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ELECTRICITY MARKETS DEVELOPMENT PROGRAM- GEMTP II

Aug 5th to 8th, 2008

Nepal

Electricity Markets Future Trends and Challenges

Transformation or Chaos?
The Challenge of Balancing Core Drivers

Rising Costs and Prices

No longer a declining cost industry
Fuel, infrastructure components, global industrialization and competition

Enormous CapEx

\$ 750 Billion → \$ 1.2 Trillion
Exceeds current capitalization
Major new coal and nuclear and transmission

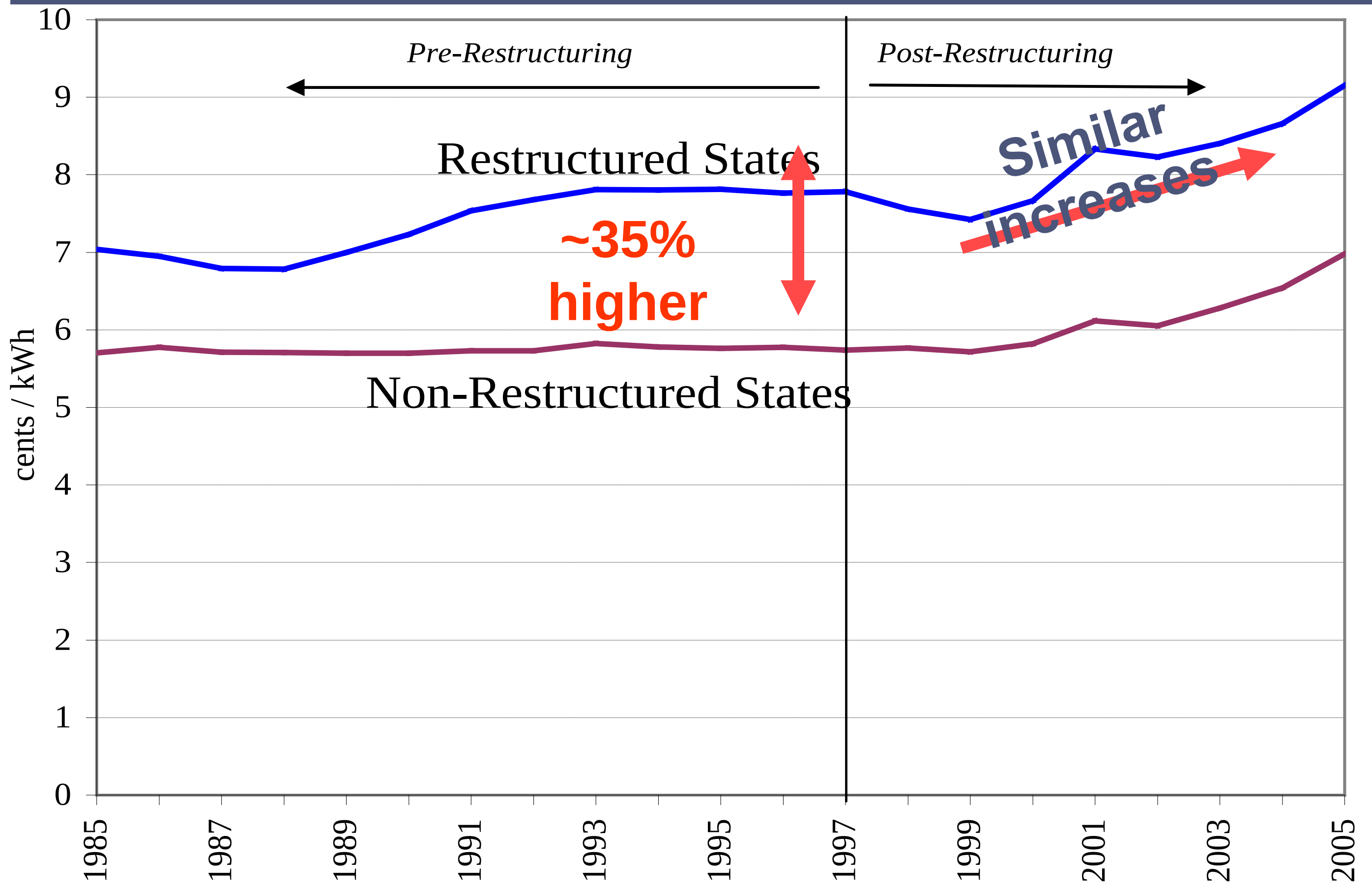
Climate Change

Dozen bills pending in Congress
States becoming aggressive
Role of Renewables – National RPS?

Energy Efficiency

Low hanging fruit for Climate Change
Need to make it a sustainable business
"Smart" appliance, buildings, grid

Rates Rising In Many States



Source: EIA Form 861, EIA Monthly Energy Review March 2006.

Recent Price Increases

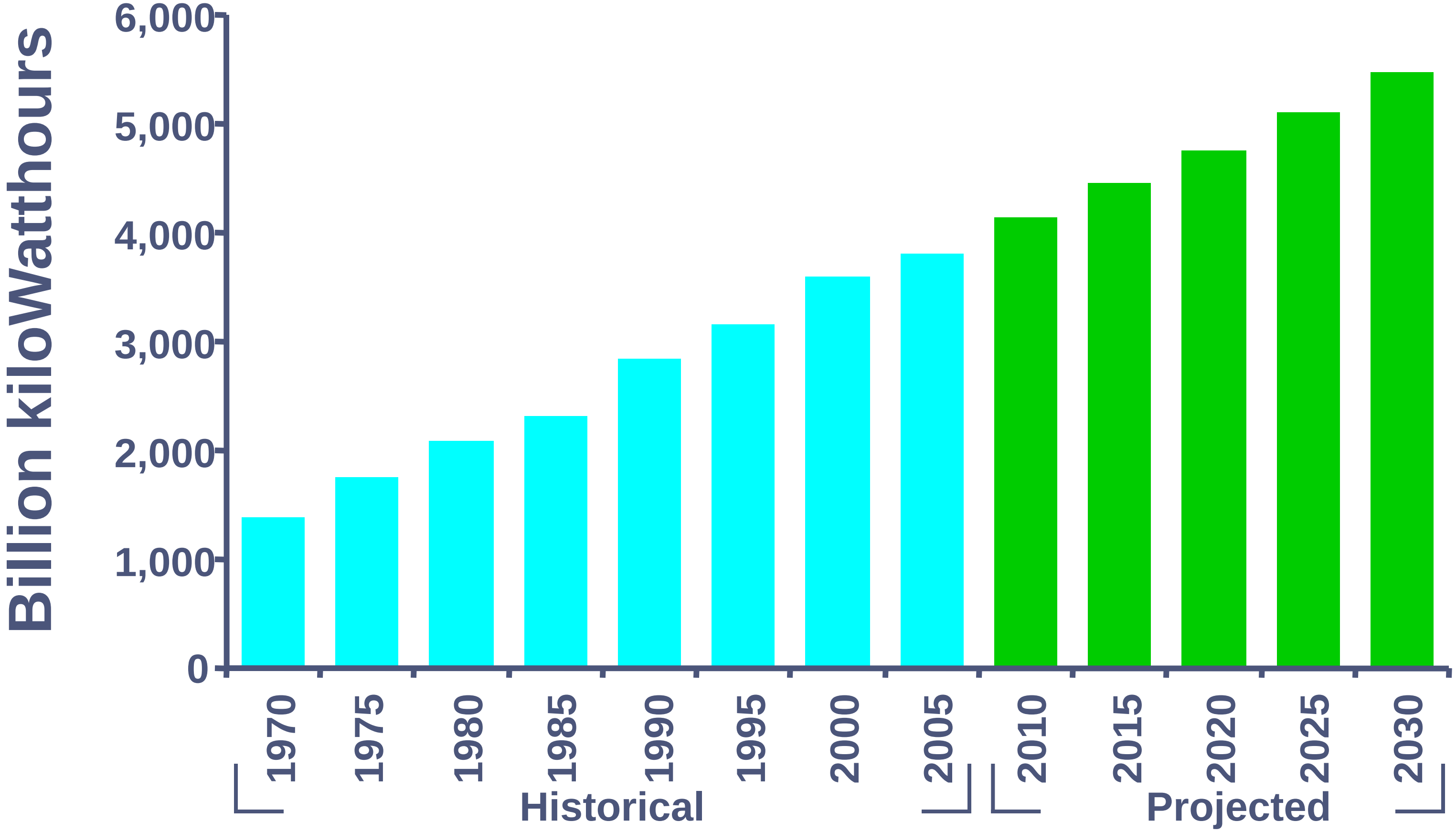
- Sharp increases in natural gas prices, other fuels and purchased power
  - Problem similar in both restructured and unrestructured markets

- Restructured states
  - Market prices sensitive to changes in gas prices—quicker adjustment
  - Rates reduced (5-20%) and frozen (5-10 years)
    - Kept rates artificially low – Illinois 20% rate reduction for 10 years
    - Maryland auction just months after Katrina disrupted gas production

- Non-restructured states
  - Rate changes more gradual--less-noticed - “routine” small, rate adjustments
  - Automatic adjustment clauses to reflect changes in fuels, power purchases

Understanding the Core Drivers

Demand for Electricity Is Increasing

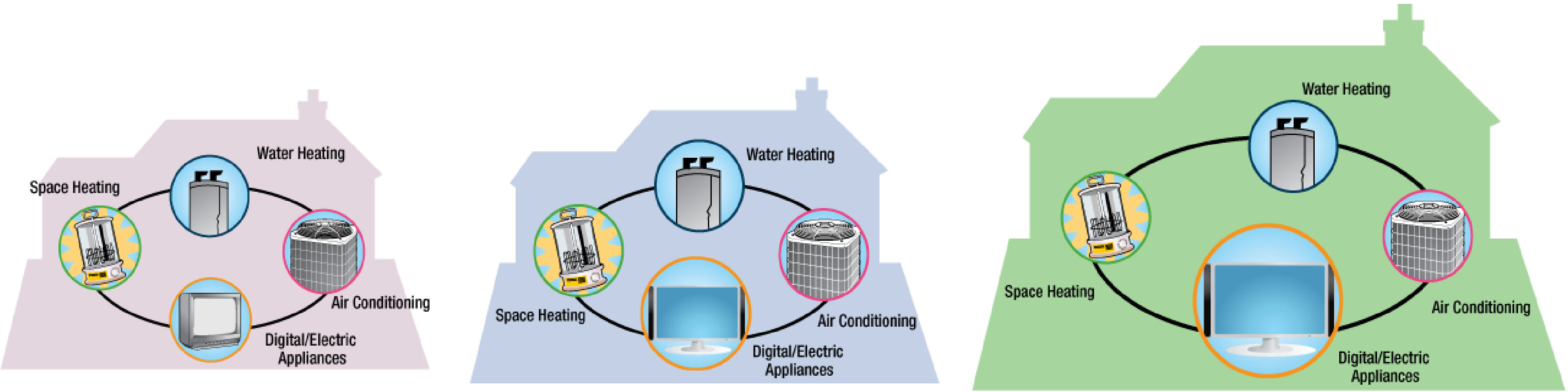


Sources: U.S. Department of Energy, Energy Information Administration, *Annual Energy Review 2005* and *Annual Energy Outlook 2007 Early Release*

Causes for Rising Demand

- Increasing population 11.18% in 10 years
- Increased economic growth 50.1% in 8 years
- Increased number of homes with central A/C 49% in 9 years
- Plasma TVs up 50% 1st Qtr 05 from 1st Qtr 04
- MP3 players up >17 million in one year
- Average US household owns 26 consumer electronics products

Typical U.S. Home Electric Use Dramatically Increasing



Past (1978)
(1,755 sq. feet)
Average Total Use:
1.07 kW/Hour/Household

Present (2003)
(2,330 sq. feet)
Average Total Use:
1.30 kW/Hour/Household

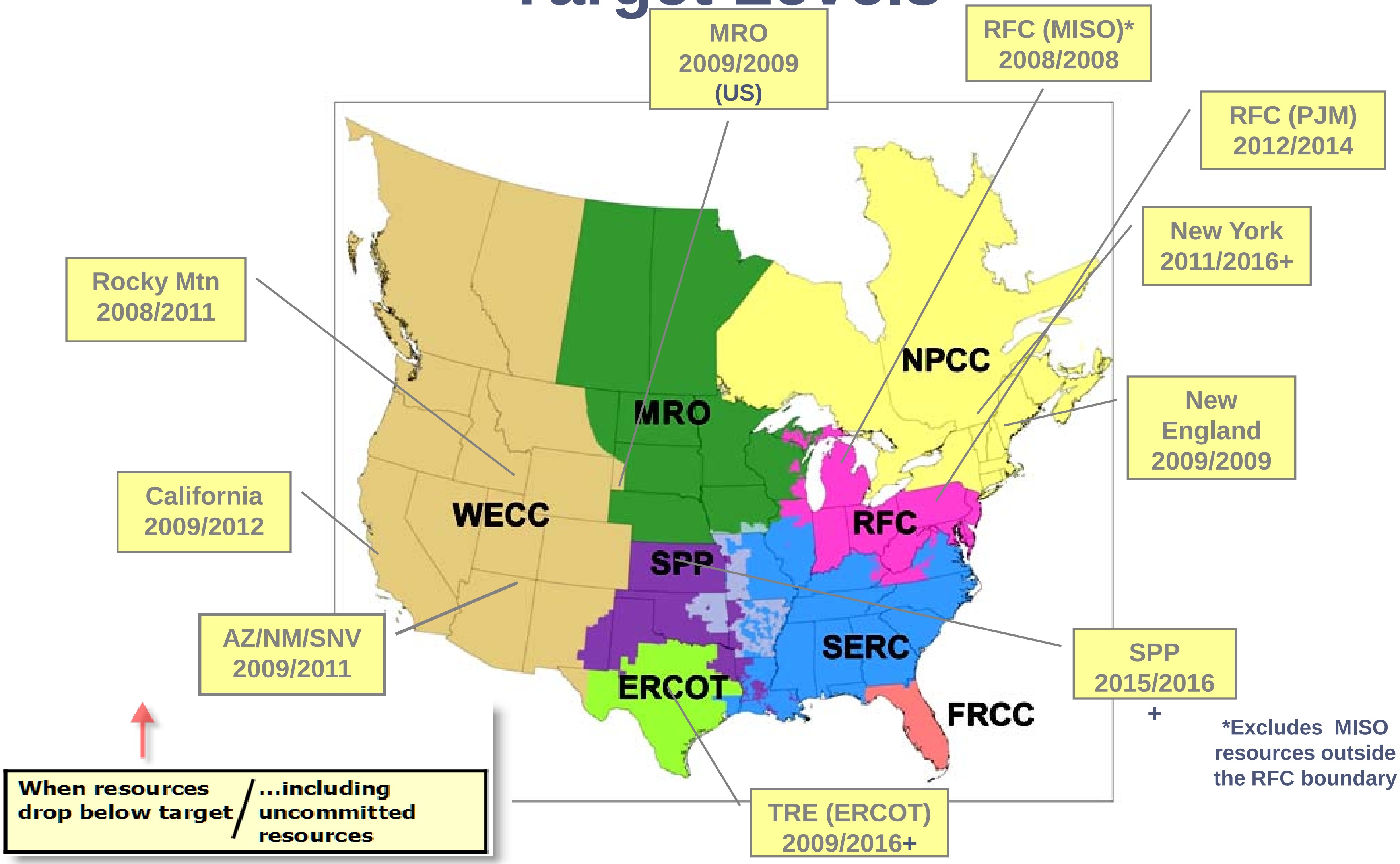
Future (2030)
Average Total Use:
1.45 kW/Hour/Household

Increased number of homes 47.85% in 8 years

Increased number of larger homes 72% in 9 years (over 2400 sq. ft.)

Sources: The Brattle Group, National Association of Home Builders

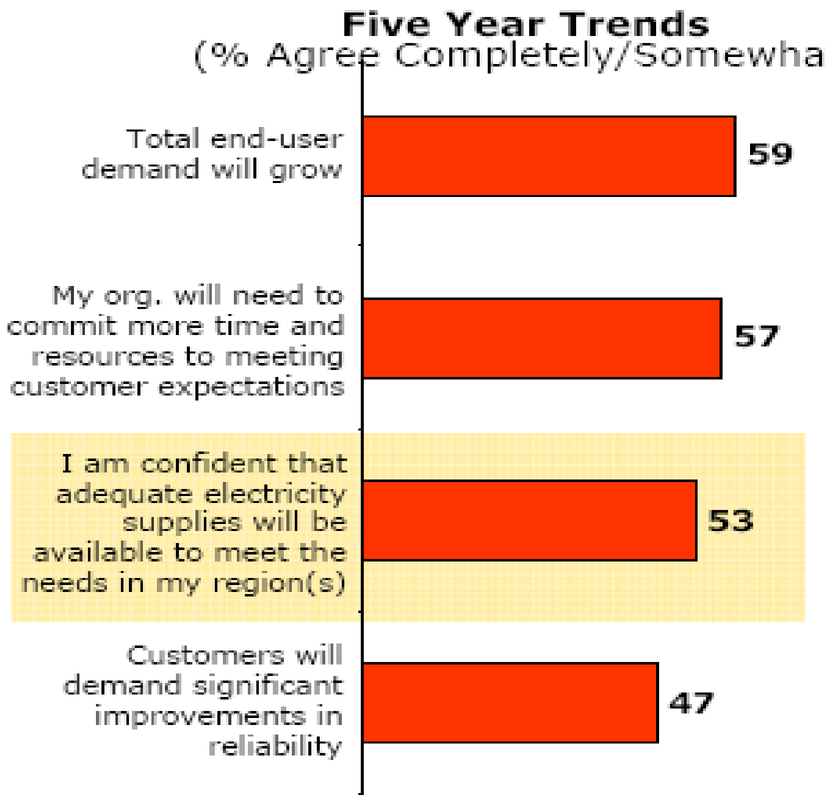
Margins Projected to Fall Below Minimum Target Levels



*Excludes MISO resources outside the RFC boundary

Can We Meet Tomorrow's Demand?

There is growing concern that the industry won't be able to meet surging demand



- **In the next 5 years, only 53% of respondents are confident they will be able to provide the needed supply in their region.**
- **Other survey data suggests generation commitments are being deferred.**

Q38. Thinking about five years from today, how much do you agree with each of the following statements (5-point scale)?

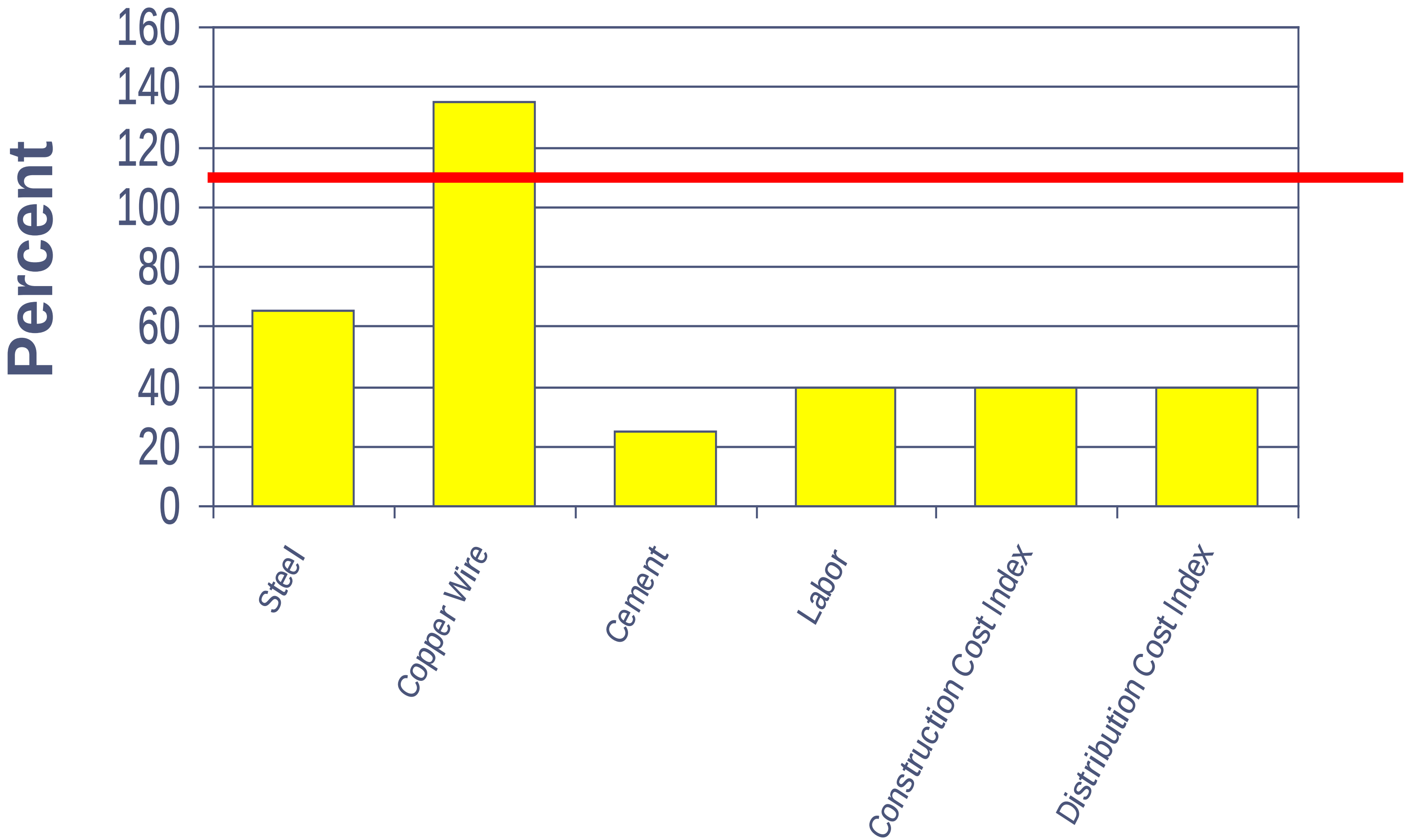
Source: GF Energy 2007 Electricity Outlook Entering the Climate Zone June 18, 2007

Electric Infrastructure Investments For Regulated Utilities

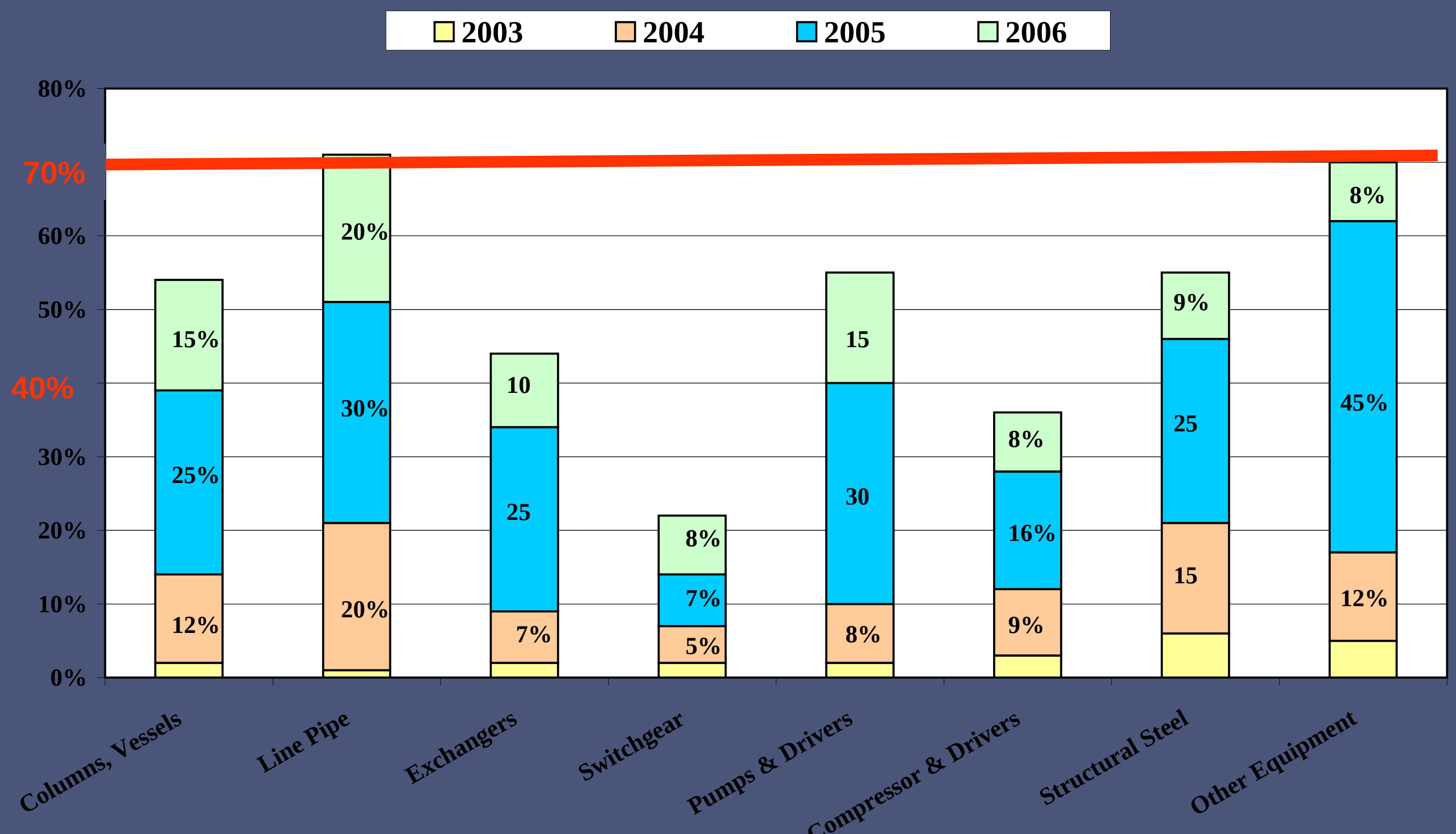
- Current net regulated electric utility property in service
  - **~ $ 400 Billion**
- Generation ~$ 53 Billion 2007-2016
  - US DOE – Energy Information Administration projects ~$412 Billion 2005 – 2030 for all generation sources
- Transmission ~$ 85 Billion 2007-2016
- Distribution ~$ 145 Billion 2007-2016
- Environmental ~$ 30-60 Billion 2007-2016
  - Excludes potential cost of climate legislation
- Other cost factors
  - Critical infrastructure protection, RTOs, pension funds, health care, disaster recovery, end of rate freezes, RPS, fuel

CapEx ~$750 Billion – $1.2 Trillion

Component Costs Increasing 1999 - 2006



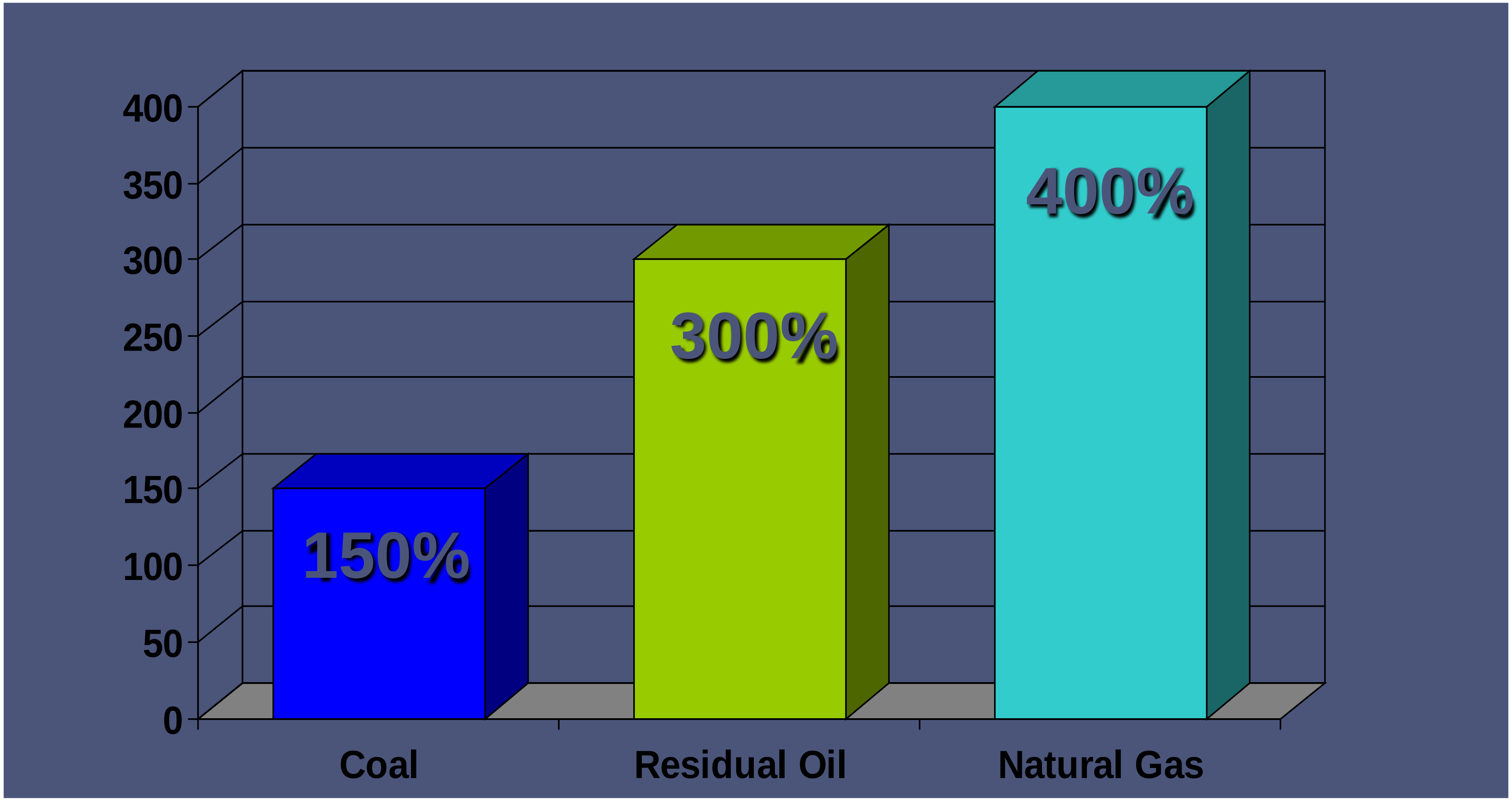
Equipment Price Increases 2002-2006



Source: "Who, What, Where, How" presentation by John Siegel, Bechtel Power Corp. Delivered at the *Next Generarion of Generation Conference* (Dewey Ballantine LLP), May 4, 2006.

Fuel Costs Increasing Dramatically

Natural Gas percentage increase 1999 – 2005



Source: U.S. DOE/Energy Information Agency & U.S. DOL/Bureau of Labor Statistics (January 2006)

Natural Gas

- Distribution $5.3 billion / year
  - Net distribution gas plant = $46.6 billion
- Transmission $2.4 billion / year
  - Net transmission gas plant = $50.1 billion
- Natural Gas Exploration / Supply $47.2 billion / year

National Petroleum Council's 2005 report, *Balancing Natural Gas Policy*

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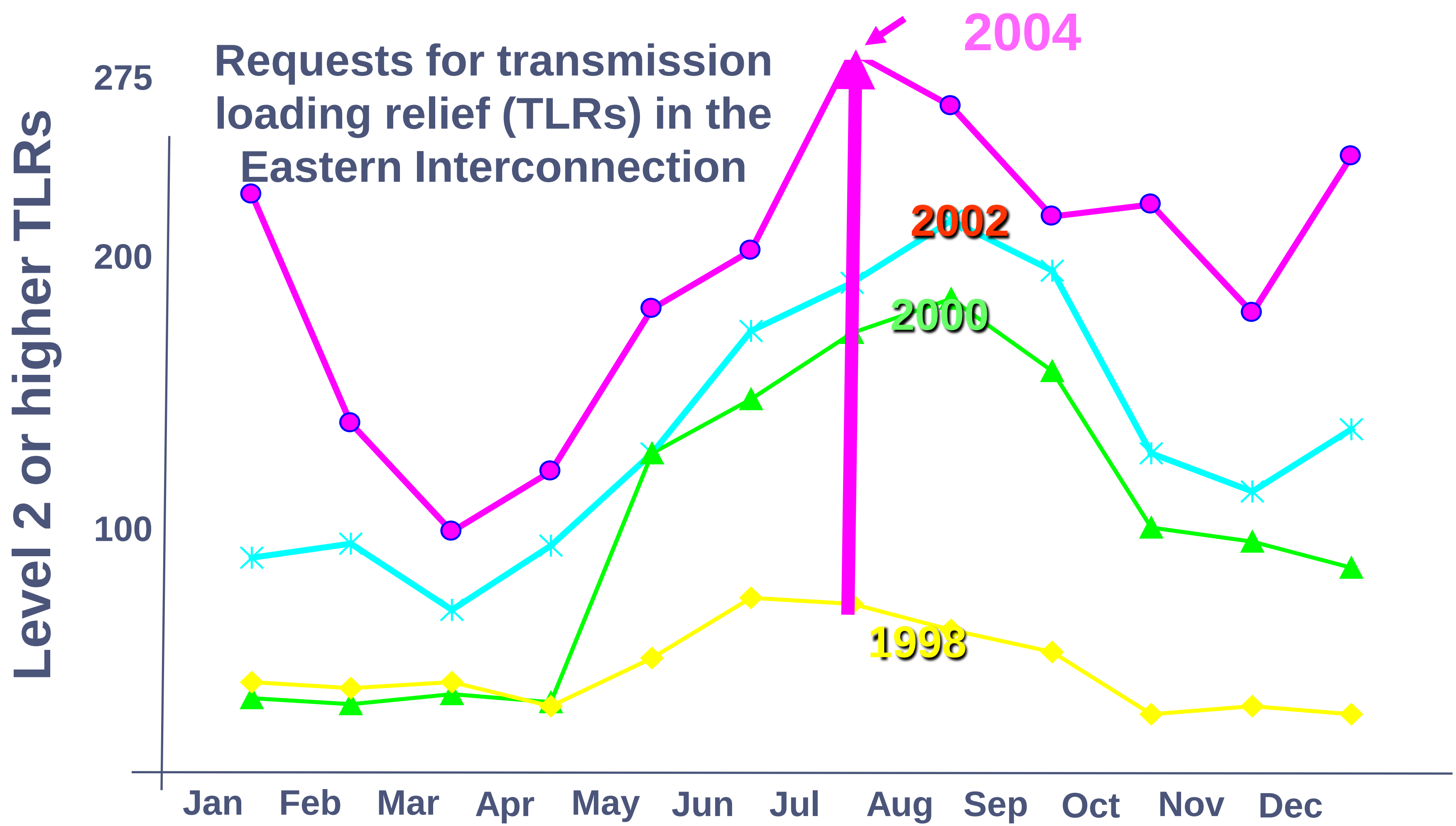
Transmission Congestion Dramatically Increasing

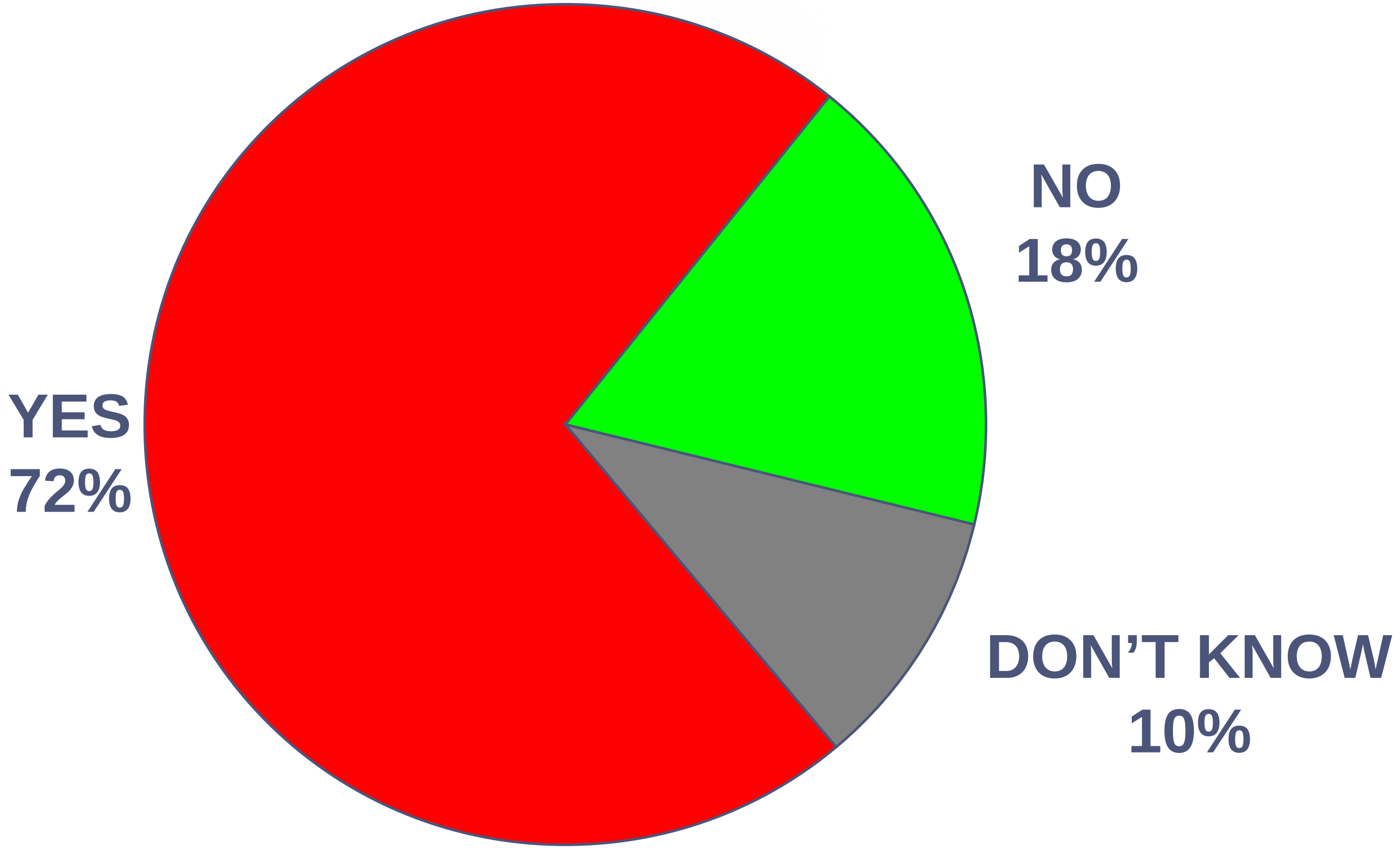


Source: NERC Transmission Loading Relief Procedure Logs

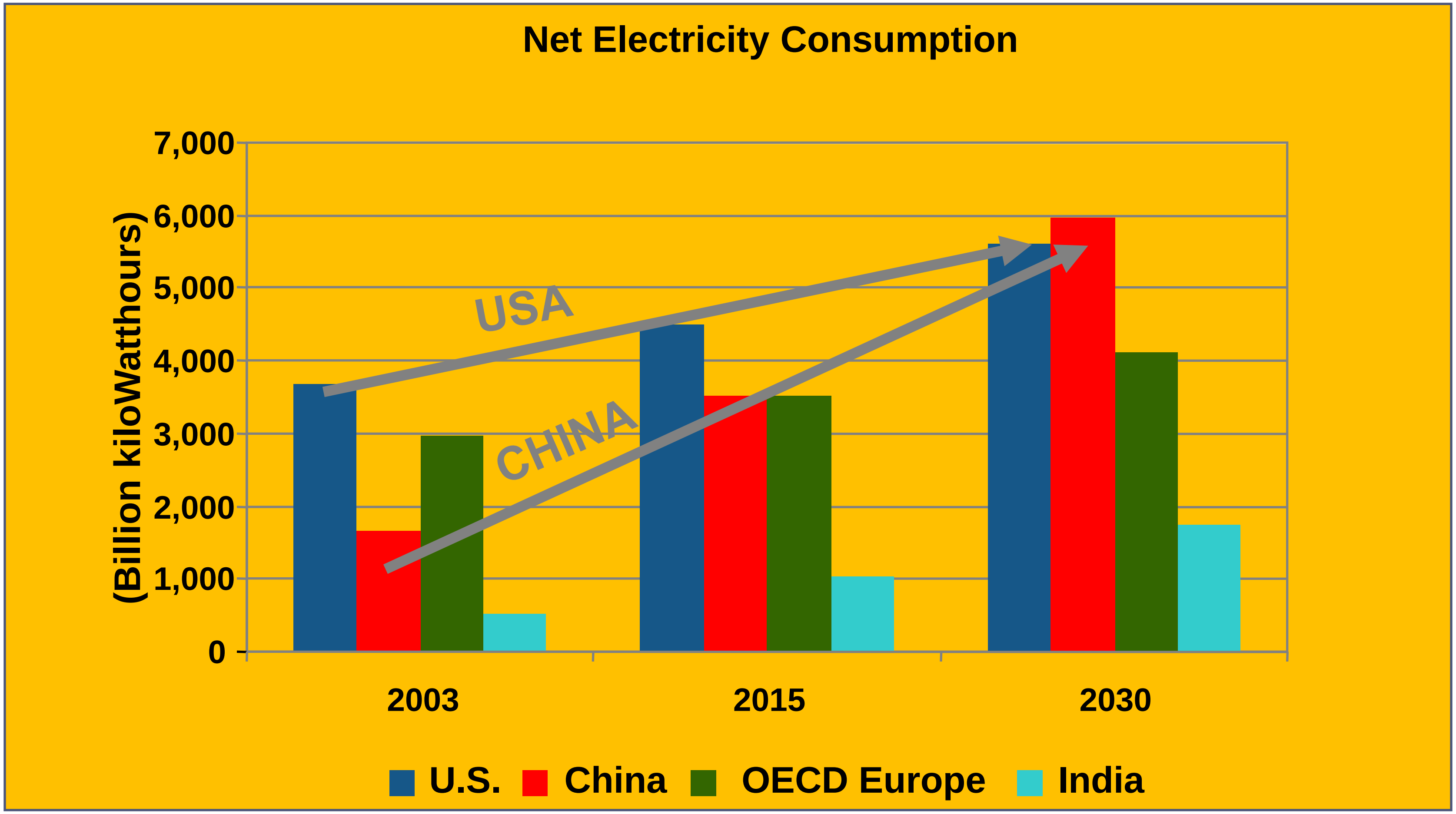
Challenge:
Siting and Public Acceptance

- *Virtually all types of infrastructure opposed by someone*
- Still a difficult process
  - – Complex, lengthy, and costly process
  - – Multiple agencies create inefficient process
    - Variety of environmental permits (state and federal) from multiple agencies
    - Need a single agency leading the process
  - – Lead times getting longer
- New challenge - Energy Policy Act 2005 transmission siting provisions under siege
  - – Dept. of Energy National Interest Electric Transmission Corridor designation
  - – Federal Energy Regulatory Commission backstop siting
  - – Access across Federal lands

"Is Global Warming Really Happening?" Consumer Survey



Worldwide Electricity Demand Growth



Source: Energy Information Administration, *International Energy Outlook 2006*

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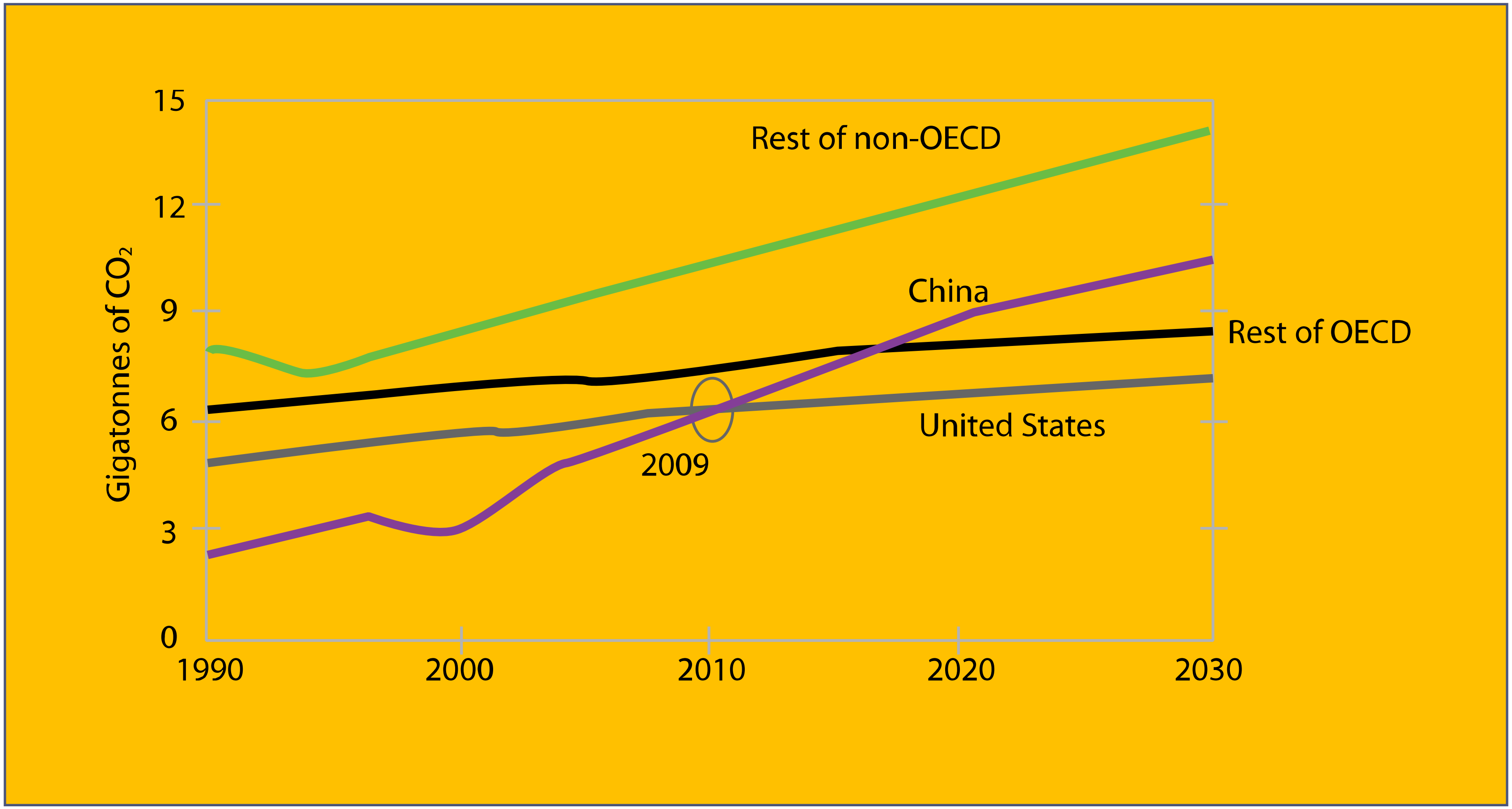
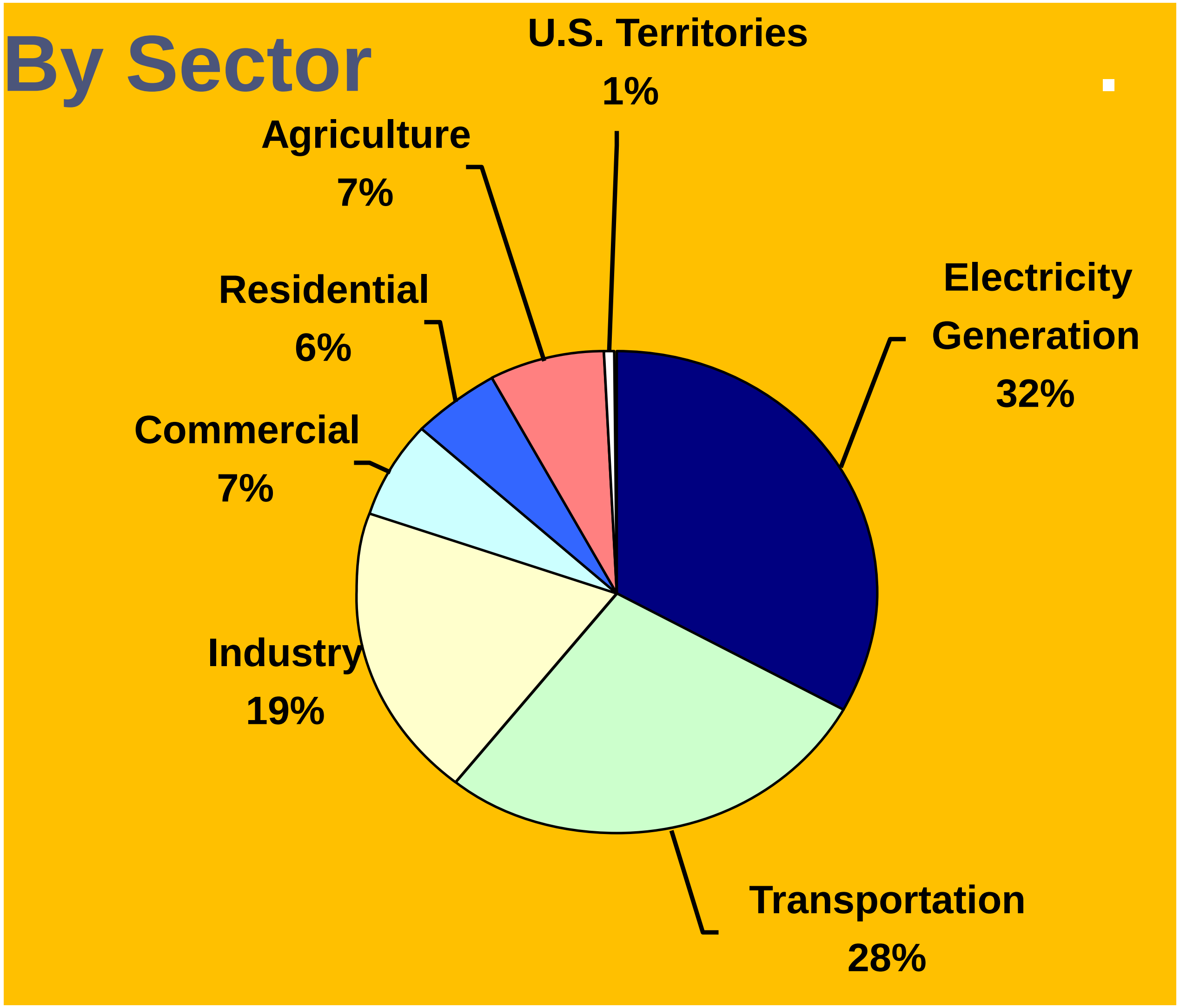
China's CO_2 Emissions Surpass U.S. in 2009



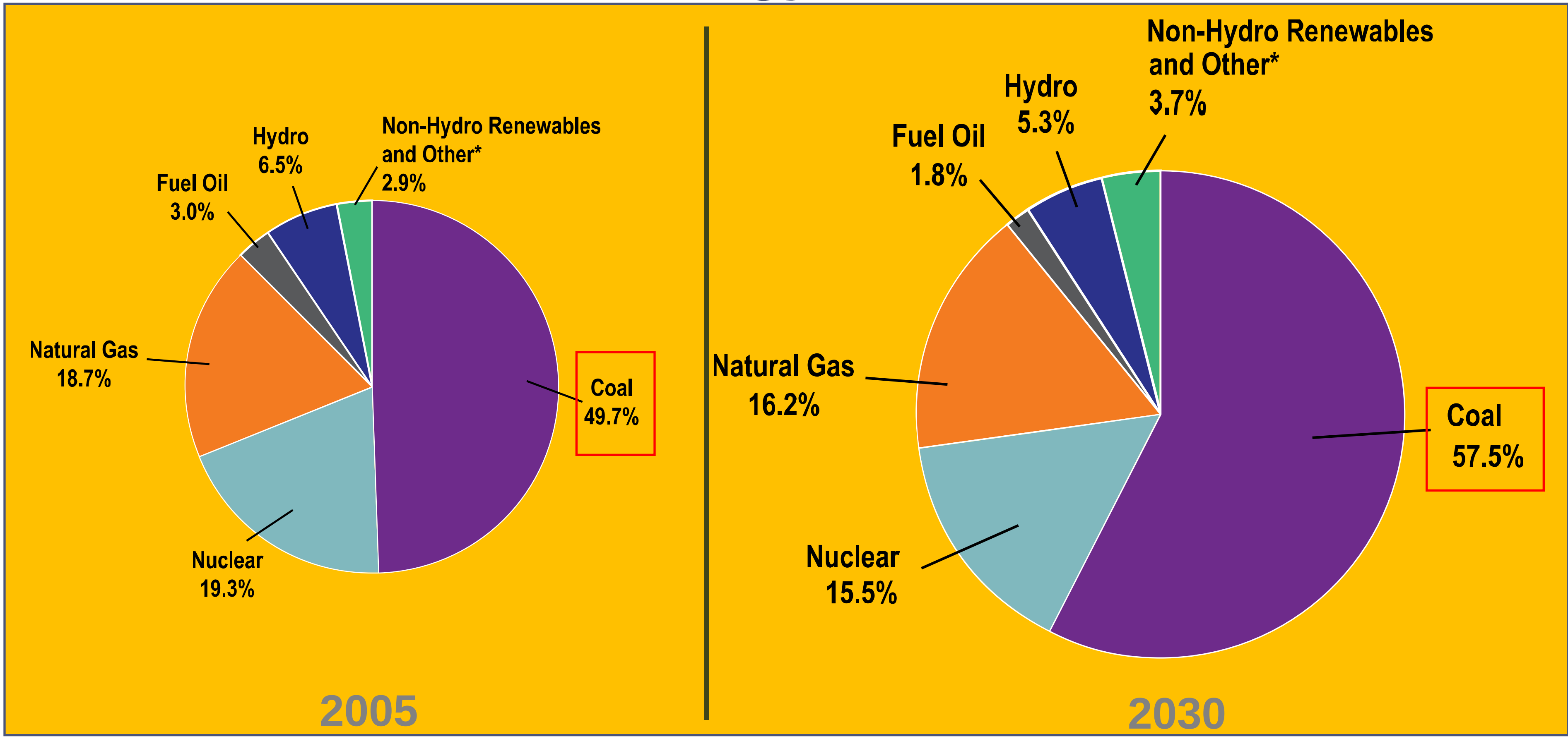
Source: International Energy Agency, *World Energy Outlook 2006*

U.S. Green House Gas Emissions

By Sector



Coal Remains A Dominant Part of Tomorrow's Energy Mix



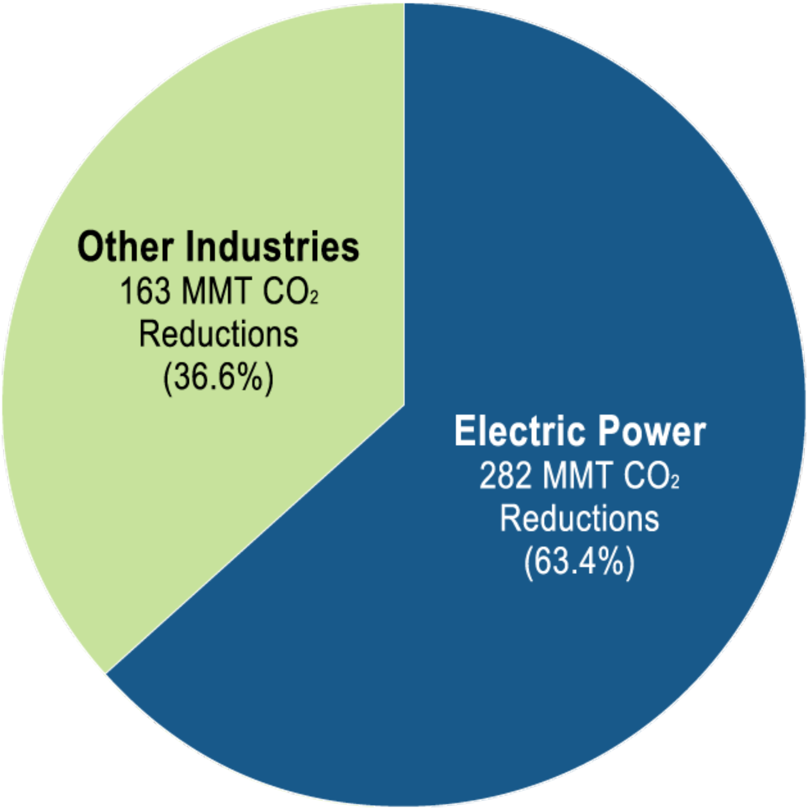
* Includes generation by agricultural waste, batteries, biomass, chemicals, geothermal, hydrogen, landfill gas recovery, municipal solid waste, non-wood waste, pitch, purchased steam, solar, sulfur, wind, and wood.

Source: U.S. Department of Energy, Energy Information Administration, 2005 data

* Includes generation by agricultural waste, batteries, biomass, chemicals, geothermal, hydrogen, landfill gas recovery, municipal solid waste, non-wood waste, pitch, purchased steam, solar, sulfur, wind, and wood.

Source: U.S. Department of Energy, Energy Information Administration, Annual Energy Outlook 2007 Early Release

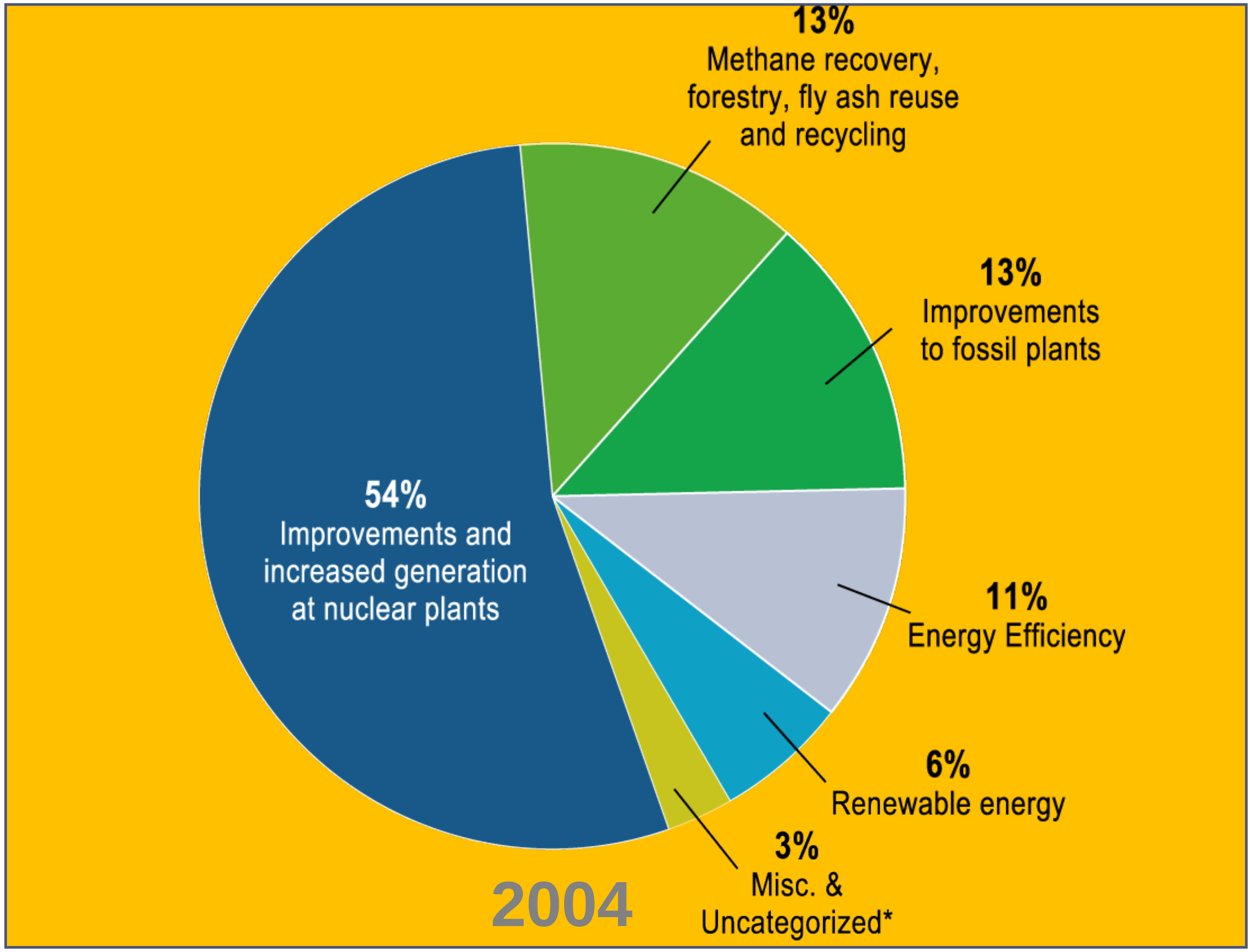
Electric Power Sector Leads All Other Industrial Sectors in Reducing CO_2



2004

Note: Million metric tons (MMT) represent the greater of project or entity amount, on reporter-by-reporter basis.
Source: U.S. Department of Energy, Energy Information Administration, *Voluntary Reporting of Greenhouse Gases Program 2004*. Analysis by Edison Electric Institute.

Electric Power CO_2 Emissions Reductions By Project Type



*Includes improvements to transmission and distribution systems, transportation and off-road vehicles, and halogenated substances. Source: U.S. Department of Energy, Energy Information Administration, *Voluntary Reporting of Greenhouse Gases Program 2004*. Analysis by Edison Electric Institute.

Controlling Greenhouse Gas (GHG) Emissions – Current Status

- Congress seriously considering legislation aimed at reducing GHG emissions
- Supreme Court rules that carbon dioxide is a pollutant under the Clean Air Act
  - EPA to regulate!
- Some states, such as California, have adopted comprehensive policies to limit GHG emissions

Key Questions In GHG Debate

- Targets and timetable for GHG reductions?
- Mechanisms to achieve cost-effective GHG reductions?
  - Cap and trade (w/ or w/o safety valve), tax, hybrid?
- Include all sectors of the economy and all sources of GHG?
- Consistency of compliance timetables with expected development and deployment of needed technologies?

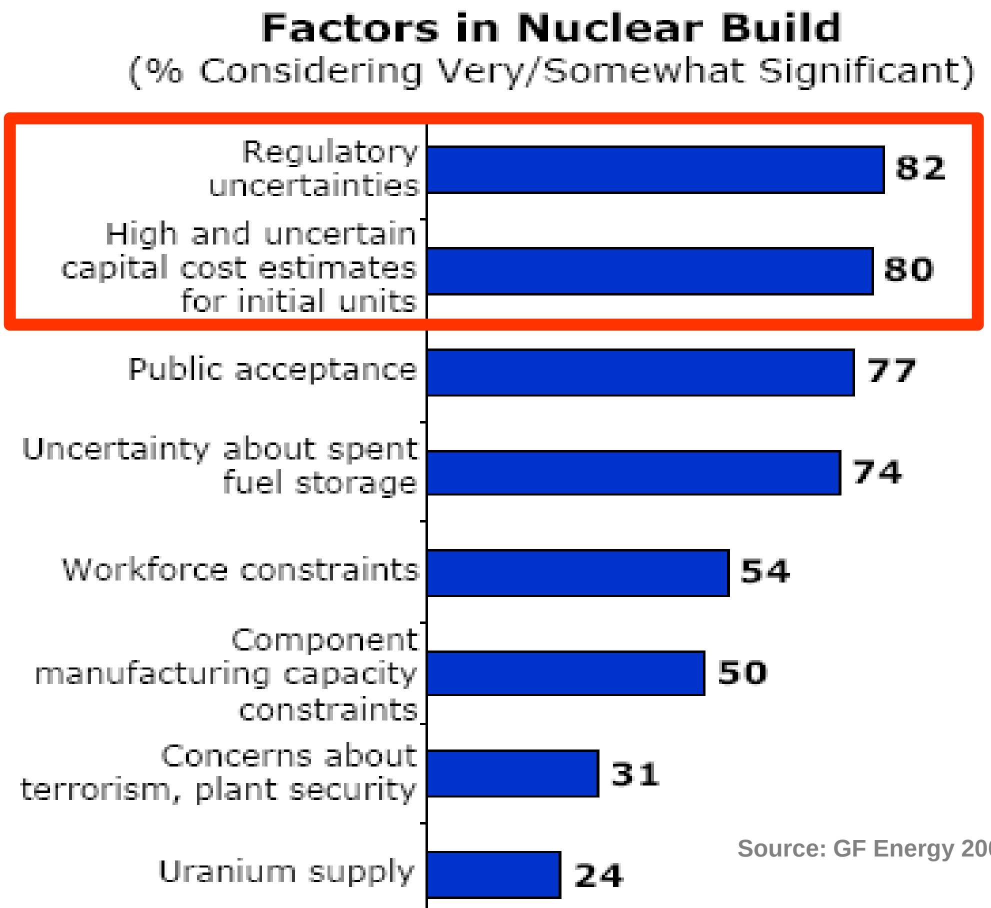
Challenge: Technologies and Timeframes

- Clean coal technologies
  - **Not commercially available until 2015**
- Carbon capture and storage (CCS) technologies
  - **Not commercially available until 2020-2025**
- Deployment of nuclear plants
  - **Not possible until 2015 at earliest**

CEO Perspective

Nuclear Issues

Significant nuclear issues are…



- **Regulatory issues remain the major constraint on new nuclear, followed by high cost and public acceptance—particularly as relates to concerns over spent fuel storage and plant security.**

Source: GF Energy 2007 Electricity Outlook Entering the Climate Zone June 18, 2007

Controlling Greenhouse Gas (GHG) Emissions

- *How do you …*
  - **Establish the price of carbon?**
  - **Minimize economic disruptions?**
  - **Ensure that low income consumers do not shoulder a disproportionate impact?**
  - **Recognize early actions / investments made to mitigate GHG?**
  - **Take into account unintended aspects of GHG emissions?**
    - Jobs? Trade balances? Cost of goods and services?

What Will It Take?

There Is No Silver Bullet!

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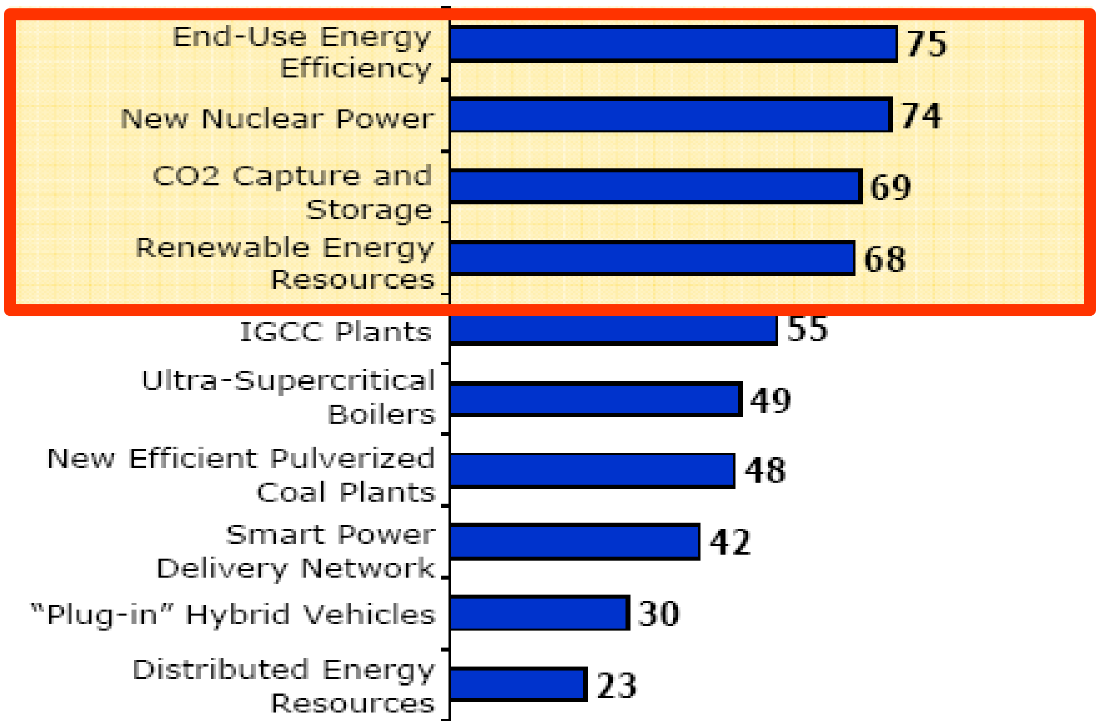
CEO Perspective Technology Strategies

There is a strong consensus on technology strategies

Important Climate Change Technology Strategies
(% Consider Very/Somewhat Important)



- **A majority of industry leaders see end-user energy efficiency, nuclear and renewables as the most effective technologies, along with carbon capture and storage, for addressing climate change**

Q27: How important will each of the following technology strategies be to utilities when it comes to addressing climate change?

Source: GF Energy 2007 Electricity Outlook Entering the Climate Zone June 18, 2007

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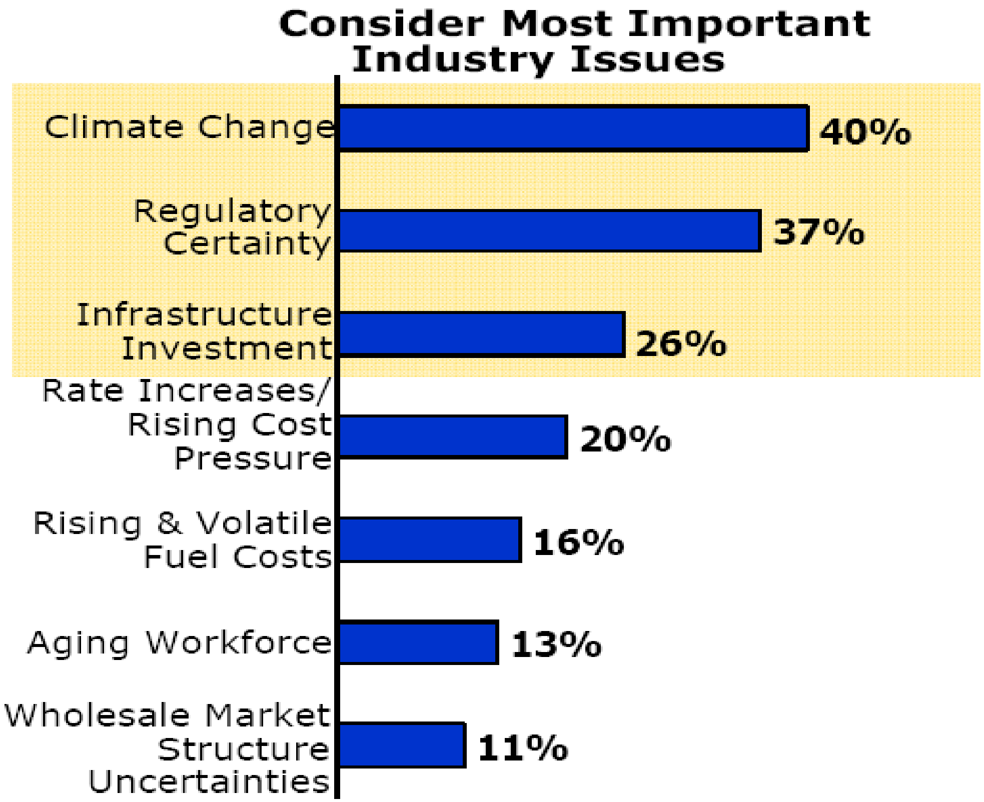
CEO Perspective

Regulatory Certainty Essential

Regulatory certainty is needed for making the most appropriate—and cleanest--infrastructure choices



- Climate change is the industry's most important issue and tied to the need for regulatory certainty to be able to make infrastructure investment.

Q7b. Of the industry issues below, select the most important issues

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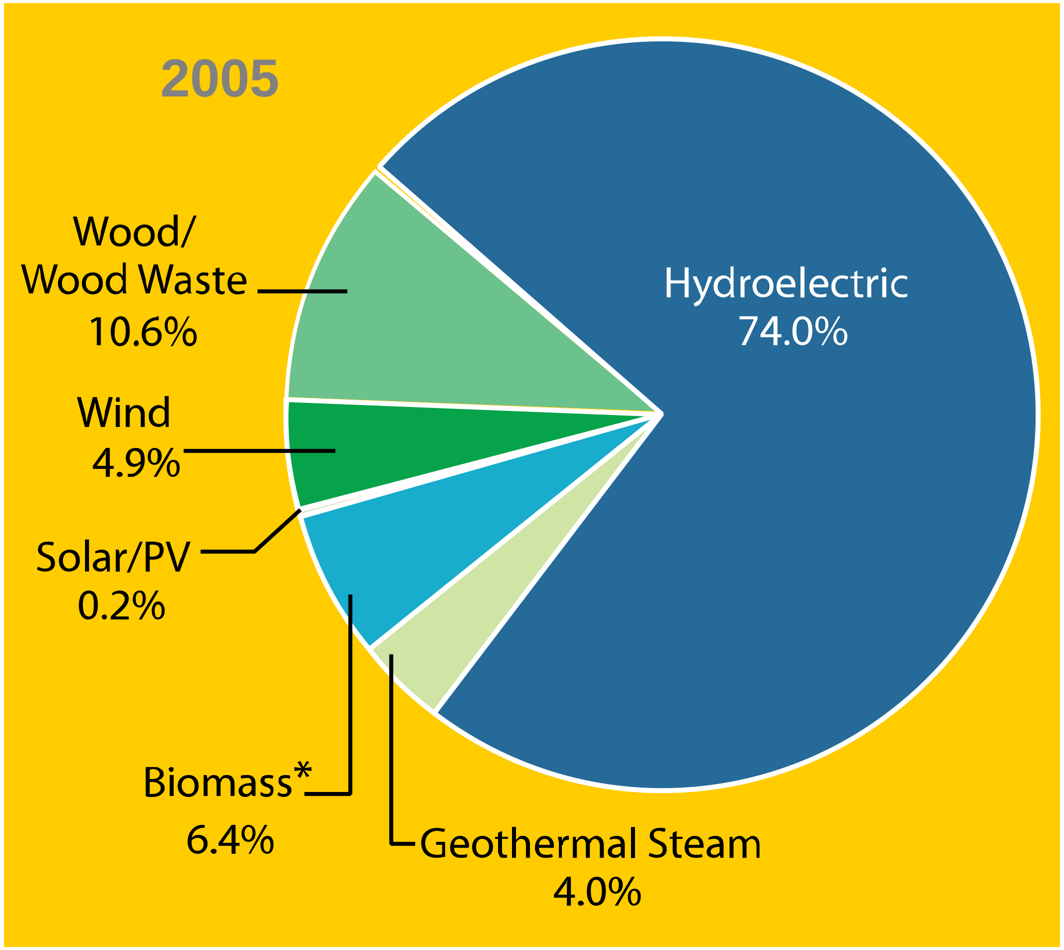
An Intensified Commitment To Renewables

- Non-hydro renewables increasing
- Wind is fastest-growing renewable
- Wind farms operate in 32 states with > 10,000 MW

What Will It Take?



Note: Numbers exceed 100% due to rounding.
Source: U.S. DOE/EIA Form EIA-906, Power Plant Report, Form EIA-920 Combined Heat and Power Plant Report; 2005 preliminary data
***Includes agricultural byproducts, landfill gas, municipal solid waste, sludge waste and tire-derived fuels.**

Electricity Generated from Renewables

Benefits:

- Renewables becoming bigger part of fuel mix
  - Wind, solar, geothermal, and biomass
- Generally less environmental impact
- Non-hydro renewables: 2.4% Today → 4.4% by 2030
  - Biomass produces 1.5% of generation
  - Wind 0.4%
  - Geothermal 0.4%
  - Solar 0.01%
- Largely CO_2 emission free

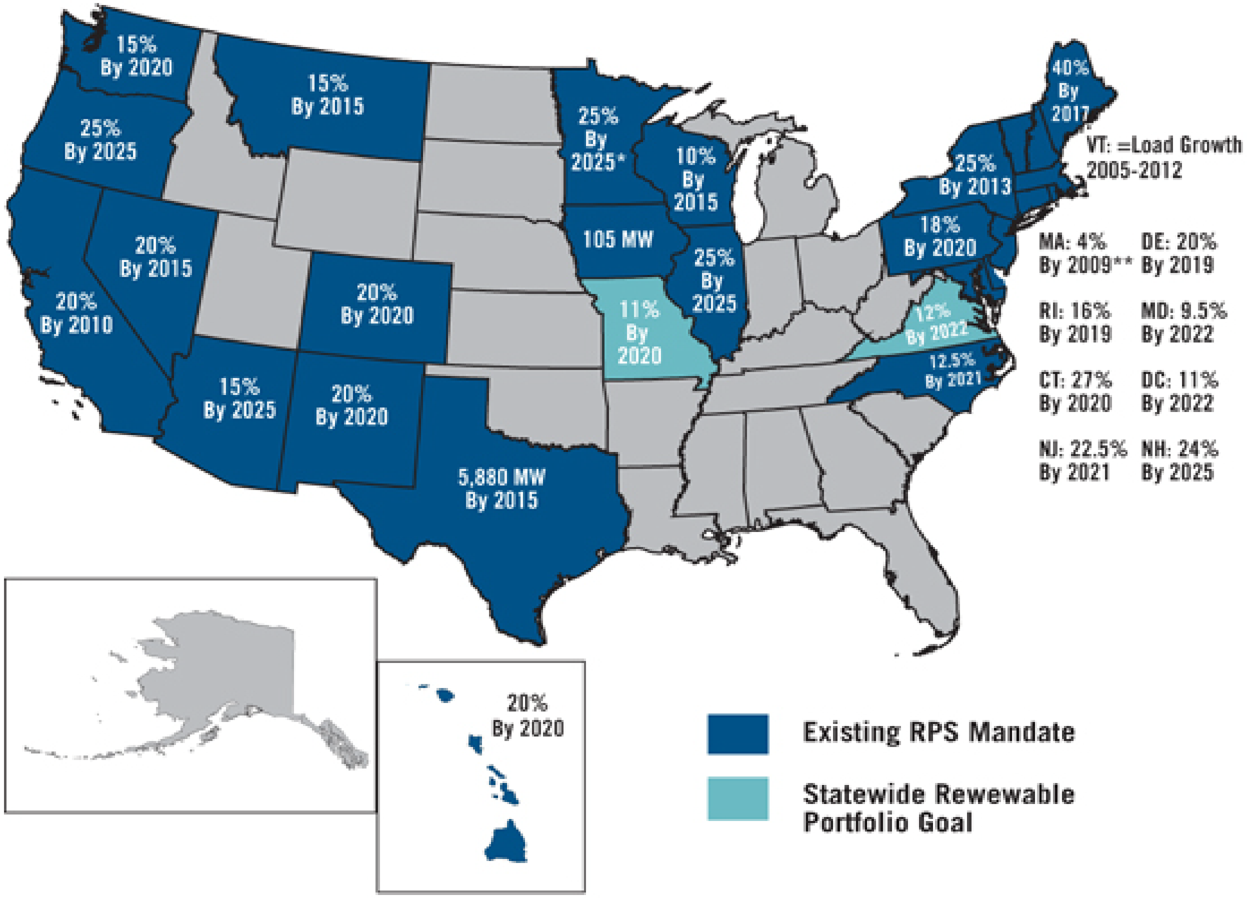
Electricity Generated from Renewables

Challenges:

- High initial capital costs
  - Need tax credits or other incentives
- Geographic limitations
- Intermittent nature of supply (i.e., wind and solar)
- Transmission availability
- Frequent expiration of production tax credit
- Environmental and aesthetic challenges

Renewables alone can not solve our energy challenges

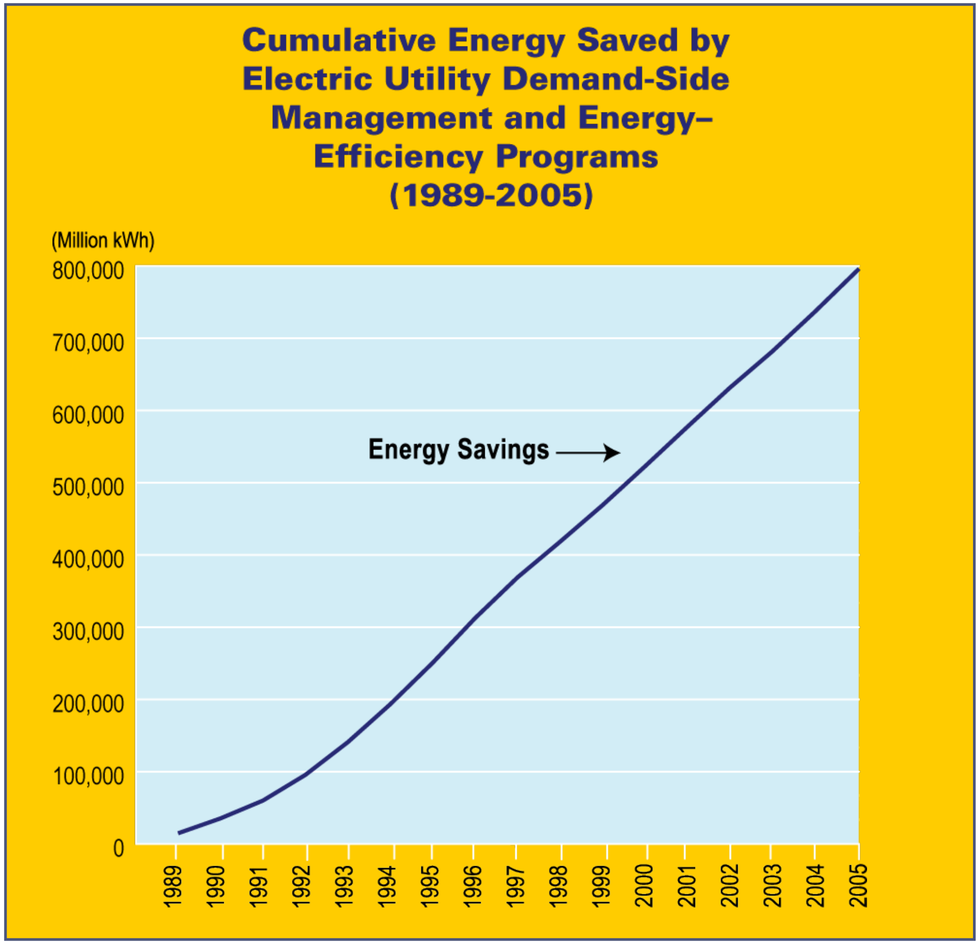
26 States & D.C. Mandate Renewable Portfolio Standards (RPS)



*Xcel Energy: 30% By 2020 **Increasing 1% per year there-after

Source: Edison Electric Institute, status as of August 28, 2007.

An Intensified National Commitment To Energy Efficiency

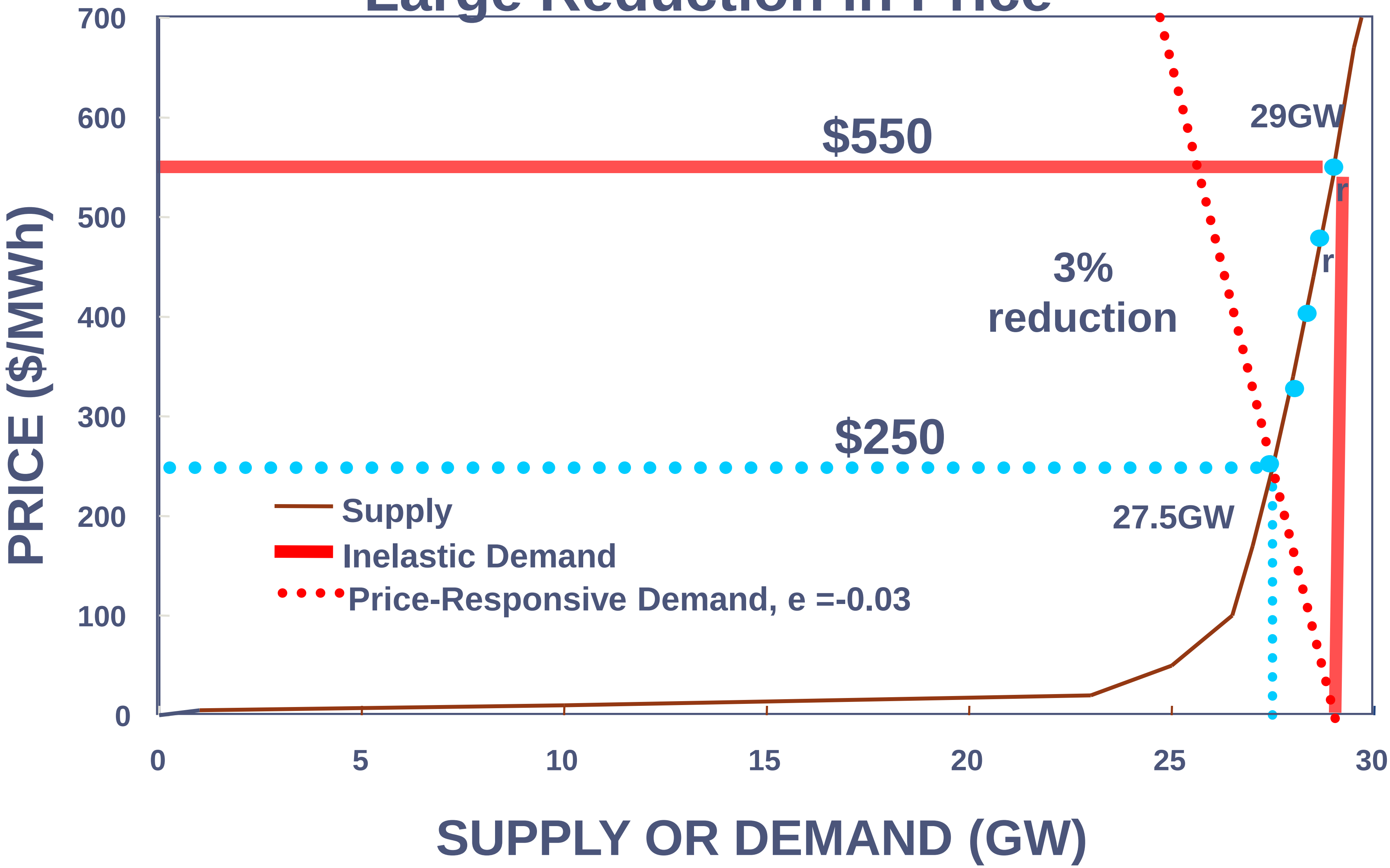


Source: U.S. Department of Energy, Energy Information Administration. Some utilities were spending money on DSM as early as 1976. National data are not available for expenditures from 1976-1988.

- DSM saved almost 797 billion kiloWatt-hours (kWh)
  - ~74 million homes for a year
  - Annual output of ~336 baseload power plants
    - 300 MegaWatts (MW) each

Getting Customers to Help - Demand Response

Small Reduction in Demand Large Reduction in Price



Price Responsive Demand Needed

- Dynamic pricing - *proper price signals at the right time*
  - Highest prices during the peak periods
    - When we have to run most expensive generation in order to meet the peak demands
  - Lowest prices during off-peak periods
    - When we run least expensive generation
- Significant benefits:
  - Can help avoid purchasing high cost energy
  - By providing a “hedge” against market volatility by mitigating “market power”
  - Another way to deal with emergency situations & increase reliability

Making Energy Efficiency A Business for Utilities

- ***Removing the Disincentive***
  - **How can I not lose money selling while meeting DSM / energy reduction goals?**
- ***Creating the Incentive***
  - **How can I create a business selling energy efficiency that is at least as profitable as my supply or energy delivery business?**
- ***Options***
  - **Removing disincentives – decoupling**
  - **Incentives**
  - **Ratebasing energy efficiency investments**
  - **Utilities as energy service companies**