

# Navigating Our Environmental Future





# What's Around the Curve?

- Energy Supply & Climate Change Risk
  - **Physical risk** to property from extreme weather
  - **Financial risk** to the health and competitiveness of firms
  - **Reputational risk** due to poor public perception
- Need a strategy to mitigate risks and embrace change for competitive advantage

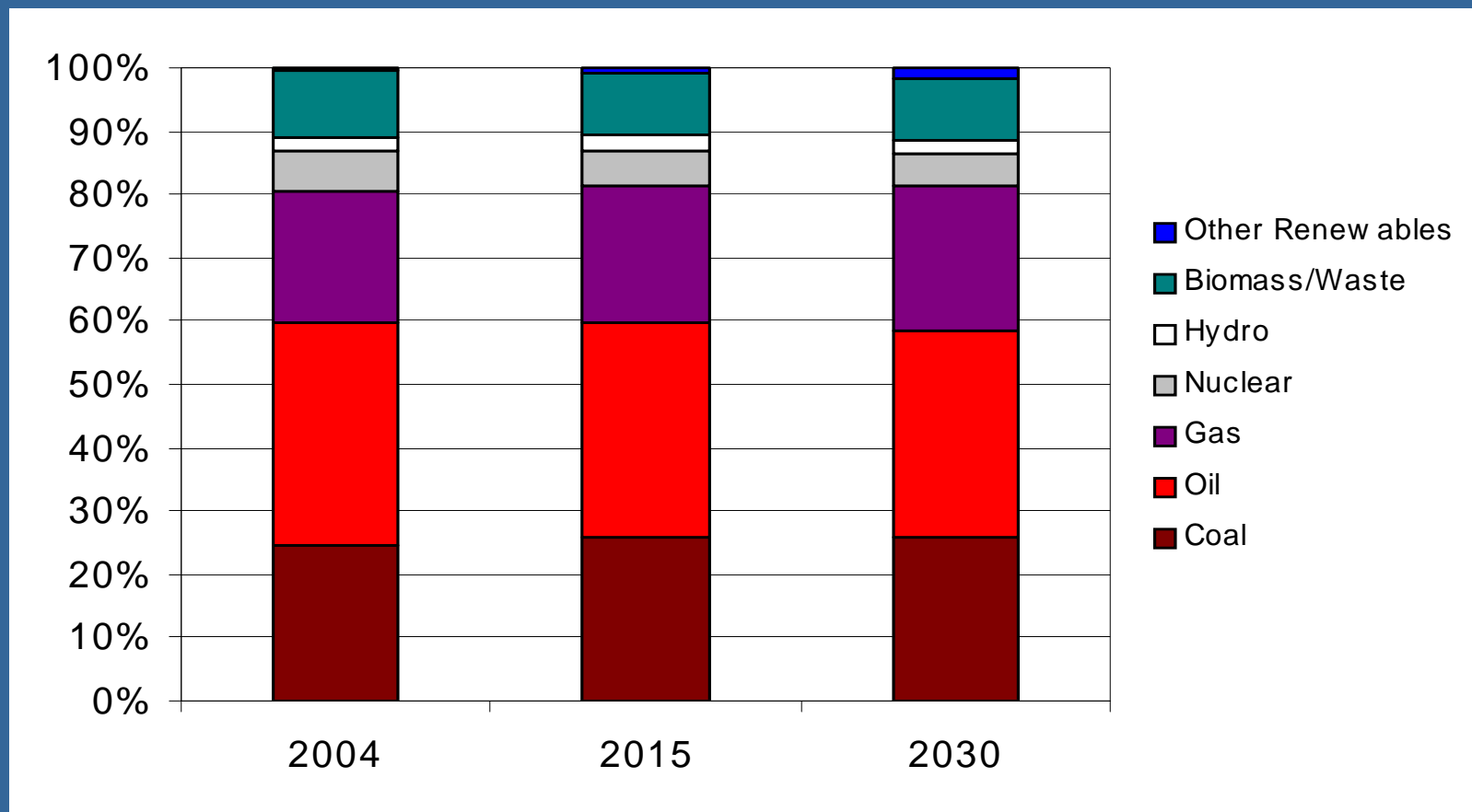
# How Do I Prepare?



- EPA's voluntary programs, from Climate Leaders to ENERGY STAR, can be part of the solution by making energy efficiency an important resource in any organization's strategic energy management plan
- **Cheapest, cleanest, quickest**
  - Cost effective - less than 4¢/kWh
  - Large potential availability
  - Can be quickly deployed
  - Buys time to address other resource issues

# World Primary Energy Demand By Major Fuel

- Fossil fuels account for 80% of world energy demand and will account for 83% of the increase in overall demand from 2004 -- 2030

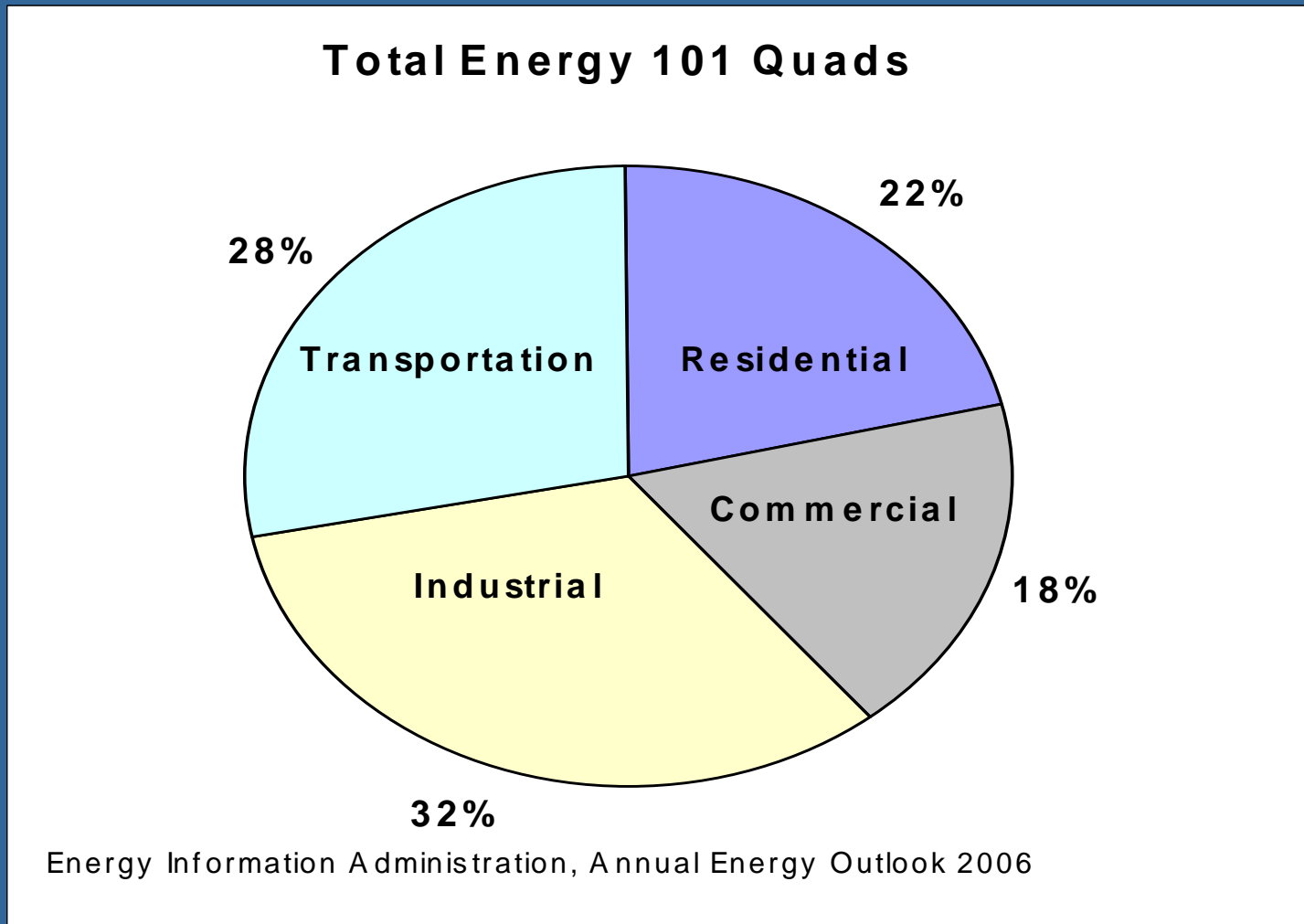


From the World Energy Outlook 2006, International Energy Agency

# EIA 2007 Energy Outlook

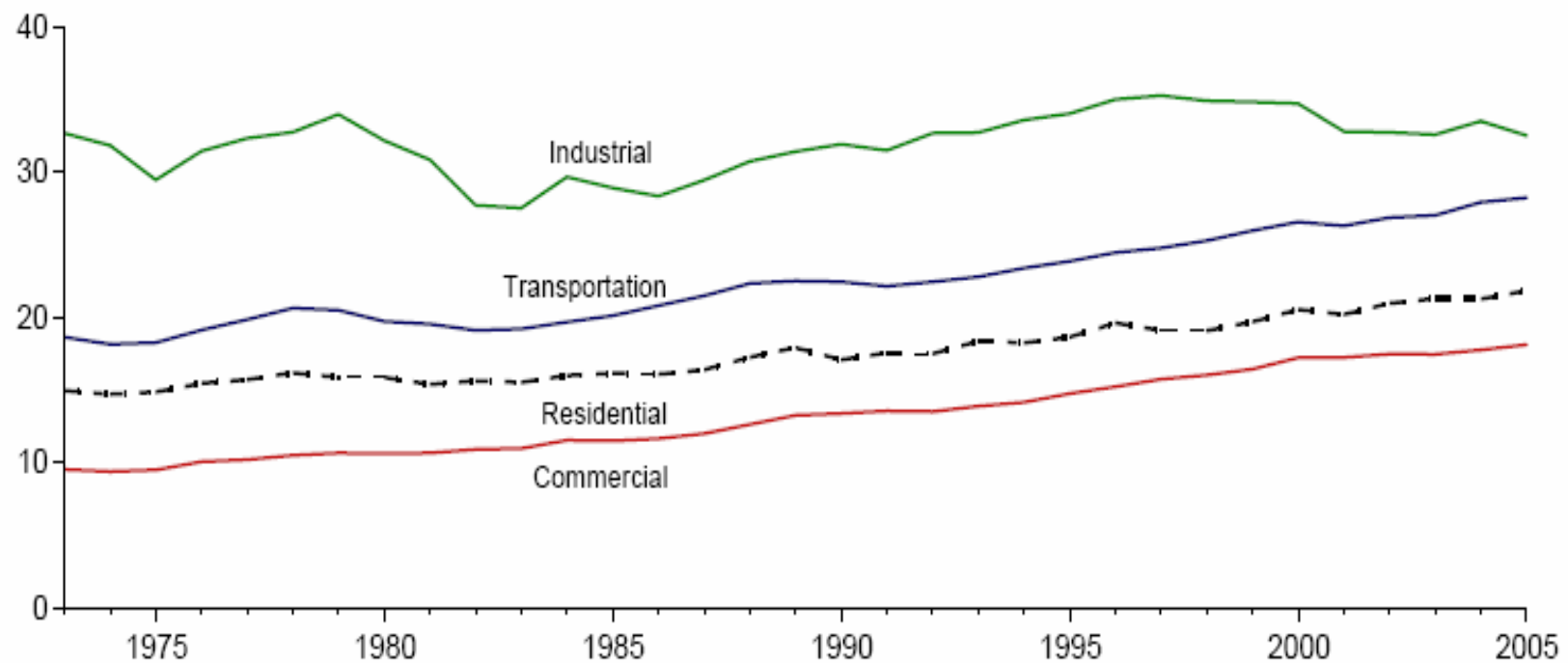
- **Increase** in total primary energy consumption
  - 101 quad Btu in 2005 to 131 quad Btu in 2030
  - Average annual increase of 1.1%
  - Projected energy-related **carbon emissions to grow** average of 1.2% annually from 2005 to 2030
- Delivered commercial energy consumption
  - From 8.5 quad Btu in 2005 to 12.4 quad Btu in 2030
- Total electricity **consumption to grow** from 3,821 billion kW in 2005 to 5,478 billion kW in 2030
  - Average annual increase of 1.5%
  - Actually less than previously predicted (5,619B in 2006) because of increases in IT and electronics

# Breakdown of Energy Use by Sector



# Energy Consumption by Sector (quadrillion Btu)

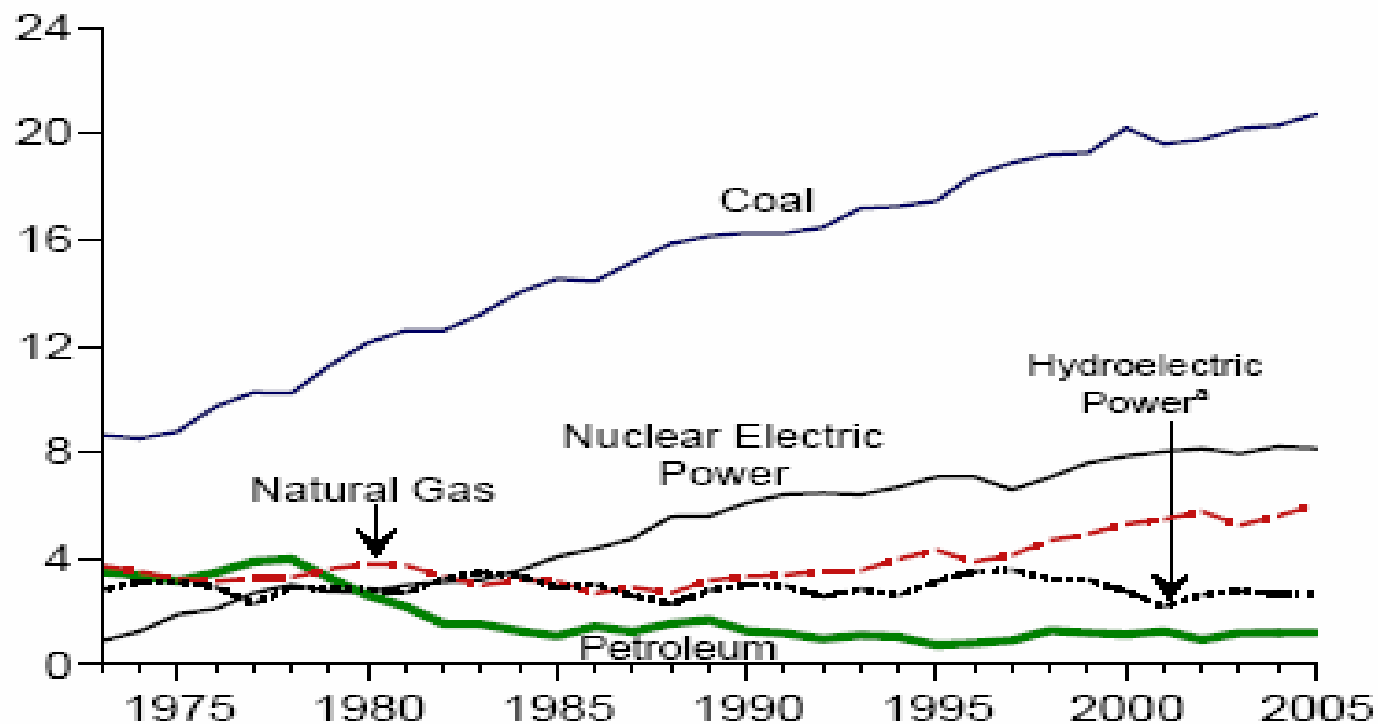
Total Consumption by End-Use Sector, 1973-2005



Source: February 2007 Monthly Energy Review, EIA

# Electric Power Sector Energy Use (quadrillion Btu)

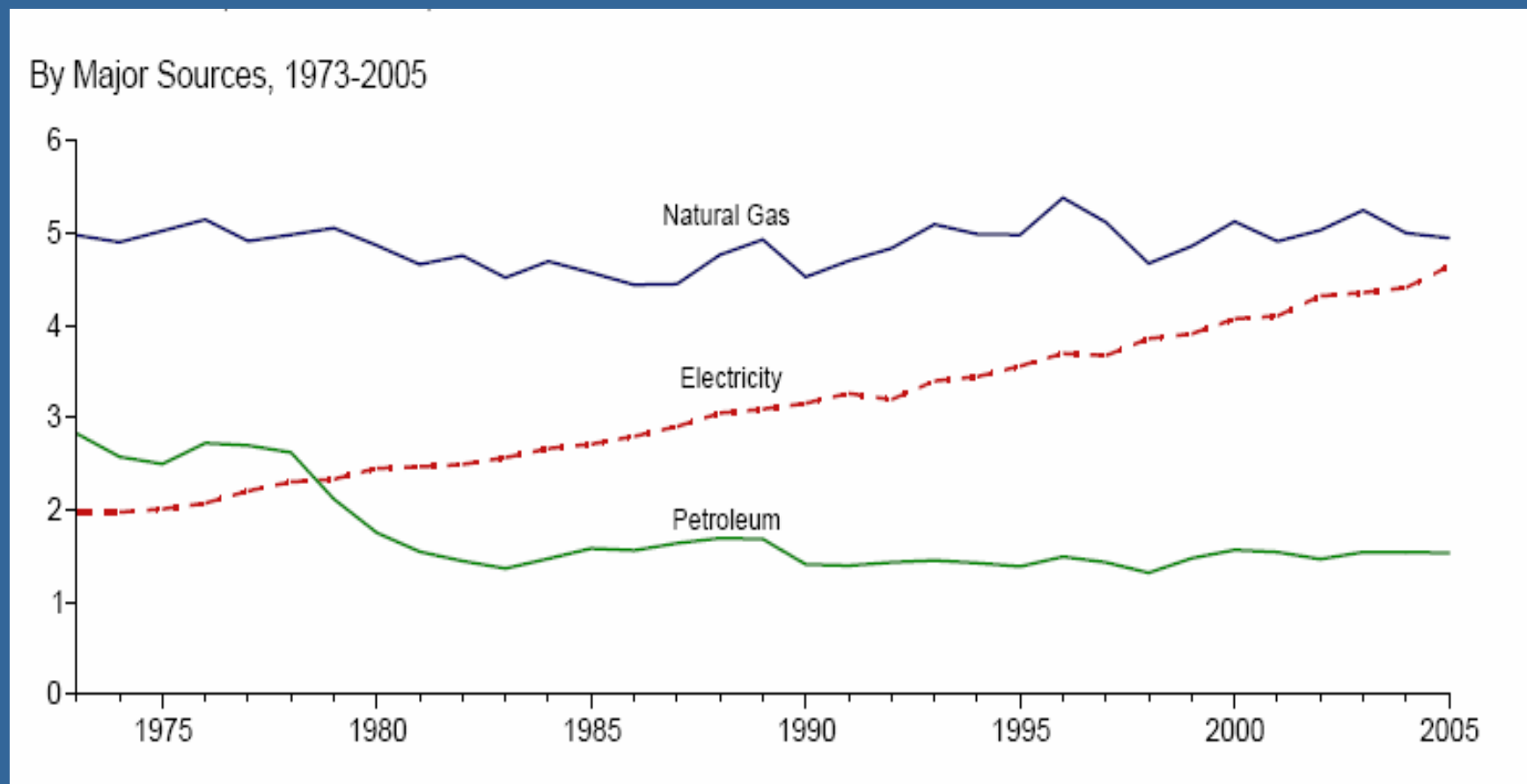
By Major Sources, 1973-2005



Source: February 2007 Monthly Energy Review, EIA

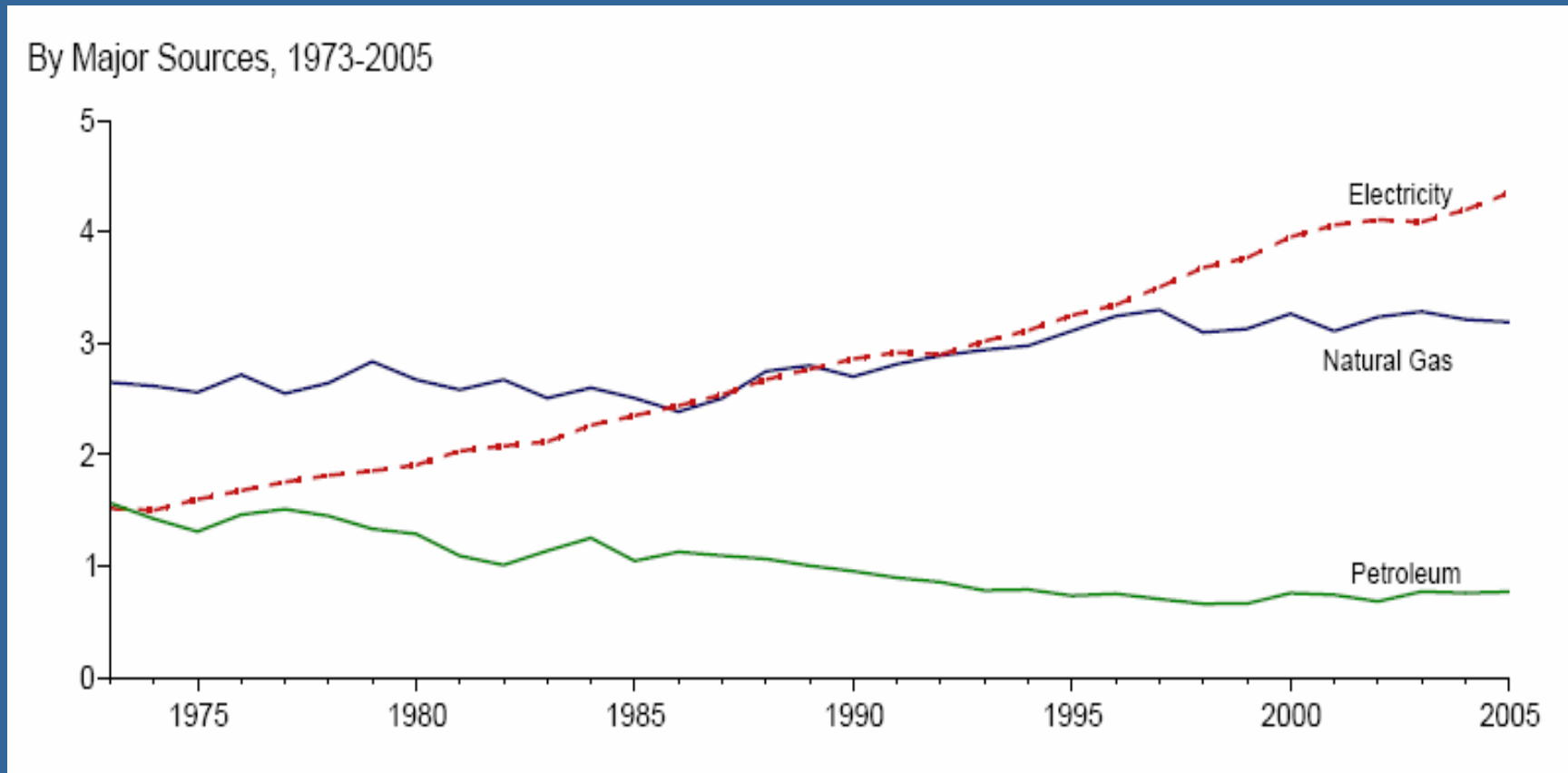


# Residential Sector Energy Consumption (quadrillion Btu)



Source: February 2007 Monthly Energy Review, EIA

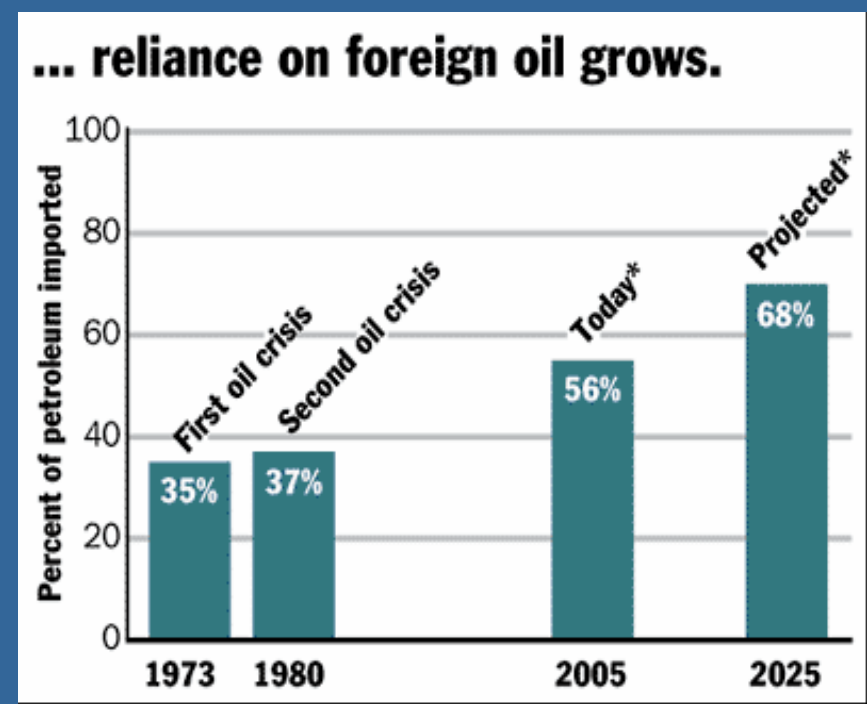
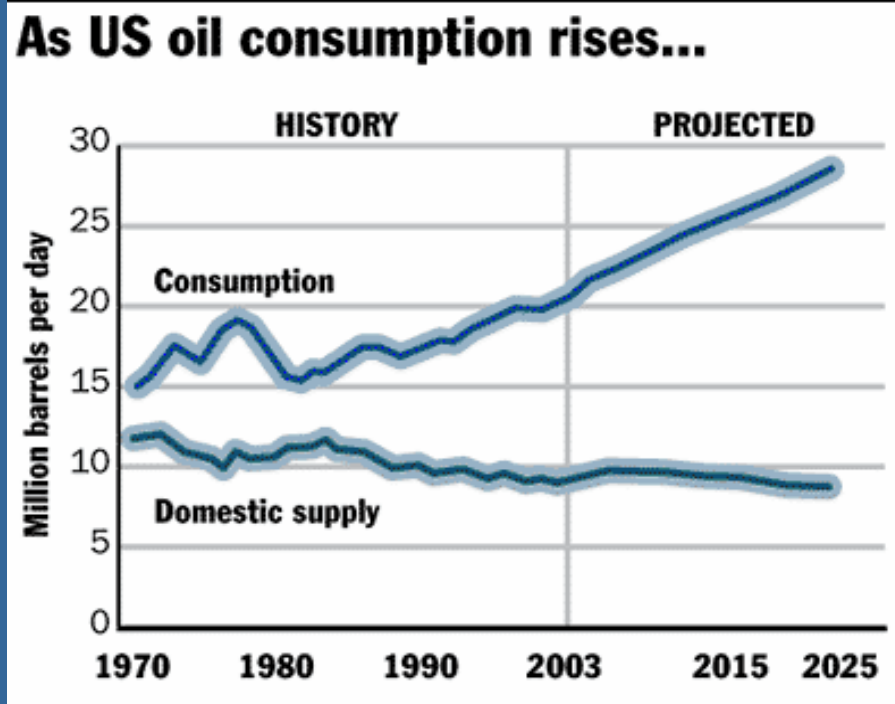
# Commercial Sector Energy Consumption (quadrillion Btu)



Source: February 2007 Monthly Energy Review, EIA

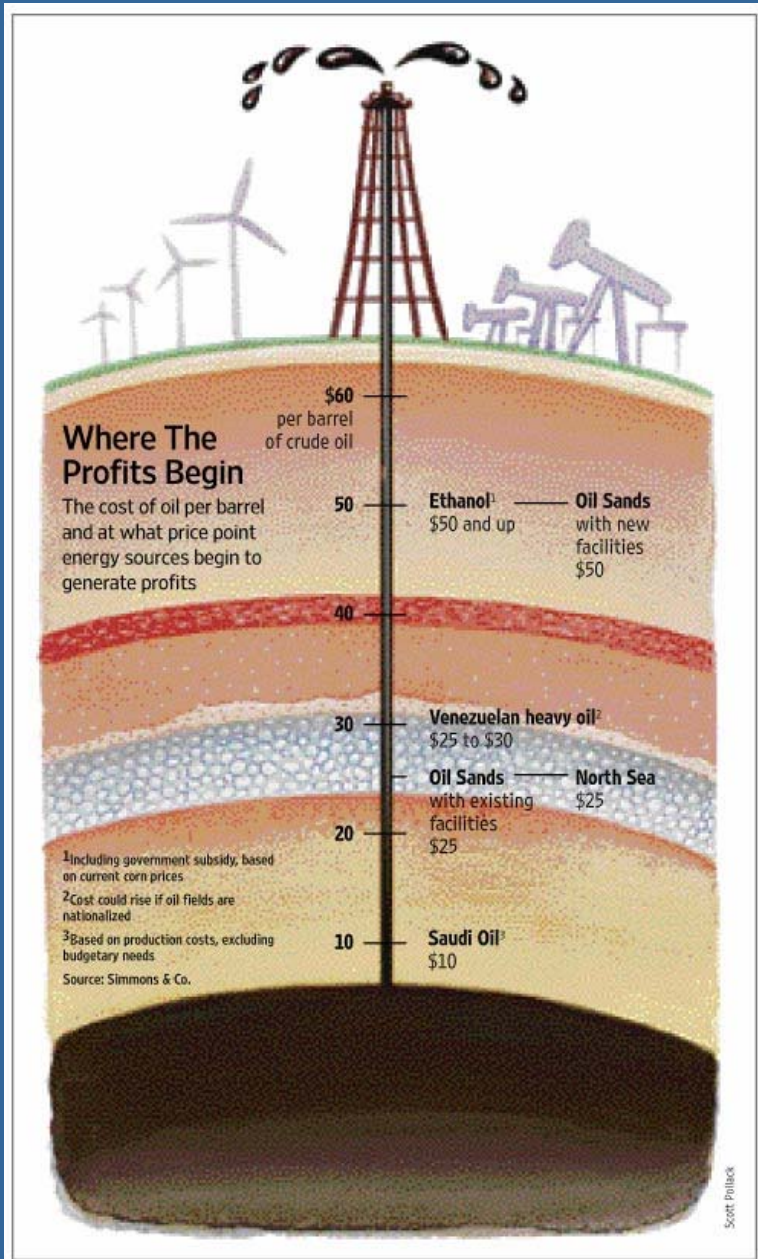
# U.S. Energy Security & Supply Challenges

- U.S. reliance on foreign oil continues to climb
  - 1973 / 35% oil imported; 2003 / 56% imported; 2025 projection / 68% imported
  - U.S. demand for oil projected to grow 37% in next 20 years <sup>[1]</sup>



[1] Deutch, Philip J. "Think Again: Energy Independence." *Foreign Policy* November/December 2005.  
[http://www.foreignpolicy.com/users/login.php?story\\_id=3262&URL=http://www.foreignpolicy.com](http://www.foreignpolicy.com/users/login.php?story_id=3262&URL=http://www.foreignpolicy.com)

# Global Oil Markets



- Industry has gotten use to high prices - likes tight markets
- Oil markets over heated by MTBE and Hurricanes
- Prices have reduced demand
- Ethanol was speculative - poised for rebalance - down 55% since June
- Refining still tight - imports up - outlook unsure

# Biofuels Take Off

- Big investments in ethanol – seen as promising alternative to gasoline
  - White House’s 2007 budget includes **\$150m to develop bio-based transportation**
  - The sector is a magnet for private investment
- **110 ethanol refineries** in U.S. with 73 more under construction
  - Capacity will nearly double to **11.4b gal/yr** <sup>[3]</sup>

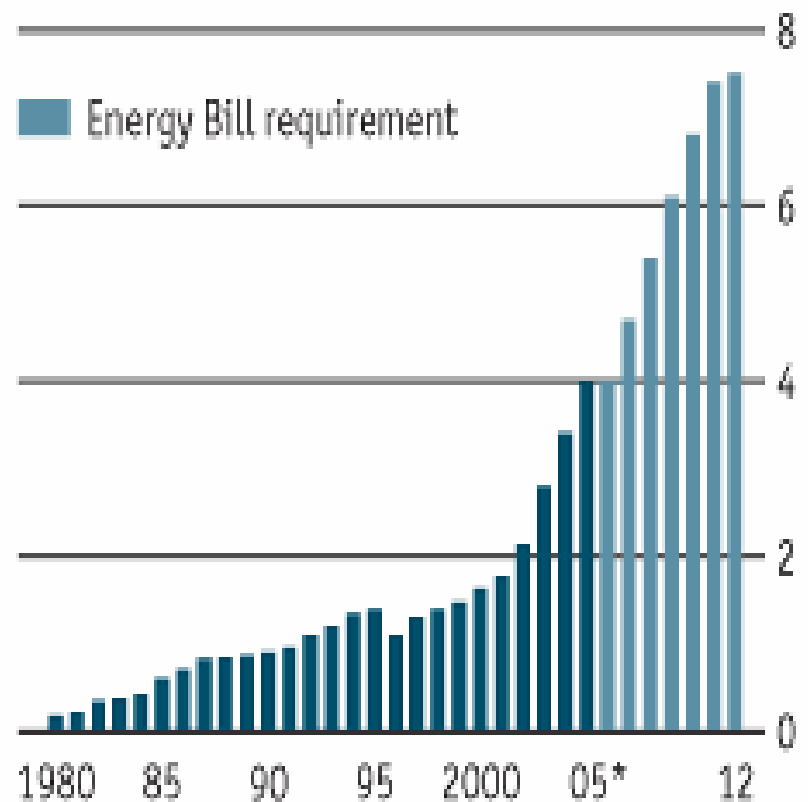
[1] Lewin, Adrienne Mand. “Switchgrass: The Super Plant Savior?” *ABC News* 1 February 2006.  
<http://abcnews.go.com/GMA/print?id=1566784>

[2] “Life After Subsidies.” *Economist* 9 February 2006.  
[http://www.economist.com/business/displaystory.cfm?story\\_id=E1\\_VVDQDPD](http://www.economist.com/business/displaystory.cfm?story_id=E1_VVDQDPD)

[3] “Waking Up and Catching Up.” *Economist* 25 January 2007.  
[http://www.economist.com/world/displaystory.cfm?story\\_id=E1\\_RVRGDGJ](http://www.economist.com/world/displaystory.cfm?story_id=E1_RVRGDGJ)

## Biomass

US fuel ethanol production, gallons bn

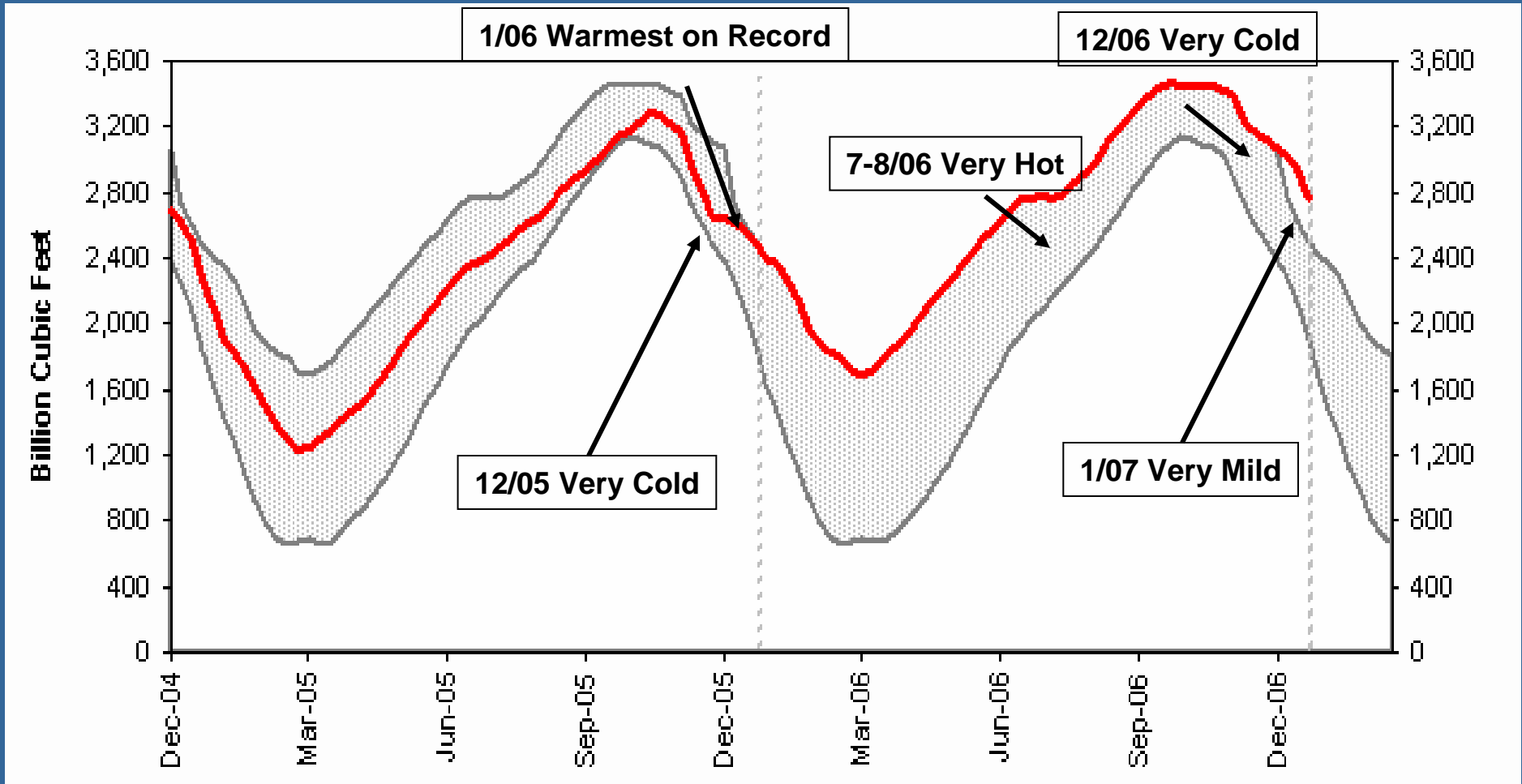


\*Estimate

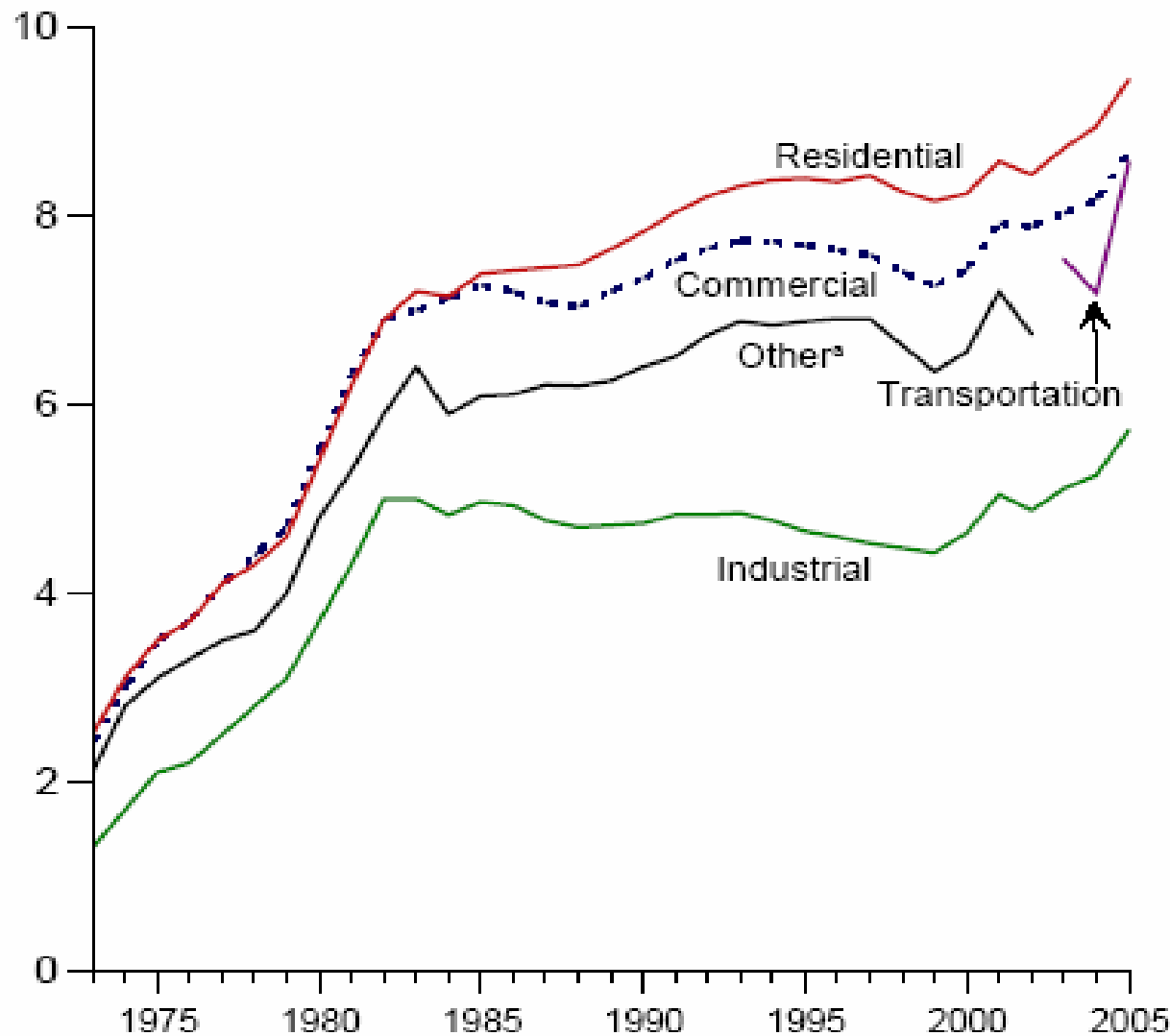
Sources: Renewable Fuels Association; *The Economist*



# Weather is Story on Natural Gas



By Sector, 1973-2005



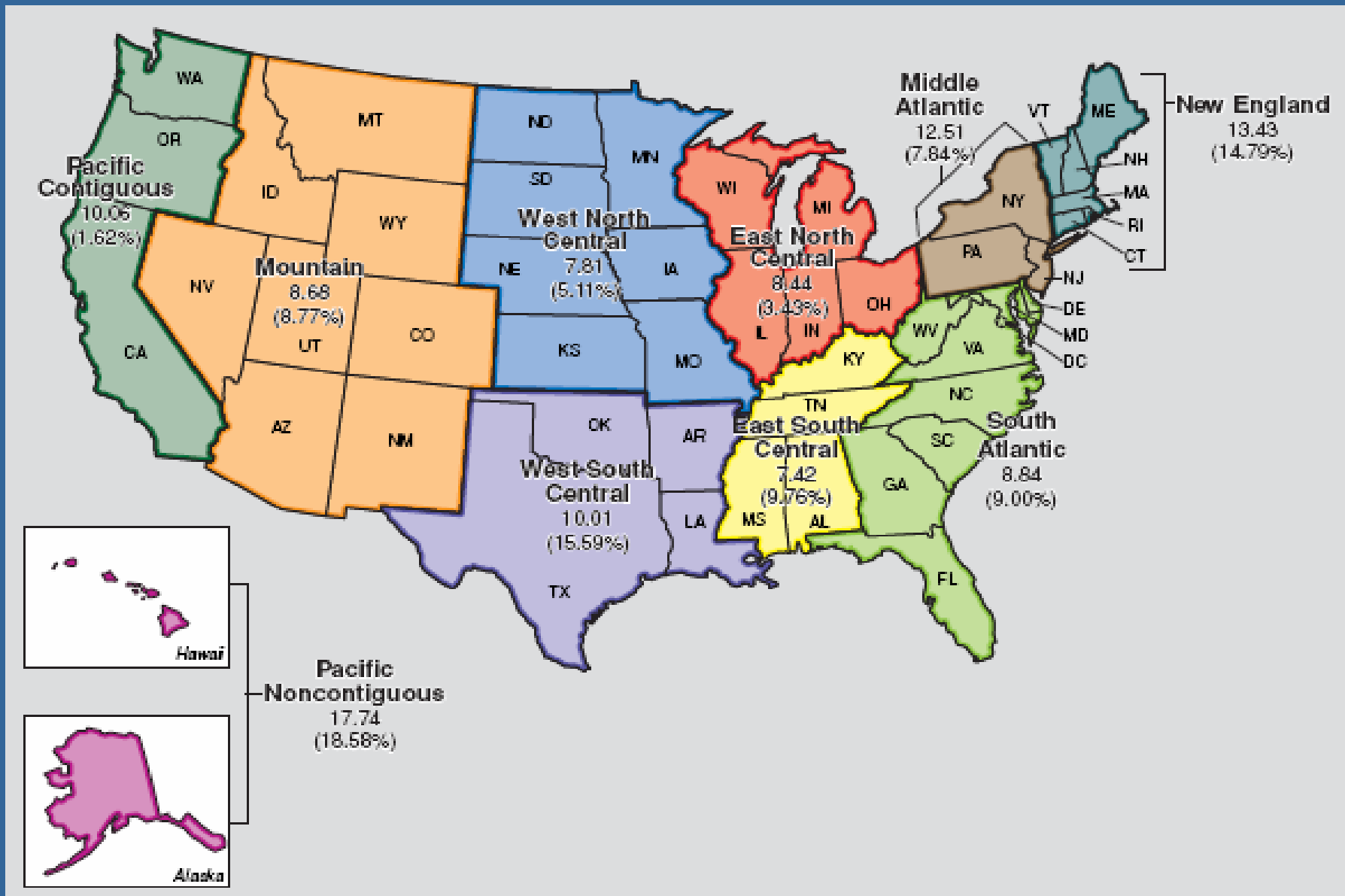
\*Public street and highway lighting, interdepartmental sales, other sales to public authorities, agricultural and irrigation, and transportation including railroads and railways.

# Average Retail Prices Electricity

Source: February 2007  
Monthly Energy Review,  
EIA

# Rising Utility Rates

## 2005 Average by Region



# Concerns about Electric Adequacy

- Concerns about gas supplies continue
- LNG imports down
- Electric demand surging
- Rate caps coming off
- Prices increasing rapidly
- Public discontent growing
- Pressure for new coal plants
- Reserve margins falling – CCGT's no longer economic

## 2006 Long-Term Reliability Assessment

*The Reliability of the  
Bulk Power Systems  
In North America*



North American Electric Reliability Council  
October 2006

# State Responses to Tight Electric Markets

- Tight electric markets leading to surge in proposed coal plants ~ 150 plants proposed
- Cost of Super Critical Pulverized Coal plants soaring / 50 -100% increase in capital cost (w/o considering carbon capture cost)
- Coal electricity now 8 -12¢/kWh in many markets
- New coal could lock in high-cost electricity and emissions for 35 - 50 years



# Still in an Energy Straitjacket

*“Not Your Parents’ Energy Crisis” \**

- No current “supply” limitations – rather “deliverability” limitations in all energy markets
- Oil markets constrained by refining
- Coal markets constrained by mining and rail capacity
- Electricity constrained by available fuel and transmission – high demand taxes infrastructure
- Renewables limited by equipment manufacturing
- Fuel switching limited by tight markets



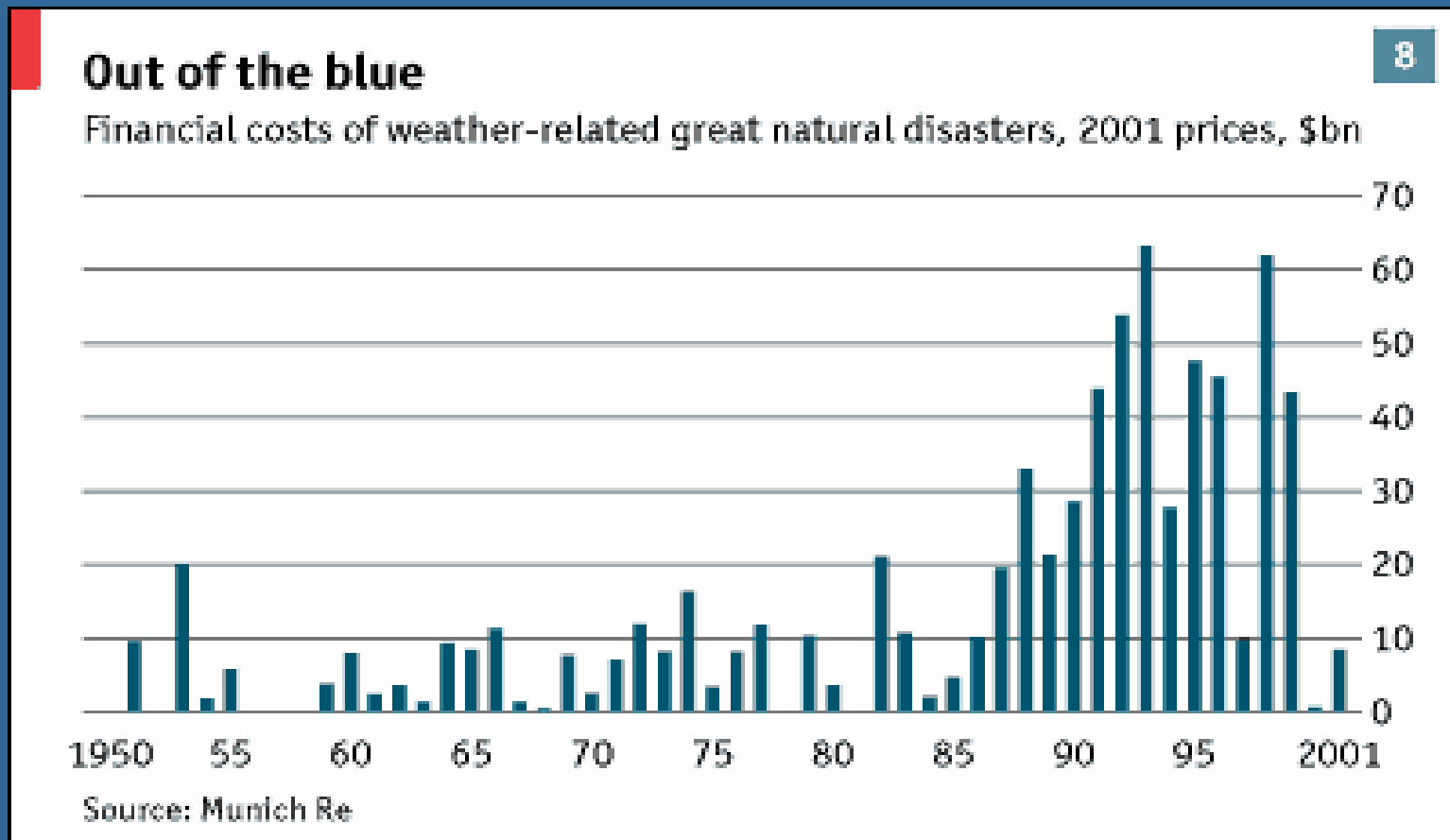
# Climate Change

## Scientific Consensus

- There is a scientific consensus that Earth's surface temperatures are increasing and human activities are part of the reason.
- Many scientists and science organizations have issued statements concluding that compelling evidence for the human modification of climate.
  - IPCC (1988, 2001, 2006)
  - National Academy of Sciences (2006)
  - American Meteorological Society (2003, 2006)
  - American Geophysical Union (2003)
  - American Association for the Advancement of Science (2004)

# The Cost of Natural Disasters

- From the 1950s to 1990s, the number of natural catastrophes worldwide increased 4x and real economic losses jumped 14x [1]



[1] David Suzuki Foundation. "Solving Global Warming."  
[http://www.davidsuzuki.org/Climate\\_Change/Impacts/Extreme\\_Weather/El\\_Nino.asp](http://www.davidsuzuki.org/Climate_Change/Impacts/Extreme_Weather/El_Nino.asp)

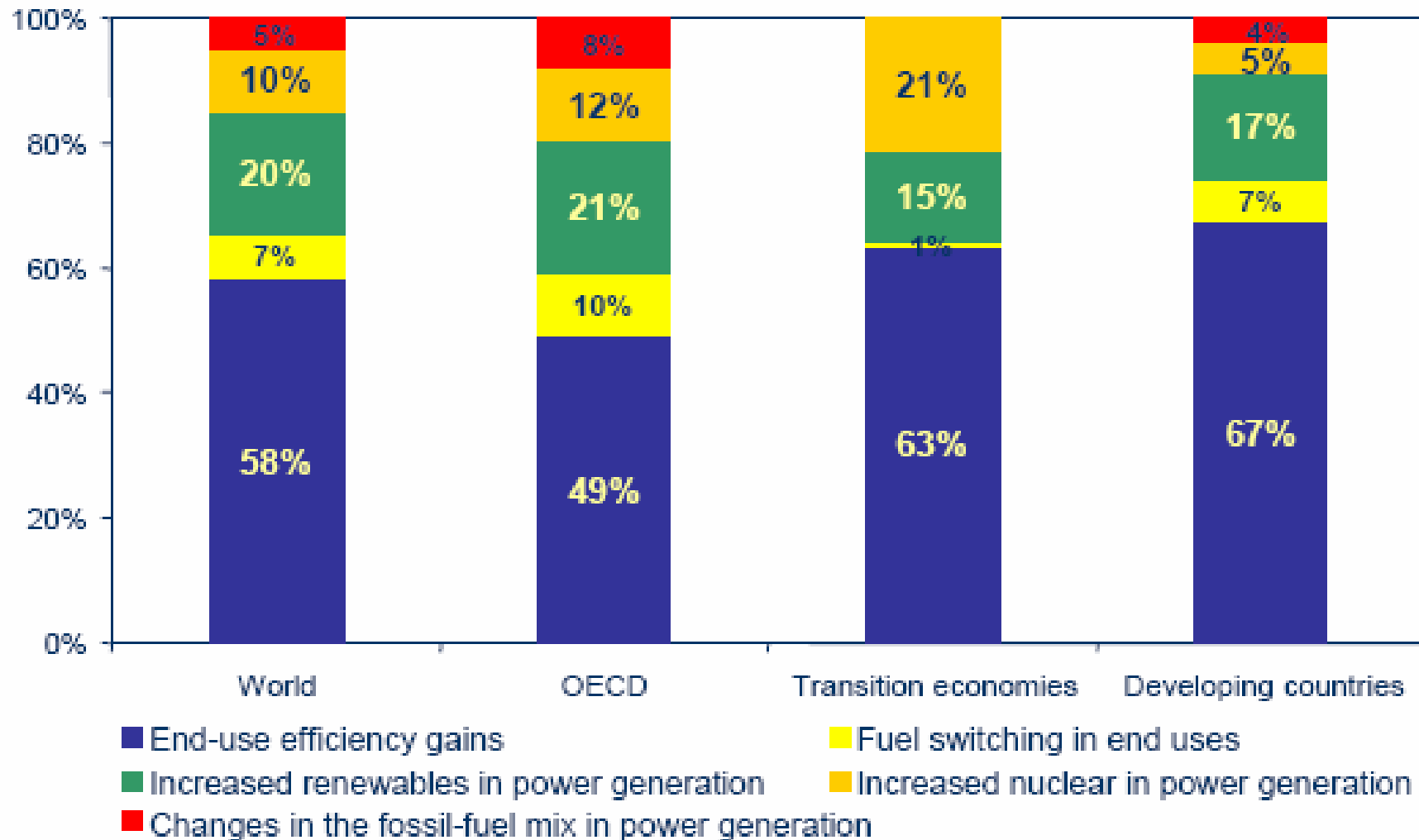
# Insurance Industry Reacts to Threat of Climate Change

- 2005 - Insurance industry **shelled out record \$57 billion** in weather-related losses, and industry calls to curb GHG emissions have accelerated <sup>[1]</sup>
- U.S.- based global insurer, **AIG**, investing in projects and technologies that reduce GHG emissions
- **Fireman's Fund** introducing insurance policies that reward "green" buildings that save energy
- **St. Paul Travelers Companies** offers 10% discount on car insurance for owners of hybrid cars <sup>[1]</sup>
- **State Farm Insurance Cos.** has suspended sales of any new commercial or homeowner policies in Mississippi <sup>[2]</sup>

[1] Gunther, Marc. "Insurance Companies Take on Global Warming." *Fortune* 24 August 2006.  
[http://money.cnn.com/2006/08/22/news/economy/pluggedin\\_gunther.fortune/index.htm](http://money.cnn.com/2006/08/22/news/economy/pluggedin_gunther.fortune/index.htm)

[2] "State Farm: No new home policies in Miss." MS NBC February 14, 2007.  
<http://www.msnbc.msn.com/id/17150886/>

# Contributing Factors in CO<sub>2</sub> Reductions 2004-2030





# What is ENERGY STAR?



- National, US government-backed symbol for energy efficiency
- Voluntary program -- over 2,700 partners to date
- ENERGY STAR helps consumers and businesses identify high-quality, energy-efficient buildings, homes, and products
  - \$12 billion in savings in 2006
- ENERGY STAR distinguishes what is efficient and better for the environment without sacrificing features or performance
- Buildings, homes, and products that earn the ENERGY STAR meet strict energy performance criteria set by EPA or DOE
- Approaching 70% consumer recognition

# Guiding Principles for Specification Development

- Cost - effective efficiency
- Performance maintained or enhanced
- Significant energy savings potential
- Efficiency is achievable with several technology options
- Product differentiation and testing are feasible
- Labeling can be effective in the market

# Why EPA Cares About Datacenters

- Datacenters are critical national infrastructure
- Economic growth, scientific advances, quality of life and national security increasingly depend on our ability to harness and apply growing computing power
- US & other governments want to encourage improved energy efficiency of this sector to meet national energy and climate change goals
- Est. 10 million servers across 10k datacenters
- Typical facility energy consumption trending up
  - .6% = 2005 est. total US server consumption
    - Projections for 2010: server energy use up 40 – 76%
  - 1.2% = 2005 est. total US energy consumption  
(includes servers + cooling + infrastructure) **does not include storage and networking equipment**

# EPA's Experience

- EPA has long standing relationships in IT and building communities (+15 years)
- Working with other countries to harmonize equipment specs.
  - UK, EU, Canada, China and others interested in servers
- Existing EPA program expertise:
  - ENERGY STAR Product Labeling
  - ENERGY STAR Commercial & Industrial (C&I)
  - Combined Heat and Power Partnerships (CHP)
  - Green Power Partnerships
  - Climate Leaders
    - We can help roll up energy savings accomplishments for recognition & examination

# EPA Study Goals & Expectations

- Inform **Congress & other policy makers** of important market trends, forecasts and opportunities
  - *Understand the impact energy consumption is having on datacenters and its implications for national energy consumption*
- Identify and recommend potential short and long term efficiency opportunities and match them with the right policies
  - Identify areas for additional strategic research outside the scope of the report
- Stress voluntary initiatives not regulatory standards
- Might incorporate national goals, e.g., 10% of datacenters benchmarked by 2009
  - Identify policies & incentives to overcome barriers in pursuit of goal(s)



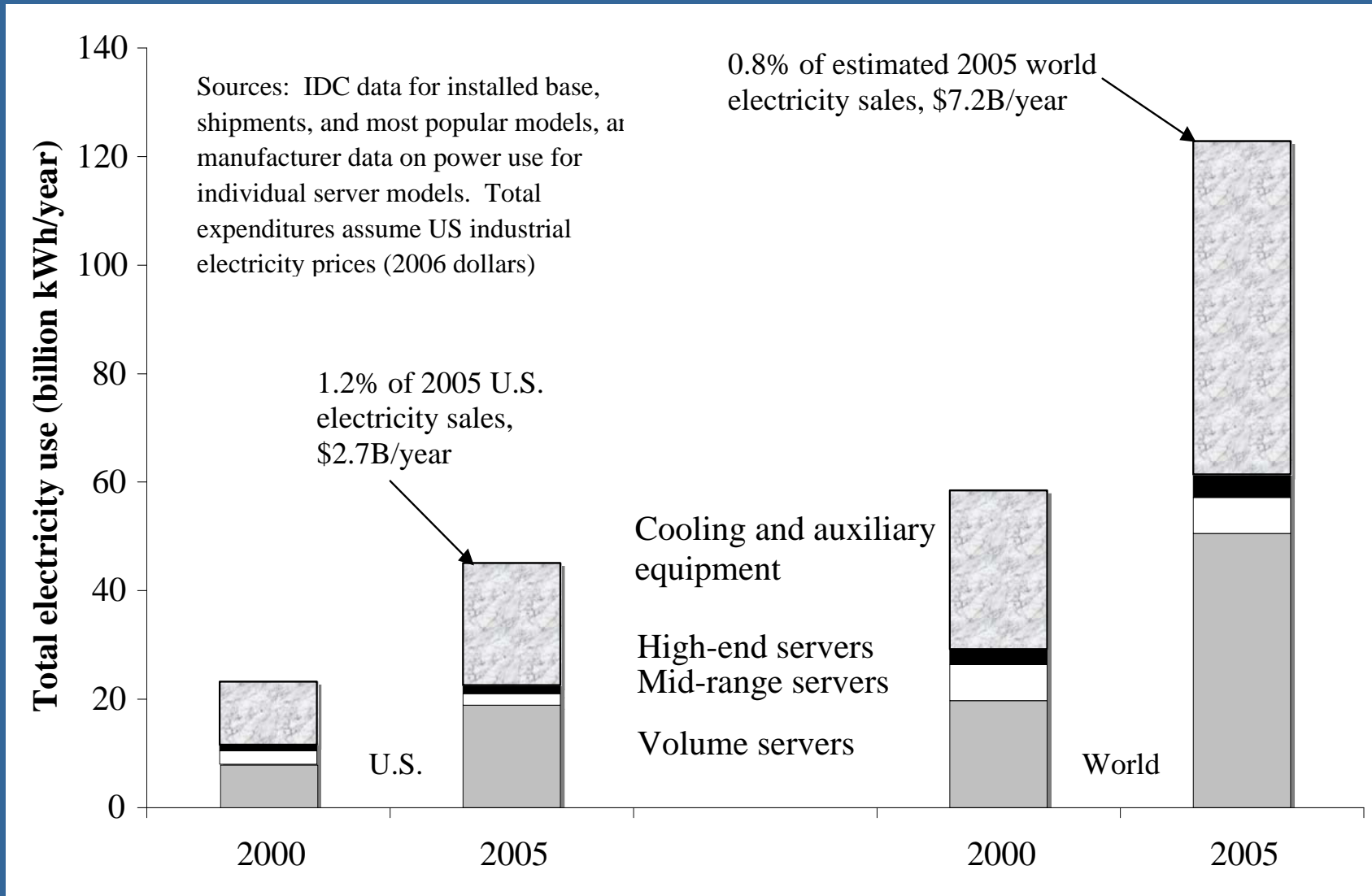
# Types of Incentives & Voluntary Programs

- **Financial incentives**
  - e.g., utility rebates, Federal tax deductions/credits
- **Education and training**
  - e.g., datacenter operator certification
- **Industry standards**
  - e.g., energy performance metrics, test procedures
- **Endorsement labeling**
  - e.g., ENERGY STAR
- **Government procurement**
  - e.g., EPA Act 2005 purchasing requirements
- **Government operation**
  - e.g., mandatory benchmarking of Federal datacenters, pilot program implementation in Federal facilities
- **Research, development, and demonstrations (RD&D)**
- **Information**
  - e.g., Technical guidance, awareness campaigns, publication of benchmark data, etc.

# ENERGY STAR For Equipment & Datacenters

- EPA announced interest in ENERGY STAR metric for servers & other equipment
  - Servers highest priority - targeting late 2007 for completion
  - Server work on a slower, but parallel track to datacenter study
- EPA also supporting development of ENERGY STAR “whole datacenter” energy efficiency performance benchmark
  - Score the efficiency of your datacenter for comparison purposes
- EPA Will work with utilities & other stakeholders to determine if a turnkey set incentives can be identified and applied nationally
- Dept. of Energy activities yet to be determined

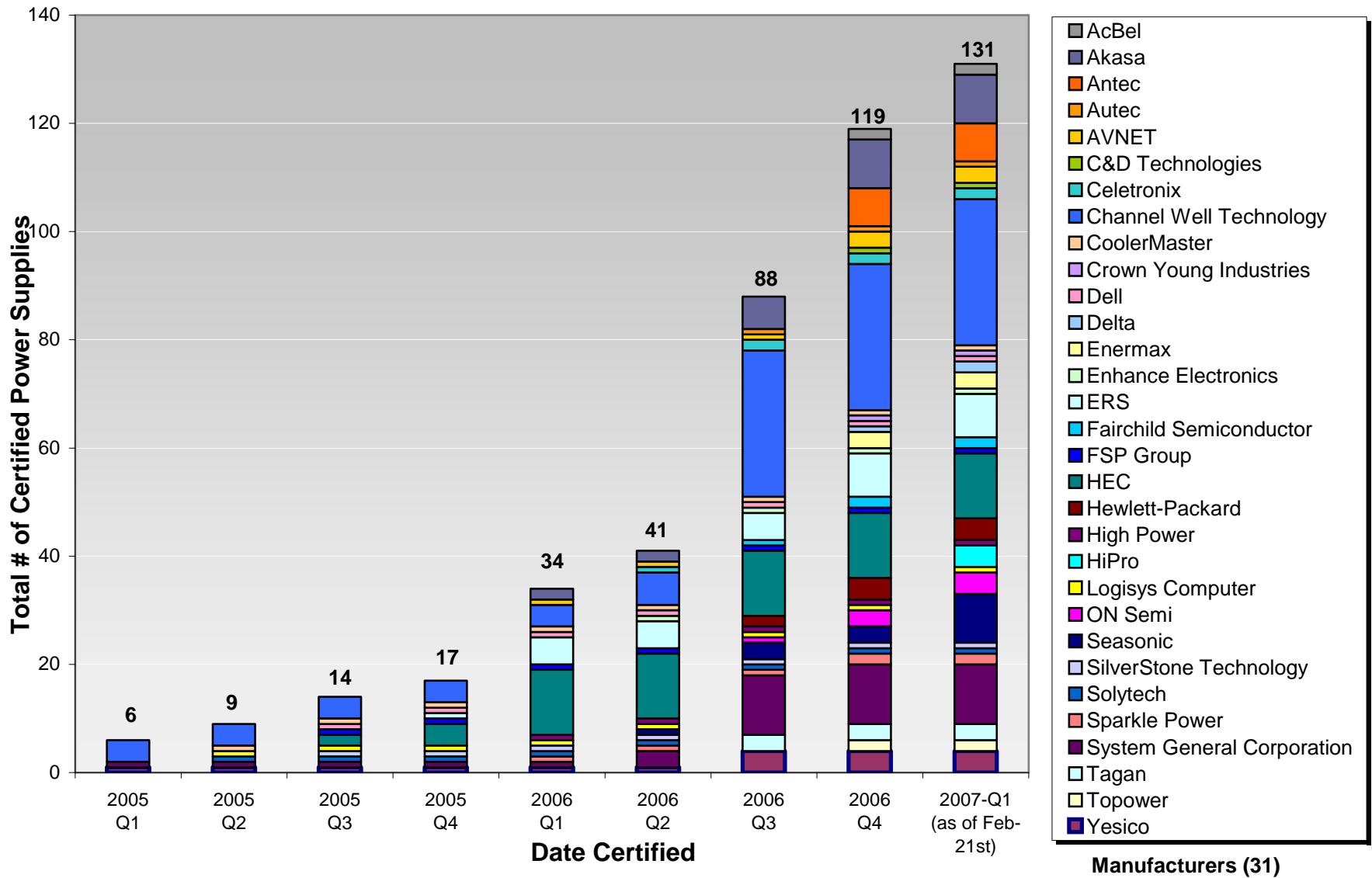
# Koomey: Server Electricity Use



Source: Jon Koomey, "Estimating Total Power Consumption by Servers in the U.S. and the World," Feb 2007.

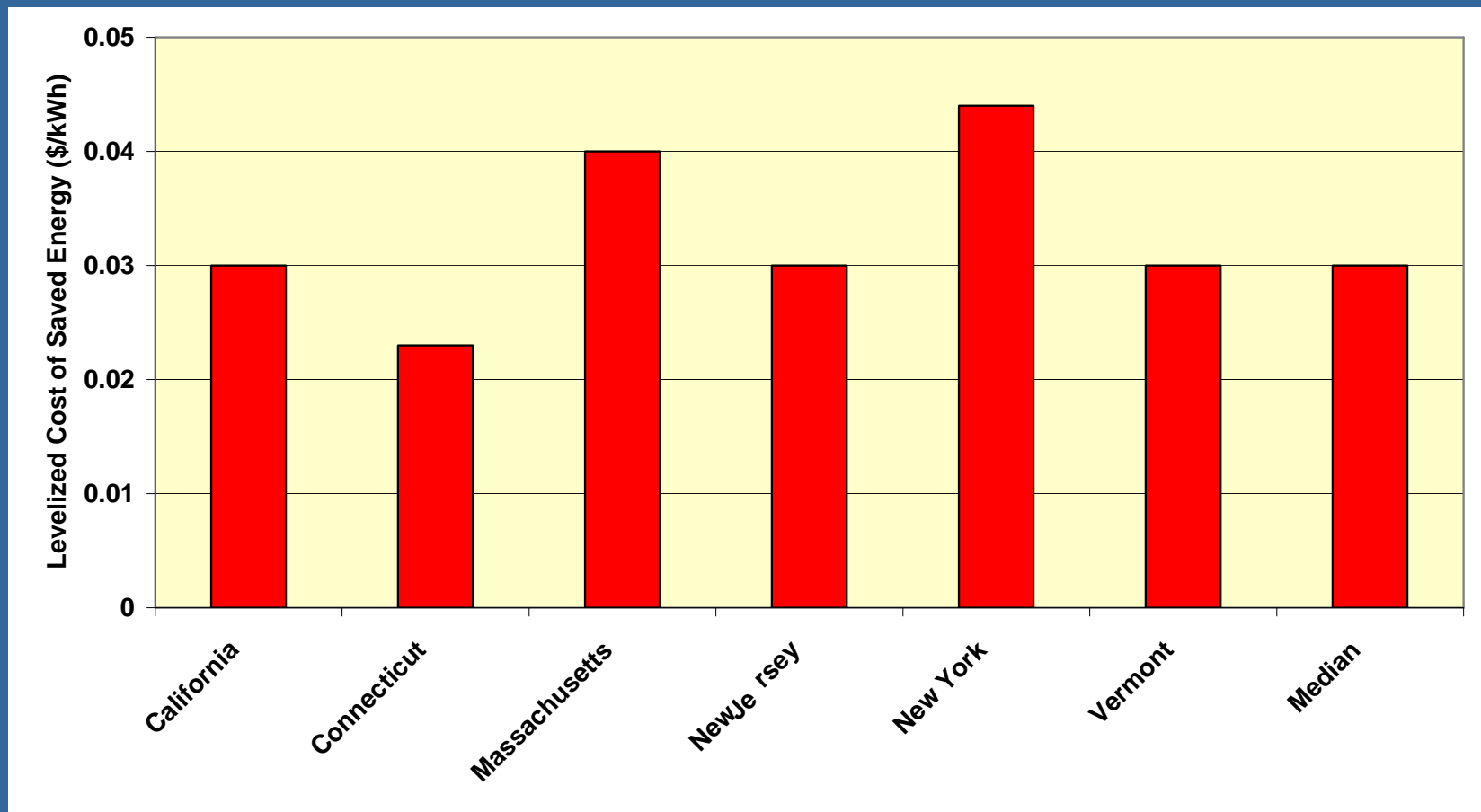
# 80 PLUS<sup>®</sup> Certified Power Supplies

Jan. 2005 – Feb. 2007



# Need to Shift EE Program focus to Low-Cost Resource Acquisition

Manufacturing & large commercial least cost EE resource



# Public & Private Benefits of Reduced Electricity Consumption



- Improve air quality
  - Less: smog, acid rain, respiratory illness
- National security
  - Less dependence on foreign sources
  - Less price volatility
- Efficiency first best resource
  - Lower first cost than new supply
- Help mitigate climate change
  - Fewer greenhouse gas emissions
- Align with broader corporate energy & environmental goals
- Improve electricity grid reliability
  - Fewer brown & black outs
- Help to deliver capacity to allow the utilization of growing amounts of computational power
- Lower energy bills
  - Consumers & businesses save

# Contact Information & Resources

Andrew Fanara, EPA

[fanara.andrew@epa.gov](mailto:fanara.andrew@epa.gov)

[www.energystar.gov/datacenters](http://www.energystar.gov/datacenters)

Koomey Report

<http://enterprise.amd.com/us-en/AMD-Business/Technology-Home/Power-Management.aspx>