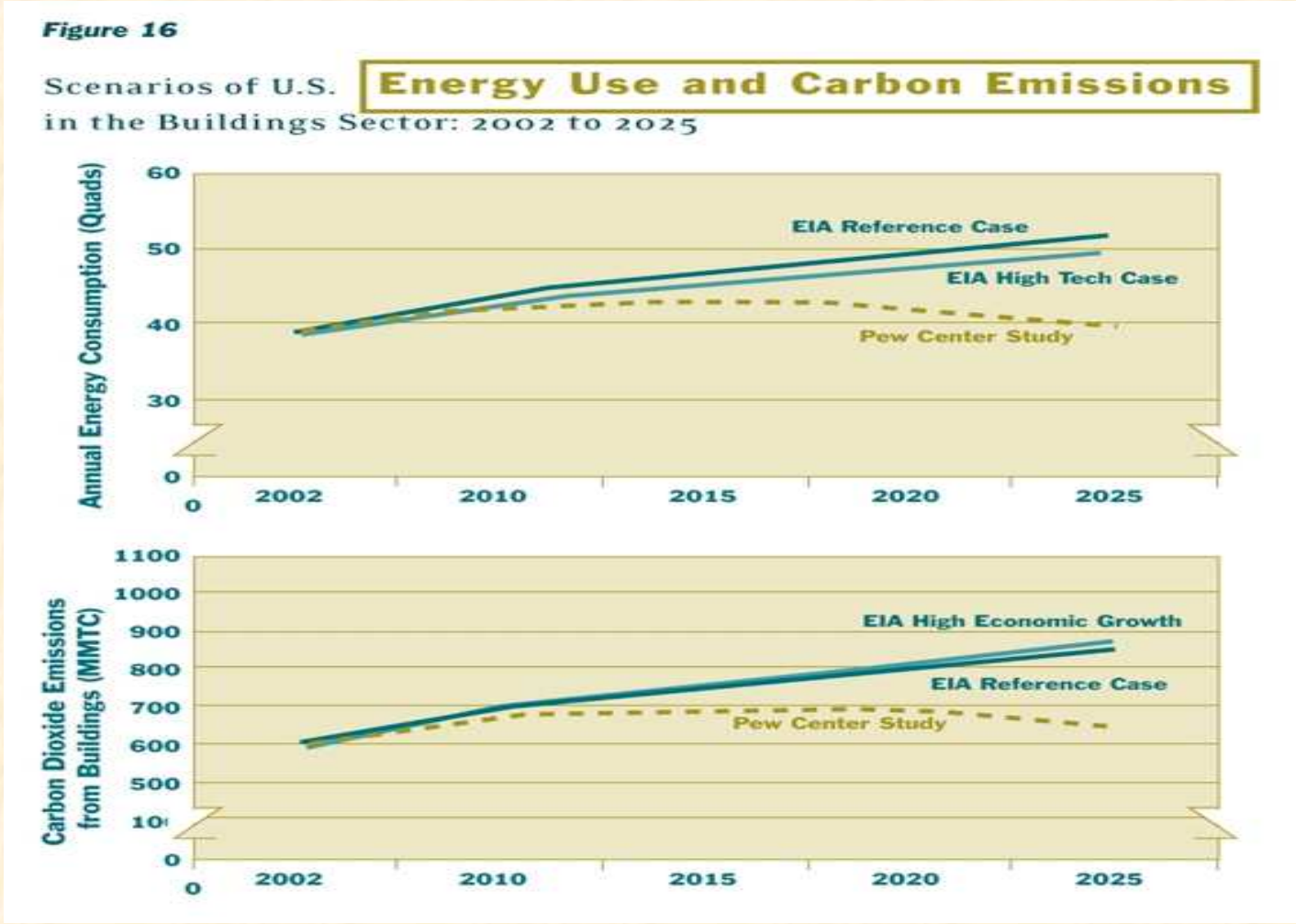
Climate-Friendly Distributed Energy is Promising Paradigm Shift

Figure 10

The Transition to **Distributed Energy Resources**



The Potential for Reduced Emissions



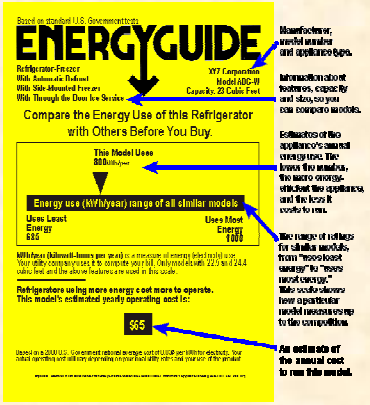
Energy Policy Act of 2005 is Stimulating Clean Energy Investments

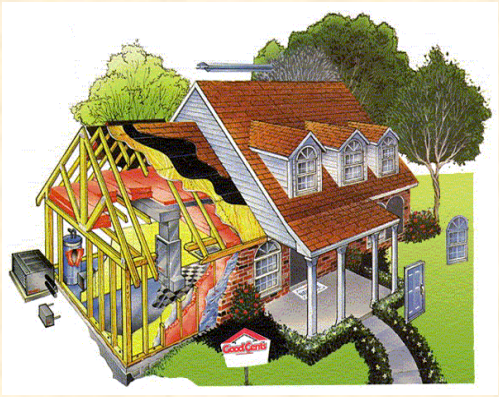
- First major energy legislation since 1992 EPACT
- Signed into law on August 8, 2005, following four years of debate
- Overall goal of the Act is to provide incentives and remove obstacles in order to:
  - Create and grow next generation of power plants, fuels, and infrastructure
  - Prepare the nation to meet the energy needs of the future

http:www.ne.doe.gov/EPAct2005/hr6_textconfrept.pdf

Energy Efficiency Provisions Include New Appliance Standards

- Legislates new efficiency standards on 12 residential and 5 commercial products
- Reauthorizes Energy Star program & divides program between EPA and DOE
- Increases authorization for Weatherization and Low Income Home Energy Assistance Programs





Tax Credits for Existing Homes

- **Consumers can receive a credit of up to 30% of the cost, or up to $2,000, for installing solar-powered hot-water systems used exclusively for purposes other than heating swimming pools and hot tubs.**
- **Consumers can receive tax credits up to a total of $500 on the amount they spend on qualified energy efficiency improvements to their home including:**
  - 10% of expenditures to improve the building envelope (The credit for new windows is limited to $200.)
  - $50 for an advanced main air circulating fan
  - $150 for a highly efficiency furnace or boiler
  - $300 credit for a highly efficient central air conditioner, heat pump or water heater

New Home Tax Credits

Business Tax Credit for homes sold by the builder or manufacturer from 01/01/06 to 12/31/07:

- **Site Built Home:**
  - **$2000 for homes 50% less heating and cooling energy than IECC code 2004 supplement**

    (1/5 from envelop improvement)

- **For HUD Code Manufactured Homes:**
  - **$1000 for Energy Star homes or homes using 30% less heating and cooling than IECC 2004 Stds.**

    (1/3 from envelope)

Tax Credit Strategies for Hot Humid Climate*

	House 1**	House 2**
• Walls	R-19 2x6	R-19 2x6
• Ceiling	R-60	R-40
• Reduced infiltration	typical	tight
• Air conditioner	SEER 15	SEER 13
• Furnace	AFUE 92.5	AFUE 80
• Ducts	inside	inside
• Estimated cost	$1,635	$1,112

* Two story 2500 ft sq house slab on grade with 18% window to floor ratio.

** These are representative strategies. Builders must conduct their own analysis to determine the changes to their homes to qualify for the tax credit.

Tax Credits for Commercial Buildings

- A deduction up to $1.80/sq. ft. to owners or tenants of new or existing commercial buildings that save 50% of heating, cooling, water heating, and interior lighting energy cost of a building that meets ASHRAE Standard 90.1-2001
- Partial deductions of up to $.60 per sq. ft. can be taken for comparable reductions from any one of three building systems
- For government-owned buildings, the deduction may be taken by the building or system designer

EE Activity is Legislated for Federal Sector

102: Annual energy reduction goal of 2% from FY 2006 – FY 2015. Reporting baseline changed from 1985 to 2003

105: Reauthorizes ESPCs through September 30, 2016

109: Buildings to be designed to 30% below ASHRAE standard or International Energy Conservation Code unless proven to be not life-cycle cost-effective

203: Renewable electricity consumption by the Federal government can not be less than:

- **3 percent in FY 2007 – FY 2009**
- **5 percent in FY 2010 – FY 2012**
- **7.5 percent in 2013 and thereafter**

204: Establishes a photovoltaic energy commercialization program in Federal buildings

Install 20,000 solar energy systems in Federal buildings by 2010

Lots of Additional EE Activity is Legislated

106: Authorizes voluntary industrial energy-efficiency agreements and establishes an Advanced Building Efficiency Testbed program ($6M/year)

132 & 134: Directs DOE to create an Energy Efficiency Public Education program and public awareness campaign

139: DOE to conduct a study of utility-run state and regional demand-side management programs

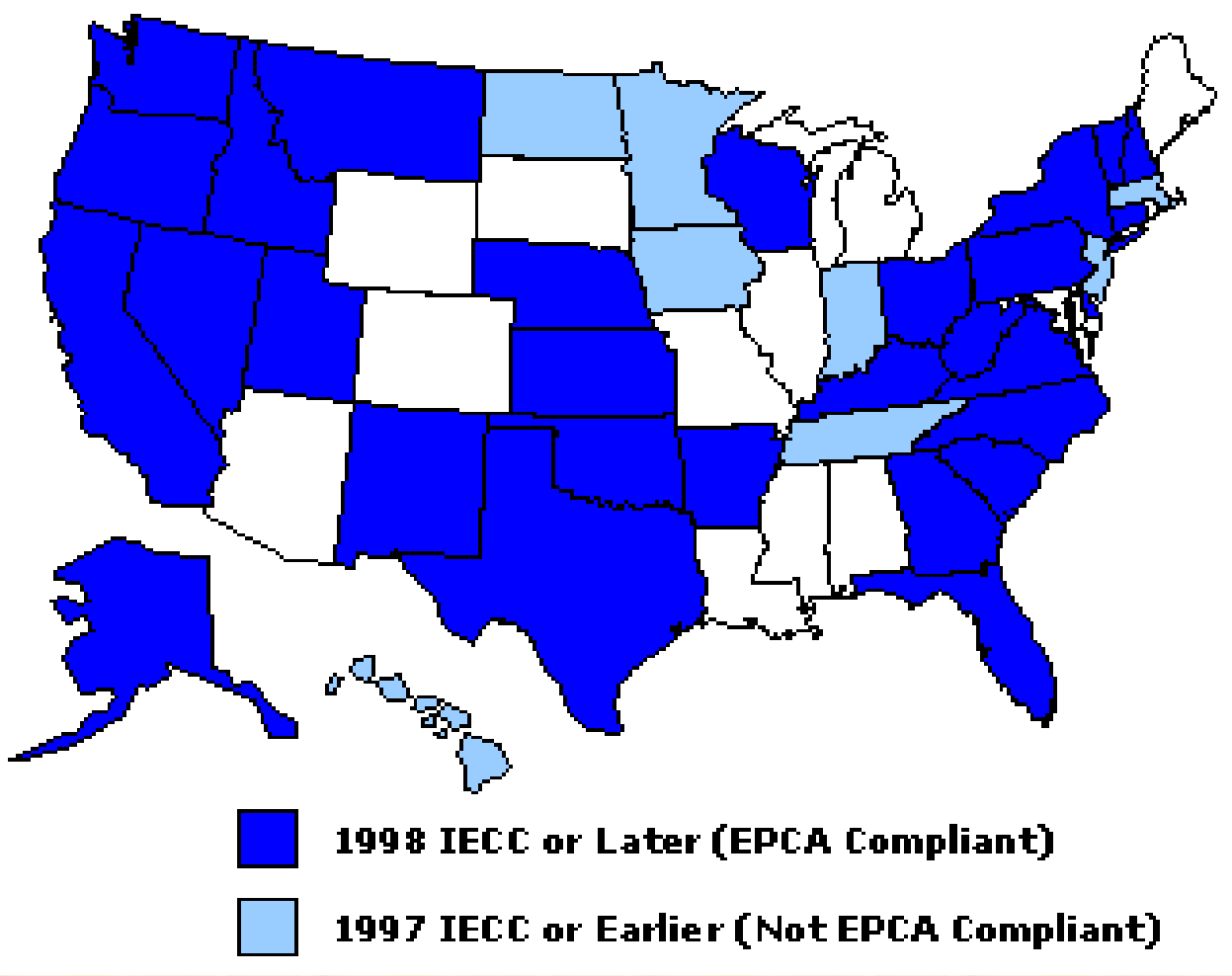
154: Requires HUD to develop EE strategy for public housing

Requires states to facilitate development of combined heat and power and distributed generation technologies

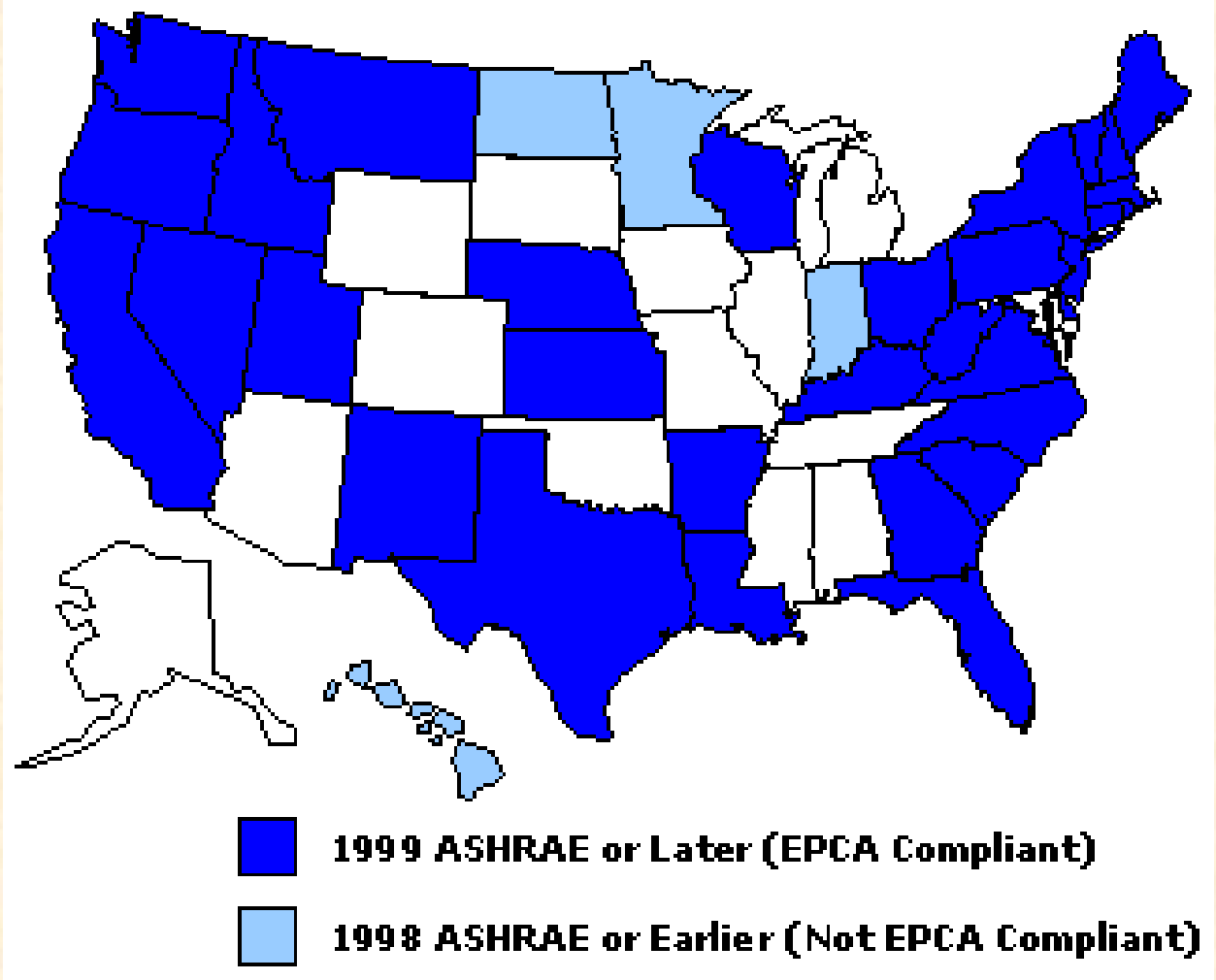
More Energy Efficiency Policies are Needed

1. State Residential Energy Codes
2. State Commercial Energy Codes
3. State Appliance Efficiency Standards
4. Green Building Standards for State Buildings
5. State Energy Efficiency Resource Standards

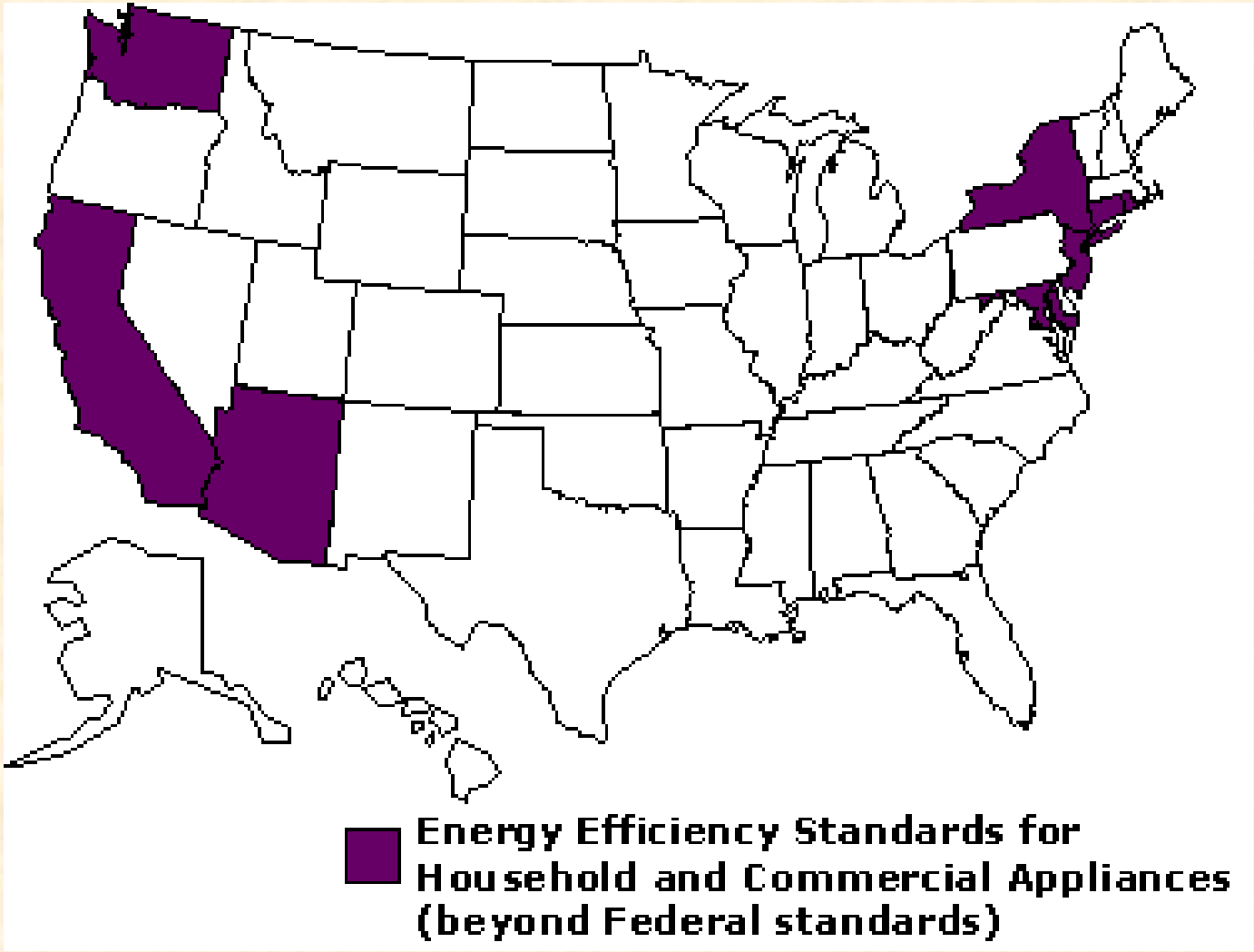
States with Residential Energy Codes



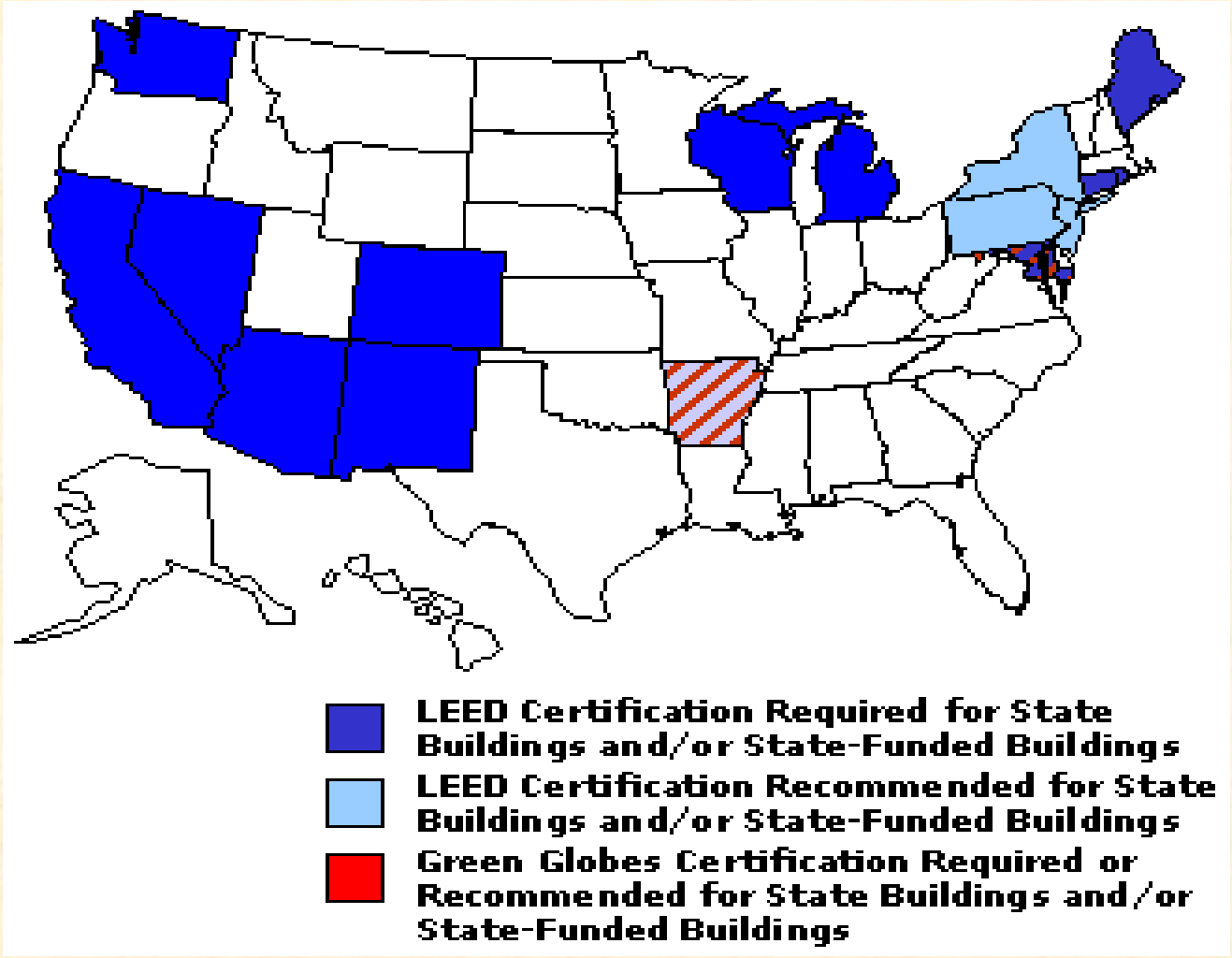
States with Commercial Energy Codes



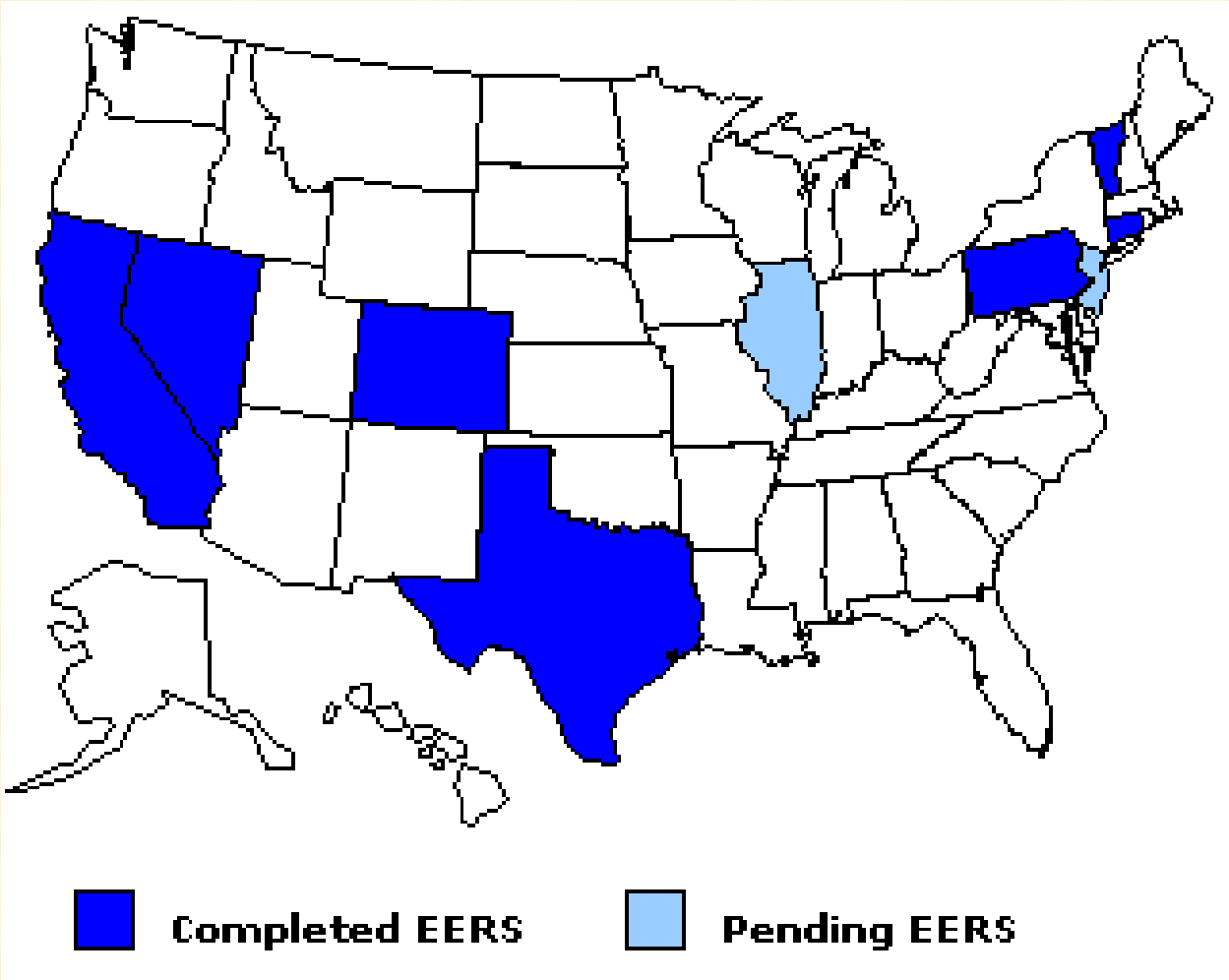
States with Appliance Efficiency Standards



Green Building Standards for State Buildings



States with Energy Efficiency Resource Standards



Conclusions

- Near term:
  - Bring current building practices up to level of best practices
  - GHG reduction potential resides mostly with the existing building stock
- By 2025 and beyond:
  - Zero-energy buildings, climate-friendly designs, and smart growth practices
- An integrated and expansive approach is needed that:
  - Coordinates across technical and policy solutions
  - Integrates engineering approaches with architectural design
  - Considers design decisions within the realities of building operation
  - Integrates green building with smart-growth concepts